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HALIFAX, NOVA SCOTIA

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OF THE

Nova Scotian Institute of Science

HALIFAX, NOVA SCOTIA

VOL. XXI. 1942-1944 PARTS 1 AND 2

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Editor: ERNEST HESS

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PROCEEDINGS

OF THE

Nova Scotia Institute of Science

SESSION OF 1942-43
(Vol. XXI, Part I)

PRESIDENTIAL ADDRESS

R. J. Bean

(Read October 19, 1942)

The Nova Scotian Institute of Science is about to complete its eightieth session with this annual meeting. A brief review of the past session will show that it was very satisfactory from the standpoint of the number of meetings held, the quality of the papers presented, and the attendance. There were six ordinary meetings at which 16 papers were read, and 3 demonstrations were inserted in the programmes at various times. The papers classified as to subject included:

Biochemistry	4	Bacteriology	3
Physiology	5	Fisheries	1
Botany	2	Nutrition	1

Classified as to the sources of origin they represent.

Biochemistry	4	Fisheries	5
Physiology	3	Pharmacology	2
Botany	2		

The average attendance was 22. For the second time in two sessional years, members of the Institute were priviledged to attend an extraordinary meeting held on October 23, 1941. At this meeting Dr. H. H. Brown, Director of the Sponge Fisheries Investigation of the Bahamas, gave a masterly address on "The Sponge Fisheries of the West Indies."

Throughout the session the Council has been busy with details which are often of the utmost importance to the Institute. Through advices from the Treasurer it was found that there were many names on the list of members which should be dropped because of delinquency on the matter of annual dues. Two changes were made in the By-Laws to control this situation in the future; (1) that the Council shall each year review the list of members for consideration of their status and the imposition of penalties, (2) that ordinary members leaving Halifax automatically become associate members or student members during the session or sessions that they are away. Vacancies in the Editorial Board were filled through the appointment of Dr. Pelluett, Dr. Bronson and Dr. Heard. Since Dr. Heard has accepted a new position at McGill, Dr. Hess has been asked to appoint another representative. Before leaving these specific references to the work of the Council, I feel bound to make some comment on this body. Members of the Institute who have never sat on the Council, do not realize the degree of responsibility for the welfare of the Institute, that Council accepts. It has been my privilege to be associated with the Council for six years. During that time I have failed to ascertain one single case in which the Council did not attack the problem at hand with rational thinking and unmistakable fidelity to the best interests of the Institute as a whole.

To-day we see a world at arms, a future of vagueness and uncertainty. We are living in a country whose most cherished freedoms, ideals, and institutions are seriously threatened. Possibly we might profit by trying to picture those happier and more promising days more than eighty years ago when the Nova Scotian Institute of Science was born and another small torch was lighted. How bright that torch was to burn in the future, none of the founders of this Institute could guess. To them it meant the opportunity to meet, to discuss, to be inspired to greater efforts in the various fields of science as they then existed. The opportunity to publish through the Institute's own "Transactions" must have been considered by the early members an achievement in itself. We, the present members have seen the original purpose of the "Transactions" unavoidably obscured by the tremendous increase in the number of scientific journals, the steady trend toward specialization, and the resultant competitive aspect that most authors of scientific papers can't ignore. Nevertheless, we would do well to think of our publication as the keystone of our whole organization. At times, the torch which we now carry has flickered dimly for various reasons, but never more seriously than when opinions that the journal should be discontinued, are cast about. We have been so accustomed over a period of years to the idea of huge enterprises, colossal figures, and concentrated power, that we often lose the sense of perspective which once lead us to consider that modest enterprise and limited activities were useful and worthwhile. Thus we really owe a great debt to the contributors, the editors, and all those who during the long years have concurred in the belief that the journal not only serves the purpose of bringing to us a valuable exchange list, but in addition, it is in itself worthwhile and identified with the very existence of the Institute. Moreover, a casual glance at the list of papers which appear in recent volumes of the "Proceedings," will show that a majority of them are of special significance to Nova Scotians. Possibly some will recall that the first paper read before the Institute was "The Common Herring of Nova Scotia." The bulk of our latest volume is made up of two papers, "The Grasses of Nova Scotia" and "The Dragon Flies of Nova Scotia."

One outstanding problem in the affairs of the Institute has been solved through the personal interest and work of the Corresponding Secretary. I refer to the new arrangements which have been made to house back volumes and reprints of the Proceedings in the Medical and Dental Library. It has been actually, a dirty job. It is but one more illustration of a member of the Council and an officer of the Institute quietly giving his time and labor that our organization shall profit.

In closing I should like to make two comments. To-day we are living in a world which has witnessed national ambition and national jealousies develop to the point where we are all caught in the crazy, screaming vortex of a global war. Yet, during the past twenty years here at Halifax, Canada, no less than four United States citizens have been elected to the highest office in the Nova Scotian Institute of Science. Of the two who have been in office during the present war, one was elected months before the United States became a belligerent by the side of Canada and Great Britain. Finally, though the Institute as a body has not been called to contribute to the war effort, we should take great pride in the fact that the Canadian and United States governments have already required the services of an impressive list of our members, that in all probability new names will be added in the months to come.

PROCEEDINGS OF MEETINGS

Session of 1942-43

(All meetings were held in the Medical Sciences Building, Halifax)

81*st Annual Business Meeting*, October 19, 1942.

The President, Professor R. J. Bean was in the chair. His annual address is printed in full in the Proceedings.

Reports of officers were given and summarized as follows:

Treasurer's Report:

Receipts	$ 930.62
Expenditures	692.29
Assets—Current Account, Cash and Bank	1,262.84
Permanent Fund, Trustee Bonds	4,500.00

The Corresponding Secretary reported that exchanges with all enemy countries and most neutral countries have been suspended because of the war. The files of back Proceedings and reprints have been moved to new convenient quarters in the Medical Dental Library. 138 copies of old numbers of the Proceedings have been requested and mailed.

The Editor reported that the issue of the current number of the Proceedings will be held up until December because of printer's delays. The manuscript was in the hands of the printers earlier than usual.

The Librarian reported that 682 books and pamphlets have been received through the Institute's exchange list, 198 less than last year. Borrowings from the Library totalled 2,082 books and pamphlets. 100 volumes have been bound, the contributions of 22 societies having been bound up to date.

Officers and Council elected for the year 1942-43 were:

President	Dr. E. Hess
1st Vice President	Dr. F. R. Hayes
2nd Vice President	Dr. C. C. Coffin
Treasurer	Prof. W. P. Copp

Corresponding Secretary ....Dr. M. K. McPhail
Recording Secretary ....Dr. C. B. Weld
Council ....Dr. A. E. Cameron, Professor R. J. Bean, Dr. E. P. Linton, Dr. A. J. Wood, F. C. Collier, Esq.
Editor ....Dr. E. Hess
Librarian ....Dr. F. R. Hayes
Institute Nominations to Provincial Science Library Commission . . Dr. E. G. Young and Dr. F. R. Hayes.
Auditors ....Dr. H. L. Bronson and P. R. Colpitt, Esq.

Following business, Professor C. B. Weld demonstrated the cine film "Control of Small Blood Vessels" showing the passage of blood through minute blood vessels and its control by nervous stimulation.

1*st Ordinary Meeting*, November 16, 1942.

The following new members were announced: (elected by Council, November 9, 1942) W. J. Archibald, Ph.D., H. B. Collier, M.A.,Ph.D., K. M. Wilbur, M.A.,Ph.D., ordinary members; Albert Wilansky, B.A.,B.Sc., Vernon Crawford, B.A., student members.

Papers: "The Grasses of Nova Scotia," by W. G. Dore and A. E. Roland; "Additions to the List of Odonata of the Maritime Provinces," by E. M. Walker; Demonstration—"Seismographic Surveying for Oil," by Dr. A. E. Cameron and Professor A. E. Flynn.

2*nd Ordinary Meeting*, December 14, 1942.

The election of Carl Webber, student member, by Council on November 16th was announced.

Papers: "The Absorption and Excretion of Allantoin," by E. Gordon Young, Helen Wentworth, and W. W. Hawkins; "Further Development of Iso-thermal Calorimetry," by J. R. Dingle and C. C. Coffin; "The Destruction of Bacteria in Solid Food Products," by A. J. Wood.

3rd Ordinary Meeting, January 11, 1943.

Messrs. J. C. Devin and J. H. Greenblatt, B.Sc., B. F. Long, B.Sc., A. G. Wood, B.Sc., were elected student members at Council meeting, December 14, 1942.

Papers: "Some Considerations of Osmotic Pressure Phenomena in Crustacea," by N. K. Panikkar; "Abscission of Leaves in *Fraxinus Americana* L.," by V. Facey; "The Normal Arsenic in Human Hair," by E. Gordon Young and F. A. H. Rice.

4th Ordinary Meeting, February 8, 1943.

Miss Francis Keeping, B.Sc., was elected student member at the Council meeting of January 11, 1943. An invitation was received from the Engineering Institute of Canada inviting our members to their meeting of February 25th to hear Mr. H. W. Lea, Director of the War-time Bureau of Technical Personnel.

Papers: "Magnesium Ammonium Phosphate (Struvite) Crystal Formation in Canned Lobster," by A. Hollett; "Relation between Feeding and the Sexual Cycle in Haddock," by R. E. S. Homans; "The Stimulating Action of Colchicine on Ovulation of the Frog's Ovary in Vitro," by M. K. McPhail and K. M. Wilbur.

5th Ordinary Meeting, March 8, 1943.

New members elected by Council on February 8: Miss V. Facey, B.Sc.,M.A., ordinary and Mr. H. C. White, B.A., associate.

The election of Mr. D. J. Matheson as honorary member of the Institute by the Council at their meeting of February 8th in recognition of his many years of faithful service as Treasurer of the Institute was announced.

Papers: "The Taxonomic Significance of Trimethylamine Oxide Reduction of Bacteria," by Elizabeth Baird and A. J. Wood; "Allantoin and Leucocytosis in Man," by W. W. Hawkins; "Pitch Discrimination in Man," by C. B. Weld.

6th Ordinary Meeting, April 5, 1943.

New member elected by Council March 8: A. W. H. Needler, M.A.,Ph.D., associate.

Papers: "Rapid Titrimetric Estimation of Sodium Chloride in the Presence of Protein," by W. J. Dyer; "The Decomposition of Allantoin by Bacteria," by W. W. Hawkins; "Phenothiazine Anaemia in Dogs," by H. B. Collier and G. E. Mack. Demonstration—"A New Stimulator for Muscle-Nerve Preparations," by C. B. Weld.

7th Ordinary Meeting, May 3, 1943.

Papers: "The Inorganic Nutrient Requirements of *Escherichia coli*," by E. Gordon Young and Irene Pentz; "Inorganic Constituents of Developing Salmon Eggs:" I. Sodium, Potassium, Calcium and Magnesium, by Douglas Darcy; II. Chloride and Phosphate, by Charlotte M. Sullivan; Demonstration—"The Waring Blender," by H. B. Collier.

C. B. WELD
Recording Secretary

ABSTRACTS

(Papers read before the Institute but not published in the Proceedings.)

The Absorption and Excretion of Allantoin. E. Gordon Young, Helen Wentworth and W. W. Hawkins, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read December 14, 1942). Allantoin may be recovered in the urine to the extent of between 50 and 80 per cent when given orally to dogs. In man only about 30 per cent is excreted after oral administration but 100 per cent after intravenous injection. There is likewise complete recovery when injected into dogs. The blood allantoin falls to normal in about five hours after a dose of 600 mgms. (Published in full in J. Pharm. Expt. Therap., *81*: 1-9, 1944).

Further Developments in Iso-thermal Calorimetry. J. R. Dingle and C. C. Coffin, Dept. of Chemistry, Dalhousie University, Halifax, N. S. (Read December 14, 1942.) Recent work on the benzene-naphthalene calorimeter is described. Improvements in design and operating technique have shown that quantities of heat from 80 to 300 calories may be measured with a reproducibility of about 0.1 per cent.

The Destruction of Bacteria in Solid Food Products. A. J. Wood, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read December 14, 1942.) Ethylene oxide has been found to have a high degree of toxicity for all bacteria associated with the spoilage of food products. Fish, meat and vegetables have been rendered sterile by short time treatment with a relatively low partial pressure of ethylene oxide. The efficiency of treatment is markedly enhanced by treatment of the various materials after evacuation. The process is commercially applicable from the practical and economic standpoints. (Submitted for publication to J. Fish. Research Bd., Canada.)

Some Consideration of Osmotic Pressure Phenomena in the Crustacea. N. Kesava Panikkar, Dept. of Zoology, University of Travancore, India. (Read January 11, 1943.) Though the majority of marine crustaceans are similar to other marine invertebrates in being isotonic with the sea water in which they live, there are certain species which show the ability to regulate their internal osmotic pressures to values lower than that of the surrounding medium. They are (1) a few shore-living and semi-terrestrial crabs belonging to the families Grapsida and Ocypodidae and (2) prawns belonging to the sub-family Palaemoninae. A similar behaviour exists in the brine-shrimp *Artemia*. The ecological factors that seem to be operative in the development of this type of osmotic behaviour are (1) the ability to live on land and (2) to penetrate into fresh water and, in the case of *Artemia*, the abiliity to survive in abnormally high concentrations of salt water. In the Palaemonid prawns there seems to exist an inverse correlation between temperature and salinity as found by acclimatization experiments and this is in agreement with the observed facts of the distribution of these prawns.

Abscission of Leaves in Fraxinus Americana L. V. Facey, Dept. of Biology, Dalhousie University, Halifax, N. S. (Read January 11, 1943.) Leaf abscission takes place in a definite region through the base of the petiole. The cells of this region remain meristematic. Prior to leaf-fall the calcium pectate of the middle lamella of these cells changes to pectic acid. The cellulose of the secondary walls remains unchanged.

Treatment of cut branches with dilute ammonium hydroxide prevented the leaves from falling as fast as those from untreated branches.

THE NORMAL ARSENIC IN HUMAN HAIR. E. Gordon Young and F. A. H. Rice, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read January 11, 1943.) Tests have been carried out to determine the best method of treating human hair prior to an estimation of its arsenic content from a medico-legal point of view. Continuous extraction with alcohol or ether, followed by dilute hydrochloric acid and dilute sodium hydroxide, removed between 70 and 90 per cent of the arsenic present. It also extracted arsenic from guinea pig hair deposited from intravenous injection. Hair soaked in arsenous acid retained its arsenic to about the same degree so that it appears as if no clear line of demarkation between internal and external arsenic in hair exists. (Published in full in J. Lab. Clin. Med., *29*: 439-446, 1944.)

MAGNESIUM AMMONIUM PHOSPHATE CRYSTAL FORMATION IN CANNED LOBSTER. A. Hollett, Fish Inspection Laboratory and Atlantic Fisheries Experimental Station, Halifax, N. S. (Read February 8, 1943.) Analyses were made to determine the concentration of magnesium, ammonia nitrogen, and inorganic and organic phosphorus in fresh lobster muscle and in canned lobster. Analytical results as well as experimental canning have indicated that the amount of struvite crystals in the canned product is limited and controlled by the concentration of magnesium. For this reason the use of sea water in any step of the canning procedure is a major contributory factor in struvite crystal formation in canned lobster. (Published in full in J. Fish. Research Bd., Canada, *6*: 183-193, 1943.)

RELATION BETWEEN FEEDING AND THE SEXUAL CYCLE IN HADDOCK. R. E. S. Homans, Atlantic Biological Station, St. Andrews, N. B. (Read February 8, 1943.) The apparent correlation between feeding and the sexual cycle in the haddock, *Melanogrammus aeglifinus* (Linn), has been investigated. The investigation shows that as haddock approach the spawning period, they practically cease to take food. This fast is rigorously adhered to throughout the spawning period. On the completion of spawning the fast is broken and the haddock feeds very voraciously for a few weeks. (Submitted for publication in full to J. Fish. Research Bd., Can.).

THE STIMULATING ACTION OF COLCHICINE ON OVULATION OF THE FROG'S OVARY IN VITRO. M. K. McPhail and K. M. Wilbur, Depts. of Pharmacology and Physiology, Dalhousie University, Halifax, N. S. (Read February 8, 1943.) It has been found that the alkaloid colchicine will potentiate the action of pituitary on the isolated frog's ovary (*Rana pipiens*). If colchicine is added to one member of a pair of pituitary-treated ovaries, that ovary will start extruding eggs earlier than the non-colchicine treated control; and further, the rate of extrusion will be greater and the total number of eggs freed larger. This action of the alkaloid has been demonstrated for 0.0001, 0.0005, 0.001, 0.005, 0.01 and 0.1 per cent solutions. Colchicine alone will not stimulate egg liberation.

The alkaloid papaverine inhibits pituitary-induced ovulation in the isolated ovary.

The left ovaries have been found to be larger and to extrude more eggs than the right ovaries. These results are statistically significant. (Published in full in J. Pharm. Expt. Therap., *78*: 304-313, 1943.)

THE TAXONOMIC SIGNIFICANCE OF TRIMETHYLAMINE OXIDE REDUCTION BY BACTERIA. Elizabeth A. Baird and A. J. Wood, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read March 8, 1943.) The reduction of trimethylamine oxide by the family Enterobacteriaceae has been studied. Some five hundred cultures representative of all species included in this family have been testea. The colon-typhoid group have been consistently strong reducers of trimethylamine oxide. The genera Shigella and Erwinia do not appear to be active in this reduction. The relationship of this reduction to that of the nitrate reduction is discussed. (Published in part in J. Bact. *46*: 106-107, 1943, and J. Fish. Res. Bd., Can., *6*: 194-201, 1943.)

ALLANTOIN AND LEUCOCYTOSIS IN MAN. E. Gordon Young and W. W. Hawkins, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read March 8, 1943.) A study of the normal blood picture of nine experimental human subjects, all adult males, showed the average variation in total leucocyte count to be 55 per cent, and the average variation in percentage neutrophils to be 34. The individual's highest count generally appeared in the afternoon, and his lowest count in the morning. There was no indication that digestive processes or exercise tended to raise the white cell count.

Despite claims made by various workers that in man a leucocytosis ensues from the ingestion of allantoin, it was impossible to demonstrate any leucocytic effect resulting from the ingestion of small single doses, large single doses, or repeated doses. It was found, however, that a neutrophilic leucocytosis resulted from the intravenous administration of as small a dose as 75 mgms. (Published in full in J. Pharm. Expt. Therap., *81*: 10-16, 1944.)

PITCH DISCRIMINATION IN MAN. C. B. Weld, Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read March 8, 1943.) The ability of 119 normal individuals, mostly medical students, to distinguish between two musical notes sounded one after the other, was determined. The instrument was a Maico Audiometer to which a variable control was added allowing the pitch of one note to be altered at will and the differences read to about 1 cycle/sec.

The range of discrimination with a reference note of 982 cycle/sec. extended from 1 cycle/sec. to something greater than 50 cycle/sec. with the mode (29 subjects) at 6-7 and the mean at 10.4 c.p.s. This compares with an unselected average reported by Seashore of about 1/17 tone or 7 c.p.s. Many subjects showed a better discrimination when the pitch was altered in one direction than in the other. At this level one-half tone is 61 c.p.s.

RAPID TITRIMETRIC ESTIMATION OF SODIUM CHLORIDE IN THE PRESENCE OF PROTEIN. W. J. Dyer, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read April 5, 1943.) Sodium chloride in protein containing samples has been determined by direct titration with standard silver nitrate solution, using dichlorofluorescein as an absorption indicator. An acetate buffer of pH 4.5 is added to the sample or solution. Under the conditions used silver is not absorbed by the protein present in the titrating solution, and results are comparable to those obtained by the Valhard method. The method has been applied to salt fish, canned fish, bacon, fish meal and various salt pickles. (Published in full in Ind. Eng. Chem., Analyt. Ed., *15*: 439-440, 1943.)

THE DECOMPOSITION OF ALLANTOIN BY BACTERIA. W. W. Hawkins, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read April 5, 1943.) Certain bacteria, including some normally present in the human intestine, possess the power of destroying allantoin when it is a constituent of their culture medium. (Published in full in J. Bact., *47*: 351-353, 1944.)

PHENOTHIAZINE ANAEMIA IN DOGS. H. B. Collier and G. E. Mack Jr., Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read April 5, 1943.) Phenothiazine, when used as an anthelmintic, may cause a haemolytic anaemia in humans, horses, and dogs. Three dogs were treated with the drug at a dosage level of 5 grams per Kg. over a week. The haemoglobin, erythrocyte count and cell volume dropped 30-40% in about one week: jaundice and the appearance of Heinz bodies indicated erythrocyte destruction. Reticulocytosis and a sharp rise in mean corpuscular volume were evidence of regeneration of new cells. Leucocytosis accompanied the anaemia. The blood levels returned to normal in about one month.

When one dog was placed on a vitamin B free diet, the anaemia and the jaundice were intensified. The haemoglobin dropped 68% and plasma bilirubin rose to 10 mg. per 100 ml. Experiments are now being carried out on the effect of supplementing the diet with the vitamin B complex. (Published in full in Can. J. Res., Sect. E., *22*: 1-11, 1944.)

THE INORGANIC NUTRIENT REQUIREMENTS OF *Escherichia Coli*. E. Gordon Young and Irene Pentz, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read May 3, 1943.) The effects of numerous metallic ions has been tried alone and in combination on the growth of *Escherichia coli* on a basal medium. This medium contained glycerol, ammonium sulphate, sodium chloride, sodium and potassium phosphates. Magnesium was shown conclusively to act as a growth stimulant between concentrations of 0.0005 g and 5 g per 10 c.c. Rhubidium, zinc, silicon, aluminium, calcium, strontium, and copper were neither depressants nor stimulants. Iron and manganese gave growth curves slightly above the basal medium alone. Cobalt and nickel were depressants above 22 g and 41 g per 10 c.c. respectively. In combination, iron and magnesium allow very nearly optimum growth as compared to that of nutrient broth. (Published in full in Arch. Biochem., *5*: 121-136, 1944.)

INORGANIC CONSTITUENTS OF DEVELOPING SALMON EGGS: I. SODIUM, POTASSIUM, CALCIUM AND MAGNESIUM. Douglas A. Darcy; II. CHLORIDE AND PHOSPHATE. Charlotte M. Sullivan, Dept. of Biology, Dalhousie University, Halifax, N. S. (Read May 3, 1943.)

I. In the developing egg of *Salmo salar L.* the amounts of sodium and potassium remain constant throughout, while calcium and magnesium show a decrease. The larva loses sodium and potassium at a fairly rapid rate beginning at about half way to hatching; it loses calcium and magnesium at a slow rate at least from half way to hatching and probably from fertilization. Measurements were made only up to three weeks after hatching. The embryo had absorbed most of original sodium, one-third of the potassium and about one-seventh of the calcium and magnesium up to three weeks after hatching.

II. Total phosphorus, inorganic phosphorus, and chloride, in whole eggs and constituent parts of eggs, have been estimated throughout development. Total phosphorus is constant up to a week before hatching when it begins to disappear from the system. Total phosphorus increases in the embryo, decreases in the yolk. Inorganic phosphorus increases throughout the observed period. It is not all used by the embryo, consequently it accumulates in the yolk. Chloride is lost from the system from fertilization on. The rate of chloride loss increases shortly before hatching. The chloride content of the embryo shows no change from the value obtained in the first observation made on the embryo alone.

There is a loss of chloride and of inorganic phosphorus from the egg at fertilization.

PROCEEDINGS

OF THE

Nova Scotian Institute of Science

SESSION OF 1943-44
(Vol. XXI. Part 2)

FOOD OF THE HADDOCK*
(*Melanogrammus aeglifinus* Linnaeus)

R. E. S. Homans**
and
A. W. H. Needler

Fisheries Research Board of Canada
Atlantic Biological Station
St. Andrews, N. B.

(Received Octobter 28, 1944)

ABSTRACT

A study of more than fifteen thousand haddock stomachs indicates that the food includes a great variety of biological groups with pisces, echinodermata, crustacea, mollusca, and chaetopoda important constituents. More than two hundred species of organisms have been identified. The type of food varies with locality, age, and season depending on availability. The organisms important in the food are present at or burrowing in the bottom. Slow moving forms predominate.

INTRODUCTION

During the past fifty years the importance of a detailed knowledge of the food and feeding habits of the economically important fishes has come to be realized. The relations of fishes to one another and to the other forms of life which serve them as food constitute an important part of their biology. In addition, a knowledge of the feeding habits of the haddock is of great importance because it is believed that they exert

*Published by permission of the Fisheries Research Board of Canada.
**Now with the Fish Inspection Laboratory, Halifax, N. S.

a considerable influence on the location of the haddock schools on the main feeding grounds lying off the North Atlantic coast of North America.

Since 1900 a great deal of work has been done on the food and feeding habits of the haddock. Practically all of it has been undertaken on the European side of the North Atlantic where British and Danish workers have taken the lead.

MacIntosh (1874) in his work on the marine fauna of St. Andrews, Scotland, listed a large number of species as commonly occurring in haddock stomachs. Brook (1887), Scott (1888, 1902), and Smith (1889-92) examined the contents of haddock stomachs in an attempt to identify the species present and to show the relative frequency of the various biological groups in stomachs collected from different localities. These workers listed the different food organisms and gave the total number of stomachs in which each species occurred. No record of the size, weight, volume of the stomach contents were made. Nor was any attempt made to correlate a seasonal variation in the type and quantity of food taken and stages of sexual development of the fish from which stomachs were removed, were not determined.

Todd (1905, 1907), in carrying out his investigations on the food of fishes in the North Sea, examined the stomachs and intestines of over seventeen hundred haddock captured by means of steam trawlers. The number of stomachs and intestines in which a particular organism was found to be present as food was recorded. A variation in the type of food on different fishing grounds was observed. Todd found only four empty stomachs among the large number examined by him. This was in all probability due to the fact that Todd collected only what he considered were stomachs containing food. Carr (1908) examined the stomachs of a small number of haddock taken in the Irish Sea by a steam trawler. He observed that the majority of empty stomachs was found in fish landed during the period from December to March and the author concluded that haddock eat little during the late winter months.

Poulsen (1928) examined the contents of a few hundred stomachs taken from haddock captured in the Belt Sea and in the Western Baltic Sea with a Danish seine. He weighed the contents of each stomach and identified the food organisms present. The relative importance of the different food groups was determined on a basis of percentage weights, and from this he attempted to show why haddock in the Baltic Sea area have a faster rate of growth than do haddock in the North Sea.

Idelson (1929) studied the relation between the food of the haddock and the distribution of bottom animals in the Barents Sea. The stomachs were taken from haddock caught by steam trawler. His analyses were based on the frequency of occurrence in the stomachs of the more important food groups, with no regard to size or weight. The author found that the distribution and the nutrition of the haddock corresponds quite well with the distribution of the bottom animals.

Ritchie (1932) examined the stomachs of some hundreds of haddock taken on the Faeroe trawling grounds by steam trawlers. He found that the sand-eel (*Ammodytes tobianus* Linnaeus) was the most important food of the haddock. Ritchie stated that about one hundred and eighty-eight species of organisms had been identified as being food for haddock in European waters.

On the American side of the North Atlantic study of the food of fishes has, in general, been slow to develop. Atwood (1865) examined the stomach contents of a few dozen haddock caught off the Maine coast. He prepared a list of the different species of organisms found but gave no information as to the relative importance of the different types eaten. Baird (1886) summarized the work done on the food of fishes in the United States to 1878. A list of the different organisms found in haddock stomachs is given. Willis (1890) listed a number of mollusks taken from haddock stomachs. A report was published by Kendall (1898) on the food of fishes which gives a long list of organisms found in haddock stomachs. Clapp (1912) examined the contents from the stomachs of fifteen hundred haddock captured by a steam trawler on Georges Banks. He compared the species found in the stomachs with species obtained in dredge hauls made on the same ground at practically the same time. He found a marked degree of similarity between the species eaten by the haddock and those brought up by the dredge. This is in agreement with results obtained by Stevens (1930) in European waters.

Needler, (MS., 1928) and Vladykov (1932) examined the stomach contents of haddock captured at various points on the Atlantic coast of Nova Scotia. They determined the relative proportions of the many biological groups eaten by the haddock in this area.

MATERIAL AND METHODS

The present work is based on the examination of the stomach contents of more than fifteen thousand haddock. These fish were caught in the coastal waters of the Maritime Provinces and on the offshore Banks, lying mainly off Nova Scotia. The areas from which samples were obtained are shown in figure 1. Some of the material was collected during 1926 and 1927, but the largest portion of it was collected during the period from 1934 to 1937. Haddock samples from the coastal waters were captured by means of line trawls, hand-lines, trap-nets, and small seines. The haddock from the Banks areas were practically all caught by means of steam trawlers.

During 1926 and 1927 the contents of haddock stomachs and intestines were examined and the contents of representative stomachs and intestines were preserved in seven to eight per cent formalin for detailed examination at a later date. It was soon found that food organisms in the intestines were usually unrecognizable and so the examination of the contents of the intestines was discontinued, since it was believed that a more accurate picture could be obtained by doing so. In the case of the material collected during 1934 to 1937 the stomachs were removed from the haddock and preserved along with their contents in six to eight per cent formalin. For examination purposes the mass of food in each stomach was sorted out into the various biological groups and the species in each group were identified as closely as possible.

The various species in each stomach were counted and representative specimens were measured. The main groups of organisms were weighed. This method gave rather complete information. Mud, sand, and gravel commonly found in haddock stomachs has been included in the miscellaneous column in the tables.

RESULTS

In Table I are given the percentage food composition for haddock caught on the offshore banks and for haddock taken in the coastal areas. It can be seen from the table that there is a distinct difference in the types of food comprising the main proportions of the diet of the haddock on the offshore banks as contrasted with the coastal areas. We will, therefore, consider the two regions separately.

TABLE I

PERCENTAGE FOOD COMPOSITION OF HADDOCK CAPTURED ON WESTERN BANKS AND IN THE COASTAL AREAS

Group	Western Banks	Coastal Areas
Pisces	53.0	3.1
Annelida	11.2	3.0
Asteroidea	0.5	0.5
Ophiuroidea	1.6	41.8
Echinoidea	7.0	0.7
Holothuroidea	0.3	1.0
Amphipoda	4.3	3.5
Isopoda	0.2	0.2
Shizopoda	0.1	0.3
Cumacea	0.1	0.2
Decapoda	4.4	1.8
Amphineura	0.1	0.5
Gasteropoda	3.1	8.1
Pelecypoda	1.0	25.0
Tunicata	1.5	1.2
Miscellaneous	10.7	9.6

FOOD OF WESTERN BANKS HADDOCK

The stomach contents of more than ten thousand haddock were examined. Pisces constitute by far the most important item in the food of the Banks haddock. Still more striking is the fact that a single species, the sand-launce (*Ammodytes americanus* De Kay), makes up the fish diet. Other species of fish, five in all, were found in only twenty instances out of more than ten thousand examinations. Fifty-three per cent, by weight, of all the food eaten by Western Banks haddock consist of the sand-launce. This fish, sometimes called the sand-eel, is a slender little fish, its body about one-tenth as deep as the total length. The sand-launce has the custom of burying itself several inches deep in the sand, into which it burrows with considerable rapidity, thanks to its sharply pointed snout. The American sand-eel, along with its European counterpart (*Ammodytes tobianus* Linneaus), plays a very important role in the economy of northern seas as food for larger animals. In addition to being eaten by haddock, the sand-launce is relentlessly pursued by all kinds of fishes. According to Kyle (1926), the sand-launce is one of the most abundant of all fishes, not even the herring yielding larger numbers of young fry to the plankton nets.

The marine annelids are the next group in order of importance. They accounted for about eleven per cent of the food taken. The commonly occurring species were *Pectinaria granulata* (Linnaeus), small worms which form tubes of sand open at both ends, which can be carried about by them; the sea-mouse (*Aphrodita aculeata* Linnaeus); the green clam worm (*Nereis virens* Sars); and *Nephthys caeca* (Fabricius), sometimes called the "White-Cat" in England. These four species comprised the bulk of the annelids eaten. Other species were eaten more rarely.

The third group in order of importance are the echinoderms. They made up approximately nine per cent of the diet. The common sanddollar (*Echinarachnius parma* Lamarck), was the most important echinoderm from the haddock's point of view. Sea-urchins (*Strongylocentrotus drobachiensis*, O. F. Muller), were eaten in fair numbers, followed by brittle-stars (*Ophiopholus aculeata* Linnaeus), and a few *Ophiura robusta* (Ayers). Three species of asteroids and four species of holothuroids were eaten in very small numbers.

The echinoderms are closely followed by the crustaceans which occur to the extent of nine per cent of the food composition. Amphipods and decapods form about equal parts, by weight, of the crustaceans eaten by the haddock on the banks, comprising between them practically the total weight of all crustaceans found in the stomachs. The hermit-crabs (*Paguridae*) with their "houses" were the decapods most commonly eaten. Two species, *Pagarus acadianus* Benedict and *Pagarus Kroyeri* Stimpson, were found. The first named occurred in largest quantities. A third species was found on a few occasions. Other decapods commonly found were the rock crab (*Cancer irroratus* Say), the common shrimp (*Crago septemspinosus* Say), the deep-water prawns (*Pandulus propinquus* G. O. Sars and *Dichelopandulus leptoceros* Smith), the shallow water prawns *Spirontocaris pusiola* (Kroyer) and *Spirontocaris spina* (Sowerby), in the order given.

The pelagic shrimp (*Meganyctiphanes norvegica* M. Sars) which annually swarms at the surface of the Bay of Fundy in enormous numbers, was found in large numbers in the stomachs of haddock caught on Sable Island Bank in August, 1935.

The amphipods which normally occurred in the stomachs in large numbers were *Aeginia longicornis* (Krorey), *Themisto compressa* Goes *forma compressa* Goes, *Unciola irrorata* Say, *Monoculodes edwardsii* Holmes, *Tmetonx nobilis* (Stimpson), *Hyperia galba* (Montagu). *Leptocheirus pinguis* (Stimpson), *Syrrhoe crenulata* Goes, and *Ampelischa macrocephala* Lilljeborg.

The Mollusks are the least important of the main biological groups eaten by the banks haddock. Gasteropods comprise much the greater part by weight and by numbers of the mollusks eaten. The moon shell (*Polynices heros* Montfort), and the bubble-shell (*Haminea solitaria* Dall) were the two gasteropods eaten in largest numbers. Other gasteropods eaten in large quantities were the wavy top shells (*Margarita obscura* Gould and *M. cinerea* Couthuoy), a small, white tectibranchiate (*Cyclinchna alba* Stimpson), the trumpet shell (*Sipho pygamaeus* Couthuoy), the ladder shell (*Scala groenlandica* Chemnitz), and a spindle shell (*Bela cancellata* Stimpson). Among the pelecypods eaten by the banks haddock were the so-called deep-water clam (*Yoldia myalis* Gould), the chestnut shell (*Astarte elliptica* Brown), the thin nut shell (*Nucula tenuis* Mighels), the finely-grooved leda (*Leda tenuisulcata* Couthuoy), a cockle shell (*Cardium pinnatulum* Conrad), and the bank clam (*Glycimerus siliqua* Lamarck), in order of occurrence. Three species of chitons were found in the stomach contents occasionally.

Among the organisms classed under the miscellaneous column may be mentioned the tunicata (mostly *Pelonaia corrugata* Goodsir, and *Bostrichobranchus pilularis* Verrill), coelenterata (ctenophores, anthozoans, and fish eggs (chiefly eggs of *Clupea harengus* Linnaeus). All of the above were eaten in very small quantities except the fish eggs which may be eaten in large quantities at certain times of the year.

FOOD OF HADDOCK IN THE COASTAL AREAS

The stomach contents of almost six thousand haddock were examined. In strong contrast with the diet of banks haddock, pisces are of little importance in the diet of shore haddock. The only fish found in the stomachs were the elver stage of the eel (*Anguilla rostata* Le Suer), the herring (*Clupea harengus* Linnaeus), the silverside (*Menidia notata* Mitchill) and the sand-launce (*Ammodytes americanus* De Kay), and these were found only very occasionally.

The principal food of the inshore haddock was the echinoderm, *Ophiopholus aculeata* Linnaeus. This brittle-star made up ninety-five per cent, by weight, of all echinoderms eaten and it accounted for forty-four per cent, by weight, of all food taken by the inshore haddock. The sea-floor of the coastal area apparently swarms with brittle-stars which effect movement by means of muscular jerks of the arms, instead of by the slow protrusion and retraction of the tubefeet as is the case with the true starfish. Brittle-stars are the most active of all echinoderms. Several other species of echinoderms were eaten in small quantities: among them were the sea-cucumbers, *Thyone briareus* (Le Seur) and *Cucumaria calcigera* (Blainville).

Mollusks, the least important major food group in the diet of Banks haddock, is the second most important group in the diet of the shore haddock, amounting to thirty-four per cent of the total weight of food eaten. Echinoderms and mollusks together account for seventy-eight per cent of the food of inshore fish. A feature of the mollusk diet is that whereas the banks haddock ate more gasteropods, the inshore haddock mostly ate pelecypods. The so-called deep-water clam (*Yoldia myalis* Couthuoy), forms by far the largest portion of the molluscan diet. Also eaten in considerable numbers were the finely-grooved leda (*Leda tenuisulcata* Couthuoy), a cockle shell (*Cardium pinnatulum* Conrad), the chestnut shell (*Astarte elliptica* Brown), the thin nut shell (*Nucula tenuis* Mighels), the little macoma (*Macoma balthica* Linnaeus), and *Macoma calcarea* Gmelin, and the small file yoldia (*Yoldia sapotilla* Gould), given in order of importance as food organisms. Gasteropods usually found in the stomachs of shore haddock were the moon shell (*Polynices heros* Montfort), the wavy top shell (*Margarita obscura* Gould), the tower shells (*Turritela erosa* Couthuoy and *Turritela acicula* Stimpson), the dog whelk (*Nassa trivitta* Say), and the spindle shell (*Bela cancellata* Stimpson).

Crustaceans provided about six per cent of the diet of inshore haddock. Amphipods made up most of the weight of crustaceans eaten. The most commonly occurring species were *Leptocheirus pinguis* (Stimpson), *Hyperia galba* (Montagu), *Ampelischa macrocephala* Lilljeborg, and *Unciola irrorata*

TABLE II

Representation of the Main Groups of Food Organisms in Percentage, by Weight, of Haddock Captured at Various Places on the Western Banks

Group	Locality															
	Emerald Bank	North of Emerald Bank	N. W. of Emerald Bank	West of Emerald Bank	Gully	N. W. Sable Island Bank	West Sable Island Bank	S. W. Sable Island Bank	North of Sable Island	South of Sable Island	Between Sable Island and Middle Ground	Middle Ground Bank	West of Middle Ground	South of Middle Ground	Banquereau	Between Banquereau and Sable Island Bank
Number of Stomachs Examined...	1716	501	968	990	610	297	355	340	622	605	514	314	1160	923	668	195
Pisces	100	...	24	92	18	18	71	37	10	19	15	66	30	86	7	46
Annelida	....	20	24	...	15	4	10	15	40	23	14	2	18	2	49	14
Asteroidea	....	...	...	...	1	1	1	2	1	...	1	...	...	...	...	...
Ophiuroidea	....	20	2	8	20	6	...	...	1	2	5	6	4	...	1	4
Echinoidea	....	...	...	...	3	37	2	6	10	7	19	11	5	1	3	...
Holothuroidea	....	...	...	...	...	...	...	4	2	...	1	1	2	...	...	...
Amphipoda	....	...	5	...	16	3	6	3	6	3	10	1	2	3	8	3
Decapoda	....	...	5	...	6	15	2	4	6	15	11	4	3	1	8	6
Gasterpoda	....	21	7	...	5	2	3	12	8	11	2	1	...	...	6	7
Pelecypoda	....	14	14	...	2	1	1	5	2	8	4	1	1	1	7	10
Tunicata	....	3	...	...	6	1	...	...	1	19	5	...	...	...	...	...
Miscellaneous	....	22	19	...	8	12	4	12	13	12	13	7	36	6	11	10

Say, in the order given. Shrimps and prawns are eaten in relatively small quantities. The commonest ones found were the shrimp (*Crago septemspinosus* Say), the shallow-water prawns (*Spirontocaris pusiola* Kroyer and *Sclerocrangon boreas* Phipps). The hermit crabs (*Pagurus acadianus* Benedict and *Pagurus Kroyer* Stimpson) were found occasionally in the stomachs. The pelagic shrimp (*Meganyctiphanes norvegica* Sars) was found in large quantities in stomachs from haddock caught in Passamaquoddy Bay.

GEOGRAPHICAL VARIATION

In table II is given a representation of the chief food groups of food organisms eaten by haddock captured by steam trawlers on the various fishing grounds which make up the very large area known as the Western Banks.

Emerald Bank. The stomachs of one thousand, seven hundred and sixteen haddock were examined. The sand-launce was the only food found. Tremendous numbers of this fish were frequently found to have been eaten by the haddock. On one occasion a stomach contained forty-three specimens, ranging in length from twenty-five to one hundred millimeters, and weighing one hundred and seventy-two grams.

North of Emerald Bank. Five hundred and one stomachs were examined. The haddock had eaten a considerable variety of organisms. Mollusks (gasteropods and pelecypods) made up the biggest portion of the food, but annelids and ophiurids had been eaten in large quantities. Not a single sand-launce was found.

North-West of Emerald Bank. Stomachs from a total of nine hundred and sixty-eight haddock were examined. The sand-launce and annelids were the most important items in the food composition, comprising between them about one-half the total amount of food eaten. A variety of other biological groups made up the remainder.

West of Emerald Bank. A total of nine hundred and ninety stomachs were examined from this area. The sand-launce accounted for more than nine-tenths of the food eaten. Ophiurans constituted the remainder.

Gully. This fishing ground lies between Emerald Bank and Sable Island Bank. The stomachs were removed from six hundred and ten haddock and examined. Ophiurans, the sand-launce, amphipods, and annelids made up about seventy per cent of the food composition. The remainder of the food included representatives of a large number of biological groups.

North-west of Sable Island Bank. Stomachs from two hundred and ninety-seven haddock were examined. These haddock had been feeding chiefly on echinoids. The sand-launce and decapods (hermit crabs) formed the greater part of the remainder of the food.

West Sable Island Bank. Three hundred and fifty-five stomachs were examined. Seventy per cent of the food of the haddock in this area consisted of sand-launces. A large number of other biological groups made up the remainder.

South-west Sable Island Bank. Three hundred and forty stomachs were examined. The sand-launce, mollusks, and annelids were the chief food supply of haddock in this area.

North of Sable Island. A total of six hundred and twenty-two stomachs were examined. The haddock in this area had been feeding mainly on annelids. The sand-launce and echinoids were the next most important biological groups in the food composition. Many other groups were represented in small amounts.

South of Sable Island. The stomachs from six hundred and five haddock were examined. These haddock, as was the case with those taken on the north side of the island, had been feeding on a wide variety of organisms. Annelids, tunicates, sand-launces, mollusks, and decapods were the main groups present in the food composition. This was the only area where tunicates formed a large portion of the food eaten.

Between Sable Island Bank and Middle Ground Bank. This is an area somewhat similar in physical features to the Gully between Emerald Bank and Sable Island Bank. The stomachs from five hundred and fourteen haddock were examined. These haddock had been feeding on a large variety of organisms, such as echinoids, sand-launces, annelids, amphipods, decapods, and many others.

Middle Ground Bank. A total of three hundred and fourteen stomachs were examined. Sand-launces comprised two-thirds of all the food present. The remainder included a large variety of organisms in relatively small quantities.

West of Middle Ground. One thousand, one hundred and sixty stomachs were examined. Sand-launces and annelids were the chief food found. Large quantities of sand were present in many stomachs.

South of Middle Ground. Nine hundred and twenty-three stomachs were examined. These haddock were feeding almost exclusively upon sand-launces.

Banquereau. Six hundred and sixty-eight stomachs were examined. Annelids formed the most important item in the diet. Other food groups were represented in small amounts.

Between Banquereau and Sable Island Bank. A gully-like area. One hundred and ninety-five stomachs were examined. Sand-launces and annelids accounted for sixty per cent of the total food present in the stomachs. The bulk of the remainder consisted of mollusks and crustaceans.

A very brief summary of the above shows that the sand-launce was by far the most important item of food to the haddock on Emerald Bank, on the extensive fishing grounds west of Emerald Bank, on Middle Ground and south and west of Middle Ground, on the western portions or Sable Island Bank, and in the area between Sable Island Bank and Banquereau. Haddock captured on the south and north sides of Sable Island had been feeding on a wide variety or organisms, consisting mainly of annelids, gasteropods, tunicates, and echinoids. Annelids were the most important food of haddock taken on fishing grounds north-west of Emerald Bank and on Banquereau. Haddock taken on fishing grounds between Sable Island Bank and Middle Ground and on the north-west part of Sable Island Bank ("Cow-Pen") had been feeding on large quantities of echinoids. Crustaceans and ophiurans were the most important food items to haddock caught in the "Gully." North of Emerald Bank there is an area where the haddock had been feeding mainly on mollusks.

In table III is given a representation of the chief groups of food organisms eaten by haddock at various fishing localities along the coastline of the Maritime Provinces.

Passamaquoddy Bay, N. B. The stomachs of seven hundred and forty-nine haddock were examined. Mollusks accounted for seventy-one per cent of the food present. Most of the haddock had been feeding on the deep-water clam (*Yoldia myalis* Couthuoy). Sixty-one per cent of all the food eaten consisted of this clam. As an illustration of the enormous quantities eaten, one sample of seventy-two stomachs contained approximately fourteen thousand specimens of this species which ranged in length from five to twenty-seven millimetres, and weighed about one thousand, five hundred grams. Ophiurans and shizopods made up most of the remainder of the food.

Digby, N. S. Three hundred and fifty-eight stomachs from haddock caught on line trawl were examined. These haddock had been feeding mostly on crustaceans (amphipods and decapods) and to a lesser extent on pelecypods and holo-

TABLE III

Representation of the Main Groups of Food Organisms in Percentage, by Weight, of Haddock Captured on Various Fishing Grounds Along the Coast of the Maritime Provinces

Group	Passamaquoddy Bay, N. B.	Digby, N. S.	Yarmouth, N. S.	Lockeport, N. S.	Roseway Bank	Lunenburg, N. S.	St. Margaret Bay, N. S.	Halifax Harbour	Liscomb, N. S.	Canso, N. S.	Canso Bank	Queensport, N. S.	Petit de Grat, C. B.	Ingonish, C. B.	Port Hood, C. B.	East Point, P. E. I.	North Rustico, P. E. I.	North Point, P. E. I.
Number of Stomachs Examined	749	358	108	200	108	73	715	420	36	131	73	164	258	1508	496	236	80	200
Pisces	...	1	...	...	...	...	24	...	...	...	...	...	...	4	...	...	...	...
Annelida	1	3	...	2	...	...	1	6	3	11	6	1	1	5	27	12	13	14
Echinoidea	...	...	...	...	...	...	...	...	...	...	...	...	...	30	...	...	...	...
Ophiuroidea	14	2	92	93	99	100	67	64	85	84	86	95	80	...	9	68	75	2
Holothuroidea	...	18	4	...	1	...	1	2	...	...	...	...	...	...	...	...	...	41
Pelecypoda	61	20	4	3	...	...	1	8	...	2	4	1	2	...	15	7	9	12
Gasteropoda	10	2	...	1	...	...	1	2	1	...	...	1	...	...	19	...	1	...
Amphipoda	...	28	...	1	...	...	1	1	...	...	...	1	3	29	18	1	1	4
Shizopoda	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Decapoda	1	16	...	...	...	...	1	...	...	1	3	...	...	11	3	6	...	...
Tunicata	...	...	...	...	...	...	...	2	1	...	...	...	...	...	...	...	...	...
Miscellaneous	5	10	...	...	...	...	3	15	9	2	1	1	14	21	9	6	1	26

thurians. A few stomachs contained large quantities of mud and one or two small stones.

Yarmouth, N. S. One hundred and eight stomachs from haddock caught on line trawl were examined. More than ninety per cent of the food consisted of ophiurans (brittle stars).

Lockeport, N. S. Approximately two hundred stomachs from haddock caught on line trawl were examined. Brittle stars composed more than ninety per cent of the total weight of food found in the stomachs.

Roseway Bank (off Lockeport, N. S.) One hundred and eight stomachs taken from haddock caught on line trawl were examined. Practically the entire stomach contents consisted of brittle stars..

Lunenburg, N. S. Seventy-three stomachs from haddock caught on line trawl were examined. The entire stomach contents consisted of brittle stars.

St. Margaret Bay, N. S. A total of seven hundred and fifteen stomachs were examined. Five hundred and ten of these were taken from haddock caught in trap-nets and two hundred and five were caught on hook and line. Brittle stars were the most important item of food, accounting for sixty-seven per cent of the total food present. The remainder consisted of pisces (*Clupea harengus* Linnaeus), mollusks, crustaceans, and annelids.

Halifax, N. S. Four hundred and twenty stomachs taken from haddock caught on line trawl and on hook and line were examined. Brittle stars were the most important item of food, amounting to sixty-four per cent of the total. The remainder consisted of mollusks, crustaceans, annelids, and tunicates.

Liscomb, N. S. The stomachs of thirty-seven haddock caught on line trawl were examined. More than eighty per cent of the food consisted of brittle stars. Annelids, gasteropods and tunicates were eaten in small quantities.

Canso, N. S. One hundred and thirty-one stomachs from haddock caught on line trawl were examined. Brittle stars amounted to more than eighty per cent of the food. The remainder was mostly made up of annelids.

Canso Bank. Seventy-three stomachs from haddock caught on line trawl were examined. Eighty-six per cent of the food present consisted of brittle stars. The remainder consisted largely of annelids and pelecypods.

Queensport, N. S. One hundred and sixty-four stomachs taken from haddock caught on line trawl were examined. Ninety-five per cent of the entire contents were brittle stars.

Petit de Grat, C. B. Two hundred and fifty-eight stomachs taken from haddock caught on line trawl were examined. Brittle stars accounted for eighty per cent of the food present. Mollusks and crustaceans were present in small amounts. A few stomachs were filled with gravel.

Ingonish, C. B. Stomachs taken from more than one thousand, five hundred haddock caught in trap-nets were examined. These fish might have been kept for several hours before being removed from the trap. Approximately sixty-five per cent of all stomachs examined were empty. Of the stomachs which contained food, the majority showed that the haddock had fed mostly on sand-dollars and amphipods. Quite a number were gorged with eggs (haddock eggs?). A few decapods and annelids were also found. Early in the trapping season elvers (*anguilla rostata* LeSeur) of the "glass-eel" stage were common in the stomachs.

Port Hood, C. B. Almost five hundred stomachs taken from haddock caught on handlines and line trawls were examined. Annelids were the chief food eaten (about one-third of the stomach contents by weight). There were many sea-mice (*Aphrodita aculeata* Linnaeus) up to three inches in length. Pelecypods and gasteropods were fairly well represented. Amphipods and ophiurans were present in small quantities. Many small pieces of coal were also found.

East Point, P. E. I. Two hundred and thirty-six stomachs taken from haddock caught on handlines and line trawls were examined. Almost seventy per cent of the food present consisted of brittle stars. The remainder was largely made up of annelids. Gasteropods and amphipods occurred in small quantities.

North Rustico, P. E. I. Eighty stomachs taken from haddock caught on handlines and line trawls were examined. Ophiurans made up seventy-five per cent of the food present. Most of the remainder consisted of annelids. A few pelecypods, gasteropods, and amphipods were found.

North Point, P. E. I. Stomachs from two hundred haddock were examined. Holothurians made up forty per cent of the food. Annelids and gasteropods made up most of the remainder. A few amphipods and ophiurans were found.

SEASONAL VARIATION IN THE KIND OF FOOD TAKEN

Although samples of haddock stomachs were collected extensively over a period of twenty consecutive months from the Western Banks areas, it is hardly possible to draw other than very general observations regarding a change of food with a change of season, due to the irregular method by which the samples were gathered. This irregularity was unavoidable since the supply of material for examination was limited to what could be obtained from three trawlers. The trawlers rarely fished in the same area consecutively. Therefore, systematic collecting of samples from a restricted area over a period of time was impossible. Furthermore, such a study should be correlated with quantitive studies of the bottom fauna to yield best results.

TABLE IV

SEASONAL VARIATION OF IMPORTANT GROUPS OF FOOD ORGANISMS IN PERCENTAGES, BY WEIGHT, FOUND IN WESTERN BANKS HADDOCK BETWEEN AUGUST, 1934, AND JULY, 1935

Group	January	February	March	April	May	June	July	August	September	October	November	December
Number of Stomachs Examined	274	597	467	811	345	665	383	449	390	367	322	288
Pisces	4	...	3	20	32	13	92	49	73	57	26	7
Annelids	29	31	32	20	18	12	2	21	10	9	11	17
Echinoderms	3	12	24	8	7	31	1	7	1	12	7	9
Crustaceans	34	5	4	11	4	8	3	13	13	10	15	23
Mollusks	10	12	14	5	2	4	1	...	2	1	20	20
Fish Eggs	...	...	...	5	5	16	1	...	...	...	...	...
Miscellaneous	20	40	23	30	31	16	...	10	1	11	21	14

A study of table IV will indicate a few very general observations on the seasonal occurrence of the chief groups which make up the bulk of the organisms eaten by the Western Banks haddock. The quantity of *Ammodytes americanus* DeKay found in the stomach contents varies widely, from being completely absent to composing ninety-two per cent of the total food taken at different times of the year. In September of 1934 and of 1935 this fish amounted to fifty-seven and seventy-three per cent, respectively, of the total weight of food eaten. In October 1935, the amount was fifty-seven per cent of the food eaten. In December 1935, the amount was eighty-two per cent and in January 1936, the amount was sixty-six per cent of the food consumed.

In general, it may be said that the sand-launce is an important article of food for the haddock during the summer, fall, and early winter months. Marine annelids are a fairly steady part of the diet throughout the winter.

Fish eggs constitute a negligable portion of the food of the haddock on the Western Banks. They are found in the stomach contents during the spring and early summer months.

The echinoderms are eaten in largest quantities shortly before the haddock commence to spawn (February-March), and immediately afterwards (June and August). Echinoderms made up sixteen per cent of the total stomach contents in February, 1935, and twenty per cent in March, 1935. In February, 1936, they made up twenty-nine per cent of the food eaten. The largest amounts of echinoderms eaten during any one period was in June, 1935, when they comprised thirty-one per cent of the total weight of food found in the stomachs.

The crustaceans are eaten in largest amounts by haddock during the winter months. The greatest quantities were consumed in December, 1934, (18 per cent of the total food consumption), in January, 1935, (23 per cent), and in February, 1936, (34 per cent).

Mollusks are eaten in largest quantities during the late fall and winter months. In November and December of 1934, and in November of 1935 they accounted for twenty per cent, sixteen per cent, and twenty per cent, respectively, of the total stomach contents. They were also eaten in considerable quantities during January, February, and March.

Generally speaking, the inshore collections of haddock stomachs were only made during the summer and fall months, coinciding with the period when the commercial inshore haddock fishery is carried on. Consequently, no concrete conclusions as to seasonal variation can be made. However, in

TABLE V

Seasonal Variation of Important Food Groups in Percentages, by Weight, for a Single Locality, Passamaquoddy Bay, N. B.

Group	June, 1936	July	August	September	October	November	January 1937	March
Number of Stomachs Examined	72	104	81	79	91	131	123	68
Pisces	..	2	2	..	1	...	...	..
Annelids	..	...	..	..	..	25	...	..
Echinoderms	30	30	20	10	..	13	100	95
Crustaceans	..	7	68	21	2	23	...	4
Mollusks	64	61	..	61	66	26	...	..
Miscellaneous	6	...	10	8	31	13	...	1

Passamaquoddy Bay, an attempt was made, not entirely successful, to collect monthly samples of haddock stomachs. These monthly catches were all made in the same locality. These results show that haddock in Passamaquoddy Bay do appear to have a seasonal variation in their diet. Table V shows that in June and July, 1936, haddock had been feeding mainly on mollusks (all *Yoldia*) and to a much lesser extent on echinoderms (all *Ophiopholis*). In August, the food taken was chiefly crustaceans (*Meganyctiphanes*). Great numbers of these euphausiids were swarming in the bay during this time. No *Yoldia* were found and only small numbers of *Ophiopholis*. In September, the main part of the diet was *Yoldia*. Small quantities of *Meganyctiphanes* and *Ophiopholis* were also found. In October, the haddock were feeding mainly on *Yoldia*. November samples showed that the diet consisted of mollusks (*Yoldia*), annelids, for the first time, crustaceans, and echinoderms, in the order given. In January, all stomachs with food contained only *Ophiopholis*. In March, the food was practically all *Ophiopholis*. To summarize briefly, the haddock in Passamaquoddy Bay appear to feed chiefly on *Yoldia* during the summer and fall months, with the exception of August when the staple diet is forsaken for the pelagic shrimps which swarm in the bay at that time. The diet was apparently almost exclusively restricted to brittle stars during the winter and spring months.

RELATION BETWEEN FEEDING AND SPAWNING

The very close relationship between feeding and spawning has been described in detail by one of the authors in a paper submitted for publication elsewhere. The facts advanced make it reasonably certain that haddock cease to take food just previous to spawning. These haddock continue to fast throughout the spawning period. Following the completion of spawning a short time elapses while the haddock is in the spent condition, before it regains its appetite. Once the appetite is regained, feeding is carried on very vigorously in order to regain lost strength and weight.

FOOD OF SMALL HADDOCK

Knowledge of the feeding habits of the very small haddock is practically non-existent. Investigators everywhere have been handicapped by the great difficulty experienced in obtaining small haddock. In table VI are given some data on the type of food eaten by the smaller-sized haddock in our waters. Two very small haddock obtained near Shelburne, N. S., had their tiny stomachs filled with cumaceans. A number of small haddock caught at Hubbards, N. S., had been feeding chiefly on the glass-shrimp and to a much lesser extent on tiny mollusks. A fairly large sample of small haddock obtained

TABLE VI

Representation of Food Organisms in Percentage, by Weight, of Small Haddock

Group	Locality					
	Shelburne	Hubbards	Georges Banks	Halifax Harbour	Halifax Harbour	Sable Island Banks
Number of Stomachs Examined	2	22	179	49	289	192
Pisces	...	...	...	...	...	1
Annelida	...	...	...	...	7	5
Echinoderms	...	...	...	...	46	18
Crustaceans	100	70	...	90	...	70
Mollusks	...	20	100	10	31	2
Miscellaneous	...	10	...	...	16	4
Size of Haddock in cms.	5-10	10-30	10-30	20-30	23-38	24-40

from George's Banks through the kindness of W. C. Herrington, United States Bureau of Fisheries, had their stomachs crammed exclusively with a shell-less gasterropod (*Aeolis papillosa* Linnaeus). A sample of small haddock taken from Halifax Harbour were feeding almost entirely on small crustaceans. A second sample of slightly larger haddock from the same area had been feeding mainly on echinoderms, and to a lesser extent on mollusks and annelids. Samples obtained from Sable Island Banks (including some fish up to 40 cm.) were feeding on crustaceans (shrimps and crabs) and echinoderms (mostly small sanddollars).

From the above meagre data it may be suggested that the very young fish feed chiefly on small free-swimming crustaceans and nudibranch mollusks, such as cumaceans and *Aeolis papillosa* (Linnaeus). As the haddock advances in age and increases in size it turns to more sedentary forms such as brittle stars, gasteropods, pelecypods, etc.

SIZE OF FOOD ORGANISMS

The size of the food organisms is relatively small. Sand-launce up to 250 millimetres have been found in very large haddock, but these were only rarely found. The average length of sand-launces was much less. Annelids longer than 200 millimetres were never found, the majority being less than 150 millimetres. Mollusks with shells over 25 millimetres in the greatest diameter were rare and found only in very large haddock. The largest mollusks found, were a bank clam (*Glycimeris siliqua* Lamarck) meauring 56 millimetres in length and a small squid (*Illex illecebrosus* LeSeur) which was 75 millimetres in length (without tentacles). Ophiurans had a maximum diameter of 20 millimetres for the central disc. Echinoids over 25 millimetres in diameter were rare. Only a few holothurians with a length as great as 75 millimetres were found. Decapods were found with carapaces usually not more than 40 millimetres in length. These instances will serve to give some idea of the maximum sizes of the food organisms found in haddock stomachs. Exceptions occur, as for example, the presence of a herring 300 millimetres in length in the stomach of a large haddock caught in St. Margaret Bay; but such cases are rare. The small size of the food organisms is striking when compared with those of cod of similar lengths and comparable size.

POSITION OF FOOD ORGANISMS

The food of haddock indicates that they are very strictly bottom feeders. All the important food organisms are found on the bottom, most of them on the bottom only, and many buried beneath the surface of the bottom. It is evident that to obtain much of their food haddock root (grub) around in the bottom somewhat in the manner of a pig. This is borne out by the frequent presence of considerable amounts of mud, gravel, and sand in their stomachs.

MOBILITY OF FOOD ORGANISMS

The majority of the organisms found in haddock stomachs are slow-moving. This is very definite. The preponderance of echinoderms, mollusks and annelids is in keeping with this fact. The relatively fast-swimming sand-launce is caught while burrowing in the sand. Of the crustaceans, amphipods and crabs are by far the most common. Fish, other than the sand-launce are unimportant components of the food. Certain swift moving crustaceans are sometimes found in the diet in considerable quantities, but this is not a general rule.

FEEDING HABITS SHOWN BY THE FISHERY

Haddock are caught readily with a variety of baits including herring, mackerel, squid, and clams (*mya arenaria* Linnaeus). The first three are cut into pieces which are placed on the hooks; the latter are used whole, but shelled. None of these occur to any considerable extent in the natural food of the haddock. They are, however, taken readily when made available by killing and cutting into pieces on the one hand and by digging and shelling on the other.

Fishing experience confirms the opinion that haddock feed only very close to the bottom. Fishermen agree that they will not follow bait close to the surface nearly as readily as cod will during hand-lining. Relatively more haddock are caught on line trawls than on handlines. The former are set right on the bottom, whereas handlines are often, if not generally, used in such a manner that the baited hooks are several feet from the bottom. On rare occasions haddock have been reported feeding near the surface. This is commonly reported for cod.

INDIVIDUAL VARIATIONS IN THE STOMACH CONTENTS OF HADDOCK AND POSSIBLE DISCRIMINATION AND EXERCISE OF CHOICE

At certain times and places there is a considerable amount of variotion between the stomach contents of individual haddock. The following facts, however, indicate that individual choice and discrimination on the part of the haddock is unimportant and that the variations in the food are determined chiefly by the nature of the food organisms available.

The different groups of organisms found in individual stomachs are such as would naturally occur close together in similar situations. Variations in the nature of the bottom would explain much of the individual variation in the food.

Entirely different groups of organisms are somtimes found in the stomach and in the intestine. This corroborates the suggestion that the nature of the bottom causes the variations in food, not individual choice. Instances of this kind indicate movement from one sort of bottom to another.

When stomachs are full, a large variety of organisms is usually present, or all haddock caught together have similar food. It is chiefly among stomachs containing small amounts of food that the individual variations are noticeable.

Many of the food organisms are likely to occur in considerable numbers close to one another and, supposing haddock to feed indiscriminately on all food of convenient size available, it would often happen that many organisms of one kind were taken together. This would give an erroneous appearance of selection on the part of the haddock.

The fact that herring, mackerel, squid, and clams, which do not occur in the natural food, are taken readily as bait, indicates that ease of capture is the deciding factor in these cases. A similar instance is the frequent occurrence of mackerel entrails in the food at Ingonish when these were made available, by the rotting of gilled mackerel.

THE FORM OF THE MOUTH AS A FACTOR IN DETERMINING THE NATURE OF THE FOOD

We have seen that haddock food is limited to rather small slow-moving animals found close to or burrowing in the bottom, but that within these limits a great variety of forms are eaten and feeding appears to be indiscriminate. Cod and hake taken on the same trawls eat larger and more quickly moving animals—even considering only fish of comparable size.

The nature of the mouths of these three species is significant. The mouths of hake and cod are much larger than those of haddock and practically if not absolutely terminal. They are provided with sharp teeth and all the mouth parts are strong. Haddock, on the other hand, have small mouths placed ventrally to quite a degree. Their mouth parts are soft and teeth ordinarily dull. They are, however, provided with better developed muscular lips. Cod and hake are well provided for the capture of large or fast-moving objects. But haddock with their smaller ventrally placed mouths are ill fitted for capturing moving objects or ingesting large ones and are best fitted for picking small animals off or out of the bottom, in which process the position of the mouth and the somewhat prehensive lips are useful. In addition, the heaviest built portion of the haddock is the anterior part of the body and it may be that this helps them to remain more easily in a forwardly tilted position while feeding.

LIST OF FOOD ORGANISMS

Two hundred and eighteen different food organisms have been taken from haddock stomachs examined by the authors.

A list of these is given in the Appendix, along with information as to the quantity in which each food organism occurred in the diet.

The authors are responsible for some of the identifications, particularly the mollusks and pisces. However, we are indebted to the following members of the United States National Museum: Mr. J. O. Maloney, Dr. Mary J. Rathbun, Dr. Waldo L. Schmitt, and Mr. C. R. Shoemaker, and to Dr. Aaron L. Treadwell of Vassar College, for the identification of the majority of the organisms and the checking of others.

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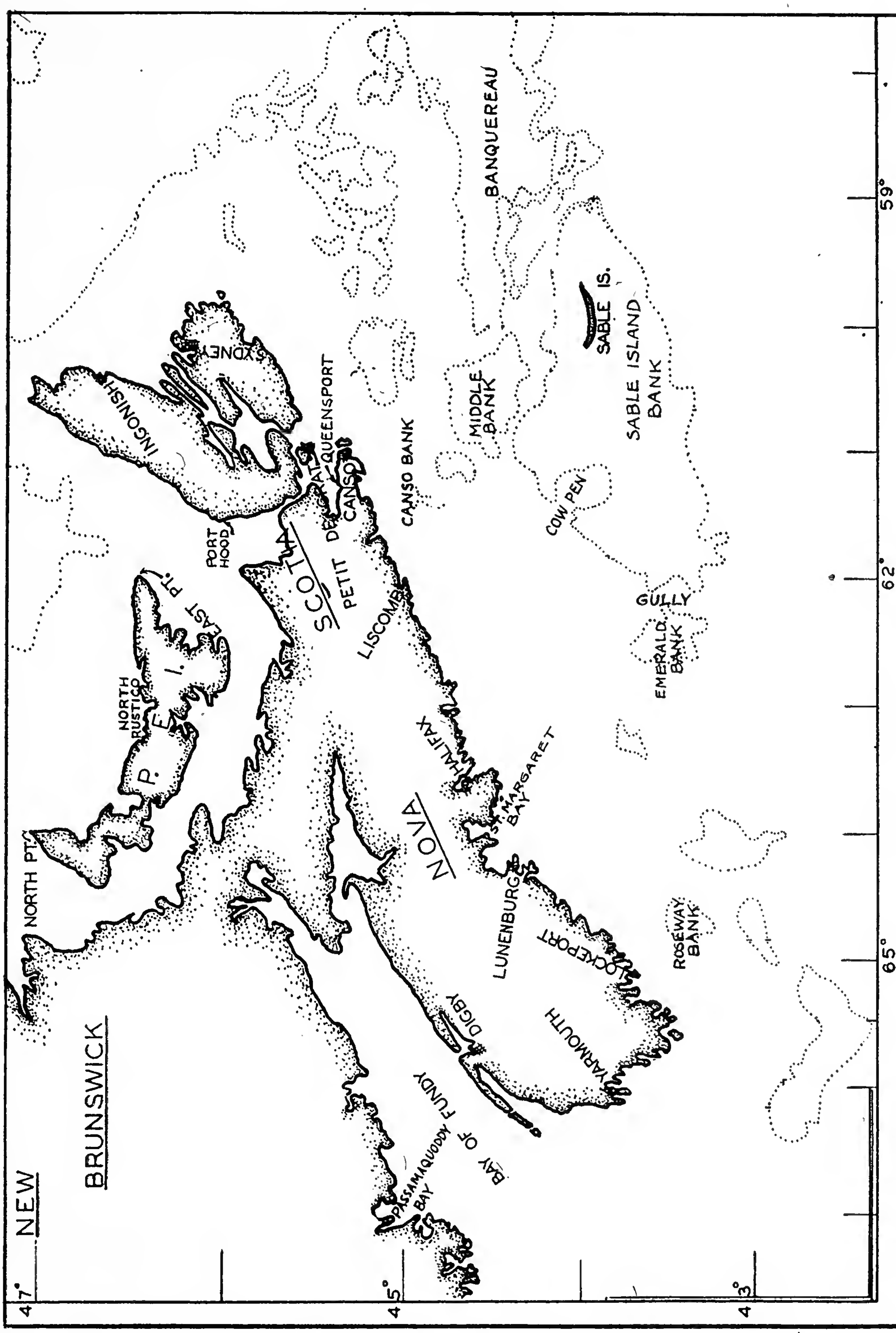

Fig. 1. Map showing banks and inshore localities from which samples of haddock stomachs were obtained.

LIST OF THE FOODS ORGANISMS TAKEN FROM HADDOCK STOMACHS AND THEIR RELATIVE OCCURENCE THEREIN

S—scarce, O—occasional, M—many, A—abundant

COELENTERATA

S Ctenophores sp. ?
O Epizoanthus americanus Verrill
S Metridium dianthus (Ellis)
S Pelagia noctulica

BRACHIOPODA

S Terebratulina septentrionalis Couthuoy

ANNELIDA

S Ammotrypane fimbriata Verrill
S Anaitides sp.?
S Amphitrite ornata Verrill
M Aphrodita aculeata L.
S Brada sp.?
S Echiurus sp.?
S Eunice oerstedii Stimp.
S Glycera sp.?
S Goniada maculata Oersted
S Hemipodia canadensis new sp.
S Hyalinoecia sp.?
S Leodice sp.?
S Lepidonotus squamatus L.
S Lumbrinereis hebes Verrill
S Maldane sp?
S Myxicola (probably steenstrupi)
M Nereis virens Sars
M Nephthys caeca (Fabricius)
S Onuphis sp.?
A Pectinaria granulata L.
S Pectinaria hyperborea Malmgen
S Phyllodoce catenula Verrill
S Phyllochaetopterus sp.?
S Sabellaria sp.?
S Sternaspis fossor Stimpson
S Terebellides sp.?

CRUSTACEA

Amphipoda

A Aeginia longicornis (Kroyer)
S Ampelisca eschrichtii Kroyer
A Ampelisca macrocephala Lillj.
O Anonyx nugax (Phipps)
S Amphithoe rubricata (Montagu)
S Apherusca megalops (Bucholz)
S Bathyporeia norvegica G. O. Sars
S Byblis affinus G. O. Sars
S Casco biglowi (Blake)
S Calliopius sp.?
S Corophium sp.?
S Dulichia sp.?
S Ericthonius hunteri Bate
S Eurystheus sp.?
S Eusirus cuspidatus Kroyer
S Haploops tubicola Lillj.
S Harpinia propinqua G. O. Sars
O Hippomedon serratus (Holmes)
A Hyperia galba (Montagu)
S Hyperia medusarum Mueller
O Hyperoche medusarum (Kroyer)
S Ischyrocerus sp.?
A Leptocheirus pinguis (Stimpson)
S Maera danae (Stimpson)
O Maera loveni (Bruzeelius)
O Melita dentata (Kroyer)
S Metopa sp.?

S Monoculodes borealis (Boeck)
A Monoculodes edwardsii Holmes
S Monoculodes latimanus (Goes)
S Monoculodes tesselatus Schneider
S Monoculodes tubercolatis (Boeck)
O Neohela monstrosa (Boeck)
S Neopleustes pulchella (Kroyer)
S Orchomenella minuta (Kroyer)
S Orchomenella pinguis (Boeck)
S Paramphithoe hystix (J. C. Ross)
S Pardalischa cuspidata Kroyer
S Paroediceros lynceus (M. Sars)
S Phoxocephalus holbolli (Kroyer)
S Pontopareia femorata (Kroyer)
S Pleustes panoplus (Kroyer)
S Priscillina armata (Boeck)
S Protemedia sp.?
S Rhachotropis aculeata (Lepechin)
S Rhachotropis oculata (Hansen)
S Stegocephalis inflatus (Kroyer)
S Stenopleustes glaber (Boeck)
M Syrroe crenulata Goes
A Themisto compressa Goes forma compressa Goes
S Tiron acanthurus Lillj.
A Tmetonyx nobilis (Stimpson)
A Unciola irrorata Say
S Westwoodilla brevicalcar (Goes)
S Westwoodilla caecula (Bate)
S Westwoodilla megalops (G. O. Sars)

Cumace

S Diastylis rathkii (Kroyer)
M Diastylis quadrispina (G. O. Sars)

Shizopoda

S Erythrops erythrophthalma (Goes)
M Meganyctiphanes norvegica M. Sars
S Thysanoessa inermis (Kroyer)

Isopoda

S Aega psora (L.)
S Calathura branchiata (Stimpson)
O Chiridotea tuftsii (Stimpson)
S Cirolana polita (Stimpson)
O Edotea montosa (Stimpson)
S Phryxus abdominalis (Kroyer)

Decapoda

S Axius serratus (Stimpson)
A Cancer irroratus Say
M Crago septemspinosus Say
O Dichelopandulus leptocerus (Smith)
S Homarus americanus (Milne-Edwards)
O Hyas coarctatus Leach
S Lithodes maia (L.)
S Megalops sp.?
S Nectocrangon dentatus (M. Sars)
M Pagurus acadianus Benedict
O Pagurus Kroyeri Stimpson
S Pagurus pubescens Kroyer
M Pandulus propinquus G. O. Sars
S Pandulus montagui Leach
S Planes minutus (L.)
S Pontophilus norvegicus (. (M. Sars)
S Sabinea septemcarinata (Sabine)
S Sclerocrangon boreas (Phipps)
S Spirontocaris fabricii (Kroyer)
S Spirontocaris gaimardii (Milne-Edwards)

S Spirontocaris groenlandica (Fabricius)
S Spirontocaris polaris Sabine
A Spirontocaris pusiola (Kroyer)
O Spirontocaris spina (Sowerby)

PANTOPODA

S Nymphon grossipes (Fabricius)

MOLLUSCA

AMPHINEURA

S Hanleyia mendicaria Mighels
S Tonicella marmorea (Fabricius)
S Trachydermon albus (L.)

GASTEROPODA

S Admete couthuoyi Jay
O Aeolis papillosa (L.)
S Bela bicarinata Stimpson
M Bela cancellata Stimpson
S Bela incisula Verrill
S Bela turricola Stimpson
O Buccinum undatum (L.)
S Crucibulum striatum Stimpson
M Cyclichna alba Stimpson
S Eupleura caudata Verrill
S Fasciolaria ligata Mighels
S Fusus ventricosus Gray
A Haminea solitaria Dall
S Lacuna vincta Turton
S Lamellaria perspicua (Stimpson)
S Lepeta caeca (Mueller)
S Littorina rudis (Donovan)
A Margarita cinerea Gould
S Margarita groenlandica (G. O. Sars)
S Margarita obscura Gould
S Margarita olivacea (Brown)
S Nassa obsoleta Say
O Nassa trivitta Say
A Polynices heros Say
S Puncturella princeps Mighels
M Scalaria groenlandica Chemn.
S Scaphander punctostriatus (Mighels)
M Sipho pygmaeus (Gould)
S Trichotropis borealis (Couthuoy)
S Turritella acicula Stimpson
S Turritella erosa Stimpson
S Velutina laevitgata (L.)

PELECYPODA

O Anomia aculeata Gmelin
O Astarte banksii (Leach)
M Astarte elliptica Brown
O Astarte subquilatera Sowerby
S Cardita borealis Conrad
S Cardita Novangliae Morse
O Cardium pinnatulum Conrad
S Ensis directus Conrad
M Glycimerus siliqua Lamarck
S Leda minuta Moller
M Leda tenuisulcata Couthuoy
M Macoma calcarea Gmelin
S Macoma fusca Gould
S Mactra procera (Solander)
S Modiola plicatula Lamarck
S Modiolaria nigra Gray
S odiolus modiolus L.
A Nucula proxima (Say)
A Nucula tenuis (Mighels)
M Nucula delphinodonta Mighels and Adams
Pecten islandicus Mull.
S Saxicava artica (L.)
S Saxicava rugosa (L.)
S Siliqua costata Say
S Siliqua squama (Blainville)
S Solecurtis gibbis (Blainville)
S Thyasira trisinuata Verrill
A Yoldia myalis (Couthuoy)
S Yoldia limatula Say
M Yoldia sapotilla Gould

SCAPHODA

S Dentalium entale (L.)

CEPHALOPODA

S Illex illecebrosus (Leseur)

ECHINODERMATA

ASTEROIDEA

S Asterias tenera Stimpson
S Asterias vulgaris Verrill
S Ctenodiscus crispatus (Retzius)

OPHIUROIDEA

A Ophiopholis aculeata (Linnaeus)
O Ophiura robusta (Ayers)
S Ophiura sarsii (Lutken)
S Stegophiura nodusa (Lutken)

ECHINOIDEA

A Echinarachnius parma (Lamarck)
O Strongylocentrotus drobachiensis (O. F. Muller)

HOLOTHUROIDEA

S Cucumaria calcigera (Blainville)
S Molpadia oolitica (Verrill)
S Psolus phantapsus (Strussenfeldt)
S Thyone briareus (Leseur)
S Thyone unisemita

TUNICATA

THALIACEA

S Salpa (Iasis) zonaria (Pallas)

ASCIDIACEA

S Boltenia ovifera (L.)
S Bostrichobranchus pilularis (Verrill)
S Pelonaia corrugata Goodsir and Forbes

PISCES

A Ammodytes americanus DeKay
S Anguilla rostrata (LeSeur)
S Argentina silus (Ascanius)
S Clupea harengus (Mitchill)
S Hippoglossoides platessoides (Fabricius)
S Mallotus villosus (Muller)
S Menidia notata (L.)
S Merluccius bilineatus (Mitchill)
S Sebastes marinus (L.)
S Triglops pingeli (Fabricius)

XENOLITHS AND CONTACTS NEAR HALIFAX, NOVA SCOTIA

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ABSTRACT

The ancient, probably Precambrian, sediments known as the Halifax and Goldenville Series were intruded by granites in the Devonian. The granites advanced by stoping. Along the St. Margaret's Bay Road, within a few miles of Halifax, a number of granitic tongues can be seen in the road cuttings. Adjacent to the sediments but in the granites there are numerous xenoliths which range from those with sharp angular boundaries to those in which there is apparently no sharp line delineating the original boundary. In the first kind the rock is a dense, metamorphosed sediment, usually a quartzite, but sometimes a slate. In the others, the original sedimentary grains are giving place to a mosaic which has a granitic texture. In fact, in some of the extreme cases the material is granite with only the barest remnants of the sediments retained.

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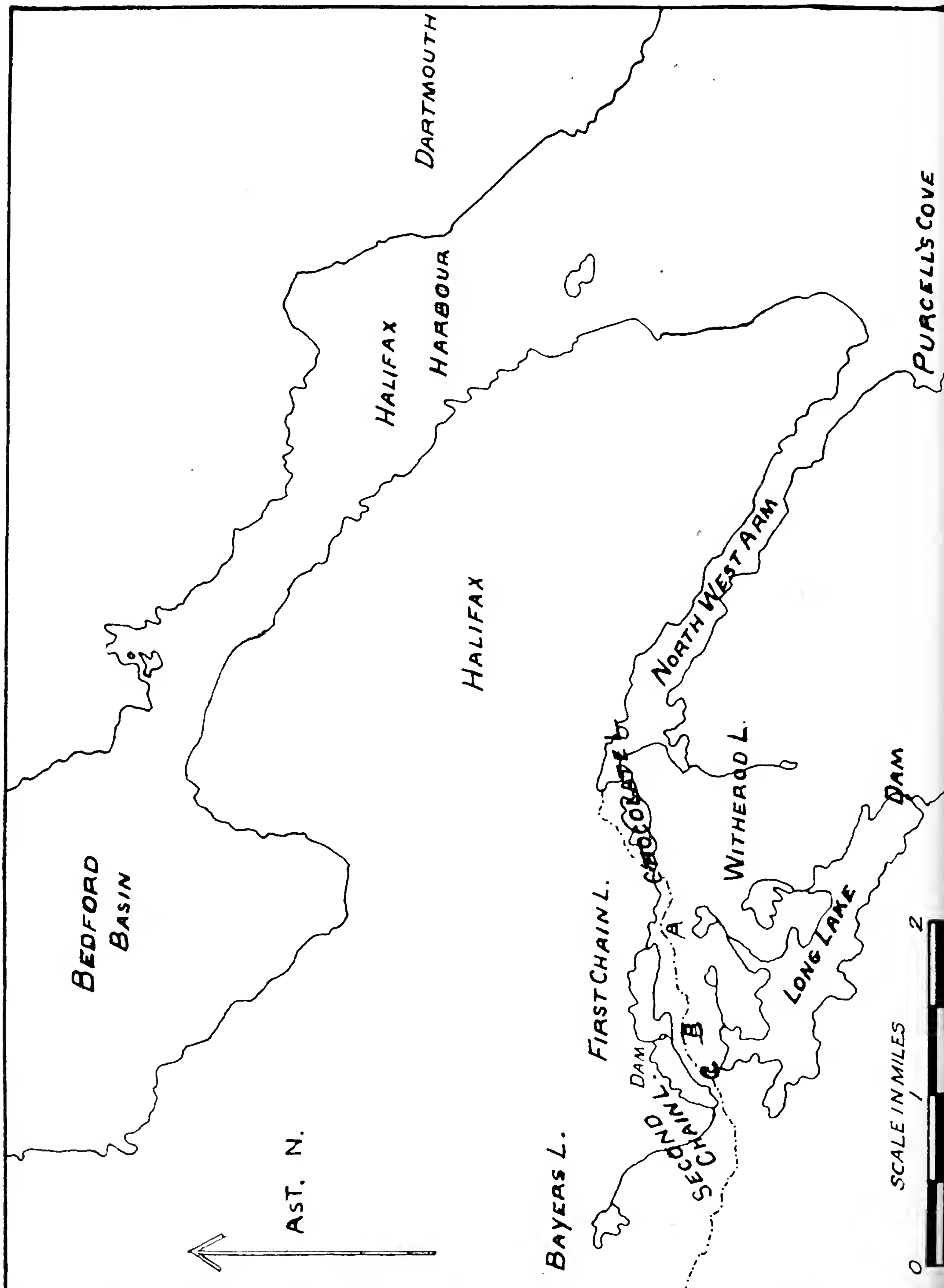

Fig. 1. Sketch Map of Area. Showing position of A, B, C.

area. These patches have been called ghost xenoliths. Between the sharp dark xenoliths and these ghosts there are all gradations.

At one place in the road, near one of the granitic tongues, there are a series of dyke and sill-like intrusions emanating from the granite and cutting a roof pendant of the sedimentary series.

Fifteen samples were taken of the xenoliths and sills, and a study of these constitutes the subject of this paper. Similar studies are described by Shand (1927, p. 62), Tyrrell (1926, p. 296), Thomas and Campbell Smith (1932).

The sediments which have been intruded by the granite have the compositions given by Douglas, Milner and MacLean (1936), as in the following table:

CHEMICAL COMPOSITION OF THE SEDIMENTS

	1	2	3
SiO_2	61.05	56.99	77.84
A_2O_3	22.36	19.79	10.72
Fe_2O_3	4.98	9.28	4.03
MgO	0.73	2.67	0.80
CaO	0.43	1.16	1.74
Na_2O	3.14	5.65*	4.31*
K_2O	3.25	2.44	1.06
H_2O-	0.36	0.36	0.09
H_2O+	2.90	3.50	0.82
	99.20	101 84	101.41

1. Average of two slates—Halifax Series.
2. Average of two siltstones—Halifax Series.
3. Goldenville Quartzites.

* Probably high.

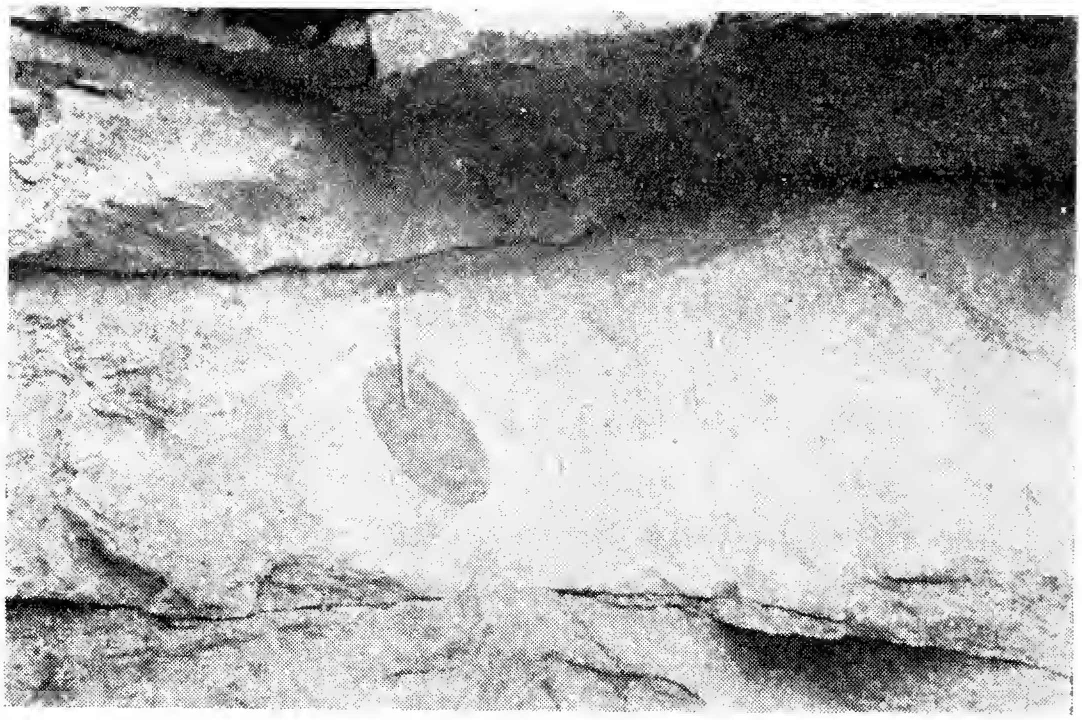

Fig. 2. Partially granitized Xenolith from "C" on map.

Fig. 3. Albite porphyroblast (Fp) growing in a matrix of quartz (Q), orthoclase (Fo) and biotite (Bi), X20.

The quartzites are made up of quartz, feldspar and biotite with grain size less than a millimetre. The slates are very similar in mineral composition but finer grained.

In the xenoliths which have sharp boundaries the granite has not penetrated the contacts. The metamorphic effects appear to be confined to a development of biotite, some of which contains pleochroic haloes often with inclusions of zircon. Figure (2) shows one of these sharp xenoliths which can be seen at "C" on the accompanying map.

In those xenoliths which show less sharp boundaries the metamorphic effects are more pronounced. Porphyroblasts of both orthoclase and plagioclase are well developed within the xenolith. In some of the sections examined garnets, sillimanite, zircon and biotite have developed. The growth of the feldspars can be so pronounced that the xenolith takes on the appearance of a granite. Figure (3).

In one specimen taken from "A" on the map, the xenolith was characterized by a considerable growth of andalusite. Figure (4).

The metamorphic effects found in the sediments at their contacts with the granite and in the wall rock of the granite sills, Figure (5), are of a higher order. Here we find abundant andalusite and cordierite. Figures (6), (7).

As the xenoliths in the granite occur within a few feet of the contacts and sill, the temperatures must have been approximately the same in both places. The metamorphic differences which have been noted are therefore due to some factor, other than heat. The suggestion is here advanced that the difference is due to the movement of the xenolith as it sank in the magma.

The conditions which have produced these results are visualized as follows:—The magma stoped its way into the sediments following cracks and weak beds. In some cases, portions of the roof were pryed off and became the xenoliths. These tended to sink, and in so doing would leave that portion of the magma which had begun to react with the surfaces of

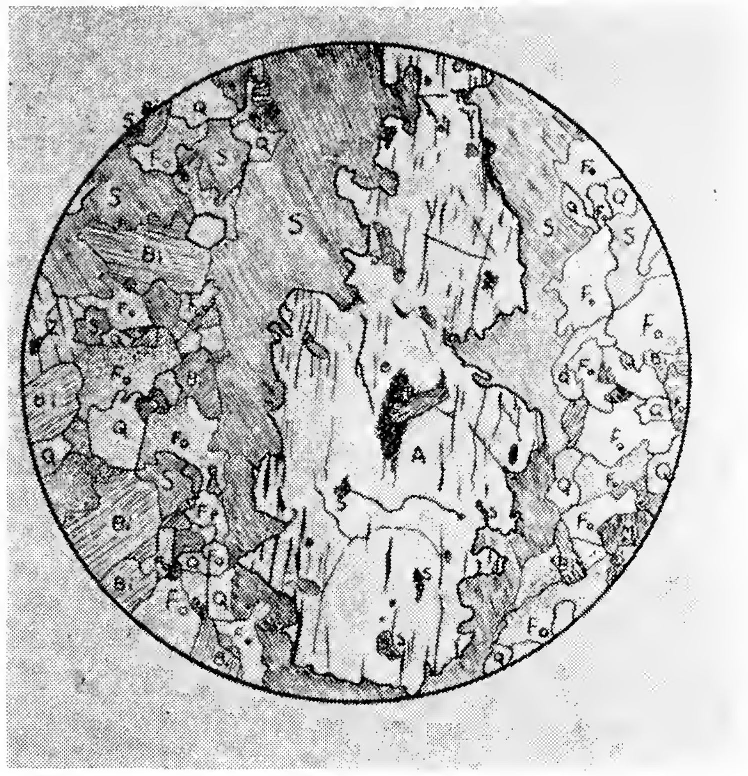

Fig. 4. Andalusite (A) being altered to sericite (S). Quartz (Q), orthoclase (Fo), biotite (Bi), muscovite (M). X20.

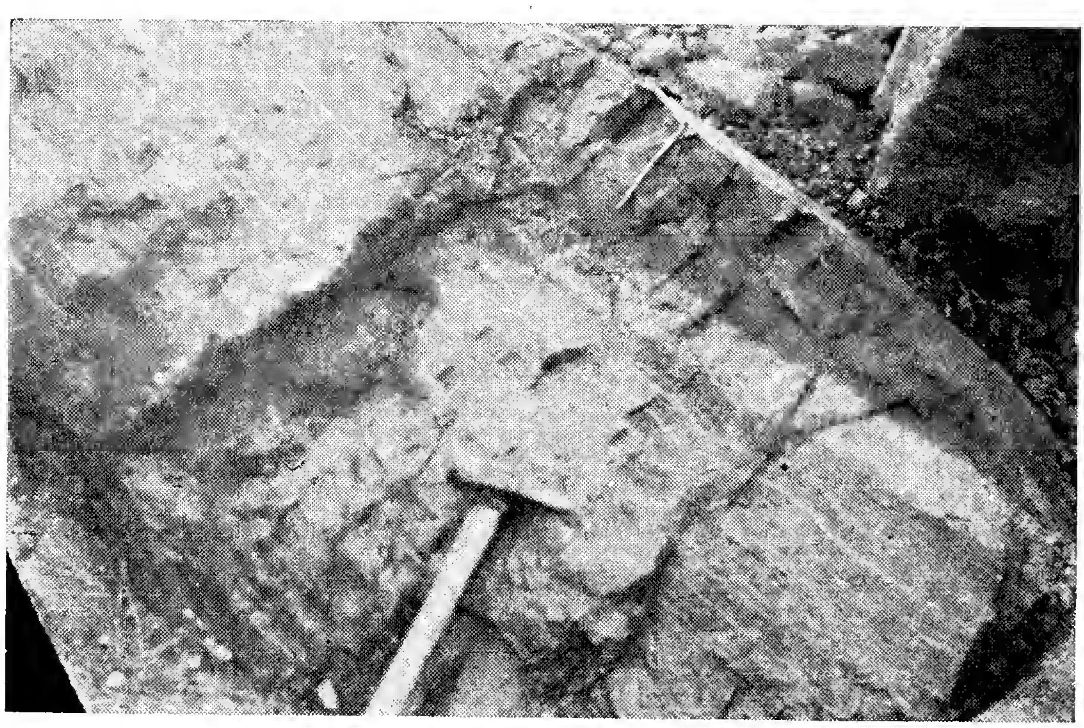

Fig. 5. Multiple sills and dyke at "B" on map.

the xenolith. The smaller the particle the more rapid the chemical action. The margins of the xenolith at the time they broke away would be the places where the finer material would be formed, and hence the places where chemical action would begin. If the rock fragment began to sink, the smaller fragments would be left behind (Stokes' Law) and the fresh surfaces of the sinking rock would encounter fresh granitic magma. The sinking mass would have to be heated to the temperature at which the metamorphic changes would take place. Obviously, the smaller the mass the more rapidly will it approach the temperature of the magma. There will also be a porosity factor, for as Harker (1939, p. 5) states, water is to be thought of as present in metamorphism. The denser the rock, the slower will be the penetration of the fluids from the magma. Even though there is no addition of material from the magma, the xenolith has to be heated to the temperature required for the recrystallization of its component minerals before it gets frozen in the viscous and cooling magma. The field evidence shows that some xenoliths are fresh and unaltered, even with sharp angular forms; others are rounded and show porphyroblasts of feldspar within them. Still others have almost disappeared, only the faint outline remaining; these are the ghosts.

In contrast with those xenoliths we have the contacts of the sills and tongue of the granite. The sills and dyke feeders are likely to have been injected along fractures or beds in which there has been comminution. In these rocks in Nova Scotia, the competent mud beds are the planes of movement producing drag folds and finely pulverized material, when the whole series was thrown into folded anticlines and synclines. Hence, if these rocks are invaded by a hot magma of low viscosity, the magma can react readily with the pulverized material. This mechanism explains why the minerals such as andalusite and cordierite are formed more abundantly in the granite of the sill and tongue adjacent to the contact, than in the xenoliths.

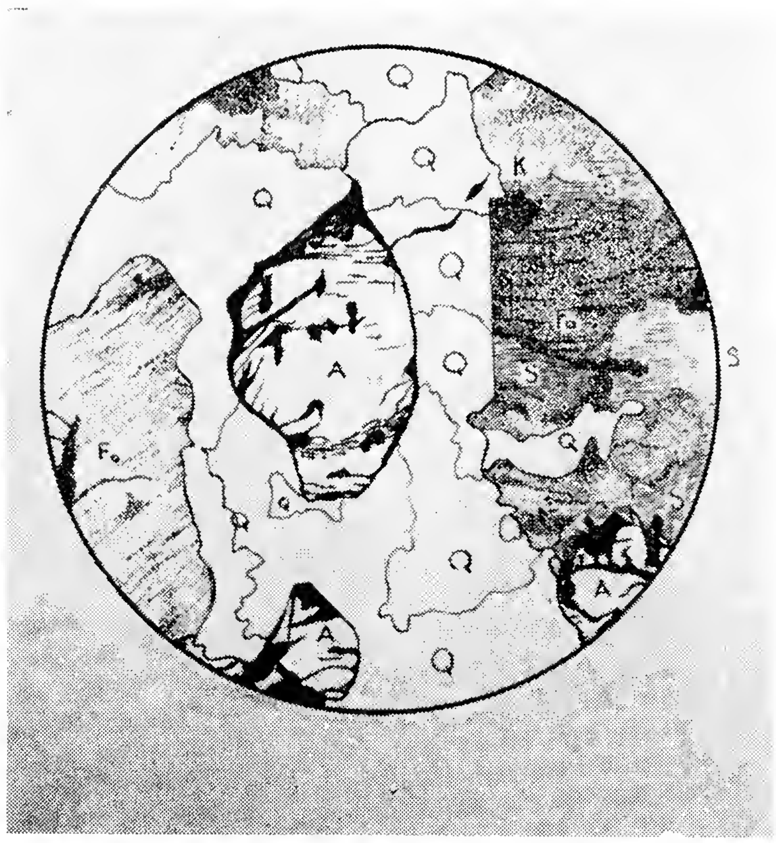

Fig. 6. Highly altered andalusite (A), orthoclase (Fo) showing kaolinization (K) and sericitization (S), quartz (Q). X20.

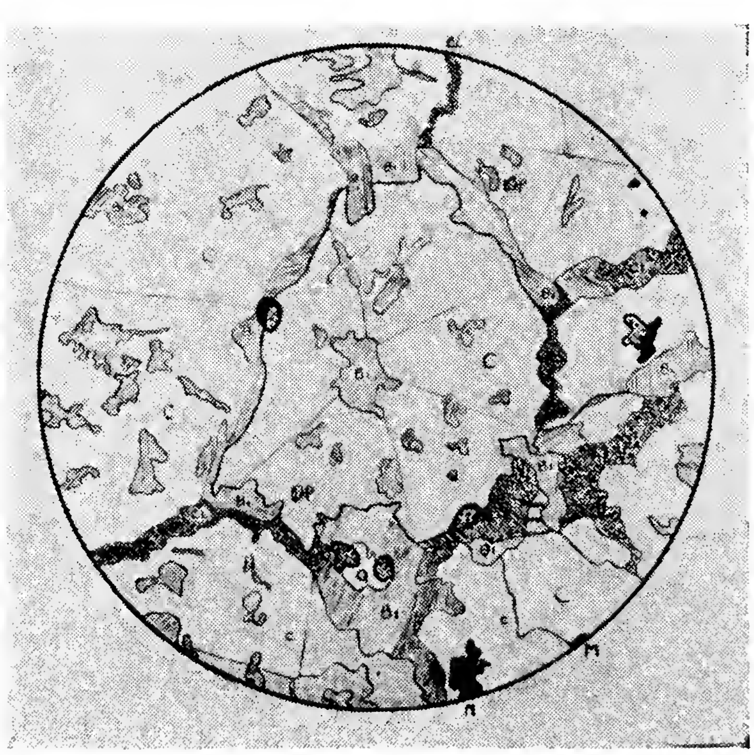

Fig. 7. Cordierite (C) showing pseudo-hexagonal twinning. Chlorite (Cl), biotite (Bi), magnetite (M) and pyrites (P). X20.

Harker (1939, p. 209), in his study of the Scottish Highlands has found various grades of metamorphism. He places the metamorphic rocks in which sillimanite, and andalusite are developed, in the higher grades of metamorphism. In Nova Scotia, sericite and the development of biotite, garnet, staurolite, and andalusite have been previously reported, but as far as the writers know this is the first time in which the higher grade of pure thermal metamorphism has been observed in the xenoliths and apophyses of the Devonian granite.

The authors wish to acknowledge, most gratefully, the suggestions and criticisms of Professor S. J. Shand of Columbia University.

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GAS EXCHANGE IN THE SWIMBLADDER OF THE MUDMINNOW

Umbra limi (Kirtland)

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ABSTRACT

Experiments were carried out to determine the extent and manner of gas exchange during asphyxiation in the swimbladder of the mudminnow, *Umbra limi* (Kirtland.) Under conditions of respiratory stress provided by lack of oxygen and presence of carbon dioxide in the environmental water the mudminnow drew extensively on the oxygen in the swimbladder. During asphyxiation in the presence of carbon dioxide, carbon dioxide entered and oxygen left the swimbladder; the rate of exchange of these gases increased at high environmental carbon dioxide tensions. Some data were obtained on oxygen consumption from the water and rate of respiratory movements duiing these experiments.

INTRODUCTION

Fish belonging to the genus *Umbra* are often found in stagnant waters and are able to live in water containing less oxygen and more carbon dioxide than most teleost fishes can tolerate. Investigations by Rauther (1914) and Geyer and Mann (1939) on European species have shown that the swimbladder acts as a supplementary organ for respiration thus enabling fish of the genus *Umbra* to use oxygen from the air when oxygen in the water is insufficient.

Rauther (1914) made the first extensive investigation of the swimbladder using the species *U. krameri* Fitz. His work on the histological nature of the swimbladder is especially significant since it gives a morphological basis for evidence he obtained that air intake into the swimbladder could maintain life when the oxygen content of the water is low.

The respiration of *U. lacustris* Grossinger is considered in two papers by Geyer and Mann (1939). They found that the oxygen consumption from the water increases when access to air is cut off and also when the swimbladder gas is removed by decompression. They concluded from their data that the swimbladder supplied $\frac{1}{4}$ to $\frac{1}{3}$ of the normal oxygen consumption. When the oxygen in the water is decreased, the use of the swimbladder for aerial respiration increases. On the other hand, in well oxygenated running water their fish did not come to the surface for air but employed only gill respiration.

It becomes apparent from the investigations of Rauther, and Geyer and Mann that the swimbladder of *Umbra* is an organ capable of accessory respiration which allows the fish to survive in a habitat in which it could not otherwise exist. The present investigations add to this knowledge by confirming the use of oxygen during asphyxiation from the swimbladder of the mudminnow, *Umbra limi* (Kirtland). In addition some experiments have been carried out to show the relation between the gases in the swimbladder and in the water during various conditions and stages of asphyxiation.

MATERIAL

Mudminnows are found in swamps and weedy brooks in Canada and north-eastern United States. The mudminnows used in these experiments were obtained from the Troyer Natural Science Service operating in the vicinity of Toronto, Ontario. The fish were of both sexes. The average weight was 4 grams; the range being from 0.5 grams to 13.6 grams. The fish were acclimatized to the temperature of the experiment, the overall time allowance for acclimatization being no more than 1° C. increase in temperature per day. Mudminnows kept at 10° C. were never observed gulping air at the surface of the water. The fish at 19° C. and 20° C. occasionally came to the surface.

METHODS

A. Fish completely asphyxiated at various carbon dioxide tensions.

Methods were identical to those used in similar experiments by Fry and Black (1938), Safford (1940) and Black (1942). Each fish was sealed in a bottle of water (275 ml. capacity) containing a known amount of dissolved carbon dioxide and having an oxygen tension of at least 100 mm. Thus there was no opportunity for renewing air in the swimbladder during the experiments. When all respiratory movements had ceased, the water was analyzed for carbon dioxide and oxygen. The swimbladder gas was withdrawn under water by syringe and needle at the conclusion of each experiment. The gas was analyzed immediately in the micro-gas-analyzer (after Krogh, 1908), using $\frac{1}{4}$ N potassium hydroxide to absorb the carbon dioxide and Oxsorbent to absorb the oxygen.

The carbon dioxide in the water was determined by equilibrating a small bubble of air (0.2-0.5 ml) with 35 ml of the water. The bubble was then analyzed for carbon dioxide by absorbing the carbon dioxide in the micro-gas-analyzer as above. Pressures were calculated by multiplying per cent gas by the barometric pressure less vapor tension at the temperature of the experiment.

The oxygen content of the water was determined by the Winkler method using a 50 ml sample of water. The pressure of oxygen was calculated by relating the quantity of oxygen found to the solubility at the temperature of the experiment and multiplying the fraction by the barometric pressure (760 mm. used in all these calculations though the actual barometric pressure varied from 750 mm. to 765 mm.).

B. Fish partially asphyxiated at various carbon dioxide tensions.

The mudminnows were placed in 275 ml bottles completely filled with water and sealed as above. The water in the bottles contained known tensions of carbon dioxide and oxygen. Each bottle was opened after a definite time (column 2, Tables 3, 4). The fish was alive in every case. Water for carbon dioxide and oxygen samples was withdrawn as shown in Figure I, to prevent the fish from gulping air. This apparatus was devised with the assistance of Dr. R. R. Langford. As the water was drawn from the bottle through the rubber tube,

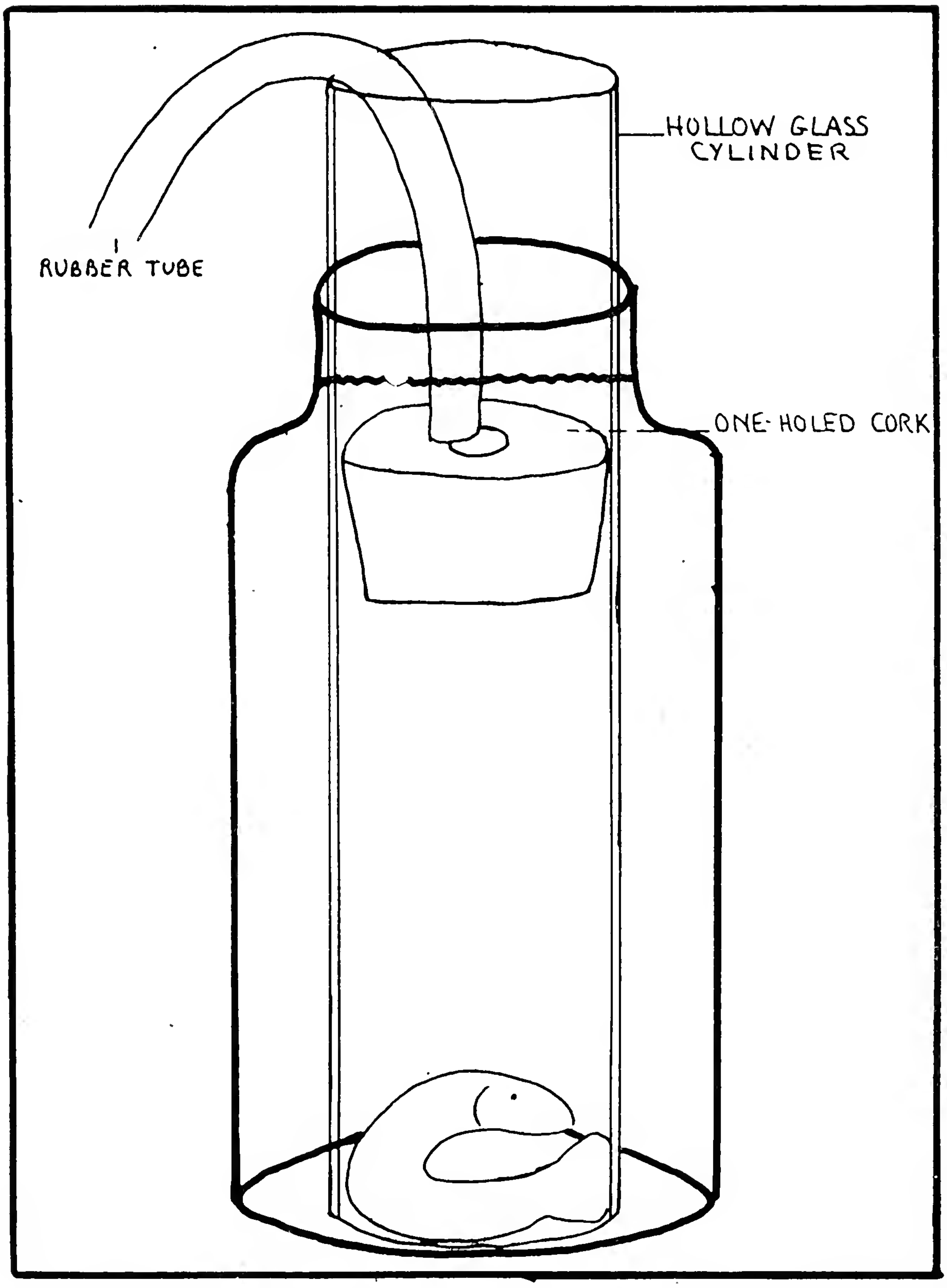

Figure I. Apparatus used for obtaining water sample without permitting mudminnow to gulp air.

the end of the rubber tube in the bottle was kept under the lowering water level by pressing down on the cork. When the samples had been taken, the entire apparatus (Fig. I) was carefully submerged in a water bath, the cork and glass tube were removed, and the fish killed by crushing its head against the side of the bottle. Swimbladder gas was obtained and analyzed as described above. The approximate volume of gas was noted.

The count of respiratory movements per minute was taken just before opening the bottle at the end of the experiment.

RESULTS AND DISCUSSION

A. *Fish completely asphyxiated at various carbon dioxide tensions, 19°C.*

This type of experiment was devised by Fry and Black (1938) to measure the carbon dioxide tolerance of a number of species of freshwater fish. Of these, the cold water fish (trout, suckers) tend to be most sensitive to carbon dioxide; the stream and lake minnows are moderately sensitive, while the bullhead (*Ameiurus nebulosus*), found in weedy lakes and sluggish rivers, is very hardy, being able to use practically all available oxygen in the presence of up to 200 mm. carbon dioxide (Fry, 1939).

Of some thirty-five species whose carbon dioxide tolerance has been determined only the mudminnow compares with the bullhead in ability to use oxygen in the presence of carbon dioxide. The mudminnow also occurs in sluggish waters, ponds and streams. Figure II shows that the mudminnow, by gill respiration, can use practically all the oxygen in water containing up to 200 mm. carbon dioxide at 19° C. Tensions of carbon dioxide greater than this affect the ability of fish to take the oxygen from the water, *i.e.* the asphyxial oxygen tension for the mudminnow increases when the environmental water contains more than 200 mm. carbon dioxide at 19° C.

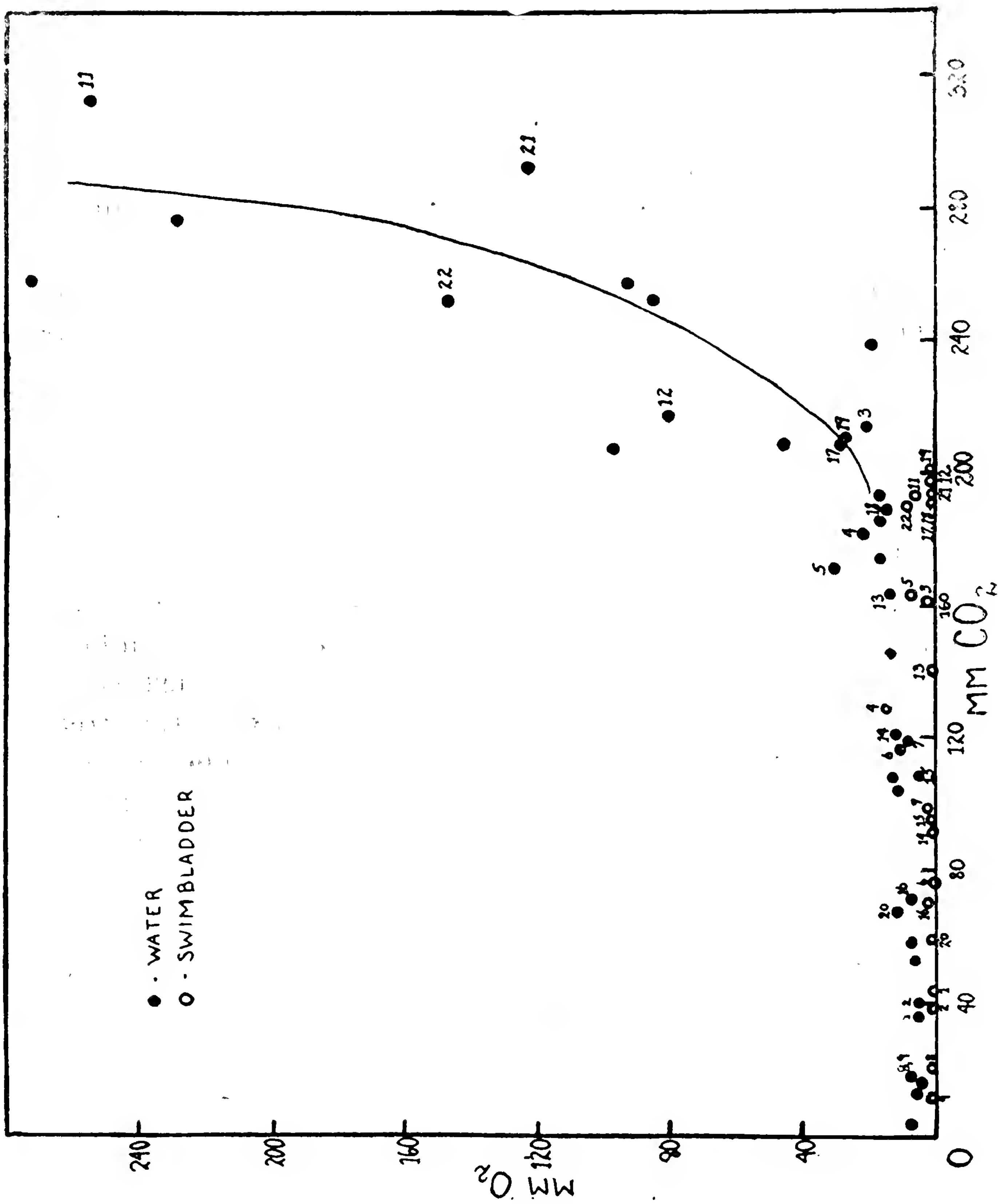

Figure II. The relation between carbon dioxide and oxygen in the water and in the swimbladder of the mudminnow after asphyxiation at 19° C.

During the course of these asphyxiation experiments the proportions of the various constituent gases in the swimbladder of the mudminnow change. The pressure of carbon dioxide normally found in the swimbladder gas of this group of mudminnows was about 9 mm., the average pressure of oxygen was 78 mm. (Table 1). The pressures of these gases in the swimbladder after complete asphyxiation is shown by hollow circles in Figure II. The numbers beside the hollow and solid circles show which gases in the swimbladder and water belong

TABLE 1

SWIMBLADDER GASES OF MUDMINNOWS UNDER "NORMAL" CONDITIONS

No. of Fish	% CO_2 Range	% CO_2 Average	mm CO_2 Average	% O_2 Range	% O_2 Average	mm O_2 Average
A. Sept., 1942						
19°C. 20	0.8-1.9	1.28	9	3.2-15.9	10.6	78
B. Jan. May. 1944						
20°C. 5	0.3-1.4	0.95	7	11.0-18.8	15.6	116
10°C. 16	0.0-1.5	0.75	6	6.1-19.0	14.0	105

to the same fish. It is apparent from Figure II that practically all of the oxygen in the swimbladder disappears during asphyxiation.

The relation between the carbon dioxide tension in the water and the carbon dioxide pressure in the swimbladder is further analyzed in Figure III. This graph shows that the pressure of carbon dioxide in the swimbladder closely approximates the carbon dioxide tension of the water as long as the fish can remove all of the oxygen from the water. At tensions of carbon dioxide above 200 mm., however, complete equilibration does not take place before asphyxiation.

The disappearance of the oxygen in the swimbladder during asphyxiation is not typical of all species of fish. In Table 2 a comparison is given of the disappearance of swimbladder oxygen in several species of fish. The first group, the

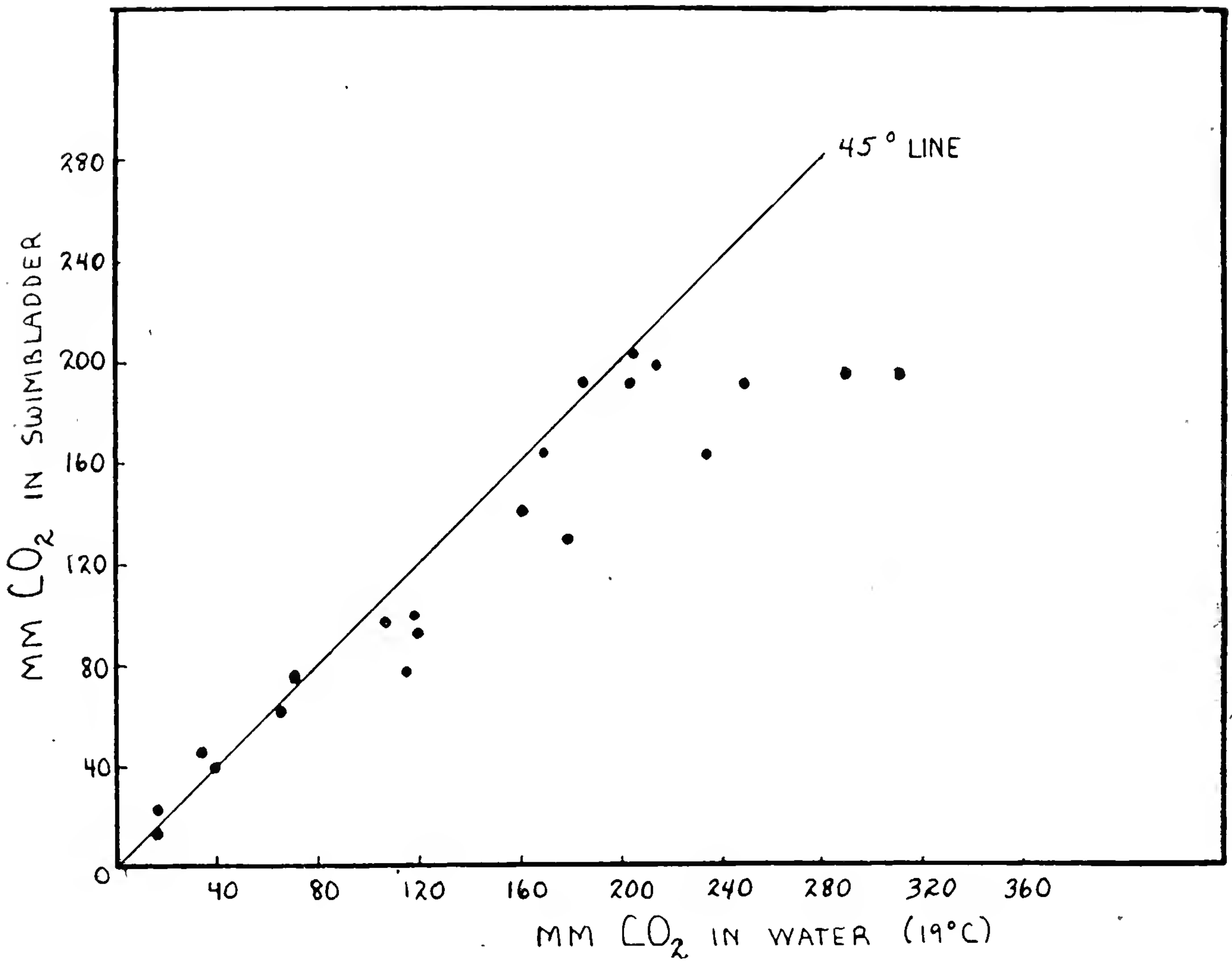

Figure III. Carbon dioxide in the water and in the swimbladder of the mudminnow after asphyxiation at 19° C.

physostomes, possess a swimbladder with a duct opening into the foregut where gas exchange may take place, but equipment for gas exchange between swimbladder lumen and blood appears to be limited in these species of physostomes. The second group, the physoclists, do not have any open duct but all gas exchange for the purpose of adjusting to changes in hydrostatic pressure must take place between the swimbladder and blood. These species possess vascular sections of the swimbladder wall which serve for the deposition and absorption of gases. The third group is represented in Table 2 by the mudminnow which has an open duct and a vascular swimbladder, both of which are essential to fulfill the function of respiration. The average percentages of oxygen found in the swimbladder of asphyxiated fish in this table are compiled from results of experiments at both high and low carbon dioxide tensions. Utilization of swimbladder oxygen was usually greater in the

TABLE 2

CHANGE IN OXYGEN CONTENT OF THE SWIMBLADDER GAS DURING ASPHYXIATION WITH AND WITHOUT CARBON DIOXIDE. AN AVERAGE OF ALL EXPERIMENTS COMPARED WITH THE AVERAGE OF THE CONTROLS

	Control % O_2	Asphyxiated % O_2	% Decrease in O_2
Physostomes (swimbladder not adapted for respiration):			
Creek chub	6.4	8.9	..
Speckled trout	6.0	6.4	..
Common sucker	11.1	9.7	13
Finescale dace	12.1	9.7	20
Brown bullhead	7.5	6.0	20
Physoclists (swimbladder adapted for gas secretion):			
Scup	9.4	7.0	25
Smallmouth bass	26.0	17.6	32
Yellow perch	19.4	10.7	45
Cunner	25.8	13.2	49
Killifish	15.6	7.3	53
Pumpkinseed	21.2	9.7	54
Brook stickleback	19.6	5.6	72
Tautog	51.3	14.6	72
Toadfish	55.0	15.0	73
Sea robin	22.8	3.6	84
Physostome (swimbladder adapted for respiration):			
Mudminnow—19°C.	10.6 (20)	0.2 (21)	98

low carbon dioxide range, except in the case of the mudminnow. During asphyxiation the first group of physostomes uses very little oxygen, the physoclists use from 25% to 84% depending on the species (Safford, 1940; Black, 1942), and in the mudminnow an average of 98% of the oxygen in the swimbladder disappears. Even when carbon dioxide in the water prevents complete utilization of oxygen from the water (Nos. 11, 12, 21, 22 in Fig. II) oxygen disappears from the swimbladder of the mudminnow. This lower oxygen pressure in the swimbladder than in the water indicates active respiration of oxygen. It is probable that the difference in the response of these three groups (Table 2) is due chiefly to the extent of vascular surface exposed to the swimbladder lumen.

Rauther (1914) has shown that there are two reasons why the morphology of the swimbladder of *U. krameri* is better fitted for respiratory function than the swimbladder of most teleosts: Although the physoclists have highly vascular sections (*retia mirabilia*) in the anterior swimbladder wall, *Umbra*, a physostome, has in addition to these, inter-epithelial capillaries, *i. e.* a capillary between almost every epithelial cell over a large portion of the swimbladder wall. This arrangement provides lung-like efficiency for gas exchange between swimbladder and blood. The second morphological feature favoring respiration of swimbladder oxygen is the blood supply to and from the swimbladder. The coeliac artery and intercostal arteries supply respectively the anterior and posterior parts of the swimbladder as is the case for most teleosts. The oxygenated blood leaving the swimbladder, however, is collected in three large veins which unite and empty into the posterior cardinal vein just as it passes into the right Cuvierian duct, which in turn empties directly into the heart. Hence partially oxygenated blood enters and leaves the heart instead of only reduced blood as is the case in fish whose swimbladder is not adapted for respiration. In this latter group of fishes the blood usually leaves the swimbladder by way of the portal vein instead of going directly to the heart.

B. Fish partially asphyxiated at various carbon dioxide tensions, 10° C. and 20° C.

This series of experiments was performed in an attempt to discover how the respiration was divided between gills and swimbladder at various carbon dioxide tensions and at various stages in asphyxiation. As is evident from Tables 3 and 4 there are fairly large individual differences in the results which may be accounted for in part by the fact that activity of the fish in the bottle could not be controlled. There appeared to be no marked correlation in every individual between oxygen consumption, respiratory rate and pressure of oxygen in the swimbladder. The data have therefore been analyzed on the basis of the *average* results for each group of carbon dioxide tensions.

TABLE 3

RESPIRATION OF MUDMINNOWS AT 20°C.

CO_2 in Water mm.	Time in Bottle Hours	Weight gms.	O_2 Consumption ml. O_2/kilo/hr.	Resp. Movements at End of Experiment Number per Min.	Swimbladder Gases CO_2 mm.	Swimbladder Gases O_2 mm.	Final O_2 in Water mm.
9.	1.0	9.6	113.0	68	10	82	59
6.	1.5	13.6	77.4	130	8	22	16
1.5	2.5	2.9	24.3	30	11	78	136
2.5	3.3	6.4	68.9	105	7	64	28
0	5.8	2.5	102.5	111	7	38	24
Average: **3.8**	**2.8**	**7.0**	**77.2**	**89**	**9**	**57**	**52**
91.	0.83	5.3	55.4	62	74	53	103
92.	1.75	3.4	103.0	60	...	..	70
99.	3.0	5.2	66.0	73	83	53	35
112.	3.	5.6	75.0	Irr.	107	10	14
Average: **98.**	**2.15**	**4.9**	**74.8**	**65**	**88**	**39**	**55**
146	1.66	2.9	68.6	60	73	45	91
148.	6.0	3.2	52.5	63	116	10	30
Average: **147.**	**3.83**	**3.1**	**60.5**	**62**	**95**	**27**	**60**
184.	1.3	3.0	20.4	Irr.	137	11	101
187.	2.5	3.4	19.8	Irr.	132	0	93
Average: **185.**	**1.9**	**3.2**	**20.1**	...	**135**	**6**	**97**

1. *Oxygen consumption from water and swimbladder.*

In Figure IV the average oxygen consumptions from the water (A) and from the swimbladder (B) are plotted against the carbon dioxide tension of the water. The data for oxygen consumption from the swimbladder were derived as shown in Table 5. The average volume of the swimbladder for each average weight was taken from Figure V where the approximate volume of gas found in the swimbladder of several fishes is plotted against the weight of the fish. Figure IVB shows that the swimbladder provides only a minute portion of the total oxygen consumed when the oxygen in the swimbladder cannot be continually renewed by gulping air. However, there is a contrast in the effect of carbon dioxide on the utilization of oxygen from the water and from the swimbladder. At high carbon dioxide tensions the oxygen consumption from the water tends to decrease (cf. Hall, 1931) whereas oxygen consumption from the swimbladder, though small, is greatest at the highest carbon dioxide tension, indicating utilization of swimbladder oxygen when carbon dioxide makes uptake of oxygen from the water difficult.

TABLE 4

RESPIRATION OF MUDMINNOWS AT 10°C.

CO_2 in Water mm.	Time in Bottle Hours	Weight gms.	O_2 Consumption ml. O_2/kilo/hr.	Resp. Movements at End of Experiment Number per Min.	Swimbladder Gases		Final O_2 in Water mm.
					CO_2 mm.	O_2 mm.	
0.	1.2	10.0	89.0	47	10	92	75
2.5	1.25	11.3	94.0	..	...	...	68
1.5	1.5	2.9	85.0	..	10	78	138
4.6	1.5	2.5	94.0	Irr.	8	140	123
6.5	3.42	9.3	54.4	..	...	...	40
0.	3.5	5.1	49.4	..	3	112	87
0.	4.0	1.2	36.8	..	...	...	135
5.	6.0	6.3	48.0	..	...	...	34
4.	6.3	4.9	54.0	62	8	35	31
4.5	6.7	2.0	34.2	..	3	28	116
5.	8.0	6.1	39.2	..	10	57	27
Average: **3.**	**3.9**	**5.6**	**61.6**	**55**	**7**	**77**	**79**
98.	0.75	6.8	18.1	36	76	75	125
83.	1.5	1.9	56.8	72	37	23	128
90.	2.3	2.5	42.1	43	51	68	115
87.	3.5	2.7	50.5	65	50	4	106
87.	5.5	2.0	54.5	60	75	11	97
95.	7.0	2.5	30.4	58	79	27	95
Average: **90.**	**3.4**	**3.1**	**42.1**	**56**	**61**	**35**	**111**
111.	0.83	5.6	39.8	45	61	59	110
105.	1.3	1.7	40.8	60	29	81	116
110.	3.75	4.3	51.5	55	68	26	64
109.	4.17	2.5	41.5	57	77	37	92
110.	5.25	3.9	49.2	50	93	44	51
108.	5.75	1.6	38.5	70	72	30	98
115.	7.5	3.7	39.6	50	88	44	44
104.	8.0	9.0	51.0	44	73	19	65
Average: **109.**	**4.6**	**3.2**	**43.9**	**54**	**70**	**42**	**80**
135.	1.0	2.5	37.0	36	55	42	119
136.	1.7	4.2	38.4	50	81	87	109
136.	2.25	1.8	46.0	48	63	43	112
147.	3.0	2.3	47.0	48	49	27	102
132.	4.3	3.1	48.8	51	...	...	76
145.	6.0	2.7	47.0	46	117	19	70
139	7.2	3.4	48.4	51	100	65	38
Average: **139.**	**3.6**	**2.9**	**44.6**	**47**	**77**	**47**	**89**
164.	0.85	1.9	67.0	50	48	16	120
159.	1.5	1.7	67.0	42	77	24	115
168.	1.5	5.0	10.2	..	53	33	102
157.	2.0	1.2	51.3	0	98	46	119
166.	4.0	5.9	9.5	0	142	21	92
159.	5.5	1.3	49.5	54	105	65	102
Average: **162.**	**2.5**	**2.8**	**42.4**	**29**	**87**	**34**	**108**
183.	0.66	4.2	0.0	23	46	39	109
179.	1.25	2.5	0.0	32	46	22	109
Average: **181.**	**0.9**	**3.3**	**0.0**	**27**	**46**	**30**	**109**

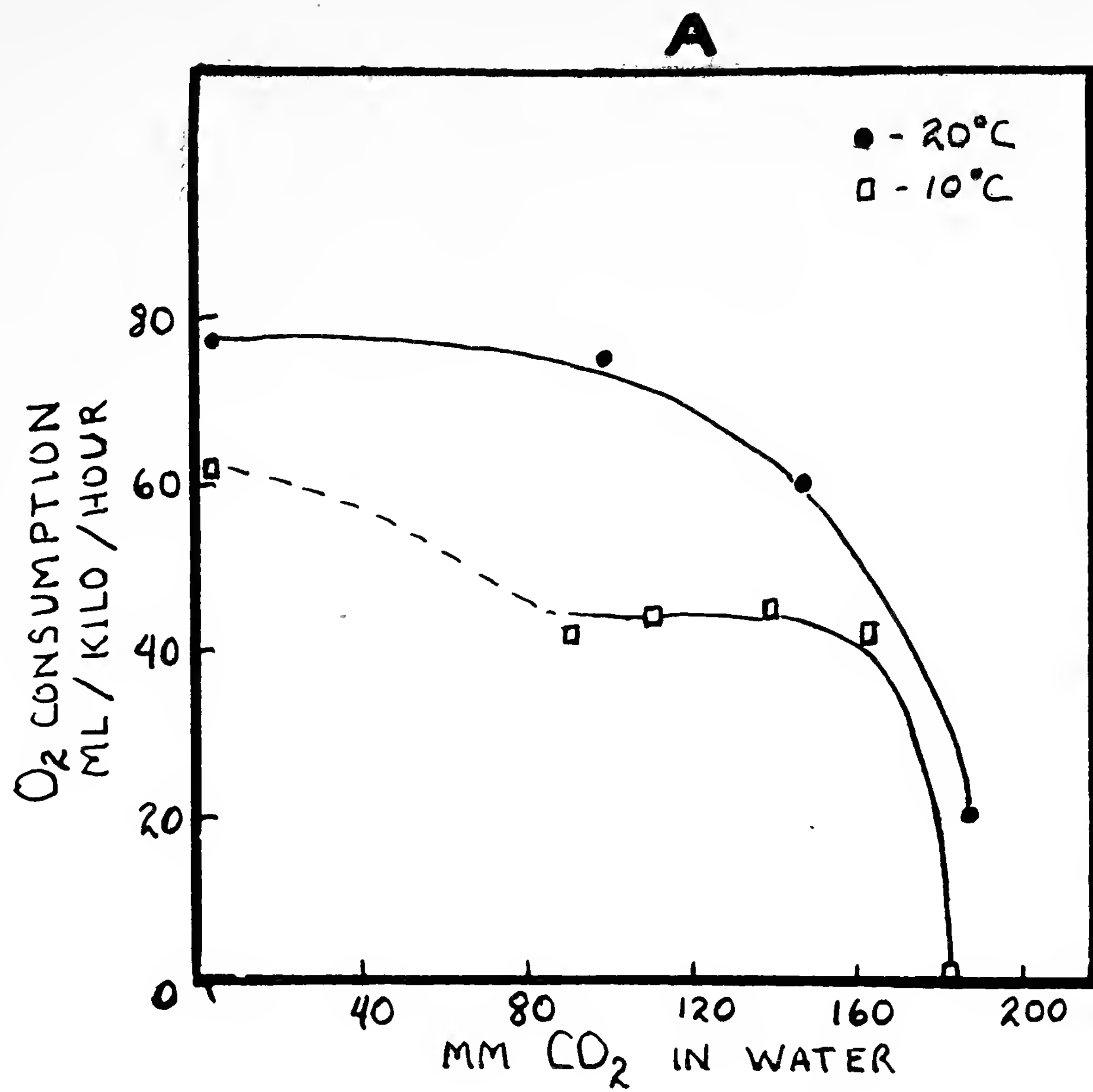

Figure IVA. The average oxygen consumption at the gills of the mudminnow at various carbon dioxide tensions in the water.

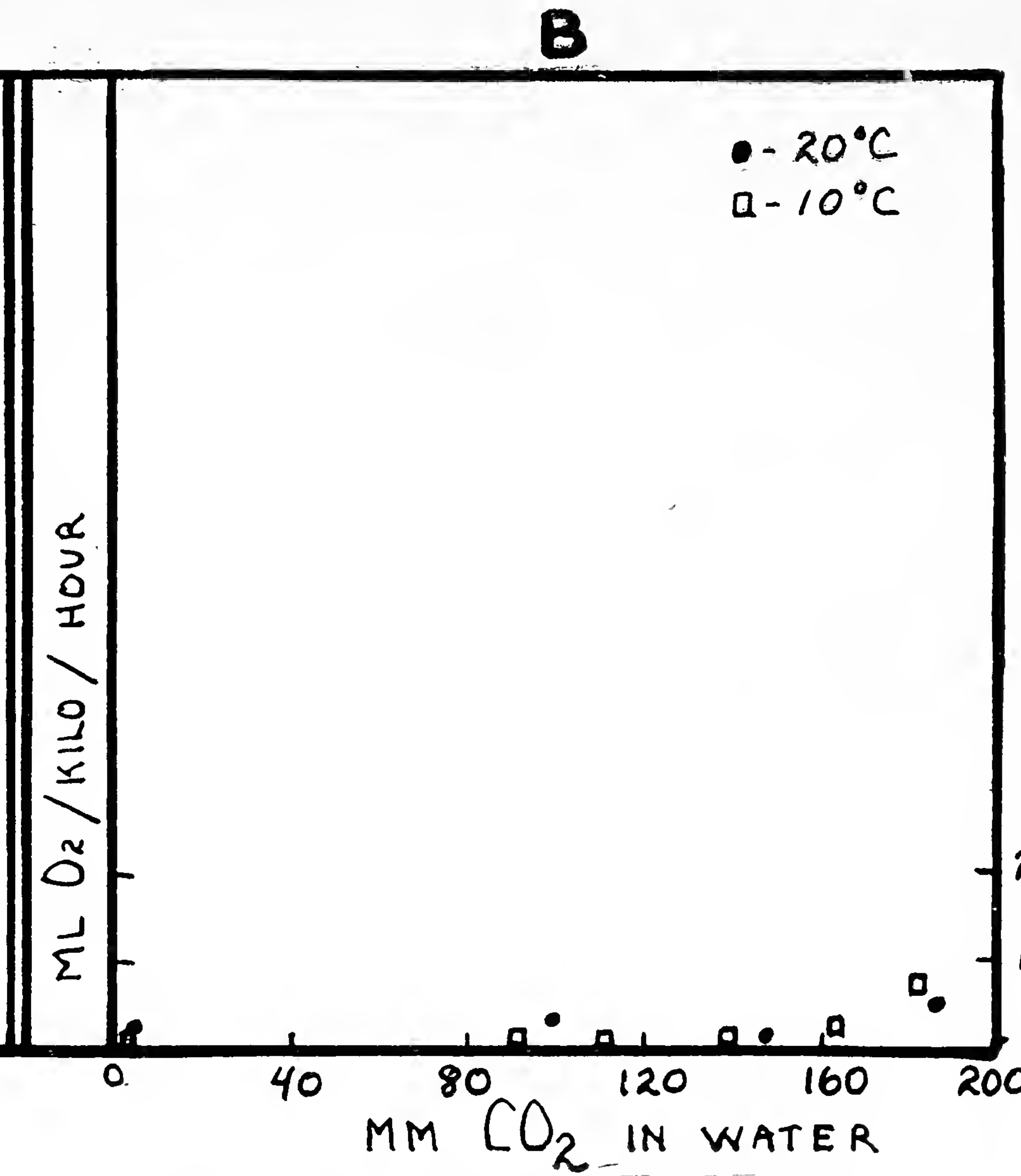

Figure IVB. The average oxygen consumption from the swimbladder of the mudminnow at various carbon dioxide tensions in the water.

TABLE 5

OXYGEN CONSUMPTION FROM THE SWIMBLADDER PER KILO PER HOUR, AT 20°C. AND 10°C.

mm CO_2 (average) at 20°C.	3.8	98	147	185
Average weight, gms.	7.0	4.9	3.1	3.2
Average volume of swimbladder (Figure V)	0.5	0.35	0.18	0.2
Average normal % O_2 in swimbladder less average % O_2 in swimbladder at end of experiment = $\triangle$ % O_2	7.9	10.3	11.9	14.8
ml. O_2 used	0.04	0.036	0.021	0.03
ml. O_2 per kilo	5.7	7.3	6.8	9.3
Average time in bottle, hours.	2.8	2.15	3.83	1.9
ml. O_2/kilo/hour	2.0	3.4	1.8	4.9

mm CO_2 (average) at 10°C.	3.0	90	109	139	162	181
Average weight, gms.	5.6	3.1	3.2	2.9	2.8	3.3
Average volume of swimbladder (Figure V)	0.4	0.18	0.2	0.17	0.16	0.2
$\triangle$ % O_2 in swimbladder	3.7	9.3	8.4	7.7	9.5	10.0
ml. O_2 used	0.015	0.017	0.017	0.013	0.015	0.02
ml. O_2 per kilo	2.6	5.4	5.2	4.6	5.4	6.1
ml. O_2/kilo/hour	0.7	1.6	1.1	1.3	2.2	7.1

2. *Exchange of carbon dioxide and oxygen to and from the swimbladder at known tensions of carbon dioxide in the water.*

To obtain comparable values for the pressure of carbon dioxide in the swimbladder at various tensions of carbon dioxide in the water, the average carbon dioxide pressure for each group of carbon dioxide tensions (Tables 3 and 4) was divided by the average weight of fish and average time of exposure to give the carbon dioxide pressure per gram per hour. These values are plotted in Figure VIA. There is a definite increase in the rate of entrance of carbon dioxide into the swimbladder at increased carbon dioxide tensions.

The rate of disappearance of oxygen from the swimbladder was obtained by calculating the average difference in oxygen pressure in the swimbladder per gram per hour

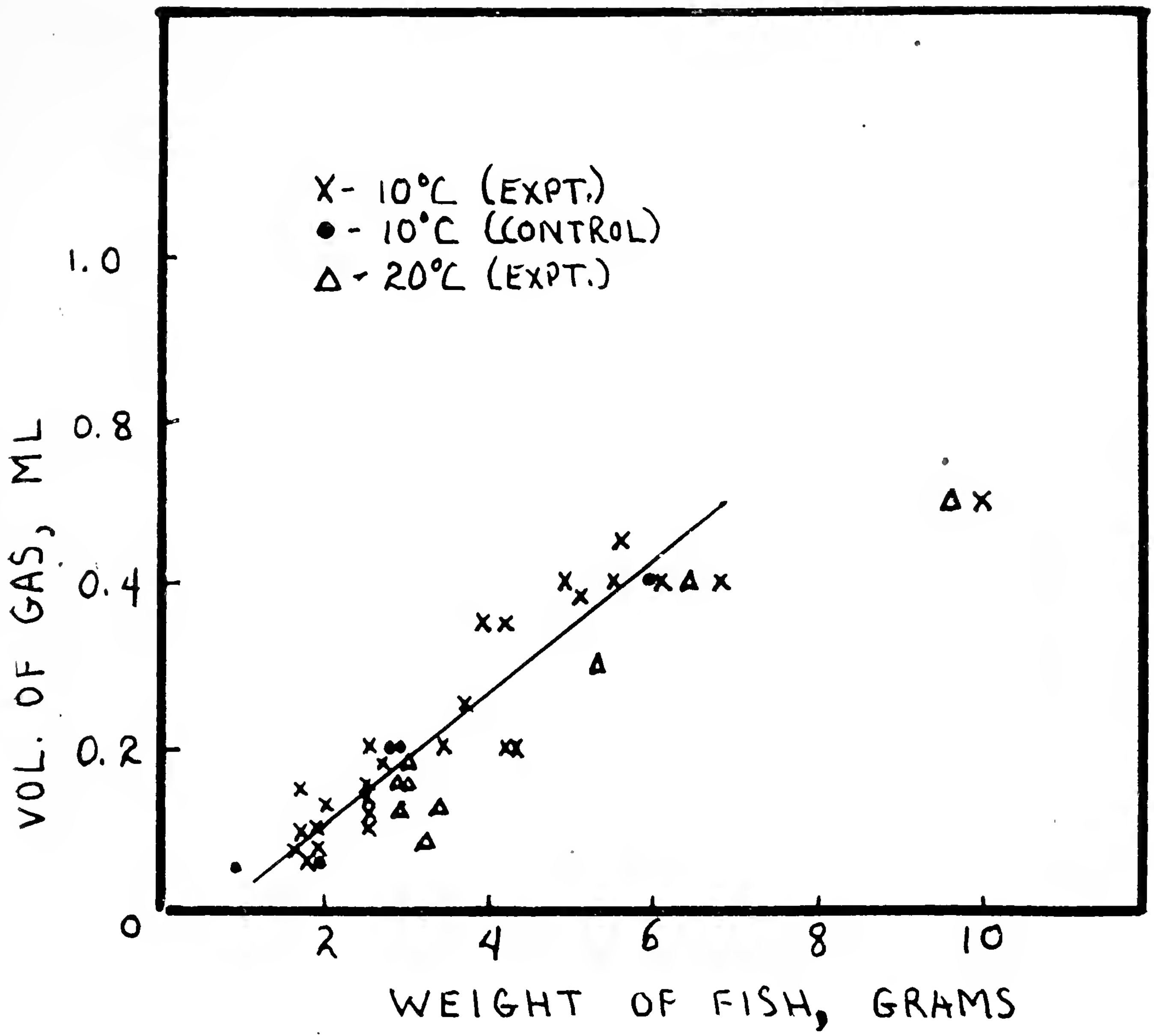

Figure V. The relation between body weight of the mudminnow and volume of gas in the swimbladder.

(Table 6). Differences in oxygen tension of the water are also plotted in Figure VIB. At both 20° C. and 10° C. the amount of oxygen taken from the water per gram per hour decreases as the carbon dioxide in the water is increased. Rate of oxygen utilization from the swimbladder, however, increases with increase in the carbon dioxide tension of the water. It is noteworthy that points which are out of line in Figure VIB are also out of line in the same direction in Figure VIA. This indicates that the rate of exchange of carbon dioxide is related to the rate of exchange of oxygen, a fact which is apparent also when the values for rate of entrance of carbon dioxide are compared with values of rate of disappearance of oxygen (Fig. VI). All experiments (Fig. II, Tables 3 and 4) indicate that the oxygen in the swimbladder is determined to a greater extent by the requirements of the fish than by the tension of oxygen in the water. When the carbon dioxide in the water is high, the necessity for using oxygen in the swim-

TABLE 6

AVERAGE DIFFERENCE IN MM O_2 IN WATER AND IN SWIMBLADDER PER UNIT TIME (HOUR) AT 20°C. AND 10°C.

mm CO_2 (average) at 20°C.	3.8	98	147	185
Average initial O_2 in water (mm.)	153.0	124.0	120.0	109.0
Average final O_2 in water (mm.)	52.0	55.0	60.0	97.0
△ mm. O_2 in water	101.0	69.0	60.0	12.0
Average weight in gms.	7.0	4.9	3.1	3.2
Average time in bottle (hours)	2.8	2.15	3.83	1.9
△ mm. O_2 in water per gram per hour	5.1	6.5	5.0	2.0
Average initial mm. O_2 in swimbladder	116.0	116.0	116.0	116.0
Average final mm. O_2 in swimbladder	57.0	39.0	27.0	6.0
△ mm. O_2 in swimbladder	59.0	77.0	89.0	110.0
△ mm. O_2 in swimbladder per gram per hour	3.0	7.4	7.1	18.1

mm CO_2 (average) at 10°C.	3	90	109	139	162	181
Average initial O_2 in water (mm.)	154.0	135.0	123.0	124.0	122.0	109.0
Average final O_2 in water (mm.)	79.0	111.0	80.0	89.0	108.0	109.0
△ mm. O_2 in water	75.0	24.0	43.0	35.0	14.0	0.0
Average weight in gms.	5.6	3.1	3.2	2.9	2.8	3.3
Average time in bottle (hours)	3.9	3.4	4.6	3.6	2.5	0.85
△ mm. O_2 in water per gram per hour	3.4	2.3	2.9	3.4	2.0	0.0
Average initial mm. O_2 in swimbladder	105.0	105.0	105.0	105.0	105.0	105.0
Average final mm. O_2 in swimbladder	77.0	35.0	42.0	47.0	34.0	30.0
△ mm. O_2 in swimbladder	28.0	70.0	63.0	58.0	71.0	75.0
△ mm. O_2 in swimbladder per gram per hour	1.3	6.6	4.3	5.5	10.1	26.8

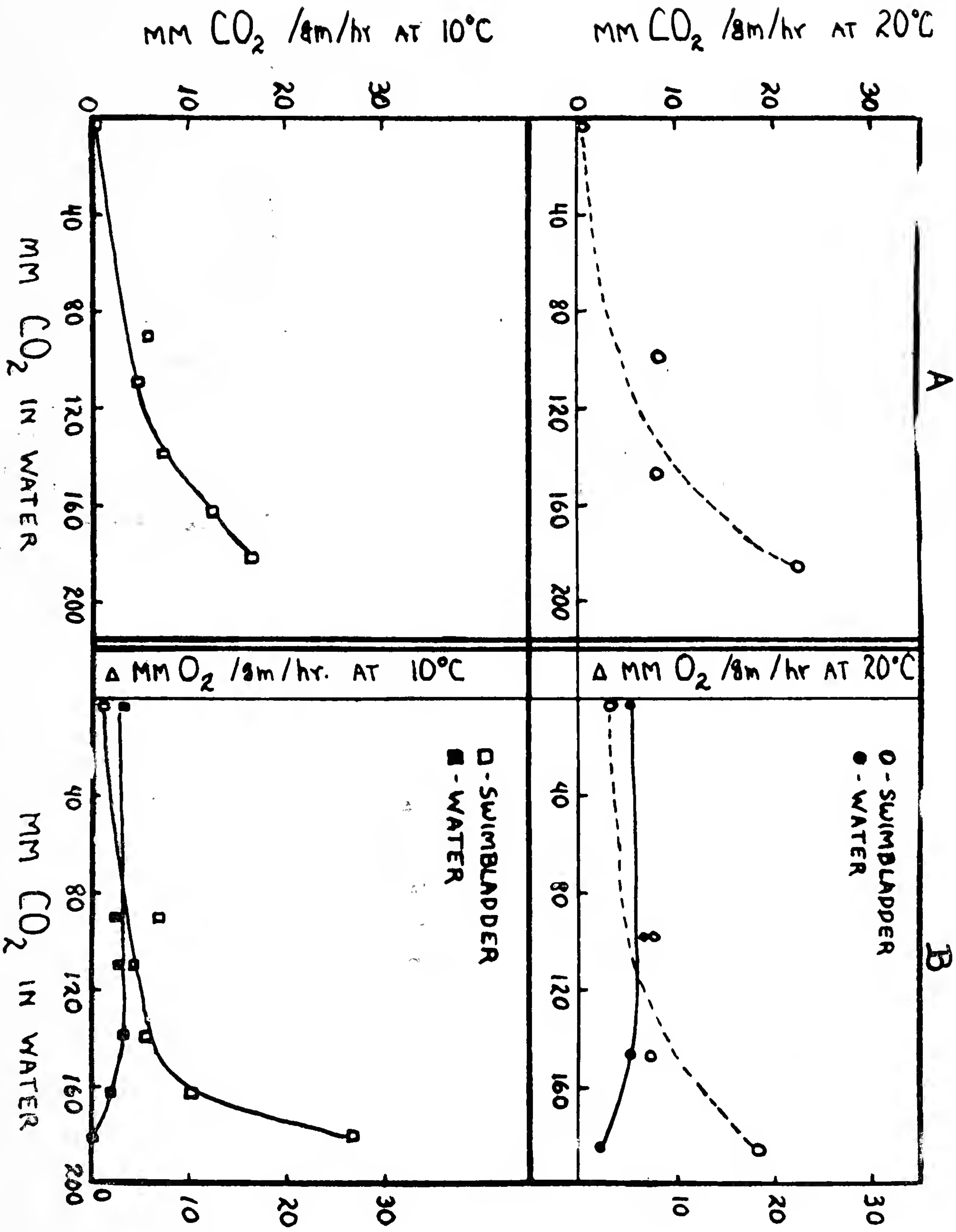

Figure VI. The average rate of gas exchange at the swimbladder of the mudminnow at various carbon dioxide tensions of the water.

A. Entrance of carbon dioxide into the swimbladder.

B. Utilization of oxygen from the swimbladder and from the water.

bladder early in the experiment becomes great and the lost oxygen is replaced by carbon dioxide.

The ability of the mudminnow to use oxygen from the swimbladder even when oxygen uptake at the gills is inhibited by the carbon dioxide tension of the water may be accounted for by the fact that the carbon dioxide in the swimbladder had not increased enough to inhibit oxygen uptake there. Even in the first set of experiments where asphyxiation was complete, the carbon dioxide in the swimbladder never exceeded 200 mm., the tension at which carbon dioxide begins to impair the ability of the mudminnow to extract oxygen from the water. At the highest carbon dioxide tensions the respiratory movements were irregular and sometimes stopped completely when the fish was first put into the bottle. It is conceivable that the fish was drawing on the swimbladder oxygen at such times.

3. *Use of swimbladder oxygen at various stages of asphyxiation.*

By examining Tables 3 and 4 it is difficult to ascertain exactly when, in the process of asphyxiation, the mudminnow draws most heavily on the oxygen in the swimbladder. In general, however, about half (or more) of the swimbladder oxygen has been used within the first hour of the experiment at both 10° and 20° when the fish is asphyxiated in the presence of carbon dioxide (90 mm. to 185 mm.). Even though the mudminnow is able, by gill respiration, to use all available oxygen up to 150 mm. carbon dioxide in the water (10° fish are more sensitive to carbon dioxide than 20° fish), respiration of swimbladder oxygen at carbon dioxide tensions in the water of 90 mm., or perhaps even less, indicates that the fish is conscious of its abnormal environment. However, when the fish is asphyxiated by lack of oxygen only, the oxygen in the swimbladder remains fairly high until the fish has lowered the oxygen in the water to about 50 mm.

Further analysis of the course of asphyxiation by oxygen lack is afforded by comparing the CO_2/O_2 ratio of the swimbladder gas of normal fish, derived from Table 1, with the same ratio for fish in various stages of asphyxiation. This comparison is made in Table 7A. The quotient tends to be greater when the oxygen tension in the water is very low, a result caused mainly by a decrease in oxygen in the swimbladder.

TABLE 7A

THE CO_2/O_2 RATIO OF THE SWIMBLADDER GAS OF THE MUDMINNOW UNDER NORMAL CONDITIONS AND DURING ASPHYXIATION BY LACK OF OXYGEN

Average Normal CO_2/O_2 Ratio

10°C.	0.053
19°C.	0.120
20°C.	0.061

Individual Ratios for Fish at Decreasing Oxygen Tensions

	Oxygen Tension of the Water mm.	Swimbladder Gas CO_2/O_2 Ratio
20°C.	136.	0.141
	59.	0.122
	28.	0.109
	24.	0.184
	16.	0.364
10°C.	138.	0.128
	123.	0.057
	116.	0.107
	87.	0.027
	75.	0.109
	31.	0.230
	27.	0.175

There is, however, no gradual decrease in the ratio with decrease in oxygen tension of the water. This situation indicates that the use of oxygen from the swimbladder of the mudminnow is governed largely by the requirements of the fish, rather than the oxygen tension of the water.

CO_2/O_2 quotients for fish asphyxiated in the presence of carbon dioxide also increase at the lowest oxygen tensions in the few experiments at 20° C. At 10° C., however, there is little correlation between the ratio and the oxygen tension of the water although the highest quotients are at medium or low oxygen tensions. In Table 7B the ratios for the average carbon dioxide and oxygen tensions in the swimbladder are recorded for each group of carbon dioxide tensions. The higher quotients at 20° C. are a result of both greater carbon dioxide and lower oxygen in the swimbladder, indicating a faster rate of exchange at the higher temperature.

TABLE 7B

THE CO_2/O_2 RATIO OF THE SWIMBLADDER GAS CALCULATED FROM THE AVERAGE PRESSURES FOR EACH GROUP OF CARBON DIOXIDE TENSIONS (TABLES 3 AND 4).

Average mm. CO_2 in H_2O	3.4	90	98	109	139	147	162	181	185
20°C.	0.16	....	2.25	....	....	3.5	....	....	22.5
10°C.	0.09	1.74	....	1.67	1.64	...	2.56	1.53	....

SUMMARY

Mudminnows were completely asphyxiated in sealed bottles of water, each containing a known tension of carbon dioxide and at least 100 mm. of oxygen. After all respiratory movements of the fish had ceased the water in the bottle and gas in the swimbladder were analyzed for carbon dioxide and oxygen. The ability of the fish to use the oxygen in the water was not impaired by carbon dioxide at 19° C. until over 200 mm. were present in the water. In these experiments practically all the oxygen disappears from the swimbladder even when the carbon dioxide prevents complete utilization of the oxygen in the water. The carbon dioxide in the swimbladder increases during the experiment and after asphyxiation is approximately equal to the carbon dioxide tension in the water at tensions below 200 mm.; above 200 mm. carbon dioxide equilibration was not reached before asphyxiation occurred.

Another series of experiments was made in which the bottles containing the fish were opened after different lengths

of time but in all cases the fish was still alive. When the swimbladder gas cannot be renewed by gulping air, as was the case in all experiments, oxygen consumption per unit weight and time from the swimbladder constitutes an extremely small portion of the total oxygen consumption but is greatest at the highest carbon dioxide tensions, whereas oxygen consumption from the water is least at the highest carbon dioxide tensions. The rate of exchange of carbon dioxide and oxygen increased as the carbon dioxide in the water was increased, i.e. more carbon dioxide entered and more oxygen left the swimbladder per unit time when the carbon dioxide tension in the water was high. The CO_2/O_2 ratio in the swimbladder during asphyxiation with and without carbon dioxide tends to be greater than the normal ratio as a result of increase in carbon dioxide and loss of oxygen.

These experiments give evidence of the facility of gas exchange which makes the swimbladder of the mudminnow a valuable supplementary organ for respiration.

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PRESIDENTIAL ADDRESS

Ernest Hess

(Read October 18, 1943)

My first duty, to-day, is to record the death of two of our members during the last session. The Institute mourns the loss of Mr. George Barratt, Chemist in the Gas Department of the Nova Scotia Light and Power Company, who lost his life in a tragic bus collision on Bedford Road on June 2, 1943. A native of England, he came to Canada 13 years ago and became intensely interested in the organized labour and co-operative movements. He was one of the younger members of the Institute, having joined us four years ago.

On September 28, 1943, we lost through death Professor George A. Burbidge, Dean of the Maritime College of Pharmacy. A native of Newfoundland, he had spent the greater part of his life in Halifax where he had been active both as a practising pharmacist, as lecturer in Pharmacy and Materia Medica, and since 1921 as Dean of the Maritime College of Pharmacy. He joined the Institute over sixteen years ago, and as a member of the Council from 1927 to 1933 contributed much to the welfare of our organization.

To the families of these deceased members the Institute extends its deepest sympathy.

Our membership now stands at 112, consisting of 6 Corresponding or Honorary Members, 50 Ordinary, 36 Associate and 20 Student Members. During the past session we gained 15 members, namely 5 Ordinary, 2 Associate and 8 Student Members, but death and a revision of the membership list has brought about the loss of an equal total number.

On February 8, 1943, the Council elected D. J. Matheson, Esq., as an Honorary Member in recognition of his twenty-two years' faithful and successful service as Treasurer of our Institute.

On November 12, 1942, the Nova Scotia Museum of Fine Arts presented a portrait of the late Harry Piers, Esq., to the

Provincial Government. A number of members of the Institute were present on this occasion to honour the memory of our late Past-President and Recording Secretary. Dr. S. G. Ritchie spoke on behalf of the Institute.

Many members also accepted the invitation of the Halifax Branch of the Engineering Institute of Canada to attend their February 25, 1943, meeting to hear an address by Mr. H. W. Lea, Director of the War-time Bureau of Technical Personnel.

Your President represented the Institute at the annual gathering of the Society of Professional Engineers of Nova Scotia and the Halifax Branch of the Engineering Institute of Canada, on January 28, 1943.

During the session under review we have had, in spite of war-time restrictions in some departments with regard to presentation of research work—notably in chemistry and physics—a better than average number of papers and meetings. Twenty papers and three demonstrations were presented at 7 ordinary meetings, with an average attendance of 24 members and guests. Eighteen of the papers were those of members, while two papers were submitted by guests of the Institute. It has become almost a tradition for the President, in his annual address, to tabulate the papers according to the field of science in which they fall, as well as according to their source. These are the lists in alphabetical order:

Subject		Source	
Bacteriology	4	Biochemistry	6
Biochemistry	4	Biology	4
Botany	2	Chemistry	1
Chemistry	2	Fisheries	5
Pharmacology	1	Pharmacology	1
Physical Chemistry	1	Physiology	1
Physiology	1	Guests	2
Zoology	5		

It is gratifying to note, that in spite of many extra demands which war-time conditions have made upon the time and work of our members, such interest in the affairs of our Institute can be recorded with regard both to presentation of papers and attendance.

While the Institute as a body, has not taken an organized part in the war effort, many of our members, individually, are contributing full time or part time work either in the Armed Services (six members), as research workers on war-time problems, or as volunteer workers in less conspicuous but nevertheless essential war-time services.

The Librarian will report to you on the condition of our library. War-time conditions have further decreased the number of accessions, and this is holding up the binding of certain sets of English periodicals. With the gradual establishment by many of the auxiliary services of libraries of their own, the demand for books from the Provincial Science Library by members of the Armed Forces has decreased to a certain extent, but is still substantial.

The Institute owes thanks to the Corresponding Secretary for the laborious work he finished during the session in rearranging the back copies of our "Proceedings." A set of each issue still available is now housed on easily accessible shelves in the basement of the Medical and Dental Library.

As to the state of the current issue of the "Proceedings" I shall report to you later on, as Editor.

The Institute has, since its beginning, been intensely interested in its library of scientific periodicals from all parts of the world, and we are justly proud of the valuable collection the library presents to-day. Another type of library has in recent years gained prominence and has a very promising future. I refer to collections of silent and sound films of educational and documentary nature on scientific subjects. Locally, the Department of Education of Nova Scotia maintains a film library now containing some 500 silent and sound films. A Joint Sound Film Library exists within this organization, where the membership fee is the purchase of one sound film to be deposited in the library, and for each such film deposited the Department will buy and deposit another one. In the national field the National Film Society and the National Film Board are active in the production and distribution of similar films. In the United States a number of scientific organizations are maintaining up-to-date lists of available films, among others the Society of American Bacteriologists. An *Educational Film Catalogue* is published annually in New York with quarterly supplements of newly produced films.

May I suggest that the Institute should appoint a small Committee to investigate the suitability and advisability of our affiliation with one or more of the already existing organizations interested in the production and distribution of scientific films, and to study in what way such films could be used to stimulate the work of our members individually, to make our meetings interesting to all members and at the same time to keep in step with new advancements in the presentation of scientific research.

PROCEEDINGS OF MEETINGS

Session of 1943-44

(All meetings were held in the Medical Sciences Building, Dalhousie University, Halifax)

82nd *Annual Business Meeting*, October 18, 1943.

The President, Dr. Ernest Hess, gave the annual address, which is printed in full in the Proceedings.

The Treasurer's report is summarized as follows:—

Receipts	$1,060.28
Expenditures	1,039.93
Assets—Current Account	1,283.19
Permanent Fund, Trustee Bonds	4,500.00

The Corresponding Secretary reported that 78 numbers of back files of Proceedings and bound volumes had been sent out. Three new exchanges had been arranged, and one had been discontinued for the duration of the war. The moving of files of Proceedings and reprints, up to 100 of each number, to the Medical-Dental Library has been completed.

The Librarian reported that 575 publications have been received through the exchange list. A total of 1190 books and pamphlets have been borrowed from the Library. The need of a reading room was stressed. One hundred and nine volumes have been bound, the publications of 26 societies being bound up to date.

The Editor reported that the Editorial Board has decided to defer publication of the Proceedings of the past session. Of the four expected papers, two were not received and two were unsuitable for publication. It was pointed out that over the past twenty years there has been a steady decline in the number of papers published; but that as the average length of papers is greater, the size of the Proceedings has changed little. Two rather lengthy botanical papers are in prospect in the next two years.

Officers elected for the year 1943-44 were:—

President........................Dr. Ernest Hess
1st Vice President..............Dr. F. R. Hayes
2nd Vice President..............Dr. C. C. Coffin
Treasurer........................Prof. W. P. Copp
Corresponding Secretary.........Dr. M. K. McPhail
Recording Secretary.............Dr. H. B. Collier
Council..........................Dr. W. J. Archibald, Mr. F. C. Collier, Mr. E. K. Crowdis, Dr. E. P. Linton, Dr. A. J. Wood.
Editor...........................Dr. E. Hess
Librarian........................Dr. F. R. Hayes
Institute Nominations to Provincial Science Library Commission—Dr. E. G. Young and Dr. F. R. Hayes.
Auditors.........................Prof. R. J. Bean and Dr. H. L. Bronson.

Following the election of officers, Dr. A. E. Cameron read a letter from the War-time Bureau of Technical Personnel concerning the problem of land mines. Dr. Cameron had been named chairman of a Joint Local Committee to organize instruction and possibly investigation on the problem. He asked the Institute to name a representative to the Joint Committee, and Dr. H. L. Bronson was so named.

The business meeting closed with the showing of a moving picture, "Body Resistance against Disease," which had been borrowed from the film library of the Provincial Department of Education.

1*st Ordinary Meeting*, November 15, 1943.

Election by Council (October 4) of Dr. L. C. Dugal as Associate Member was announced; on October 16 the Council elected W. J. Chute, Ph.D. and H. V. French as Ordinary Members and A. K. Archibald and T. R. Ingraham as Student Members.

Papers: "Criteria for the Recognition of Developmental Stages in Salmon (*Salmo salar*)," by D. Pelluet; "Production of Trimethylamine in Choline Broth by Enterobacteriaceae," by F. Keeping; "The Haemolytic Action of Lysolecithin and Saponin," by K. M. Wilbur and H. B. Collier.

2nd Ordinary Meeting, December 13, 1943.

The following new members were announced (elected by Council, November 15): Ordinary, W. W. Judd; Student Miss R. B. Campbell.

Papers: "On the Determination of Minor Degrees of Color Blindness: The Use of the Eastman 'Color Temperature Meter' as an Anomaloscope," by C. B. Weld; "On the Optical Activity of Allantoin," by E. G. Young and W. W. Hawkins. Demonstrations: "The Dropping Mercury Electrode," by H. B. Collier; "Home-made Micro Torsion Balances," by F. R. Hayes.

Extraordinary Meeting, January 17, 1944.

The meeting took the form of a Symposium on Vitamins A and D, with the following papers:—"The Chemistry, Sources, and Production of Vitamins A and D," by A. J. Wood; "The Physiology of Vitamin A," by C. B. Weld; "The Physiology of Vitamin D," by A. G. Gornall.

The meeting closed with a very interesting film on nutrition "Training Table," very kindly loaned by the R.C.A.F.

3rd Ordinary Meeting, February 14, 1944.

F. A. H. Rice was announced as Student Member (elected December 13, 1943).

Papers: "The Estimation of Volatile Phenols in Smoked Fish," by H. V. French and E. P. Linton; "The Colorimetric Determination of Trimethylamine," by W. J. Dyer. Demonstration: "The Growth of Crystals under Polarized Light," by W. J. Archibald and W. J. Chute.

4th Ordinary Meeting, March 13, 1944.

Papers: "Leucocytosis as an Index of Pyrogenicity in Fluids for Intravenous Use," by E. G. Young and F. A. H. Rice; "A Scheme for Representing Inter-relationships among the Thermodynamic Functions," by C. C. Coffin; "Food of the Haddock," by R. E. S. Homans and A. W. H. Needler.

5th Ordinary Meeting, April 17, 1944.

R. M. Lewis was announced as Associate Member (elected March 17).

Papers: "Heparin and Blood Fat," by C. B. Weld; "Estimation of the Anti-hemolytic Value of Blood," by H. B. Collier and K. M. Wilbur; "Lactic Acid: A Corrosive Poison," by E. G. Young and R. P. Smith. Demonstration: "Chemiluminescence," by J. C. Devins and A. K. Archibald.

In response to a request from the National Council for Canadian-Soviet Friendship, Toronto, the following resolution was passed:—*Resolved* that the members of the Nova Scotian Institute of Science go on record as expressing sympathy with Soviet scientists and other professional workers of the U. S. S. R. for the hardships which they have had to endure in the present conflict and for the loss of scientific laboratories and cultural institutions; and that they look forward to the time when the international fellowship of science shall be re-established.

ABSTRACTS

(Papers read before the Institute but not published in the Proceedings.)

CRITERIA FOR THE RECOGNITION OF DEVELOPMENTAL STAGES IN SALMON (*Salmo salar*). D. Pelluet, Dept. of Biology, Dalhousie University, Halifax, N. S. (Read November 15, 1943.) A series of 16 stages is established for the embryological history of the salmon, ranging from fertilization to the development of the fry. Each stage is characterized by a diagnostic feature which can be easily recognized in the living egg or embryo without the aid of sections. A comparison is made between these stages and others proposed by workers for various types of teleost fishes. The early phases of the development up to the closure of the blastophore claim the special attention of several of the workers. It has been pointed out that a similar diagnostic feature does not imply that these different forms of teleosts will show agreement in other phases of development. (Published in full in J. Morphology, *74*: 395-407, 1944.)

PRODUCTION OF TRIMETHYLAMINE IN CHOLINE BROTH BY ENTEROBACTERIACEAE. Frances Keeping, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read November 15, 1943.) About 300 identified bacterial cultures of members of the family Enterobacteriaceae were grown in nutrient broth containing choline hydrochloride (Eastman) 0.5%. The presence of trimethylamine was determined at one, two and seven days(Wood and Baird, 1942.)

Members of the genera *Serratia*, *Salmonella*, *Eberthella*, *Klebsiella*, and *Erwinia* were unable to produce trimethylamine from choline. In the genus *Proteus*, *P. mirabilis*, *P. vulgaris*, and *P. rettgeri* produced trimethylamine from choline. Strains of *Escherichia* and *Aerobacter* differed in their ability to break down choline. In the genus *Shigella* the single species *S. alkalescens* was able to utilize choline. Since this test easily distinguishes *S. alkalescens* from other *Shigella* species, including *S. paradysenteriae* with which it is frequently confused, it should be of value in clinical laboratories.

Repeated serial transfer in choline broth and plain nutrient broth has shown that the ability or inability of a culture to produce trimethylamine from choline is a constant characteristic.

Quantitative studies with *S. alkalescens*, using a colorimetric method of trimethylamine determination (Dyer, 1943), have shown that glucose inhibits choline breakdown. Mannitol, which is also fermented by this species has no effect. This suggests that choline is used as an energy source by bacteria and that glucose is used in preference to choline and choline in preference to mannitol. (Published in part in J. Bact., *47*: 309-310, 1944.)

THE HAEMOLYTIC ACTION OF LYSOLECITHIN AND SAPONIN. K. M. Wilbur and H. B. Collier, Depts. of Physiology and Biochemistry, Dalhousie University, Halifax, N. S. (Read November 15, 1943.) Hemolysis was followed by measuring the opacity of cell suspensions photoelectrically. The opacity varied with changes in cell volume over a wide range of tonicity. Using hypertonic and hypotonic solutions it was found that initial cell volume affected the rate of hemolysis by saponin and by lysolecithin: increase in volume slowed the action of saponin and accelerated that of lysolecithin. Sodium citrate shrinks the cells, and brought about a corresponding change in the rate of hemolysis by the two lysins. Oxalate brought about an acceleration with saponin, but had no marked effect on lysolecithin. Glucose inhibited lysolecithin hemolysis. The general conclusion is that saponin and lysolecithin differ in their effects upon the cell membrane. This is substantiated by results with mixtures of the lysins. (Published in full in J. Cell. Comp. Physiol., *22*: 233-249 1944.)

On the Determination of Minor Degrees of Color Blindness: the Use of the Eastman "Color Temperature Meter" as an Anomaloscope. C. B. Weld, Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read December 13, 1943.) The Eastman Color Temperature Meter allows one to vary the proportions of a red-green mixture so as to match a standard yellow. If one uses a standard light source, the instrument thus becomes an anomaloscope, useful in the study of individuals deficient in their sense of red or green and differing from normal people in their judgment of yellow (anomalous trichromat).

Using the instrument in this way the red-green-yellow color sense of 100 individuals was determined; they were also checked by Ishihara charts for red-green color blindness. Two-thirds of the normal subjects gave readings of the standard light source (3300° K) within the range 3100-3500° K, and four-fifths between 3100 and 3700° K, while the remainder of the Ishihara normal gave readings between 2800 and 4400° K. All those abnormal by the Ishihara charts gave readings even further removed from the true color temperature reading and most of them indeed could not properly match the colors at all, giving very erratic readings, often off the scale altogether. Minor degrees of color blindness are well shown by the instrument.

On the Optical Activity of Allantoin. E. Gordon Young and W. W. Hawkins, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read December 13, 1943.) The procedure of Fosse, Thomas, and deGraeve (*Cmpt. rend.* 198: 689, 1934) for the preparation of *l*-allantoin by the action of allantoinase from *Soja hispida* has been repeated twice on commercial allantoin. No optical activity could be detected on the initial crude product or the purified substance employing a saturated solution in a 4 dm. tube in a Hilger polarimeter. It is noteworthy that neither the lactam nor lactim formula can be constructed with Hirschfelder atomic scale models, without great strain in the closure of the ring. The symmetrical formula of allantoin can be readily constructed.

The Estimation of Volatile Phenols in Smoked Fish. H. V. French and E. P. Linton, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read February 14, 1944.) The volatile phenolic substances in smoked fish were estimated with Folin's colorimetric reagent. The phenol content is directly proportional to the time of smoking and remains constant irrespective of the time of storage or the state of decomposition of the smoked fish. The phenols are found mainly in the surface layers of the smoked fish even after prolonged storage. The method provides a satisfactory means for measuring the smoke content of the fish. (Published in full in J. Fish. Research Bd., Can. *Vi*: (4): 338-48, 1945.

The Colorimetric Determination of Trimethylamine. W. J. Dyer, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read February 14, 1944.) A discussion of titration and colorimetric methods, with the development of a new colorimetric method depending on the formation of a yellow trimethylamine picrate.

Leucocytosis as an Index of Pyrogenicity in Fluids for Intravenous Use. E. G. Young and F. A. H. Rice, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read March 13, 1944.) A study has been made on the dog of criteria indicating the presence of pyrogenic substances in distilled water. Leucocytosis was the most sensitive, being measurable in three to six hours after intravenous administration and lasting for many hours. Progressively less sensitive were neutrophilia, leucopenia, and hyperpyrexia. (Published in full in J. Lab. Clin. Med., *29*: 735-741, 1944.)

A SCHEME FOR REPRESENTING INTER-RELATIONSHIPS AMONG THE THERMODYNAMIC FUNCTIONS. C. C. Coffin, Dept. of Chemistry, Dalhousie University, Halifax, N. S. (Read March 13, 1944.) It is shown that most of the important thermodynamic equations can be obtained at once from a simple energy diagram in which intensity factors are plotted against capacity factors. It is presented mainly as a scheme for introducing to students the more abstruse concepts of the subject.

HEPARIN AND BLOOD FAT. C. B. Weld, Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read April 17, 1944.) The observation of Hahn that alimentary lipemia in dogs is cleared within a minute or so by heparin has been confirmed and extended. The visual opacity of the lipemic plasma is promptly removed by intravenous heparin in dogs, cats, rabbits, and humans. Heparin has no such effect *in vitro*. While some degree of parallel relationship between the total plasma lipid and the opacity of the plasma is common, the opacity of the plasma in lipemia may clear with no change or even with an increase in plasma lipid.

In attempting to determine the site of action of the heparin, lipemic heparinized blood has been perfused through the leg and through the liver. Heparin has also been injected into an animal (cat) whose hepatic artery, portal vein, and mesenteric arteries had been occluded. The liver is implicated but is probably not solely responsible for the clearing of the lipemic blood.

ESTIMATION OF THE ANTIHEMOLYTIC VALUE OF THE BLOOD. H. B. Collier and K. M. Wilbur, Depts. of Biochemistry and Physiology, Dalhousie University, Halifax, N. S. (Read April 17, 1944.) Previous workers have found that on incubation of blood serum the lysolecithin content increases. This is believed to be related to hemolysis *in vivo*. We have found that the extraction method for lysolecithin determination gives very low results. No specific method for lysolecithin has been developed to date. The method adopted was a direct titration, with pure lysolecithin, taking 50% hemolysis as the end-point. In this way the antihemolytic value of the blood can be expressed in terms of lysolecithin. The effect of various factors such as time, temperature, enzyme inhibitors, oxygen tension, has been determined. (In press, in J. Lab. Clin. Med., 1944.)

LACTIC ACID: A CORROSIVE POISON. E. G. Young and R. P. Smith, Depts. of Biochemistry and Pathology, Dalhousie University, Halifax, N. S. (Read April 17, 1944.) The deaths of three premature infants have been investigated both pathologically and chemically and have been found due to acute gastritis following the administration of an acid milk mixture containing an excess of lactic acid. After administering *per cs* a lactic acid milk mixture, containing 10.1 grams in 30 c.c. to rabbits, death followed in 10 minutes, 2, 6, and 40 hours in four animals. The symptoms and findings were identical with those of the infants, and death was attributed to acute hemorrhagic gastritis. There was a moderate degree of acidosis. Lactic acid must therefore be regarded as a corrosive poison and due care must be exercised in its use as an infant food. (Published in full in J. Am. Med. Assoc., *125*: 1179-81, 1944.)

EDITOR'S NOTES

A large manuscript, entitled "The Flora of Nova Scotia," by A. E. Roland, Provincial Botanist, Truro, N. S., has been accepted for publication in the Proceedings, but owing to war-time labour conditions in the printing trade, publication had to be postponed until Part III of the present Volume goes to press.

Bound copies of *A Catalogue of Scientific Periodicals in Libraries of the Maritime Provinces*, pp. 1-82, 1936, may still be obtained through the Editor. Price 50 cents.

Paperbound reprints of Vladikov and MacKenzie's *The Marine Fishes of Nova Scotia*, 96 pages, with keys and 131 text figures (Proceedings, Vol. XIX, Part 1, 1935), are also available through the Editor.

Paperbound reprints of Roland's *The Ferns of Nova Scotia*, 63 pages, with keys, 11 maps and 28 text-figures (Proceedings, Vol. XX, Part 3, 1941) and of Dore and Roland's *The Grasses of Nova Scotia*, 111 pages, with keys, 91 text-figures, 89 maps, and with indices (Proceedings, Vol. XX, Part 4, 1942), may be obtained through the Provincial Botanist, Truro, N. S.

PROCEEDINGS

OF THE

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HALIFAX, NOVA SCOTIA

VOL. XXI 1944-1946 PARTS 3 AND 4

CONTENTS

PART 3

PART 4

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PROCEEDINGS

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SESSION OF 1944-45
(Vol. XXI, Part 3)

THE FLORA OF NOVA SCOTIA

A. E. ROLAND

Nova Scotia Agricultural College

Truro, N. S.

(Received September 28, 1945)

ABSTRACT

The "Flora of Nova Scotia" treats, with the exception of the grasses, all the vascular plants of the province. These comprise 1202 species, 222 additional varieties, and 72 forms. If the grasses are added, a total of 1323 species, 255 varieties and 100 forms are present.

The introduction discusses the physical background and climate, the history of our knowledge of the flora, the main herbaria and literature, and the general distribution of the plants.

The region shows three main physiographic areas: the Atlantic Upland or south slope, composed of resistent slates, quartzites and granites; the true uplands along the northern length of the province which are composed of igneous basalt, syenites and granites; and the lowlands carved from the less-resistent shales, sandstones, limestones and gypsums. Botanically, Nova Scotia is on the margins of the hemlock-white pine northern hardwood region and the boreal evergreen forest. The hardwood forests are best developed along the north uplands; pines are common on the lowlands; and the evergreen forest is dominant along the Atlantic slope and eastward in Cape Breton.

The total flora is divided into six main types of plants according to their general distribution; one, plants of a wide southern or western Alleghenian, Hudsonian or Canadian range; two, plants mostly northern in range, found in Cape Breton or on the coastal headlands; three plants found predominately in southwestern N. S. and for the most part related to the coastal flora further south; fourth, isolated plants closely related to the European flora; five, endemic plants; and six, introduced weeds and escapes. Lists are given for each of these types and the local distribution discussed.

The early knowledge of the flora depended largely upon the work of the local botanists and the Dominion Botanist, John Macoun. This was greatly augmented later by the collections made by the Gray Herbarium Expedition to southwestern N. S. and to a limited extent elsewhere. Numerous collections exist. The principal ones are at the Gray Herbarium, in the National Herbarium at Ottawa, and at Acadia University.

The main part of the treatment includes keys to the families, genera, species and forms; and the general habitat, range and abundance of each is noted. 177 plates are included, illustrating about 700 plants. 477 dot maps show the distribution of the more interesting species.

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INTRODUCTION

The aim of this work is to give a list of the native and introduced plants growing without cultivation in the province, to bring up to date the nomenclature, and to provide a means of identification for the various species, varieties and forms that have been found in the region.

The order of the families is that used in Gray's New Manual of Botany, edition 7; and, with the exception of the ferns, which are arranged according to the order in "The Ferns of Nova Scotia" (Roland, 1941), the genera are likewise placed in the order found in that treatment. The grasses have been omitted, since they have been treated in a previous publication (Dore and Roland, 1942).

The International Botanical Rules are followed in the nomenclature. Specific or subspecific names derived from proper nouns are capitalized. Abbreviations of authors follow that of Gray's Manual or of recent treatments. The general ranges of the plants have been obtained from recent monographs or floras.

Keys to the families, genera and species are included. Recent monographs have been freely used and references to such monographs or discussions of nomenclature are included with the discussion of the plants concerned. Descriptions of families and genera are excluded because of the extra space involved and their general availability in other publications. Keys to the species and sub-specific forms are, however, relatively detailed.

Maps showing the ranges of the various species were compiled from herbarium specimens and from reports which were considered authentic. Doubtful or unusual records have been discarded until further study is made. In general those species which have been mapped are those which show an unusual or interesting range or are ones which are not well known. Since most of the roads are near the coast, few plants have been collected in the center of the province and the ranges shown are usually incomplete in this respect. The region along the Atlantic Coast from Halifax to northern Cape Breton will likewise show many gaps. The plant distribution in New Brunswick, Prince Edward Island and the Magdalen Islands is not worked out in detail but is shown only in so far as the data were easily available when the Nova Scotian plants were checked.

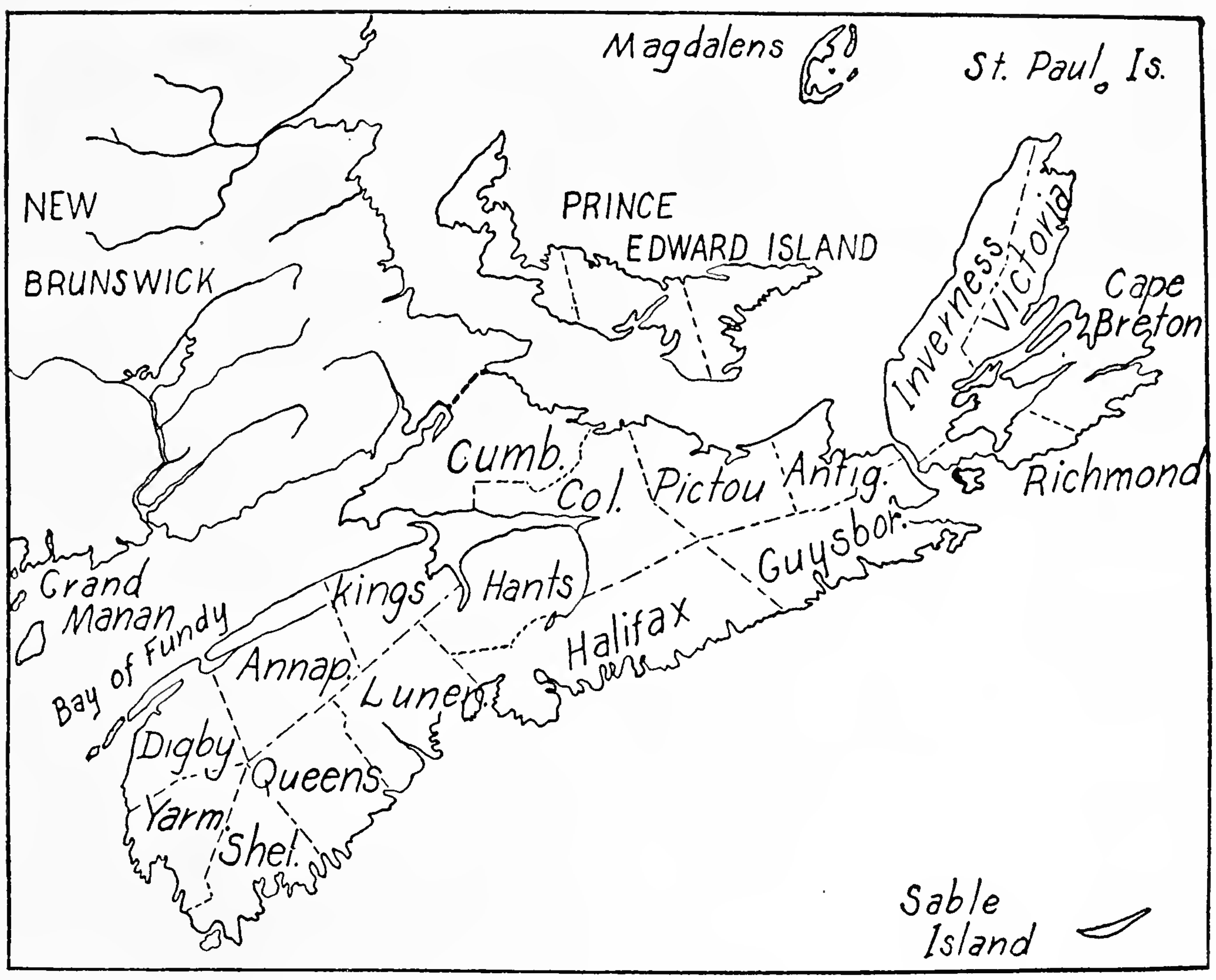
Since this report has been in progress a number of years I wish to express my thanks to the Department of Agriculture of Nova Scotia for their continued support. The work also covers in part the requirements for the degree of Doctor of Philosophy from the University of Wisconsin. A research fellowship from the Wisconsin Research Foundation has made possible an extra year's study to complete the library and herbarium work.

I here express my thanks particularly to Dr. N. C. Fassett of the University of Wisconsin; and to Mr. C. A. Weatherby of Gray Herbarium who has helped me in many ways and placed data on the plants of Grand Manan at my disposal.

The curators of the various herbaria have freely placed at my disposal the Nova Scotian collections. Many collectors in the province have given me data or shown me collections. Mr. W. G. Dore of Dalhousie University and Mr. Rundall Lewis of the Plant Pathology Station at Kentville have carried on much field work; and Mr. Eville Gorham of Dalhousie University has assisted in working up the Juncaceae.

THE PHYSICAL BACKGROUND

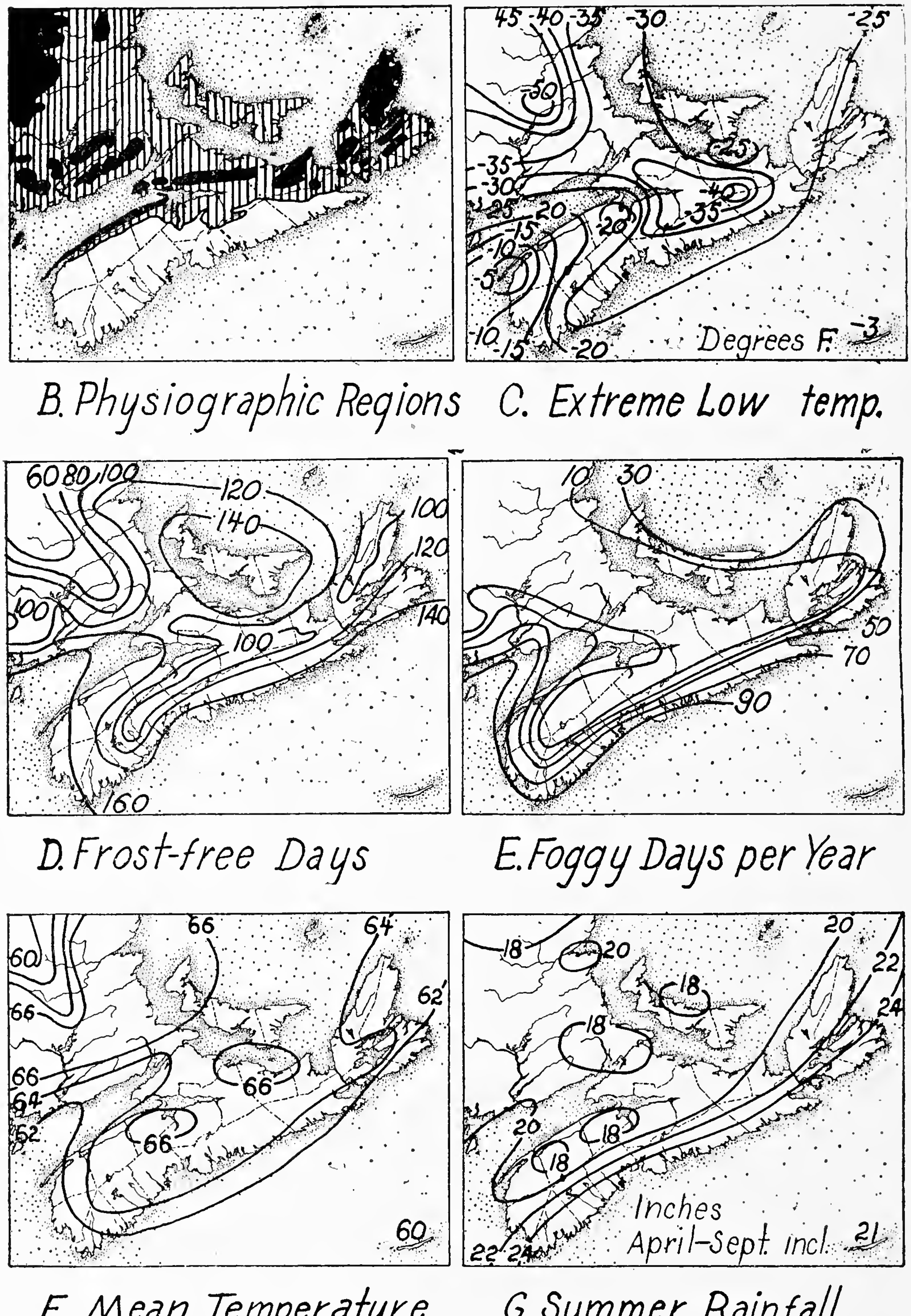
Nova Scotia, the most eastern of the provinces of Canada, lies between 43° and 47° north latitude with the axis running in a general north-east south-west direction. It has a length of about 340 miles and an average width of 50 miles; it consists of a peninsula joined to the mainland by the low swampy Isthmus of Chignecto, and the Island of Cape Breton separated from the eastern end of the peninsula by the narrow Strait of Canso. Two small islands, extensively explored botanically, lie off Cape Breton. St. Paul Island is a few miles north of the northern tip ; and Sable Island, a narrow sandy bar 20 miles long, is one hundred miles to the southward. The province is divided into 18 counties as shown in map A.



Map A.—Map of Nova Scotia showing the counties.

Geologically the province is the up-tilted and eroded surface of an old Cretaceous peneplain. This dips below the surface of the Atlantic Ocean to produce the drowned and very irregular coast-line, and raises gradually and evenly to the northward to attain in the highlands of northern Cape Breton and southern New Brunswick a height of 1200 feet. The weaker rocks and structures of the northern area have worn away so that the province, which is flat, sterile and poorly-drained along the Atlantic Coast, becomes increasingly hilly and irregular inland.

Map B shows the main physiographic areas of the province. The unshaded area comprising nearly the southern half of the area is called the Atlantic Upland. This is composed of very resistent rocks, slates, quartzites and granites and it is not essentially an upland but rather gently rises from sea-level at the southern edge to a height of 100 to 500 feet at its northern boundary. The western half of this upland has the three main types of rocks in about equal proportions, with the areas of slate appearing in southern Yarmouth, central Queens and in Lunenburg counties while



Map B. Physiographic regions, with explanation in the text. Maps C-G. Climatic data, after Putnam, courtesy of the Canadian Geographic Journal.

the eastern half is mainly granites and quartzites. The topography is of slight relief, and innumerable lakes, streams, bogs, barrens and stillwaters occur.

The shaded areas comprise the true uplands of the province. The long range, or North Mountain, from Kings County to Digby County, is composed of basalt or trap rock and it gradually falls from a height of nearly 600 feet at its eastern end until it dips beneath the sea at the southern end of Digby Neck. From western Cumberland County to northern Cape Breton occur ranges of hills and highlands composed of igneous rocks, syenites, diorites, and granites. Those occurring from Cumberland County to Pictou County, known as the Cobequid Mountains, rise to 1000 feet and are covered mostly with deciduous forest; the broad plateaus of northern Cape Breton, often attaining a height of 1200 feet, have a much poorer drainage, a more severe climate and a shorter growing season, and are covered with bogs, swamps, and coniferous trees.

The vertically hatched areas are lowlands of Carboniferous to Triassic age very diverse in character. The Annapolis Valley from Digby County to Kings County is carved from Triassic sandstones; the northern and eastern lowlands have various mixtures of sandstones, shales, congolomerates, limestones and gypsum. Extensive intervales occur; deep valleys and rugged cliffs are found next to the uplands; and lakes and ponds are relatively few.

The climatic data given in maps C to G are taken from Putnam (1940). The southwestern part of the province shows a longer frost-free period, lower July temperatures, more foggy days per year, and a higher minimum winter temperature than the other regions. The Island of Cape Breton differs markedly in having a shorter growing season. The temperature and the number of fog-free days, of the northern region at least, are also low throughout the year.

The soils of the province have not been studied in detail. Although the region has been wholly glaciated they show close correlation with the underlying rocks. The soils of the granitic and quartzite areas are thin and rocky. Extensive sand areas occur in the Annapolis Valley and in Cumberland County. The undulating or hilly areas are usually well-drained with deep soils; but much of the lowlands of northern and eastern Nova Scotia have soils heavy in texture and of poor drainage. Near the coast extensive peat bogs and swamps occur and raised Sphagnum bogs are common in Guysborough County and in Cape Breton.

HISTORICAL ASPECTS AND HERBARIA

The local history of our knowledge of the flora of Nova Scotia may properly be started when the first number of the Transactions of the N.S. Institute of Science was published in 1863. Before this time there had been scattered lists, published or unpublished, and a book on the wild flowers of the province had been written by Maria Morris and illustrated by twelve colored plates, but no comprehensive work on the plants had been undertaken. The publication of the Transactions gave, for the first time, a medium of publication which would bring together the scattered information and place it in a form which would later be readily available for reference.

At about this same time a number of workers in different parts of the province began to make systematic collections of the plants. Dr. Howe collected at Windsor; Dr. A. H. MacKay worked in the neighborhood of Pictou; Dr. A. W. H. Lindsay of Halifax collected extensively in the eastern part of the province; and the Rev. E. H. Ball made numerous collections at various places where he held pastorates. Many of these collections are still preserved in the Provincial Museum at Halifax. In general they consist of the common plants of the province, usually correctly named, but in some cases with names attached of plants now known not to occur or to be rare in the province.

The results of this early work were gathered together by Lindsay (1877) to form his Catalogue of the Flora of Nova Scotia, published in the Transactions of the Institute of Science; this has remained until today as the only attempt to bring together a comprehensive list of the plants of the province.

Most of the papers following this catalogue have been lists of plants collected in scattered localities throughout the province or they have been notes upon rare or unusual plants. Howe, the following year, made a list of additions to Lindsay's list; Lawson (1884, 1890) notes the occurrence of other rare plants; Campbell, (1885, 1886) lists the plants found in the vicinity of Truro; Cox (1894) likewise gives a list from Shelburne; Robinson (1903, 1907) notes plants collected in eastern Nova Scotia, and especially intervale plants; Fowler (1907) reported on the plants of Canso; Barbour

(1908) reviews the flora of McNab's Island in Halifax Harbour; and Prest (1908) discusses the edible plants of the province. Many of the discoveries of these early botanists, as well as the numerous collections from northern and eastern Nova Scotia of John Macoun himself, were reported or listed in the various volumes of Macoun's Catalogue of Canadian Plants which appeared between the years 1883 and 1902.

The ferns were perhaps the most intensively studied. Rev. E. H. Ball (1876) early studied this group and his information was later supplemented by the work of Lawson. Lawson's Fern Flora of Canada, printed in Halifax in 1889, was used extensively in the common schools of the province.

Two ecological works published during this period may also be mentioned since they add to the distributional knowledge of the plants. These were the only attempts to study the vegetation instead of the individual species, and were based on the successional concepts developed by Cowles in his study of the vegetation about Lake Michigan. Ganong (1903) discusses in detail the vegetation about the head of the Bay of Fundy, the ecological factors, and the various plant associations of the salt and dyked marshes to be found in that region. The short paper by Transeau (1909) is a study of the littoral vegetation of the rocky coast at the southern end of the province.

By this time, 1907, the plants of Nova Scotia as a whole were still imperfectly known, and the enthusiasm of the earlier workers had largely died down. To be sure, the repeated visits of the Dominion Botanist, John Macoun, to the province had resulted in extensive collections being made of the plants of the northern and eastern parts of the province, but the flora of the southwestern counties was almost entirely unknown. Little collecting had been done between Halifax and northern Cape Breton and many other counties were represented by only occasional specimens. Plants now known to be dominant or common over much of the western area of the province were discarded or believed to be rare. The grasses and sedges were very imperfectly known and many other groups were poorly collected.

The second period in this history includes the twenty years following the publication of the seventh edition of Gray's Manual in 1907. During this period the plants of the province were studied mostly by outside workers and few additions were made to the local herbaria. Several publications gave a much more comprehensive picture of the flora and vegetation, and laid a firm foundation for future work. Fernow, Howe and White were called in to study the forest conditions of the province. The vegetation of northern Cape Breton was studied in detail by Nichols (1918) and this resulted in one of the most important ecological studies of any area in northeastern North America, as well as an increased knowledge of the flora in general. St. John (1921) studied the flora of Sable Island, and reviewed the earlier collections made by Macoun and Gussow ; and the reports of Fernald (1921, 1922) of the Gray Herbarium Expedition to southwestern Nova Scotia are indispensable to anyone studying the plants of the province. The study of the estuarine plants by Fassett carried on during this period, although it does not deal in much detail with the plants of Nova Scotia, gives a further background to our knowledge of plant distribution.

From 1927 to the present time the local botanists have been mainly occupied in enlarging the herbaria in the province and in gaining a more adequate knowledge of the distribution of the plants. Most of this work has not been published; but Perry (1931) describes the vascular flora of St. Paul Island in northern Cape Breton, and the studies of Weatherby (1942) have enlarged our knowledge of a little-known region in central Queens County. During this same period the plants of north-eastern North America in general have been intensively studied, and practically no group of plants is present that has not been recently revised or monographed.

The geographical setting of the flora and its relation to that of other regions is given by Fernald (1918) and further enlarged in his report in 1921. The distribution of many of the northern plants and their bearing on the problem of glaciation was discussed in 1925 in his paper on "The persistence of plants in unglaciated areas of boreal America."

The earlier collections of Nova Scotian plants exist mainly in the Provincial Museum at Halifax. The collections made by Dr. Howe at Windsor, mostly between the years 1862 and 1866, are found here; as are also the numerous collections of E. H. Ball from Springhill, Westville, Mahone Bay and other localities. The Lindsay collection, upon which many of the reports in his catalogue are based, comprise eight drawers of plants. These are unmounted between single sheets of the N.S. Journal of Agriculture and were collected mostly between 1869 and 1873. The Museum has also a duplicate set of the plants collected by C. D. Howe and W. F. Lang in Nova Scotia and Newfoundland during the summer of 1901.

The most representative collection exists at the Gray Herbarium, Harvard University. This is composed of the extensive collections made by the Gray Herbarium Expedition to the province in the summers of 1920 and 1921. It also includes duplicate sets made by Howe and Lang, by Fowler at Canso in 1901, by C. A. Hamilton at Boylston, Guysborough County in the 1890's, and many of the collections of Macoun. Harold St. John collected in Pictou County in 1913, and on Sable Island in the same year. Many of Nichols' collections from northern Cape Breton, obtained mainly during the summers of 1914 and 1915, are here, as are also J. G. Jack's collections of woody plants made in the province in 1924. Other more limited collections were made by botanists who made shorter visits to the province.

In addition to the Nova Scotian collections, others from surrounding areas are shown upon the distributional maps. Thus, collections made by Fernald, Bartram, Long and St. John in Prince Edward Island in 1912, and by Macoun in 1888, give a representative sample of the flora of that province. Likewise collections by Fernald, Long and St. John, supplemented later by the work of Frere Victorin and others of the Botanical Institute of the University of Montreal, were seen for the Magdalen Islands. F. Tracey Hubbard made extensive collections at Shediac Cape, N.B. during the summer of 1914; Mr. C. A. and Una Weatherby repeatedly visited the Island of Grand Manan and compiled information of the plants; and S. F. Blake collected on the Gulf of St. Lawrence coast of New Brunswick.

While the Gray Herbarium is especially rich in the plants of southwestern Nova Scotia, the National Herbarium at Ottawa contains the best representation of the plants of the eastern region. These are mainly the collections of John Macoun, but comprise also the plants collected by Jacques Rousseau in eastern Halifax County and Guysborough. Duplicates of many plants of the Gray Herbarium Expedition are found here, so that in general there is a good representation of the plants of this province. The weed flora is best represented by the many collections made by Herbert Groh and J. Adams, in the herbarium of the Central Experimental Farm, Ottawa.

The best and most extensive herbarium in the province itself is at Acadia University. This was built up mainly by the efforts of Drs. H. G. Perry and M. V. Roscoe and their students, of whom might be mentioned in particular A. E. Longley and R. W. Ward. A set of the estuarine plants of northeastern North America collected by Fassett and the herbarium of Dr. G. U. Hay of New Brunswick are found here. The Laboratory of Plant Pathology at the Kentville Experimental Station has a representative collection consisting mainly of plants found in Kings County, but also containing many sheets from other parts of the province. For the north-central counties the best collection is at the Agricultural College, Truro. This is composed in large part of the plants collected by A. R. Prince and C. E. Atwood between 1925 and 1930., and the collections made by the author since that time. The main collections of grasses and sedges have been made by W. G. Dore of Dalhousie University and are in the herbarium of that institution or at the Central Experimental Farm, Ottawa.

Thus in general the flora is becoming fairly well known and extensive collections are being built up. Unfortunately for local botanists, however, the more valuable ones are to be found outside the province. Particular groups of plants, and the variation within individual species and their ecological variation on the other hand, have been little studied. Complex groups like *Oenothera, Rubus, Crataegus, Agrostis* and *Aster* offer much ground for investigation, and certain areas of the province are virtually unstudied. Distributional maps are thus often incomplete, and the central part of the province and the eastern Atlantic region in particular are yet to be covered in a systematic manner.

THE FLORA OF THE REGION

Botanically, Nova Scotia lies within the hemlock-white-pine-northern hardwood region of eastern North America (Nichols, 1935). The dominant trees are the hemlock, sugar maple, beech, yellow birch, white and red pine, white ash, red and white spruce, balsam fir and red maple. Sugar maple is found on the better well-drained soils, beech on the drier ridges, and hemlock and yellow birch on lower ground or on more poorly-drained soils. Sandy soils formerly had good stands of pine. Red maple is found in swampy areas or near lake borders. Poorly-drained areas or exposed locations of the northern plateaus or the Atlantic Upland have a dominant vegetation of balsam fir and red spruce, while larch and black spruce predominate in bogs and swamps. In general, the hardwoods are more common in the northern half of the province, while the spruces, fir and red maple are dominant in the southern and eastern regions. Eastward towards Cape Breton, and to some extent along the Bay of Fundy, white birch, fir and mountain ash increase in amount. Basswood, silver maple and butternut have never penetrated into Nova Scotia, although they are found in central and southern New Brunswick. White cedar is very local; jack pine is found only on the poorest soils and originally in small amounts.

The vascular flora of Nova Scotia consists of 1323 species, 255 additional varieties and 100 forms. Of these, 368 species and 26 varieties are introduced plants. The total flora may be divided roughly into six main types of plants: one, plants of a wide southern or western Alleghenian, Canadian or Hudsonian range; two, plants mostly northern in range found mostly in Cape Breton or on the coastal headlands; three, plants found predominantly in southwestern Nova Scotia and related to the flora found near the coast further south, or in a few cases of a more general inland range; four, plants related to the European flora, rare or unknown westward; five, endemic species or varieties; and six, introduced plants. The salt marsh plants, which will be discussed separately, show much the same general divisions.

1. PLANTS OF ALLEGHENIAN, CANADIAN OR HUDSONIAN RANGE.

Plants that show an affinity to the Alleghenian flora are mainly plants of deciduous woods. Consequently they are found in, and are often restricted to, the northern part of the province from Annapolis County to Cape Breton in the region of rich woodlands or intervales. Some, like *Allium tricoccum* or *Caulophyllum thalictroides* are very local; others are widespread and general. A few are rare or scattered on the intervales of central Nova Scotia, and become general only along the flood-plains along the rivers of northern Cape Breton. *Caltha palustris*, for example, is luxuriant on some of the intervales of Cape Breton, but only an unverified report of it exists for the peninsula. Characteristic plants of this southern range which are confined mainly to the northern half of the province are listed below.

Adiantum pedatum
Athyrium thelypterioides
Botrychium virginianum
Sparganium eurycarpum
Glyceria melicaria
Hystrix patula
Carex scabrata
Spirodela polyrhiza
Lemna trisulca
Uvularia sessilifolia
Allium tricoccum
Lilium canadense
Erythronium americanum
Polygonatum pubescens
Trillium erectum
Trillium cernuum
Ostrya virginiana
Laportea canadensis
Polygonum arifolium
Ranunculus recurvatus
Claytoniana caroliniana
Hepatica americana
Caltha palustris
Caulophyllum thalictroides
Sanguinaria canadensis
Dicentra Cucullaria
Dentaria diphylla
Tiarella cordifolia
Desmodium acuminatum
Desmodium canadense
Impatiens pallida
Viola pensylvanica
Circaea latifolia
Aralia racemosa
Panax trifolium
Sanicula marilandica
Sanicula gregaria
Osmorhiza longistylis
Osmorhiza Claytoni
Apocynum sibiricum
Verbena hastata
Mimulus ringens
Veronica americana
Solidago flexicaulis
Bidens discoidea

Other plants of a more distinctly Canadian range across the continent often show much the same distribution in the province and are usually found in similar habitats. The great majority, however, are those of general distribution such as the spruces, poplars and birches. Many of the herbaceous plants are likewise general throughout; and plants like Clintonia, twin-flower, blueberries, cranberries and many of the goldenrods and asters are found everywhere. Plants of this group which are restricted to the northern part of the province are:

Pteretis pensylvanica	Ribes lacustre
Botrychium matricariaefolium	Ribes triste
Equisetum scirpoides	Potentilla palustris
Sagittaria cuneata	Geum macrophyllum
Poa saltuensis	Geum laciniatum
Alopecurus aequalis	Geranium Robertianum
Milium effusum	Rhamnus alnifolia
Scirpus rubrotinctus	Viola Selkirkii
Carex disperma	Circaea quadrisulcata
Carex diandra	Cicuta bulbifera
Carex leptalea	Cornus stolonifera
Carex aurea	Cornus rugosa
Carex retrorsa	Lysimachia thyrsiflora
Habenaria hyperborea	Fraxinus nigra
Listera convallarioides	Menyanthes trifoliata
Spiranthes Romanzoffiana	Satureja vulgaris
Polygonum amphibium	Mimulus moschatus
Ranunculus Gmelini	Viburnum trilobum
Ranunculus abortivus	Triosteum aurantiacum
Anenome quinquefolia	Bidens cernua

Similarly, the wide-ranging northern plants are usually found wherever bogs, barrens or headlands occur. Plants like *Scirpus cespitosus*, var. *callosus*, *Carex oligosperma*, *Juncus filiformis*, *Rubus Chamaemorus* or *Empetrum nigrum* are found in such localities throughout the province. A small group, however, are restricted to the northern part of the province where they may be found on heavy clay soils, or in swamps or bogs. The following are more or less general in this northern region, but countless others have been collected once or a few times and are commoner northwards in

N.B., P.E.I. or on the Magdalen Islands.

Lycopodium sabinaefolium	Eriophorum viridi-carinatum
Scirpus hudsonianus	Carex limosa
Eriophorum Chamissonis	

2. NORTHERN PLANTS.

Plants that have their range mostly to the north of Nova Scotia are concentrated mainly in northern Cape Breton. They are much like the preceding group of plants and may be considered as forming a continuous series with them. Plants rare in the province that have been found only in Cape Breton, or in a few cases on Cape Blomidon or at some other local point around the coast, may be represented by the following:

Asplenium viride	Draba norvegica
Woodsia glabella	Saxifraga Aizoon
Botrychium Lunaria	Potentilla pectinata
Sparganium hyperboreum	Empetrum atropurpureum
Trisetum spicatum	Empetrum Eamesii
Carex gynocrates	Cornus suecica
Tofieldia glutinosa	Vacciniun uliginosum
Salix cordifolia	Pinguicula vulgaris
Salix Uva-ursi	Lobelia Kalmii
Silene acaulis	Solidago multiradiata
Draba arabisans	Hieracium Robinsonii

Plants rather general in Cape Breton but not found upon the mainland are:

Polystichum Lonchitis	Betula pumila
Dryopteris Filix-mas	Sanguisorba canadensis
Lycopodium Selago	Angelica atropurpureum
Luzula parviflora	Galium kamtschaticum
Goodyera decipiens	Viburnum edule
Populus tacamahacca	Solidago macrophylla

Other plants are common in Cape Breton and are also found throughout much of the northern part of the mainland. These comprise plants like *Asplenium Trichomanes, Polystichum Braunii, Dryopteris fragrans, Schizachne purpurascens* and *Primula mistassinica*. Similarly many of the plants which are found about the coast of northern Cape

Breton are also found at scattered places around the coast of the whole province.

Juniperus communis megistocarpa	Sedum roseum
Juniperus horizontalis	Coelopleurum lucidum
Iris setosa canadensis	Halenia deflexa
Smilacina stellata	Euphrasia Randii

Senecio Pseudo-Arnica

One other group of plants which shows a more or less localized range in the province may be mentioned here. They are found on or near gypsum. Some are northern plants that here find a habitat free from competition; others also grow in rich woods. *Senecio balsamitae* var. *neoscoticus*, *Erigeron hyssopifolius*, *Sphenopholis intermedia* and *Carex eburnea* are restricted to this habitat. *Cystopteris bulbifera* and *Fragaria vesca* var. *americana* are common here and also are found elsewhere in very rich woods or on calcareous slopes; and such shrubs as *Shepherdia canadensis*, *Potentilla fruticosa* and *Cornus rugosa* are frequently seen.

3. SOUTHWESTERN PLANTS.

The southwestern part of the province has a floral element allied to the plants growing further south along the coast. This region comprises that part of the old Atlantic Upland in the southwestern part of the province, particularly that part of it formed from slates. Roughly this area comprises the part of the province south of a line from Digby Neck east through central Annapolis and Hants Counties to Musquodoboit Harbour in Halifax County, with parts of eastern C.B. and the plateau of northern C.B. showing some similarities in climate and habitats. The plants typical of this region are largely lacking in the quartzite and granitic areas northwards and eastwards.

It is a region of lakes and barrens, of innumerable pondholes and sloughs, with rather level lands, high humidity and acid soils. Plants which are absent or rare in the northern regions often grow here in great luxuriance and abundance. At the same time many of the heaths, sedges and bog plants of more northern range are also common. This intermingling of northern and southern plants is often very conspicuous.

Fernald (1921) commenting upon Merriam's life zones remarks: "In a region where the Louisianian *Lycopodium inundatum*, var. *Bigelovii* (*L. adpressum*) and the Louisianian and Carolinian *Utricularis subulata* creep among the bases of *Carex Goodenowii* (Greenland and arctic America, south to Nova Scotia and eastern Massachusetts) or of *Juncus filiformis* (Greenland to Massachusetts and the mountains of Pennsylvania); where the Louisianian and Carolinian *Eleocharis tuberculosa* vies with *Carex oligosperma* (Labrador to Great Bear Lake, etc.) for the possession of the edge of a savannah; where the dominant undergrowth in the spruce, fir and larch swamps includes the Louisianian and Carolinian Inkberry, and such a distinctly southern plant as *Solidago Elliottii*; where the Inkberry makes tall thickets with *Ledum groenlandicum* or pushes its branches through the carpet of arctic Crowberry, *Empetrum nigrum*, or the arctic Cloudberry or Bakeapple (*Rubus Chamaemorus*); —in a region where these comminglings are met at every turn, one is certainly perplexed to make Merriam's zones fit the facts."

At least 75 species are either confined to this area of the province or are else abundant here with only scattered stations elsewhere. The following are typical of plants that are local and rare in southwestern Nova Scotia and which are found elsewhere near the coast from southern Maine or Massachusetts southward.

Woodwardia areolata	Polygonum puritanorum
Potamogeton pulcher	Rhexia virginica
Panicum clandestinum	Hydrocotyle umbellata
Panicum dichotomiflorum	Lilaeopsis lineata
Panicum longifolium	Sabatia Kennedyana
Eleocharis tuberculosa	Utricularia inflata
Lachnanthes tinctoria	Eupatorium dubium
Lophiola aurea	

Plants which are general or abundant in this area and very rare or unknown elsewhere in eastern Canada are:

Dryopteris simulata	Sisyrinchium atlanticum
Glyceria obtusa	Ilex glabra
Panicum spretum	Myriophyllum humile
Eleocharis Robbinsonii	Proserpinaca pectinatus
Rynchospora glomerata	Vaccinium corymbosum
Carex bullata	Bartonia virginica

Xyris caroliniana	Utricularis subulata
Smilax rotundifolia	Solidago Elliottii

Some of the plants, like *Vaccinium corymbosum,* and to a lesser degree plants like *Cyperus dentatus, Eleocharis Smallii, Scirpus Longii* and *Utricularia purpurea,* are also found in southern Quebec or extend locally into southwestern New Brunswick. Others like *Symplocarpus foetidis, Juncus marginatus, Decodon verticillatus* and *Cephalanthus occidentalis* are confined to southwestern Nova Scotia but have a general range far to the westward and of an Alleghanian or Canadian type. On the other hand some of these plants which are abundant in the southwestern region also are scattered northward to the Annapolis Valley or through Cumberland County to P.E.I. Here belongs plants like *Woodwardia virginica, Muhlenbergia uniflora,Carex cumulata, Subularia aquatica, Polygonum hydropiperoides* and *Nymphoides lacunosum.*

A few of the plants belonging to this group of the southwest are also found on the plateau of northern Cape Breton or on the southern or south-eastern, area of Newfoundland.

Schizaea pusilla	Elatine minima
Lycopodium inundatum var. Bigelovii	Myriophyllum tenellum
	Gratiola aurea
Potamogeton confervoides	Bartonia paniculata
Juncus militaris	Xyris montana

Still other plants which are related to a more southern coastal flora are general throughout the whole area of the province wherever suitable habitats occur. Here belong *Juncus canadensis, Eriocaulon septangulare, Lobelia Dortmanna* and *Utricularia cornuta.*

The flora of Sable Isand has been treated in detail by Harold St. John. In general it is an attenuated flora of mostly herbaceous plants with a few low creeping shrubs and consisting of plants capable of existing in open situations. It does not differ greatly from that of the mainland. 147 species, varieties and forms are known, of which St. John divides the native ones into 30% boreal types, 24% Canadian and Alleghenian types, 16% southwestern types, 15% coastal plain species and 7 endemic plants, some of which have since been found on the mainland.

The northern plants are represented by *Juniperus communis* var. *megistocarpa, Juniperus horizontalis, Smilacina stellata, Coelopleurum lucidum, Menyanthes trifoliata* and *Senecio Pseudo-Arnica.* The rarer southwestern plants are *Sisyrinchium graminoides, Tillaea aquatica, Viola primulifolia, Bartonia paniculata, Gerardia neoscotica* and *Myriophyllum tenellum.* Particularly interesting are three European plants: *Centaurium umbellatum, Potamogeton polygonifolius,* and *Juncus bulbosus.* The last two, at least, are also found in southeastern Newfoundland; and *J. bulbosus* reaches Cape Cod. The five endemic varieties are listed below.

4. EUROPEAN PLANTS.

Three European plants localized on Sable Island are mentioned above. Several others are found in eastern Nova Scotia, but the number is much smaller than is found in Newfoundland. *Potentilla procumbens* and *Linum Catharticum* are found in Cape Breton, but it is difficult to know whether they are native or introduced. Similarly *Gnaphalium sylvaticum* shows much the habits of a native plant. Around the coast are several plants that are found in the Baltic Sea or neighboring regions of northern Europe: *Polygonum Raii, Polygonum acadiense, Polygonum maritimum* and *Atriplex glabriuscula.* The rockweed, *Fucus serratus,* shows much the same distribution. *Ranunculus Flammula* has been found at one place in Yarmouth County; it occurs also in Newfoundland and Europe. The genus *Corema* is also known from Spain; and *Eriocaulon septangulare* is common in western Ireland and Scotland. Many other plants are common to both continents but show no peculiar range.

5. ENDEMIC PLANTS.

Since Nova Scotia is a peninsula the plants are more or less isolated from those of other regions Further, those of southwestern Nova Scotia are separated by 350 miles of ocean from those on Cape Cod, New Jersey or further south. Consequently it might be expected that many local species or varieties would evolve and that their number would give some idea of how fast the evolution of the plants has proceeded. Outside of *Rubus* and *Crataegus* only two dubious species and thirteen minor varieties are found. In many cases these varieties are also of uncertain value. The larger part of them are found in the southwestern counties, and five are confined to Sable Island.

Agropyron pungens var. acadiense.
Panicum longifolium var. tusketense.
Eleocharis tuberculosa forma pubnicoensis
Juncus pelocarpus var. sabulonensis
Juncus subcaudatus var. planisepalus
Pogonia ophioglossoides var. brachypoda
Polygonum hydropiperoides var. digitatum
Polygonum hydropiperoides var. psilostachyum
Lathyrus japonicus var. retusus
Epilobium nesophilum var. sabulonense
Asclepias incarnata var. neoscotica
Gerardia neoscotica
Solidago galetorum
Rudbeckia laciniata var. gaspereauensis
Hieracium scabrum var. leucocaule

6. INTRODUCED PLANTS

The number of introduced plants in the province is high relative to the total flora. 368 species and 26 varieties, are included here, with several others belonging to the doubtful list. Nova Scotia, since it is a coastal province, has had numerous foreign plants brought in around the ports where they were merely adventive or became locally established. Many of these are probably no longer found and, if further exploration does not rediscover them, they should be relegated to the list of excluded species.

The common weeds are found throughout; others like the mustards and many hawksweeds are still rapidly spreading. Many of the small plants are found mainly as railroad weeds; and numerous plants of European origin are being repeatedly introduced from western America in grains and feeds.

Several species are common in southwestern Nova Scotia and have not spread far outside this region. Here may be mentioned *Sieglingia decumbens, Holcus lanatus* and

Alchemilla pratensis. In the eastern part of the province the Ragwort, *Senecio Jacobaea,* has overrun the country. The European Cuckoo Flower, *Cardamine pratensis,* is very common in the Annapolis Valley; other weeds that are rapidly spreading are *Rumex Acetosa, Hieracium aurantiacum, Sonchus arvensis,* and *Daucus Carota.* In several cases the introduced species and a native very similar variety grow together.

SALT MARSH PLANTS

The plants of the sea-strands and brackish marshes are well-developed and estuaries and brackish ponds near the coast also often have a characteristic flora. Such plants as *Spartina alterniflora* and *Spartina patens* are common throughout, as is the bulrush *Scirpus paludosus. Plantago decipiens,* various species of *Polygonum, Suaeda, Sarsola,* and *Amaranthus* are all common. In general the plants of the seashores show as much diversity in general distribution as do the more inland plants. Many, like *Limonium Nashii* var. *trichogonum,* are common from the Gulf of St. Lawrence south to New Jersey; others, like *Spergularia canadensis, Cakile edulenta, Ligusticum Scothicum, Glaux maritima* and *Potentilla pacifica* are also common on the West Coast.

A few, already mentioned above, like *Polygonum Raii, Atriplex glabriuscula* and *Polygonum acadiense* are found about the coast of Europe; and several, like *Scirpus rufus,* have isolated stations westward in James Bay.

A number of the typical salt marsh plants, for example *Scirupus paludosus, Atriplex hastata* and *Distichlis spicata* or very similar varieties of them, are common on the brackish or alkaline plains in Western America. A further group, which are confined entirely, or nearly so, to the upper borders of brackish marshes or sea-shores on the Atlantic Coast, are often found in fresh-water or on lake shores around the Great Lakes and westward. A few of these are listed below.

Zannichellia palustris	Spartina pectinata
Potamogeton pectinatus	Carex lacustris
Potamogeton bupleuroides	Juncus Gerardi
Distichilis spicata	Juncus balticus
Phragmites communis	Lathyrus japonicus
Hierochloe odorata	Bidens frondosa anomala

Scirpus Olneyi and *Eleocharis rostellata* are general in southwestern Nova Scotia and are found elsewhere from southern Maine southward; while *Gerardia maritima* and *Iva frutescens* var. *oraria* are known from one and two stations respectively. Similarly, some of the northern plants are found isolated at one or a few stations in the northern part of the province. Estuarine plants of our coast have been studied by Fassett (1928), who visited numerous points in Nova Scotia.

PTERIDOPHYTA FERNS AND THEIR RELATIVES

a. Stems conspicuously grooved, with conspicuous toothed sheaths at the nodes (Fig. 4, 5). *Equisetaceae* p. 149

a. Stems not conspicuously grooved, without toothed sheaths.

b. Stem very short, corm-like, usually submersed; leaves long, linear, in a rosette; sporangia sunken on the inner faces of the leaf-bases (Fig. 7, a, b). *Isoetaceae* p. 159

b. Stem erect or prostrate; leaves scattered; spores not borne in the leaf-bases.

c. Leaves small and scale-like, spreading or overlapping, numerous; sporangia in the axils of ordinary or reduced leaves, in a terminal cone, or on the upper part of the plant.

d. Plants moss-like, less than 5 cm long; spores of 2 sizes (Fig. 6, d, e). *Selaginellaceae* p. 158

d. Plants much larger; spores of one size (Fig. 6, 7). *Lycopodiaceae* p. 153

c. Leaves (fronds) not scale-like, growing from underground root stocks or on short prostrate or erect stems.

e. Sterile blade entire, ovate or else thread-like.

f. Plant 1-4 dm high; sterile blade ovate; fertile portion spike-like, unbranched (Fig. 4, g). *Ophioglossum* p. 147

f. Plant 4-7 cm high; sterile fronds thread-like, curly; fertile frond with a very short folded blade (Fig. 4, h). *Schizaea* p. 145

e. Sterile blades lobed or divided.

g. Fertile frond, or portions of it, conspicuously unlike the sterile; sporangia not on the lower surface of green fronds.

h. Rootstock obscure; roots fleshy; plants mostly with solitary stems, up to 5 dm high (Fig. 3, h; 4, f). *Botrychium* p. 147

h. Rootstock conspicuous, woody; roots fibrous; plants forming large clumps, 5-40 dm high.

i. Sporangia exposed in powdery masses; veins of the ultimate divisions forked (Fig. 3, c, f, g). *Osmundaceae* p. 146

i. Sporangia enclosed in bead-like or tube-like inrolled segments of the frond; veins unforked or anastomosing (Fig. 1, b, c). *Polypodiaceae* p. 131

g. Fertile frond like the sterile; sporangia borne on the lower surface of green fronds. *Polypodiaceae* p. 131

SPERMATOPHYTA SEED PLANTS

SUBDIVISION I. GYMNOSPERMAE "CONIFERS OR EVERGREENS"

a. Seed formed in cones; trees. *Pinaceae* p. 160

a. Seed formed in berry-like structures.
b. Berry blue, of 3-6 fleshy scales, with 1-3 seeds (Fig. 9, g, h). *Juniperus* p. 166
b. Berry bright red, cup-shaped, with one seed. (The sharp point to the leaves together with the long green base adherent to the twig, will separate this species from prostrate young growth of other Gymnosperms (Fig. 9, a). *Taxaceae* p. 160

SUBDIVISION II. ANGIOSPERMAE FLOWERING PLANTS

CLASS I. MONOCOTYLEDONEAE

Leaves parallel-veined, (ex. *Trillium*); flower-parts in 3's; herbaceous, (ex. *Smilax*); wood of stem broken up into strands, scattered, not increasing in thickness.

a. Plants less than 2 cm long, without true leaves, floating free in or on the water (Fig. 32, d-f). *Lemnaceae* p. 244
a. Plants much larger, differentiated into stems and leaves.
b. Perianth absent, or else scale- or bristle-like.
c. Flowers enclosed, or partly so, by scales; plants grass-like with jointed stems, sheathing leaves and 1-seeded fruits.
d. Stem hollow, round or flattened; leaf-sheaths usually split; anthers attached by the middle. *Gramineae* (not included)
d. Stems solid, usually more or less triangular, with the leaves in three ranks; leaf-sheaths not split; anthers attached at the base. *Cyperaceae* p. 185
c. Flowers not enclosed nor closely subtended by scales, although sometimes in involucrate heads.
e. Plants aquatic, mostly submerged, leafy and branching, the upper leaves often floating.
f. Leaves alternate or opposite; pistils solitary or aggregated into loose cluster, the styles absent or filiform (See also *Vallisneria*, p. 185). *Najadaceae* p. 170
f. Leaves alternate; pistils and nutlets in a round, very compact head; style bases stiff, mostly 1-4 mm long (nearly absent in *S. hyperboreum*) (Fig. 10). *Sparganiaceae* p. 167
e. Plants terrestrial or of marsh habitats, erect.
g. Leaves petioled, the blades wide and pinnately-veined (Fig. 31). *Araceae* p. 242
g. Leaves linear or sword-shaped; blades parallel-veined.
h. Flowers in a long spike-like raceme; ovaries 3-6, separating, at least when ripe (Fig. 14, a, b). *Juncaginaceae* p. 181
h. Flowers in dense short spikes, or in heads.
i. Flowers in dense short spikes, the fruiting spike solitary on the scape.

j. Pistillate spike erect on the round scape, with the staminate one above it; fruit with downy hairs. *Typhaceae* p. 167

j. Pistillate spike lateral near the summit of the two-edged scape; fruit naked (Fig. 31, d). *Acorus* p. 342

i. Flowers clustered or in round heads.

k. Head button-like, whitish, solitary at the summit of the scape; roots with prominent cross-markings; leaves basal (Fig. 32, b). *Eriocaulaceae* p. 245

k. Head globose, green to brownish, usually several; roots without prominent markings; leaves scattered.

l. Flowers dioecious, the staminate and pistillate ones in separate heads; pistils prominent; perianth very small; fruit 1-2-seeded (Fig. 10). *Sparganium* p. 167

l. Flowers perfect, with 3 bract-like sepals and 3 similar petals; pistil with 3 carpels and numerous seeds. *Juncaceae* p. 247

b. Perianth always present, herbaceous or colored, neither scale-like nor bristle-form.

m. Pistils numerous in a head or ring (Fig. 14, c-f). *Alismaceae* p. 183

m. Pistils 1, compound, with mostly 3 cells.

n. Pistil superior or only partly joined to the calyx.

o. Stamens 3; plants rush-like; marshes and bogs.

p. Flowers in a long loose or spike-like raceme, greenish to greenish-yellow (Fig. 13, e). *Juncaginaceae* p. 181

p. Flowers in a dense scaly head, yellow, showy (Fig. 32, c). *Xyridaceae* p. 246

o. Stamens 4 or 6; flowers not in scaly heads nor in long slender racemes.

q. Plants rush-like; perianth small, greenish to purplish-brown (Fig. 35). *Luzula* p. 256

q. Plants not rush-like; flowers mostly showy.

r. Perianth woolly, partly joined to the ovary, yellowish. (Fig. 39, d). *Lophiola* p. 268

r. Perianth not woolly, not joined to the ovary.

s. Flowers tubular, 2 lipped, violet blue, in a thick dense spike subtended by a leafy bract (Fig. 32, a). *Pontederiaceae* p. 246

s. Flowers mostly of separate perianth parts, not violet-blue, solitary or in an open inflorescence. *Liliaceae* p. 257

n. Pistil inferior.

t. Flowers regular or nearly so; stamens 3 or 6.

u. Flowers loosely woolly, dingy-yellow; plants rare; stem hairy near the top (Fig. 39, e). *Lachnanthes* p. 267

u. Flowers not woolly; stem smooth. *Iridaceae* p. 268

t. Flowers very irregular; stamens 1 or 2; lowest placed petal forming a conspicuous lip. *Orchidaceae* p. 270

CLASS 2. DICOTYLEDONAE

Leaves netted-veined; flower-parts mostly in 4's and 5's; wood of stem increasing in thickness; embryo of seed with 2 seed-leaves.

a. Corolla none; calyx present or absent.
 b. Flowers pistillate and staminate, or perfect, one or both types in catkins or catkin-like heads.
  Plants rough, herbaceous (Fig. 49, a-d). *Urticaceae* p. 304
  Plants either shrubs or trees.
   Fertile flowers 1-3, in a cup or involucre; fruit a nut (Fig 48, a-c). *Fagaceae* p. 302
   Fertile flowers in catkins or catkin-like heads.
    Ovules many; fruit a many-seeded capsule; seeds hairy-tufted (Fig. 43, 44). *Salicaceae* p. 283
    Ovule one; fruit one-seeded, not hairy-tufted.
     Fertile flowers 2 or 3 at each scale of the catkin; shrubs or trees; leaves not resinous-dotted beneath (Fig. 46, 47). *Betulaceae* p. 295
     Fertile flowers solitary in the axils of the scales; leaves resinous-dotted and often aromatic (Fig. 45). *Myricaceae* p. 294
 b. Flowers not in catkins.
  c. Shrubs or trees.
   Shrubs, less than 3 dm high, low or trailing; leaves evergreen, needle-like (Fig. 80, a, b). *Empetraceae* p. 433
   Shrubs over 1 m high, or trees.
    Leaves silvery-downy and scurfy beneath; fruit a yellowish berry; flowers in early May; shrubs (Fig. 82, f). *Shepherdia* p. 455
    Leaves not silvery-downy beneath.
     Leaves pinnately-compound, the terminal leaflet not lobed.
      Trees; fruit a one-seeded samara. Ash (Fig. 97). *Fraxinus* p. 499
      Shrubs; flowers in a terminal spike; fruit an achene, enclosed in the 4-angled dry calyx-tube (Fig. 74, a). *Sanguisorba* p. 407
     Leaves simple, or if irregularly compound with leaflets then the terminal one lobed.
      Leaves palmately lobed or divided, opposite; fruit of two united winged halves. Maples (Fig. 83). *Aceraceae* p. 438
      Leaves not lobed nor compound, alternate.
       Tree; fruit a single winged nutlet; leaves toothed. Elm (Fig. 48, d, e). *Ulmus* p. 304

Shrubs; fruit a berry.

Flowers pinkish, in late April before leaves appear; calyx lobes 4; leaves entire; fruit reddish (Fig. 82, g). *Daphne* p. 455

Flowers greenish, June; calyx lobes 5; leaves serrate; fruit black (Fig. 82, c-e). *Rhamnus* p. 441

c. Herbaceous plants.

Pistils several to many; stamens numerous.

Calyx tube constricted at the mouth, enclosing the pistils, 4-lobed. *Rosaceae* p. 378

Calyx tube not enclosing the pistils. *Ranunculaceae* p. 342

Pistil one.

Plant less than 3 cm high, parasitic and forming witches' brooms on the branches of conifers (Fig. 49, e). *Arceuthobium* p. 308

Plant larger, not parasitic on conifers.

e. Leaves, at least the lower, deeply lobed or divided.

Plants terrestrial, erect; calyx-tube enclosing the fruit, 4-lobed. *Rosaceae* p. 378

Plants aquatic.

Leaves repeatedly forked, the divisions toothed along one side. *Ceratophyllum* p. 340

Leaves pinnately divided, not toothed along one side of the divisions (Fig. 89). *Haloragidaceae* p. 463

e. Leaves entire or merely toothed, or absent.

f. Leaves reduced to scales or absent.

Leaves small, scale-like, alternate; fresh water habitats (Fig. 89, a). *Myriophyllum* p. 463

Leaves absent; branches opposite, very fleshy; salt marshes (Fig. 54, a). *Salicornia* p. 326

f. Leaves green, prominent.

g. Leaves opposite; pistillate flowers few, in the axils of the leaves.

Staminate flowers separate in terminal interrupted spikes. *Mercurialis* p. 429

Staminate flowers in the same involucre as the pistillate, or else the flowers perfect.

Leaves nearly round, obscurely and crenately lobed (Fig. 66, f). *Chrysosplenium* p. 375

Leaves linear to oblong, entire.

Plants erect; calyx bell-shaped, pinkish, petal-like (Fig. 98, a). *Glaux* p. 499

Plants prostrate; calyx small, greenish.

Plant with milky juice; staminate and pistillate flowers in an urn-shaped involucre; fruit triangular, 3-seeded (Fig. 78, e-f). *Euphorbia* p. 430

Plant without milky juice; flowers perfect, generally solitary in the leaf axils.

Ovary superior; fruit minute, flattened, separating into 2 portions; lower leaves linear, sessile (Fig. 79, c,d). *Callitriche* p. 432

Ovary inferior; fruit 4-sided with the 4 calyx lobes at the tip; leaves lanceolate, short-petioled (Fig. 88, h). *Ludwigia* p. 457

g. Leaves alternate.

Stipules present, sheathing the stem above the nodes; calyx often corolla-like, 4-6 lobed (Fig. 50-52). *Polygonaceae* p. 308

Stipules not sheathing the stem, or absent.

Flowers included in a large palmately lobed bract, axillary, both staminate and pistillate kinds. *Acalpha* p. 430

Flowers not included in a lobed bract.

Fruit 3-angled and 3-seeded; flowers in a compound inflorescence which is terminal and umbel-like; juice milky. *Euphorbia* p. 430

Fruit 1- or 2-seeded; juice not milky.

Plants about 1 dm high, from running rootstocks; ovary inferior, forming a dryish or fleshy berry-like fruit. *Santalaceae* p. 307

Plants various, without running rootstocks.

Flowers in a terminal raceme; fruit roundish, flattened, 2-celled and 2-seeded; basal leaves often deeply lobed (Fig. 62, b). *Lepidium* p. 359

Flowers crowded in a large inflorescence; fruit a small roundish achene.

Calyx lobes papery; flowers surrounded by scarious bracts (Fig. 53, c). *Amaranthaceae* p. 329

Calyx lobes fleshy; bracts absent (Fig. 53-54). *Chenopodiaceae* p. 322

a. Corolla and calyx both present.

h. Corolla of separate petals.

i. Stamens numerous, more than 10, and more than twice as many as the petals.

Plants aquatic; leaves mostly floating, large, peltate or deeply cordate (Fig. 57). *Nymphaeaceae* p. 340

Plants terrestrial; submersed forms may be found.

Filaments numerous, united into a tube about the pistil; pistils several, united in a ring or to form a several-celled ovary(Fig. 79, e-f) *Malvaceae* p. 443

Filaments not united in a tube; pistils not in a ring.
Leaves trumpet-shaped; insectivorous bog plants (Fig. 65, f). *Sarracenia* p. 370
Leaves flattened, not trumpet-shaped.
Sepals 2.
Juice milky or colored; petals 4-12, showy. *Papaveraceae* p. 352
Juice watery; prostrate garden weed with wedge-shaped, thick fleshy leaves, flowers very small (Fig. 54, e). *Portulaca* p. 339
Sepals more than 2.
Leaves punctate with translucent dots, entire, opposite; pistil one (Fig. 84). *Hypericaceae* p. 444
Leaves not punctate.
Pistil one, 1-celled, opening by 3-5 valves; low wiry herbs or shrubs; flowers minute, or else large and yellow; leaves simple, narrow. *Cistaceae* p. 447
Pistils several; or else one without several valves.
Stamens inserted on the receptacle; calyx usually colored or petal-like; stipules absent. *Ranunculaceae* p. 342
Stamens inserted on the calyx or on a raised disk; sepals green; stipules usually present. *Rosaceae* p. 378

i. Stamens few, not more than twice the number of petals.
j. Shrubs, trees or vines.
k. Leaves compound or palmately lobed.
Leaves compound.
Leaves pinnately compound.
Leaflets entire, smooth; branches thorny. *Leguminosae* p. 413
Leaflets serrate, downy beneath, lanceolate (Fig. 82, a). *Rhus* p. 435
Leaves palmately once or twice compound.
Leaflets 3-5, simple; ovary superior.
Leaflets mostly 3; tendrils absent; berries whitish, 1-seeded; short shrubby or low trailing plants (Fig. 82, b). *Rhus* p. 435
Leaflets mostly 5; tendrils present; berries becoming purplish, usually 4-seeded; long trailing vines. *Vitaceae* p. 442
Leaflets again divided into many divisions; ovary inferior (Fig. 90). *Aralia* p. 467
Leaves not compound, palmately lobed only.
Low shrubs; ovary inferior; fruit a berry; currants and gooseberries (Fig. 67). *Ribes* p. 376
Tall shrubs or trees; ovary superior; fruit a samara. Maple (Fig. 83). *Aceraceae* p. 438

k. Leaves neither lobed nor compound.
Flowers in hanging racemes; introduced thorny shrubs (Fig. 61, a). *Berberis* p. 352
Flowers solitary or in an upright inflorescence.
Flowers very irregular; ovary superior; fruit a capsule, persistent on the heath-like plants. *Ericaceae* p. 479
Flowers regular; fruit few-seeded.
Flowers in late fall; fruit a persistent thick woody capsule; leaves ovate with wavy edges (Fig. 68, a). *Hamamelis* p. 378
Flowers in early summer; fruit berry like.
Flowers few or clustered in the leaf-axils; ovary superior.
Stamens alternate with the petals; petals slightly joined at the base, or else linear and free (Fig. 81). *Aquifoliaceae* p. 436
Stamens opposite the petals and enclosed by the small rolled petals (Fig. 82). *Rhamnus* p. 441
Flowers numerous in a large flattish inflorescence; ovary inferior.
Petals large and conspicuous; thorns present. Hawthorns (Fig. 69, d, e). *Crataegus* p. 387
Petals minute; thorns absent (Fig 93). *Cornus* p. 477

j. Plants herbaceous.
l. Flowers extremely irregular; ovary superior.
Leaves compound.
Leaves but once divided; flowers with flaring lateral petals; fruit a legume. *Leguminosae* p. 413
Leaves very finely divided glaucous beneath, thin; petals not widely flaring (Fig. 61, d, e). *Fumariaceae* p. 354
Leaves not compound.
Petals 3; the two lateral sepals petal-like; neither sepals nor petals spurred (Fig. 77, g). *Polygala* p. 429
Petals 2 or 5, the flower conspicuously spurred.
Petals 5, the lower one spurred; flowers on long erect peduncles (Fig. 85-86). *Viola* p. 449
Petals 2, each 2-lobed; lower sepal forming a large spurred sac: flowers pendant on slender pedicels (Fig 79, a, b). *Impatiens* p. 440
l. Flowers regular or but slightly irregular.
m. Leaves deeply lobed, or compound.
n. Leaves compound with 3 leaflets (occasionally 4 or 5).
Leaflets heart-shaped, the margins entire; flowers yellow, or white veined with pink (Fig 77, e, f). *Oxalis* p. 426

Leaflets widely lanceolate, coarsely-toothed; flowers whitish.

Plants from a superficial thick root-stock; flowers in a short raceme; pistil superior; petals 4 (Fig. 65, b). *Dentaria* p. 369

Plants from a deep, globular tuber; flowers minute, in a simple umbel; pistil inferior; petals 5 (Fig. 87, d). *Panax* p. 468

n. Leaves finely divided or deeply lobed.

Plants aquatic; submersed leaves finely divided (Fig. 89). *Haloragidaceae* p. 463

Plants terrestrial.

Ovary superior.

Sepals 4; petals 4, white or yellow; leaves pinnately divided. *Cruciferae* p. 356

Sepals 5-6; petals 5-6; leaves palmately lobed or divided.

Leaves ternately tricompound, sessile; flowers greenish-yellow; styles 2. *Caulophyllum* p. 352

Leaves deeply lobed, petioled; ovary deeply lobed; style conspicuous (Fig. 78, a-c). *Geraniaceae* p. 427

Ovary inferior.

Plant a vine with tendrils; leaves palmately lobed (Fig. 110, e). *Cucurbitaceae* p. 562

Plant not vine-like, without tendrils; flowers in umbels.

Styles 2; fruit dry, splitting at maturity into two halves. *Umbelliferae* p. 468

Styles more than 2; fruit berry-like (Fig. 90). *Araliaceae* p. 467

m. Leaves entire, or but shallowly toothed.

o. Leaves basal; plants often tufted.

Leaves provided with long gland-tipped bristles; plants insectivorous (Fig. 65, d, e). *Droseraceae* p. 371

Leaves without such bristles; plants not insectivorous.

Plants of salt marshes only; corolla bluish, papery (Fig. 96, a). *Limonium* p. 494

Plants never growing on brackish soil; corolla cream to white, not papery.

Ovary 1 or 2-celled; stamens inserted on the calyx; leaves thin; petals delicate, often lobed (Fig. 66, e-g). *Saxifragaceae* p 374

Ovary 5-celled; stamens free from the calyx; leaves leathery; petals fleshy, never lobed. *Ericaceae* p. 479

o. Leaves scattered along the stem.
Pistils 3-5; separate; leaves thick and succulent (Fig. 66, a-d). *Crassulaceae* p. 372
Pistil 1; leaves not succulent, or absent.
Leaves reduced to hollow thickened petioles; flowers white, small, in umbels; dwarf creeper. *Lilaeopsis* p. 475
Leaves with an expanded blade.
Ovary plainly inferior.
Flowers small, in a close cluster surrounded by usually 4 white or purplish large petal-like bracts (Fig. 93). *Cornus* p. 477
Flowers not surrounded by petal-like bracts.
Leaves orbicular; flowers minute, in umbels; plants trailing; petals and stamens in 5's (Fig. 91, g). *Hydrocotyle* p. 471
Leaves ovate to linear; flowers various, often large, the parts in 2's or 4's.
Leaves bristly along the margin and the 3 prominent veins, opposite, sessile (Fig. 88, g). *Rhexia* p. 456
Leaves not bristly, various. *Onagraceae* p. 457
Ovary superior; flowers not in umbels.
Middle and upper stem-leaves alternate.
Leaves thick, leathery, evergreen; plant woody near the base and usually trailing; petals 5; stamens 10. *Ericaceae* p. 479
Leaves not leathery, the upper not evergreen.
Petals 4; sepals 4; stamens 6. *Cruciferae* p. 356
Petals 3 or 5; sepals 5; stamens 3 to many. *Cistaceae* p. 447
Middle and upper stem-leaves opposite.
Leaves with punctate translucent dots (Fig. 84). *Hypericaceae* p. 444
Leaves without translucent dots.
Flowers sessile, axillary, the parts in 2's; seeds visible through the capsule wall, with rounded pits; plants small (Fig. 79, h). *Elatinaceae* p. 446
Flowers not sessile.
Stamens equal in number to the petals, opposite them and adherent to the petal base.
Sepals 2; stamens 3 or 5; styles

3 or 1 and 3-cleft.
Portulaceae p. 329

Sepals 5; stamens 4-8; style 1.
Primulaceae p. 494

Stamens not of the same number as the petals, or alternate with them if so.

Flowers whorled in the leaf axils or in an interrupted spike (Fig. 88, a). *Lythraceae* p. 455

Flowers not whorled.

Ovules, and usually seeds, several to many in each cell.
Caryophyllaceae p. 329

Ovules and seeds 1 or 2 in each cell (Fig 77, c, d).
Linaceae p. 424

h. Corolla with the petals more or less united.

p. Stamens more numerous than the corolla lobes.

Leaves compound.

Leaves finely divided, thin, glaucous beneath; flowers very irregular (Fig. 61, d, e). *Fumariaceae* p. 354

Leaves but once compound.

Flowers regular, bell-like; leaflets 3, obcordate; fruit a capsule (Fig. 77, e, f). *Oxalidaceae* p. 426

Flowers very irregular; leaflets not as above except in *Trifolium*; fruit a pod. *Leguminosae* p. 413

Leaves simple, sometimes deeply lobed palmately.

Filaments very numerous, united in a tube about the pistil; leaves palmately lobed. *Malvaceae* p. 443

Filaments not united in a tube; leaves simple.
Ericaceae p. 479

p. Stamens not more numerous than the corolla lobes.

r. Stamens of the same number as the lobes and opposite them; flowers regular; ovary superior.

Style 1; plants of non-brackish habitats.
Primulaceae p. 494

Styles 5; plants of salt marshes; fruit a one-seeded sac (Fig. 96, a). *Limonium* p. 494

r. Stamens alternate with the corolla lobes or fewer.

s. Flowers not in a dense head on a common receptacle, nor surrounded by a scaly involucre.

t. Shrubs.

Leaves alternate.

Style absent; flowers clustered in the leaf axils, regular; fruit berry-like, 4-8-seeded (Fig. 81).
Aquifoliaceae p. 436

Style 1; flowers mostly in a terminal inflorescence, often irregular; fruit a capsule. *Ericaceae* p. 479

Leaves opposite.

Flowers in a dense spherical head, white, small, regular (Fig. 111, a). *Cephalanthus* p. 554

Flowers not in a dense head, irregular if crowded (Fig. 111, 112). *Caprifoliaceae* p. 555

t. Herbaceous plants.

Plants parasitic, without green color or nearly so.

Plant twining, attached to the stems of other plants; capsule 1-4-seeded (Fig. 99, f). *Cuscuta* p. 508

Plants stout, erect, rooted in the soil or parasitic on roots; capsule many-seeded (Fig. 108, a, b). *Orobanchaceae* p. 545

Plants not markedly parasitic, green.

u. Flowers quite irregular.

Aquatic plants or rooting in wet mud; leaves absent or finely divided; bladders present, sometimes in the wet substrate; insectivorous plants (Fig. 107). *Utricularia* p. 540

Terrestrial plants; bladders absent, leaves present.

Ovary superior; anthers not united in a tube.

Ovary deeply 4-lobed; fruit of 4 nutlets.

Leaves alternate; inflorescence coiled when young, gradually unrolling. *Boraginaceae* p. 511

Leaves opposite; inflorescence not coiled. *Labiatae* p. 514

Ovary not deeply lobed, the style coming from the apex; fruit a capsule.

Leaves scattered on the stem. *Scrophulariaceae* p. 526

Leaves all basal, not scattered.

Leaves linear; corolla nearly regular, not spurred (Fig. 104, d). *Limosella* p. 531

Leaves elliptical or wider; corolla irregular, spurred. *Pinguicula* p. 544

Ovary inferior; anthers 5, united in a tube about the pistil; fruit a many-seeded capsule (Fig. 114, d, f). *Lobeliaceae* p. 564

u. Flowers regular or nearly so.

v. Leaves in a basal rosette; flowers solitary or in dense spikes, small and insignificant. *Plantaginaceae* p. 546

v. Leaves usually scattered on the stem.

w. Ovary superior.

x. Leaves opposite, or all basal.

Filaments united in a tube, covered with a crown of 5 hooded and spurred bodies; juice milky; fruit of 2 follicles (Fig. 99, g). *Asclepias* p. 506

Filaments not united; a crown not present.

Juice milky; ovaries 2, forming 2 follicles united only by their tips (Fig. 99, a, b, e). *Apocynaceae* p. 504

Juice not milky; ovary 1; fruit not a follicle.

Ovary 3-celled; capsule 3-celled; corolla rolled in the bud, with a slender tube and flaring limb (Fig. 100, a). *Phlox* p. 509

Ovary not 3-celled.

Leaves deeply lobed or palmately divided; flowers small, in a long spike (Fig. 100, g). *Verbena* p. 514

Leaves entire, or toothed only.

Ovary deeply 4-parted, with the style arising between the lobes; fruit of 4 nutlets. *Labiatae* p. 514

Ovary not deeply lobed; fruit a many-seeded capsule.

Flowers regular; capsule 1-celled. *Gentianaceae* p. 501

Flowers usually sightly irregular; capsule 2-celled. *Scrophulariaceae* p. 526

x. Leaves alternate, or lily-like and floating.

Leaves floating, lily-like; flowers white, borne near the surface, small, in an umbel (Fig. 98, g). *Nymphoides* p. 504

Leaves not lily-like, nor floating.

Leaves with 3 thickish leaflets; flowers in an erect raceme; bogs (Fig. 98, d). *Menyanthes* p. 504

Leaves entire, or finely divided, or lobed.

Plants long-trailing; leaves sagittate or hastate; flowers large, funnel-form (Fig. 99, c, d). *Convolvulus* p. 507

Plants not long-trailing, if slightly so then woody.

Ovary deeply 4-lobed, with the style arising between the lobes; inflorescence coiled when young. *Boraginaceae* p. 511

Ovary not deeply lobed; inflorescence not coiled when young.

Ovary 3-celled; capsule 3-celled.
Polemoniaceae p. 509

Ovary 2-celled; fruit 2-celled.
Fruit a capsule; flowers less than 1 cm wide.
Scrophulariaceae p. 526

Fruit a berry, or rarely a capsule; flower over 1 cm wide.
Solanaceae p. 523

w. Ovary inferior.
Plant a vine; leaves deeply and palmately 5-lobed; corolla lobes 6; tendrils present (Fig. 110, e). *Echinocystis* p. 562

Plant not a vine; leaves not palmately lobed.
Leaves deeply and pinnately lobed (Fig. 110, f). *Valeriana* p. 561

Leaves entire.
Leaves alternate.
Flowers bell-like, large (Fig. 114, a-c).
Campanulaceae p. 562

Flowers irregular, small to minute.
Lobeliaceae p. 564

Leaves opposite or whorled.
Leaves opposite, without stipules.
Caprifoliaceae p. 555

Leaves whorled, or opposite with stipules. *Rubiaceae* p. 549

s. Flowers in a dense head on a common receptacle, surrounded by an involucre of bracts, the outer of which may be leafy.
Stamens 4, not united; heads subglobose; flowers bright blue; chaff or bracts mixed with the flowers and of about the same length (Fig. 114, e). *Succisa* p. 561

Stamens 5, their filaments united in a tube about the style.
Compositae p. 565

PTERIDOPHYTA

1. **POLYPODIACEAE** FERN FAMILY

a. Fronds of two types; sterile ones flat and expanded; fertile ones with the divisions inrolled, tube or berry-like, brown when mature.

b. Sterile fronds once -divided or lobed, the divisions with netted veins; fertile fronds with the divisions berry-like (Fig. 1, b).
10. *Onoclea*

b. Sterile fronds twice-divided, the divisions with unforked straight veins; fertile fronds with the divisions tube-like, strongly ascending (Fig. 1, c). 11. *Pteretis*

a. Fronds all green, not of two conspicuous types.

c. Sporangia protected by an indusium associated with or consisting of the inrolled edge of the frond.

d. Sporangia forming a continuous line around the whole edge of the frond; frond large, conspicuously three-parted or ternate (Fig. 1,d). 2. *Pteridium*

d. Sporangia associated with a reflexed tooth of the margin; frond not ternate.

e. Sporangia in minute cup-like indusia; frond lanceolate, the lower surface with erect glandular hairs (Fig 1, e). 7. *Dennstaedtia*

e. Sporangia covered with a membranous inturned lobe; frond repeatedly forking, glabrous; stipe and branches shining purplish brown (Fig. 1, g). 3 *Adiantum*

c. Sporangia naked, or else covered by an indusium not associated with the edge of the frond.

f. Sori, and indusium when present, more or less round.

g. Fronds deeply lobed, or once-divided.

h. Sporangia not covered; margin of the frond not toothed (Fig. 1, a). 1. *Polypodium*

h. Sporangia covered with a round indusium; margin of the frond finely toothed (Fig. 2, g). 8. *Polystichum*

g. Fronds twice divided or more finely so.

i. Indusium absent (That of *Woodsia* is obscure). (Fig. 2, a, d). 9. *Dryopteris*

i. Indusium present.

j. Indusium round, attached by a dot at the center, or by a notch or line from the center to the margin.

k. Indusium attached by the center; stipe very chaffy; frond thick, evergreen (Fig. 2, e). 8. *Polystichum*

k. Indusium attached at a notch; stipe smooth, or chaffy chiefly near the base (Fig. 3, a, b, d, e). 9. *Dryopteris*

j. Indusium not as above.

l. Indusium delicate, attached at its base and arching over the sporangia; fronds delicate (Fig. 2, c, f). 12. *Cystopteris*

l. Indusium of several jagged lobes or thread-like divisions attached below the sporangia and curving over them; fronds 3-15, rarely to 30, cm long (Fig. 2, b). 13. *Woodsia*

f. Soria and indusia elongated, oblong to linear, often curved.

m. Sori and indusia parallel to the mid-rib of the pinnae and the midveins of the segments (Fig. 2, i). 4. *Woodwardia*

m. Sori and indusia not parallel as above.

n. Fronds 5-15 cm long, once-divided, with rounded pinnae; cliffs, rare. 5. *Asplenium*

n. Fronds 30-100 cm long, twice-divided; common (Fig. 2, h). 6. *Athyrium*

1. POLYPODIUM (Tourn.,)L.

1. **P. virginianum** L. ROCK POLYPODY. (Rhodora **24**: 125-142. 1922). Fig. 1, a.

Common throughout; on damp cliffs, boulders, wooded banks, preferring a rocky substratum with shallow leaf-mold. In very moist regions it is sometimes found on the trunks of trees .(P. *vulgare* L. of earlier American authors).

Nfld. to Alta. south to Ga. & Ark.

2. PTERIDIUM Scop.

1. **P. aquilinum** (L.) Kuhn, var. **latiusculum** (Desv.)

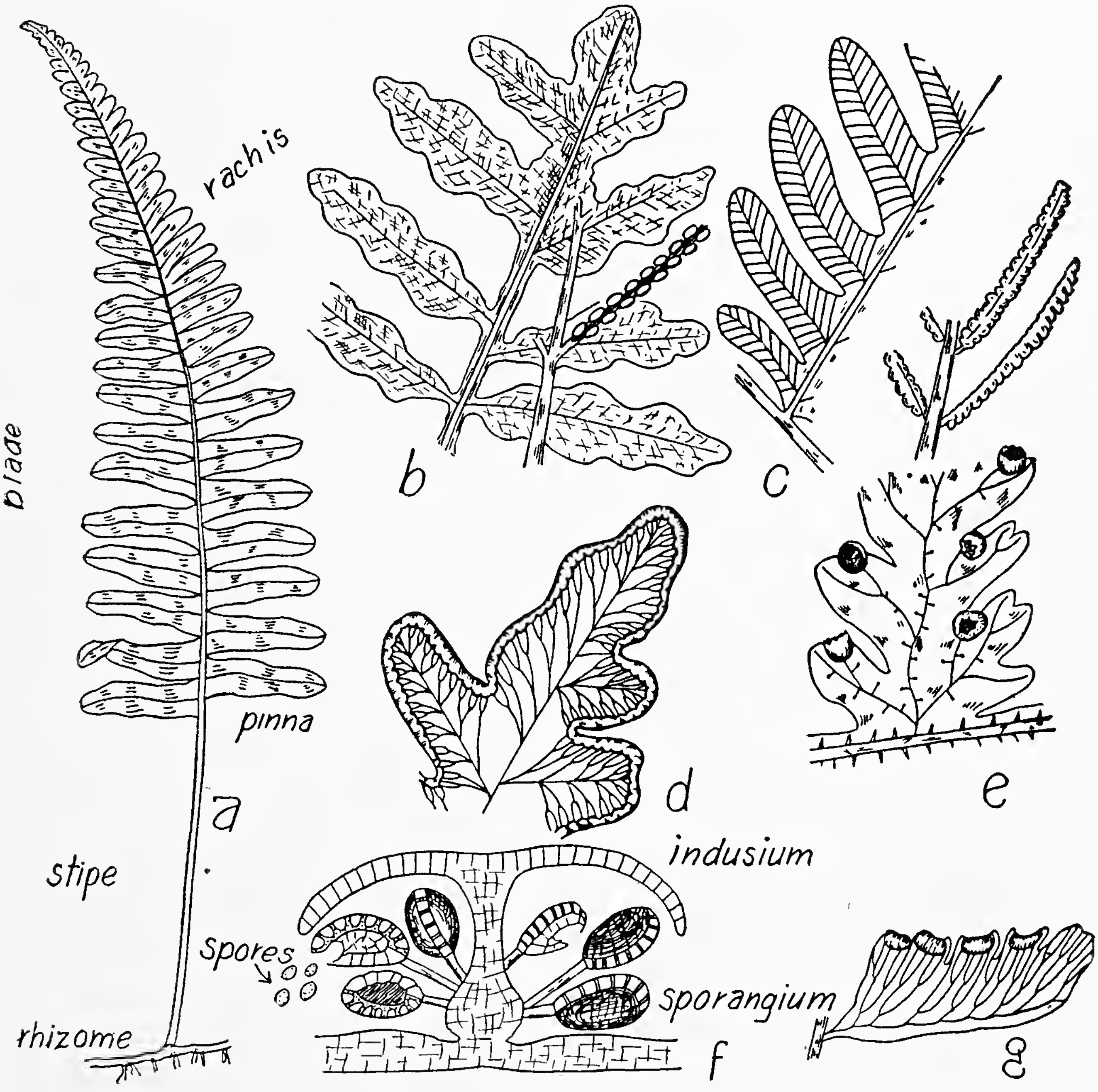


Figure 1.—**Polypodium.** a, plant, x ½. **Onoclea.** b, parts of fertile and sterile fronds, x½. **Pteretis.** c, detail of pinna and part of fertile frond, x3. **Pteridium.** d, small part of frond, x2. **Dennstaedtia.** e, part of pinnule showing sori, x3. Fern: cross-section through a sorus such as that of **Dryopteris,** highly magnified. **Adiantum.** g, pinna, x1½.

Underw. BRACKEN. (See Tryon, R. M., Jr. Rhodora **43:** 1-31, 37-67. 1941. Fig. 1, d.

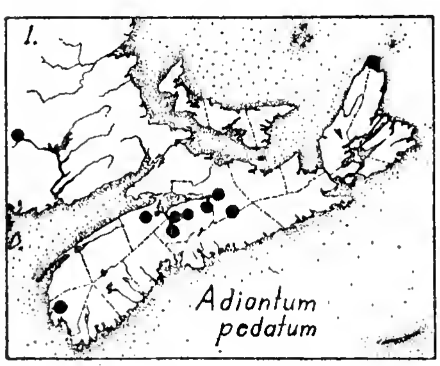
Common throughout; in pastures, barrens, waste land and burnt-over areas; often associated with sweet fern and wire birch and characteristic of light soils. Scattered plants have the blade ovate instead of ternate, with the segments of the frond minutely hairy near the margin and beneath. This form may be the result of burning or other adverse growing conditions. Nfld. to Alta. south to Ga. & Ark.

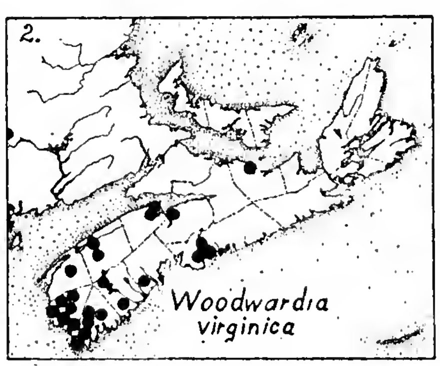
3. ADIANTUM (Tourn.) L.

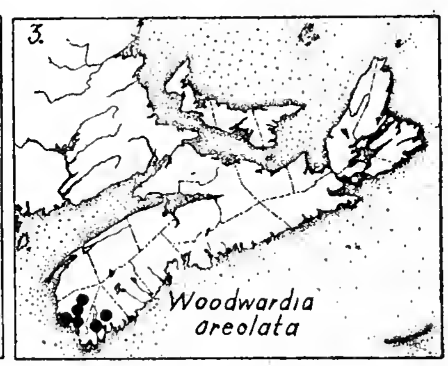
1. **A. pedatum** L. MAIDENHAIR FERN. Map 1. Fig. 1, g.

Rare; found only in rich woods, about gypsum or in limestone locations.

N. S. to Minn. south to Ga. & Okla; Alaska to Calif.; Asia.







4. WOODWARDIA J. Sm.

a. Fronas twice-oivided, the fertile and the sterile ones similar
1. *W. virginica*

a. Fronds once-divided only, the fertile ones much narrowed, more erect. and with narrow divisions. 2. *W. areolata*

1. **W. virginica** (L.) J. Sm. CHAIN FERN. Map 2. Fig. 2, i.

Characteristic of swampy woods, boggy shores, swamps and cobbly lake-shores from Yarmouth Co. east to Halifax; scattered north to Pictou and Kings Co. (*Anchistea* Presl).

Coastal plain plant from Fla. to Tex. north to L. Is. and N.S.; rarer inland to Ont. & Mich.

2. **W. areolata.** (L.) Moore. DWARF CHAIN FERN. Map 3.

Local in the Tusket Valley; abundant and well-developed along the upper limits of the Clyde and Roseway river systems where it is found in swamps, wet woods, and at the margins of bogs. (*Lorinseria* Presl).

Fla. to Tex. north along the coast to Mass. & N.S.; rare inland to Mo. & Mich.

5. ASPLENIUM L.

a. Rachis shining-purplish; fronds wiry and stiff. 1. *A. Trichomanes*
a. Rachis greenish; fronds thinner and delicate. 2. *A. viride*

1. **A. Trichomanes** L. MAIDENHAIR SPLEENWORT.

Rare and local; damp shaded cliffs. Specimens have been seen from Kings, Cumberland, Guysborough and Inverness Cos. Scattered records exist for other localities in the northern part of the province.

N.S. to Alaska south to Ga. & Ariz.; Eu. & Asia.

2. **A. viride** Huds. GREEN SPLEENWORT.

Collected by Macoun at Big Intervale, Inverness Co. in July, 1898. No other collection or record is known for the province.

Nfld. & N.S. west to Wisc.; and northwest to Alaska.

6. ATHYRIUM Roth

a. Sori and indusia often curved, not silvery; pinnules pointed at the tip with irregular sharp teeth.
b. Fronds of two kinds, the fertile thicker and more leathery in texture; sori at maturity running together and covering the lower surface of the frond.
c. Longest pinnae of the fertile frond 5-12 cm long; pinnules 4-12 mm long, with the sori mostly straight, those of the sterile frond oblong and rounded, but slightly toothed or lobed. 2. *A. angustum*
c. Longest pinnae of the fertile frond 1-2 dm long; pinnules 12-15 mm long, somewhat pointed, strongly toothed or lobed. *A. angustum* var. *elatius*
b. Fronds all alike, the fertile ones almost membranous; sori separate at maturity; pinnules pointed, often strongly toothed. *A. angustum* var. *rubellum*
a. Sori and indusia straight, silvery when immature; pinnules rounded at the tip, with blunt teeth.
d. Pinnules with straight sides and rounded tips; the margins undulate or but slightly toothed. 1. *A. thelypteroides*
d. Pinnules with curved sides and slightly pointed tips, the margins coarsely toothed. *A. thelypteroides* forma *acrostichoides*

1. **A. thelypteroides** (Michx.)Desv. SILVERY SPLEENWORT. Map 4.

Common in rich woods, on seepy slopes and along stream alluvium; rarely in the open; rare in the southwestern counties, scattered from Annapolis to northern C.B. (A. *acrostichoides* of earlier authors).

Forma **acrostichoides** (Sw.)Gilbert is characteristic of the richest locations in its range. It was collected in a run on the slope of Cape Blomidon, and plants from the Cobequids approach it.

N.S. to Minn. south to Ga. & Mo.; Asia.

2. **A. angustum** (Willd.)Presl. See Butters, F. K., Rhodora **19**: 170-207. 1917. LADY FERN. Fig. 2, h.

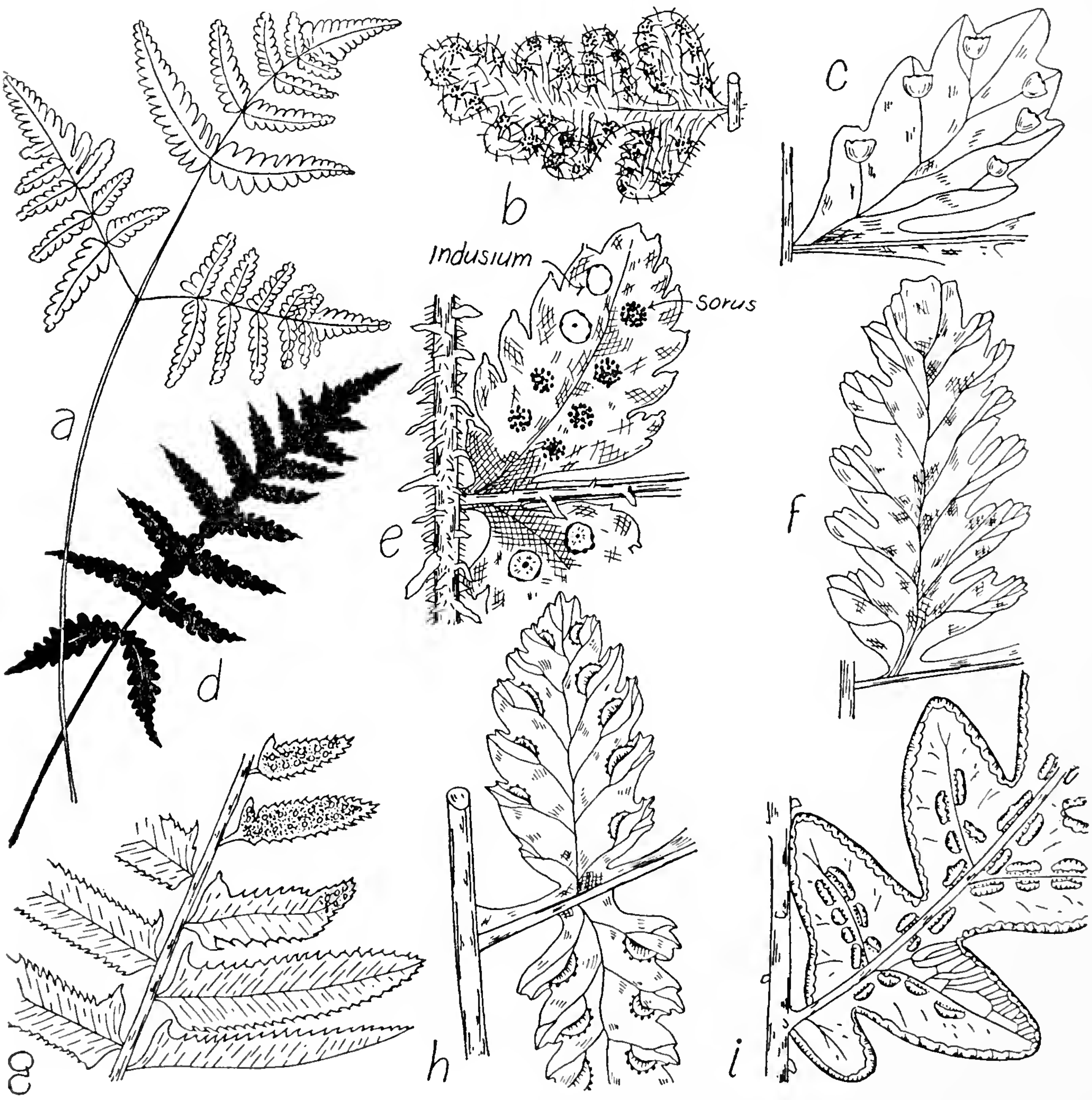


Figure 2.—**Dryopteris.** a, frond of **D. disjuncta,** x1/3. d, **D. Phegopteris. Woodsia.** b, pinna of **W. ilvensis,** x 3. **Cystopteris.** c, pinnule of **C. fragilis,** x 5. f, pinnule of **C. bulbifera,** x 2. **Polystichum.** e, pinnules of **P. Braunii,** x $2\frac{1}{2}$. g, part of frond of **P. acrostichoides,** x$\frac{1}{2}$. **Athyrium.** h, pinnules of **A. angustum,** x 3. **Woodwardia.** i, part of pinna of **W. virginica,** x 2.

Scattered. This seems to be the sun form and is found in open situations, pastures and along roadsides. N.S. to Man. south to Penn. & Iowa.

Var. **elatius** (Link) Butters is a luxuriant form of rich, moist soil. It is rather rare but is scattered in the center of the province. N.S. to Me. & Md. west to Minn.

Var. **rubellum** (Gilbert) Butters is common throughout along roadsides, in pastures, moist thickets, swamps and open woods. The three varieties treated grade into each other. Earlier records of *A. Filix-femina* belong here.

Nfld. to Man. south to Va. & Colo.

7. DENNSTAEDTIA Bernh.

1. **D. punctilobula** (Michx.) Moore. HAY-SCENTED FERN. Fig. 1, e.

Dry hillsides and slopes throughout, especially around rock piles and hummocks; typical of upland pastures from Annapolis to northern C. B.; frequent also in open or dryish woods, along roadsides and rarely in swamps, often a weed. (*Dicksonia punctilobula* (Michx.) Gray).

N.S. to Minn. south to Ga. & Mo.

8. POLYSTICHUM Roth

a. Fronds once-divided; stipe and rachis chaffy only near the base.
  b. Fruiting pinnae smaller than the sterile ones; sori very crowded; pinnae lanceolate, not curved. 1. *P. acrostichoides*
  b. Fruiting pinnae similar to the sterile ones; sori well separated; pinnae about twice as long as wide, scythe-shaped. 2. *P. Lonchitis*
a. Fronds twice-divided with the divisions lobed or cut; stipe and rachis very chaffy. 3. *P. Braunii*

1. **P. acrostichoides** (Michx.) Schott CHRISTMAS FERN. Fig. 2, g.

Common throughout; in moist woods, cool ravines, thickets and on wooded banks. More luxuriant forms have the pinnae deeply toothed. This is named forma **incisum** (Gray) Gilbert. Intergrading plants are found in the same woods.

N.S. to Ont. & Wisc. south to Fla. & Tex.

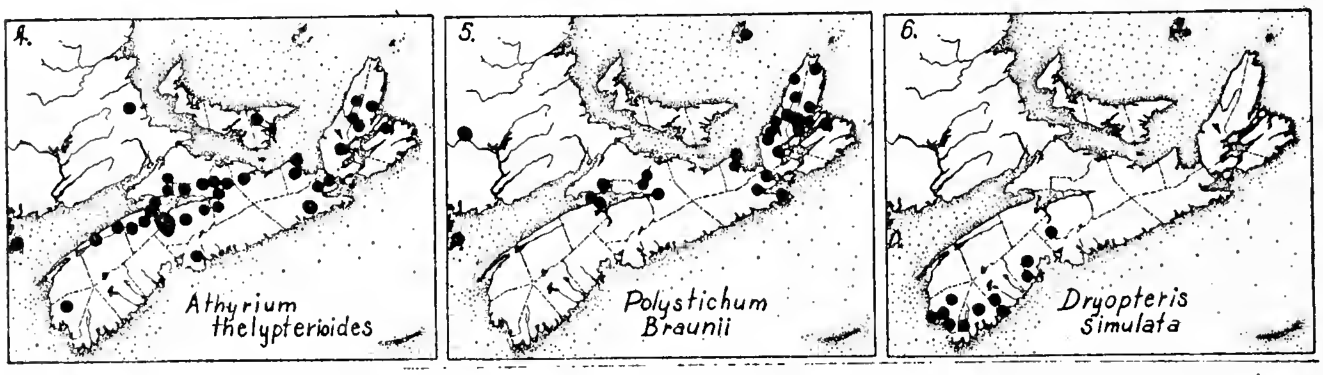
2. **P. Lonchitis** (L.) Roth HOLLY FERN.

Known only from C.B. It was reported from Aspy Bay (Macoun); from along the roadside near the top of

Glencoe Mountain, (Robinson, 1904); and from River Deny's Cave. It is rather common along the sides of the gypsum sinkholes in the region between Cape North Corner and Dingwall; and Nichols collected it in similar locations west of Ingonish.

Nfld. & Greenland to Alaska south to N.S., Gaspe, around the Great Lakes, and south in the Rocky Mts.; Eu.

3. **P. Braunii** (Spenner)Fee, var. **Purshii** Fern., Rhodora **30:** 28-30. 1928. BRAUN'S HOLLY FERN. Map 5. Fig. 2, e.



Typical of rich woods, ravines and seepy hillsides; Cape Split and Blomidon in Kings Co., and from Cumberland Co. east along the Cobequids and to northern C.B. It is rare in the western part of the range but in the hill country of C.B. it becomes luxuriant with clumps exceeding four feet in height.

Nfld. to northern Wisc. south to the uplands of N. Eng.; N.Y., Penn ; also in Alaska.

9. DRYOPTERIS Adans.

a. Indusium absent or present; fronds thin not evergreen, the smallest divisions obscurely toothed or with a smooth margin; veins simple or but once-forked; stipe smoothish.
  b. Fronds lanceolate in outline; pinnae not stalked.
    c. Indusium present; lowermost pinnae not deflexed.
      d. Blade with the lower pinnae as long as the middle ones.
        e. Veins of the sterile fronds mostly forked. 1. *D. Thelypteris*
        e. Veins of the sterile fronds mostly unforked. 2. *D. simulata*
      d. Blade with the lower pinnae gradually decreasing in size to mere auricles. 3. *D. noveboracensis*
    c. Indusium absent; blade finely chaffy, the lower pair of pinnae deflexed. 4. *D. Phegopteris*
  b. Frond triangular in outline with three almost equal divisions; lower pinnae stalked; frond smooth. 5. *D. disjuncta*
a. Indusium always present; fronds thick, often evergreen, the divi-

sions toothed or cut; veins twice-forked or more; stipe more or less chaffy with scales near the base.

f. Frond small, to 25 cm long and 5 cm wide, resinous, with the teeth of the pinnules blunt. 6. *D. fragrans*

f. Frond much larger, not resinous.

g. Scales at the base of the stipe numerous and linear.

h. Sori placed near the margin of the blade; pinnules not sharply toothed. 7. *D. marginalis*

h. Sori not marginal; pinnules minutely and sharply toothed towards the tip. 8. *D. Filix-mas*

g. Scales at the base of the stipe ovate or oblong.

i. Fronds bipinnate or partly tripinnate near the base.

j. Indusium glabrous; pinnae rather triangular, firm in texture. 9. *D. cristata*

j. Indusium glandular-pubescent; pinnate mostly more divided and thinner than the above species. 10. *D. Bootii*

i. Fronds tripinnate, the segments with spinulose teeth.

k. Upper and lower inside pinnules of the basal pinnae nearly opposite, 4 mm or less apart.

l. Inner pinnule on the lower side of each basal pinna as long or longer than the one next to it; pinnae oblique to the rachis; stipe-scales light brown.

m. Indusium and frond glabrous. 11. *D. spinulosa*

m. Indusium, and often the frond, glandular. *D. spinulosa* var. *fructuosa*

l. Inner pinnule shorter than the one adjacent to it; pinnae mostly at right angles to the rachis and lanceolate; stipe-scales with a dark center. *D. spinulosa* var. *intermedia*

k. Upper and lower inside pinnules of the basal pinnae widely separated; blade widely triangular; indusium glabrous, or rarely with a few marginal glands. *D. spinulosa* var. *americana*

1. **D. Thelypteris** (L.) Gray, var. **pubescens** (Lawson) Nakai, Bot. Mag. Tokyo **45:** 97. 1931. MARSH FERN.

Common throughout; along ditches, damp roadsides, in meadows and on bog hummocks. Forma **suaveolens** (Clute) A. R. Prince, Am. Fern. Jour. **26:** 95. 1936, is a fragrant form reported from N. H. and from near Baddeck (Fernald, 1921). (*Thelypteris palustris* Schott, var. *pubescens* (Lawson) Fern., Rhodora **31:** 27-36. 1929).

Nfld. to Man. south to Ga. & Okla.

2. **D. simulata** Davenp. BOG FERN. Map 6.

Scattered from Yarmouth east to Lunenburg and Hants Cos.; swales, wet thickets, knolls in peaty barrens and in sphagnous spruce bogs, growing in situations too shady for the marsh fern and too wet for the New York fern

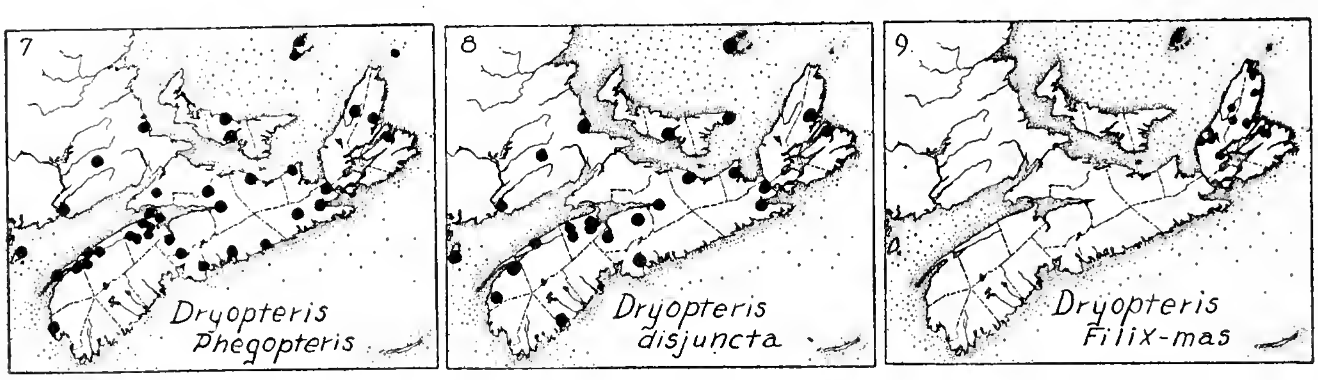
(*Thelypteris simulata* (Davenp.) Nieuwl.).

Ala. north near the coast to N. S., and sporadically inland to P. E. I., southern Que., N. Y. & W. Va.

3. **D. noveboracensis** (L.)Gray. NEW YORK FERN. Fig. 3, b.

Common throughout; dry woodlands, along shady roadsides and fences, not vigorous either in open sunlight or in wet locations. (*Thelypteris noveboracensis* (L.) Nieuwl.).

Nfld. to Minn. south to Ga. & Ark.



4. **D. Phegopteris** (L.)C. Chr. BEECH FERN. Map 7. Fig. 2, d.

Common throughout; rich cool woods, shaded hillsides, and especially on damp, dripping cliffs and in ravines near running water. (*P. polypodioides* Fee. *Phegopteris connectilis* Watt).

Nfld. to Alaska south to the Gulf States.

5. **D. disjuncta** (Rupr.) Morton, Rhodora **43**: 216-219. 1941. OAK FERN. Map 8. Fig. 2, a.

Common throughout in rocky or dryish hardwoods. Forma **erecta** (Lawson) Roland, Proc. N.S. Inst. Sci. **20**:92. 1941, is a taller form with the frond rigid and erect, the lower pinnae little larger than the upper one. Lawson states that this form grows around the shores of Bedford Basin, the Basin of Minas, and in Ontario. (*Phegopteris Dryopteris* (L.) Fee).

Nfld. to Alaska south to Va. & N.M.

6. **D. fragrans** (L.) Schott, var. **remotiuscula** Komarov, Fl. U.R.S.S. **1**: 38. 1934. FRAGRANT FERN.

Local; Nichols records it as characteristic of the cliff crevices along streams in northern C.B.; and it has been found on the mainland at Hartley's Waterfall on the Strait of Canso and on cliffs of Moose R., near Parrsboro. (*T. fragrans* var. *Hookeriana* Fern., Rhodora **25**: 3. 1923).

Nfld. to central Minn. south to N.Y.; eastern Asia.

Figure 3.—**Dryopteris.** a, **D. cristata.** b, **D. noveboracensis.** d, pinnule of **D. marginalis**, x $1\frac{1}{2}$. e, pinnule of **D. cristata**, x $1\frac{1}{2}$. **Osmunda.** c, **O. Claytoniana.** f, upper part of frond of **O. regalis**, x$\frac{1}{2}$. g, detail of **O. Claytoniana** or **O. cinnamomea**, x $1\frac{1}{2}$. **Botrychium.** h, **B. matricariaefolium**, x $\frac{1}{2}$.

7. **D. marginalis** (L.) Gray. MARGINAL FERN. Fig. 3,d.
Common through the center and eastern part of the province; apparently rare in the southwestern counties; rocky woods, shady slopes, ravines and characteristic of hardwood forests of C.B. Forma **Traillae** (Lawson) Gruber, (see Weatherby, Amer. Fern. Journ. **31**: 59-62. 1941), is a luxuriant form found on gypsum at Antigonish Harbour and near Newport. (Forma *tripinnatifidum* Clute).
N. S. to Minn. south to Ala. & Okla.; B.C.

8. **D. Filix-mas** (L.)Schott. MALE FERN. Map 9.
Known only from C.B.; rich woods and ravines in the south, becoming commoner northwards and there character-

istic of the hardwood climax forest. Around Cape North and Bay St. Lawrence it is frequent in thickets and along open roadsides.

Nfld. to Vt. and northern Mich.; B.C. to Calif. & Tex.; Greenland, Iceland, and northern Eurasia.

Forma **incisa** (Moore) Hayek is an European form found also in Nfld. & N.S. It is characterized by the coarsely toothed pinnules tapering somewhat to a rounded or slightly pointed tip. This luxuriant form is common near Cape North.

9. **D. cristata** (L.)Gray. CRESTED FERN. Fig. 3,a,e.

Common throughout; well-drained swamps, swales, boggy ground and wet thickets, usually in shady situations but persisting for some time in open sunlight.

Nfld. to Idaho south to Va.; Eu.

10. X **D. Bootii** (Tuckerm.) Underw. BOOTT'S SHIELD FERN.

This hybrid of D. *cristata* and *D. spinulosa* var. *intermedia* has the characters of the parents in varying proportions. Frequent in swampy woods of Yarmouth Co.; found at various places east to Shelburne and Lunenburg; scattered elsewhere.

N.S. to Minn. south to Va.

11. **D. spinulosa** (O.F. Muller)Watt. WOOD FERN.

Scattered; in swamps, wet thickets and rich alluvial soil through the center of the province. Nfld. to Idaho south to Va. & Mo.; Greenland & Eurasia.

Var. **fructuosa** (Gilbert) Trudell is found growing with the species, and probably occurs wherever the species is found. It is considered to be a variety by some, and by others a hybrid between the species and var. *intermedia.*

Var. **intermedia** (Muhl.) Underw. is common throughout; woods, rocky slopes and swamp hummocks. Nfld. to Wisc. south to N.C. & Mo.

Var. **americana** (Fisch.) Fern., Rhodora **17:** 48. 1915, is luxuriant along the Bay of Fundy, scattered in rich woods in the southwestern counties, and common along the Cobequids to northern C.B.. Miss Perry (1931) states that both this and var. *intermedia* were common on St. Paul Is. and about as common was a form transitional between the two. (*Aspidium spinulosum,* var. *dilatatum* f. *anadenium. D. campyloptera* (Kunze) Clarkson).

Lab. to B.C. south to N.C., Tenn & Wisc.

10. ONOCLEA L.

1. **O. sensibilis** L. SENSITIVE FERN. Fig. 1, b.

Common throughout; in mucky soil, around streams, pools, in ditches, wet woodlands or low open areas. Forma **obtusilobata** (Schkuhr) Gilbert, produced when the early fronds are injured, has the fronds intermediate between the sterile and fertile ones.

Nfld. to Sask. south to Fla. & Tex.

11. PTERETIS Raf.

1. **P. pensylvanica** (Willd.) Fern., Rhodora **47:** 123. 1945. OSTRICH FERN. Map. 10. Fig. 1, c.

Common from Annapolis to northern C. B.; rare in the southwestern counties and absent from the more acid regions; in rich soil, alluvial ground, about limestone and gypsum outcrops; characteristic of the higher parts of the flood plains in northern C.B. (*Onoclea Struthiopteris* (L.)Hoffm. *P. nodulosa* (Michx.)Nieuwl.).

Nfld. to Alaska south to Va. & Mo.

12. CYSTOPTERIS Bernh.

a. Frond lanceolate, usually long-attenuate, often bearing bulblets beneath; veins of the pinnules ending mostly in a notch.
1. *C. bulbifera*

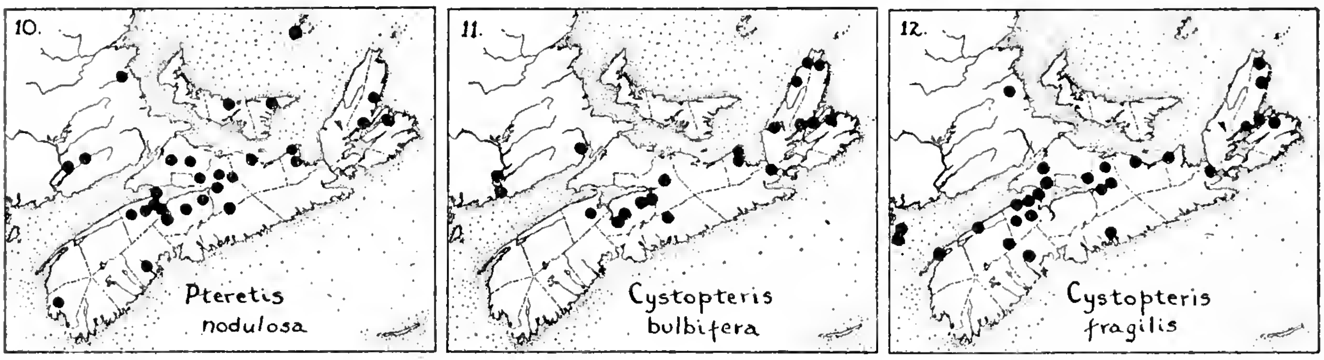
a. Frond lanceolate but not attenuate; veins of the pinnules ending mostly in a tooth or on the un-notched margin.
 b. Pinnules, at least the basal, orbicular to triangular, rounded to the base; indusium to 1 mm long, more or less cleft at the apex.
  c. Indusium without glands; fronds up to 3 dm long. 2. *C. fragilis*;
  c. Indusium glandular on the back; fronds 3.8-4.8 dm long.
C. fragilis var. *laurentiana*
 b. Pinnules oblong to nearly lanceolate, wedge-shaped at the base indusium about 0.5 mm long, shallowly or not at all toothed.
C. fragilis var. *Mackayii*

1. **C bulbifera** (L)Bernh. BULBLET FERN. Map 11. Fig. 2, f.

Found only in rich or calcareous areas; Moore's Falls, south of Kentville; common on the gypsum outcrops in

Hants Co.; and scattered on rich hillsides from Cumberland Co. to northern C.B. It is abundant on the gypsum areas, often carpeting the ground or covering the sides of ravines.

Nfld. to Man. south to Ga. & Ariz.



2. **C. fragilis** (L.) Bernh. FRAGILE FERN. Map 12. Fig. 2, c.

Common throughout the northern parts of the province; shaded cliffs, rich moist woods and rocky crevices. Intermediate forms between this and var. *Mackayii* often occur. Forma **cristata** (Lowe) Weatherby has the fronds and their divisions much forked. Th's was reported from Whycocomagh by Macoun & Burgess.

Nfld. to Alaska south to N. Eng., Penn., Mo., Tex. and southern Calif.

Var. **laurentiana** Weatherby, Rhodora **28**: 128-131. 1926, grows on dolomite ledges west of Dingwall, and in moist sinkholes in plaster, South Ingonish. It is one of a number of plants found about the Gulf of St. Lawrence, and sparingly westward to Ont. & Wisc.

Var. **Mackayii** Lawson is found on shaded ledges, damp cliffs and occasionally in rich woods; frequent but never abundant. N.S. & southern Que. to Minn. south to N.C.

13. WOODSIA R. Br.

a. Stipe plainly jointed near the base; lobes of the indusium linear; frond chaffy or smooth, not glandular.
 b. Frond chaffy throughout; blade oblong-lanceolate. 1. *W. ilvensis*
 b. Frond smooth; blade linear, delicate. 2. *W. Bellii*
a. Stipe not jointed; lobes of the indusium of a few broad segments; frond often glandular. 3. *W. obtusa*

1. **W. ilvensis** (L.) R. Br. RUSTY WOODSIA. Map 13. Fig. 2, b.

Local, often abundant where found; basaltic cliffs, slate ledges, talus slopes and rocky ravines from Digby Neck to Halifax and Truro; characteristic of cliff associations in C.B.

Lab. to Alaska south to N.C., Iowa & Calif.

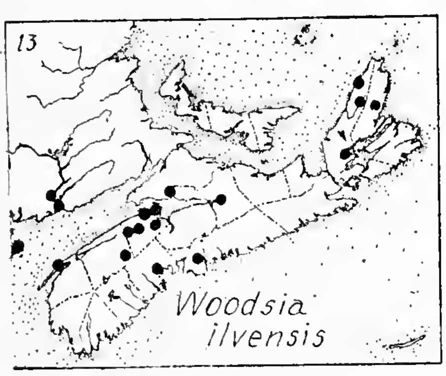
2. **W. Bellii** (Lawson)Porsild, Rhodora **47**: 147-148, 1945. SMOOTH WOODSIA.

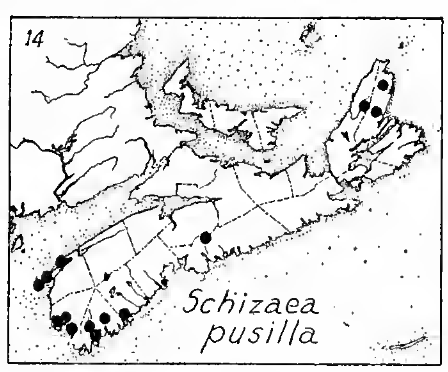
Recorded but once for the province: two plants were found near the summit of a hill, 1300 feet high, near Cheticamp (Robinson, 1904). The American relative of *W. glabella*.

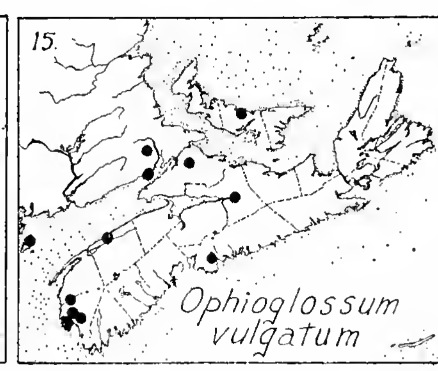
Nfld. to N.Y. west to Lake Superior.

3. **W. obtusa** (Spreng.)Torr. BLUNT-LOBED WOODSIA.

Macoun lists this plant as occurring "In the gorge through which Dr. Hamilton's road winds up to the summit of the North Mountain near Canning", Kings Co. No recent collections are known, and this report seems to be the







only basis for the inclusion of N.S. in the range of this fern.

N.S. to Minn. south to Fla. & Tex.; B.C. to Alaska.

2. SCHIZAEACEAE
CURLY-GRASS FAMILY

1. SCHIZAEA J. Sm.

1. **S. pusilla** Pursh. CURLY-GRASS FERN. Map 14. Fig. 4, h.

Scattered to local along Digby Neck, and from southern Yarmouth Co. to Queens Co.; Grand Lake, Halifax Co.; and on the highlands of C.B. It is found in sphagnous bogs, peaty borders of lakes, sphagnous hollows and in wet, undrained depressions, apparently most abundant in bogs at the southern ends of Long and Brier Islands, Digby Co. within a few yards of the sea.

Nfld.; N.S.; southern N.J.; Bruce Peninsula, Ont.

3. OSMUNDACEAE
FLOWERING-FERN FAMILY

1. OSMUNDA (Tourn.) L.

a. Fertile frond with only a few pinnae modified to bear sporangia; fronds without a tuft of cinnamon wool at the base of each pinna.
b. Modified fruiting pinnae only in the middle of the frond; pinnae deeply lobed with the small divisions not separated. 2. *O. Claytoniana*
b. Modified fruiting pinnae at the top of the frond; pinnae large, with widely separated pinnules. 3. *O. regalis*
a. Fertile fronds with the pinnae all modified, cinnamon-colored; fronds with a tuft of wool at the base of each pinna. 1. *O. cinnamonea*

1. **O. cinnamomea** L. CINNAMON FERN. Fig. 3, g.

Common throughout; swamps, bogs, wet pastures, low fields and roadsides everywhere; often a weed in poorly-drained areas where the stout rootstocks are extremely difficult to eradicate. Forma **frondosa** (Torr. & Gray) Britt. is not uncommon. This has the fronds intermediate between fertile and sterile ones. Other variations may occur.

Nfld. to Minn. south to Fla. & N.M.; S.A. & Eurasia.

2. **O. Claytoniana** L. INTERRUPTED FERN. Fig. 3, c, g.

Throughout, not as common as the last; moist thickets, margins of swamps, and wooded poorly-drained areas.

Nfld. to Man. south to Ga.

3. **O. regalis** L., var. **spectabilis** (Willd.) Gray. ROYAL FERN. Fig. 3, f.

Common throughout; in wet places, usually along streams next to running water but often also on the shores of lakes, in marshes or wet woods.

Nfld. to Sask. south to Fla., Tex. and into S.A.

4. OPHIOGLOSSACEAE
ADDER'S TONGUE FAMILY

Clausen, Robert T. A monograph of the Ophioglossaceae. Mem. Torrey Bot. Club 191:1-77. 1938.

a. Sterile portion ovate with a smooth margin and netted veins; fertile part a simple spike arising from the base of the blade. 1. *Ophioglossum*
a. Sterile part more or less lobed or divided, often 3-parted, with fork-

ing veins; fertile part paniculate, often nearly separate from the leafy part. 2. *Botrychium*

1. OPHIOGLOSSUM (Tourn.)L.

1. **O. vulgatum L.**, var. **pseudopodum** (Blake)Farw., see Fernald, Rhodora **41:** 494-499. 1939. ADDER'S TONGUE. Map 15. Fig. 4, g.

Frequent in Yarmouth and Digby Cos.; scattered eastward to Halifax and Amherst; damp sandy and cobbly beaches of lakes, sterile meadows, or grassy swamps. It is very insignificiant and probably often overlooked.

N.S. & P.E.I. to Wash. south to Dela., Ind. & Mex.

2. BOTRYCHIUM Sw.

a. Sterile blade small, oblong to triangular, attached near the middle or top of the plant.
  b. Sterile blade oblong or ovate, with a short stalk, the segments obtuse.
    c. Sterile blade once-divided, with three or more pairs of fan- or spoon-shaped pinnae. 1. *B. Lunaria*
    c. Sterile blade variously cut, with pinnae of different shapes; if the pinnae fan- or spoon-shaped, the plants very small with not more than two pairs of pinnae.
      d. Sterile blade simple with the sides at the base curving inward, or if once-divided with fan-shaped pinnae, or twice-divided with the pinnules smooth-margined. 2. *B. simplex*
      d. Sterile blade usually larger and more divided; if undivided, with the sides at the base curving outward; if once-divided, with the pinnae ovate; if twice-divided, with the pinnules toothed. 3. *B. matricariaefolium*
  b. Sterile blade triangular, sessile with acute lobes. 4. *B. lanceolatum*
a. Sterile blade large, triangular, finely-divided.
    e. Sterile blade stalked, joined to the fertile portion near the base of the plant.
      f. Chief terminal divisions elongate, more than twice as long as broad, often deeply dissected. 5. *B. dissectum*
      f. Chief terminal divisions mostly ovate to oblong, not elongate. 6. *B. multifidum*
    e. Sterile blade not stalked, thin, finely divided, attached near the middle or upper part of the plant. 7. *B. virginianum*

1. **B. Lunaria** (L.) Sw. MOONWORT

The only collection of this species is reported by Clausen (l.c.) from New Campbellton, C.B. and is referred to var.

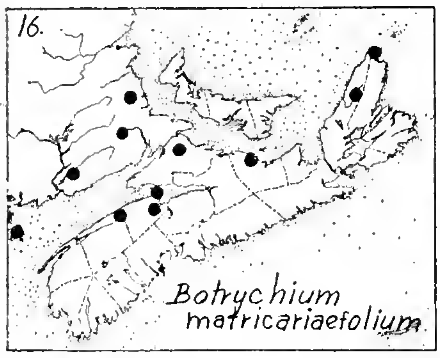
minganense (Vict.)Dole. See Victorin, Trans. Roy. Soc. Canada **21**: 331. 1927.

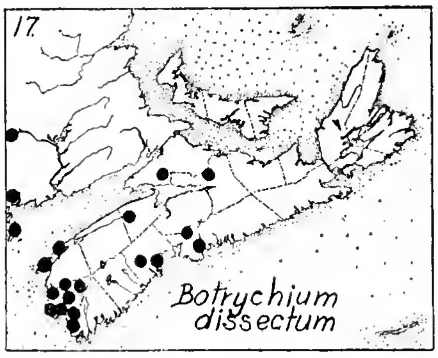
Nfld. to Alaska south to Me., northern Mich. and south in the Rockies.

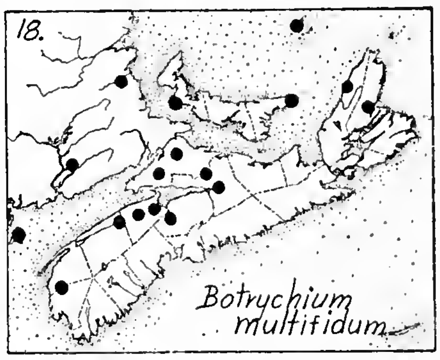
2. **B. simplex** Hitchc.

Rare; Clausen reports it as common in Me., and from Cumberland, Lunenburg and Yarmouth Cos. in N.S. with no mention of N.B. or P.E.I. Macoun lists it from Truemanville in Cumberland Co.; and Fernald (1921) says "Rare, a small colony of extremely dwarf plants, sandy and gravelly beach of Cedar Lake," on the border of Yarmouth and Digby Cos.

Nfld. to B.C. south to N.J., Penn. & Calif.; Euras a.







3. **B. matricariaefolium** A. Br. MATRICARY GRAPE FERN. Map 16. Fig. 3, h.

Scattered from Annapolis Co. to C.B.; usually in rich alluvial soil or leaf mold in hardwoods where the plants are small and delicate. Nichols states that it is commonly encountered on bleak, exposed headlands around northern C.B. A field was noted on Beech Hill south of Kentville during the dry summer of 1942 with thousands of plants growing upon it. (B. *ramosum* (Roth)Aschers.).

Nfld. to Alta. south to Md. & Ohio; northern Eurasia.

4. **B. lanceolatum** (S. G. Gmel.)Angstroem, var. **angustisegmentum** Pease and Moore. LANCE-LEAVED GRAPE FERN.

Rare: rich wooded hillsides in Cumberland and Inverness Cos.

Nfld. to Wisc. south to Penn. & W. Va.

5. **B. dissectum** Spreng. CUT-LEAVED GRAPE FERN. Map 17.

Frequent to common in sandy or gravelly, either open or turfy soils of Digby, Yarmouth and Shelburne Cos; scattered east to Hants and Halifax Cos. Forma **obliquum**

(Muhl.) Fern., Rhodora **23**: 151, 1921, is of similar range but has the segments of the blade smooth or lobed at the base and merely finely toothed. Common with the species in the southwestern counties, rarer east to Colchester and Cumberland Cos. (*B. obliquum* Muhl.).

N.S. to Minn. south to Fla. & Mo.

6. **B. multifidum** (S. G. Gmel.)Rupr. GRAPE FERN. Map 18. Fig. 4, f.

Scattered from Digby Co. to C.B.; rare or absent in the southwestern area; grassy pastures and sandy hillsides. Luxuriant forms approach var. *intermedium* (D. C. Eaton) Farw. but the rather thick, crowded segments of the blade are more typical of the species. (B. *ternatum* (Thunb.)Sw., var. *rutaefolium* (A. Br.) D. C. Eaton. *B. matricariae* Spreng.).

Nfld. to Alta. south to N.Y.; northern Eu. & Asia.

7. **B. virginianum** (L.) Sw. RATTLESNAKE FERN. Map 19.

Scattered from Annapolis Co. and Amherst to northern C.B.; rich hardwoods and calcareous slopes, usually occuring as isolated plants.

N.S. to B.C. south to Fla. & Calif.

5. **EQUISETACEAE** HORSETAIL FAMILY

1. **EQUISETUM** (Tourn) L.

a. Aerial stems pale-colored, with very little chlorophyll, unbranched at first or permanently so; cones present, without a sharp point.
  b. Sheaths not reddish-brown nor translucent, the teeth not cohering in 3 or 4 lobes.
    c. Fertile stem not developing branches; teeth of the sheath yellowish-brown with dark-brown teeth (Fig. 4, a). 1. *E. arvense*
    c. Fertile stem soon developing whorls of 3-angled green branches; sheaths pale and with white-margined teeth (Fig. 4, d). 2. *E. pratense*
  b. Sheaths reddish-brown, translucent, the teeth long and cohering in 3 or 4 broad lobes; fertile stem with whorls of compound green branches (Fig. 4, b). 3. *E. sylvaticum*
a. Aerial stems green or with green branches, with or without a cone.
  d. Main stem without a central cavity, with 6 ridges; plant small, slender, tufted, flexous; cone small, apiculate(Fig. 5, b). 7. *E. scirpoides*
  d. Main stem mostly with a central cavity; if not, very different from the above.
    e. Teeth of the sheaths cohering in 3 or 4 broad lobes, bright reddish-

brown, persistent; branches numerous, compound.
3. *E. sylvaticum*

e. Teeth of the sheaths not cohering in lobes, not reddish-brown; branches, mostly simple.

f. Teeth of the sheaths not jointed with the sheath, persistent; stems annual; cones not apiculate.

g. Central cavity of the main stem small, half or less the diameter of the stem, often with side cavities nearly as large; sheaths rarely with more than 10 teeth.

h. Sheaths of the branches with 3-4 teeth; cone-bearing stems different than the sterile ones; branches solid.

i. Sheaths with the teeth usually longer than wide, with long subulate tips (Fig. 4, c). 1. *E. arvense*

i. Sheaths with the teeth about as wide as long, not long-tipped but thin and papery (Fig. 4, d). 2. *E. pratense*

h. Sheaths of the branches with 5 or more teeth; cone-bearing

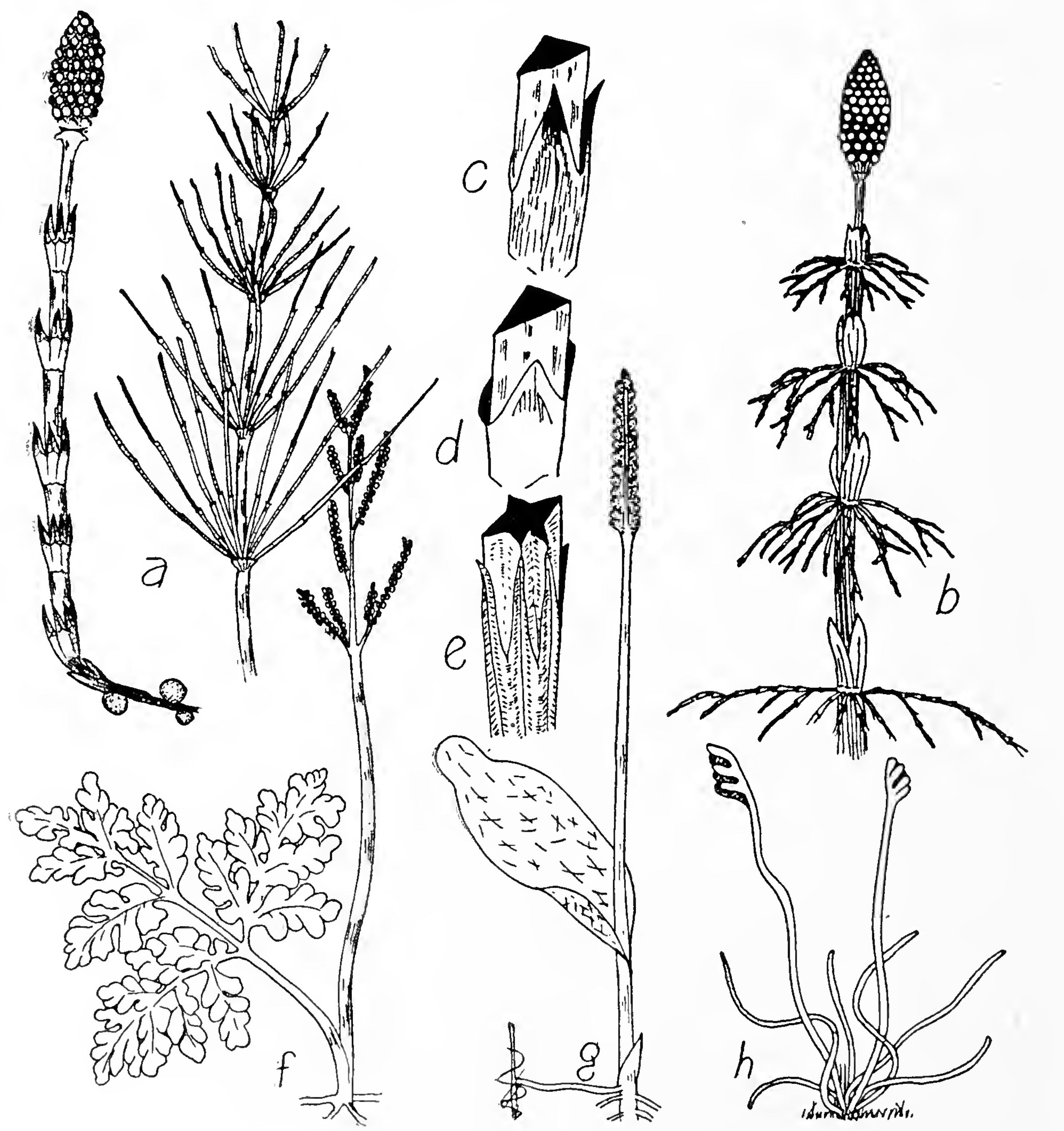


Figure 4.—**Equisetum.** a, **E. arvense**, x ½. b, **E. sylvaticum**, x ½. c.d.e, sheaths and teeth of **E. arvense, E. pratense** and **E. litorale. Botrychium.** f, **B. multifidum**, x ½. **Ophioglossum.** g, **O. vulgatum**, x ½. **Schizaea.** h, plant x 1/3.

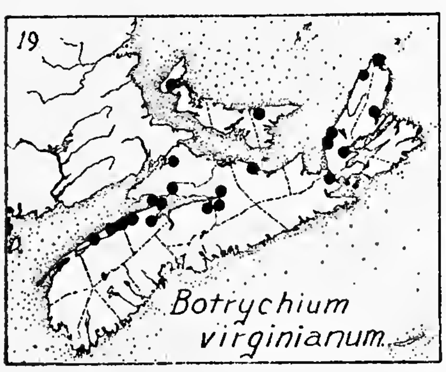
stems similar to the sterile ones, with the central cavity about half the stem diameter; branches with a small cavity (Fig. 4, e, 5, a). 4. *E. litorale*

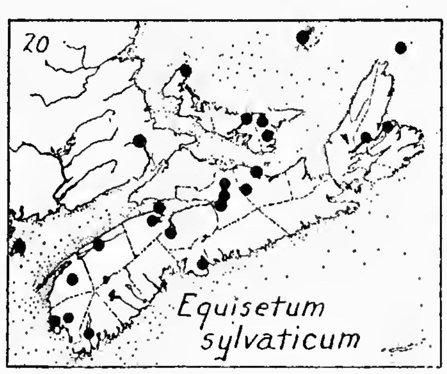
g. Central cavity of the main stem at least four-fifths the diameter of the stem; sheaths with 15-20 teeth (Fig. 5, a, c). 5. *E. fluviatile*

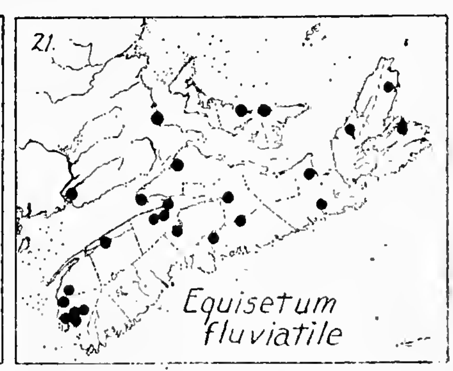
f. Teeth of the sheaths definitely jointed and falling away; sheath ashy-gray; cones apiculate; stems stout, 3-8 dm high, perennial, usually not branched (Fig. 5, d). 6. *E. hyemale* var. *affine*

1. **E. arvense** L. FIELD HORSETAIL. Fig. 4, a, c.

Common throughout; low areas, wet fields, along roadside embankments and railroads, often a bad weed in poorly-drained areas. Many plants have the branches 3-angled instead of 4-angled, but this seems very variable. This variety, var **boreale** (Bongard)Rupr., may be more northern but is as yet of dubious value. The species is very







variable and a large number of ecological forms have been named.

Widely distributed in the Northern Hemisphere.

2. **E. pratense** Ehrh. MEADOW HORSETAIL. Fig. 4, d.

Doubtful; Howe's records from Windsor and Musquodoboit belong to *E. fluviatile*; Macoun records it from the North West Arm, Halifax and from near Annapolis. I have not seen it during several summers' collecting in the central part of the province.

Nfld. to Alaska south to N.J. & Ia; Eurasia.

3. **E. sylvaticum** L. WOOD HORSETAIL. Map 20. Fig. 4, b.

Common throughout; wet meadows, slopes, open woods, and banks of streams. The common American plant is sometimes treated as var. *multiramosum* (Fern.)Wherry, Amer. Fern. Jour. **27:** 58. 1937.

Nfld. to Alaska south to Va., Ohio & Iowa.

4. **E. litorale** Kuehl. Fig. 4, e.

Scattered in ditches and near streams about Truro;

very abundant on the wet lower gravelly beach of Shubenacadie Grand Lake (Fernald 1921). The status of these plants is at present unknown; they may be hybrids between the next species and *E. arvense.*

N.S. to Penn., Minn. and westward.

5. **E. fluviatile** L. WATER HORSETAIL. Map 21. Fig. 5, a, c.

Common throughout; in ditches, along the edges and in the bottoms of shallow slow-moving streams, edges of lakes, at the heads of salt marshes and in low areas on the dyke-lands. Various ecological forms have been named which have little value and may be found in the proper habitat. Forma **typica** has numerous branches at each node; forma **natans** (Vict.)Broun has the branches reduced to 1-2 at a node, turned all one way. Forma **Linnaeanum** (Doll)Broun has unbranched stems. (*E. limosum* L.).

Nfld. to Alaska south to Va., Nebr. & Ore. Eurasia.

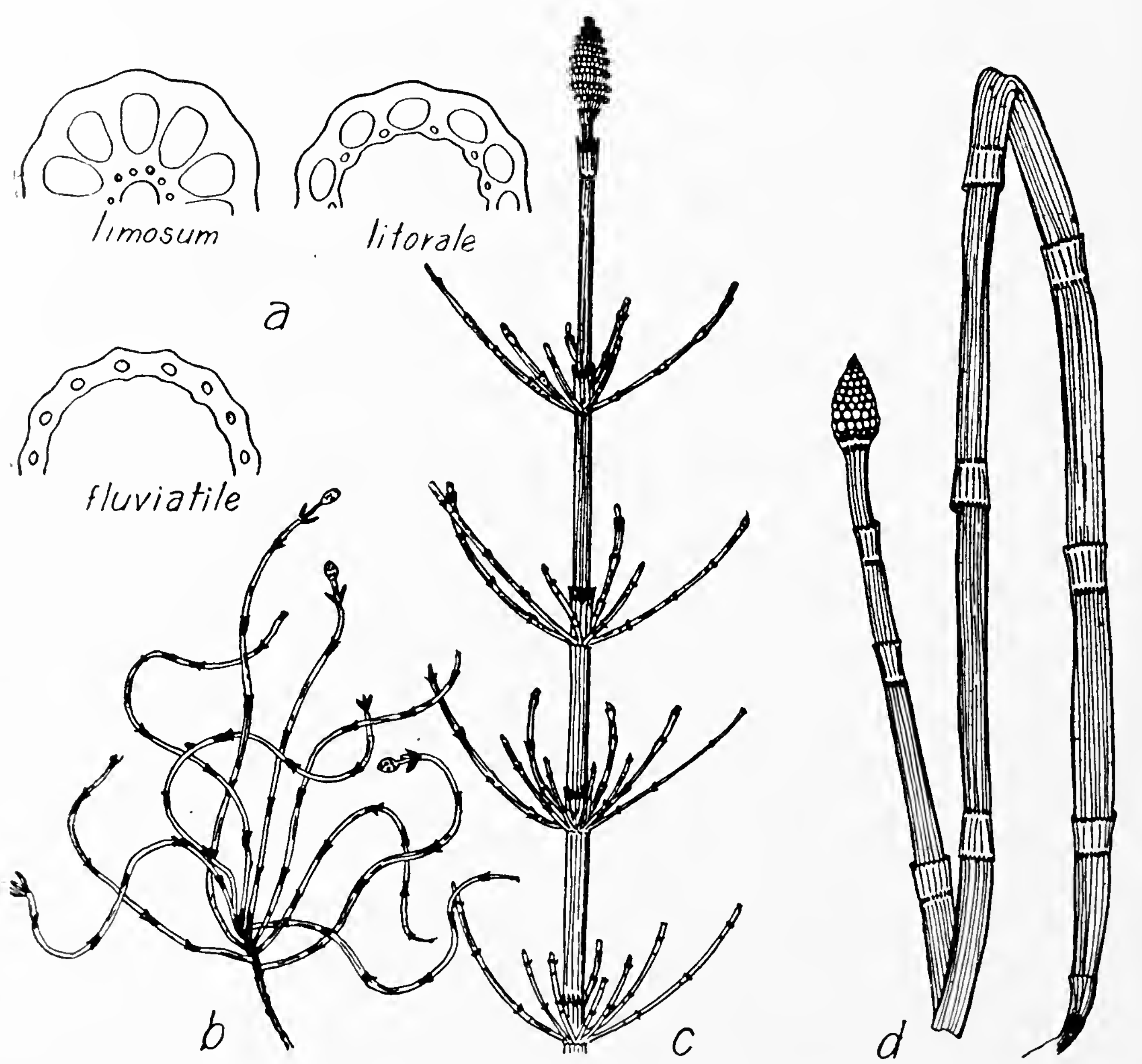
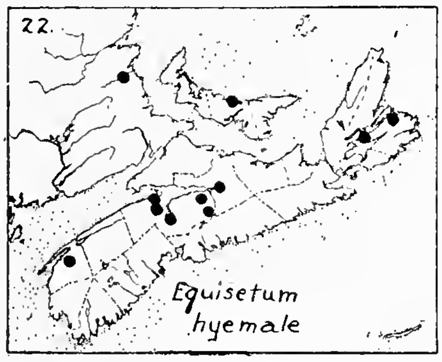
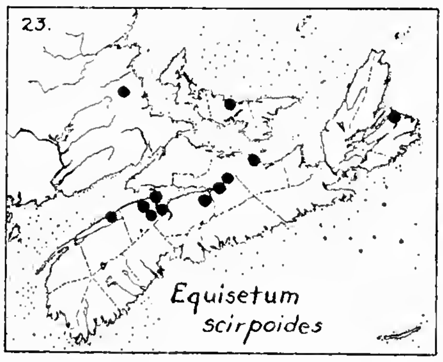


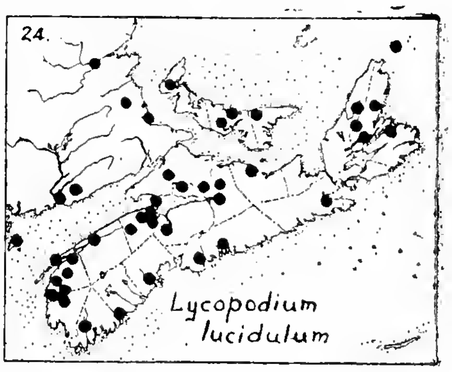
Figure 5.—**Equisetum.** a, cross-sections of the main stem. b, **E. scirpoides,** x ½. c, **E. fluviatile,** x ½. d. **E. hyemale,** x ½.

6. **E. hyemale** L., var. **affine** (Engelm.) A. A. Eaton. SCOURING RUSH. Map 22. Fig. 5, d.

Light sandy or gravelly banks, railroad embankments, shaded banks, and low areas in calcareous places; scattered







through the northern counties; common near Truro, and occasionally west to the banks of the Sissiboo R., Digby Co. In most parts of its range in the province the plant is associated with calcareous soil or marly areas. (*E. praealtum* Raf.).

Nfld. and Canada to Mexico.

7. **E. scirpoides** Michx. DWARF SCOURING RUSH. Map 23. Fig. 5, b.

Rich wooded banks and mossy slopes from northern C.B. to Cumberland Co., and along the North Mt. to Annapolis Co.; rather scattered and typical of alkaline areas.

Nfld. to Alaska south to N. Y., Wisc., S. D., & Wash.

6. **LYCOPODIACEAE** CLUBMOSS FAMILY

1. **LYCOPODIUM** L. CLUBMOSS

a. Sporangia in the axils of ordinary leaves, not in terminal spikes; plants acending from a prostrate base.
  b. Stems erect, in tufts; leaves all the same length, yellowish, ascending, attenuate. 1. *L. Selago*
  b. Stems ascending, isolated or loosely grouped; leaves dark green, spreading to deflexed, toothed, in alternate zones of shorter and longer ones (Fig. 6, g, h). 2. *L. lucidulum*

a. Sporangia in the axils of reduced or scale-like leaves, in a terminal spike.
  c. Leaves of the spike green, but slightly reduced; spike sessile, greenish; plant small, the prostrate base superficial on the surface of the ground.
    d. Plants dwarf, 3-10 cm high; spikes 1-3 cm long (Fig. 6, f). 3. *L. inundatum*

d. Plants stout, 1-3 dm high; spikes 2-5 cm long.
L. inundatum var. *Bigelovii*

c. Leaves of the spike scale-like and yellowish, very different from the stem leaves; spike yellow.

e. Leaves in 6 or more ranks; ultimate branches not flattened, or but obscurely so.

f. Spikes sessile, terminal on leafy branches.

g. Plants creeping on the surface; ascending branches similar to the prostrate stem, little forked.

h. Leaves toothed, spreading to reflexed (Fig. 6, b).
4 *L. annotinum*

h. Leaves not toothed, rigid, rather narrow.

i. Leaves 5-10 mm long, firm, spreading.
L. annotimum var. *acrifolium*

i. Leaves 3-5 mm long, ascending to appressed, narrow and pointed, often incurved. *L. annotinum* var. *pungens*

g. Plants from scaly underground rootstocks; upright stems much branched; bushy or tree-like.

j. Branches loose and spreading; leaves over 1 mm wide, the upper and lower ranks reduced so that the branches appear flattened (Fig. 6, c). 5. *L. obscurum*

j. Branches ascending, crowded; leaves less than 1 mm wide, all alike so that the branches appear terete, often appressed.
L. obscurum var. *dendroideum*

f. Spikes on long bracted peduncles; leaves soft, linear, with long tips.

k. Spikes normally 2-4 on each stalk (Fig. 6, a). 6. *L. clavatum*

k. Spikes mostly solitary. *L. clavatum* var. *megastachyum*

e. Leaves in 4 ranks, small, scale-like, joined to the branch by half their length or more.

l. Leaves nearly alike, spreading with incurved tips, joined by half their length; peduncles mostly less than 10 mm. long; spikes mostly solitary (Fig. 7, e). 7. *L. sabinaefolium*

l. Leaves of two kinds, the upper and lower rows much reduced, making the branches flattish, appressed, joined by more than half their length.

m. Branching regular, the main branches almost opposite upon the axis, the secondary ones arranged fan-like; constrictions not marking the ends of the year's growth; rootstock superficial (Fig. 7, f). 8. *L. flabelliforme*

m. Branching very irregular; constrictions present on the branches marking the end of each year's growth.

n. Rootstocks superficial; ventral leaves reduced, free only at the points. 9. *L. complanatum*

n. Rootstalk very deeply buried; ventral leaves scarcely reduced; branches stiff, narrow and erect (Fig. 7, g).
10. *L. tristachyum*

1. **L. Selago.** L. FIR CLUBMOSS.

Scattered on stream cliffs and in moist ravines in northern C.B. It has not been found on the mainland.

Nfld. to Alaska south to Conn., N.C., Wisc. & Ore.

2. **L. lucidulum** Michx. SHINING CLUBMOSS. Map 24. Fig. 6, g, h.

Throughout; common in the northern and hardwood region from Annapolis to northern C.B.; scattered elsewhere. It is characteristic of rich hardwoods, damp hillsides and alluvial woods.

Nfld. to B.C. south to N.C., Iowa & Wash.

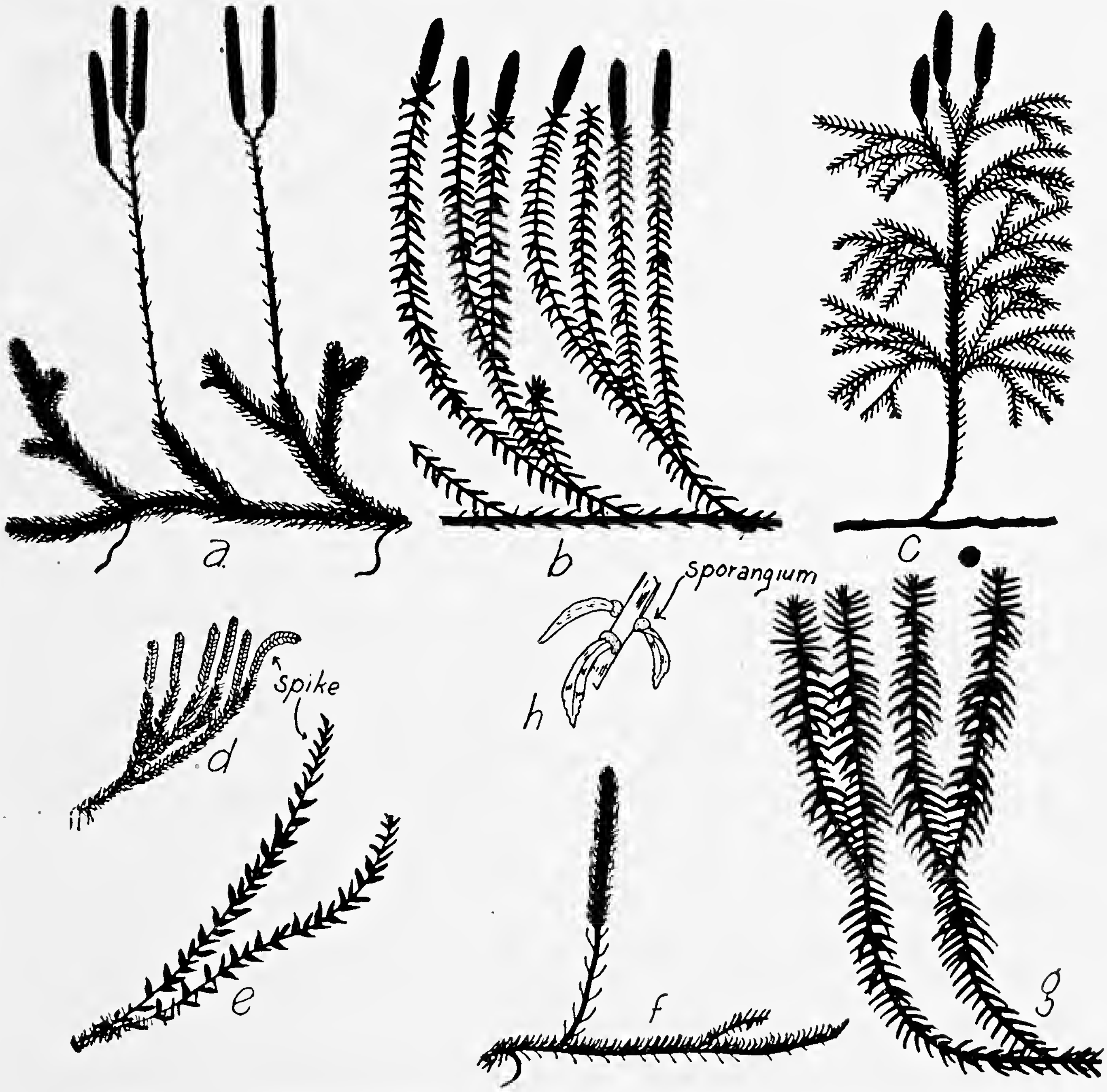
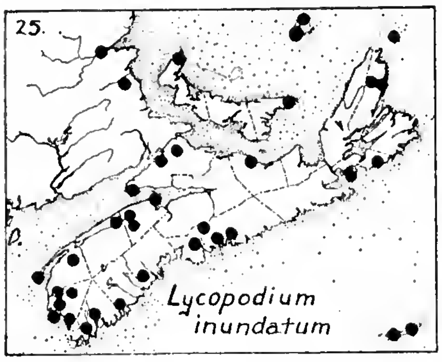
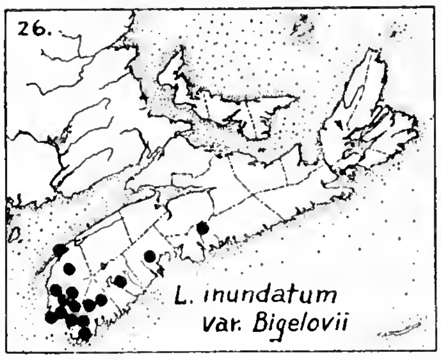


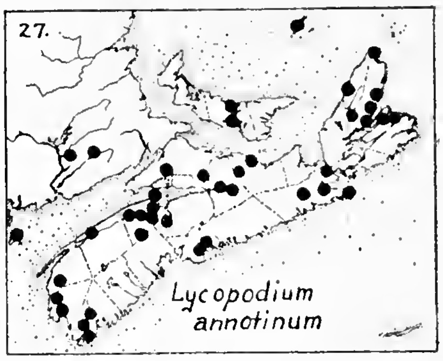
Figure 6.—**Lycopodium.** a, **L. clavatum.** b, **L. annotinum.** c, **L. obscurum.** f, **L. inundatum.** g, **L. lucidulum.** h, **L. lucidulum** leaves and sporangia. **Selaginella.** d, **S. rupestris,** x ½. e, **S, selaginoides,** x ½.

3. **L. inundatum** L. BOG CLUBMOSS. Map 25. Fig. 6, f.

Common throughout in its habitat; swamps, bog mead-







ows, poorly-drained depressions, sandy beaches; somewhat general in the wet dune hollows on Sable Island.

Nfld. to Alaska south to W. Va., Ind. & Ore.

Var. **Bigelovii** Tuckerm. Map 26. This giant form is common from Digby Neck and Yarmouth around to Shelburne; scattered eastward to Grand Lake in Halifax Co.; collections from North Sydney and Louisburg are intermediate between the species and the variety. It is found on sandy and peaty beaches, boggy savannahs, and wet depressions.

Nfld.; N.S.; Mass. to N.J.

4. **L. annotinum** L. BRISTLY CLUBMOSS. Map 27. Fig. 6, b.

Common throughout; open dry hardwoods. Nfld. to Alaska south to Penn., Wisc., Colo. and Ore.

Var. **acrifolium** Fern., Rhodora **17:** 124. 1915, is less common than the species and occurs in drier or more acid habitats. Scattered throughout, common on dry hillsides in beech woods. Nfld. to Wisc. south to Va.

Var. **pungens** Desv. is more northern; characteristic of the grass-sedge heath association of northern C.B. (Nichols); grading into the species inland. Nfld. to Minn. south to W. Va.

5. **L. obscurum** L. FLATBRANCH CLUBMOSS. GROUND PINE. Fig. 6, c.

Common throughout; dry hillsides and open woods.

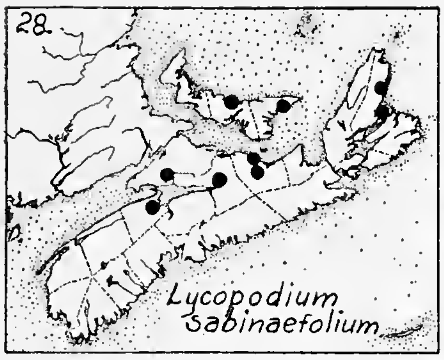
Nfld. to B.C. south to Ala.

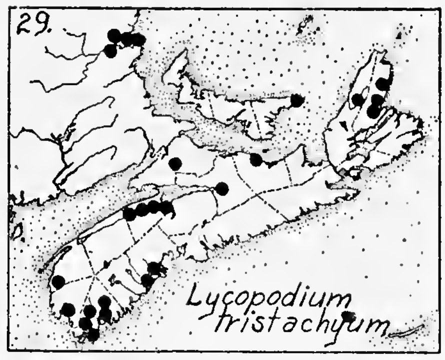
Var. **dendroideum** (Michx.) D. C. Eaton is frequent in open dry woods, pastures and clearings, often found in sandy areas or pine country.

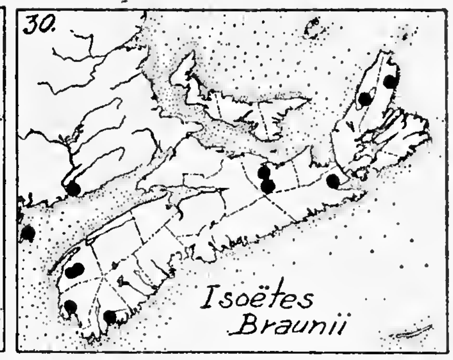
Nfld. to Wash. & Alaska south to N.C. & Ind.

6. **L. clavatum** L. CLUBMOSS. Map 34. Fig 6, a.

Common throughout; light soil on hillsides, pastures and in dry open bush. Cosmopolitan.







Var. **megastachyon** Fern. & Bissell, Rhodora **12**:53, 1910, is likewise common throughout in dry soils and open sandy areas. Other minor forms and varieties of little significance have been named.

7. **L. sabinaefolium** Willd., var. **sitchense** (Rupr.)Fern., Rhodora **25:** 166. 1923. Map 28. Fig. 7, e.

Characteristic of the grass-sedge association in northern C.B. (Nichols); scattered west to Cumberland and Kings Cos. in exposed places, on wet hillsides and clayey ill-drained soils. (*L. sitchense* Rupr.).

Lab. to the mts. of N. Eng. & N.Y.; near Lake Superior and in Alaska.

8. **L. flabelliforme** (Fern.)Blanchard, Rhodora **13:** 168. 1911. Fig. 7, f.

Common throughout; mixed woods, pastures, sometimes on sandy soil, or even in spruce woods. (*L. complanatum*, var. *flabelliforme* Fern.). Nfld. to Minn. south to Ga.

Forma **ambiguum** Vict., Contrib. Inst. Bot. Univ. Montreal, no. **3:** 65. 1925, shows a transition to the next species. Plants with the spikes having a few more or less normal leaves at the summit are named forma **proliferum** Vict. l.c. page 66. Both these variations are commonly seen.

9. **L. complanatum** L.

Rare; hardwoods, or on hillsides, rarely in coniferous woods; scattered in the Cobequids and south along the Annapolis Valley; also in C.B. It is rarely seen fruiting.

Nfld. to Alaska south to N.S., Mich. & Wash.

10. **L. tristachyum** Pursh. Map 29. Fig. 7, g.

Dry barrens, sandy woods and gravelly embankments; scattered throughout, but common on the sandy soils of Shelburne, Kings and Cumberland Cos. Plants intermediate between this species and L. *complanatum* were found in the Cobequids and in C.B. and may be called var. *Haberi* (House) Vict., l.c. page 51.

Nfld. to James Bay & Minn. south to Ala.

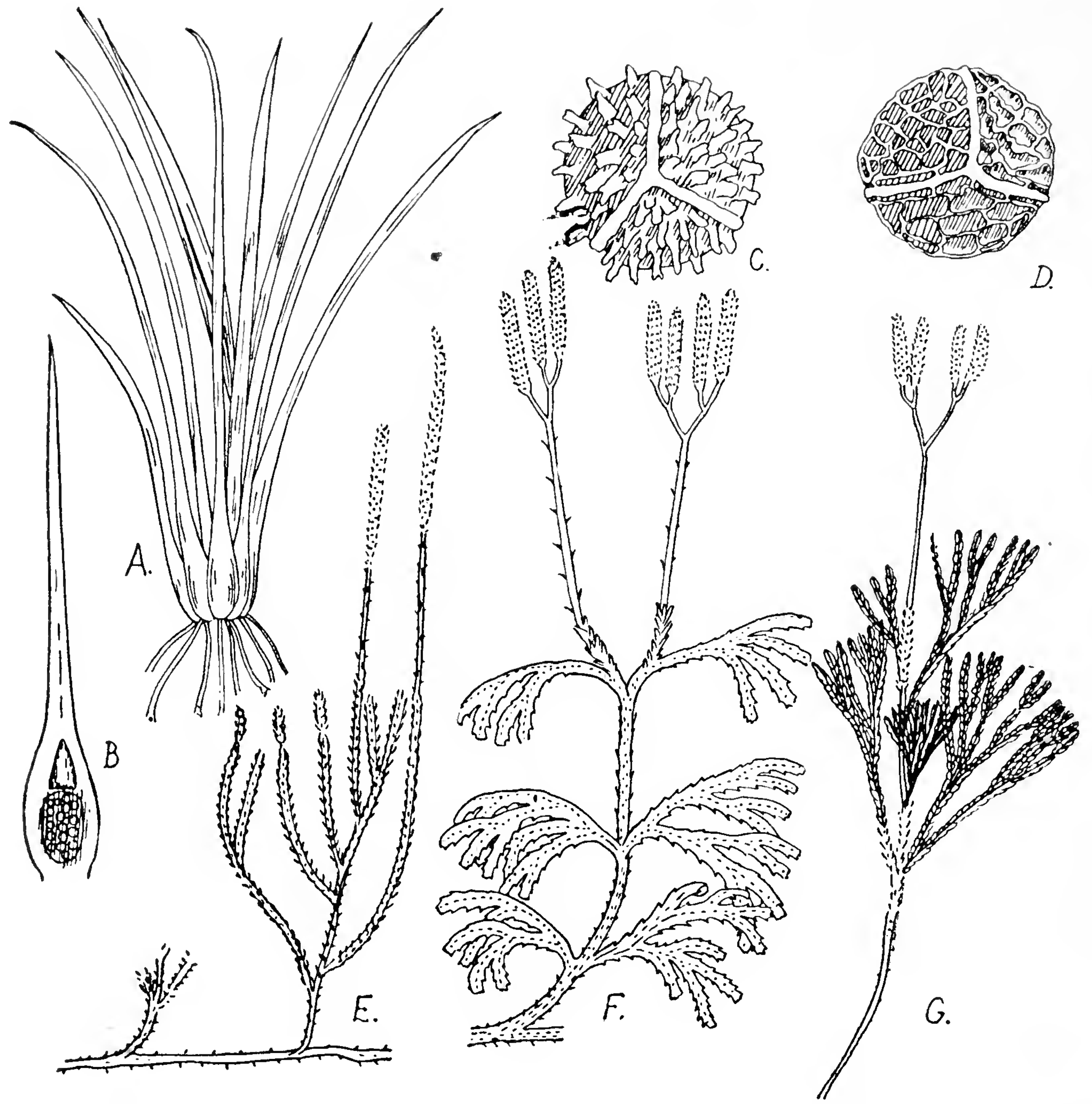


Figure 7.—**Isoëtes.** a, habit sketch, x 1. b, inner view of a single sporophyll (leaf). c, spore of **I. Braunii**, x 40. d, spore of **I. Tuckermani**, x 40. **Lycopodium.** e, **L. sabinaefolium**, x ½. f, **L. flabelliforme**, x ¼. g, **L. tristachyum**, x ½.

7. SELAGINELLACEAE

1. SELAGINELLA Beauv.

a. Plant densely tufted, grayish green; leaves rigid and appressed, minutely ciliate and bristle-tipped. 1. *S. rupestris*

a. Plant prostrate or creeping, often solitary, green; leaves spreading, or the two lower ranks smaller and appressed, soft, bristly-margined, not bristle-tipped. 1. *S. selaginoides*

1. **S. rupestris** (L.) Spring. ROCK SELAGINELLA. Fig. 6,d.

Known only from basalt ledges at the summit of Shobel's Mt., Sandy Cove, Digby Neck.

Dry exposed rocks and sandy sterile soil; N.S. to Minn. south to Ala.

2. **S. selaginoides** (L.) Link. Fig. 6, e.

Scattered in many of the sphagnous bogs in northern C.B.; borders of tussocks, overhanging the margins of a sluggish stream, St. Paul Is. (Perry, 1931).

Nfld. to N.Y.; west to Idaho & Alaska; Magdalen Islands.

8. ISOETACEAE QUILLWORT FAMILY

1. ISOETES L. QUILLWORT

a. Megaspores spiny, 420-580 microns in diameter. 1. *I. Braunii*
a. Megaspores with a network of ridges or projections.
  b. Megaspores 600-800 microns in diameter. 2. *I. macrospora*
  b. Megaspores 460-600 microns in diameter. 3. *I. Tuckermani*

1. **I. Braunii** Dur. QUILLWORT. Map 30. Fig. 7, a, c.

Scattered, probably throughout; well-drained lakes and ponds in C.B. (Nichols); gravelly and muddy bottoms of brooks in southwestern N.S. (Fernald, 1921); scattered elsewhere. (*I. echinospora* Dur., var. *Braunii* (Dur.) Engelm., and including var. *muricata* (Dur.) Engelm.).

Nfld. to N.J., Ohio, Minn. and westward.

2. **I. macrospora** Dur. Map 31.

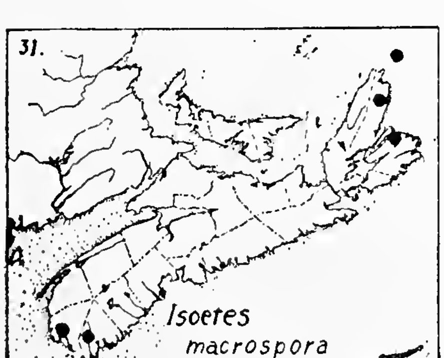
Sandy soil in a lake at North Sydney, Warren Lake at Ingonish, cobbly margins of east branch of the Tusket R. and gravelly bottom of the Clyde R.; abundant in Ethel Lake on St. Paul Is.

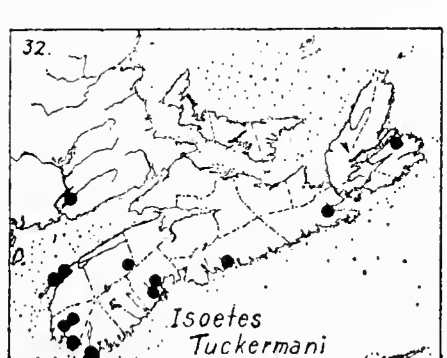
Nfld. to Minn. south to Mass.

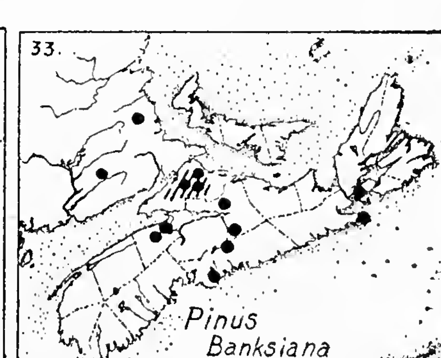
3. **I. Tuckermani** A. Br., including var. *borealis* Eaton. Map 32. Fig. 7, d.

Shallow water of brooks, quiet pools, and lakes, on sandy, peaty or muddy margins; scattered throughout the Atlantic region from Digby and Yarmouth Cos. to Sydney.

Lab. to Conn.







SPERMATOPHYTA

9. **TAXACEAE** YEW FAMILY

1. **TAXUS** (Tourn.)L.

1. **T. canadensis** Marsh. CANADA YEW. Fig. 9, a, f.
Rather common throughout; cool damp woods, ravines, coniferous climax forests and wooded swamps; sometimes it forms a dense ground cover which excludes other plants.
Nfld. to Man. south to Va. & Iowa.

10. **PINACEAE** PINE FAMILY

a. Leaves linear, in bundles of 2 or 5, or many together (Fig. 8, a, b).
 b. Leaves in 2's or in 5's; evergreen. 1. *Pinus*
 b. Leaves on short spurs, many in each cluster, or solitary on the more rapid terminal growth, deciduous. 2. *Larix*
a. Leaves short, linear or scale-like, solitary.
 c. Leaves all linear; seeds in a woody cone.
  d. Leaves squarish in cross-section, not in two ranks. 3. *Picea*
  d. Leaves flattish in cross-section, whitened along the lower side, in two ranks so that the twigs appear flattened.
   e. Cone 5-10 cm long, upright, the scales readily falling away from the axis; leaves 1-3.2 cm long, leaving a smooth circular scar upon the twig (Fig. 9, b, d). 4. *Abies*
   e. Cone 1.5-2.5 cm long, hanging, the scales not falling away from the axis; leaves 8-13 mm long, attached to the twigs by hard, raised woody bases, leaving raised scars (Fig. 9, c, e). 5. *Tsuga*
 c. Leaves shorter, overlapping and often scale-like; seeds in an ellipsoid cone of 8-12 scales, or in a bluish, berry-like structure.
  f. Seeds in a cone; leaves scale-like, blunt, more or less 2-ranked (Fig. 8, g). 6. *Thuja*
  f. Seeds in the axils of 3-6 fleshy scales, which coalesce to form a round, bluish, berry-like structure; leaves not 2-ranked (Fig. 9, g, h). 7. *Juniperus*

1. **PINUS** (Tourn.) L. PINE

a. Leaves 5 in a bundle; cones 10-15 cm long. 1. *P. Strobus*
a. Leaves 2 in a bundle; cones 2-6 cm long.
 b. Leaves 9-16 cm long; stout tree with reddish bark. 2. *P. resinosa*
 b. Leaves less than 8 cm long; bark not reddish.

c. Leaves 1-4 cm long, widely divergent; resin ducts mostly 2 in each leaf, deeply imbedded (Fig. 8, d); bark of the upper branches and trunk dark. 4. *P. Banksiana*

c. Leaves 4-6 cm long, not widely divergent; resin ducts many in each leaf, nearly peripheral (Fig. 8, c); bark of the upper branches and trunk yellowish. 3. *P. sylvestris*

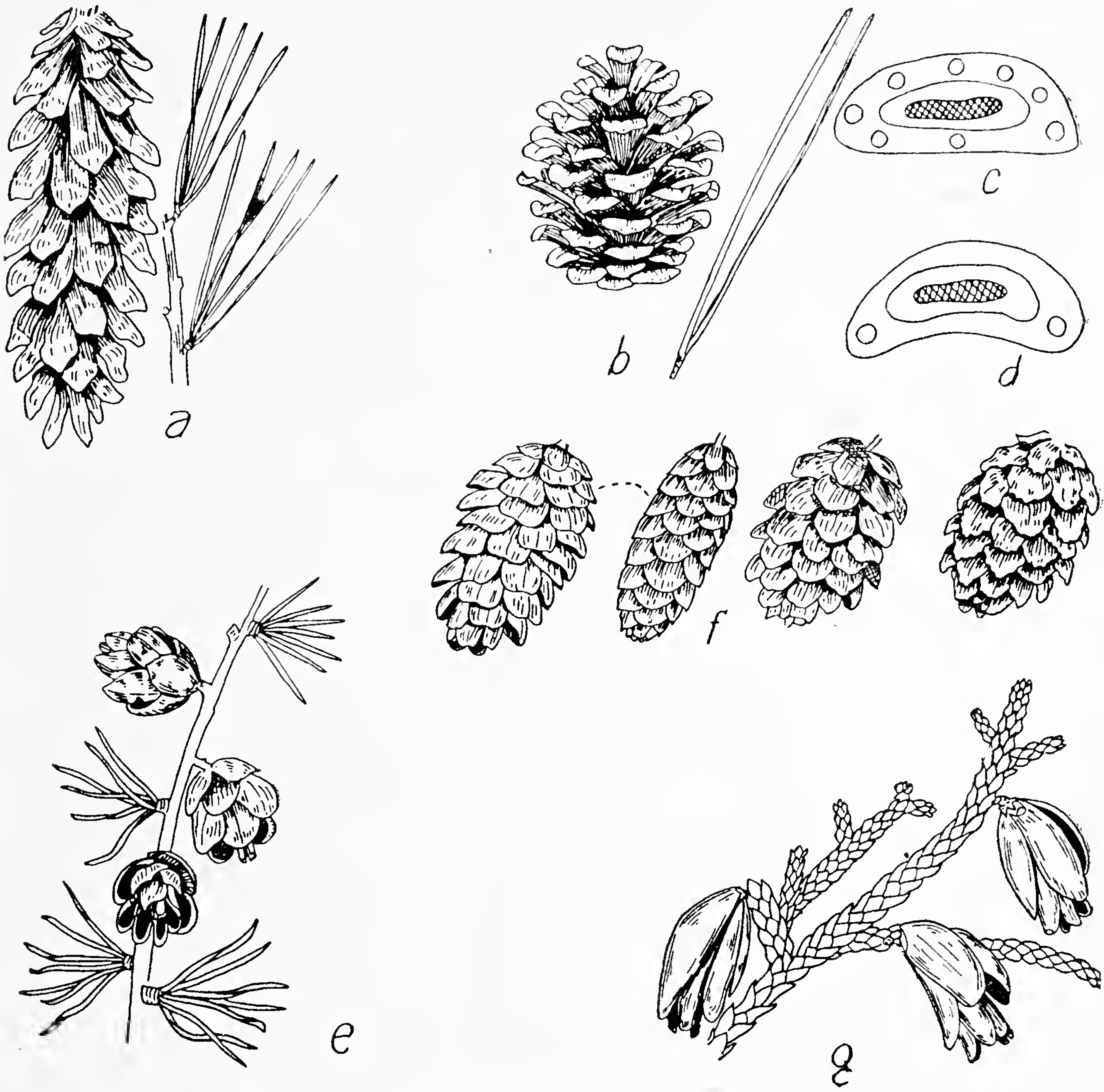


Fig. 8.—**Pinus.** a, **P. Strobus,** cone and leaves, x ½. b, **P. resinosa,** cone and leaves, x ½. c, **P. sylvestris,** cross-section of leaf. d, **P. Banksiana,** cross-section of leaf. **Larix.** e, **L. laricina,** x ½. **Picea.** f, cones of **P. glauca, P. rubens,** and **P. mariana. Thuja.** g, twig, x ½.

1. **P. Strobus.** L. WHITE PINE. Fig. 8, a.

Common on the sandy or gravelly well-drained soils of the province; formerly reaching its best development on the glacial granitic sands of Shelburne Co., on the sands of the Annapolis Valley, and on the lowlands of Cumberland and north Colchester Cos; scattered elsewhere, becoming rarer east to C.B.

Nfld. along the mts to Ga. west to Man. & Iowa.

2. **P. resinosa** Ait. RED PINE. Fig. 8, b.

Common in the Annapolis valley and the lowlands of Colchester and Cumberland Cos. on sandy or rocky soils; scattered in other parts of the province. It is frequently found in poorly-drained areas. Due to cutting and frequent fires it has been replaced in the northern part of the province by Jack Pine.

Nfld. to Man. south to Penn. & Wisc.

3. **P. sylvestris** L. SCOTCH PINE.

Frequently planted; common only around towns. Introduced from Eu.

4. **P. Banksiana** Lamb. JACK PINE. Map 33.

Very sandy, barren or poorly-drained soils; common and spreading rapidly in Cumberland Co.; rare in the Annapolis Valley; scattered eastward.

Forma **procumbens** Rousseau, Nat. Canad. **65:** 301. 1938, is a shrubby form 0.5-2 m high, with the branches procumbent. Found on the exposed rocky headlands in the vicinity of Canso. Known also from Que.

N. S. to northern N.Y., n. Ind., Minn. and northward.

2. LARIX (Tourn.) Adans.

a. Leaves 10-25 mm long; cones 12-16 mm long, with scales smooth; branches stiff. 1. *L. laricina*

a. Leaves 20-40 mm long; cones 20-40 mm long, with scales finely hairy; branches slender and pendulous. 2. *L. decidua*

1. **L. laricina** (DuRoi) Koch. TAMARACK, LARCH, HACKMATACK, "JUNIPER". Fig. 8, e.

Common in bogs and poorly-drained soils throughout; one of the few trees able to grow in peat bogs, where stunted individuals a few feet high may be almost 100 years old. Nichols states that it is rare in northern C. B., but this may have been due to an earlier insect infestation.

Depressed forms of the tree which grow on exposed and sterile places are forma **depressa** Rousseau, Bull. Nat. Mus. Canada **66:** 28. 1931. Common, according to Rousseau, on exposed headlands at Canso.

Lab. & Nfld. to the mouth of the Mackenzie, south to Penn.

2. **L. decidua** Mill. EUROPEAN LARCH.

Occasionally seen along roadsides, and planted as windbreaks. Introduced from Eu.; throughout eastern N.A.

3. **PICEA** Link SPRUCE

a. Native and common; cones 2-5 cm long; branches usually spreading.
 b. Twigs smooth; cones cylindrical, 2-5 cm long, with 60-90 scales which are flexible and smooth-edged; leaves blue-green, sharp (Fig. 8, f). 1. *P. glauca*
 b. Twigs finely hairy; cones ovoid to roundish, with about 30 scales which are often wavy or ragged-edged; leaves blunter, rigid at maturity (Fig. 8, f).
  c. Leaves grayish or bluish-green; cones persisting 2-5 years on the branches; scales of the cones ragged-edged; branches stiff; bark usually dark. 2. *P. mariana*
  c. Leaves yellowish-green, rather long and blunt, not shiny; cones mostly falling the first autumn and confined to the top of the tree; scales of the cones smooth- to wavy-edged; branches often drooping; bark reddish-tinged. 3. *P. rubens*
a. Introduced, occasionally planted; cones 10-15 cm long; branches drooping; leaves sharp-pointed, 12-25 mm long. 4. *P. Abies*

1. **P. glauca** (Moench)Voss. WHITE, PASTURE, or CAT SPRUCE.

This tree was probably not common in the original forest but is now common throughout, and invariably occupies any grazed pasture or neglected field. (*P. canadensis* (Mill.) BSP.).

Forma **parva** (Vict.) Fern. & Weatherby, Rhodora **34:** 187. 1932, is a prostrate form found in exposed places, upon headlands, sand beaches and bogs in the northern part of the province.

Nfld. & Lab. to Alaska south to Mass., Wisc. & Mont.

2. **P. mariana** (Mill.) BSP. BLACK or BOG SPRUCE.

Common throughout in swamps, bogs and poorly drained areas, rarely found on the uplands or in dense forests. In many places it is difficult, or impossible, to distinguish this from the next species. The prostrate form found on the exposed bogs and sterile headlands is forma **semi-prostrata** (Peck) Blake, Rhodora **15:** 200. 1913. This is common along the Atlantic Coast from Halifax northward.

Nfld. to N.J. west along the Great Lakes and northward.

3. **P. rubens** Sarg. RED SPRUCE.

Common throughout in good soils, well- to medium-drained situations. In places, as around Amherst, the red spruce covers large areas of lowland soils. (*P. rubra* (DuRoi) Dietr.).

N.S. to eastern Que. south in the mts. to N.Y.

4. **P. Abies** (L.)Karst. NORWAY SPRUCE.

Occasionally planted as an ornamental or for windbreaks.

Intro. from Eu. into many parts of N.A.

4. **ABIES** (Tourn.) Hill FIR

1. **A. balsamea** (L.) Mill. BALSAM FIR. Fig. 9 b, d.

This is one of the commonest trees of the province, replacing many of the more valuable hardwoods and spruces. The interior of C.B. is covered mostly with fir; elsewhere fir comes in whenever deciduous woods are opened up, and often establishes itself in the open pasture or bush before the spruces or other conifers.

Nfld. to the Yukon, south around the Great Lakes and in the mts. to Va.

Var. **phanerolepis** Fern., Rhodora **11:** 203. 1909, is similar to the species but with the cones shorter and the mature scales sub-orbicular or reniform, and with a conspicuous exserted awn which gives a peculiar whitish appearance to the cones. Scattered along the Atlantic Coast; growing with the typical form at Argyle, Yarmouth Co; rather common at Musquodoboit Harbour and Jeddore (Rousseau), and the commonest form on St. Paul Is. (Perry).

Scattered and its distribution not well-known; Nfld., Que. and northern N.J.

5. **TSUGA** (Endl.) Carr.

1. **T. canadensis** (L.) Carr. HEMLOCK. Fig. 9, c, e.

Hemlock is now one of the commonest trees cut for lumber. It is rather local, sometimes being the predominant tree but often scattered or local. It prefers northern slopes, ravines, or sandy soil with subsurface water. Annapolis has been called the hemlock county, but the tree is commonest in southwestern N.S. and gradually gives way to the spruces and firs eastward.

N.S. to Minn. south along the mts. to Ga.

6. THUJA L.

1. **T. occidentalis** L. ARBOR VITAE, WHITE CEDAR Fig. 8, g.

Local; scattered along some of the lakes in the back regions of Digby and Yarmouth Cos.; absent elsewhere, although it is possible that it exists on the isthmus between N.S. & N.B. In places in the Annapolis Valley it has escaped and spread extensively along the rocky pastures.

N.S. to Man. & Minn. south to Penn. & N.C.

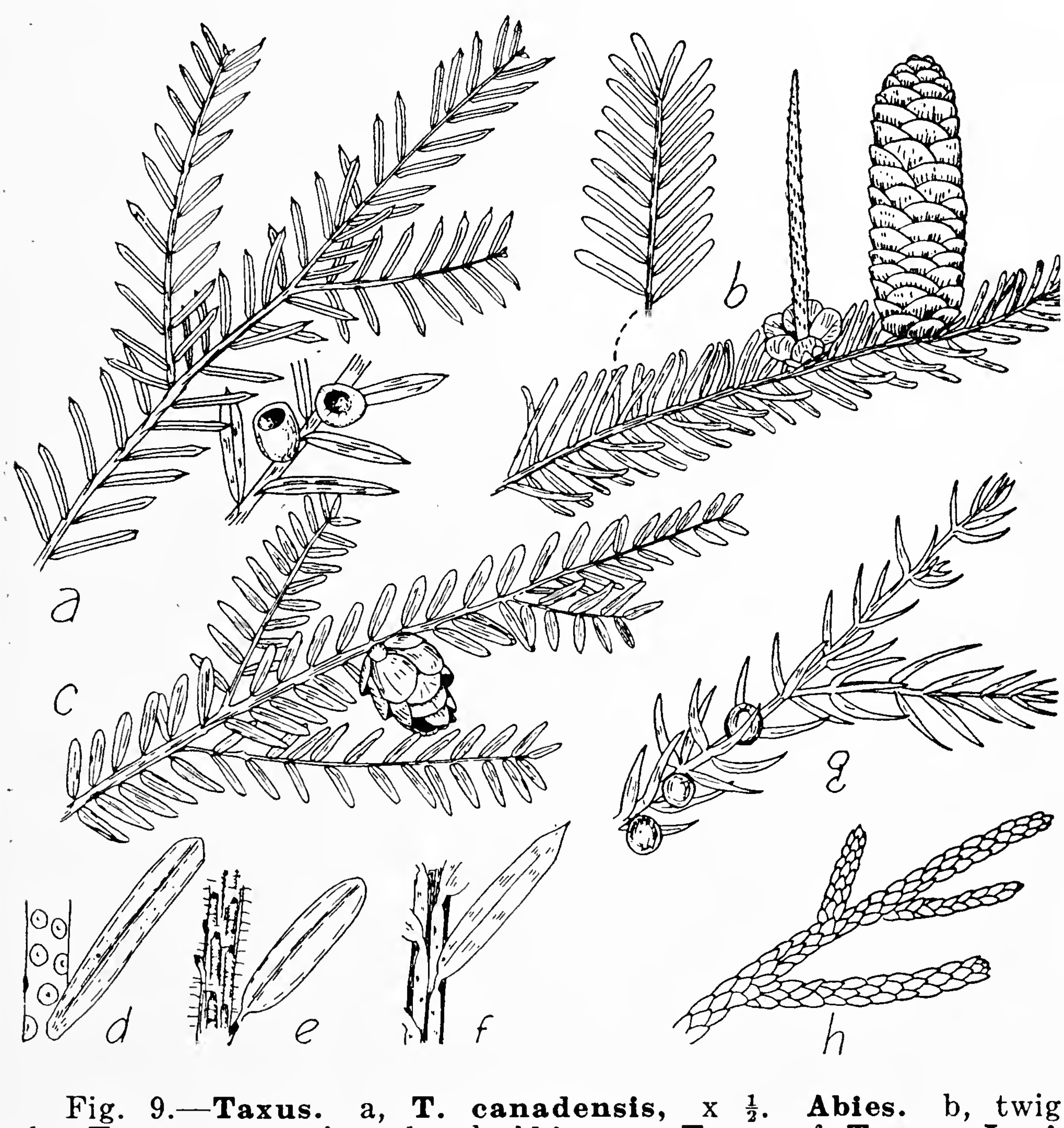


Fig. 9.—**Taxus.** a, **T. canadensis,** x ½. **Abies.** b, twig, x ½. **Tsuga.** c, twig, x ½. d, **Abies.** e, **Tsuga.** f, **Taxus. Juniperus.** g, **J. communis,** twig, x ½. h, **J. horizontalis,** twig, x 2.

7. **JUNIPERUS** (Tourn.) L. JUNIPER

a. Leaves needle-like, more or less whorled, 7-22 mm long (Fig. 9, g).
  b. Shrub low or erect, but not strictly depressed with age; leaves narrow, sharp and straight.
    c. Shrub erect; leaves 7-22 mm long. 1. *J. communis*
    c. Shrub depressed with the branch tips erect or creeping, forming circular patches 2-4 m in diameter; leaves usually shorter than the last. *J. communis* var. *depressa*
  b. Shrub decumbent with the branches pressed against the soil; leaves short, stout and incurved.
    d. Fruit less than 9 mm in diameter; seeds less than 5 mm long. *J. communis* var. *montana*
    d. Fruit 9-12 mm in diameter; seeds 5-7 mm long. *J. communis* var. *megistocarpa*
a. Leaves scale-like, generally opposite, 1.5-3 mm long, much overlapping, (juvenile forms may have the leaves sharp and spreading, 4-5 mm long). Fig. 9, h. 2. *J. horizontalis*

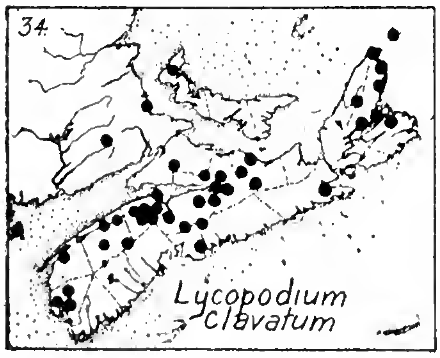
1. **J. communis** L. COMMON JUNIPER. Fig. 9, g.

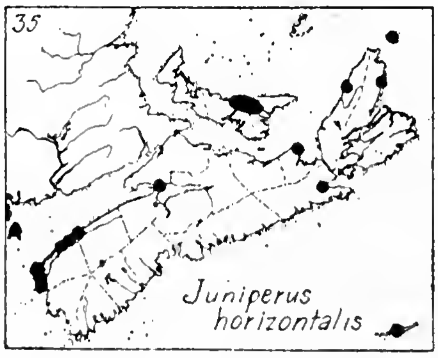
Erect bush-like forms occur near Halifax which may be placed with the species. (See Sommers, Trans. N.S. Inst. Sci. **9**: 2: 175-179. 1896). Such transitional forms, which resemble to some extent the European plant, occur from N.S. and Me. south to N.C.

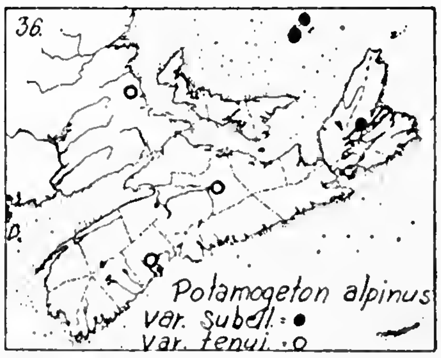
Var. **depressa** Pursh is common throughout, in sandy areas, hillside pastures, poorly-drained soil, or even in bogs and on heaths. It is especially common in the Annapolis Valley. Lab. to B.C. south to N.Y., Ind. & Utah.

Var. **montana** Ait. is rare around the coast: bogs near Canso, on the heaths of northern C .B., and scattered on St. Paul Is.

Var. **megistocarpa** Fern. & St. John, Proc. Bost. Soc. Nat. Hist. **36**: 58. 1921, is found near the coast. It was originally described from Sable Island; and is reported from St. Paul Is., Nfld., the Magdalen Islands, and Gaspe.







2. **J. horizontalis** Moench. CREEPING JUNIPER. Map 35. Fig. 9, h.

Rocky headlands, or on cliffs, pastures or beaches near the coast; scattered along the Bay of Fundy; rare on the North Shore; common in northern C.B. and on Sable Is. Plants reported by Rousseau from Guysborough have the leaves needle-like and sharp like the juvenile branches. This has been named forma **alpina** (Loud.) Rehd., Journ. Arnold Arb. **6**: 203. 1925.

Nfld. to N.Y., northern Minn. and northward.

11. TYPHACEAE CAT-TAIL FAMILY

1. TYPHA (Tourn.) L. CAT-TAIL

a. Leaves flat, 12-24 mm wide; staminate and pistillate spikes touching; pistillate spikes in fruit 2.5 cm thick. 1. *T. latifolia*

a. Leaves usually slightly rounded, 3-7 mm wide; staminate and pistillate spikes separated by an interval; pistillate spike in fruit 10-17 mm thick. 2. *T. angustifolia*

1. **T. latifolia** L. BROADLEAVED CAT-TAIL. Fig. 10, a.

Common throughout; in miry swamps, shallow ponds, wet areas in fields, edges of rivers and streams, in estuaries above salt water, and occasionally in floating bog associations. Local on Sable Is., growing on the borders of the fresh water ponds; very rare on the highlands of C.B.

Throughout N.A.

2. **T. angustifolia** L.

Local around some of the small lakes south of Amherst near the head of the tide. Dore has collected it near Cheticamp in C.B. Lindsay lists it from Beaverbank in Halifax Co.; and Macoun reports it from near Windsor. The last two are not supported by records; but the plant is to be expected in scattered localities near the coast.

Southern Me. and N.S. south along the coast to Fla. and inland about the Great Lakes.

12. SPARGANIACEAE BUR-REED FAMILY

1. SPARGANIUM (Tourn.) L. BUR-REED

a. Stigmas 2; fruit squarish across the top when mature; plants large and stout (Fig. 10, b). 1. *S. eurycarpum*

a. Stigma 1; mature fruit tapering at each end (Fig 10, e).

b. Beak of the fruit long and slender; staminate heads 2-many.

c. Beak of the fruit slender, straight or nearly so; leaves erect or floating; sepals attached near the top of the flower stalk.

d. Pistillate heads or branches borne directly in the axils of the leaves; nutlets not ribbed at the summit (Fig. 10, c).
2. *S. americanum*

d. Pistillate heads or branches usually borne some distance above the leaf axils (Fig. 10, d); nutlets ribbed or angled above the middle.

e. Plants usually with erect leaves; nutlets ribbed plainly at the summit, with beaks about the length of the body.

f. Pistillate heads 2-4, well separated, 1.5-2.7 cm in diam.; staminate part of the inflorescence 2-10 cm long, of 4-9 heads.
3. *S. chlorocarpum*

f. Pistillate heads 1-3, the upper touching each other, 1-2.2 cm in diam.; staminate part of the inflorescence 1-4 cm long, of 2-5 heads. *S. chlorocarpum* var. *acaule*

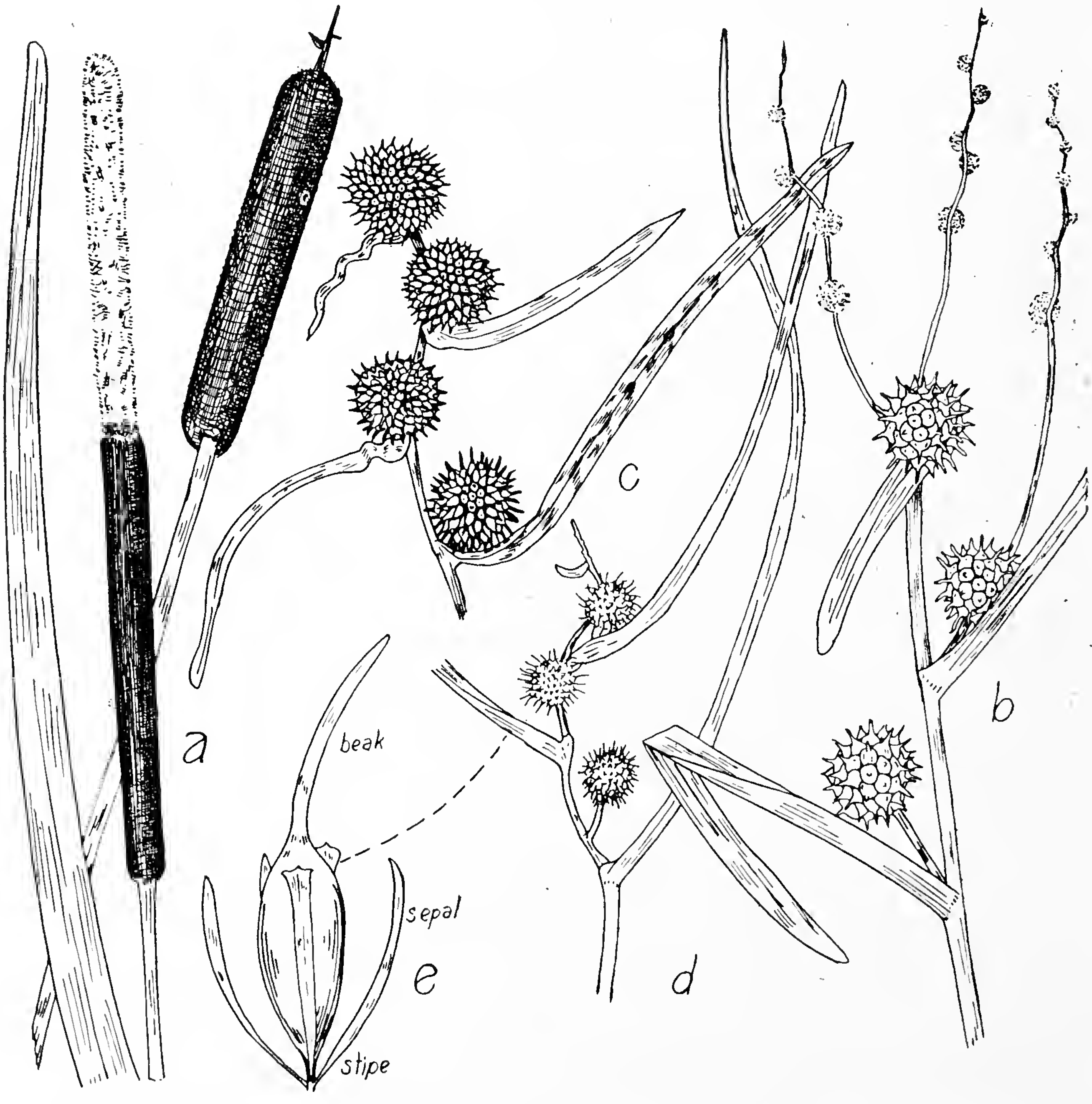


Figure 10.—**Typha latifolia.** a, plant, x ¼. **Sparganium.** b, **S. eurycarpum**, top of plant, x ¼. c, **S. americanum**, x 1/3. d, **S. fluctuans**, x 1/3. e, single floret of **S. fluctuans**, x 8.

e. Plants with usually floating leaves; nutlets obscurely or not ribbed; beak shorter than the body.
g. Leaves 1.5-4 mm wide, rounded on the back; pistillate heads 1.3-2 cm in diam.; nerves on the underside of the leaf 0.2-0.8 mm apart. 4. *S. angustifolium*
g. Leaves 5-10 mm wide, flat on both sides; pistillate heads 2-2.5 cm in diam.; nerves on the under side of the leaf 0.8-2 mm apart. 5. *S. multipedunculatum*
c. Beak of the fruit long and very curved; leaves all floating; sepals attached near the base of the flower stalk (Fig. 10, d, e). 6. *S. fluctuans*
b. Beak of the fruit short or none; staminate head one; plants small.
h. Beak short and conical, 0.5-1.5 mm long; pistillate heads all borne directly in the axils of the leaves. 7. *S. minimum*
h. Beak none; pistillate heads a short distance above the leaf axils. 8. *S. hyperboreum*

1. **S. eurycarpum** Engelm. GIANT BUR-REED. Fig. 10, b.

Common in rich swampy areas, on mucky shores, borders of sloughs and sink-holes; Annapolis Valley east to C.B., rare elsewhere.

N.S. to B.C. south to Fla. & Calif.

2. **S. americanum** Nutt., including var. *androcladum* Fern. and Eames. Map 37. Fig. 10, c.

Common throughout; muddy shores of lakes and slow-moving streams; probably more abundant in southwestern N.S. than elsewhere, where it forms extensive areas with *Pontederia* around the shallow edges of the lakes.

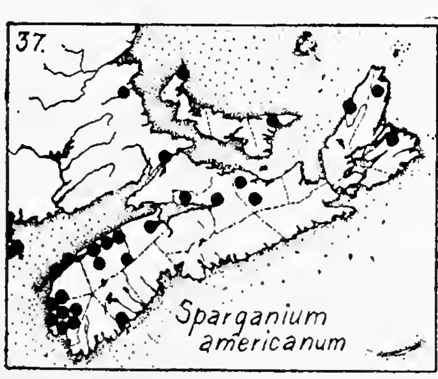
Nfld. to Minn. south to Fla. & Mo.

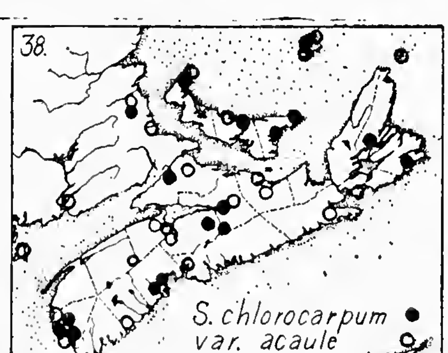
3. **S. chlorocarpum** Rydb. Map 38.

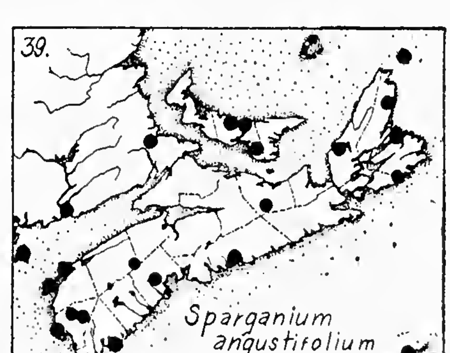
Common throughout on wet mucky shores, and in muddy shallow water. (*S. diversifolium* Graebner). Nfld. & Ont. to Iowa south to N.J. & Ind.

Var. **acaule** (Beeby)Fern. is also frequent throughout in much the same locations.

Nfld. to N.D. south to Va.







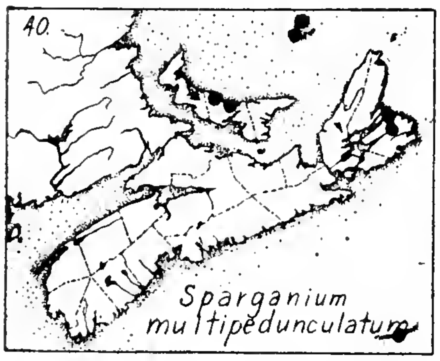
4. **S. angustifolium** Michx. Map 39.

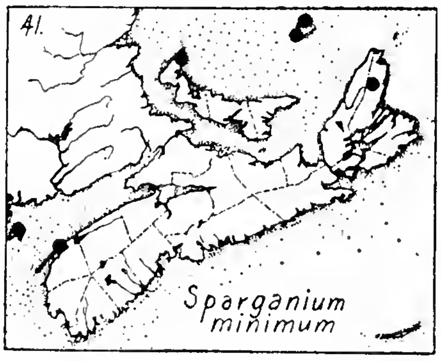
Common throughout the Atlantic Region, scattered elsewhere; sandy shores of ponds, edges of lakes, and marshy places.

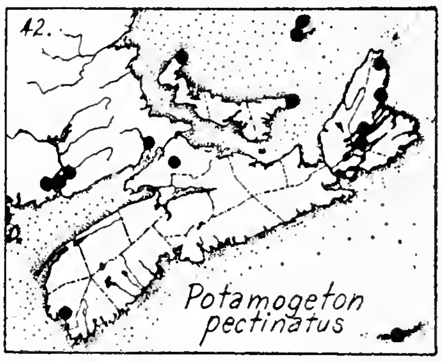
Nfld. to N. Eng. west to Alaska and Ore.

5. **S. multipedunculatum** (Morong)Rydb. Map 40. See Fernald, Rhodora **27:** 190-193. 1925.

Rare; known only from Sable Island, and from North Sydney and Sydney Mines. It is found at the edge of fresh







or brackish lakes or ponds.

Southern Lab. to Alaska south to N.S., N.H., & Calif.

6. **S. fluctuans** (Morong)Robinson. Fig. 10, d, e.

Scattered; found in shallow to deep water at the edge of ponds: near Yarmouth, Millstream in Pictou Co., and around the edges of the dykelands at the head of Cobequid Bay.

Nfld. to Minn. south to Penn. & Wisc.

7. **S. minimum** Fries. Map 41.

Local; collected in quiet pools in the Little River, east of Tiddville, Digby Co. (Fernald, 1921), and previously found by Nichols in a brook, mountains west of Ingonish.

Nfld. to Alaska south to Conn., Mich. and Ore.

8. **S. hyperboreum** Laestad.

The only record is that of Macoun: ditch near Louisburg (Cat. Can Pl. IV:71).

Arctic regions south to N. S., Que. & Man.

13. NAJADACEAE PONDWEED FAMILY

a. Leaves alternate.

b. Flowers perfect, in spikes or clusters; leaves widely scattered along the stem (Fig. 11, a-c).

c. Fruits sessile, in spikes or heads; floating leaves often present; fresh to brackish water. 1. *Potamogeton*

c. Fruits more or less stalked, with a cluster on a long peduncle; brackish to salt water (Fig. 13, c). 2. *Ruppia*

b. Flowers of two kinds, of sessile anthers, or pistils attached in 2 vertical rows on the inner side of a leaf-like spadix; leaves very long and grass-like, the bases sheathing the short jointed rootstock; salt water only. 3. *Zostera*

a. Leaves opposite.

d. Leaves linear, entire; fruits in clusters of 3-5, on short stalks in the leaf axils, flattened and toothed along one side; brackish water (Fig. 13, b). 4. *Zannichellia*

d. Leaves less than 1 mm wide, serrulate; flowers solitary; fresh water only (Fig. 13, d). 5. *Najas*

1. **POTAMOGETON** (Tourn.) L. PONDWEED

St. John, Harold. *Potamogeton*, Section *Coleophylli*. Rhodora **18:** 121-138. 1916. Fernald, M.L. The linear-leaved North American species of *Potamogeton*. Mem. Amer. Acad. Arts and Sci. **17:** pt. 1, 1-183. 1932. Ogden, E. C. The broad-leaved species of *Potamogeton* of North America north of Mexico. Rhodora **45:** 57-105; 119-163; 171-214. 1943.

a. Floating leaves present.

b. Floating leaves delicate, translucent, grading with no sharp distinction into the petiole; fruits with the exocarp hard and smooth; beak of the fruit linear, 1-1.3 mm long. 12. *P. alpinus*

b. Floating leaves thick and leathery, the blade distinct from the petiole; fruit with the exocarp soft and porous.

c. Floating leaves with 21-41 nerves (in *P. epihydrus* 11-33); spikes large with numerous flowers; fruit 2.5-5 mm long.

d. Floating leaves typically cordate at the base, or occasionally tapering in running water (Fig. 12, d, e).

e. Floating leaves with 23-37 nerves, one third more prominent than the rest; fruit 3.5-5 mm long; submersed leaves linear, 0.8-2 mm wide, with 3-5 obscure nerves (Fig. 12, d). 16. *P. natans*

e. Floating leaves with 21-29 equal nerves; fruit 3-3.5 mm long, with the beak 1 mm long; submersed leaves on the upper part of the stem lanceolate, 10-25 mm wide, with 11-21 nerves and 4-8 rows of areolae each side of the mid-rib (Fig. 12, e). 15. *P. pulcher*

d. Floating leaves tapering to the base.

f. Floating leaves with 29-41 nerves, one-quarter more prominent than the others; submersed leaves on upper part of the stem broadly lanceolate to ovate, strongly arcuate; fruit with the beak up to 1 mm long (Fig. 12, a). 14. *P. amplifolius*

f. Floating leaves with 11-33 nerves; submersed ones strongly distichous, long, 2-8 mm wide, 5-7 nerved with a wide reticulated mid-rib (Fig. 12, f); fruit essentially beakless. 11. *P. epihydrus*

c. Floating leaves all with less than 21 nerves, the bases rounded to tapering.

g. Submersed leaves linear with parallel sides, 0.5-2 mm wide, with 1-3 nerves; floating leaves 0.7-4 cm long, 0.2-2 cm wide (Fig, 12,c).

h. Spikes 2-6 cm long, with 3-8 whorls of flowers, in the axils of upper leaves; fruit 2.5-3.5 mm long, with a short broad beak; stipules of the submersed leaves not joined to the edges of the leaves. 17. *P. Oakesianus*

h. Spikes small and few-flowered, common in the axils of the submersed leaves, the lower 1-6-flowered and sessile; fruit 1.3-2.2 mm long, the beak absent; stipules joined to the edges of the submersed leaves to form a sheath (Fig 11, c, f). 10. *P. Spirillus*

g. Submersed leaves with curving sides, 2-15 mm wide, with 5-11 nerves; fruiting spikes 6-8 mm thick.

i. Submersed leaves with sharp apices, and 1 or 2 rows of obscure areolae at the mid-rib; fruit 1.7-3.5 mm long, with a weak linear beak 0.3-0.5 mm long; floating leaves 1.5-5 cm long, 1-2 cm wide (Fig. 12, b). 18. *P. gramineus*

i. Submersed leaves with blunt apices, with 2-4 obscure rows of areolae; fruit reddish, 2-2.5 mm long, with the beak absent or minute; floating leaves 3-8 cm long, 1-4 cm wide. 13. *P. polygonifolius*

a. Floating leaves absent.

j. Submersed leaves elliptic to ovate, cordate or tapering to the base, more than 1 cm wide (Fig. 13, a).

k. Leaves elliptic or wider, cordate or rounded at the base, plainly clasping.

l. Leaves 10-20 cm long; stipules usually persistent and conspicuous; peduncles 15-60 cm long; fruit more than 4 mm long, with the dorsal keel strongly developed. 19. *P. praelongus*

l. Leaves 1-6 cm long; stipules delicate, disappearing; peduncles 1-9 cm long; fruit less than 3 cm long, with the keel absent or weak. 20. *P. bupleuroides*

k. Leaves linear to linear-oblong, sessile, but slightly clasping, 1-2 cm wide. 12. *P. alpinus*

j. Submersed leaves linear, less than 10 mm wide.

m. Stipules joined to the base of the leaf, making a sheath 1 cm long or longer; flowering spikes slender and interrupted; leaves 2 mm wide or less.

n. Leaves tapering to long slender points; fruit with a short beak; stem much branched (Fig 11, b). 1. *P. pectinatus*

n. Leaves blunt or rounded at the tips; fruit without a beak.

o. Sheaths tightly clasping the stem; leaves 0.5 mm wide or less; flowers in 2-5 whorls. 2. *P. filiformis*

o. Sheaths swollen, 2-5 times wider than the stem; leaves ribbon-like, 1-2 mm wide (Fig. 11, h); flowers in 5-12 whorls. 3. *P. vaginatus*

m. Stipules not joined to the base of the leaf; or, if so, with the sheath less than 5 mm long; spikes usually not interrupted.

p. Stipules joined to the leaf-base, forming a sheath longer than the free tips (Fig. 11, f); spikes of the lower submersed leaves 1-6 flowered, sessile, the upper peduncled (Fig, 11, c); fruit 1.3-2.2 mm wide, the beak absent, the form of the coiled embryo clearly visible. 10. *P. Spirillus*

p. Stipules not joined; spikes with peduncles 3-100 mm long; fruits definitely beaked, or else with the beak obscure and the fruit more than 2.5 mm long; embryo not clearly visible.

q. Leaves 0.5-4 mm wide; fruit plump, beaked.

r. Rootstock extensively creeping; leaves thread-like, 0.1-0.5 mm wide; stipules essentially nerveless; peduncle long and erect, a continuation of the main stem (Fig. 11, a). 4. *P. confervoides*

r. Rootstock short or wanting; leaves coarser; peduncles mostly in the upper forks of the stem.

s. Leaves 1.5-3.5 mm wide, 5-7 nerved; stipules strongly fibrous, becoming whitish. 6. *P. Friesii*

s. Leaves 0.3-4 mm wide, 1-3- rarely-5-nerved; stipules not strongly fibrous nor becoming whitish.

t. Plants coarse; leaves with 2-4 bands of areolae each side of the mid-rib, and usually 2 large glands at the base on the stem; inflorescence dense, thick-cylindric; fruit 3-4 mm long. 8. *P. obtusifolius*.

t. Plants delicate; leaves narrow with the areolae poorly developed, and the glands small or absent; inflorescence few flowered, globose or interrupted; fruit 1.8-2.8 mm long.

u. Spikes with 3-5 distant whorls of flowers; stipules joined to form a short sheath; peduncles 1.5-8 cm long 7. *P. pusillus*

u. Spikes subglobose, or short, thick cylindric.

w. Stipules joined to form a sheath (Fig. 11, e); leaves without areolae or with 1-3 rows near the base; peduncles 0.4-1 cm long. 5. *P. foliosus*

w. Stipules separate (Fig. 11, g); leaves with 1 or more rows of areolae; peduncles 0.5-3 cm long. 9. *P. Berchtoldi*

q. Leaves 2-8 mm wide, strongly 2-rowed; fruit essentially beakless. 11. *E. epihydrus*

1. P. pectinatus L. SAGO POND WEED. Map 42. Fig. 11, b.

Brackish ponds around the coast; common in ponds on Sable Is; forming, with *Ruppia*, the bulk of the vegetation in brackish ponds around C.B.; common in the salt lake at

Oxford; found also in alkaline sink-holes. Bennett, Jour. Bot. **39:** 199. 1901, names a form, forma **pseudomarinus** Benn. and credits it to Sable Is.

Alkaline, brackish or sometimes fresh water; Nfld. to B.C. southward; widely distributed throughout the world.

2. **P. filiformis** Pers., var. **borealis.** (Raf.) St. John, l. c. page 134.

Reported by Fernald (1921) from a fresh to brackish swale at the head of Baddeck Bay. Scattered in cool spring streams in eastern P.E.I.

Calcareous water: Nfld. to Alaska south to Penn. & Colo.; Asia.

3. **P. vaginatus** Turcz.

Rare; cold shallow brook at the head of Baddeck Bay

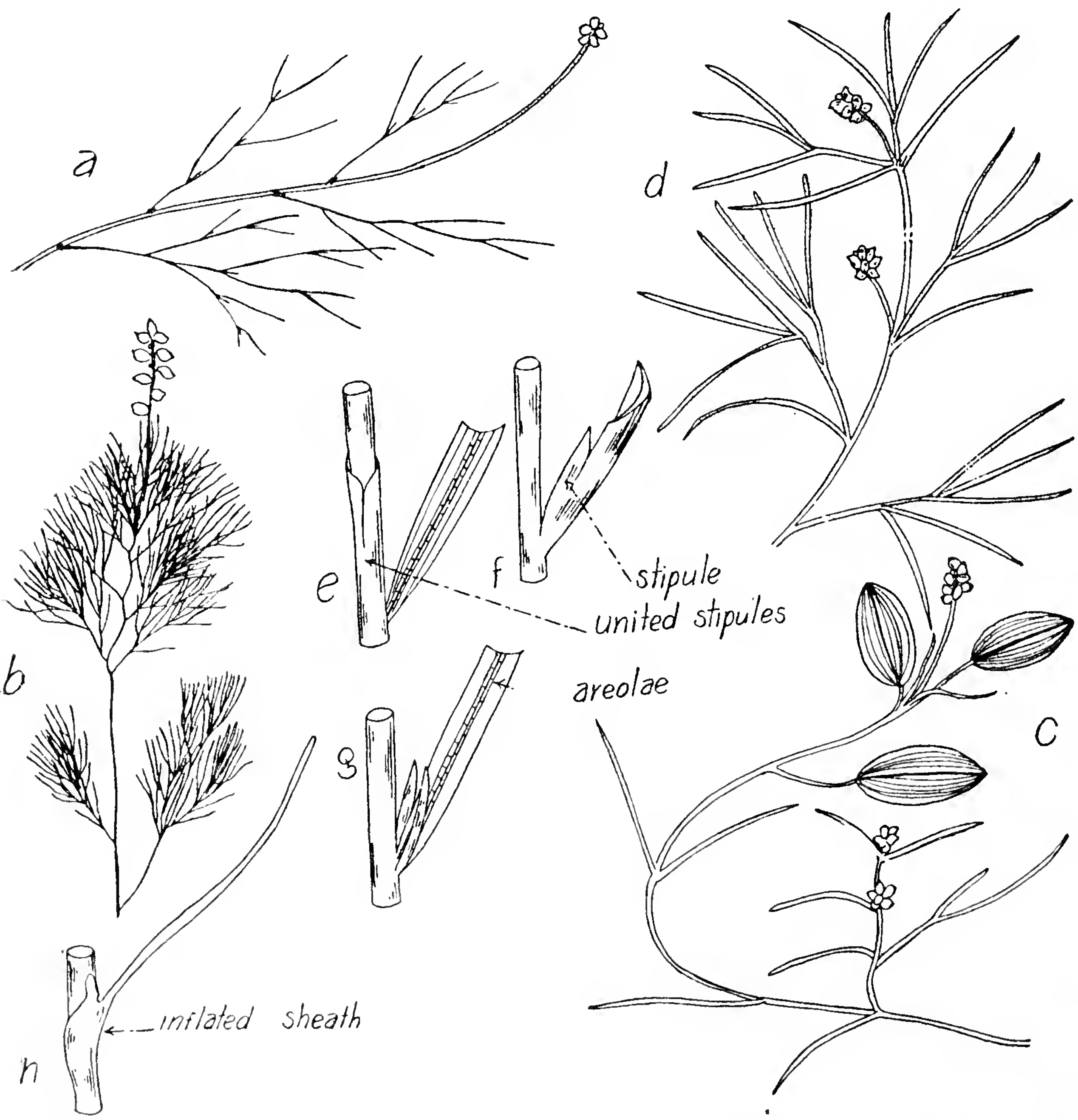


Figure 11.—**Potamogeton.** a, **P. confervoides,** x ½. b, **P. pectinatus,** x ½. c, **P. Spirillus,** x ½. d, **P. foliosus,** x ½. e, f, g, h, leaf-sheaths of **P. foliosus, P. Spirillus, P. Berchtoldi,** and **P. vaginatus.**

(Fernald, 1921), poorly fruiting in the northeast. Re-described as *P. moniliformis* by St. John, l. c.

Local in hard or brackish waters; Lab. to Alta. south to N.Y., Wisc. and N.D.

4. **P. confervoides** Reichenb. Map 43. Fig. 11, a.

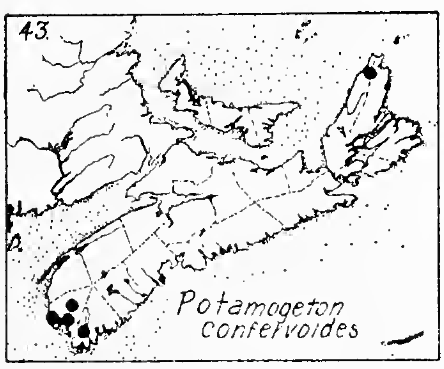
Lakes, small ponds and bog pools; frequent in Yarmouth Co.; occasional in Shelburne Co; found on the mountains east of Pleasant Bay, C.B.

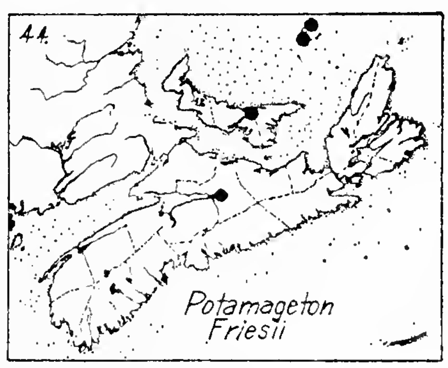
Acid or siliceous regions; Nfld to N.Y., southern N.J. and Penn.

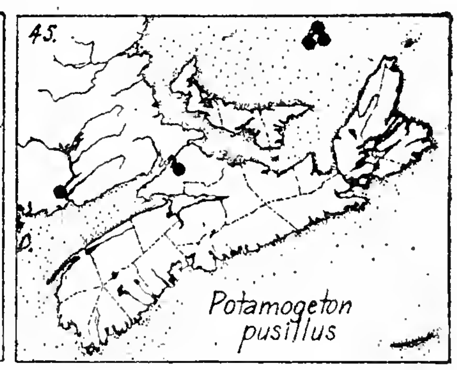
5. **P. foliosus** Raf., var. **macellus** Fern., l.c. page 46.

Fresh to brackish water; Sydney Mines, Truro and Sandy Cove.

N.S. & Gaspe to the Yukon south to Fla. & Calif.







6. **P. Friesii** Rupr. Map 44.

Quiet waters of the Salmon River., Truro; the record from south of Amherst apparently belongs elsewhere. Chiefly in calcareous or brackish water.

Lab. & Nfld. to the MacKenzie south very locally to N.S., Mass., N.J., Wisc. & B.C.; Eurasia.

7. **P. pusillus** L. See Jour. Bot. **76:** 89-92. 1938. Map 45.

Spring pools and ditches south of Amherst (Fernald, l.c. page 62). Basic or brackish water. (*P. panormitanus* var. *major* G. Fischer. *P. strictifolius* Benn.).

N.S. to B C. south to Va., Mex. & Calif.; Eurasia, etc.

8. **P. obtusifolius** Mert. & Koch.

Collected by Macoun at Mira Bay, C.B.

Cold water of ponds and lakes, Lab. to Minn. south to C.B., & N.J., Mich. & Vancouver Is.; Eurasia.

9. **P. Berchtoldi** Fieber, see Rhodora **42:** 246. 1940.

a. Leaf-tips subacute to sharply pointed, only exceptionally obtuse.

b. Primary leaves of principal stems 0.5-1.5 mm wide, with well-defined lacunae often in 2 rows each side of the lower half of the midrib. var. *typicus*

b. Primary leaves 0.3-1 mm wide, with a single row of frequently evanescent lacunae each side of the midrib. var. *tenuissimus*

a. Leaf-tips rounded or obtuse. var. *mucronatus*

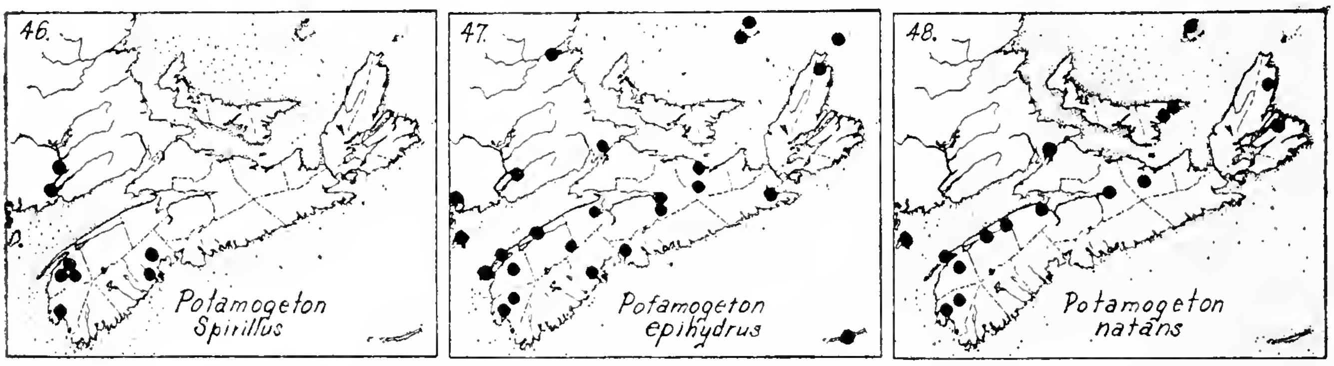
Var. **typicus** was collected by Howe and Lang in a brook pool, Grand Pre; and by Long and Linder at Hectanooga Lake, Digby Co. (*P. pusillus* of earlier authors).

N.S. to Minn. south to La.; Alaska to Calif.; Eurasia.

Var. **tenuissimus** (Mert. & Koch) Fern. is found in fresh or brackish pools on Sable Is. and in southwestern N.S. Reports of *P. Sturrockii* Benn. and *P. Aschersonii* from Sable Is. are based on plants of this and the following variety. Distribution and range as in the typical plant.

Var. **mucronatus** Fieber is scattered in brackish, alkaline or fresh water; Digby Co; Sable Is.; and C.B.

Greenland to Dela. west around the Great Lakes to B. C. and north to Alaska.



10. **P. Spirillus** Tuckerm. Map 46. Fig. 11, c.

Shallow pools, lake margins and quiet streams; known from Digby, Yarmouth and Lunenburg Cos. (*P. dimorphus* Raf.).

Nfld. & N.S. to S.D. south to Iowa & Penn.

11. **P. epihydrus** Raf., var. **Nuttallii** (Cham. & Schlecht.) Fern., l.c. page 115. Map 47.

Shallow water of pools, streams and ponds; throughout. (*P. epihydrus* in Gray Man.).

Nfld. to Man. south to Ga; Alaska to Calif.

12. **P. alpinus** Balbis

a. Submersed leaves 7-25 cm long, usually more than 8 times as long as broad, tapering to an obtuse or acutish apex. var. *tenuifolius*

a. Submersed leaves 4-10 cm long, usually less than 8 times as long as broad; apex rounded and sometimes slightly cucullate. var. *subellipticus*

Var. **tenuifolius** (Raf.) Ogden, l.c. page 90, has been found at Truro and Mahone Bay. (*P. microstachys* Wolfg.).

Streams and cold ponds, Greenland to Alaska south to Penn., Colo. and Calif.

Var. **subellipticus** (Fern.) Ogden, l.c. page 94, collected by Fernald and Long from a cold shallow brook Baddeck Bay.

Nfld. south to Vt. and east N.Y., west to Wisc., etc.

13. **P. polygonifolius** Pourret

Abundant in fresh-water ponds on Sable Island, even in ponds that dry up for part of the summer.

Nfld., St. Pierre and Sable Is.; Europe & Africa.

14. **P. amplifolius** Tuckerm. Fig. 12, a.

Lakes and streams, usually in deep water; scattered

Figure 12.—**Potamogeton.** a, **P. amplifolius,** x ½. b, **P. gramineus.** c, **P. Oakesianus.** d, **P. natans.** e, **P. pulcher.** , submersed leaves showing veining.

lakes from Yarmouth Co. through Digby and Annapolis Cos. to Kings Co., where it is found in the streams around Minas Basin.

Nfld. south to Tenn.; west to Mo. & Kans.; Wash. to Calif.

15. **P. pulcher** Tuckerm. Fig. 12, e.

Muddy cove in Lily Lake, Sandy Cove, Digby Co.; quagmire margin of Sears Lake, New Tusket, Digby Co.; brook beds in peaty swale, Rhodenizer Lake east of Bridgewater.

Chiefly on the coastal plain and Mississippi embayment; N.S.; Mass. to Ga. and scattered west to Mo. & Minn.

16. **P. natans** L. Map 48. Fig. 12, d.

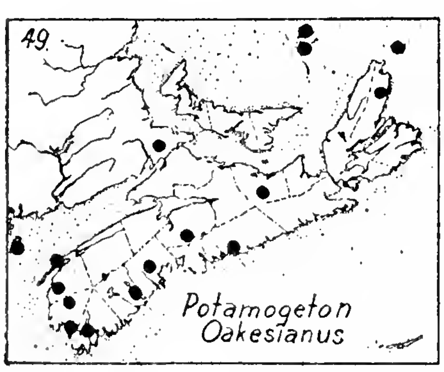
Throughout; common from Digby Neck to C.B.; probably scattered elsewhere. It is often the only species on the larger rivers, where it fruits abundantly.

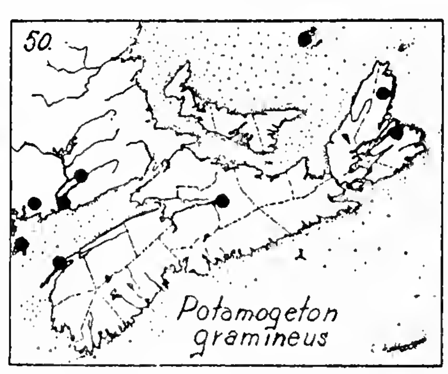
Lakes and streams, Nfld. to Alaska south to Penn. & Calif.

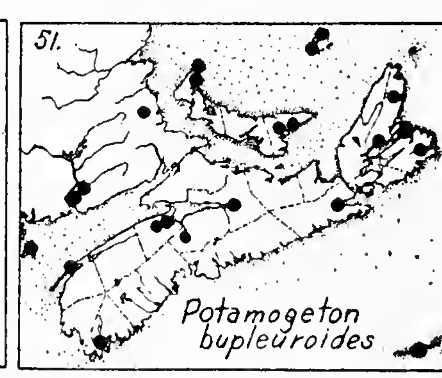
17. **P. Oakesianus** Robbins . Map 49. Fig. 12, c.

Frequent in shallow peat- or sand-bottomed lakes and pools of Yarmouth and Digby Cos.; scattered eastward.

Nfld. to N.J. west to Central N.Y.; local in Ont., Mich. Wisc. and westward.







18. **P. gramineus.** L. Map 50. Fig. 12, b.

a. Principal submersed leaves 1.5-4.5 cm long, 0.2-0.6 cm wide, with 5-7 nerves. var. *typicus*

a. Principal submersed leaves 6-9 cm long, 0.6-1 cm wide, with 7-9 nerves. var. *maximus*

This species is scattered, and but little collected. (Including var. *graminifolius* Fries. *P. heterophyllus* Schreb.).

Var. **maximus** Morong has been collected in the Salmon R. at Truro.

Hybrids between this species and *P. perfoliatus* var.

bupleuroides are rather common in the Maritimes. Plants reported as *P. gramineus* var. *spathulaeformis* Robbins from Centreville, Digby Co. (Rhodora **23**: 190. 1921) are placed here by Ogden; also that of Fassett from Shinimicas R., Northport, and of Nichols from Dingwall.

Greenland to Alaska south to N.J., Ariz. & Calif.

19. **P. praelongus** Wulf.

The only collection known is that of McKay from the Earltown Lakes, 1883.

Deep cold water, Lab. and Nfld. south to N.J. and west.

20. **P. bupleuroides.** Fern. Map 51. Fig. 13, a.

Frequent in brackish water around the province; reported from fresh water only from Midway Lake, Digby Neck (Fernald, 1921); but often growing above tide level near the mouth of streams. Common in brackish ponds on Sable Is.

Nfld. to Fla. west to Ont., Ohio & La.

2. RUPPIA L.

Fernald, M.L. & K. M. Wiegand. The genus *Ruppia* in eastern North America. Rhodora **16**: 119-127. 1914.

1. **R. maritima** L. DITCH-GRASS. WIDGEON-GRASS. Fig. 13, c.

a. Carpels ovoid, slightly oblique but not strongly eccentric nor curved, bluntish or not tapering to a conspicuous beak; pedicels 6-25 mm long. var. *obliqua*
a. Carpels strongly eccentric and distinctly beaked, or very strongly curved.
  b. Mature pedicels (podogynes) 1-3 cm long.
    c. Peduncles at maturity 3-30 cm long, spiraling or flexuous. var. *longipes*
    c. Peduncles at maturity 0.5-3 cm long, not spiraling. var. *rostrata*
  b. Mature pedicels 2-6 mm long. var. *subcapitata*

Common around the province in flat pools on the tidal marshes, brackish ponds or stagnant salt water. Var. **obliqua** (Schur) Aschers. & Graebn. has been found on the Magdalens and on P.E.I., but not yet in N.S. Var. **longipes** Hagstrom is common. Var **rostata** Agardh is found at Truro and Guysborough and undoubtedly elsewhere. Var. **subcapitata** Fern. & Wieg. is known from P.E.I., and was reported from Point Pleasant, Halifax Co. (Rousseau, 1935).

The species in its various forms is worldwide.

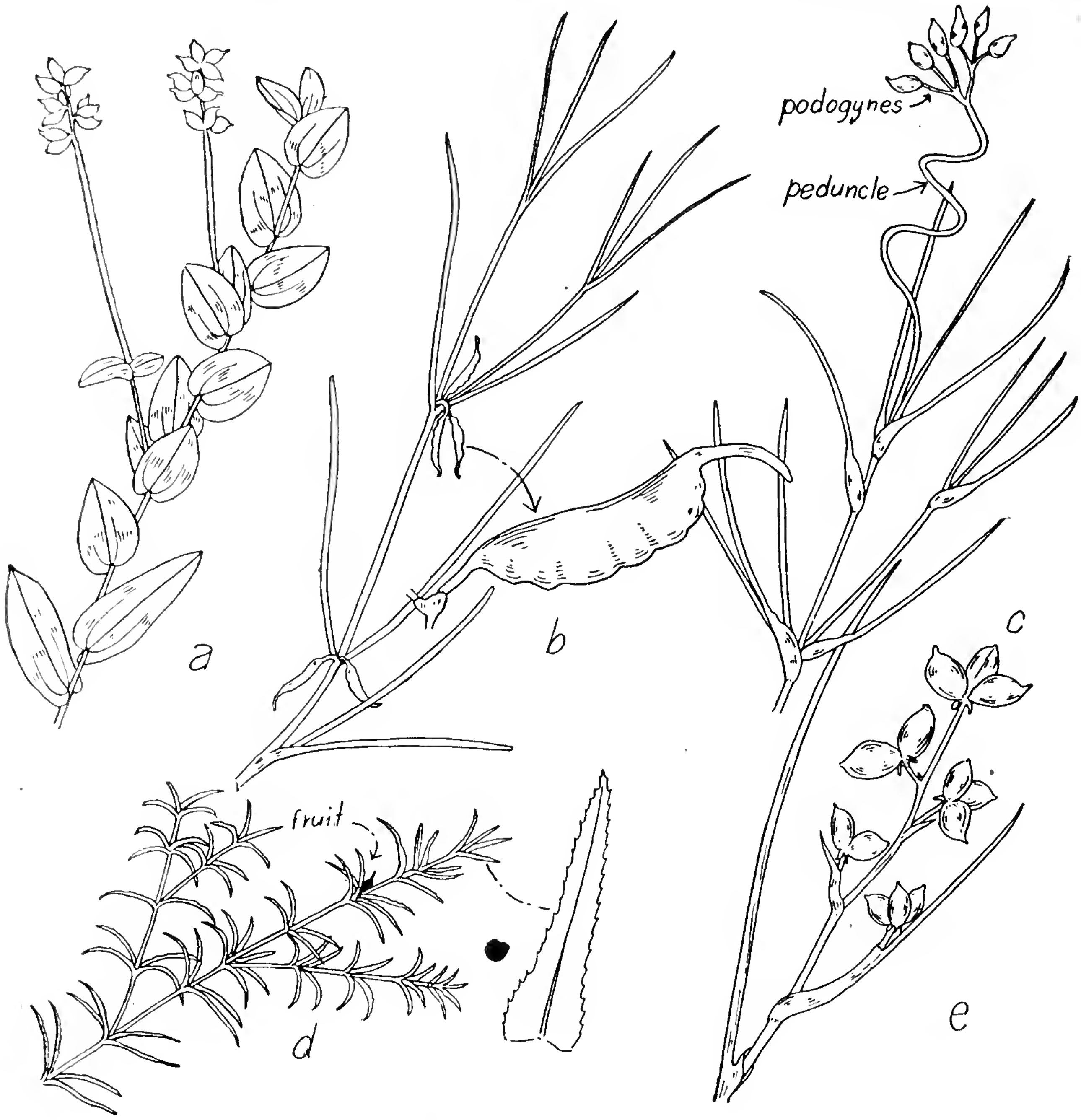


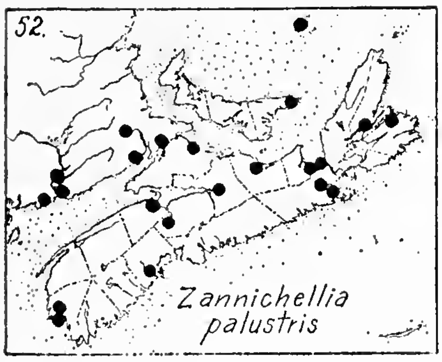
Figure 13.—**Potamogeton.** a, **P. bupleuroides**, x ½. **Zannichellia.** b, part of plant, x 1. **Ruppia.** c, fruiting part of plant, x 1. **Najas.** d, branches, x ½. **Scheuchzeria.** e, upper part of plant showing fruits, x 1.

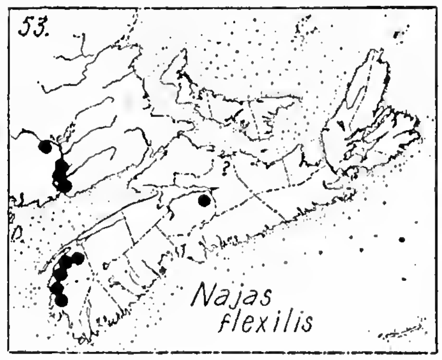
3. **ZOSTERA** L.

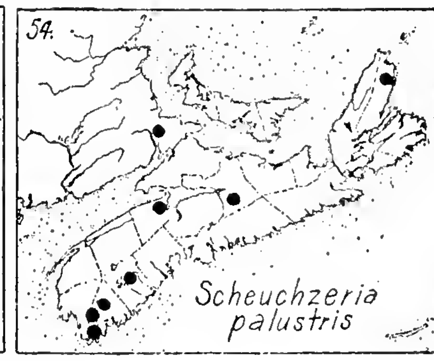
1. **Z. marina** L. EEL-GRASS

Common around the coast in salt water and washed up on the beaches; abundant in salt lakes and ponds in C.B.; abundant in Wallace Lake on Sable Is. Var. **stenophylla** Aschers, & Graebn. is a very slender extreme reported as abundant in the gravel about Kidstone Is., Great Bras d'Or Lake (Fernald, 1921).

Lab. & Nfld. along the coast to N.C.; James Bay; Alaska to Ore.; Eurasia.







4. ZANNICHELLIA (Mich.) L.

1. **Z. palustris** L. var. **major** (Boenn.) Koch, See Rhodora **23:** 110. 1921. Map 52. HORNED PONDWEED Fig. 13, b.

Frequent in brackish or in saline waters or on saline mud; often found in streams at or just above the head of the tide; around the coast.

Nfld. and the Gulf of St. Lawrence to Fla.; James Bay.

5. NAJAS L.

1. **N. flexilis** (Willd.) Rostk. & Schmidt. BUSHY PONDWEED Map 53. Fig. 13, d.

Distribution poorly known; Fernald (1921) states that it was not seen in Yarmouth, Shelburne or Queens Cos. It is present through Digby Co.; at Five-Mile R. in Hants; and was reported by Macoun as collected by McKay in the Earltown Lakes.

Common and widespread across the continent.

14. JUNCAGINACEAE ARROW-GRASS FAMILY

a. Flowers 3-8, in a loose short raceme; ovaries 3, nearly separate; rootstock creeping. 1. *Scheuchzeria*

a. Flowers numerous in a long linear raceme; ovaries united until maturity; rootstock but little developed. 2. *Triglochin*

1. SCHEUCHZERIA L.

1. **S. palustris** L., var **americana** Fern., Rhodora **25:** 178. 1923. Map 54. Fig. 13, e.

Quagmires of Shelburne Co. (Fernald, 1922); sphagnum mat around Lily Lake, Centreville, King's Co.; reported by Nichols as associated with the sphagnum mat of undrained swamps in the highlands of C.B. June.

Nfld. to Alaska south to N. Eng., Penn., Wisc. & Calif.

2. TRIGLOCHIN L. ARROW-GRASS

a Fruit oblong, with a rounded base, separating into 6 sections; scape stout, 2-4 mm in diameter. 1. *T. maritima*

a. Fruit linear or club-shaped, with a tapering base, separating into 3 sections; scape slender, 1 mm in diameter. 2. *T. palustris*

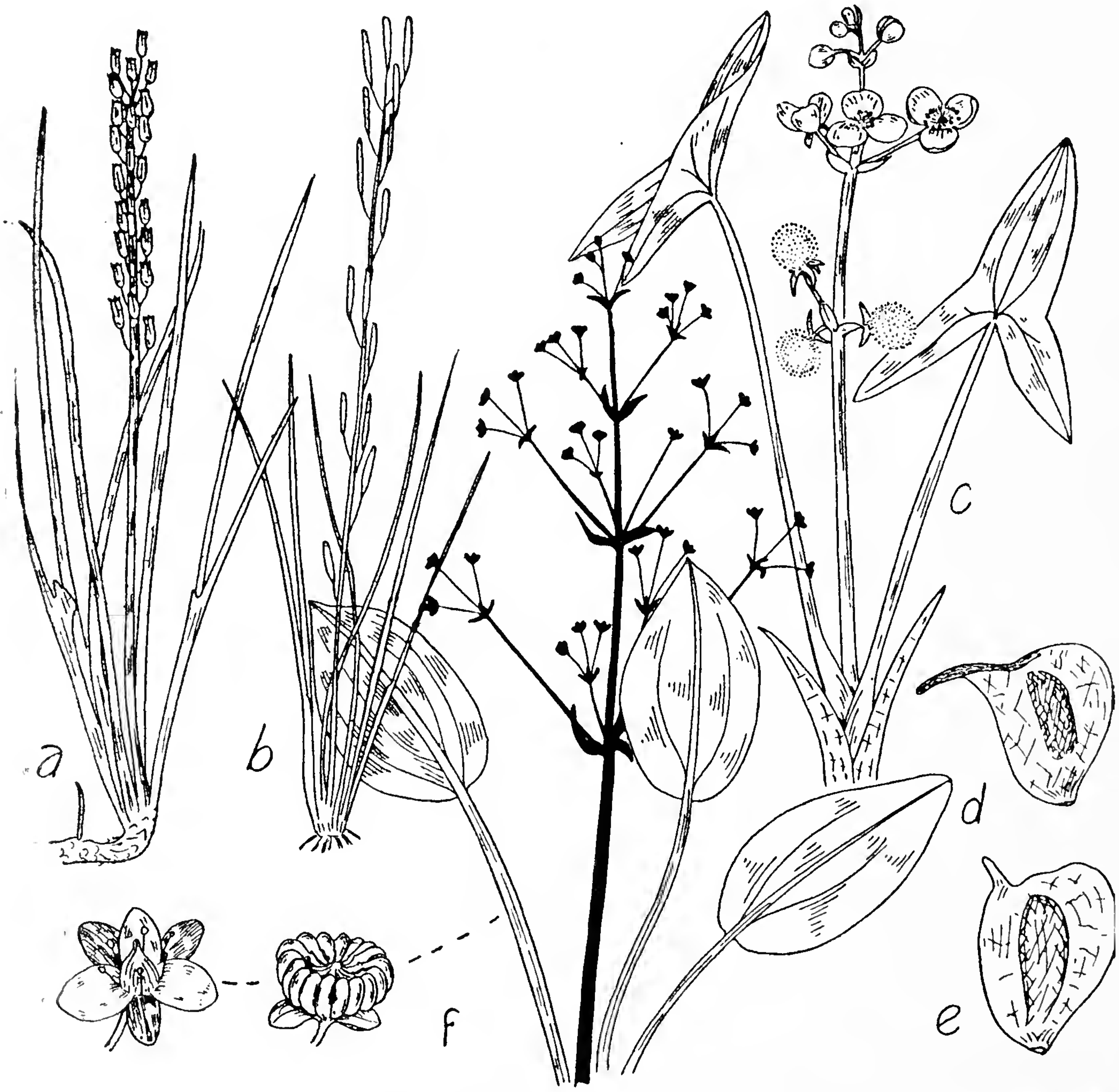


Fig. 14.—**Triglochin maritima.** a, plant, x $\frac{1}{4}$. **T. palustris.** b, plant, x 1/3. **Sagittaria cuneata.** c, plant, x $\frac{1}{4}$; e, achene, x 8. **S. latifolia.** d, achene, x 8. **Alisma.** f, plant, x $\frac{1}{4}$; flower and fruit.

1. **T. maritima** L ARROW-GRASS. Map 56. Fig. 14, a.

Scattered to common in salt marshes, especially on the older mown areas; rarely found in highly acid peat around lakes or pools. June-July.

Lab. to Alaska south to N.J. & Mex.

2. **T. palustris** L. Map 57. MARSH ARROW-GRASS. Fig. 14, b.

Characteristic of the inner brackish marshes or on brackish sand flats, in swampy marshes, open springy or damp areas along streams or more rarely acid peat; scattered throughout but rather rare and little noticed. July-Aug.

Greenland to Southern Me; inland to the Great Lakes; on the West Coast; Eurasia.

15. ALISMACEAE
WATER PLANTAIN FAMILY

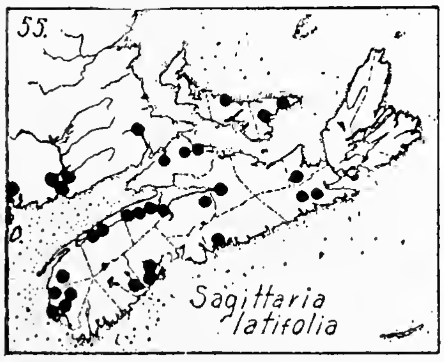
a. Leaves sagittate or lanceolate; lowest flowers with stamens only or carpels only; stamens many; achenes forming a dense spherical head. 1. *Sagittaria*

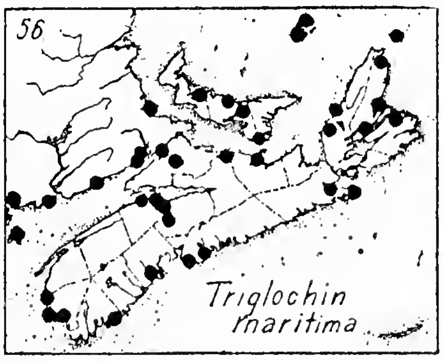
a. Leaves usually ovate or oblong, never sagittate; lower flowers all perfect; stamens usually 6; achenes in a thick dense ring (Fig 14, f). 2. *Alisma*

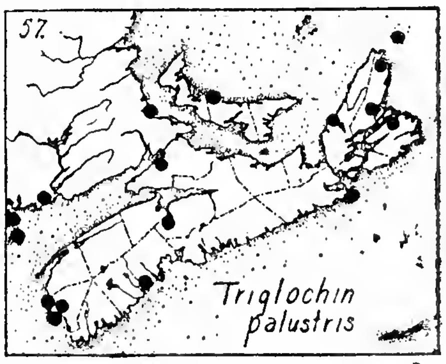
1. SAGITTARIA L. ARROWHEAD

a. Blades sagittate; bracts at the base of each whorl of flowers separate. (Submersed forms may have the blades of the leaves lacking).
  b. Beak of the achene 0.5-2 mm long, arising from the inner margin of the top and pointing inward, making the fruiting head smoothish (Fig, 14, d); leaves usually 10-30 cm long.
    c. Tip of the leaf sharp; leaves narrow; pedicels of the fruiting heads less than twice as long as the heads. 1. *S. latifolia*
    c. Tip of the leaf blunt or rounded; leaves broad; pedicels more than twice as long as the heads. *S. latifolia* var. *obtusa*
  b. Beak of the achene short, less than 0.5 mm long, erect so that the fruiting heads are roughened (Fig, 14, e); leaves mostly 4-15 cm long. 2. *S. cuneata*

a. Blades all elliptical to lanceolate, without basal lobes; bracts united, the uppermost for over half their length; plants rather small. 3. *S. graminea*







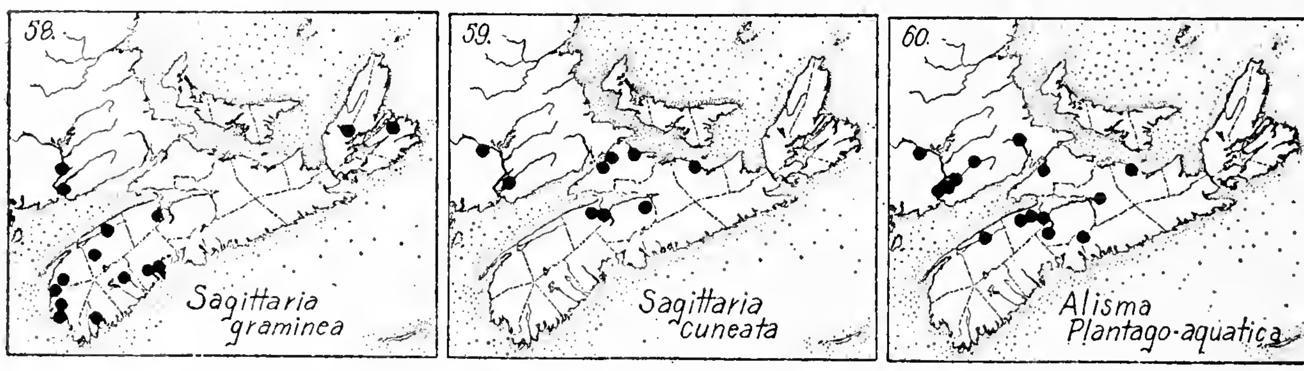
1. **S. latifolia** Willd. COMMON ARROWHEAD. Map. 55. Fig. 14, c, d.

Common throughout, found around the margins of lakes, in mucky streams bottoms and around ponds. The leaf-blade is very variable in outline. The narrow extreme, forma **gracilis** (Pursh) Robinson, with the leaves and their lobes less than 1 cm wide is often seen in running water.

N.S. to B.C. south to Fla. & Calif.

Var. **obtusa** (Muhl.) Robinson is not as common as the species, but is occasionally seen growing with it.

General distribution unknown.



2. **S. cuneata** Sheldon. Map 59. Fig. 14, c, e.

Occasional and probably general in the center of the province; common in shallow water and rooting in mud at Grand Pre; common around the sink-holes in the gypsum area south of Amherst; and in the richer alluvial soils near Pictou. (*S. arifolia* Nutt.).

N.S., Que. to B.C. south to Conn., Kans. & Calif.

3. **S. graminea** Michx. Map 58.

Sandy or silty margins of ponds or on fresh tidal mud at various places from Yarmouth Co. to C.B.; apparently local and rare in the northern and central parts of the peninsula.

Nfld. to Sask. south to Fla. & Tex.

ALISMA L.

1. **A. triviale** Pursh, see Fernald, Rhodora **48:** 86-88. 1946. WATER PLANTAIN. Map 60. Fig. 14, f.

Scattered, and often rather common, from Annapolis County to Pictou and northwards into N.B.; wet mud of ditches, edges of quiet pools or muddy edges of slow streams. (*A Plantago-aquatica* L., var. *brevipes*, and var. *parviflora* of some authors).

N.S. to B.C. south to Md., Mich. & Calif.

16. HYDROCHARITACEAE

1. VALLISNERIA (Michx.) L.

1. **V. americana** Michx., see Fernald, Rhodora **20:** 108-110. 1918. WILD CELERY.

This plant has not been recently collected. Older records are: near Prince's Lodge, Halifax (Lindsay;); in a small lake, N. Sydney (Macoun); and Friar's Head, C.B. (Robinson, 1906). It is desirable to establish new locations. (*V. spiralis* L.).

N.S., Me. to S.D. south to Fla. &. Tex.

17. GRAMINEAE GRASS FAMILY

The grasses are not treated in this flora ,since they were taken up in detail by Dore, W.G., and A. E. Roland, Proc. N.S. Inst. Sci. 20: 177-288, 1942.

18. CYPERACEAE SEDGE FAMILY

a. Stamens and pistils in the same flower; achenes in the axils of bracts of the inflorescence, not enclosed in sac-like perigynia.

b. Spikelets with 6-many fertile flowers; or, if fewer-flowered, terminal without leafy bracts.

c. Scales of the spikelet strictly 2-ranked, folded and keeled.

d. Inflorescence terminal; flowers without bristles; achenes beakless; stem solid, more or less 3-angled. 1. *Cyperus*

d. Inflorescence lateral; flowers with 6-9 bristles; achenes long-beaked; stem hollow, round (Fig, 15, b). 2. *Dulichium*

c. Scales of the spikelet spirally arranged and imbricated.

e. Spikelet solitary and terminal; leaves reduced to sheaths; base of the style persistent as a tubercle at the top of the achene; bristles present, little longer than the achene (Fig. 15, d, etc.). 3. *Eleocharis*

e. Spikelets one to usually many; leaves present, or occasionally absent in *Scirpus*; base of the style not peristent, or if so not sharply delimited from the achene.

f. Bristles 0-8, usually short, if exserted the spikelets solitary, or else small and very numerous (Fig. 17). 4. *Scirpus*

f. Bristles 6, 4-6-cleft to near the base and appearing very numerous, long and exerted (Fig. 18). 5. *Eriophorum*

b. Spikelets with 1-2 fertile flowers and several empty lower scales; inflorescence subtended by one to several leafy bracts.

g. Style 2-cleft, the enlarged base forming a persistent tubercle on the achene; bristles present (Fig. 19, a-c). 6. *Rynchospora*

g. Style 3-cleft, the base not enlarging to form a tubercle; bristles absent (Fig. 19, d). 7. *Cladium*

a. Stamens and pistils in separate flowers, often in separate spikes; achenes enclosed in a sac-like papery covering called a perigynium, with the style projecting from the apex (Fig. 20-30.). 8. *Carex*

1. **CYPERUS** (Tourn.)L. GALINGALE

a. Spikelets flattened, often replaced by bulblets, the scales spreading and overlapping most of the next scale above on the same side. 1. *S. dentatus*

a. Spikelets terete, not replaced by bulblets, the scales pointng forward and overlapping less than half of the next scale above. 2. *S. esculentus*

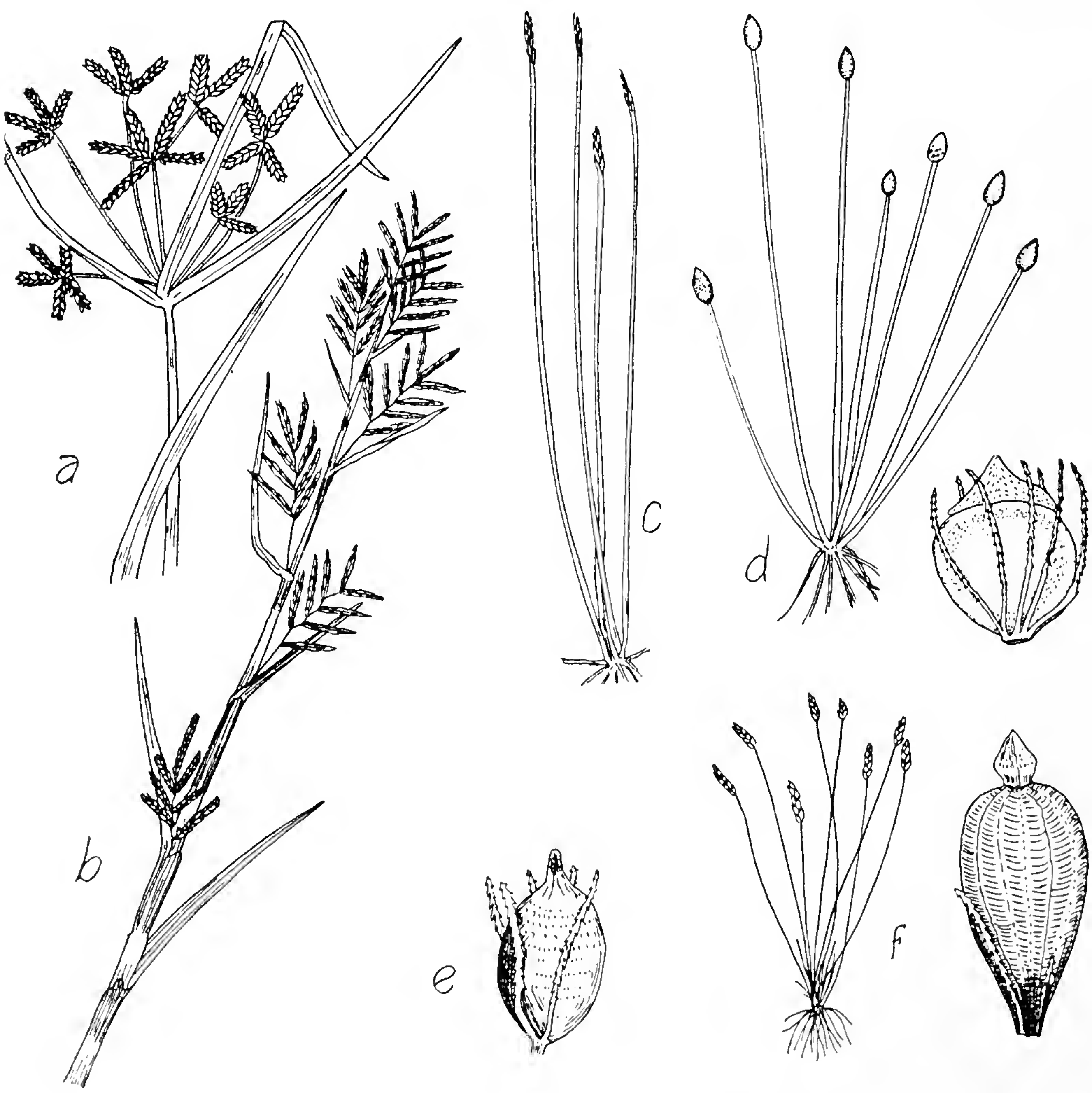


Fig. 15.—**Cyperus dentatus.** a, top of plant, x $\frac{1}{2}$. **Dulichium arundinaceum.** b, top half of plant, x $\frac{1}{2}$. **Eleocharis Robbinsii.** c, plant, x $\frac{1}{4}$. **E. obtusa.** d, plant, x $\frac{1}{4}$; achene, x 12. **E. rostellata.** e, achene, x 8. **E. acicularis.** f, plant, x $\frac{1}{4}$; achene, x 25.

1. **C. dentatus** Torr. Map 61. Fig. 15, a.

Characteristic of many sandy and gravelly lake-shores and beaches; common in Yarmouth Co., scattered east at least to Lunenburg Co. (Fernald, 1922).

N.S. & Me. to Ind. south to W. Va. & S.C.

2. **C. esculentus** L.

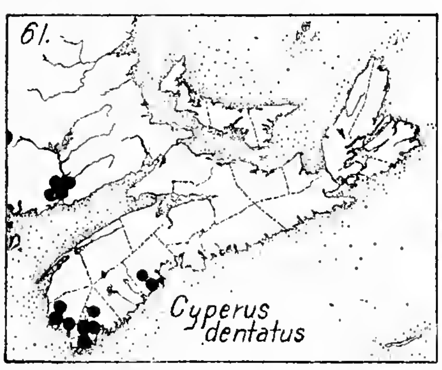
Found but once; rich orchard soil at Starr's Point, Kings Co., where it is scattered; introduced.

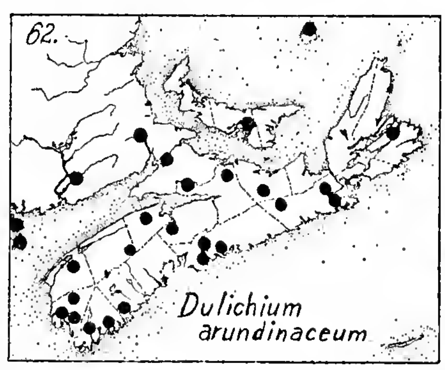
N.S. to Minn. south to Fla. & Tex.; Alaska to Calif.

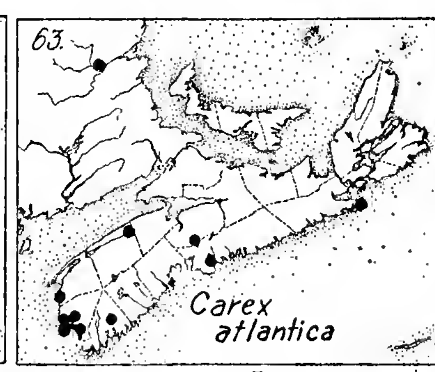
2. DULICHIUM Pers.

1. **D. arundinaceum** (L.) Britt. Map 62. Fig. 15, b.

Muddy shores, around lakes and ponds, and occasionally in poorly-drained swamps; throughout, especially abundant







in the Atlantic Region of the province; common in the dense vegetation along the bog meadows above the influence of the tide on the Fundy marshes.

Nfld. to Wash. south to Fla. & Tex.

3. ELEOCHARIS R. Br. SPIKE RUSH

Fernald, M.L. & A.E. Brackett. The representatives of Eleocharis palustris in North America. Rhodora **31:** 56-77. 1929. Svenson, H. K. Monographic studies in the genus *Eleocharis*—V. Rhodora **41:** 1-19, 43-77, 90-110. 1939.

a. Spikelets hardly, if at all, thicker than the spongy stems; scales firmly persistent; stem 1-2 mm thick, bluntly 3-angled (Fig. 15, c). 1. *E. Robbinsii*

a. Spikelets usually much thicker than the stem; scales easily removed when the achenes are mature.

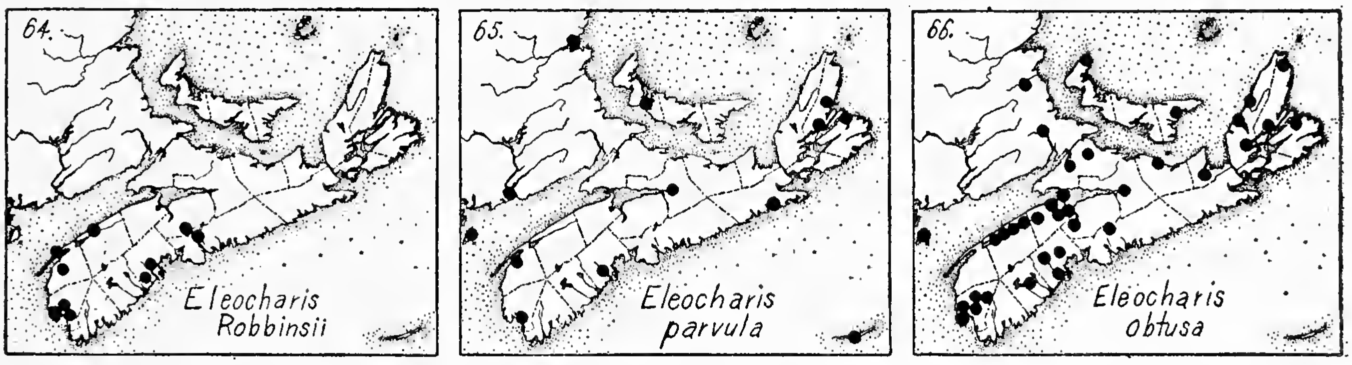
b. Tubercle not plainly distinct from the body of the achene, appearing merely like an acute point at the apex (Fig. 15, e, ; 16, b).

c. Spikelets 3-9- (rarely -15) flowered; plants mostly less than 5 cm high.
d. Scales dark-brown, often with a green mid-rib; stems solitary or a few together; on marl bogs or calcareous areas. 2. *E. pauciflora*
d. Scales light-brown or greenish; plants forming a mat over the ground; near the coast, usually on salt marshes. 3. *E. parvula*
c. Spikelets 12-20-flowered; stems 25-150 cm high, often reclining and rooting at the tip; salt marshes, southwest N.S. only. 4. *E. rostellata*
b. Tubercle plainly distinct, in appearance at least, from the body of the achene (Fig. 16, b).
e. Spikelets mostly 5-8- flowered; plants 2-20 cm high, forming a turf (Fig. 15, f). 5. *E. acicularis*
e. Spikelets many-flowered; plants mostly taller and stouter.
f. Tubercle much smaller than the body of the achene.
g. Plants growing from fibrous roots.
h. Stems 3-50 cm high; sheaths firm and not whitish at the tip; spikelets round- to cylindrical-ovoid, blunt at the apex; common (Fig. 15, d). 6. *E. obtusa*
h. Stems 2-15 cm high; sheaths whitish and inflated towards the apex; spikelets oblong-ovoid and acute at the apex. 7. *E. olivacea*
g. Plants with rootstocks.
i. Achene flattened with 2 angles; style 2-cleft.
j. Rootstock thread-like; spikelets lanceolate to slenderly ovoid loosely 5-30-flowered with a single sterile scale at the base; salt marshes. 11. *E. halophila*
j. Rootstock generally 2 mm or more thick; plants not or very rarely found in brackish places.
k. Sterile scales at base of the spikelet 2 or 3.
l. Tubercle higher than broad; stem softish; scales of the spikelet acute but not long-pointed (Fig. 16, a, b). 8. *E. palustris*
l. Tubercle as broad or broader than high; stems wiry; lower scales of the spikelets usually very long-pointed. 10. *E. Smallii*
k. Sterile scale of the spikelet 1, encircling the base of the spikelet; plant rare. 9. *E. calva*
i. Achene 3-cornered; style 3-cleft; stem often capillary.
m. Tip of the upper sheath dark-girdled; stems usually stout; achenes 0.9-1.5 mm long.
n. Achenes waxy-yellow; pits in the surface usually shallow; stems relatively stout, 6-8-angled. 12. *E. elliptica*
n. Achenes yellowish-olive; pits on the surface usually deep; stem capillary, rarely over 30 cm high, 4-5-angled. 13. *E. tenuis*
m. Tip of the upper sheath whitened; stem capillary, less than

8 cm high; achenes 0.7-1.0 mm long. 14. *E. nitida*

f. Tubercle nearly or quite as large as the body of the achene (Fig. 16, b). 15. *E. tuberculosa*

1. **E. Robbinsii** Oakes. Map 64. Fig. 15, c.



Lake margins and bog-pools; scattered in southwestern N.S., and collected by Howe and Lang at Windsor Junction, Halifax Co.

A plant of the coastal plain fromFla. northward to N. S. and entering into southwestern N.B.

2. **E. pauciflora** (Lightf.) Link., var **Fernaldii** Svenson Rhodora **36:** 30. 1934.

Rare in N.S.; known only from Baddeck Bay where it grows in the springy border of a salt marsh. In the northeastern part of its range the plant is said to occur almost entirely on marl bogs or wet calcareous ledges. (*Scirpus pauciflorus* Lightf. in part).

Nfld. to James Bay & Calif. south to N. Eng., & Ind.

3. **E. parvula** (R. &. S.) Link, see Svenson, Rhodora **31:** 168-171. 1929. Map 65.

Salt marshes or about salt springs; scattered round the coast. It usually forms mats with the thread-like stems 2-7 cm high. (*Scirpus nanus* Spreng.).

Nfld. to Cuba, rarely inland to Wisc.

4. **E. rostellata** Torr.

Saline or brackish marshes and swales of Yarmouth Co; Sand Beach, Chebogue, Tusket, and Argyle (Fernald, 1921); and scattered up the Bay of Fundy.

A coastal plain species occurring from N.S. and southern Me. to Fla; also in Bermuda, the Carribean, and on the West Coast.

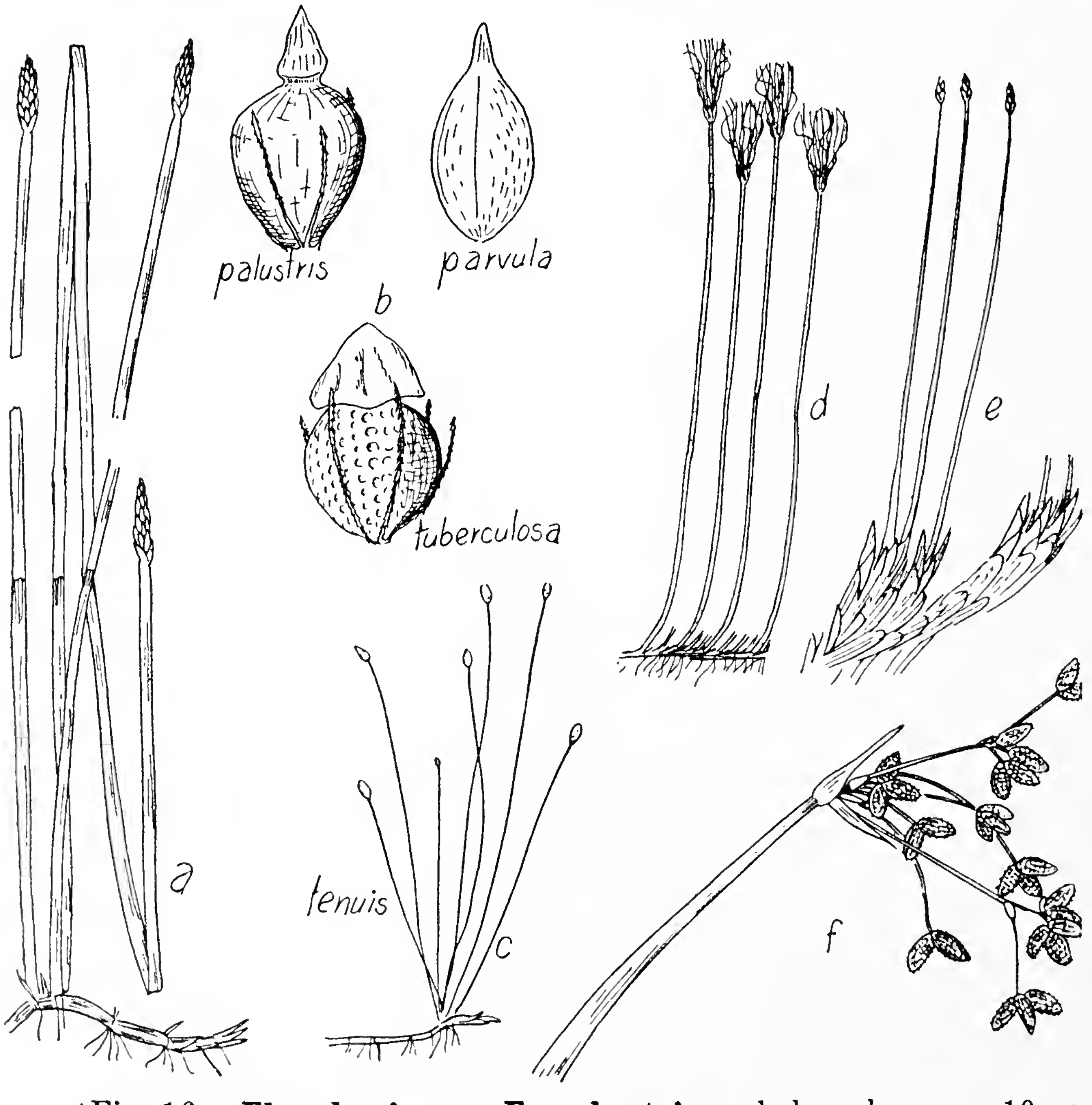
5. **E. acicularis** R. & S. Fig. 15, f.

Common on wet shores and in shallow water throughout the Maritime Provinces, becoming abundant and growing in large patches where shallow ponds become dried up. A form with bristles absent is found on Cape Cod and the adjacent territory, and has been collected at Great Pubnico Lake in Yarmouth Co. (Svenson, Rhodora **31:** 190. 1929).

Nfld. and Lab. west to B.C., south to Penn.; Asia.

6. **E. obtusa** (Willd.) Schultes. Map 66. Fig. 15, d.

Muddy or wet places, edges of ponds, slow streams and ditches; common from Annapolis Co. eastward, rare in the southwestern Cos. Var. *jejuna* Fern., Proc. Amer. Acad. Sci. **34:** 492. 1899, seems to be an ecological phase which occurs when the plant is growing in muddy inundated places. The stems are generally decumbent, 1 dm or less high, with smaller and fewer-flowered heads. This intergrades with the typical form. A collection from Springhaven, Yarmouth Co. has been placed here (Svenson, Rhodora **31:** 215. 1929).



tFig. 16.—**Eleocharis.** a, **E. palustris,** x ¼. b, achenes, x 10. c, **E. enuis,** x ¼. **Scirpus.** d, **S, hudsonianus,** x ¼. e, **S, caespitosus,** x ¼. f, **S. validus,** top of plant, x 1/3.

N.S. to Wisc. and B.C. south to Mex.; West Coast & Hawaii.

7. **E. olivacea** Torr.

Rare in the province; edge of peaty quagmire pools, or sphagnous pond-holes. The most northeastern stations known are in southwestern N.B., and in southwestern N.S. at Italy Cross, Tiddville, and Argyle Head.

Chiefly on the coastal plain; N.S. & N.B. to Fla.; and sparingly west to Ont. & Minn.

8. **E. palustris** (L.) R. & S., var. **major** Sonder, Fl. Hamb. 22. 1851. Map 67. Fig. 16, a, b.

Common throughout; shallow to comparatively deep water, or in sandy to gravelly and muddy pond-margins and marshy shores, varying greatly in size. Nichols lists it as typical of the edges of periodic ponds, or brackish marshes, and the shoreward reaches of salt marshes in C.B. It is luxuriant around sink-holes in gypsum south of Amherst. True *E. palustris* is essentially more northern and is unknown from the province. (*E. palustris* var *rigens* Bailey).

Lab. to B.C. scuth to Penn. & Calif.

9. **E. calva** Torr. See Fernald & Brackett, Rhodora **31:** 68-70. 1929.

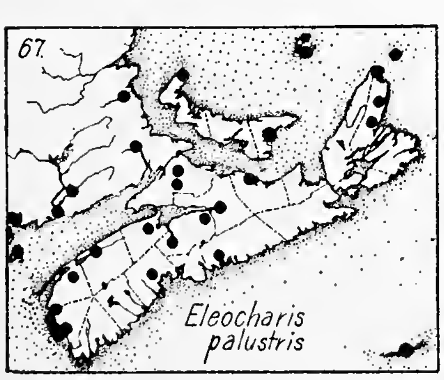
Rare; known for certainty only from McDonald's Barren, Northeast Margaree, C.B.,where it was collected by C.B. Robinson.

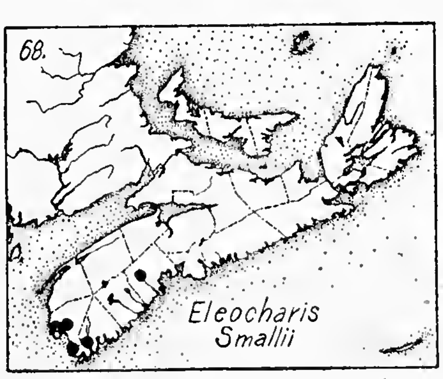
N.S. to Alta. south to Fla. & Mex.

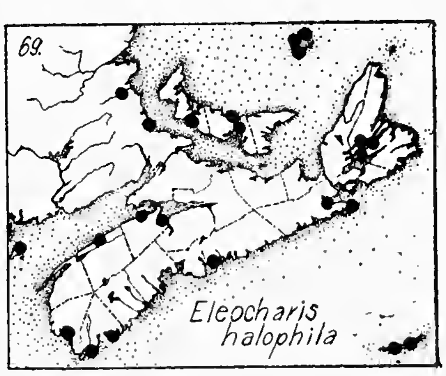
10. **E. Smallii** Britt. Map 68.

This species reaches Canada in the southwestern parts of N.B. & N.S. where in both places it is associated with other southern species. Scattered from Yarmouth to New Germany in Lunenburg Co., with an isolated station at Pictou; peaty and wet sandy swamps, shores, and pond and river margins.

N.S. to Wisc. & Nebr. south to Dela. & Mo.







11. **E. halophila** Fern. & Brackett, Rhodora **37:** 395. 1935. Map 69.

Brackish shores, salt marshes, and damp spots behind shore dunes; scattered around the coast. (*E. uniglumis,* var. *halophila* Fern. & Brackett).

Nfld. to Que. and south to Dela.

12. **E. elliptica** Kunth, see Svenson, Rhodora **41:** 65. 1939. Map 70.

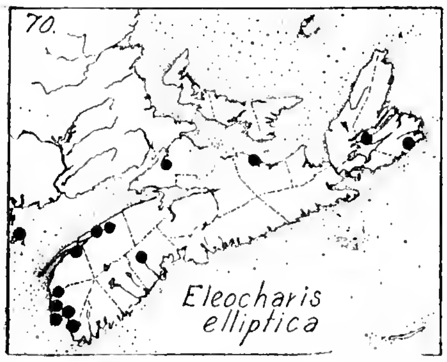
Cool swamps, bogs and brackish marshes; scattered throughout. (*E. capitata,* var. *borealis* Svenson).

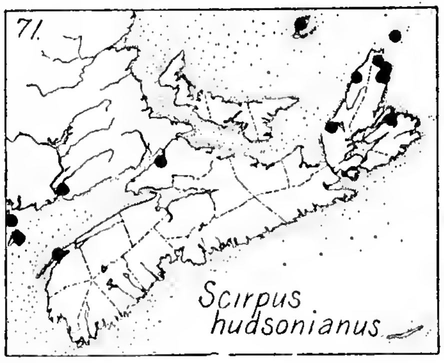
Nfld. to N.J. & Ill; sparingly westward to B.C.

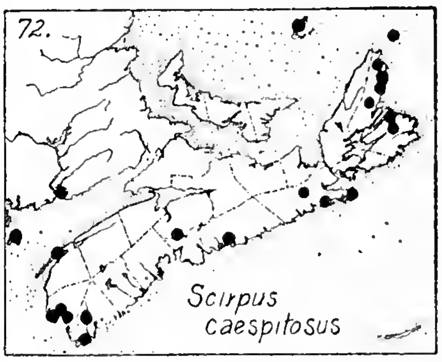
13. **E. tenuis.** (Willd.) Schultes, see Svenson, Rhodora **34:** 199. 1932; and **41:** 65. 1939. Fig. 16, c.

Gravelly banks, peaty pastures and open moist fields scattered throughout.

N.S. to S.C. west to western Penn.







14. **E. nitida.** Fern.

Moist places, chiefly in acid peat; known in N.S. only from an exsiccated roadside gutter, North Mt., Belle Isle, Annapolis Co. (Fernald, 1922).

Nfld. south to N.S. & N.H. west to Que., Wisc., and the Aleutians.

15. **E. tuberculosa** (Michx.) R. & S.

A collection from the wet or peaty beach of Harper's Lake, Shelburne, Co., has the bristles downwardly barbed and is named forma **retrorsa** Svenson, Rhodora **39:**250. 1937.

A collection from a boggy savannah and sandy beach at Great Pubnico Lake in Yarmouth Co. has the bristles smooth. This is named forma **pubnicoensis** (Fern), Svenson, Rhodora **39:** 250. 1937, and is known from no other region.

The species occurs on the coastal plain from central

Mass. south to Fla. & Tex. Forma *retrorsa* is also scattered in Mass.

4. **SCIRPUS** (Tourn.)L. BULRUSH

a. Spikelets terminal, solitary; involucre none or merely an outer scale of the spikelet; plants erect, with the leaf-blades reduced to short awl-like bracts.

b. Plants densely cespitose; culms terete, smooth above; bristles of the spikelets barely longer than the achene. (Fig. 16, e) 1. *S. caespitosus*

b. Plants with running rootstocks; culms triangular and scabrous above; bristles 2-3 cm long, silky and conspicuous (Fig. 16, d). 2. *S. hudsonianus*

a. Spikelets not terminal, usually numerous; involucre varying from a short continuation of the stem to numerous leafy bracts; plants with definite leaf-blades (Fig. 17).

c. Spikelet solitary; involucre green, 5-15 mm long; plant usually floating or submersed in water, with long weak filiform leaves. 3. *S. subterminalis*

c. Spikelets several to many, rarely one; plants normally erect.

d. Involucre short, appearing to be a continuation of the stem (Fig. 17, a, b).

e. Spikelets 2-5-flowered, crowded in a 2-ranked subterminal spike; plant 1-6 dm high. 4. *S. rufus*

e. Spikelets many-flowered, plainly lateral, not 2-ranked; plants 2-25 dm high.

f. Stems sharply 3-angled, to 12 dm high; spikelets in a sessile cluster, occasionally solitary.

g. Involucral leaf 4-15 cm long; upper sheath with a long narrow leaf; spikelets pointed (Fig. 17, a). 5. *S. americanus*

g. Involucral leaf 1-3 cm long; upper sheath with a short triangular leaf or none; spikelets blunt (Fig. 17, b). 6. *S. Olneyi*

f. Stem round, 0.5-2.5 m high (Fig. 16, f). 7. *S. validus*

d. Involucre consisting of several to many leafy bracts.

h. Spikelets large, 1-2 cm long, 6-10 mm thick; salt-marsh plants (Fig. 17, c).

i. Spikelets mostly sessile in a dense glomerule, or occasionally a few in a secondary one; leaves 1.5-9 mm wide, borne chiefly below the middle of the stem; achenes compressed trigonous. 8. *S. paludosus*

i. Spikelets mostly on elongate rays, very rarely sessile; leaves 6-15 mm wide, their sheaths covering more than one-half the length of the stem; achenes sharply triangular to nearly lenticular. 9. *S. maritimus*

h. Spikelets smaller, 2-15 mm long, 1-3 mm thick, numerous in a compound inflorescence; plants of non-brackish habitats (Fig. 17, d-g).

j. Bristles retrorsely barbed; stems solitary or loosely clustered, with thick scaly stolons; spikelets in glomerules.

k. Lower sheaths reddish-tinged; bristles barbed almost to the base, longer than the achene; spikelets 4-8 mm long (Fig. 17, g). 10. *S. rubrotinctus*

k. Lower sheaths green; bristles barbed only above the middle, shorter than the achene; spikelets 2-4 mm long (Fig. 17, d). 11. *S. atrovirens*

j. Bristles smooth or sparingly barbed upward; stems loosely or densely clumped, without stolons; spikelets separate or in glomerules.

l. Spikelets nearly all in glomerules of 3-15.

m. Involucels reddish-brown (Fig. 17, e). 12. *S. cyperinus*

m. Involucels dull brown with blackish bases. *S. cyperinus* var. *pelius*

l. Spikelets nearly all single and pedicelled.

n. Spikelets 3-6 mm long; base of the involucre not glutinous; achenes whitish to light-colored.

o. Plant stout, with leaves 5-8 mm wide; involucels and scales brownish; rare. 13. *S. pedicellatus*

o. Plant slender with leaves 3-5 mm wide; involucels and scales blackish-green; scales 1-2 mm long; common (Fig. 17, f). 14. S. *atrocinctus*.

n. Spikelets 6-10 mm long; base of the involucre glutinous, blackish; achenes reddish-brown; scales 2-3 mm long. 15. *S. Longii*

1. **S. caespitosus** L., var. **callosus** Bigelow. See Fernald, Rhodora **23:** 21-25. 1921. Map 72. Fig. 16, e.

General on the Atlantic slope of the province where it is often abundant on the dryish, peaty barrens from Digby Co. to Northern C.B.; scattered to rare inland and in the north-central region; characteristic of bogs, poorly-drained swamps, and sedge heaths.

Ireland to the Aleutians south to Me., Wisc. & Utah.

2. **S. hudsonianus** (Michx.) Fern. Map 71. Fig. 16, d.

Occasionally along the Atlantic coastal region from C.B. to Digby Neck; common in northern C.B. where it is found in poorly-drained swamps and bogs; scattered to rare elsewhere in bogs.

Lab. to the Yukon south to R.I. & Mont.

3. **S. subterminalis** Torr. Map 73.

This species is somewhat general but often overlooked. Fernald (1923) records it from sandy and peaty pools and lake margins, Yarmouth to Hants Co; oxbow ponds in northern C.B. (Nichols); swamps in Guysborough Co., and occasionally seen elsewhere.

Nfld. to B.C. south to N.J., Mo. & Idaho.

Fig. 17.—**Scirpus.** a, **S. americanus,** x 1/3. b, **S. Olneyi,** x 1/3. c, **S. paludosus,** x ¼. d, **S. atrovirens,** x ¼; achene, x 10. e, **S. cyperinus;** part of the inflorescence, x ½; achene, x 12. f, **S. atrocinctus,** part of inflorescence, x ½. g, **S. rubrotinctus,** part of inflorescence, x ½; achene, x 12.

4. **S. rufus** (Huds.) Schrad. var **neogaeus** Fern., Rhodora **45:** 287. 1943. Map 74.

Typical of brackish marshes in northern C.B. (Nichols); brackish or saline marsh, Sand Beach, Yarmouth Co. (Fernald, 1921).

Rare; Nfld to the Gaspe, the Maritime Provinces, Me. and isolated stations on Hudson Bay.

5 **S. americanus** Pers. Map 75. Fig. 17, a.

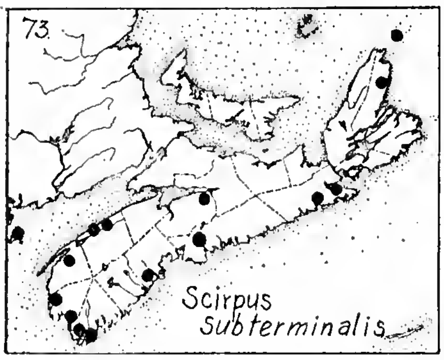
Common on brackish marshes, and occasionally in bogs near the coast; common in the dune hollows of Sable Island; around the coast of the mainland and C. B.

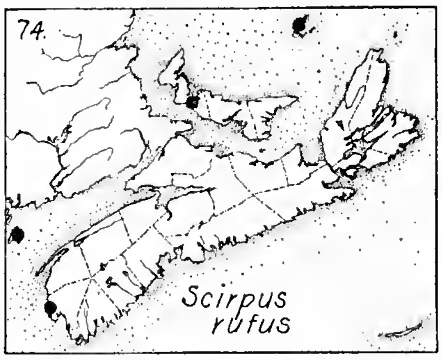
Temperate N.A., in fresh water inland; S.A. & Eu.

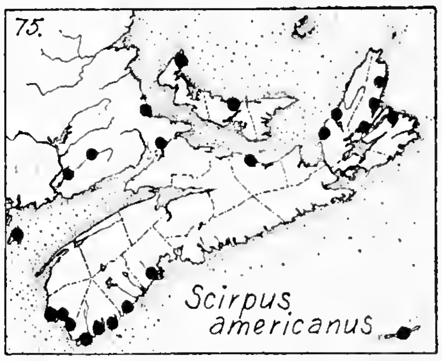
6. **S. Olneyi** Gray. Fig. 17, b.

Recorded from Canada only from salt and brackish marshes and swales of Yarmouth Co.: Sand Beach, Chebogue, Arcadia, Tusket, and Eel Lake; extensive sloughs along Abram River were full of it (Fernald, 1921).

Salt marshes, N.S. to the Gulf of Mexico; rarely inland; on the Pacific coast.







7. **S. validus** Vahl. Including *S. acutus* Muhl. or *S. occidentalis* (Wats.) Chase. Fig. 16, f.

For discussions of the variability, varieties and forms of this group see: St. John, Contrib. Gray Herb. **62**: 65 for the Sable Island plants; Res. Studies State Coll. Wash. I: 90-91. 1929, for further comment; Fernald, Rhodora **45**: 283-286. 1943. The plants are so variable throughout their range and there is such difference of opinion regarding the specific characters that it seems advisable to consider them together until extensive field studies have been made.

Brackish or calcareous pools, lake margins near the coast; sandy pond-shores and estuaries; common throughout and on Sable Is. Throughout N.A.

8. **S. paludosus** Nels., var. **atlanticus** Fern., Rhodora **45**: 291-292. 1943. Fig. 17, c.

Common around the coast; brackish marshes, bare areas on the marshes or dyke-lands, often dominant on the shoreward reaches of the salt meadows; brackish ponds on Sable Is. Along the coast from the Gulf of St. Lawrence to northern N.J.; salt springs in N.Y.

9. **S. maritimus** L., var. **Fernaldi** (Bickn.) Beetle. See Fernald, Rhodora **45**: 288-291. 1943.

Scattered at various places around the coast; including var. *novae-angliae* into which it grades. Collections from Baddeck have been listed under *S. robustus* Pursh (Beetle, Amer. Jour. Bot. **29:** 86. 1942). The species is very luxuriant along the Annapolis R. above Annapolis, there producing plants that are very similar to the more inland *S. fluviatilis* (Torr.) Gray of fresh-water habitats.

Forma **agonus** Fern., Rhodora **45:** 288. 1943, with plano-convex instead of trigonous achenes, is about as common as the variety. This was treated by Beetle, l.c page 84, 85, as *S. maritimus* of Eu.

Gulf of St. Lawrence along the coast to Va.

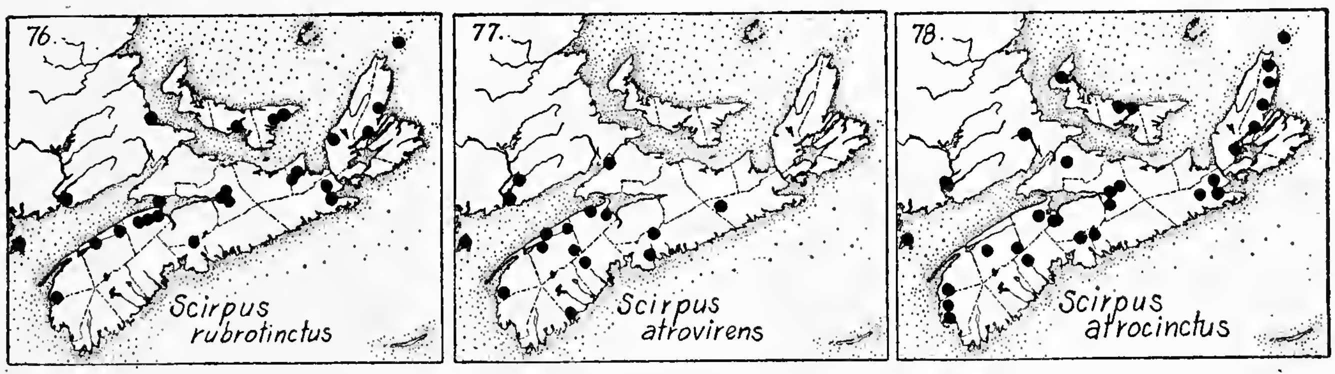
10. **S. rubrotinctus** Fern. Map 76. Fig. 17, g.

Throughout; abundant in swamps, well-drained swamps, low haylands, meadows and along ditches and streams. Forma **radiosus** Fern., Rhodora **45:** 295. 1943, with the spikelets linear-cylindrical, 7-13 mm long, and aggregated, has been collected in swales near Aylesford, Kings Co.

Nfld. to Man. south to Conn., N.Y. & Minn.

11. **S. atrovirens** Muhl., var. **georgianus** (Harper) Fern., Rhodora **23:** 134. 1921. Map 77. Fig. 17, d.

Swales and damp thickets; occasional through the Annapolis Valley to Cumberland Co; abundant along the basaltic North Mt. from Digby Neck to Cape Blomidon; common to



rather scattered from Yarmouth to Guysborough Co., growing in moister areas. Earlier records of *S. atrovirens* are placed here.

Nfld. to Wisc. south to Ga. & Ark.

12. **S. cyperinus** (L). Kunth. Fig. 17, e.

Rare; known from but one collection: peaty and cobbly beach of a large lake, Kemptville, Yarmouth Co. (Fernald, 1921). N.S. to Sask. south to Fla. & La.

Var. **pelius** Fern. is common to abundant throughout; sandy shores, bogs, meadows, ditches, edges of streams, etc. Forma **condensatus** (Fern.) Blake, with the panicle very condensed, is occasionally seen.

Nfld. to Conn., west to Minn.

13. **S. pedicellatus** Fern.

Known from but a single collection; wooded bank of the Sissiboo R., Weymouth (Fernald, 1921).

N.S.; and Que. to Conn., Penn. & Iowa.

14. **S. atrocinctus** Fern. Map 78. Fig. 17, f.

Very common throughout; poorly-drained soil, swamps, bogs, beside streams and in ditches, often characteristic of areas that are inundated early in the season.

Nfld. to Sask. south to Conn. & Iowa.

15. **S. Longii** Fern., Rhodora **13:** 6. 1911.

Rare; peaty marsh, shore of Ponhook Lake, Queens Co.; also one battered individual, probably of this species, at Moosehorn Lake, in the same region (Weatherby, 1942).

N.S.; Que., to N.J., N.C.

5. **ERIOPHORUM** L. COTTON-GRASS

a. Spikelets solitary and terminal without a leafy involucral bract; leaves of the stem mostly reduced to bladeless sheaths (Fig. 18, a).
  b. Stems solitary from underground rootstocks; spikelets with 7 or fewer empty basal scales. 1. *E. Chamissonis*
  b. Stems densely tufted, without rootstocks; spikelets with 10-15 empty scales at the base; bristles shining white. 2. *E. spissum*

a. Spikelets 2-several in a head or umbel, with an involucre of 1 or more leafy bracts (Fig. 18, b-e).
  c. Involucral bract 1; leaves 1-2 mm wide, triangular-channelled.
    d. Plant weak and slender, with no basal leaves at flowering time; upper leaf-blade smooth and round-tipped, 1-4 cm long; base of involucre and scales of spikelets dark; achenes 1.5-2 mm long. (Fig. 18, c). 3. *E. gracile*
    d. Plant stiff and erect with long, slender, pointed basal leaves; uppermost leaf-blade rough, sharp, 3-18 cm long; base of involucre and scales of spikelets brownish; achenes 2.5-3 mm long (Fig. 18, b). 4. *E. tenellum*
  c. Involucral bracts 2 or more; leaves flat, 1.5-8 mm wide.
    e. Spikelets loosely umbellate; bristles white or rarely buff; scales of the spikelet with but one prominent rib; stamens 3 (Fig. 18, e).
      f. Scales of the spikelets with a wide, blunt, whitish tip, and indistinct midrib (Fig. 18, f); upper leaf-sheaths ringed with black at the apex.
        g. Leaves 1.5-4 mm wide. 5. *E. angustifolium*
        g. Leaves 5-8 mm wide. *E. angustifolium* var. *majus*
      f. Scales of the spikelet with a sharp, thick tip, and the midrib prominent to the tip (Fig. 18, g); upper leaf-sheaths usually not dark-ringed. 6. *E. viridi-carinatum*

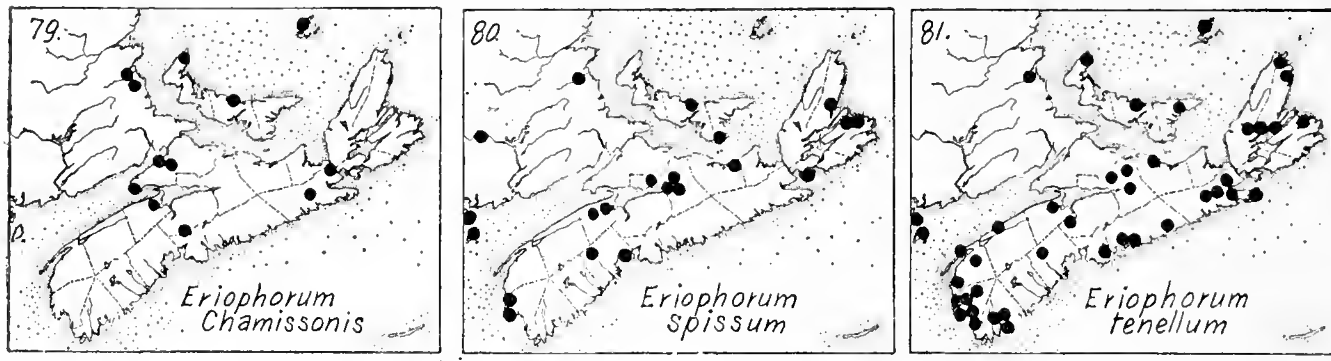
e. Spikelets in a dense head; bristles tawny or copper-colored, rarely whitish; scales of the spikelet with several prominent ribs; stamen 1 (Fig. 18, d). 7. *E. virginicum*

Fig. 18.—**Eriophorum.** a, **E. spissum,** x 1/3. b, **E. tenellum,** x 1/3. c, **E. gracile,** x 1/3. d, **E. virginicum,** x 1/3, e, **E. angustifolium** young plant, x $\frac{1}{3}$. f, scale of spike of **E. angustifolium.** g, scale of **E. viridi-carinatum.**

1. **E. Chamissonis** C. A. Mey. RUSTY COTTON-GRASS. Map 79.

Scattered, not uncommon near the coast; bogs, muskegs, and swamps; Cumberland and Hants Cos. to C.B. Forma **albidum** (F. Nylander) Fern., Rhodora **23:** 131, 1921, is a form with white bristles found in many parts of the range of the species. Bog south of Amherst.

Lab. to Alaska south to N. S., N. B. and down the Rockies.



2. **E. spissum** Fern., Rhodora **27:** 203-210. 1925. Map 80. Fig. 18, a.

Throughout; flowering very early and forming white clumps before the end of May in dryish bogs, swales and muskegs; common on sphagnum mats in wet, or dry and mature bogs in northern C.B. (*E. callitrix* Cham. of American authors).

Lab. to Athabaska south to N. Eng., Ind. & Wisc.

3. **E. gracile** Roth. Fig. 18, c.

Scattered, and probably the rarest member of the genus in N.S.; cold bogs and swamps, usually near the coast; near Two Rivers, Truro, and on the Magdalens. June-July.

Lab. to B.C. south to Conn., Mich. & Calif.; Eurasia.

4. **E. tenellum** Nutt. Map 81. Fig. 18, b.

Common throughout; our most abundant late summer species; grassy swamps, peat bogs and swales. (E. *pauci-nervum* (Engelm.) A.A. Eaton). July-Sept.

Nfld. to Ont. south to N.J. & Ill.

5. **E. angustifolium** Roth. COTTON-GRASS. Map 82. Fig. 18, e.

Common throughout; bogs, swamps, wet meadows, cranberry bogs and sphagnous areas. Places in the Annapolis Valley turfed for cranberry bogs often come into a dense mat of this species. In the Cobequids and northward the following species seems to replace it to a great extent, although *E. angustifolium* is also common in northern C.B. June-July.

Nfld. to B.C. south to Me., the Great Lakes & Colo.; Eurasia.

6. **E. viridi-carinatum** (Engelm.) Fern. Map 83.

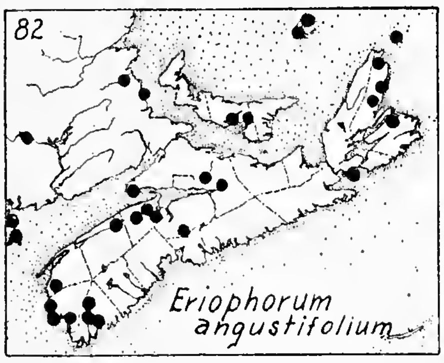
Common in C.B. and in the Cobequids, scattered west to Digby Neck; in bogs, wet meadows, and swamps. June-July.

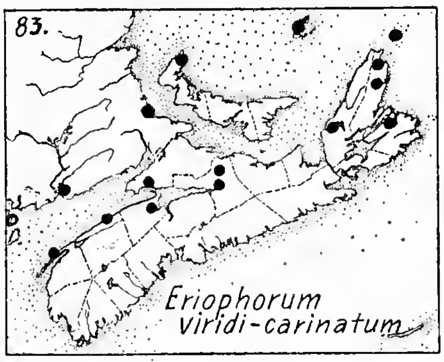
Nfld. to Sask. & B.C. south to N.Y., Ga., Wisc. & Ore.

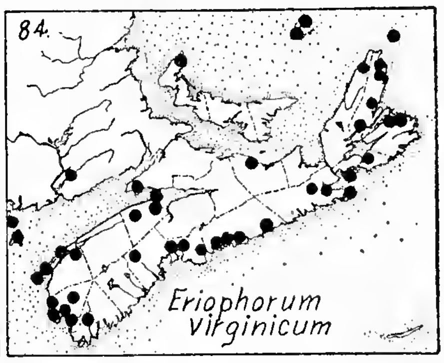
7. **E. virginicum** L. Map 84. Fig. 18, d.

Very common throughout; bogs, swamps, and on the sphagnum mat around lakes or ponds. It is conspicuous in late summer, and is stouter and more restricted to bogs than is *E. tenellum*. The bristles of the species are typically tawny, but often verge towards white as they get older. Plants with white bristles occasionally occur, and have been named forma **album** (Gray) Wieg., Rhodora **26**: 2. 1924. Bog near North Sydney, and on Digby Neck. July 15-Sept.

Nfld. to Man. south to Fla. & Nebr.







6. **RYNCHOSPORA** Vahl. BEAK RUSH

Gale, Shirley. Rynchospora, Section Eurynchospora in Canada, the United States and the West Indies. Rhodora 46: 89-134, 207-249, 255-278. 1944.

a. Scales of the spikelets white, becoming tawny when mature; spikelets usually 2-flowered, 3.5-5 mm long; stamens usually 2; bristles 9-12 (-20), (Fig. 19, a). 2. *R. alba*

a. Scales of the spikelet chestnut-colored; spikelets with several flowers and fruits; bristles 6.

b. Bristles upwardly barbed; spikelets 4-6 mm long, few and ascending in the inflorescence; leaves about 1 mm wide, flat or involute (Fig. 19, c). 1. *R. fusca*

b. Bristles downwardly barbed or smooth; spikelets 3.5-5 mm long, crowded in the inflorescence with the lower spreading or reflexed; leaves 1.5-3 mm wide, flat (Fig. 19, b). 3. *R. capitellata*

1. **R. fusca** (L.) Ait. Map 85. Fig. 19, c.

Common in southwestern N.S., east at least to Lunenburg and Hants Cos. (Fernald, 1922); scattered east of Halifax (Rousseau, 1935); found in various situations in northern C.B.; wet peaty, sandy or gravelly shores and bogs, poorly drained swamps, or sphagnum mats, much rarer than the following species.

Nfld. to Ont. south to Dela. & Mich.

2. **R. alba** (L.) Vahl. Fig. 19, a.

Common throughout bogs, sphagnum mats, poorly drained swamps, or even in wet meadows.

Nfld. to Alaska south to Fla.; the Great Lakes and Calif.

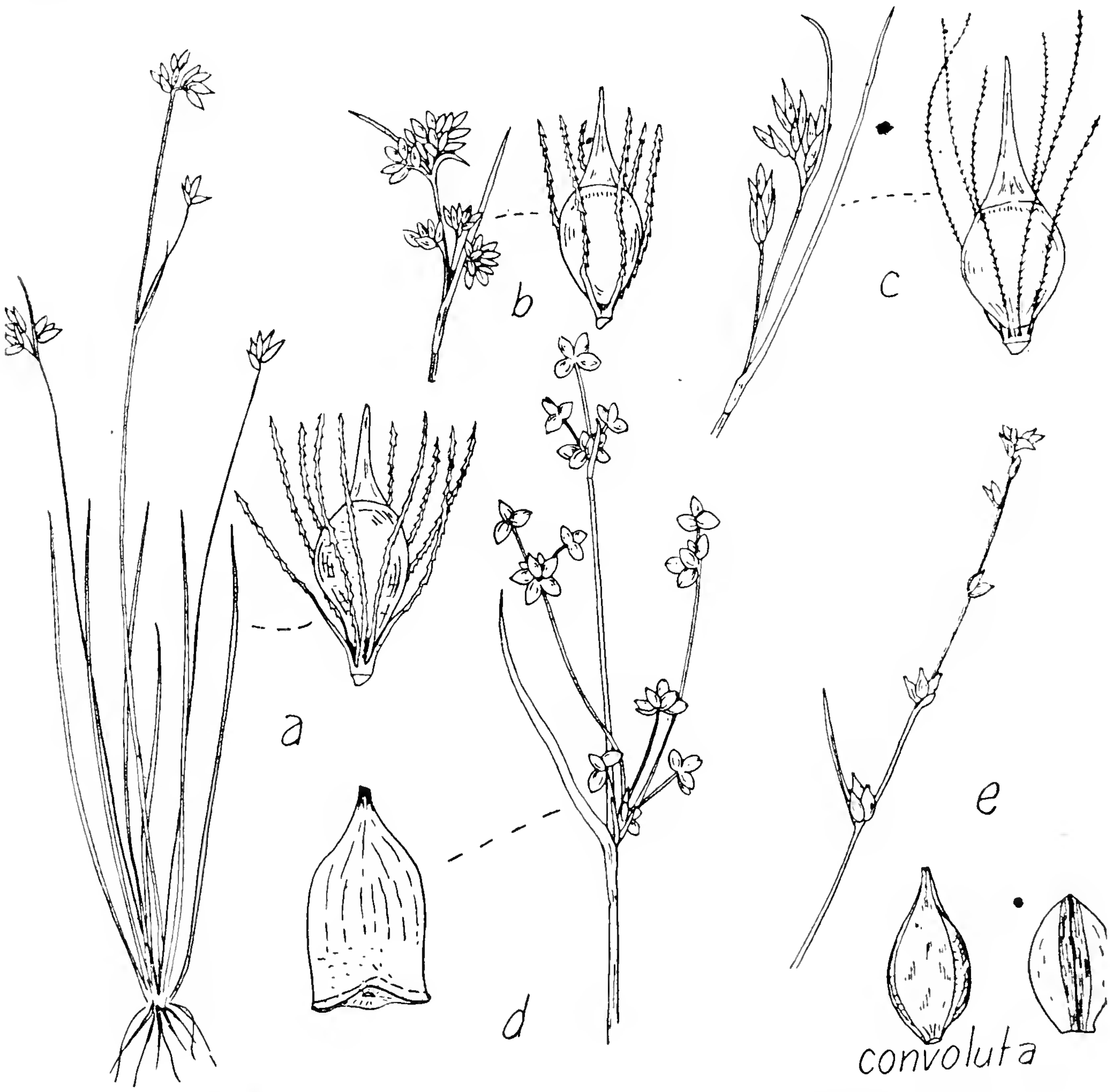


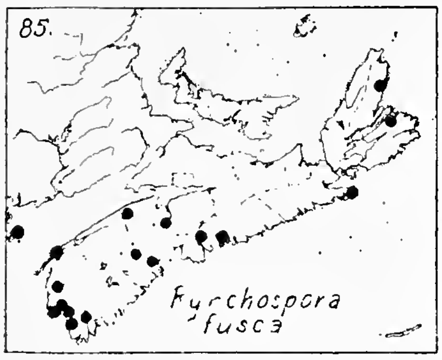
Fig. 19.—**Rynchospora.** a, **R. alba,** x ½; achene, x 10. b. **R, capitellata.** c, **R. fusca.** **Cladium.** d, **C. mariscoides,** plant. x ½; achene, x 10. **Carex.** e, **C. convoluta,** inflorescence, x ½; perigynium and pistillate scale, x 5.

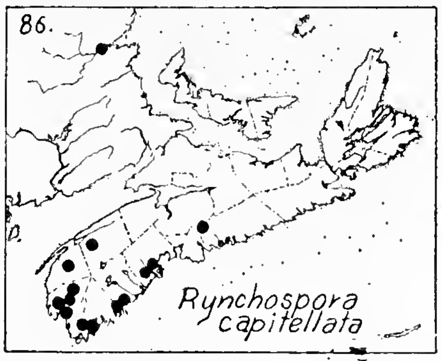
3. **R. capitellata** (Michx.) Vahl. Map 86. Fig. 19, b.

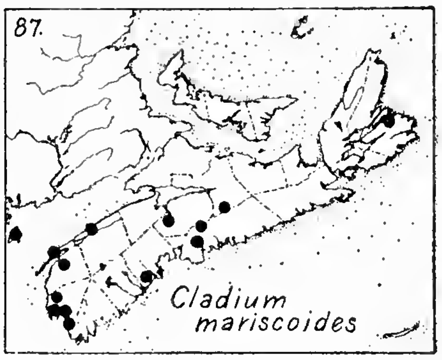
This northern relative of *R. glomerata* with retrorsely-barbed bristles is frequent on lake shores, savannahs, and peaty openings in the southwestern counties, and scattered east to Annapolis and Halifax Cos. Forma **discutiens** (Clarke) Gale, with smooth bristles, is less common than the species but is local in Yarmouth, Shelburne and Lunenburg Cos. (*R. glomerata* var. *minor*(L.) Vahl.).

Fla. to Tex. north to N.S., N.B., southern Ont. & Wisc.

7. CLADIUM R. Br. TWIG RUSH







1. **C. mariscoides** (Muhl.) Torr. Map 87. Fig. 19, d.

Rather local, throughout and often abundant where found; boggy swales, inundated lake margins, marshes, or swales in the gypsum areas. Forma **congestum** Fern., Rhodora **23:** 234. 1921, has the inflorescence compacted with the branches short or suppressed. This occurs scattered with the typical form; first described from Tiddville, Digby Co., but also common in low areas outside of Windsor in the gypsum area.

N.S. to Ont. & Minn. south to Fla. & Iowa.

8. CAREX (Dill.) L. SEDGE

The most recent and comprehensive treatment of Carex is K. K. MacKenzie's monograph in the North American Flora **18:** 1-478. 1931-35. This has been freely used in the following account in the preparation of keys and ranges of the species.

a. Stigmas two and achenes lenticular; spikes usually bi-sexual, the lateral ones sessile. Subgenus *Vignea*

a. Stigmas three and achenes triangular or, if stigmas two achenes lenticular, the lateral spikes stalked; spikes mostly unisexual. Subgenus *Eu-Carex*

SUB-GENUS VIGNEA

a. Spikes solitary on each culm.

b. Plants loosely stoloniferous, 4-30 cm high; pistillate spike without empty scales at the base; perigynia spreading to reflexed, finely nerved dorsally. 12. *C. gynocrates*

b. Plants densely cespitose, 15-70 cm high; spikelet with empty scales at the base; perigynia ascending to spreading, coarsely 3-5 ribbed on the back (Fig. 20). 13. *C. exilis*

a. Spikes more than one.

c. Spikes with the staminate flowers terminal, and the lower flowers pistillate; perigynia not sub-terete.

d. Spikes few, usually less than 10, widely separated (Fig. 19, e). Sect. I. **BRACTEOSAE**

d. Spikes numerous, more than 10, closely crowded into a terminal spike-like inflorescence (Fig. 21).

e. Perigynia 2.0-2.75 mm long, olive to brown, abruptly narrowed to the beak; culms not weakly cellular; leaves 1-4 mm wide.

f. Inflorescence 3-10 cm long, with many setaceous bracts; spikes more or less separated and oblong-ascending; perigynia yellowish-green. 4. *C. vulpinoidea*

f. Inflorenscence 2-5 cm long, without setaceous bracts; spikes closely crowded, spreading-orbicular; perigynia shining-brown. 5. *C. diandra*

e. Perigynia 4-5 mm long, straw-colored, gradually narrowed from the base to the end of the beak; culms weakly cellular, flattening in drying; leaves 4-8 mm wide. 6. *C. stipata*

c. Spikes with the pistillate flowers terminal; if otherwise, with the perigynia sub-terete and the spikes 1-3-flowered.

g. Perigynia without winged margins, at most thin-edged, the lower part of the body spongy-thickened; culms not hollow.

h. Perigynia 2-4 mm long, ascending to reflexed (Fig. 20).

i. Perigynia elliptic, ascending or appressed, not thin-edged. Sect. 5. **HELEONASTES**

i. Perigynia spongy and widest near the base, widely spreading or reflexed, thin edged. Sect. 7. **STELLULATAE**

h. Perigynia 4-5 mm long, appressed (Fig, 22, a). Sect. 8. **DEWEYANAE**

g. Perigynia winged, the lower part not spongy-thickened; spikes oval with the perigynia usually closely appressed; culms hollow (Fig. 22, b-d). Sect. 9. **OVALES**

SUBGENUS **EU-CAREX**

a. Spikes solitary on each culm.

Perigynia 1-10, glabrous.

Perigynia oval, rounded at the tip, appressed-ascending, greenish (Fig. 22, e). 34. *C. leptalea*

Perigynia tapering to a long acute tip, strongly reflexed, yellowish (Fig. 28, b). 83. *C. pauciflora*

Perigynia many, pubescent, in a dense cylindrical spike 1.5-3 cm long; staminate plant with one spike only. 43. *C. scirpoidea*

a. Spikes more than one per culm.

b. Stigmas 2; achenes lenticular; lateral spikes stalked, or if sessile, elongate; terminal spike usually staminate.

Lowest bract long-sheathing; perigynia orbicular, becoming golden-yellow at maturity (Fig, 24, a). 47. *C. aurea*

Lowest bract sheathless, or very rarely short-sheathing; perigynia not orbicular.

Achenes not constricted in the middle; pistillate scales not long-awned, shorter or about the same length as the perigynia, 1-nerved (Fig. 27). Sect. 29. **ACUTAE**

Achenes constricted in the middle; scales long-awned or acute and much longer than the perigynia, 3-nerved. Sect. 30. **CRYPTOCARPAE**

b. Stigmas 3; achenes trigonous.

c. Perigynia pubescent or scabrous (*C. tonsa* with short leaves and crowded basal spikelets may be nearly glabrous).

d. Beak of the perignynia absent or nearly so.

Upper sheath of the fertile culm bladeless; spikes with 1-8 perigynia; plant glabrous; lowest bract long-sheathed. 44. *C. pedunculata*

Upper sheath of the fertile culm with long blades; perigynia numerous; lowest bract sheathless or nearly so.

Perigynia 10-30; culm and leaf-blades finely pilose. 65. *C. Swanii*

Perigynia 50-100; culms and leaves glabrous and glaucous (Fig. 26, e). 70. *C. flacca*

d. Beak of the perigynia prominent, or if short then the lower bract being sheathless.

e. Leaf-blades glabrous; or if soft-hairy (*C. hirta*) the teeth of the beak long, widely spreading and hispidulous.

Perigynia strongly-ribbed; the teeth long, spreading, and hispid or scabrous within (Fig. 25, e; 26, a). Sect. 24. **HIRTAE**

Perigynia more obscurely nerved, the teeth small, short, erect, smooth within.

Culms 0.2-4 dm high, about equalled by the leaves; of dry situations (Fig. 23, a-c). Sect. 11. **MONTANAE**

Culms 3-12 dm high, the leaves 2-6 dm long; of bogs and swamps. Sect. 24. **HIRTAE**

e. Leaf-blades hirsute or scabrous above; teeth of the perigynia short, not spreading.

Bracts leafy, at least twice as long as the inflorescence; perigynia and blades scabrous; perigynia strongly nerved (Fig. 26, b). 69. *C. scabrata*

Bracts not exceeding the inflorescence; perigynia and blades hirsute; perigynia nerveless (Fig. 23, d). 45. *C. hirtifolia*

c. Perigynia glabrous.

f. Style articulated with the achene, at length deciduous; perigynia membranous, with beak absent or if present the teeth small and erect; spikes either long and slender, or else up to 1.5 cm. wide and barely longer than wide; plants relatively small.

g. Beak of the perigynium absent, or very short and lacking teeth.

h. Pistillate spikes plainly stalked.

i. Pistillate spikes loosely-flowered, 1-5 cm long, to 5 mm wide; lowest bract long-sheathing.

Spikes long-peduncled, drooping, the terminal with pistillate flowers above; perigynia beakless (Fig. 24, e).
54. *C. gracillima*

Spikes short-peduncled, erect, the terminal staminate; perigynia more or less short-beaked.

Plants from elongated rootstocks, often with stolons, glaucous or bluish-green; edges of the lower sheath smooth (Fig. 24, b). Sect. 17. **PANICEAE**

Plants without elongated rootstocks and stolons, not glaucous; sheath with the edges serrulate, or smooth with the ventral side prolonged upwardly.
Sect. 18. **LAXIFLORAE**

i. Pistillate spikes very small or else ovoid to oblong, 4-12 mm thick.

Lower sheath bladeless; pistillate spikes 4-8 mm long; perigynia 2-6, 2 mm long, very persistent (Fig. 23, e).
46. *C. eburnea*

Lower sheath with a blade; perigynia more numerous.

Lower bract long sheathing, serrulose upwardly on the margin (Fig. 24, d). 53. *C. conoidea*

Lower bract very shortly if at all sheathing.

Leaves soft-pubescent below, 2-3 mm wide, flat; pistillate scales not longer than the perigynia; fields and meadows (Fig. 25, d). 64. *C. pallescens*

Leaves glabrous, 1-4 mm wide; pistillate scales longer than the perigynia; bogs (Fig. 26, c,d).
Sect. 27. **LIMOSAE**

h. Pistillate spikes sessile, or the lower very short-peduncled, the scales dark; basal sheaths fibrillose.
73. *C. Buxbaumii*

g. Beak of the perigynia conspicuous and toothed.

Spikes loosely-flowered, oblong to linear on long peduncles.
Sect. 21. **SYLVATICAE**

Spikes dense, short-cylindrical to globose, sessile (Fig. 25, b, c). Sect. 22. **EXTENSAE**

f. Style continuous with the achene and of the same texture, persistent; perigynia with beak conspicuous, toothed, the teeth stiff and 0.3-1 mm long or longer, often spreading; spikes 5-25 mm thick; plants stout, 4-12 dm high.

j. Pistillate spike ovoid to cylindrical with 20-75 perigynia.

Perigynia very closely and coarsely nerved, strongly reflexed when mature; scales long-awned with the awns serrulate (Fig. 29, a). 86. *C. Pseudo-Cyperus*

Perigynia with widely spaced ribs, or not reflexed and the nerves many but weak.

Perigynia coriaceous, closely overlapping, elliptical, the

beak rather short and with weak teeth; scales not serrulate, acute to short-awned (Fig. 29, b).
87. *C. lacustris*

Perigynia membranous more spreading, contracted to a beak; beak with prominent teeth.
Spike cylindrical; perigynia less than 12 mm long, contracted into prominent teeth.
Sect. 35. **VESICARIAE**
Spike ovoid; perigynia 13-20 mm long, tapering evenly into a serrulate beak (Fig. 30, d). 95. *C. lupulina*

j. Pistillate spikes globose with 1-15 perigynia.
Leaves 1-3 mm wide, involute; pistillate spikes 7-9 mm thick, sessile, widely separated (Fig. 30, a).
92. *C. oligosperma*
Leaves 2-15 mm wide; pistillate spikes over 1 cm thick, peduncled, or sessile on the plant having wide leaves.
Beak of the perigynia serrate; pistillate spikes short-cylindrical, with the mature perigynia straw-colored (Fig. 28, d, e). Sect. 32. **FOLLICULATAE**
Beak of the perigynia smooth; pistillate spikes dense, ovoid or round, with the mature perigynia green (Fig. 30, c). Sect. 94. *C. intumescens*

SECT. I. **BRACTEOSAE**

a. Perigynia with the lower third to half corky-thickened; spikes separated in a slender inflorescence 3-6 cm long; scales of pistillate spike about half as long as the perigynia.
b. Stigmas long, slender, usually not twisted, light reddish; perigynia 2.5-3.5 mm long; leaf-blades 1-2 mm wide. 1. *C. rosea*
b. Stigmas short, stout, strongly twisted or contorted; perigynia 3.25-4.5 mm long; leaf-blades 1.5-3 (averaging 2.5) mm wide.
2. *C. convoluta*

a. Perigynia with the body inconspicuously corky-thickened, often spongy at the base, 4-4.5 mm long; spikes aggregated in a head 1.5-3 cm long; scales acuminate, nearly as long as the perigynia.
4. *C. spicata*

1. **C. rosea** Schkuhr.

Alluvial woods and damp thickets, rare; along the 5-Mile River, Hants Co.; damp thickets and clearings, North Mt., Granville, Annapolis Co.; Big Intervale, Inverness Co.

Dry woodlands; N.S. to N.D. south to Ga. and La.

2. **C. convoluta** Mack., Bull. Torrey Bot. Club **43**: 428. 1916. Fig. 19, e.

Scattered from Annapolis to Pictou and Cumberland

Cos.; grassy intervales, rich open woods, near gypsum cliffs, etc. *C. radiata* (Wahl.) Dewey has been reported from the province, but I believe that these plants should be placed in the preceeding species.

Dry woods; N.S. to Man. south to Ala. and Ark.

3. **C. spicata** Huds.

Common along the roadsides in the gypsum area around Windsor, Newport and Brooklyn in Hants Co., growing in large stools (Fernald, 1922); Liverpool. (*C. muricata* L. of earlier authors).

Locally naturalized from Eu.: N.S. to Ohio and Va.

SECT. 2. **MULTIFLORAE**

4. **C. vulpinoidea** Michx. Map 110. Fig. 21, a.

Common along roadside ditches between Berwick and Middleton in the Annapolis Valley; often abundant on damp slopes along the North Mt. in the same area; a few stools in moist ground in an abandoned saw-mill clearing, Lake Rossignol Reservoir, Queens Co. (Weatherby, 1942).

Swampy places Nfld. to B.C. south to Fla. and Tex.

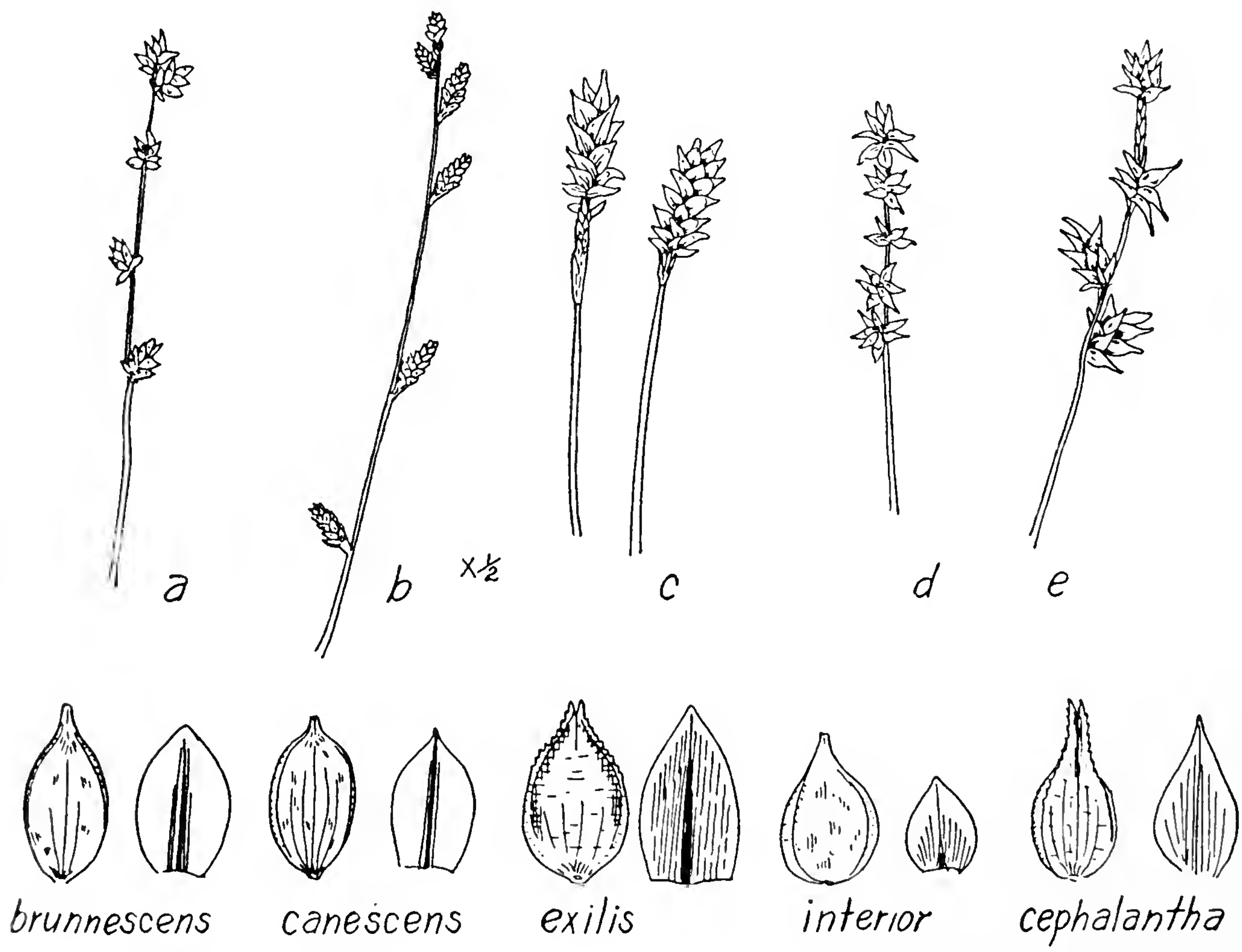


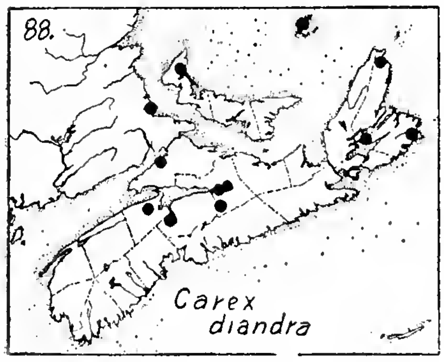
Fig. 20.—**Carex:** inflorescences, x 1; perigynia and scales, x 5.

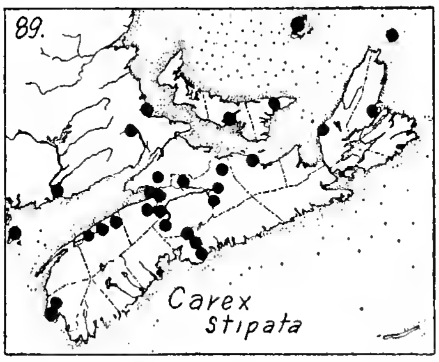
SECT. 3. **PANICULATAE**

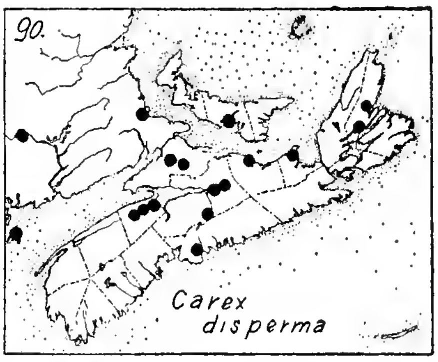
5. **C. diandra** Schrank Map 88. Fig. 21, b.

Common and locally abundant in bogs, cat-tail swales, and marshes along the northern part of the province; common in the extensive areas above Kentville, near Truro and at Amherst.

Wet meadows; Nfld. to Yukon south to N.J., Ind. and Calif.; Eurasia; N.Z.







SECT. 4. **VULPINAE**

6. **C. stipata** Muhl. Map 89. Fig. 21, c.

Swamps, swales, damp meadows, roadside ditches; general throughout, often abundant.

Swamps and wet meadows; Nfld. to Alaska south to N.C., and N.M.; Japan.

Sect. 5. **HELEONASTES**

a. Spikes with the staminate flowers terminal, mostly with 1-3 fertile flowers; perigynia unequally biconvex, almost terete (Fig. 21). 7. *C. disperma*

a. Spikes with the staminate flowers basal; perigynia flattened and plano-convex.

b. Lowest bract of the inflorescence bristle-like, many times exceeding the 1-5-flowered spike; spikes widely separated.

c. Leaves 1-2 mm wide; spikes 2-3, 2-5-flowered; perigynia 3.3-4.8 mm long (Fig. 21). 8. *C. trisperma*

c. Leaves 0.3-0.5 mm wide; spikes 1-2, 1-3-flowered; perigynia 2.5-3.5 mm long. *C. trisperma* var. *Billingsii*

b. Lowest bract of the inflorescence lacking or to about twice as long as the spike; spikes several to many-flowered, the upper approximate.

d. Scales reddish-brown, larger than the perigynia; culms smooth; perigynia coriaceous, obscurely beaked, enveloped by the scales; salt marshes. 9. *C. Mackenziei*

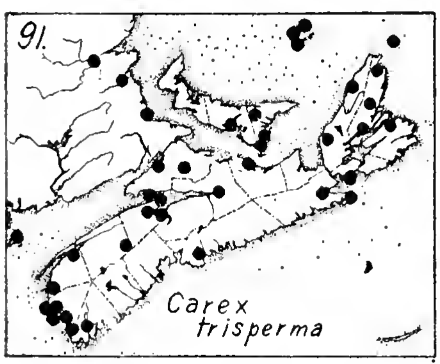
d. Scales light-colored, smaller than the perigynia; culms rough above; perigynia membranous, distinctly short-beaked, not enveloped by the scales; not salt-marsh plants.

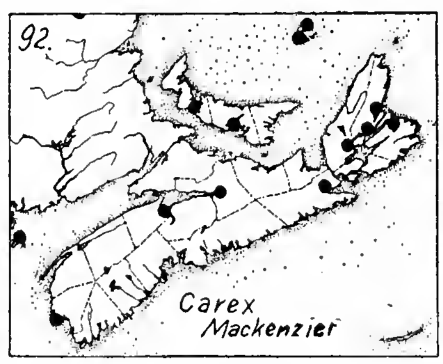
e. Perigynia loosely spreading, 5-10 to a spike; leaves green, 1-2.5 mm wide (Fig. 20). 10. *C. brunnescens*

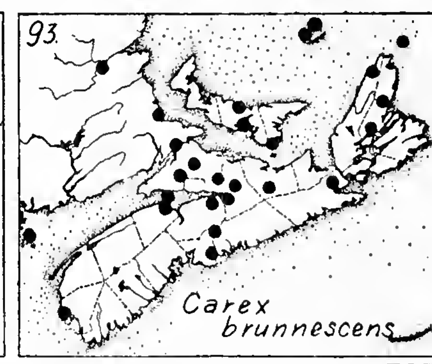
e. Perigynia appressed-ascending, 10-30 to a spike; leaves glaucous, 2-4 mm wide (Fig. 20).

f. Inflorescence 2-5 cm long; spikes 4-7 mm long; perigynia to 2 mm long. 11. *C. canescens*

f. Inflorescence 5-10 cm long; spikes 6-12 mm long, the lower remote; perigynia 2.3-3 mm long, the beaks serrate. *C. canescens* var. *disjuncta*







7. **C. disperma** Dewey Map 90. Fig. 21.

Mossy woods, shaded swamps and wet to sphagnous shaded areas; Kings and Halifax Cos. to C. B. (*C. tenella* Schkuhr).

Nfld. to the Yukon south to N.J., Ind. & Calif.

8. **C. trisperma** Dewey Map 91. Fig. 21.

Mossy woods and wet thickets, throughout. Nfld. to Que. south to N.J. & Penn.

Var. **Billingsii** Knight is characteristic of dryish knolls in bogs and peaty barrens throughout; often abundant and sometimes covering the ground in open woods or cut-over areas near the coast.

Acid soils, swampy woods or bogs, Nfld. to Sask. south to Md., Ill. & Minn.

9. **C. Mackenziei** Krecz. Map 92.

Scattered around the coast; brackish soil, sometimes forming a band with other plants about the heads of the marshes or about salt ponds; little collected, but probably general. (*C. norvegica* Willd. See Flora U.R.S.R., **3:** 183. 1935).

Lab. to Me.; Hudson Bay; Alaska; Eurasia.

10. **C. brunnescens** (Pers.) Poir, var **sphaerostachya** (Tuckerm.) Kukenth. See Fernald, Rhodora **28:** 163. 1926. Map 93. Fig. 20.

Common from Halifax and Kings Cos. to northern C.B.; scattered west to Yarmouth. This species is characteristic of open moist woods and thickets in acid soil. The variety is the southern extreme and may be an ecological form.

Nfld. to Alaska south to N.J., N.C. & Wash.; Eurasia.

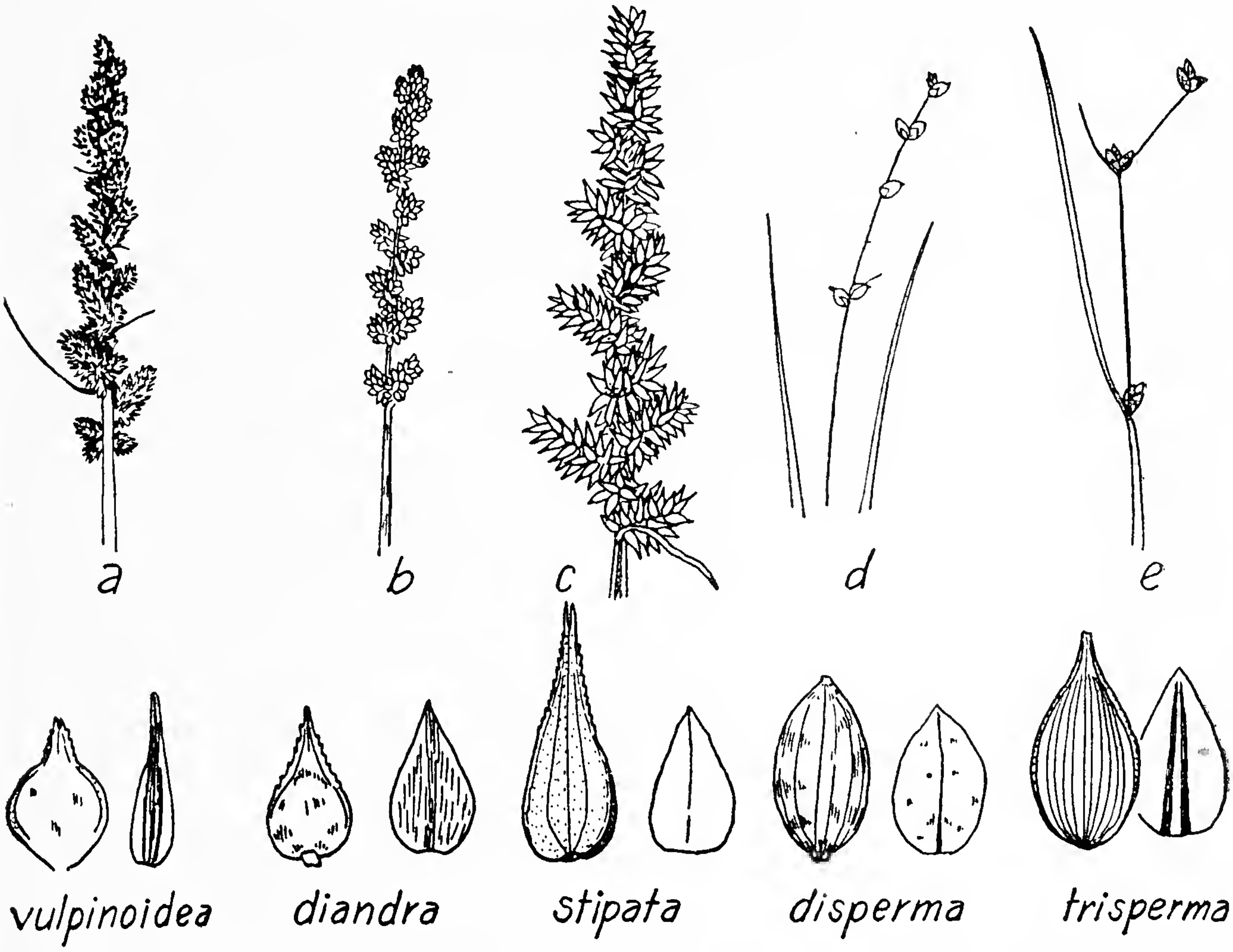


Fig. 21.—**Carex:** inflorescences, x 1; perigynia and scales, x 5.

11. C. **canescens** L. Fig. 20.

Common throughout and very variable; grading into and represented mostly by the following variety.

Var. **disjuncta** Fern. Common throughout; lake margins, marshes, swamps, sphagnum mats, and wet meadows.

Greenland to Alaska south to Va., Ariz. & Calif.; Eurasia; S.A. & Australia.

SECT. 6. **DIOICAE**

12. C. **gynocrates** Wormsk.

The only collection from the province is from a bog on St. Paul Is., northern C.B. (Perry, 1931).

Greenland to Yukon south to N.Y., Mich. & B.C.; Siberia.

SECT. 7. STELLULATAE

a. Spike one to a culm; leaves narrow, involute and rigid (Fig. 20). 13. *C. exilis*

a. Spikes more than one; leaf-blades not rigid, 0.5-4 mm wide.

b. Perigynia 2.25-3.25 mm long, the beak very shallowly bi-dentate, one-quarter to one-third the length of the body; scales one-half to two-thirds the length of the body (Fig. 20, d).

c. Perigynia nerveless ventrally or few-nerved at the base, yellowish-brown, the beak with the ventral false suture inconspicuous; scales obtuse; leaves 1-3 mm wide. 14. *C. interior*

c. Perigynia strongly nerved ventrally, deep green, the beak with the ventral false suture conspicuous; scales subacute; leaves 0.25-1 mm wide. 15. *C. Howei*

b. Perigynia 2.75-4.75 mm long, the beak deeply bidentate and the ventral suture conspicuous.

d. Body of the perigynia sub-orbicular or widely ovate, deep-green at maturity; beak less than half as long as the body; scales obtuse, one-half the length of the perigynia, almost orbicular. 16. *C. atlantica*

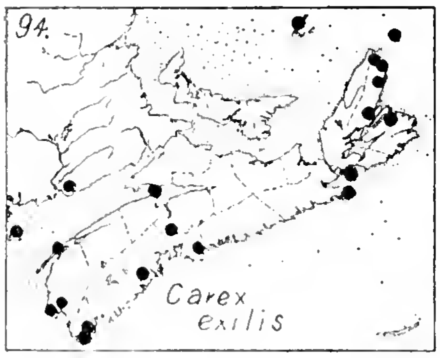
d. Body of the perigynia ovate to lanceolate, yellowish at maturity; beak half the length of the body or more; scales acute.

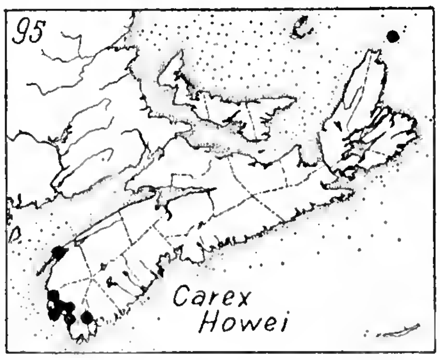
e. Staminate flowers terminal, basal or in separate spikes; culms very rough above; upper part of the perigynium body serrulate; scales chestnut-brown with shining-white margin, acute, as long or longer than the perigynium body. 17. *C. sterilis*

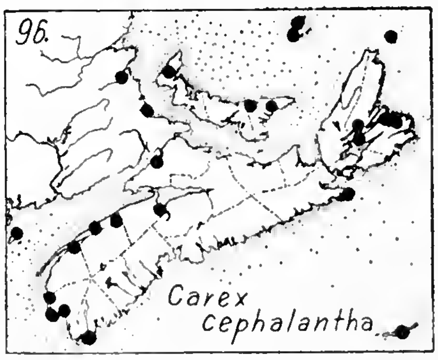
e. Staminate flowers mostly basal in the terminal spikes; upper part of the perigynium body serrulate or smooth; culms little or not roughened above; scales two-thirds the length of the perigynium body.

f. Mature perigynia lanceolate, 2.5-3.5 mm long, nerveless or impressed-nerved towards the base; culms slender; achenes much longer than wide; leaves 0.75-2 mm wide. 18. *C. angustior*

f. Mature perigynia ovate, 3.5-4 mm long, with raised nerves ventrally; culms stouter; achenes about as long as wide; leaves 1.5-2.5 mm wide (Fig. 20). 19. *C. cephalantha*







13. **C. exilis** Dewey Map 94. Fig. 20.
Bogs and peaty barrens; scattered throughout.

Lab. to Dela., mostly near the coast; locally inland to Minn.

14. **C. interior** Bailey Fig. 20.

Spruce swamps, wet or swampy meadows, widely distributed throughout.

Nfld. to B.C. south to Penn., Ind. & N. Calif.

15. **C. Howei** Mack. Map 95.

Spruce swamps, wet woods, thickets and boggy swales; abundant in Yarmouth and Digby Cos. (Fernald, 1921); peat bog on St. Paul Is. (Perry, 1931). (*C. scirpoides* Schkuhr, var. *capillacea* (Bailey) Fern.).

Fla. to La. north to N.S.; locally west to Ohio & Mich.

16. **C. atlantica** Bailey Map 63.

Common on bogs and peaty barrens; Yarmouth to Annapolis Co., and Guysborough (Fernald, 1921); probably throughout. It is very common near the Atlantic Coast; and is characteristic of the Polytrichum areas in the sand-barrens near Middleton. *C. sterilis* in Gray's Man.).

Near the coast, N.S. to Fla. & Tex.

17. **C. sterilis** Willd.

Mackenzie does not list this species from N.S., but gives the range as more inland. Older records then must be critically examined. The northern part of the province would seem to be within the range of the plant.

Nfld. to Minn. south to N.J., N.Y. & Wisc. in swampy meadows in calcareous regions.

18. **C. angustior** Mack.

Swampy meadows; apparently not at all common. (*C. stellulata* var. *angustata* Carey).

Nfld. to Wash. south to D.C., N.C. & Calif.

19. **C. cephalantha** (Bailey) Bickn. Map 96. Fig. 20.

Swamps, sphagnum mats, and bogs; common in northern C. B., and probably throughout. (*C. stellulata.* var. *cephalantha* (Bailey) Fern.).

Nfld. to Wisc. south to Md.; Vancouver to Wash.

SECT. 8. **DEWEYANAE**

a. Culms very rough above, with the spikes aggregated, terminal and closely appressed, the lower bracts much shorter than the spikes; perigynia narrowly lanceolate, with the achenes linear-lanceolate. *20. C. bromoides*

a. Culms smooth to more or less roughened above, with the spikes separated, spreading, the lower bracts much longer than the spikes; perigynia oblong-lanceolate with the achenes sub-orbicular.
21. C. Deweyana

20. **C. bromoides** Schkuhr

Known from a marsh near Truro; specimens were collected by Macoun and identified by Mackenzie.

Swampy woods; N.S. to Wisc. south to Fla. & La.

21. **C. Deweyana** Schwein. Map 97. Fig. 22.

Annapolis and Lunenburg Cos. to C.B.; rich woods, more frequent in gypsum or limestone areas; common in hemlock woods on gypsum near Windsor.

Dry woods; Lab. to Mackenzie and B.C. south to Penn. & Colo.

SECT. 9. **OVALES**

a. Perigynia widely lanceolate, serrulate above, with a long slender terete beak the upper 1-2 mm of which are little if at all serrulate, concealed by scales of the same shape; leaves 2-4 mm wide.
22. *C. leporina*

a. Perigynia with the beak flattened, margined and serrulate to the apex.

b. Scales shorter than the perigynia, lanceolate and tapering above to expose the tops of the perigynia (Fig. 22, b,c).

c. Perigynia lanceolate, 3.5-6.5 mm long, 0.5-2 mm wide, widest near the base; scales acute to acuminate (Fig. 22, b).

d. Spikes usually crowded; perigynia appressed; leaves 1-3 mm wide, those of the sterile culms ascending, usually clustered at the apex, the sterile culms poorly developed.

e. Winged margin of the perigynia (not the whole area outside the achene) nearly obsolete at the base; plant 1-6 dm high, leaves 7-15 cm long, perigynia 3.5-4 mm long. 23. *C. Crawfordii*

e. Winged margin of the perigynia plainly visible to the base; plant 1.5-10 cm high, leaves 5-50 cm long, perigynia 4-6.5 mm long (Fig. 22, b).

f. Plant to 10 dm high; spikes 4-12; perigynia lanceolate, 1.2-2 mm wide; scales light brownish. 24. *C. scoparia*

f. Plant 2-4.5 dm high; spikes 3-6; perigynia broadly elliptical, 2 mm wide; scales dark brown. *C. scoparia* var. *tessellata*

d. Spikes separated in a moniliform inflorescence; perigynia ascending-spreading; leaves 3-7 mm wide, those of the sterile culms widely spreading, well-developed, numerous and not clustered.
31. *C. projecta*

c. Perigynia elliptical to obovate, at most twice as long as they are wide (Fig. 22, c).

g. Upper leaf-sheath green and strongly nerved ventrally nearly to the mouth; perigynia widely lanceolate; bracts often several times the length of the spikes; on or near salt marshes.
26. *C. hormathodes*

g. Upper leaf-sheath strongly white-hyaline ventrally; perigynia wider, often obovate and widest above the middle.

h. Spikes approximate to closely aggregated, rarely distant, the lateral rounded or truncate to the base.

i. Perigynium body almost orbicular, 2.5 mm wide; culms stiff and rigid; sheaths strongly prolonged on the ventral side to nearly truncate across top (Fig. 22, c). 27. *C. cumulata*

i. Perigynium body elliptical, 1.5-2 mm wide; culms slender, sheath very slightly prolonged at the base of the blade.
25. *C. Bebbii*

h. Spikes approximate to distant, the lateral strongly clavate at the base.

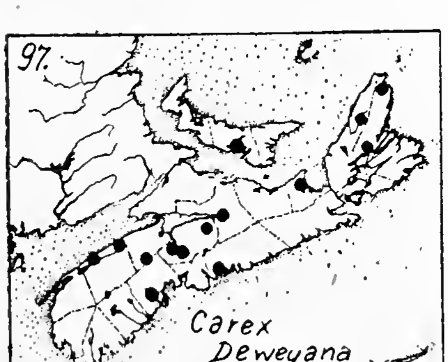
j. Spikes silvery-greenish or brownish in a moniliform flexuous inflorescence; leaf-blades knobbed on either side of the junction with the sheath; sheaths very strongly prolonged and truncate.
28. *C. silicea*

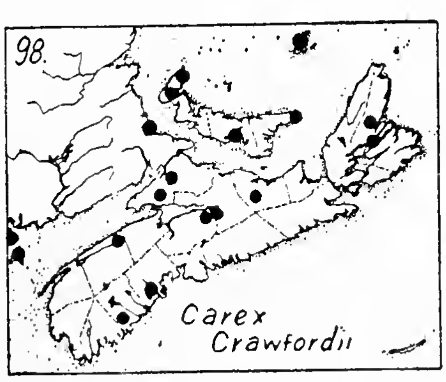
j. Spikes greenish, in a head 2-6 cm long; leaf-blades not knobbed at the base; sheaths very slightly prolonged, the ventral side v-shaped. 29. *C. albolutescens*

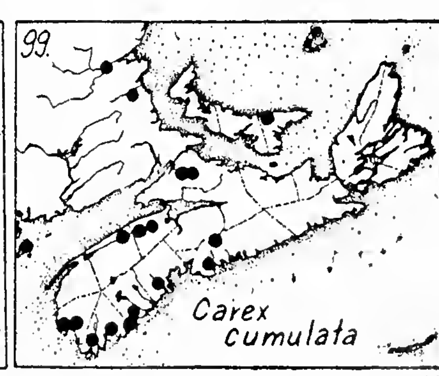
b. Scales about the length of the perigynia and about the same width above, hiding the tips of the perigynia; perigynia widely lanceolate to ovate (Fig. 22, d).

k. Inflorescence stiff, the spikes approximate to aggregated; lower bract dilated and longer than the inflorescence.
31. *C. adusta*

k. Inflorescence not stiff, but flexuous or moniliform; lower bract shorter than the spike.







1. Perigynium body widest near the base, nerveless or occasionally few-nerved ventrally, the beak reddish-brown tipped; scales dull- or yellowish-brown (Fig. 22, d). 32. *C. aenea*
1. Perigynium body widest near the middle, strongly nerved ventrally, the beak hyaline-tipped; scales silvery-green. 33. *C. argyrantha*

22. **C. leporina** L.

Common in springy or seepy fields or along roadsides; Digby, Yarmouth and Shelburne Cos. (Fernald, 1921).

Naturalized from Eu.; Nfld. & P.E.I. to Mass. & N.Y.

23. **C. Crawfordii** Fern. Map 98.

Swales and damp peaty barrens; Annapolis and Queens Cos. to C.B. (Fernald, 1921).

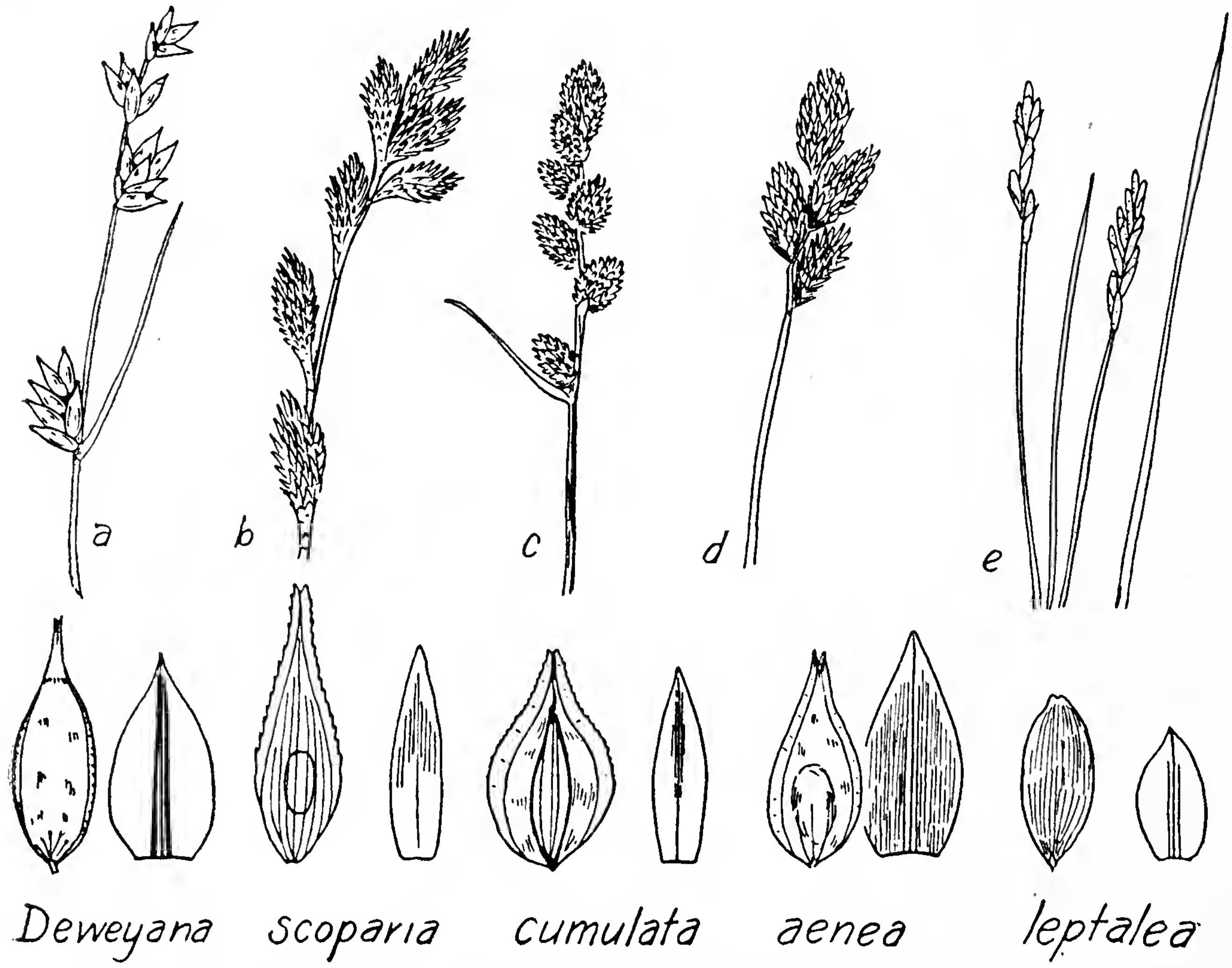


Fig. 22.—**Carex:** inflorescences, x 1; perigynia and scales, x 5.

Open places; Nfld. to B.C. south to Conn., Mich. & Wash.

24. **C. scoparia** Schkuhr Fig. 22.

Very common throughout; in ditches, and poorly-drained soil. Some plants have the inflorescence more elongate, with the spikes obovoid or top-shaped. These grade into the typical plants and have been named forma **subturbinata** (Fern. & Wieg.) Fern., Rhodora **44**:284. 1942.

Var. **tessellata** Fern. & Wieg., Rhodora **12**: 135. 1910, has been found in wet sandy and gravelly swales and roadsides, Belleville, Yarmouth Co. (Fernald, 1921). N.S. & Me.

Nfld. to B.C. south to S.C., N.M. & Ore.

25. **C. Bebbii** Olney

Local: boggy swale on a hillside near limestone quarries, George R., C.B. Co. (Fernald, 1921); dryish swales near the Wentworth gypsum quarries, Windsor (Fernald, 1922).

Swampy meadows in calcareous or neutral soils; Nfld. to B.C. south to N.J., Ill. & Wash.

26. **C. hormathodes** Fern.

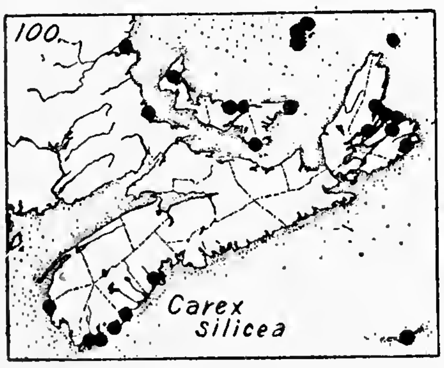
Common near the coast on poorly-drained soils and around the salt marshes; around the province. Macoun's record of *C. straminea* var. *festucacea* from Baddeck belongs here.

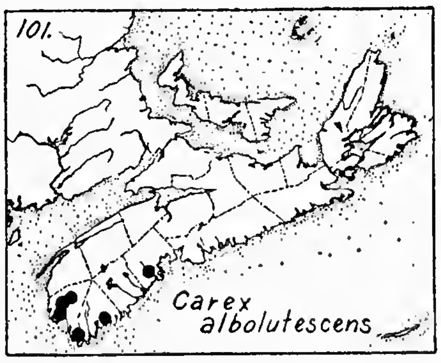
Salt marshes and their borders; Nfld. & Que. to Va.

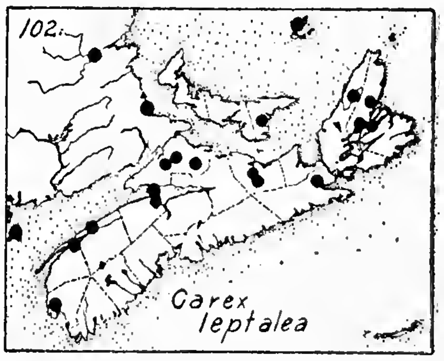
27. **C. cumulata** (Bailey) Mack., Bull. Torrey Bot. Club **49**: 366. 1922. Map 99. Fig 22.

Dry or moist open barrens; frequent from Yarmouth to Halifax and Cumberland Cos.; common on the cranberry bogs of the Annapolis Valley. A collection from Broad R., Queens Co., with the spikes 7-20 mm apart, has been named forma **soluta** Fern., Rhodora **44**: 285. 1942. A hybrid with *C. scoparia* was found on damp *Polytrichum*-covered plains at Middleton, Annapolis Co., growing with the parents and more abundant than either of them (Fernald, 1921). (*C. albolutescens*, var. *cumulata* Bailey).

Acid soils; N.S. to the pine barrens of N.J. west to Sask.







28. **C. silicea** Olney Map 100.

Sands, barrier beaches and rocks of the outer coast from Yarmouth Co. to northern C.B.; seldom absent on the shingle beaches in C.B.; common on the dunes and drier sand flats of Sable Is.

Acid soils; N.S. to Nfld. & south to Dela.

29. **C. albolutescens** Schwein. See Svenson, Rhodora **40**: 329-331. 1933. Map 101.

Somewhat general on the borders of the savannahs along the east branch of the Tusket R., Yarmouth Co.; rare in low woods and thickets by Butler's L., Gavelton; thicket bordering salt marsh, Villagedale, and moist *Polytrichum*-covered barrens near Clement Pond, Barrington, Shelburne Co. (*C. straminea* Willd. of Mackenzie, not of Gray's Man.).

La. near the coast to Mass, southern N.H. & N.S.; in the Mississippi Valley to Ind.

30. **C. projecta** Mack., Bull. Torrey Bot. Club **35**: 264. 1908.

Meadows, damp thickets and shaded swamps; scattered throughout. (*C. tribuloides* var. *reducta* Bailey, and including var. *cristata* Bailey of Macoun's Cat.).

Nfld. to B.C. south to D.C. & Iowa.

31. **C. adusta** Boott

A single plant was found growing among disturbed rocks by the roadside, Armdale, Halifax Co. (Fernald, 1922); not mentioned by Mackenzie as occurring in N.S. Plants from Truro belong here.

Dry acid soils; Nfld. to southern Me., northern N.Y. & west to Minn., Sask & Mackenzie; adventive in B.C.

32. **C. aenea** Fern. Fig. 22.

Apparently rare; dry *Polytrichum*-covered barren near the head of Abram R., Yarmouth Co.; dry open barrens, Springhill Junction, Cumberland Co.; and collected by Macoun in Point Pleasant Park, Halifax, the specimen being referred to *C. pratensis* in 1902 (Fernald, 1921).

Dry places; Lab. to Conn. west to B.C. & Yukon.

33. **C. argyrantha** Tuckerm., see Rhodora **40**: 328. 1938.

Sandy thicket, Middleton, Annapolis Co.; sand plains in the center of Kings Co. (*C. foenea* Willd including var. *perplexa*).

Dry woods; Que. & N.S. to Mich. south to Va.

SECT. 10. **POLYTRICHOIDEAE**

34. **C. leptalea** Wahl. Map 102. Fig. 22.

Wooded swamps; throughout the northern half of the province from Yarmouth to northern C.B.

. Bogs and wet meadows; Lab. to Alaska south to Fla. & Calif.

SECT. 11. **MONTANAE**

a. Staminate and pistillate spikes at most moderately separate, both near the top of an erect culm (Fig. 23, a, b).

b. Culms slender and very loosely cespitose, the individual ones separated by 2 cm or more; staminate spike 0.5-1 mm wide; scaly stolons present. 35. *C. novae-angliae*

b. Culms densely cespitose.

c. Perigynium-body elliptical; staminate spikes narrow, 0.75-2 mm wide; culms without horizontal stolons; pistillate scales straw-colored or merely purple-tinged (Fig. 23, b).

d. Culms 3-25 cm high, slender; leaves 0.5-1.5 mm wide, often overtopping the culms. 36. *C. albicans*

d. Culms 15-50 cm high, erect; leaves 2-4 mm wide, shorter than the culms. 37. *C. communis*

c. Perigynium-body orbicular or nearly so;staminate spikes 2-3.5 mm wide; culms very fibrillose at the base, with long horizontal stolons; pistillate scales reddish-brown.

e. Beak of the perigynia less than half the length of the body; staminate spike 2-3 mm wide. 38. *B. pensylvanica*

e. Beak of the perigynia nearly as long as the body; staminate spike 2.5-3.5 mm wide. 39. *C. lucorum*

a. Lower pistillate spikes widely separated, the peduncles arising from near the base of the culm; or all the spikes crowded near the base of the plant (Fig. 23, c).

f. Bract of the lowest non-basal pistillate spike leaflike, normally exceeding the culm; leaves thin and narrow; perigynia 2.5 mm long, short-beaked. 40. *C. deflexa*

f. Bract of the lowest non-basal pistillate spike scale-like and shorter than the culm, if rarely longer then auriculate and reddish-brown-tinged at the base; perigynia 3.2-4.7 mm long, the beak about as long as the body.

g. Perigynia subcoriaceous, the body glabrous to very sparsely short-pubescent above; leaf-blades short, thick, stiff and deep-green, 2.0-4.5 mm wide. 42. *C. tonsa*

g. Perigynia membranous, the body short-pubescent above; leaf-blades thinnish, light-green, erect or ascending, not stiff, 1.5-3 mm wide. 41. *C. umbellata*

35. **C. novae-angliae** Schwein. Fig. 23.

Common to scattered throughout; damp woods, pasture knolls and recent clearings.

Nfld. to Wisc. and locally south to Conn. & Penn.

36. **C. albicans** Willd.

Abundant in dry or moist peaty soil, even on knolls in sphagnous bogs; Yarmouth and Shelburne Cos. (Fernald,

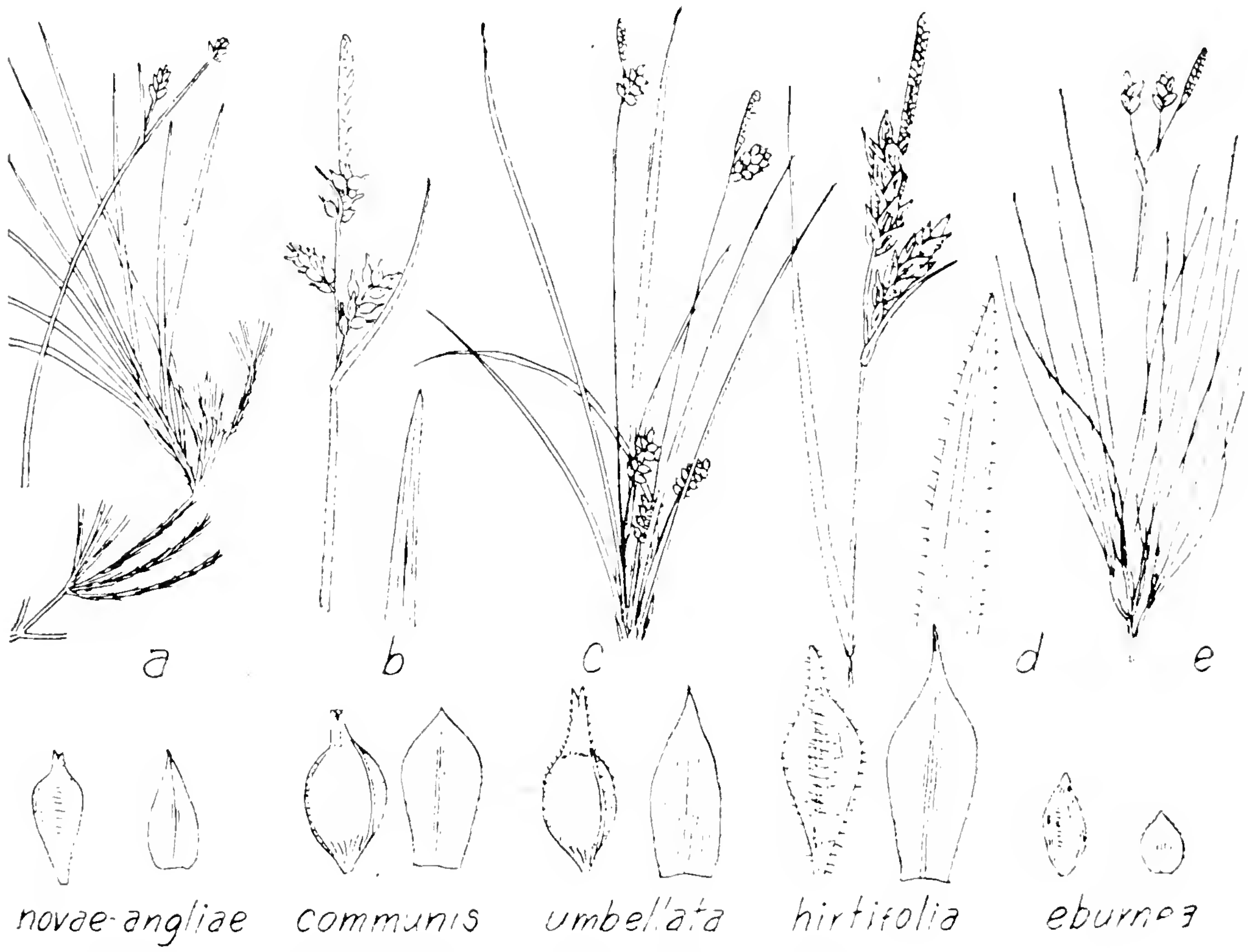


Fig. 23.—**Carex:** inflorescences, x 1; perigynia and scales, x 5.

1921); scattered east to Halifax and Cumberland Cos., the distribution here poorly known. (*C. varia* in part).

Dry woodlands and acid soil; P.E.I. to Fla.; around the Great Lakes.

37. **C. communis** Bailey Fig. 23.

Very common throughout: dry woodlands, roadsides and clearings.

N.S. to Minn. south to Ga., Ky. & Ark.

38. **C. pensylvanica** Lam.

Rare: a specimen from Bridgewater collected by Macoun and determined by Mackenzie is in the National Museum, Ottawa. No other collections are known.

Dry, often sterile soil; N.S. to N.D. south to S.C. & Iowa.

39. **C. lucorum** Willd.

Dry rocky and gravelly soil west of Bridgewater (Fernald, 1921); distribution otherwide unknown, but probably the plant is scattered. [*C. Pennsylvanica,* var. *lucorum* (Willd.) Fern.].

Dry open woodlands; N.S. to Wisc. south to N.C.

40. **C. deflexa** Hornem.

Scattered, probably throughout on light soils; Yarmouth, Liverpool & Truro. (Including *C. deflexa* var. *Deanei* Bailey of Macoun's Cat.).

Dry open woodlands; Greenland to Alaska south to Mass. & B.C.

41. **C. umbellata** Schkuhr, see Fernald, Rhodora **44**: 288-290. 1942. Fig. 23.

Sterile, sandy fields and roadsides in the Annapolis Valley and in Cumberland Co.; probably scattered elsewhere. (*C. rugosperma* Mack.).

N.S. & P.E.I. to Minn. south to Md.

42. **C. tonsa** (Fern.)Bickn., Bull. Torrey Bot. Club **35**: 492. 1908.

A specimen from Truro was identified by Mackenzie; it is scattered to common in the Annapolis Valley and in Cumberland Co. along sandy roadsides. (*C. umbellata,* var. *tonsa* Fern.).

N.S. to Minn. & Alta. south to D.C. & Ind.

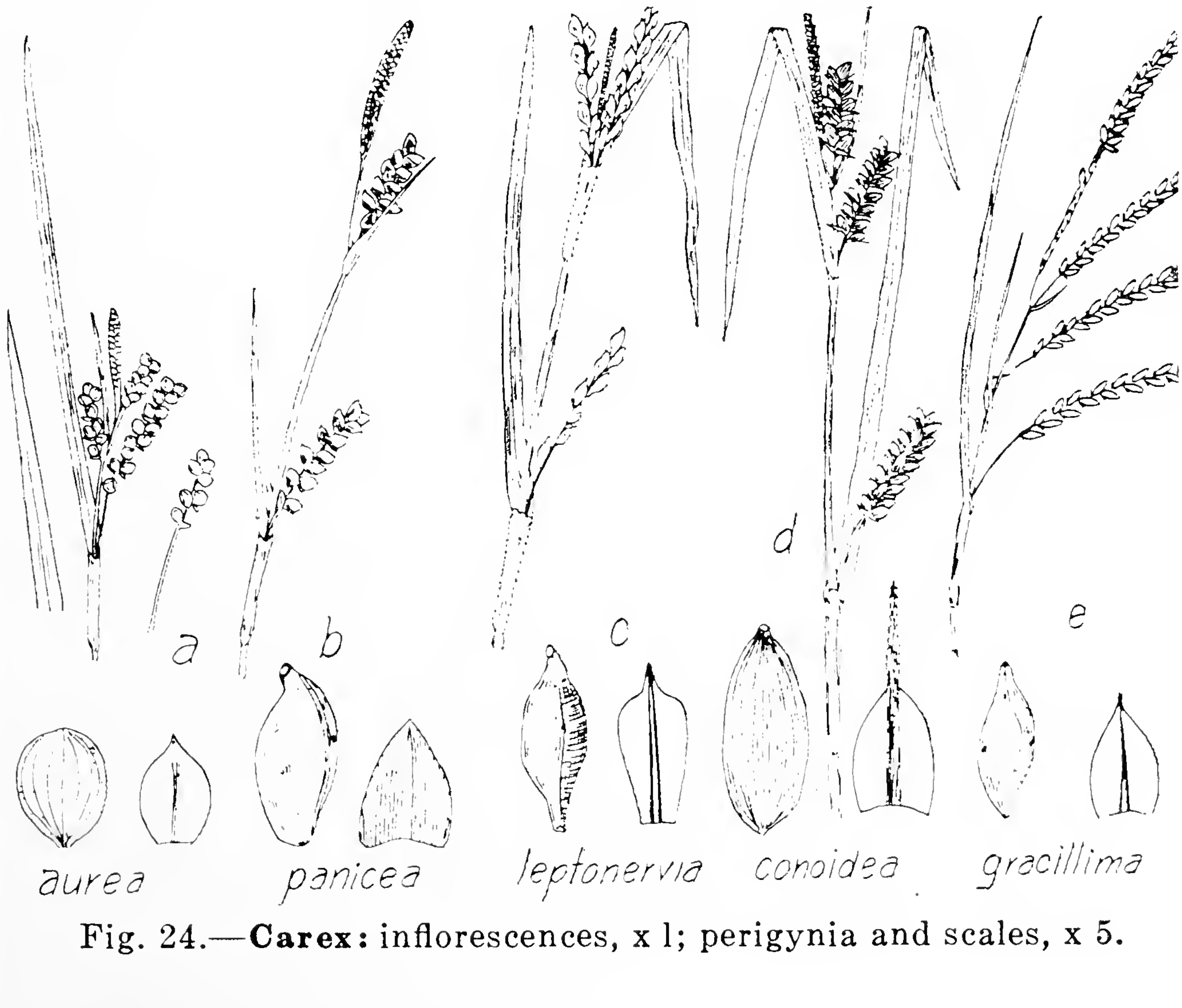


Fig. 24.—**Carex:** inflorescences, x 1; perigynia and scales, x 5.

SECT. 12. SCIRPINAE

43. **C. scirpoidea** Michx.

A specimen in the Canadian National Museum was collected by Macoun on the coast of northern C.B. near Glace Bay.

Dry open places in calcareous districts; Greenland to Alaska south to N.H., Colo., & B.C.; rare in arctic Eurasia.

SECT. 13. DIGITATAE

44. **C. pedunculata** Muhl.

Rare; collected on the North Mt. north of Annapolis and on the talus slopes of Cape Blomindon.

Dry woodlands in calcareous districts; Nfld. to B.C. south to Va., Iowa & S.D.

SECT. 14. TRIQUETRAE

45. **C. hirtifolia** Mack. Fig. 23.

Scattered to common on the intervales, rich alluvial meadows and grassy thickets in the calcareous districts near Shubenacadie and Brookfield.

N.S. to Minn. south to D.C. & Kans.

SECT. 15. ALBAE

46. **C. eburnea** Boott Fig. 23.

Rare on cliffs, talus slopes, or slopes under coniferous woods on gypsum; apparently found wherever gypsum exists in any amount in the province.

Nfld. to B.C. south to Va., Tenn. & Nebr.

SECT. 16. BICOLORES

47. **C. aurea** Nutt. Map 105. Fig. 24.

Common in the northern, more alkaline districts of the province from Annapolis Co. and Cumberland Co. to northern C.B. It is common along the basaltic North Mt.; often abundant in fields and low areas in Cumberland Co.; and in intervales and hillsides eastward.

Wet meadows and banks; Nfld. to B.C. south to Conn., Mich. & Calif.

SECT. 17. PANICEAE

a. Leaves and perigynia strongly glaucous; leaves quickly becoming plicate or involute; perigynia without a beak, filled by the achene. 48. *C. livida*

a. Leaves and perigynia not glaucous, bluish-green; leaves flat; perigynia with a minute beak, loose over the achene.

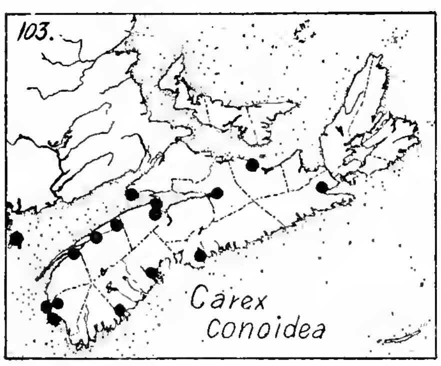
b. Perigynia 3.5-5 mm long. 49. *C. panicea*

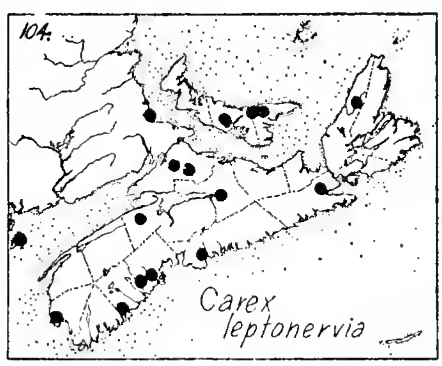
b. Perigynia about half as long. *C. panicea* var. *microcarpa*

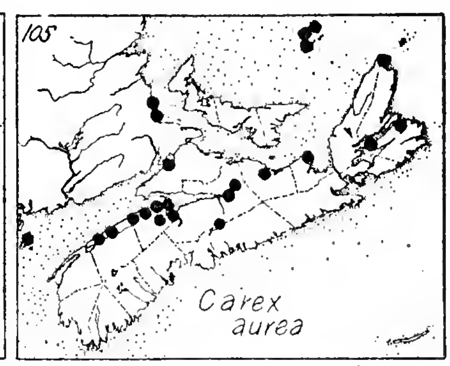
48. **C. livida** (Wahl.) Willd.

Mackenzie does not mention this species from N.S. Macoun lists it from Louisburg and from near Windsor. No specimens have been seen.

Sphagnous bogs or wet places; Lab. & Nfld. to Alaska south to Conn., Mich. & Calif.







49. **C. panicea** L. Fig. 24.

Damp, grassy or peaty slopes; local and perhaps introduced; abundant in Yarmouth Co.; scattered in other places east to Antigonish Co.

Var. **microcarpa** Sonder is known from thin, open humus by a roadside on the North Mt., above Belle Isle, Annapolis Co. (Fernald, 1922); Eu.

N.S. to Conn.; Eu. & western Asia.

SECT. 18. LAXIFLORAE

a. Leaves 3-10 mm wide; sterile shoots forming short culms; beak of perigynia very short, usually twisted.

b. Lowest bract almost smooth on the edges; perigynia 2.5-3.5 mm long, with numerous conspicuous nerves. 50. *C. ormostachya*

b. Lowest bract serrulate on the edges; perigynia 3.5-4.5 mm long, the nerves absent or very faint. 52. *C. leptonervia*

a. Leaves 7-20 mm wide; sterile shoots merely a tuft of leaves; perigynia 3-4.25 mm long, the beak conspicuous and nearly straight. 51. *C. laxiflora*

50. **C. ormostachya** Wieg., Rhodora **24**: 196. 1922.

Scattered in beech woods, South Mt., in Kings Co.

Woods, mostly in dry soil; N.S. & Que. to Minn. south to Mass. & Penn.

51. **C. laxiflora** Lam., see Fernald, Rhodora **44**: 315-318. 1942.

Annapolis Co.; damp clearings and open rocky woods, North Mt., Granville; the first authentic record from east of southern Maine (Fernald, 1922). Earlier records belong to the following species. (*C. anceps* Muhl.).

N.S. to Mich. south to N.C. & Ky.

52. **C. leptonervia** Fern., Rhodora **16**: 214. 1914. Map 104. Fig. 24.

Throughout, but rarer southwestward; rich woods and thickets. (*C. laxiflora* var. *leptonervia* Fern.).

Nfld. to Minn. south to N.J., N.C. & Wisc.

SECT. 19. GRISEAE

53. **C. conoidea** Schkuhr. Map 103. Fig. 24.

Sterile or peaty fields and meadows, often near the coast; frequent from Yarmouth to Antigonish and Pictou Cos.; probably throughout, but not yet collected in C.B.

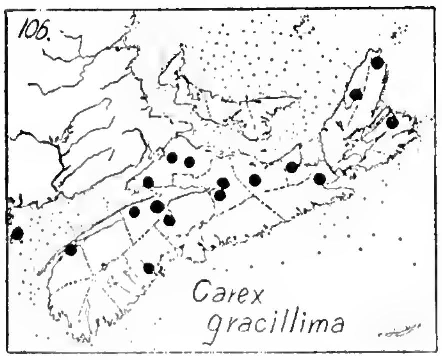
Nfld. to Minn. south to Dela., N.C., Ohio & Iowa.

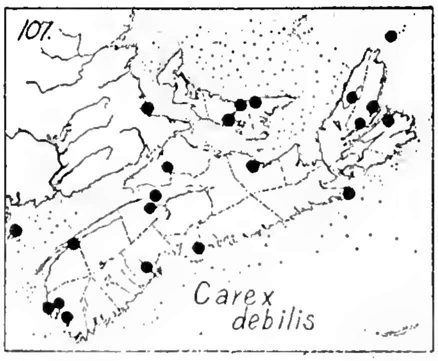
SECT. 20. GRACILLIMAE

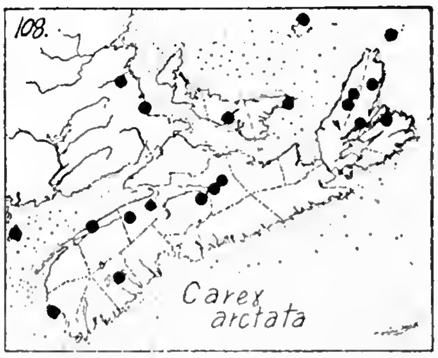
54. **C. gracillima** Schwein. Map 106. Fig. 24.

Dry or moist woods and thickets, wet meadows and roadsides; throughout. It is common in the northern counties and becomes rarer southwestward.

Nfld. to Man. south to Va., Ky. & Mo.







SECT. 21. **SYLVATICAE**

a. Pistillate spikes oblong-cylindric, 8-25 mm long; leaves soft-hairy; pistillate scales light-chestnut-brown. 55. *C. castanea*

a. Pistillate spikes linear, the larger 2.5-8 cm long; leaves not pubescent, except sometimes towards the base and at the mouth of the sheaths; pistillate scales greenish (Fig. 25, a).

b. Achenes slenderly stalked; pistillate scales mostly obtuse, the mid-vein not extending to the tip, about half as long as the perigynia. 56. *C. debilis*

n. Achenes sessile or barely stalked; pistillate scales cuspidate or aristate with the mid-vein extending to the tip, usually more than half the length of the perigynia. 57. *C. arctata*

55. **C. castanea** Wahl.

Mackenzie reports this plant from N.S.; a specimen was collected by Macoun near Black Brook, C.B.; and it is also known from near Aspy Bay, and from Bass R., N.B.

Dry thickets and on banks in calcareous regions; Nfld. to Minn. south to Conn., N.Y. and the Great Lakes region.

56. **C. debilis** Michx., var. **Rudgei** Bailey, see Fernald, Rhodora **44**: 310. 1942. Map 107.

Scattered to common throughout; in open thickets and meadows. (*C. flexuosa* Muhl.).

Dry woods and acid soils; Nfld. to Wisc. south to Va. & Mo.

57. **C. arctata** Boott. Map 108. Fig. 25.

Common from Digby and Cumberland Cos. to C.B.; rare in Digby and Yarmouth Cos.; woods and rich thickest, shaded banks.

Nfld. to Minn. south to Penn., Ohio. & Wisc.

SECT. 22. **EXTENSAE**

a. Perigynia 2-3.5 mm long, not at all or but little deflexed, the beak markedly shorter than the body, smooth or nearly so; culms bluntly triangular; plants small (Fig. 25, b).

b. Sheath of the lowest bract convex and prolonged upward at the mouth opposite the blade; perigynia with the beak nearly half as long as the broadly ovoid body. 58. *C. serotina*

b. Sheath of the lowest bract concave or truncate and not prolonged upward at the mouth; perigynia with the beak about one-third the length of the obovoid body. 59. *C. viridula*

a. Perigynia 3.5-6 mm long, at least the lower conspicuously deflexed, the beak about as long as the body; culms sharply triangular above (Fig. 25, c).

c. Beak of the perigynia smooth or nearly so, whitish or with age slightly tawny-tinged at tip; perigynia 3.5-4.5 mm long, concealing the scales. 60. *C. cryptolepis*

c. Beak of the perigynia serrulate, reddish-tinged at the tip; scales conspicuous.

d. Perigynia little inflated, 4-6 mm long; staminate spike normally sessile or nearly so.

e. Perigynia 4 mm long, the middle and upper not deflexed; leaves 2-4 mm wide; ligule mostly wider than long; achenes short-apiculate. 61. *C. laxior*

e. Perigynia 4.5-6 mm long, all except the uppermost deflexed; leaves 3-5 mm wide; ligule mostly longer than wide; achenes strongly apiculate. 62. *C. flava*

d. Perigynia markedly inflated, 4 mm long, not deflexed except the lower; staminate spike conspicuously long-peduncled; achenes strongly apiculate. 63. *C. lepidocarpa*

58. **C. serotina** Merat, see Nelmes, Jour. Bot. **77** 301-304. 1939.

Sphagnous swales, gravelly and rocky shores, and low pastures near the sea, often at the borders of rather brackish ponds or inlets; scattered around the province. A long spiked form has been collected at Margaretsville, Annapolis

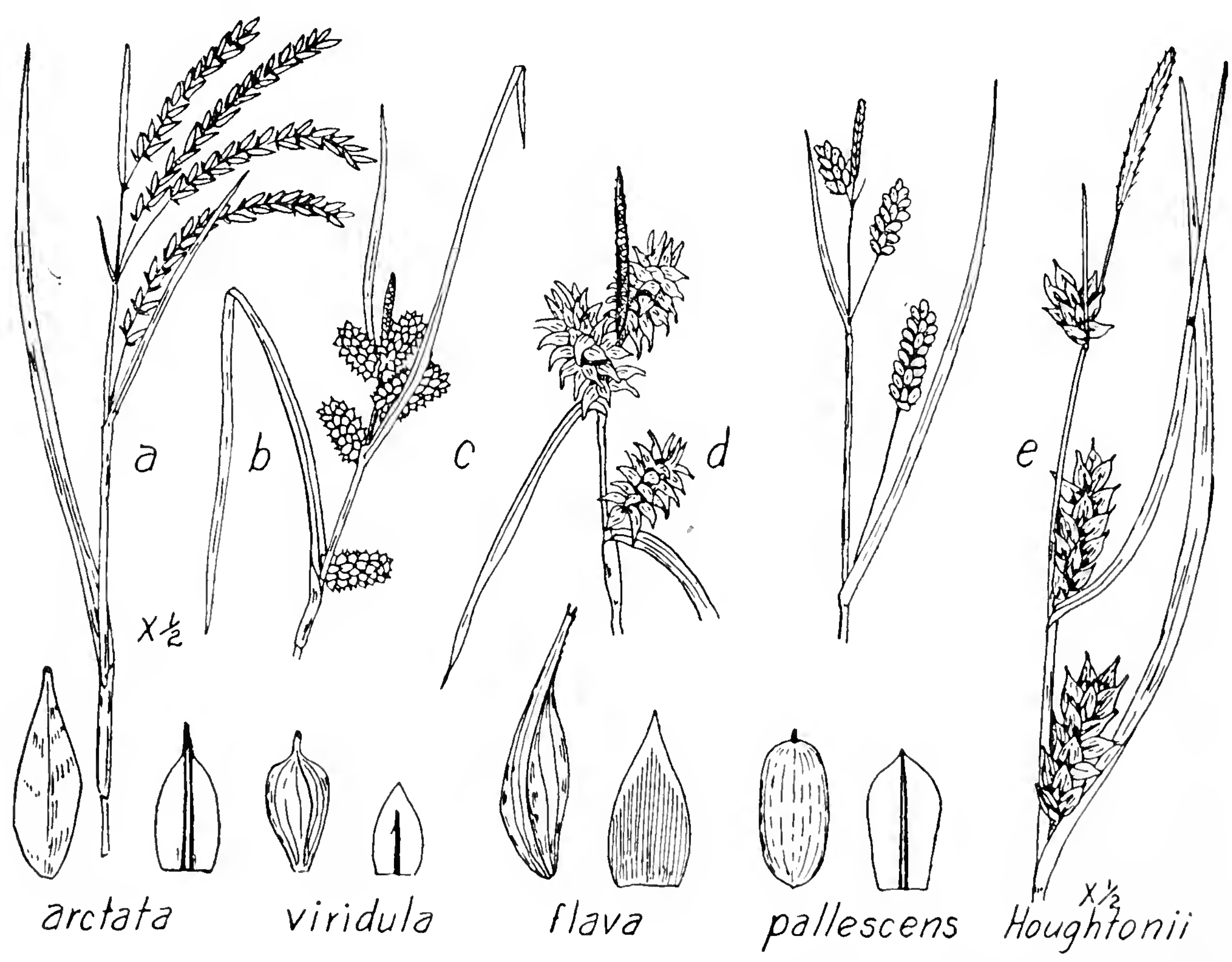


Fig. 25.—**Carex:** inflorescences, x 1; perigynia and scales, x 5.

Co., along the Bay of Fundy, and by Macoun at Baddeck (Fernald 1921). (*C. Oederi* Retz.).

Nfld. to Que. & N.S.

59. **C. viridula** Michx. Map 109. Fig. 25.

Common throughout; often growing in brackish marshes; frequent in bogs; typical of rocky or sandy beaches in the highlands and northern part of C.B.; frequently hybridizing with *C. flava* (Fernald, 1921). (*C. Oederi* var. *pumila*).

Seepy lake and river banks in calcareous areas; Nfld. to Alaska south to N.J., Ind. & Calif.; Japan.

60. **C. cryptolepis** Mack., Torreya **14**: 157. 1914.

Scattered; edges of ponds, bogs and swales; Lunenburg and Kings Co. east to Guysborough Co.

Wet meadows; Nfld. to Minn. south to N.J. & Ind.

61. **C. laxior** (Kukenth.) Mack., N.A. Flora **18**: 306. 1935

Probably local, very similar to the following species and doubtfully distinct; reported from a gravelly shore at Guysborough (Rousseau); and from N.S. by Mackenzie.

Swampy meadows in calcareous areas; N.S. & Que. to Me. & N.Y.

62. **C. flava** L. Fig. 25.

Frequent to common throughout; well-drained swamps, bogs, meadows, around the outside of the salt marshes, and in ditches and low areas.

Wet meadows; Nfld. to B.C. south to N.J., Penn. & Mont.

63. **C. lepidocarpa** Tausch

Mentioned by Mackenzie from N.S.; no specimens have been seen. (*C. flava* var. *elatior* Sclecht.).

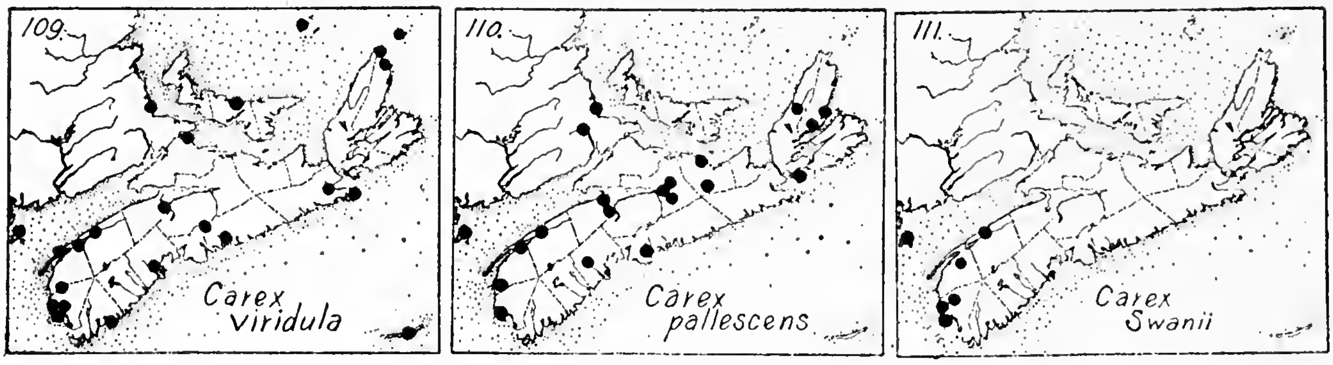
Swamp-meadows in calcareous districts; Nfld., St. Pierre and the Magdalens to Que., N.B. & N.S.; Eu.

SECT. 23. VIRESCENTES

a. Terminal spike staminate; perigynia glabrous. 64. *C. pallescens*

a. Terminal spike pistillate above and staminate at the base; perigynia white-hirsute. 65. *C. Swanii*

64. **C. pallescens** L., var. **neogaea** Fern., Rhodora **44**: 306.1942. Map 110. Fig. 25.



Common throughout; grassy meadows, sunny banks, fields and open thickets.

Nfld. to Wisc. south to N.J., Penn. & Ill.

65. **C. Swanii** (Fern.) Mack., Bull. Torrey Bot. Club **37**: 246: 1910. Map 111.

Local in Yarmouth Co.; dryish peaty barrens, Yarmouth; boggy pasture, Central Chebogue; scattered east to Annapolis Co. (*C. virescens* var. *Swanii* Fern.).

Dry woodlands and thickets; N.S. to Wisc. south to Tenn. & Ark.

SECT. 24. HIRTAE

a. Staminate scales not long-ciliate; foliage glabrous; leaf-sheaths not pilose at the mouth.
  b. Perigynia 5-6 mm long, conspicuously 15-20-ribbed, with the beak half as long as the body; teeth prominent, strongly pubescent within; leaves 2.5-4 mm wide; sandy soils. 66. *C. Houghtonii*
  b. Perigynia 2.5-5 mm long, the ribs obscured by dense pubescence; teeth of the short beak erect, glabrous within; leaves less than 2 mm wide, involute; wet or swampy places. 67. *C. lasiocarpa*
a. Staminate scales long-ciliate; foliage usually soft-hairy; leaf-sheaths pilose at the mouth. *68. C. hirta*

66. **C. Houghtonii** Torr. Fig. 25.

Sandy road-shoulders, abundant along the pavement south of Truro; common on sandy soil in Cumberland Co.

Nfld. to Sask. south to Me., Mich. & Minn.

67. **C. lasiocarpa** Ehrh., var. **americana** Fern., Rhodora **44**: 304. 1942. Map 112. Fig. 26.

Common throughout; peaty meadows, swales, borders of lakes and bogs; characteristic of bog-marsh formations about the head of the Fundy Marshes (Ganong); typical of lakes, ponds and swamps in northern C. B. (*C. filiformis* L.).

Nfld. to B.C. south to N.J., Iowa, Man. & Wash.

68. **C. hirta** L.

Abundantly naturalized on a sandy railway bank,

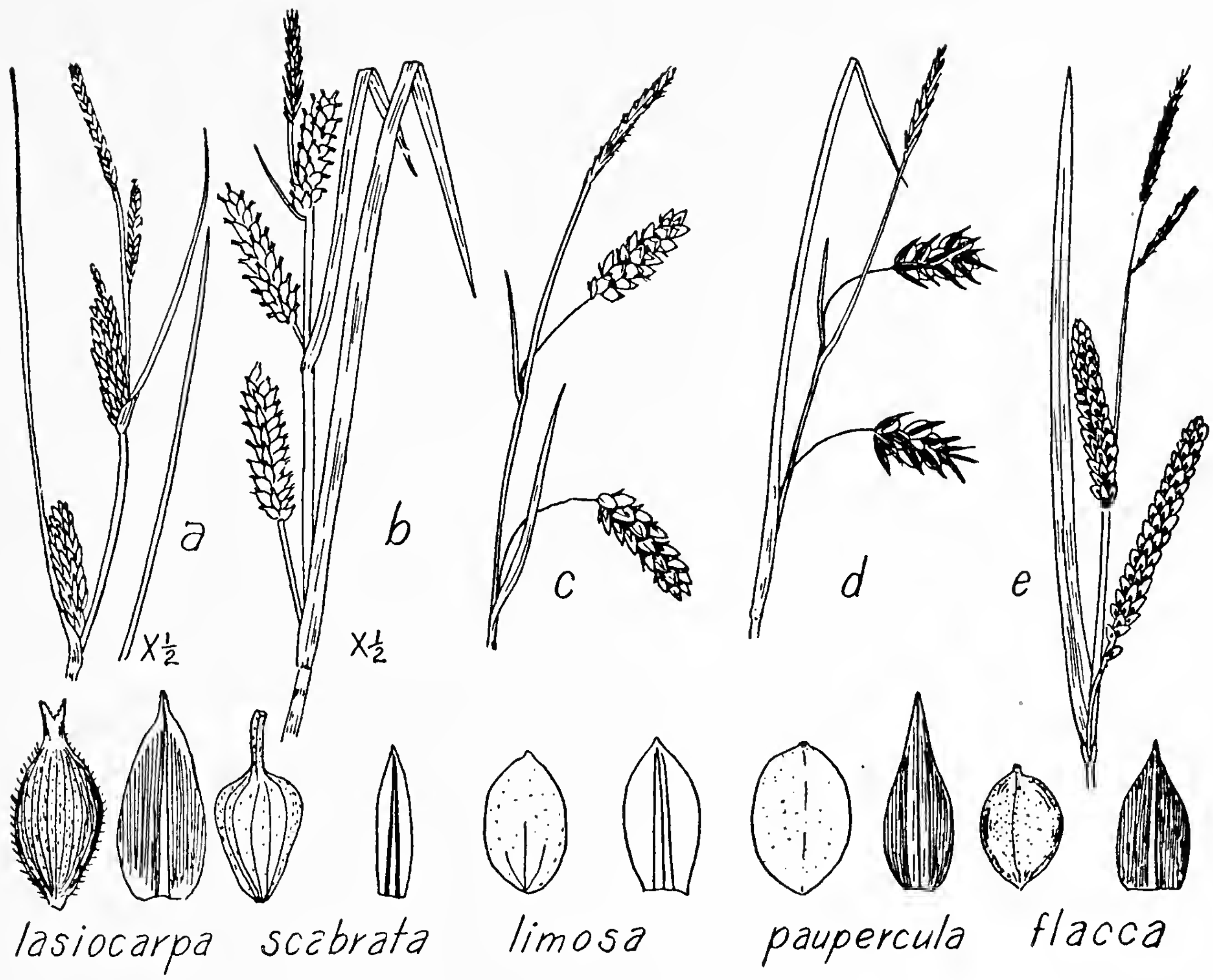


Fig. 26.—**Carex:** inflorescences, x 1 and ½; perigynia and scales, x 5.

Annapolis Royal; formerly collected in a pastured field at Charlottetown, P.E.I. (Fernald, 1922).

Introduced from Eu.; locally established in P.E.I. to N.Y. & Penn.; Ore.

SECT. 25. **ANOMALAE**

69. **C. scabrata** Schwein. Map 113. Fig. 26.

Throughout the northern part of the province from Digby Co. to northern C.B.; alluvial woods, rich thickets, along woodland streams, and in well-drained swamps, usually in mucky soil or in seepage areas.

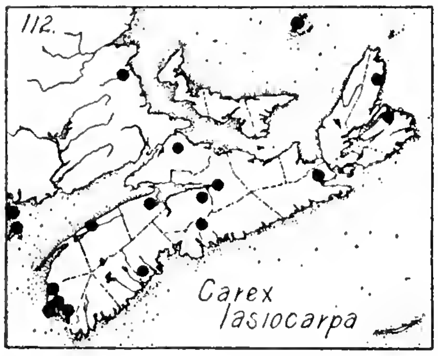
N.S. to Mich. south mostly in the mts. to S.C. & Tenn.

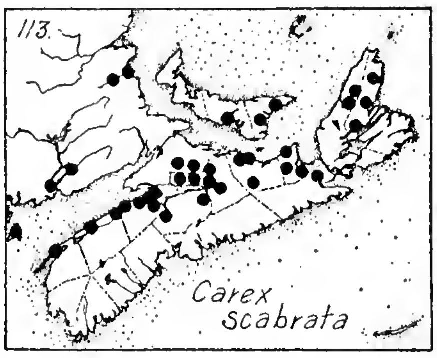
SECT. 26. **PENDULINAE**

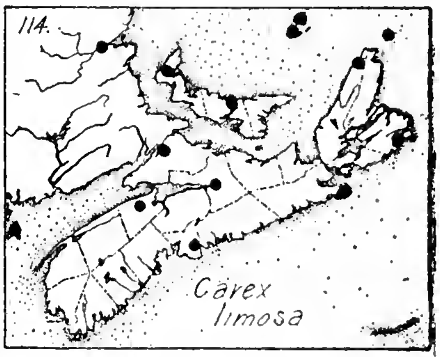
70. **C. flacca** Schreb. Fig. 26.

This species, reported by Macoun in 1888 from dry, clay banks on the railway cutting just outside of Windsor, is now a very abundant and variable species throughout this gypsiferous region, often growing in grassy pastures near the gypsum cliffs. (*C. glauca* Murr.).

Naturalized; N.S., Que., Ont. & Jamica; Asia, Eu. & Africa.







SECT. 27. **LIMOSAE**

a. Plant strongly stoloniferous; leaves glaucous, 1-3 mm wide; pistillate scales ovate to sub-orbicular, equalling the perigynia.
71. *C. limosa*

a. Plant loosely cespitose; leaves deep-green, 2-4 mm wide; pistillate scales lanceolate or ovate-lanceolate, exceeding the perigynia.
72 *C. paupercula*

71. **C. limosa** L. Map 114. Fig. 26.

Common in C.B. and scattered east to Cumberland and Kings Cos.; floating mat at the edge of ponds, in sphagnum swamps, or in poorly-drained bogs.

Nfld. to Yukon south to Dela., Iowa & Calif.

72. **C. paupercula** Michx., including vars. *irrigua* and *pallens*. Map 115. Fig. 26.

Common throughout; swampy areas, bogs and wet sphagnum; often in spruce or open bogs about the heads of the salt marshes or near the sea. The two varieties are considered to be merely trivial forms. (*C. Magellanica* acc. Ganong).

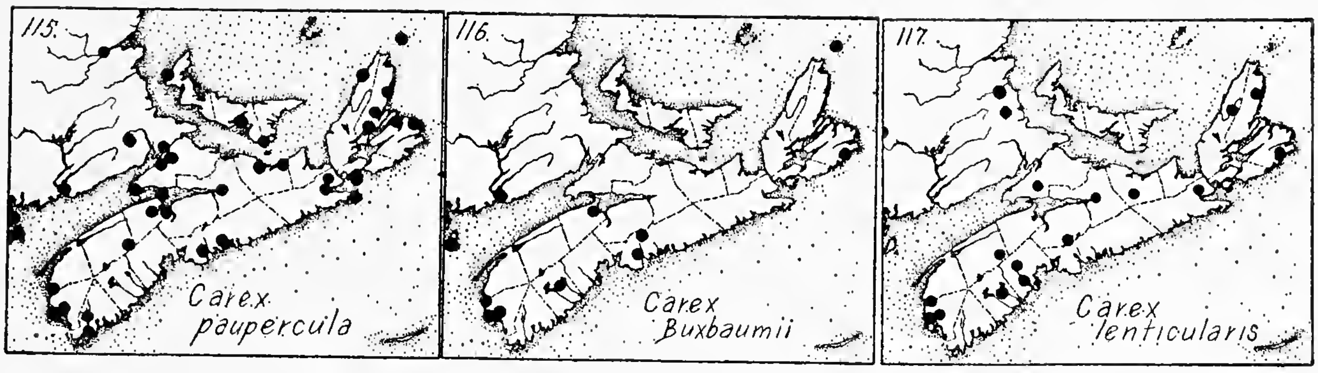
Nfld. to Alaska south to Penn., Minn. & Utah.

SECT. 28. **ATRATAE**

73. **C. Buxbaumii** Wahl. Map 116.

Local and rare; swamps, swales and in marshes, mostly near the sea. (*C. polygama* Schkuhr).

Swamps and meadows in calcareous places; Nfld. to Alaska south to Ga., Colo & Calif.; Eurasia.



SECT. 29. **ACUTAE**

a. Culms aggregated close to the summit of the culm, the lower progressively longer, producing a broom-like effect; scales obtuse; perigynia conspicuously nerved ventrally (Fig. 27, a).
  b. Spikes dense, 2-4 cm long; perigynia oval, 1.75-2.0 mm long. 74. *C. lenticularis*
  b. Spikes loose, 2.5-5 cm long; perigynia tapering, 2.0-2.8 mm long. *C. lenticularis* var. *Blakei*

a. Culms not closely aggregated or not producing a broom-like effect.
  c. Lower sheaths conspicuously fibrillose with a net-work of fibrous lines across the ventral side; plants tall (Fig. 27, c). 77. *C. stricta*
  c. Lower sheath not conspicuously fibrillose.
    d. Spikes erect; staminate spike one and the pistillate ones stout and 1-4 cm long, or several and the pistillate spikes slender; beak of the perigynia usually not twisted.
      e. Perigynia with strongly-raised nerves on the ventral face; leaves 1.5-2.5 mm wide (Fig. 27, b).
        f. Plants loosely cespitose; pistillate spikes crowded, 1-4 cm long, densely-flowered. 75. *C. nigra*
        f. Plants densely cespitose, to 7.5 dm high; pistillate spikes scattered, relatively loosely-flowered, about 4 cm or more in length. *C. nigra* var. *strictiformis*
      e. Perigynia nerveless ventrally or only obscurely impressed-nerved.
        g. Plant slender, 2-8 dm high; spikes 1-4 cm long; upper part of culm obtusely angled and smooth; perigynia mostly elliptic and broadest below the apex. 76. *C. aquatilis*
        g. Plant coarse, to 1.5 m high; spikes to 10 cm long; upper part of culm sharply angled, smooth or scabrous; perigynia mostly obovate and broadest towards the apex. *C. aquatilis* var. *altior*
    d. Spikes widely spreading or drooping; staminate spikes solitary, the pistillate ones slender, 2-7.5 cm long; beak of the perigynia usually prominent and twisted (Fig. 27, d). 78. *C. torta*

74. **C. lenticularis** Michx. Map. 117. Fig. 27.

Gravelly and sandy lake shores; throughout the province wherever the proper habitat occurs; commonest from Yarmouth to Halifax Co.

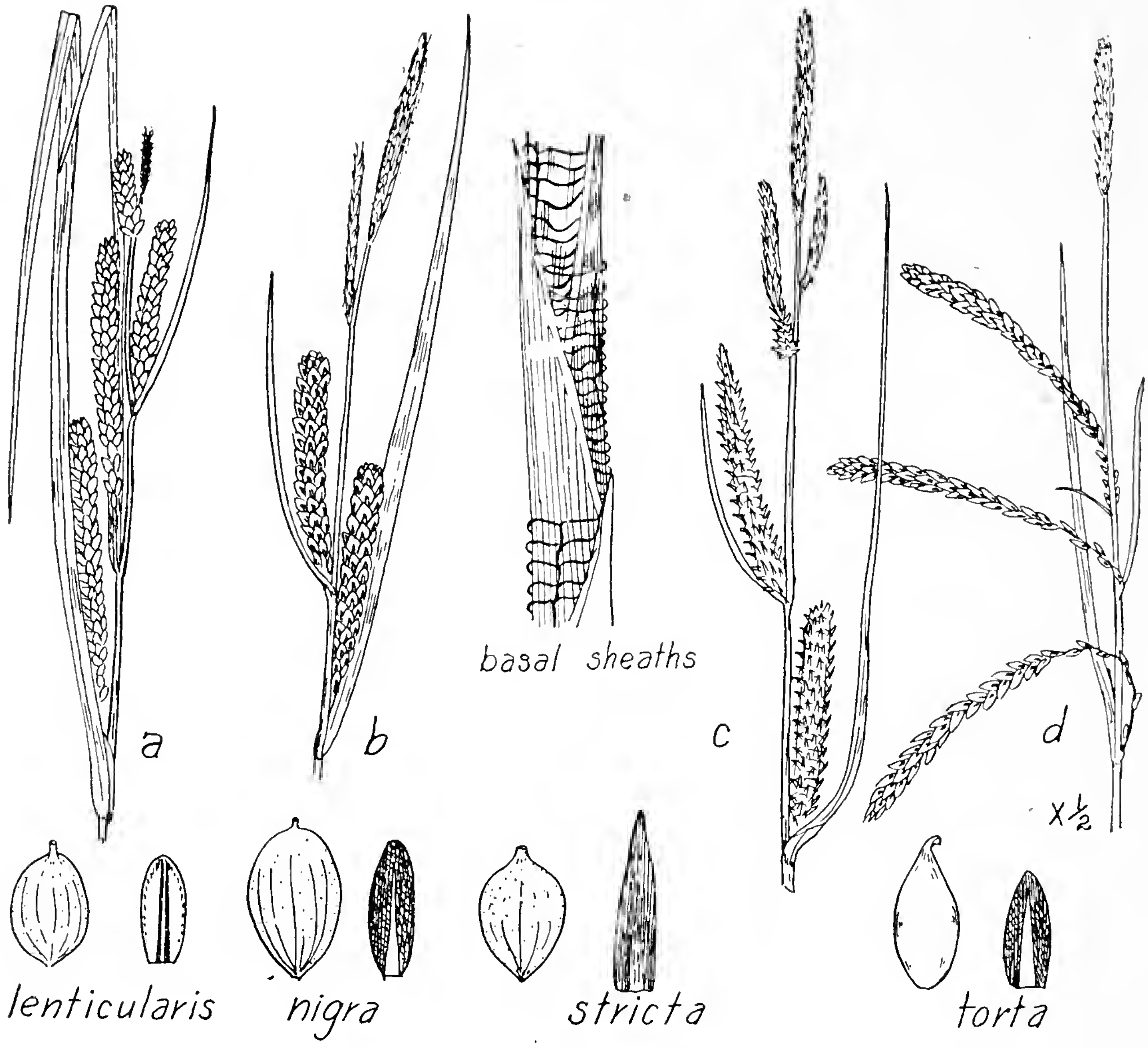


Fig. 27.—**Carex:** inflorescences, x 1 and ½; perigynia and scales, x 5.

Var. **Blakei** Dewey, in Wood, Class-Book, ed. 1861: 755, was first described from Me. It is known in Canada from scattered areas in N.S. & N.B. cobbly beach of Wentzell L., Lunenburg Co. and at Ingonish, C.B. (Fernald, 1922); stony strand of First Christopher Lake, South Brookfield, Queens Co. (Weatherby, 1942).

Lab. & Nfld. to Mackenzie south to Mass. & Minn.

75. **C. nigra** (L.) Reich., see Fernald, Rhodora **44**: 300-302. 1942. Map 118. Fig. 27.

Common throughout; poorly-drained soil, near the coast, in meadows, along streams and low areas in fields, often growing in large pure colonies in cut-over meadows where the taller grasses or sedges have been eliminated. (*C. acuta* L. *C. Goodenowii*). Var. **strictiformis** (Bailey) Fern. Rhodora **44**: 299. 1942 is the larger extreme, widely distributed in brackish or fresh habitats in the province.

Greenland to R.I.; Eu.

76. **C. aquatilis** Wahl.

Swamps and edges of bogs; on the plateau of northern C.B.; grading into the following variety. Arctic America south to Nfld. C.B., Gaspe, and in the mts. to N.M. & Calif.

Var. **altior** (Rydb.) Fern., Rhodora **44**: 295-298. 1942, is found in ditches, flood-plains, around lakes and ponds; rather common, especially in the northern counties. (*C. substricta* (Kukenth) Mack. *C. aquatilis* var. *substricta. C. aquatilis* var. *elatior* Bab.).

Nfld. to B.C. south to N.J., Ind., Neb. & Ore.

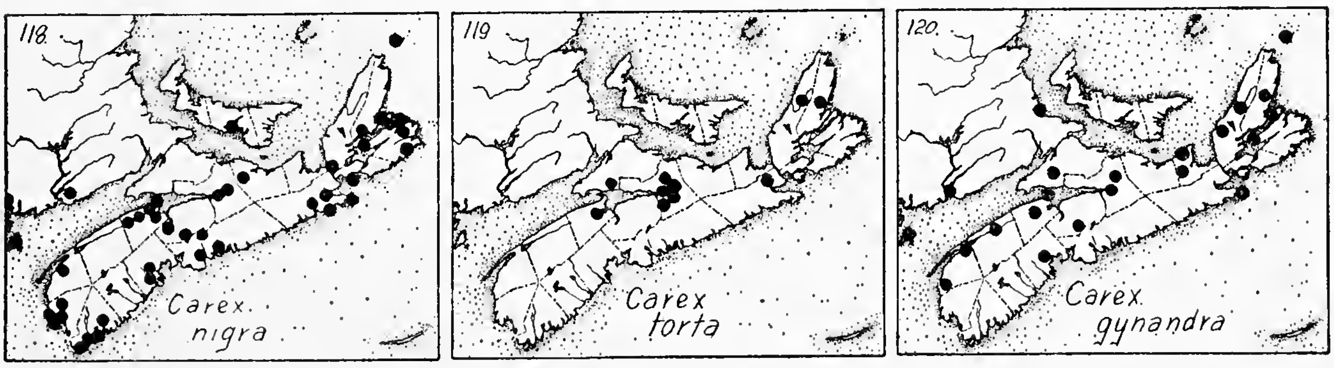
77. **C. stricta** Lam. Fig. 27.

The status of this species and its variety is rather obscure for the province. Mackenzie does not admit *C. stricta* to the flora of N.S., although collections in herbaria are often named this. Like the complex of *Scirpus acuta* and *S validus*, I believe that it should be further studied in the field before a satisfactory disposition can be made. At any rate one or both are common, particularly in the north-central counties, being often the dominant vegetation over large areas of poorly-drained depressions, in bogs or swales. The key from the N.A. Flora is given for further study.

a. Plants forming beds, with long horizontal stolons numerous; leaf-blades glaucous-green, light-green, or blue-green, flat or nearly so to base; leaf-sheaths markedly hispidulous ventrally and with a narrow hyaline jagged margin at mouth. Var. *strictior* (Dewey) Carey

a. Plants very densely cespitose, forming dense tussocks, long horizontal stolons usually not conspicuous; leaf-blades deep-green, channeled and keeled towards the base; leaf-sheaths smooth ventrally and without a narrow hyaline jagged-ciliate margin at mouth. *C. stricta*

N.S. to Minn. south to N.C. & Tex.



78. **C. torta** Boott Map 119. Fig. 27.

Common from Annapolis Co. to C.B.; characteristic of brooksides, margins of rivers, on boulder plains, occasionally beside lakes. The habitat is widely different from that of most other members of this section.

Rocky stream beds; N.S. to Minn. south to N.C. & Ark.

SECT. 30. **CRYPTOCARPAE**

a. Long horizontal stolons or rootstocks absent; plants of non-brackish habitats only; spikes long and usually drooping (Fig. 28, a).

b. Sheaths rough-hispidulous on the ventral side; lower pistillate scales tapering into the awn.

c. Culms tall with leaves 4-12 mm wide; pistillate spikes 2.5-10 cm long, drooping; perigynia to 3.5 mm long. 79. *C. gynandra*

c. Culms shorter, with leaves 4-6 mm wide; pistillate spikes 1-3.5 cm long, sub-erect; perigynia 2.5-3 mm long. *C. gynandra* var. *simulans*

b. Sheaths smooth on the ventral side; lower pistillate scales mostly abruptly contracted into the awn.

d. Spikes moderately separated, spreading to drooping, 3-10 cm long; pistillate scales all exceeding the perigynia. 80. *C. crinita*

d. Spikes aggregated towards the top of the culm, ascending to spreading, not over 3.5 cm long; pistillate scales not exceeding the upper perigynia and commonly less than twice as long as the lower. *C. crinita* var. *minor*

a. Long horizontal stolons or creeping rootstocks present; plants of tidal flats or saline marshes.

e. Spikes rarely erect, stout and elliptical, long-stalked; scales very long-awned (Fig. 28, c). 81. *C. paleacea*

e. Spikes erect, sessile or nearly so, long and slender; pistillate scales acute, cuspidate or short-awned, much longer than the perigynia. 82. *C. recta*

79. **C. gynandra** Schwein. Map 120.

General throughout; ditches, moist places, in clumps along roadsides, by streams and in swampy woodlands. (*C. crinita* var. *gynandra* (Schwein.) Schwein. & Torr.) Swampy wood-lands Nfld. to Wisc. south to Fla. & La.

Var. **simulans** (Fern.) n. comb. was collected in a woodland on St. Paul Island (Perry, 1931). It is a northern var. ranging from Nfld. south to Vt. & Mass. (*C. crinita* var. *simulans* Fern.).

80. **C. crinita** Lam. Map. 121. Fig. 28.

Scattered from Kings and Cumberland Co. to northern C.B.; wet meadows, flood plains, along brooks and streams, and in ditches. N.S. to Minn. south to N.C. & Tex.

Var. **minor** Boott, see Weatherby, Rhodora **44**: 232. 1942. This smaller extreme is found in the south-

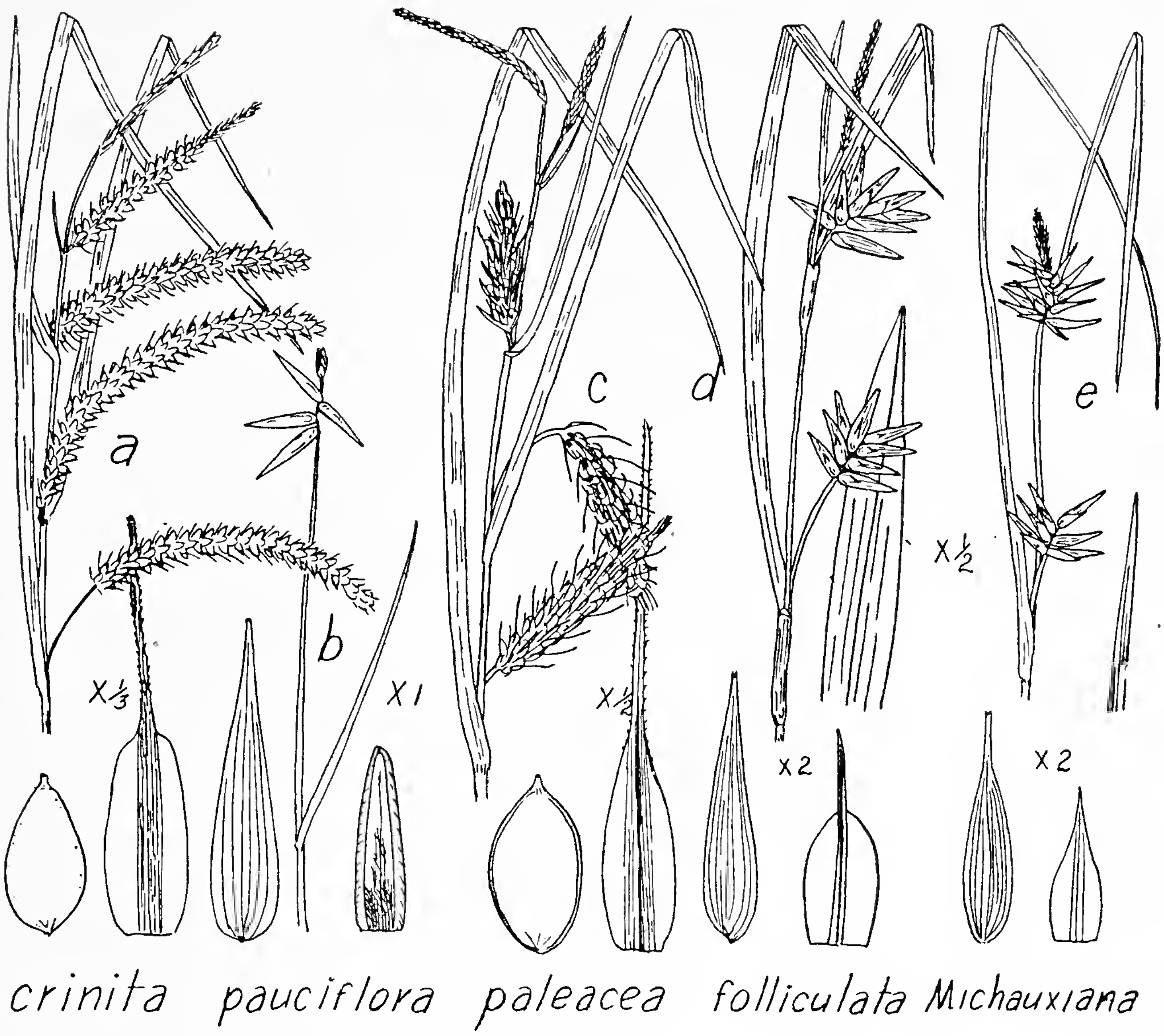


Fig. 28.—**Carex:** inflorescences; perigynia and scales, x 5 and x 2.

western counties and extends east at least to the middle of the province. Most of the specimens northward, however, are luxuriant and very long-spiked. N.S. to N.Y.

81. **C. paleacea** Wahl. Map 122. Fig. 28.

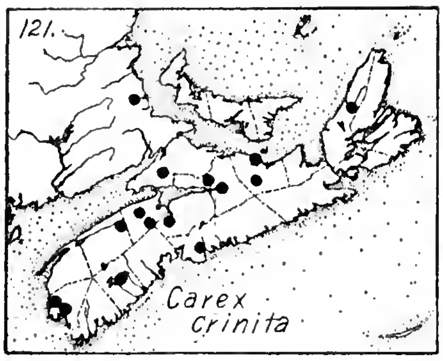
Common around the coast; growing in large pure areas around the heads of the salt marshes, or scattered with other salt marsh plants where the soil is more brackish; occasionally growing in swales or in pockets of the cliffs near the salt water. (*C. paleacea* var. *transatlantica* Fern. *C. maritima* of Gray's Man.).

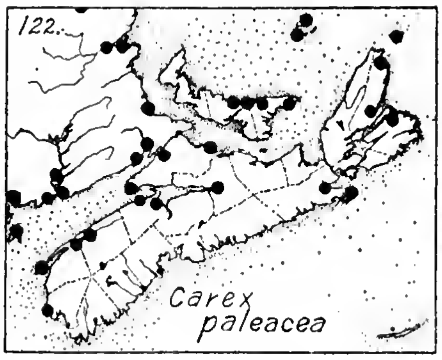
An extreme form with very short, and short-stalked, pistillate spikes which are erect instead of drooping, has been named forma **erectiuscula** Fern., Rhodora **44:** 293. 1942.

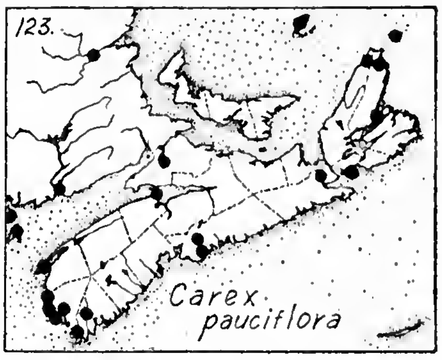
Salt meadows; Greenland & Nfld. south to Mass.; Eu.

82. **C. recta** Boott.

Common in parts of the province and possibly around the whole coast; brackish meadows, heads of the salt marshes and coastal swales. It much resembles *C. strictior* and may







occasionally hybridize with it. (*C. salina* vars. *cuspidata* Wahl. & *kattegatensis* (Fries) Almq.).

Lab. to Mass. and west to Alaska; Eu.

SECT. 31. **ORTHOCERATES**

83. **C. pauciflora** Lightf. Map 123. Fig. 28.

Common throughout, characteristic of sphagnum bogs, especially near the coast; common in northern C.B. in bogs, along flood-plains or even out on dryish heaths and barrens.

Nfld. to Alaska south to Conn., Minn. & Wash.; Eurasia.

SECT. 32. **FOLLICULATAE**

a. Leaves 2-4 mm wide; bract-sheaths concave at the mouth; staminate spikes 5-15 mm long, sessile or very short-stalked.
84. *C. Michauxiana*

a. Leaves 3.5-16 mm wide; upper or all bract-sheaths prolonged at the mouth; staminate spikes 12-30 mm long, long-stalked.
85. *C. folliculata*

84. **C. Michauxiana** Boeckl. Map 124. Fig. 28.

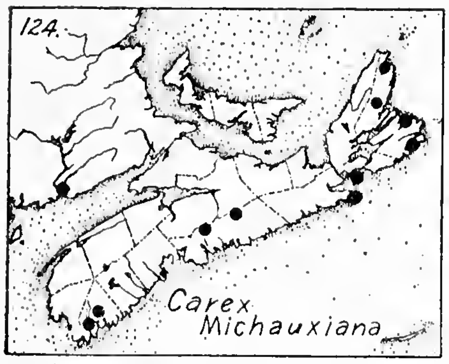
Rare in the southwestern counties, becoming commoner east to C.B.; boggy savannah, Sable R., Shelburne Co. & swale bordering Grand L., Halifax Co. (Fernald, 1921); characteristic of mountain swamps, sandy or rocky beaches and in poorly-drained swamps in C.B. (*C. abacta* Bailey).

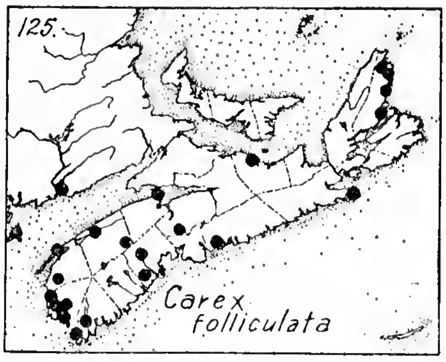
Nfld. to Ont. south to Penn.; Asia.

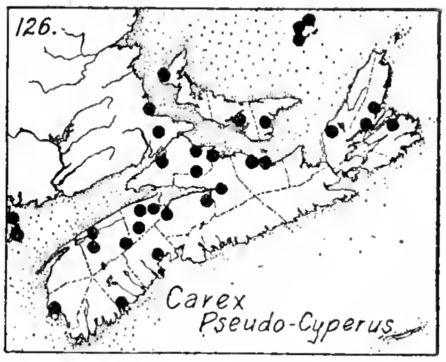
85. **C. folliculata** L. Map 125. Fig. 28.

Throughout; wet woods, swales and thickets; scattered in Kings Co.; common on the quartsite or granitic areas; characteristic of wooded swamps in C.B.

Nfld. to Wisc. south to N.C.







SECT. 33. **PSEUDO-CYPEREAE**

86. **C. Pseudo-Cyperus** L. Map 126. Fig. 29.

Rare in the southwestern counties (Fernald, 1921); scattered from Annapolis and Queens Cos. to C.B., never abundant; wet meadows, undrained ponds, swampy thickets and grassy swales.

Nfld. to Sask. south to Penn. & Minn.

86a. **C. comosa** Boott.

An examination of some specimens of *C. Pseudo-Cyperus* collected in swales east of Aylesford near the Caribou Bog showed one plant of the closely allied *C. comosa.* This plant has also been recently collected in other parts of the Valley by Mr. David Erskine. It is distinguished from *C. Pseudo-Cyperus* by the fact that the teeth of the perigynia are up to 2 mm or more long and strongly spreading, instead of being short and erect.

N.S. to Wash. south to Fla. and Calif.

SECT. 34. **PALUDOSAE**

87. **C. lacustris** Willd. Fig. 29.

Local, growing between brackish marshes and the *Typha latifolia* zone bordering the upland; border of brackish marsh near Yarmouth; often growing in large pure colonies around the estuaries at the head of the Bay of Fundy. (*C. riparia* Curtis. *C. riparia* var. *lacustris* (Willd.) Kuk.).

N.S. & Que. to Man. south to D.C. & Iowa.

SECT. 35. **VESICARIAE**

a. Pistillate scales, except rarely the lowest, without long rough awns.
  b. Pistillate spikes oblong to cylindrical; leaves flat, over 3 mm wide.
    c. Bracts usually not much longer than the inflorescence; perigynia very rarely reflexed; plants with creeping rootstocks.

d. Perigynia with smooth beaks; spikes cylindrical with 30-150 perigynia.

e. Perigynia sub-globose, loosely ascending; spikes 4-8 mm wide; basal sheaths rather fibrillose and without blades; culms sharply triangular above; plants with short rootstocks (Fig. 29, c).
88. *C. vesicaria*

e. Perigynia narrower, often spreading; spikes various; basal sheaths not fibrillose, with leaf-blades; culms rather obtusely-triangular above; long slender rootstocks present (Fig. 29,d).

f. Plant 3-6 dm high; leaves canaliculate, 3-4 mm wide; pistillate spikes 6-8 mm thick; scales short, blunt to acute; perigynia 3-5 mm long. 89. *C. rostrata*

f. Plant 4-12 dm high; leaves flat, 4-12 mm wide; pistillate spikes denser, 10-20 mm thick, the scales acuminate to aristate; perigynia 4-10 mm long. *C. rostrata* var. *utriculata*

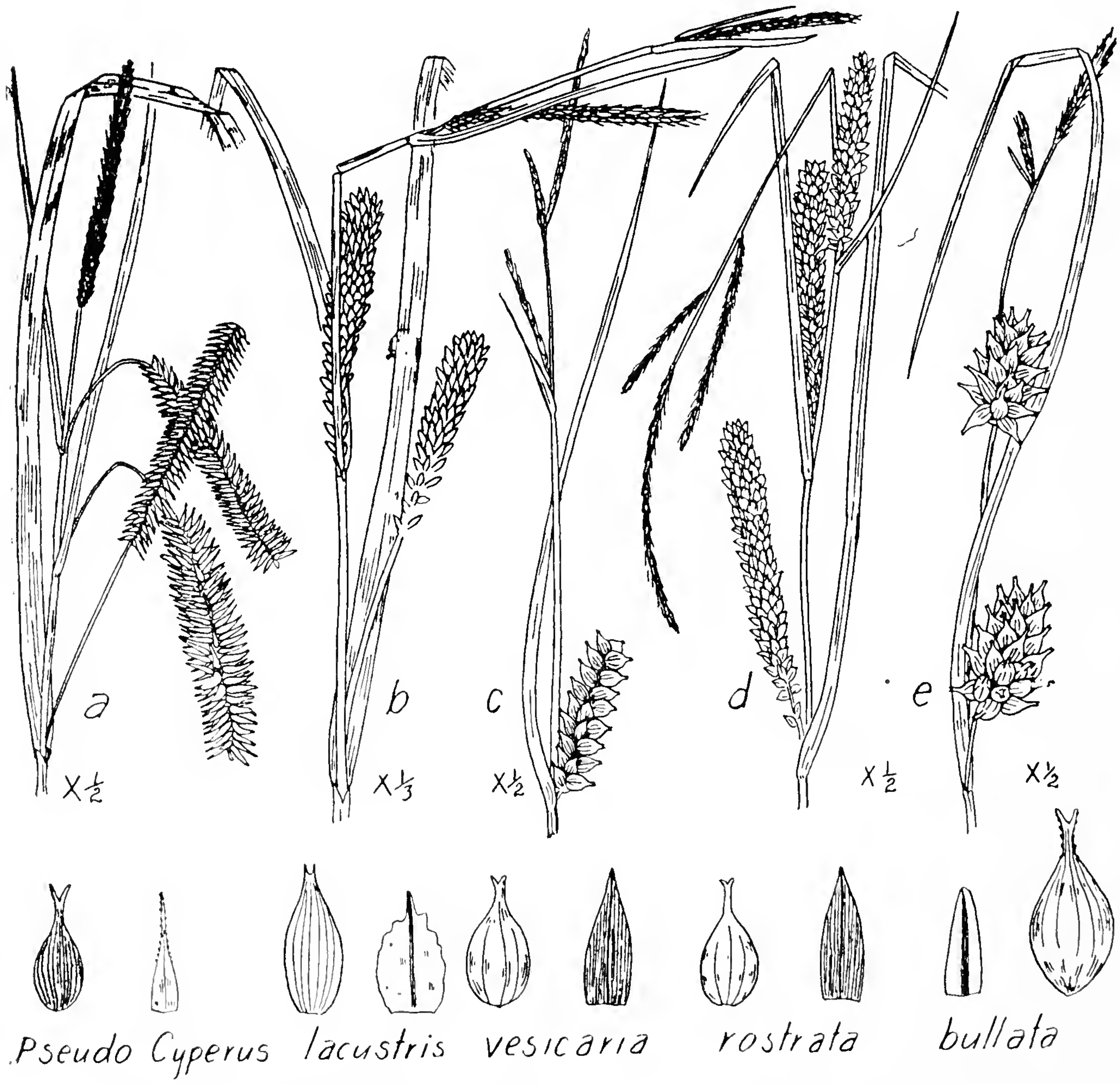


Fig. 29.—**Carex:** inflorescences; perigynia and scales, x 2.

d. Perigynia with rough beaks; pistillate spikes short, with 20-40 perigynia; culms slender, sharply triangular (Fig. 29, e).
90. *C. bullata*

c. Bracts several times the length of the inflorescence; perigynia reflexed to widely spreading; culms cespitose, without long horizontal stolons. 91. *C. retrorsa*

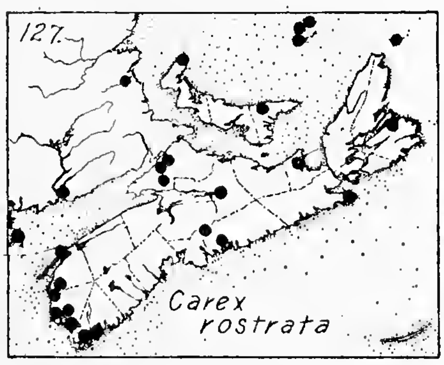
b. Pistillate spikes small, globose, 3-15-flowered; leaves 1-3 mm wide, strongly involute (Fig. 30, a). 92. *C. oligosperma*

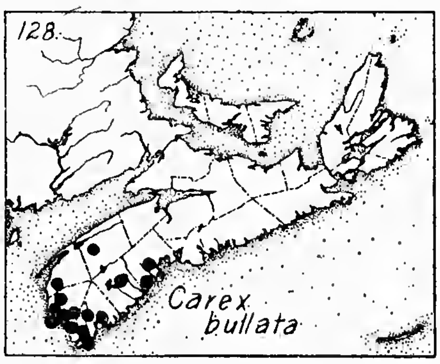
a. Pistillate scales with long, rough awns (Fig. 30, b). 93. *C. lurida*

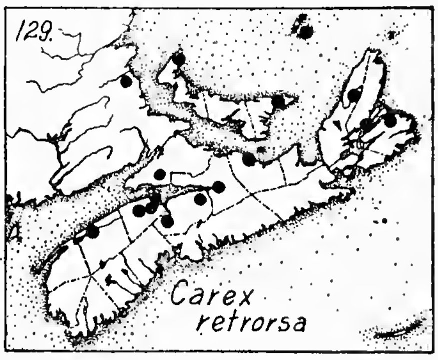
88. **C. vesicaria** L. Fig. 29.

Scattered throughout, very variable; meadows, intervales and along streams. The commoner varieties are: var. **jejuna** Fern. with pistillate spikes 5-8 mm thick; var. **distensa** Fries, with these spikes 10-15 mm thick, collected at Gavelton, Yarmouth Co.; and var. *laurentiana* Fern., Rhodora **35**: 232. 19-33, which ranges from Nfld. to Grand Manan should be found in the northern parts of the province. It has the spikes 7-12 mm. thick with very long and broad, usually dark-purple scales. A report of *C. Grahami* from Ingonish, Rhodora **3**: 49. 1901, probably belongs here; and also Macoun's records of *C. monile* Tuckerm.

Nfld. to B.C. south to Dela. & Calif.; Africa; Eurasia.







89. **C. rostrata** Stokes. See Fernald, Rhodora **44**: 324-331. 1942, and Nelmes, Jour. Bot. **80**: 109-112. 1942. Map 127. Fig. 29.

Rare; swamp on St. Paul Is., northern C.B. (Perry, 1931). This is the northern plant which barely reaches south to N.S.

Var. **utriculata** (Boott) Bailey is scattered throughout; wet meadows, open wet pastures and in ditches and swales.

Lab. to B.C. south to N.S., N. Eng., Minn. & Calif.; Eurasia.

90. **C. bullata** Schkuhr, var. **Greenei** (Boeckl.)Fern. Map 128. Fig. 29.

Abundant in the southwestern counties, and scattered east to Annapolis and Lunenburg; swales, boggy meadows, wet woods and edges of streams and lake shores.

Ga. north to Me.; N.S.

91. **C. retrorsa** Schwein. Map 129.

Annapolis Co. to C.B.; apparently rather rare; alluvial woods and swales.

N.S. to B.C. south to N.J., Ohio, & Ore.

92. **C. oligosperma** Michx. Map 130. Fig. 30.

Common near the coast from Yarmouth to C.B.; scattered inland, and abundant in C.B.; boggy swales, barrens, swamps and occasionally peat bogs.

Nfld. to the Mackenzie, south to Mass., Penn. & Ind.

93. **C. lurida** Wahl. Map 131. Fig. 30.

Common throughout, especially so from Annapolis east; swamps, wet meadows, ditches, and thickets. Besides the common form there occurs in the center of the province a small plant with short erect spikes and whitish inflated perigynia, var. **gracilis** (Boott) Bailey. (*C. tentaculata* Muhl.).

N.S. to Minn. south to Fla. & Tex.

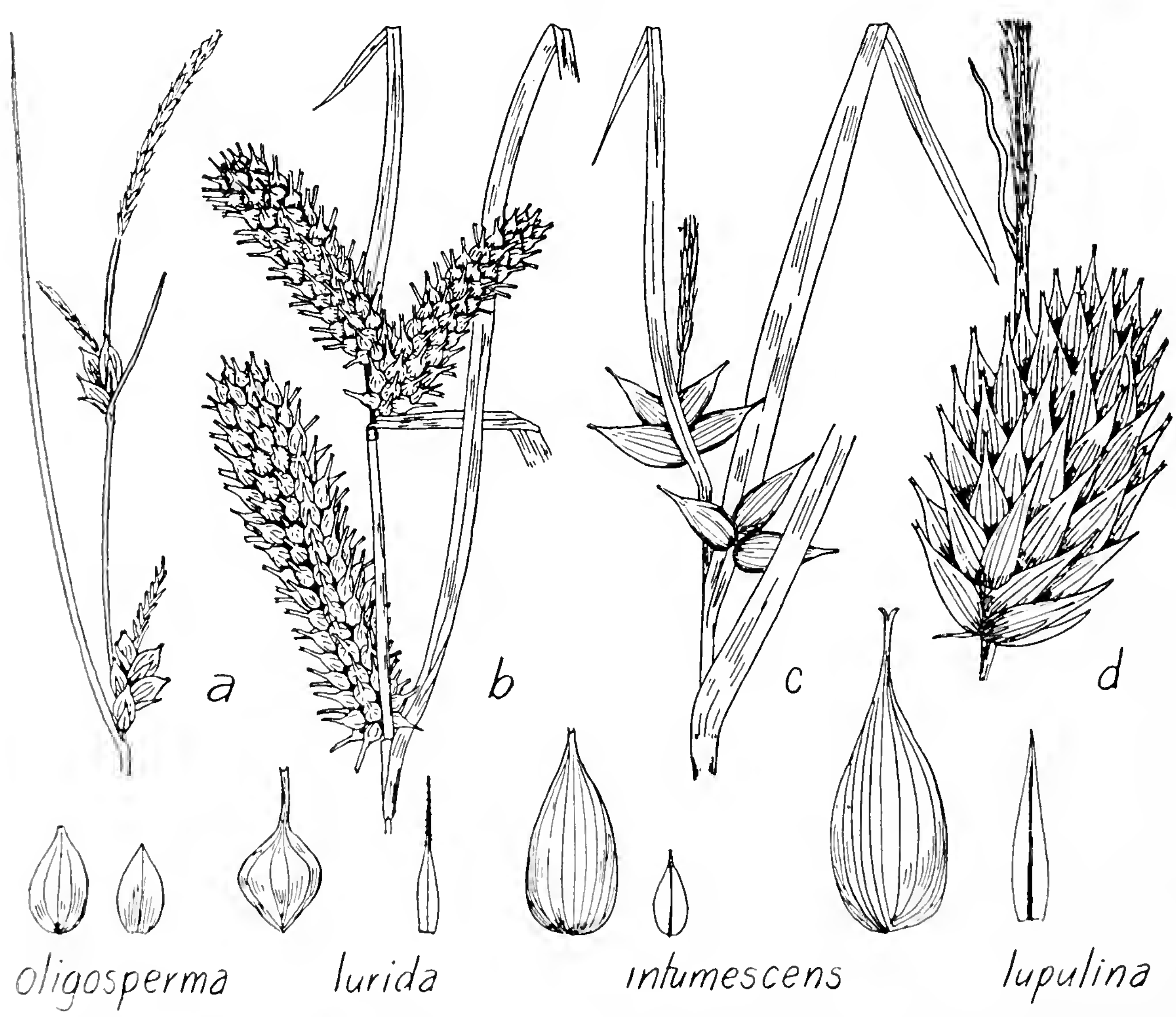
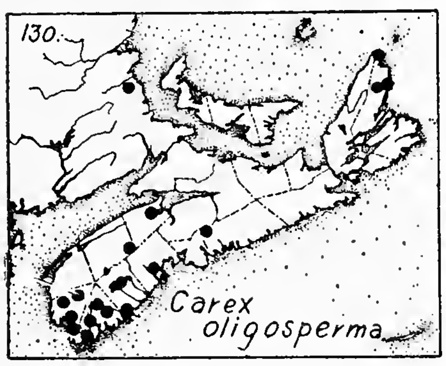
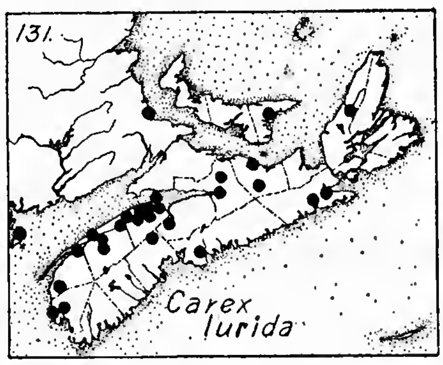


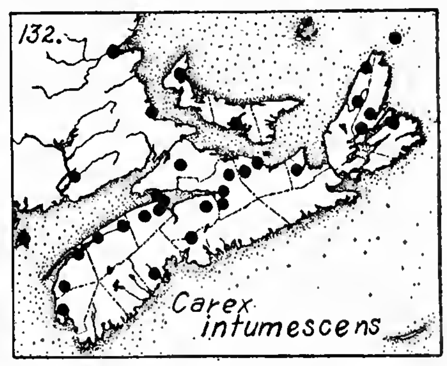
Fig. 30.—**Carex:** inflorescences, x 1; perigynia and scales, x 2.

SECT. 36. **LUPULINAE**

a. Pistillate spikes globose with 1-15 perigynia; perigynia spreading to reflexed, the sides of the beak usually smooth, the teeth hispid within.
 b. Achenes ellipsoid, broadest near the middle and tapering to the beak; perigynia ovoid and distended, 5-8 mm wide. 94. *C. intumescens*
 b. Achenes obovoid, broadest near the summit and gradually to broadly rounded to the beak. *C. intumescens* var. *Fernaldii*
a. Pistillate spikes oblong to cylindrical with 20-75 perigynia; perigynia closely appressed, the teeth smooth within. 95. *C. lupulina*



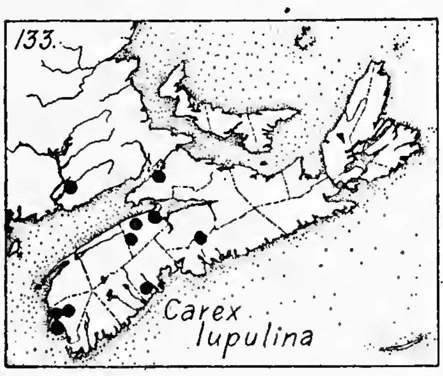


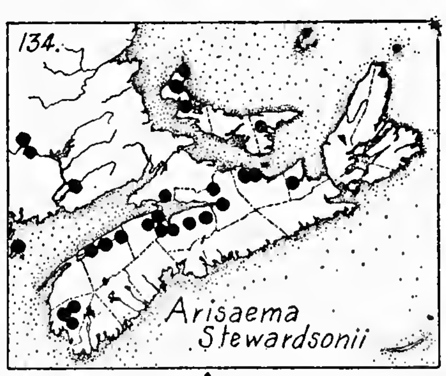


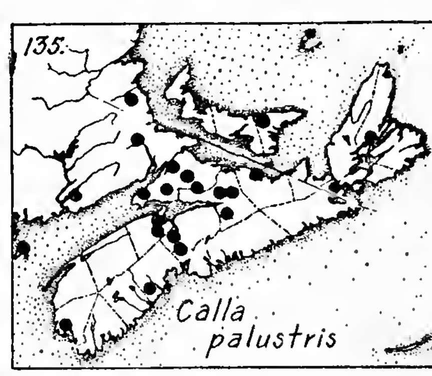
94. **C. intumescens** Rudge, see Fernald, Rhodora **44**: 321-322. 1942. Map 132. Fig. 30.

Scattered to frequent throughout; wet, usually deciduous, woods, in swamps and at edges of intervales. Var. **Fernaldii** Bailey is commoner than the species, and is occasionally found with inflated perigynia like the species. This is called forma *ventriosa* Fern.

Nfld. to Minn. south to N.S., N.Y., and in the mts. to N.C., with the species ranging south to Fla. & Tex.







95. **C. lupulina** Muhl. Map 133. Fig. 30.

Scattered to local; local in Yarmouth Co., occasional in Kings and Cumberland Cos.; mucky meadows, along intervales and in rich swales.

N.S. to Ont. & Mich. south to Fla. & Tex.

19. ARACEAE ARUM FAMILY

a. Leaves broad; spathe or leaf near the flowers, wide and thin.
  b. Spathe leafy, surrounding or arching over the spadix.
    c. Spadix or flowering spike, elongated with the upper part not flowering; leaves with 3 leaflets. 1. *Arisaema*
    c. Spadix thick, without a sterile end, nearly sessile on the ground; leaves ovate or heart-shaped, not divided; early spring. 3. *Symplocarpus*
  b. Spathe white and flat, behind the spadix. 2. *Calla*
a. Leaves narrow and sword-like; spathe like a continuation of the stem; spadix cylindrical, borne on the side of the 2-edged stem. 4. *Acorus*

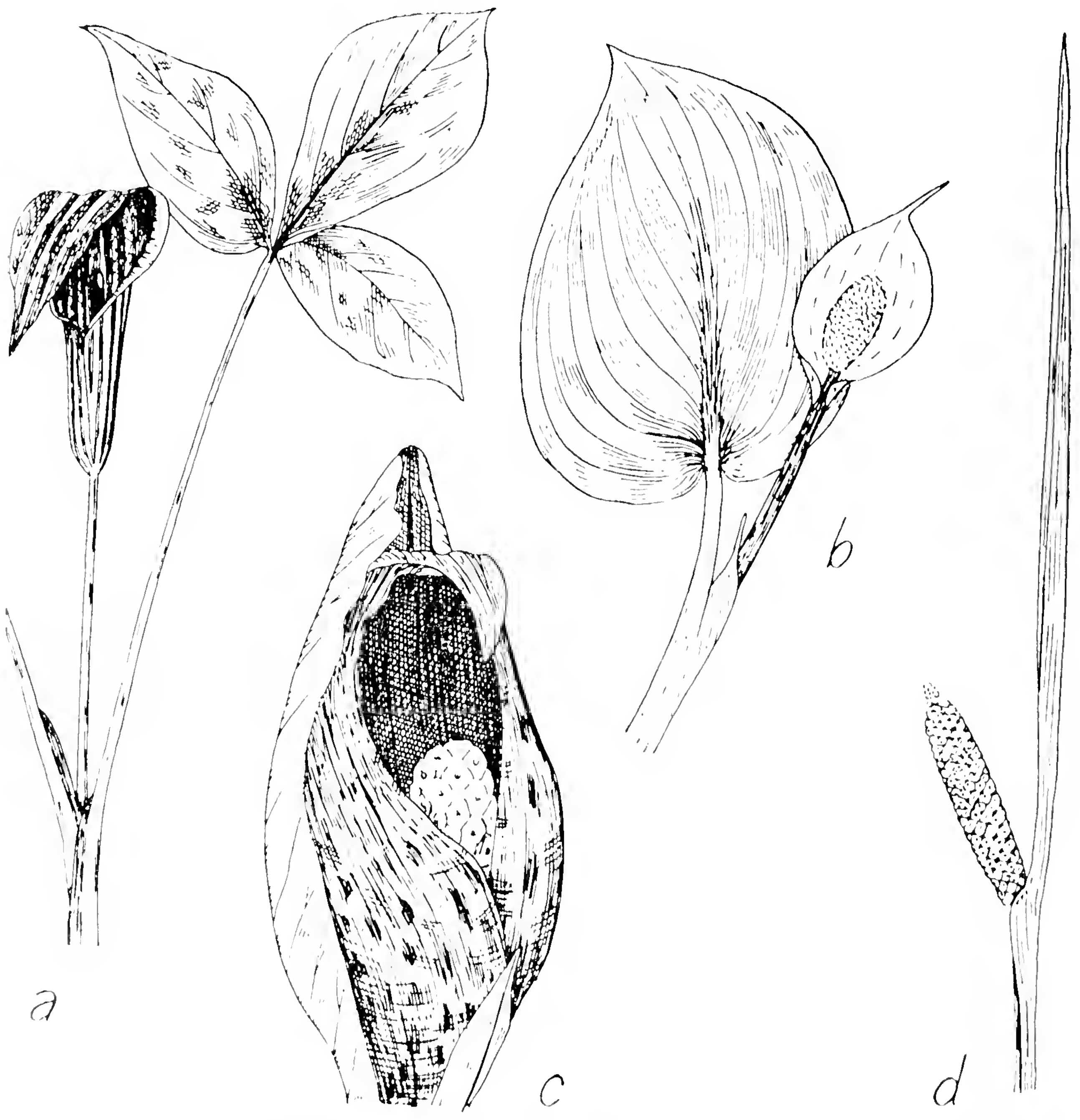


Fig. 31.—**Arisaema.** a, plant, x ½. **Calla.** b, plant, x ½. **Symplocarpus.** c, flowering plant, x ½. **Acorus.** d, upper third of plant, x ½.

I. **ARISAEMA** Martius

1. **A. Stewardsonii** Britt., see Fernald, Rhodora **42**: 247-254. 1940. JACK-IN-THE-PULPIT. Map 134. Fig. 31, a.

Rich low woods, mucky areas usually in thickets, or along the edge of stream intervales; rather common from Yarmouth east along the northern half of the province. All Maritime material seen belongs here. [*A triphyllum* (*L.*) Schott of Gray's Man. in part].

N.S. & P.E.I. to Minn. south to N.J. & Penn.

2 **CALLA** L.

1. **C. palustris** L. WATER ARUM. Map 135. Fig. 31, b.

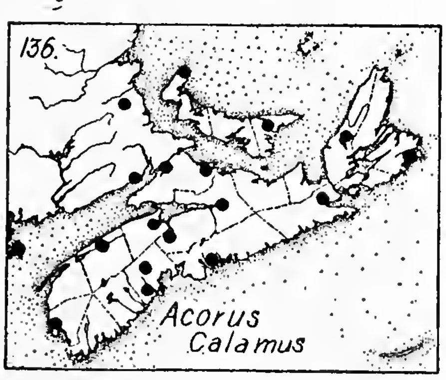
Rare in western N.S.; known only from the quaking margin of Trefry's L., Arcadia; scattered in bogs in the AnnapolisValley; common in the bogs and edges of lakes in sphagnum in the granitic and quartzite areas; rare or absent in C.B. June 15-July.

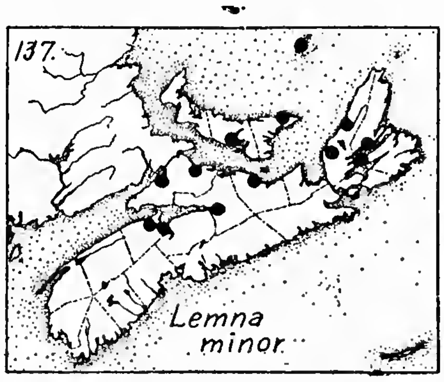
Cold bogs; N.S. to Hudson Bay & Minn. south to Penn., Wisc. & Iowa; Eurasia.

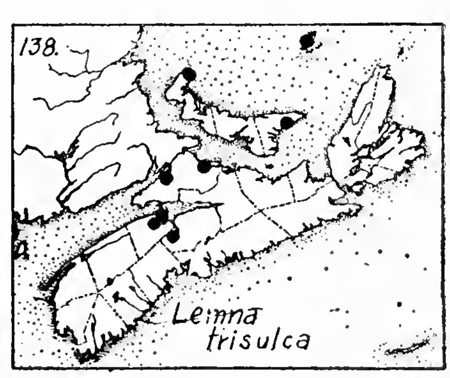
3. **SYMPLOCARPUS** Salisb.

1. **S. foetidus** (L.)Nutt. SKUNK CABBAGE. Fig. 31, c.

Found only in the southwest from Digby Co. and Digby Neck south to southern Yarmouth Co.; springy swales,







open bogs, mossy sphagnum woods and wet thickets. May.

N.S. to Minn. south to Ga. & Iowa.

4. **ACORUS** L.

1. **A. Calamus** (L.) SWEET FLAG CALAMUS. Map 136. Fig. 31, d.

Throughout, most abundant in the northern counties; often abundant in marshes, along rivers, shallow edges of ponds and wet meadows where the bases of the plants are continually submersed; always in open sunlight, often crowded out by the growth of cat-tails which prefer much the same habitat. It is especially abundant just above high tide near Kentville and Truro.

N.S. to Minn. south to Fla. & Tex.; Eurasia.

20. **LEMNACEAE** DUCKWEED FAMILY

a. Plants with several roots, reddish beneath, almost round, 3-8 mm long. 1. *Spirodela*

a. Plants with a single root, oval or elongated, green beneath. 2. *Lemna*

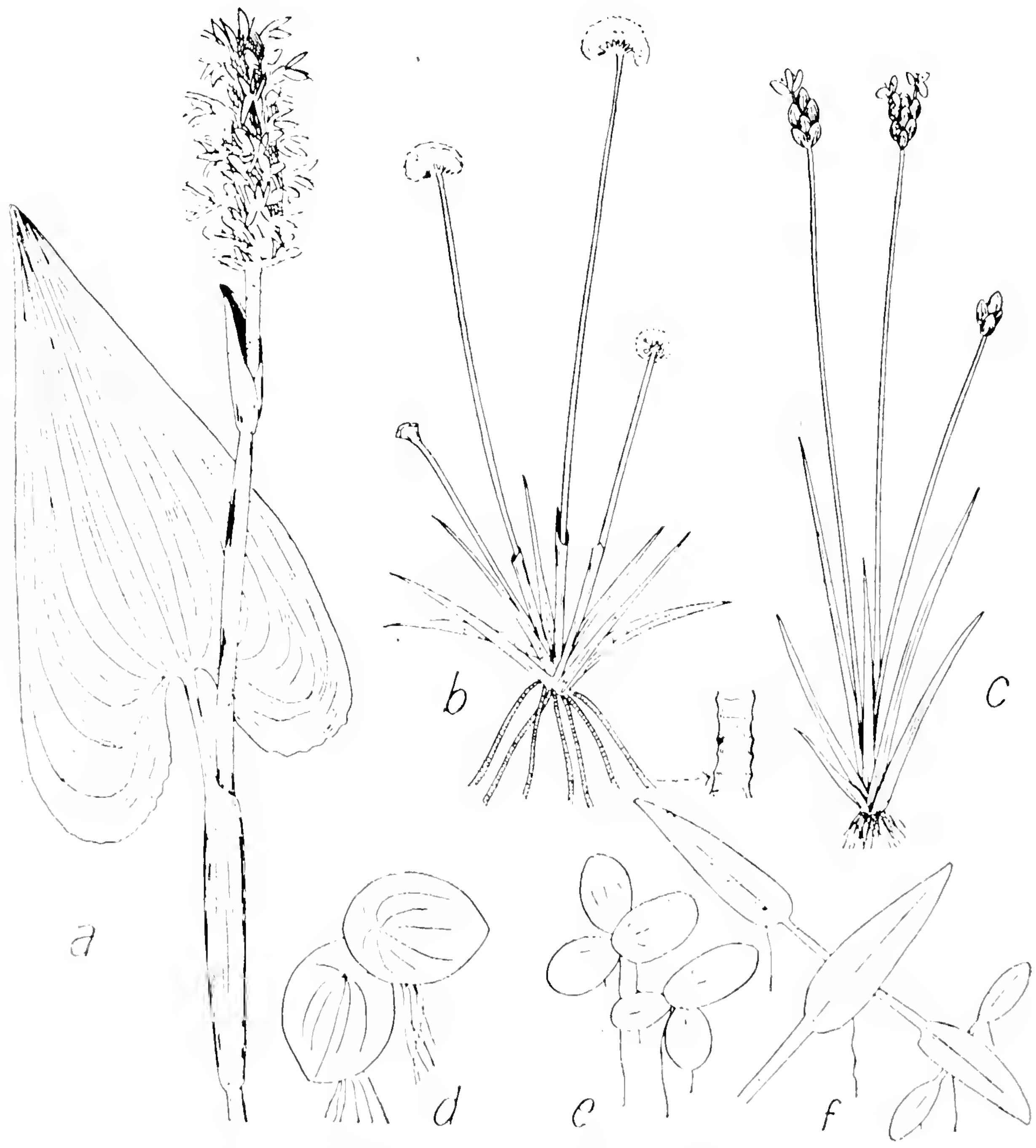


Fig. 32.—**Pontederia.** a, plant x ½. **Eriocaulon.** b, plant, x 1. **Xyris.** c, **X. montana**, x ½. **Spirodela.** d, plants, x 2. **Lemna.** e, **L. minor**, x 2. f, **L. trisulca**, x 2.

1. **SPIRODELA** Schleid.

1. **S. polyrhiza** (L.)Schleid. GREATER DUCKWEED. Fig. 32, d.

Common on the surface of the water in streams and in ponds, in Kings and Cumberland Cos.; scattered elsewhere in eastern N.S. & P.E.I.: Tracadie, Mabou and near Louisburg.

N.S. to B.C. south to Fla. & Calif; tropical America and Eurasia.

2. **LEMNA** L.

a. Plant roundish, 2-5 mm in diam., floating on the surface of the water 1. *L. minor*

a. Plant long and narrow with the new plants stalked, 6-10 mm long often sinking below the surface. 2. *L. trisulca*

1. **L. minor** L. LESSER DUCKWEED. Map 137. Fig. 32, e.

Common in stagnant pools, running brooks and ponds, often forming a greenish film over the surface; Annapolis Co. to C.B., often found until late October.

Throughout the world except in the colder regions.

2. **L. trisulca** L. SUBMERSED DUCKWEED. Map 138. Fig. 32, f.

Scattered in springs, flowing brooks and weedy pools, often submerged and on this account probably much overlooked. It is scattered in the Annapolis Valley and in Cumberland Co.

N.S. to B.C. south to Fla. & Calif.; Eurasia, Africa and Australia.

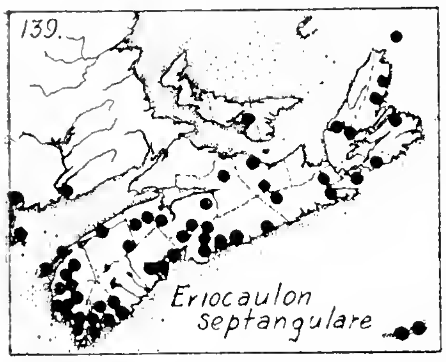
21. **ERIOCAULACEAE** PIPEWORT FAMILY

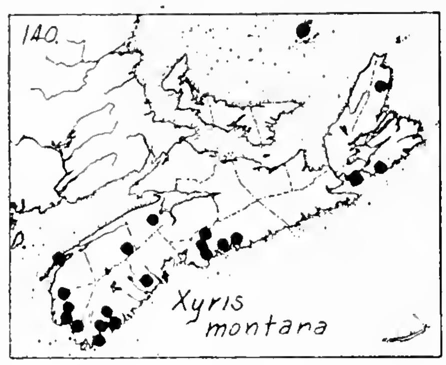
1. **ERIOCAULON** (Gronov.) L.

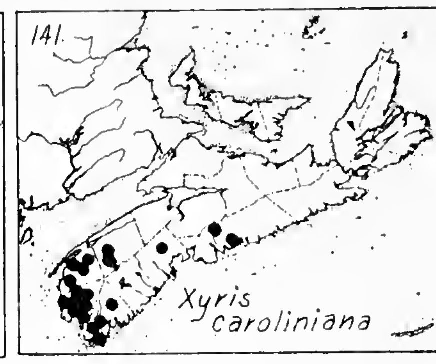
1. **E. septangulare** With., see Rhodora **11**: 40-41. 1909. PIPEWORT. Map 139. Fig. 32, b.

Common on sandy lake shores, rarely in running water; commonest in the southwestern and Atlantic regions. Sterile plants often form a green growth on the bottom of lakes as much as 2 m below the surface. The plant may be distinguished by its banded roots. July 15-Sept. (*E. articulatum* (Huds.) Morong).

Nfld. to Minn. south to N.J. & Ind.; western Scotland and Ireland.







22. **XYRIDACEAE** YELLOW-EYED GRASS FAMILY

1. **XYRIS** (Gronov.) L.

a. Plants rarely as much as 3 dm high; leaves 2-6 cm long and 1-2 mm wide, $\frac{1}{3}$ to $\frac{1}{2}$ the length of the flowering scape; scales of the head dark brown; fruiting heads 4-6 mm thick. 1. *X. montana*

a. Plants 0.5-3 dm high; leaves to 2 dm long and 4 mm wide, more than half the length of the flowering scape; fruiting heads 8-10 mm thick, with the scales having a greenish area in the center. 2. *X. caroliniana*

1. **X. montana** Ries. YELLOW-EYED GRASS. Map 140. Fig. 32, c.

Characteristic of peaty hollows, boggy barrens, sand flats and lake margins; common in the southwestern areas and east along the coast to Isle Madame; scattered and becoming rare inland and northward. July, Aug.

Nfld. to Penn. west to Wisc.

2. **X. caroliniana** Walt. Map 141.

Common from Digby to Shelburne Co., scattered east to Musquodoboit Harbour in Halifax Co.; wet, sandy, gravelly or peaty lake-margins, and sloughs in peaty barrens, often growing with the preceeding species.

N.S. & Me. to Fla. & La.; also in northern Ind. & Mich.

23. **PONTEDERIACEAE** PICKEREL-WEED FAMILY

1. **PONTEDERIA** L.

1. **P. cordata** L. PICKEREL-WEED. Map 142. Fig. 32, a.

Abundant in the southwestern area, frequent in lakes in Guysborough Co., scattered eastward and northward. It generally grows in large pure colonies around the mucky margins of ponds and lakes, along slow-moving streams or at the edge of pond-holes. Forma *angustifolia* (Pursh) Solms is a narrow-leaved form which is found throughout the range of the species. July-Sept.

N.S. to Minn. south to Va. & Tex.

24. **JUNCACEAE** RUSH FAMILY *

a. Capsule 1- or 3-celled, many-seeded; plant never hairy; leaf-blades round, channelled down inside, or flat, when flat seldom exceeding 1 mm in width (except in *J. marginatus*). 1. *Juncus*

a. Capsule 1-celled, 3-seeded; plant more or less hairy; leaf-blades flat, the basal ones seldom less than 2 mm wide. 2. *Luzula*

1. **JUNCUS** (Tourn.) L. RUSH

a. Inflorescence appearing lateral, the involucral leaf seeming a continuation of the stem (Fig. 33).

b. Stamens 3; stems in dense clumps.

c. Inflorescence generally compact, 1-4 cm in diam.; sepals 1.7-2.6 (rarely 2.9) mm long; perianth somewhat spreading.

d. Sheaths at base of stem pale, brownish below; stem 1.5-4.0 mm in diam. at top of sheath.

e. Stem finely lined, usually deep green; capsule not mucronate; bractlet below the individual flower broad-ovate.
9. *J. effusus* var. *compactus*

e. Stem 12-15-ridged just below the inflorescence, usually pale green; capsule often mucronate; bractlet below the individual flower lanceolate. 9. *J. effusus* var. *conglomeratus*

d. Sheaths darker, purplish or reddish brown at base; stem 1-2 mm in diam. at top of sheath (rarely greater).
9. *J. effusus* var. *decipiens*

c. Inflorescence usually diffuse, up to 14 cm in diam.; sepals 2.2-4.3 mm long; perianth somewhat appressed.

f. Sheaths purplish or reddish brown at base; capsule not exceeding the sepals but darker and contrasting with them in color; stem commonly ridged.

g. Sepals exceeding both petals and capsule, 3.0-4.3 mm long.
9. *J. effusus* var. *Pylaei*

g. Sepals and petals equal, 2.2-3.0 mm long; capsule equalling or only slightly shorter than the perianth.
9. *J. effusus* var. *costulatus*

* The text for this family has been written with the assistance of Eville Gorham, Dalhousie University.

f. Sheaths pale brown; capsule exceeding the perianth but not contrasting in color; sepals and petals equal, 2.5-3.5 mm long; stem not ridged. 9. *J. effusus* var. *solutus*

b. Stamens 6; stems in rows from underground root-stocks.

h. Stem with the part above the flowers much shorter than that below; sepals and petals with lateral dark brown bands, 3.5-5.0 mm long; anthers much longer than the filaments; capsule brown to blackish; seeds about 1 mm long (Fig. 33). 7. *J. balticus*

h. Stem with the part above the flowers about equalling that below; flowers greenish to light brown, 2-3 mm long; anthers shorter than the filaments; capsule yellowish brown; seeds about 0.5 mm long (Fig. 33). 8. *J. filiformis*

a. Inflorescence terminal, subtended by an involucral leaf which may or may not exceed the inflorescence.

i. Leaf-blade flat, or round and channeled; never hollow nor partitioned by cross-walls.

j. Plant annual; inflorescence about one-half the total height.

k. Sepals and petals long-attenuate, much exceeding the greenish white or pale brown capsule; flowers scattered singly along the branches; seeds tapering, pointed at both ends (Fig. 33). I. *J. bufonius*

k. Petals blunter, not long-attenuate, shorter than or but slightly exceeding the usually darker brown capsule; flowers often in pairs; seeds mostly truncate at one or both ends; plants of halophytic habitat, often lower and more spreading. 1. *J. bufonius* var. *halophilus*

j. Plant perennial; inflorescence less than one-quarter the total height of the plant.

1. Flowers subtended by bracteoles in addition to the bractlet at the base of the pedicel, scattered, not in compact heads.

m. Sepals blunt, green with lateral brown bands; leaf-sheaths covering one-half of the stem.

n. Plant of halophytic habitat, not glaucous; anthers about twice as long as the filaments; capsule ellipsoid-ovoid, as long as or slightly exceeding the perianth (Fig. 33). 2. *J. Gerardi*

n. Plant not halophytic, glaucous; anthers as long as the filaments; capsule globose, ovoid, exceeding the perianth. 3. *J. compressus*

m. Sepals acute, without lateral dark brown bands; leaf-sheaths covering one-quarter of the stem at most.

o. Capsule not exceeding the sepals, yellowish or brownish; leaf-blade flat.

p. Lobes at the top of the leaf-sheath quite conspicuous, whitish and membranous; anthers much shorter than the filaments (Fig. 33). 4. *J. tenuis*

p. Lobes inconspicuous, brown and cartilaginous; anthers only slightly shorter than the filaments. 5. *J. Dudleyi*

o. Capsule distinctly exceeding the sepals, shining, reddish brown; leaf-blade round, channelled on the upper side. 6. *J. Greenei*

l. Flowers with only the bractlet at the base of the short pedicel, in compact heads.

q. Capsule at most 3.5 mm long, about equalling the sepals: seeds about 0.5 mm long; heads more than 1 or 2, 3-12-flowered (Fig. 34). 20. *J. marginatus*

q. Capsule 6-9 mm long, much exceeding the sepals; seeds 3-4 mm long; heads 1 or 2, 1-4-flowered. 19. *J. stygius*

i. Leaf-blade round and hollow, paritioned by cross-walls (to show this, dissection may be necessary in *J. bulbosus* and *J. pelocarpus*).

r. Stamens 3, seeds 0.3-1.8 mm long.

s. Seeds with definite white appendages, 0.8-2.0 mm long.

t. Heads mostly 2-7-flowered.

Perianth 2.5-3.5 mm long.

Capsule much exserted, deep brown, tapering to the tip; inflorescence rather small and narrow (Fig. 34). 10. *J. brevicaudatus*

Capsule little if at all exserted; inflorescence larger, 0.4-3 dm high, with branches partly spreading. 11. *J. canadensis* forma *apertus*

Perianth 3.4-5.0 mm long; capsule little if at all exserted, rather abruptly pointed; inflorescence with stiffly erect branches, 0.3-1.5 dm high. 11. *J. canadensis* var. *sparsiflorus*

t. Heads mostly many-flowered; inflorescence spreading.

Capsule abruptly short-pointed, little if at all exserted; perianth 2.5-4.0 mm long; seeds long-tailed, 1-2 mm long; stem stout (Fig. 35). 11. *J. canadensis*

Capsule tapering, conspicuously exserted; perianth 2-3 mm long; seeds scarcely 1 mm long, with only short white appendages. 12. *J. subcaudatus*

s. Seeds without definite white appendages 0.3-0.5 mm long.

u. Stem erect, or reclining and rooting at the nodes, 0.5-2.5 dm high, usually bulbous at the base; leaves with inconspicuous cross-walls; petals blunt; heads 4-15-flowered, often bearing tufts of reduced leaves. 14. *J. bulbosus*

u. Stem erect, mostly exceeding 2.5 dm in height, not bulbous; leaves few, with conspicuous cross-walls; petals acute; heads many-flowered. 17. *J. acuminatus*

r. Stamens 6; seeds 0.3-0.6 mm long.

v. Flowers grouped in heads.

w. Heads not spherical; root-stock without tubers; capsule, if much exceeding the perianth, not subulate.

x. Stem 1.5-9.0 dm high, the base not bulbous; leaves with conspicuous cross-walls; heads without tufts of reduced leaves.

y. Stem stout, erect; elongate thread-like leaves sometimes borne in dense tufts on the root-stocks; lower stem-leaf overtopping the rather narrow inflorescence; capsule equalling the sepals; anthers longer than the filaments. 15. *J. militaris*

y. Stems slender, sometimes reclining; elongate thread-like leaves never present; stem-leaves seldom exceeding the spreading inflorescence; capsule exceeding the sepals; anthers not exceeding the filaments (Fig. 35).

z. Capsule tapering, shiny, dark brown to nearly black, 3-4 mm long; flowers brown, 2.5-3.0 mm long (Fig. 34).
18. *J. articulatus*

z. Capsule abruptly mucronate, 2.5-3.0 mm long, often duller and paler; flowers often greenish, smaller.
18. J. *articulatus* var. *obtusatus*

x. Stem 0.5-2.5 dm high, usually bulbous at the base; cross-walls of the leaves inconspicuous; heads often bearing tufts of reduced leaves. 14. *J. bulbosus*

w. Heads mostly spherical; root-stock often bearing tubers; capsule subulate, exceeding the perianth (Fig. 34). 16. *J. nodosus*

v. Flowers solitary or in pairs along the branches of the inflorescence. Stem erect; inflorescence often bearing tufts of reduced leaves (Fig. 34). 13. *J. pelocarpus*

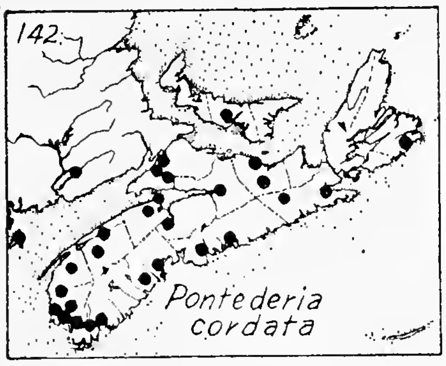
Stem prostrate; plant much reduced in all parts; inflorescence not being tufts of reduced leaves.
13. *J. pelocarpus* var. *sabulonensis*

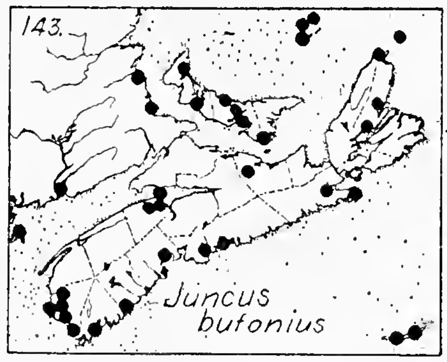
Fig. 33.—**Juncus.** Inflorescences, x ½.

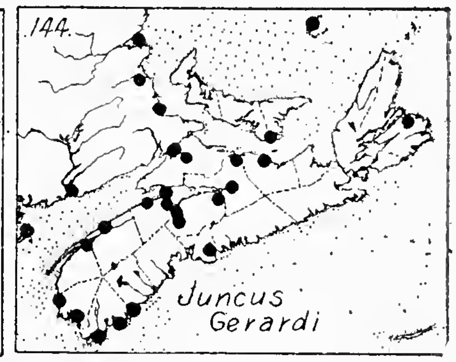
1. **J. bufonius** L. TOAD-RUSH. Map 143. Fig. 33.

Common throughout; open areas, especially along roadsides, farm yards and beaten paths; scattered in wet land, lake-sides or boggy places. Widely distributed.

Var. **halophilus** Buch. & Fern. is scattered near the coast from the Gulf of St. Lawrence around C.B. and along the Atlantic Coast south to Mass.; West Coast.







2. **J. Gerardi** Loisel. BLACK-GRASS. Map 144. Fig. 33.

Common around the coast; on the upper limits of the salt marshes, often forming large pure colonies on flat brackish dykelands or in fields overflowed by the sea; forming a narrow band just below the area occupied by cultivated grasses and legumes.

Salt marshes near the Atlantic Coast; more rarely inland around the Great Lakes; Pacific Coast, Eurasia and N. Africa.

3. **J. compressus** Jacq.

The only record is that of Rousseau (1938); brackish meadow at Guysborough. It is an European species that has been introduced at various places in North America.

4. **J. tenuis** Willd., see Fernald, Rhodora 47:117-123. 1945. Fig. 33.

Abundant throughout; fields, roadsides, open thickets and moist places. Two forms are often found growing together. The typical plant has the flowers mostly clustered at the tips of the short floral branches. Var. **Williamsii** Fern. has the floral branches 3-6-flowered, 1-2 cm long, with the flowers scattered and on one side along them. (*J. macer* S. F. Gray).

Throughout N.A.; widely adventive elsewhere.

5. **J. Dudleyi** Wieg.

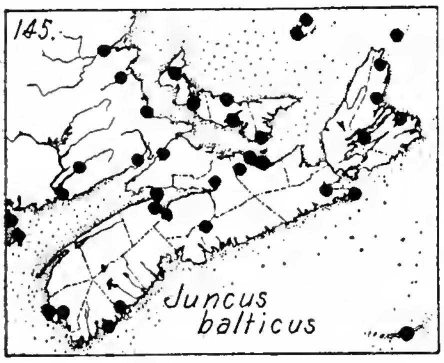
Rare; swale at the southern base of the North Mt., Middleton, Annapolis Co. (Fernald, 1921). It is also known from Grand Manan and at Bathurst in N.B.; and is scattered in eastern P.E.I.

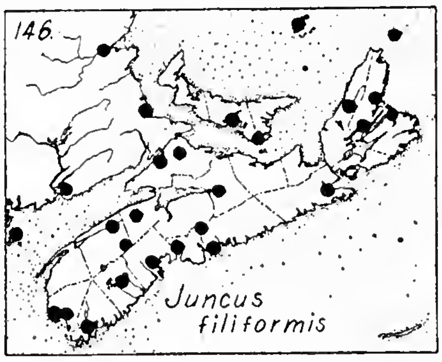
Nfld. to Sask. south to Va., Kans. & Mex.

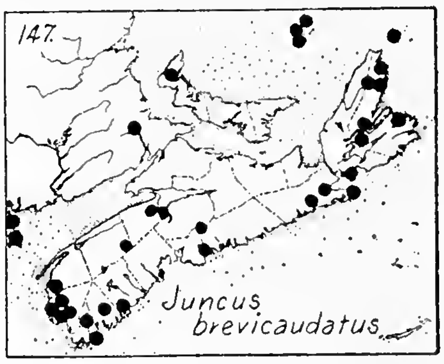
6. **J. Greenei** Oakes & Tuckerm.

Known from but one station; dunes at Villagedale, Shelburne Co.

N.S. Me. to Vt. & N.J.; locally in the Great Lakes region.







7. **J. balticus** Willd., var. **littoralis** Engelm. Map 145. Fig. 33.

Common around the coast, dominant sometimes in the shoreward reaches of the salt marshes; occasionally found in wet meadows or dykelands near the coast, and rarely in bogs in the same zone. Forma **dissitiflorus** Engelm., Rhodora **25**: 208. 1923, with the inflorescence diffuse, remotely-flowered, 4-15 cm long, is reported from a sphagnous hill-side at Truro; probably scattered.

Along the coast south to Penn.; inland in brackish places, around the Great Lakes and west to the Pacific.

8. **J. filiformis** L. Map 146. Fig. 33.

Scattered throughout; swales, bogs, edges of lakes, low meadows and sandy shores.

Lab. to B.C. south to Penn., Wisc & Colo.

9. **J. effusus** L. SOFT-RUSH Fig. 33.

Abundant and extremely variable. Var. **compactus** Lejeune & Court. is common throughout, abundant north-eastward. Var. **conglomeratus** (L) Engelm., see Rhodora **12**: 85. 1910, is not well known. It is locally abundant in Shelburne Co. (Fernald, 1922). Older records are dubious. Var. **decipiens** Buch. is scattered, at least in western N.S. Var. **Pylaei** (Laharpe) Fern & Wieg., Rhodora **12**: 92. 1910, is found in open swampy thickets near Baddeck; swales near Uniacke Lake in Hants Co.; probably more common. Var. **costulatus** Fern., Rhodora **23**: 239-240. 1921, is scattered with the distribution unknown. Var. **solutus** Fern. & Wieg., Rhodora **12**: 90. 1910, is occasional in Kings Co. probably scattered.

The typical form of the species is unknown in N.A. while the varieties are widely distributed.

10. **J. brevicaudatus** (Engelm.)Fern. Map 147. Fig. 34.

Common in moist damp places throughout; ditches, periodic ponds, swamps, estuaries, and sandy or rocky lake- and pond-beaches.

Nfld. to Minn south to Conn., Penn. & W. Va.

11. **J. canadensis** J. Gay Fig. 35. See Fernald, Rhodora **47**: 127-131,1945.

Common to abundant throughout; wet, sandy or peaty soils, marshy places and shallow water. N.S. to Minn. south to Ga. & La. Forma **apertus** Fern. is scattered in the range of the species.

Var. **sparsiflorus** Fern., Rhodora **23**: 241. 1921, is found around some of the lakes in the Tusket River Valley and sparingly elsewhere in the southwestern counties. Nfld. N.S. & Mass.

12. **J. subcaudatus** (Engelm.) Coville & Blake, var. **planisepalus** Fern., Rhodora **23**: 241. 1921. Map 148.

Characteristic of wet boggy woods and openings in spruce swamps in southwestern N.S.; found east to Kings Co. and Halifax Co., and with one collection known from Pictou. This is apparently an endemic N.S. variety of the southern species which ranges northward to Cape Cod.

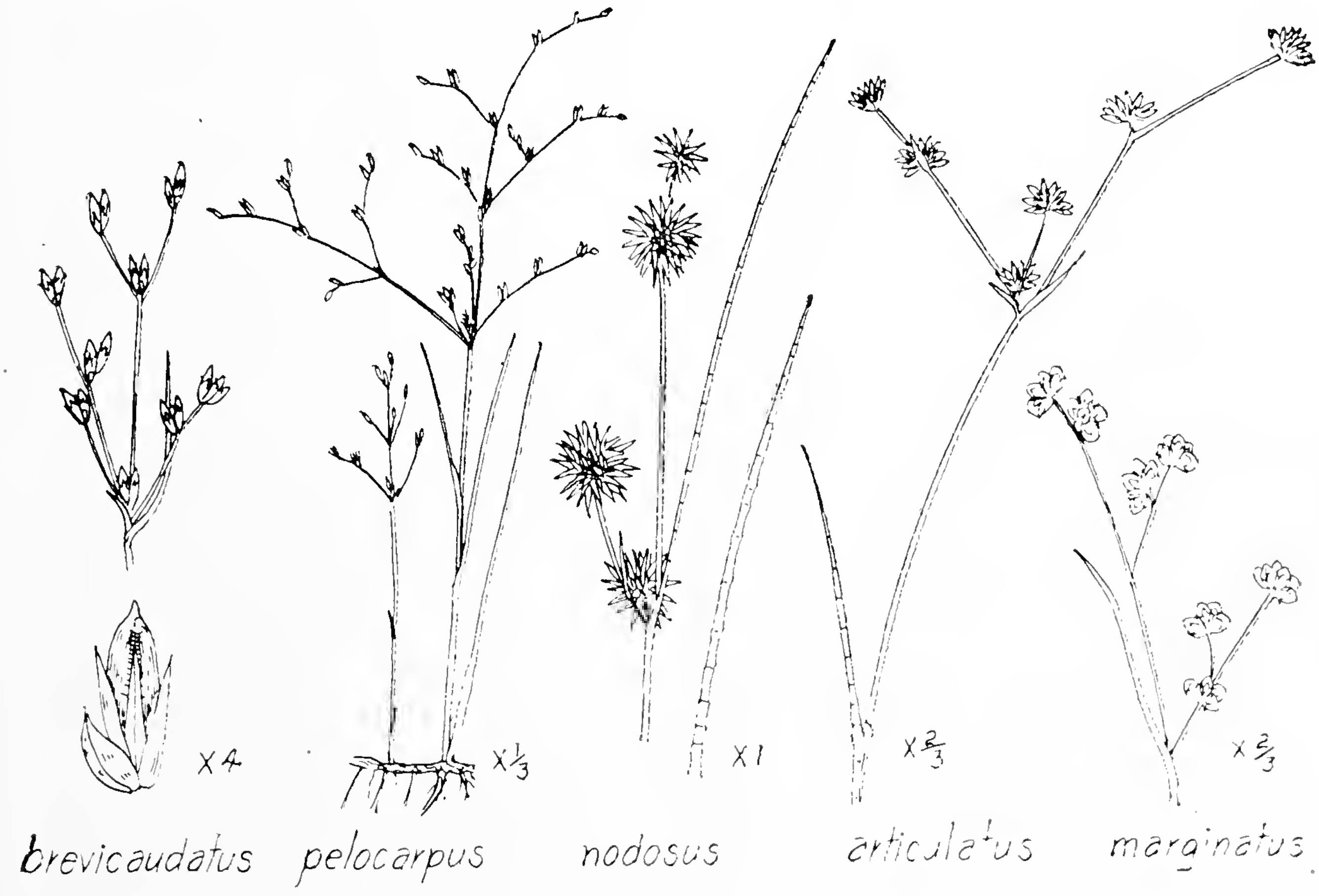


Fig. 34.—**Juncus.**

13. **J. pelocarpus** Meyer. Map 149. Fig. 34.

Sandy and muddy shores, bogs and wet roadsides; common to abundant in the western counties, scattered elsewhere to northern C.B. Nfld. to N.J. west to Minn.

Var. **sabulonensis** St. John, Proc. Boston Soc. Nat. Hist. **36**: 67. 1921, is a much reduced, prostrate variety that is known only from Sable Island; shallow ponds and wet dune hollows.

14. **J. bulbosus** L.

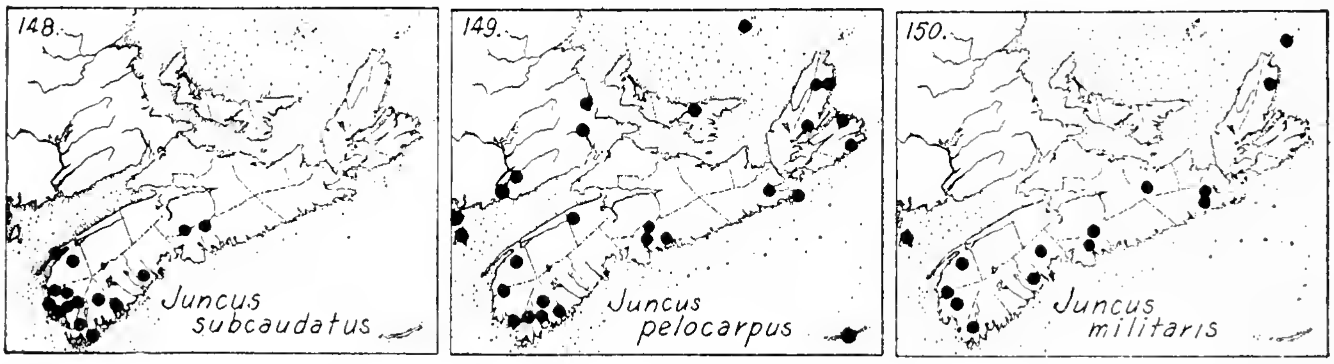
Common along the marshy borders of fresh-water ponds on Sable Island; not known on the mainland.

Eu.; Iceland, southern Nfld., Sable Is. and eastern Mass.

15. **J. militaris** Bigel. Map 150. Fig. 35.

Sandy and peaty lake-margins in the siliceous region from Yarmouth to northern C.B.; rare or absent in the northern counties. Two minor forms, Rhodora **24**: 166. 1922, have been reported. Froma **bifrons** Fern. has two leaf-blades on the culm, with no upper bladeless leaf-sheath; forma **subnudus** Fern. has one leaf-blade and no bladeless sheath; while the typical form has one leaf-blade near the middle of the culm and a bladeless sheath nearer the top.

N.S. to N.Y. & Ala.



16. **J. nodosus** L. Map 151. Fig. 34.

Swales near Wentworth gypsum quarries; Windsor; Truro and scattered in Cape Breton.

Muddy shores; Nfld. to B.C. south to Va. & Nebr.

17. **J. acuminatus** Michx. Map 151.

Local in Yarmouth Co., east to Kings and Lunenburg Cos.; wet clayey roadsides, sterile meadows, wet roadsides and ditches; sandy and muddy flats of the Tusket R. The records in Lindsay's Catalog are apparently erroneous; and his specimens are immature and indeterminable.

N.S. to Minn. south to Ga. & Tex.

18. **J. articulatus** L. Fig. 34.

One of the commonest species throughout; wet ditches and muddy shores, low areas in fields, swamps and boggy land. Nfld. to Mich. & B.C. south to Mass. & N.Y.; Eurasia.

Hybrids with *J. brevicaudatus* (X *J. fulvescens* Fern. Rhodora **35**: 236. 1933) are abundant in peaty swales at Yarmouth, at Argyle, and on a savannah near Tiddville, in every place failing to set fruit (Fernald, 1921). Hybrids with *J. nodosus* were noticed in brackish swale at Baddeck; and with *J. canadensis* at Tiddville, Digby Co., and at Lower Argyle, Yarmouth Co. (Fernald, 1921).

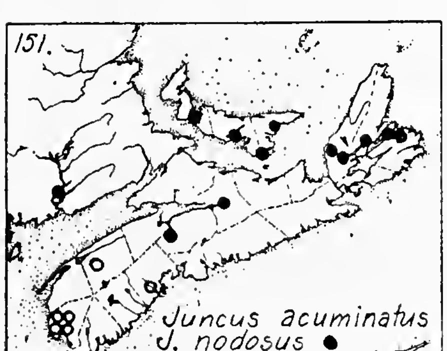
J. alpinus Vill., var. *insignis* Fries has been recorded from Truro and on sand, Liscomb R., Guysborough Co. (Macoun, 1888). No substantiating specimens have been seen, and since the interpretation of *J. alpinus* and its varieties has changed (See Rhodora **35**: 233-235. 1935), the exact indentities of these plants cannot be determined. This species resembles *J. articulatus* but can be distinguished by its narrow ascending inflorescence and blunt, sometimes mucronate, sepals.

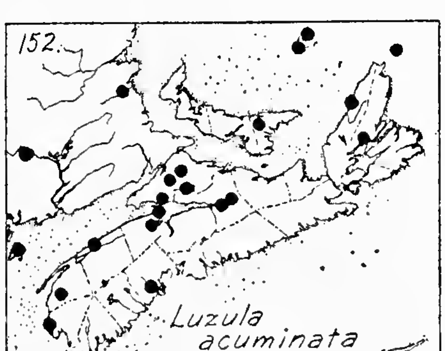
Var. **obtusatus** Engelm. is common throughout, especially in brackish soil, where it largely replaces the typical form.

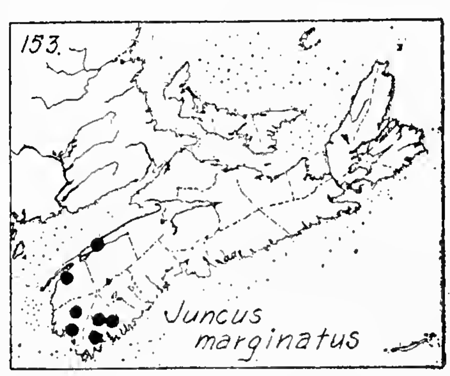
19. **J. stygius** L., var. **americanus** Buch.

One specimen from N.S. is in the Gray Herbar um at Harvard; bog thicket, Isle Madame, Cape Ereton. J.A. Allen 21, VII, 1882.

Nfld. & Lab. to Ont. south to N.S., N.Y. & Minn.







20. **J. marginatus** Rostk. Map 153. Fig. 34.

Local in Yarmouth and Shelburne Cos., north to Belle Isle, Annapolis Co.; clayey brooksides, spring ditches, wet roadsides and fields.

N.S. to Neb. south to Fla.

2. LUZULA DC. WOOD RUSH

Fernald, M.L. Notes on eastern American *Luzula*. Rhodora **47**: 265-271. 1945. Fernald and Wiegand. The variations of *Luzula campestris* in North America. Rhodora **15**: 38-43. 1913.

a. Flowers solitary at the tips of the ultimate branches of the inflorescence (Fig. 35).
  b. Inflorescence an umbel, the rays unbranched; spikelets 3-4.5 mm long; plants 2-4 dm high. 1. *L. acuminata*
  b. Inflorescence a decompound cyme, the rays repeatedly branched; spikelets 2 mm long; plants 6-12 dm high. 2. *L. parviflora*
a'. Flowers aggregated in heads or spikes.
  c. Perianth 2.5-3.5 mm long, equalling or usually shorter than the mature capsule; seeds 1.5-2.0 mm long, with a round-tipped bulb-like caruncle.
    d. Leaves longer and flexuous, to 5 mm wide; sepals and capsules mostly pale or straw-colored. 3. *L. multiflora*

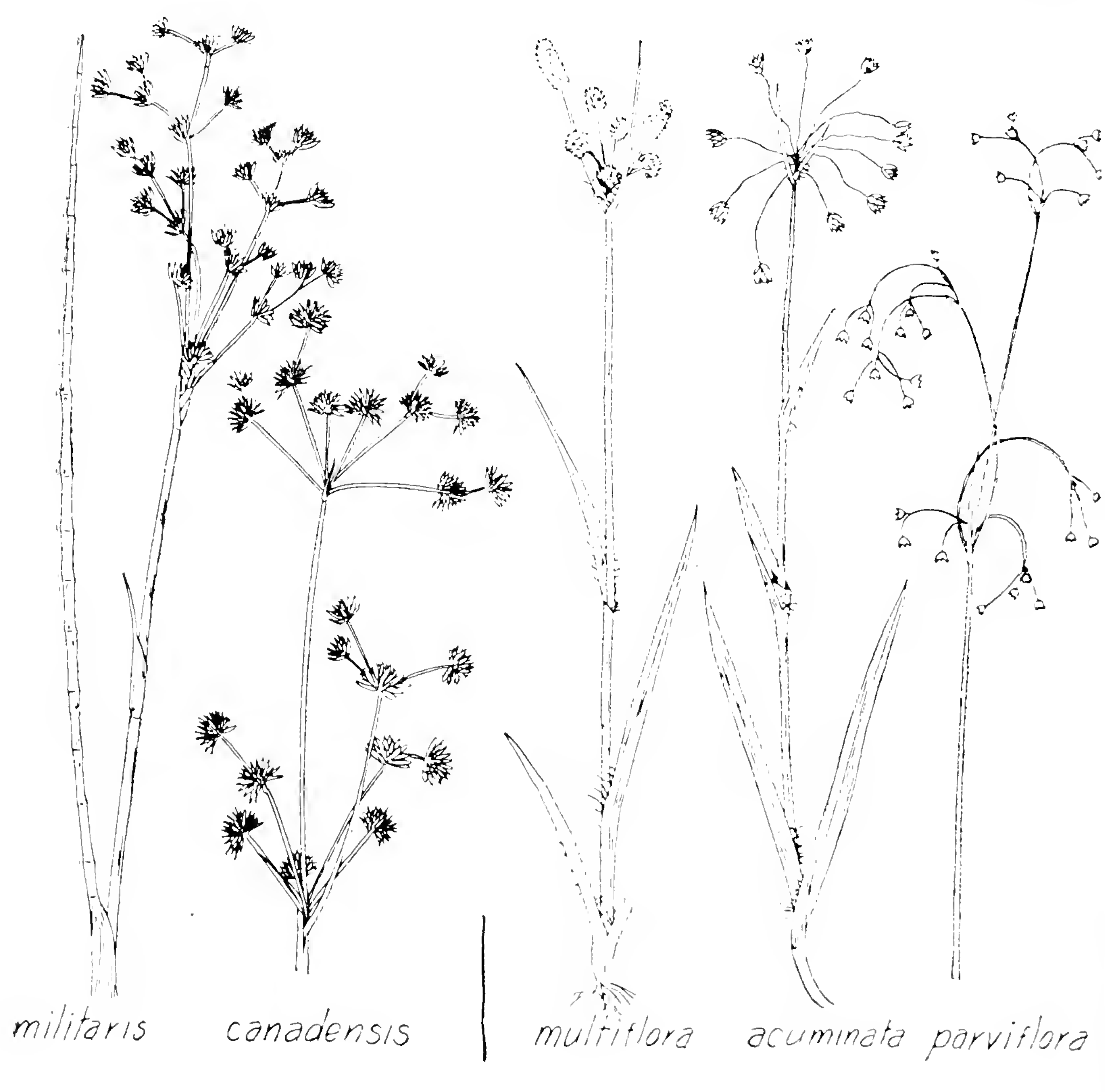


Fig. 35.—**Juncus**, x ½, **Luzula**; x ½.

d. Leaves stiff and narrow; sepals dark-brown to fulvous; capsules dark chestnut to blackish; plant low, found near the coast.
L. multiflora var. *fusconigra*

c. Perianth 3-4 mm long, greatly exceeding the capsule; seeds 1.5-1.7 mm long, with a conically tapering caruncle; inflorescence more condensed with the spikes sessile or subsessile.
L. multiflora var. *acadiensis*

1. **L. acuminata** Raf., see Fernald, Rhodora **46**:. 4. 1944. Map 152. Fig. 35.

Scattered to common throughout; banks, thickets, and in deciduous or mixed woods. Map. (*L. saltuensis* Fern. *Juncoides Carolinae*).

Nfld. to Sask. south to N.J., Ga., Ind. & Minn. Eurasia.

2. **L. parviflora** (Ehrh.) Desv. Fig. 35.

Scattered along the rocky stream-banks or on cliffs in northern C.B.; collected by Nichols in the Valley of the Barrachois R., and common around Bay St. Lawrence, Victoria Co.

Labrador to Alaska south to N.S., Me., N.Y. and south in the Rockies.

3. **L. multiflora** (Retz.) Lejeune, see Hermann, Rhodora **40**: 83-84. 1938. COMMON WOODRUSH Fig. 35.

Abundant throughout; fields, thickets, barrens and open woods. (*Luzula campestris* var. *multiflora*. *Juncoides campestre*). Nfld. to Alaska south, to N.J., Ill. and Calif.; Eurasia.

Var. **fusconigra** Celak is a more dwarf, stiffer form with blackish inflorescence and capsules. It is found mostly near the coast from the strait of Belle Isle to Mass.; inward on the mts. of N.Y. Shag Harbour and elsewhere along the coast of N.S.

Var. **acadiensis** (Fern.) Fern., Rhodora **47**: 267. 1945. This plant, originally described from P.E.I. (Rhodora **19**: 38. 1917), is rather rare in the northern parts of the province. It is common, and the only variety, on Sable Island. A collection from St. Paul Island, originally referred to var. *comosa*, is considered to belong here.

25. LILIACEAE LILY FAMILY

a. Leaves all nearly or quite basal, or absent at flowering time.

b. Flowers 8-11 cm long, orange; leaves linear, 5-20 dm long (Fig. 36, d)
5. *Hemerocallis*

b. Flowers much smaller, not orange; leaves less than 3 dm long.
  c. Flowers solitary, yellow, 2-3 cm long; leaves elliptical, mottled with purple (Fig. 36, f). 7. *Erythronium*
  c. Flowers several to many, less than 2 cm long; leaves not mottled.
    d. Leaves linear or absent at flowering time.
      e. Plants with a strong onion-like odor; leaves fleshy; flowers numerous, in umbels. 4. *Allium*
      e. Plants without a strong odor; leaves grass-like; flowers not in umbels.
        f. Flowers crowded in a short narrow raceme; top of the scape glutinous with dark glands. 1. *Tofieldia*
        f. Flowers 3-8 in an open corymb; top of the scape smooth. 8. *Ornithogalum*
    d. Leaves oval to elliptical, present at flowering time.
      g. Flowers yellow, in a 3-6-flowered umbel; perianth-parts separate (Fig. 36, e). 10. *Clintonia*
      g. Flowers white, several, in a one-sided raceme; perianth-parts united (Fig. 38, c). 15. *Convallaria*

a. Leaves in whorls or alternate on the stem.
  h. Plant herbaceous, not trailing or climbing.
    i. Leaves in one or more whorls upon the stem.
      j. Whorls numerous; flowers 4-10 cm in diameter, orange spotted with brown (Fig. 37, a). 6. *Lilum*
      j. Whorls one or two; flowers much smaller.
        k. Leaves in two whorls, each whorl with 5-9 leaves; flowers yellow, incurved beneath the upper leaves. (Fig 37, b). 16. *Medeola*
        k. Leaves 3, in a single whorl; flowers white to purple (Fig. 37, d-f). 17. *Trillium*
    i. Leaves alternate upon the stem.
      1. Flowers numerous, in a terminal inflorescence.
        m. Flowers green; inflorescence 1-4 dm long; leaves oval, 1-3 dm long, plaited, clasping the stem; rare. 2. *Veratrum*
        m. Flowers white; inflorescence rarely to 1 dm long; leaves much smaller, not plaited; common.
          n. Perianth parts 6; leaves tapering to the base, 3-many (Fig. 37,c; 38, b). 11. *Smilacina*
          n. Perianth parts 4; leaves heart-shaped at the base, 1-3 (Fig. 38,d) 12. *Maianthemum*
      1. Flowers solitary or in 2's, terminal or scattered.
        o. Flowers solitary to few on each plant, 15-45 mm long, yellowish, at first terminal then becoming lateral (Fig. 36, a). 3. *Uvularia*
        o. Flowers numerous, much smaller.
          p. Plants erect, 1-2 m high; stem finely branched, the smaller thread-like; leaves scale-like; flowers small, greenish white. 9. *Asparagus*

p. Plant arching, 1-2 dm high; stem unbranched or forking; leaves lanceolate to oval, over 10 mm wide.
q. Flowers bell-like, borne singly on a jointed stalk or rarely in pairs from just below each leaf; rootstock without prominent scars (Fig. 36, b, c). 13. *Streptopus*
q. Flowers cylindrical, the parts joined, in pairs upon a forked peduncle from the leaf axils; rootstock with prominent oval scars (Fig. 38, a). 14. *Polygonatum*
h. Plants trailing or climbing, woody and spiny; southwest N.S. only (Fig. 39, f). 18. *Smilax.*

1. **TOFIELDIA** Huds.

1. **T. glutinosa** (Michx.)Pers. FALSE ASPHODEL

Collected but once, by Dore in peaty and boggy soil from the region of Cheticamp.

Nfld. to Minn. & Alaska south to Me., N.C. & Ore.

Fig. 36.—**Uvularia.** a, plant, x 1/3. **Streptopus.** c, **S. roseus** x 1/3. b, **S. amplexifolius**, x l. **Hemerocallis.** d, flower, x 1/4. **Clintonia.** e, plant, x 1/3. **Erythronium.** f, plant, x 1/3.

2. **VERATRUM** (Tourn.) L.

1. **V. viride** Ait. GREEN HELLEBORE

Reported but once, no specimen seen: west Halifax Co. (MacKay. N.S. Inst. Sci. 1904: 287).

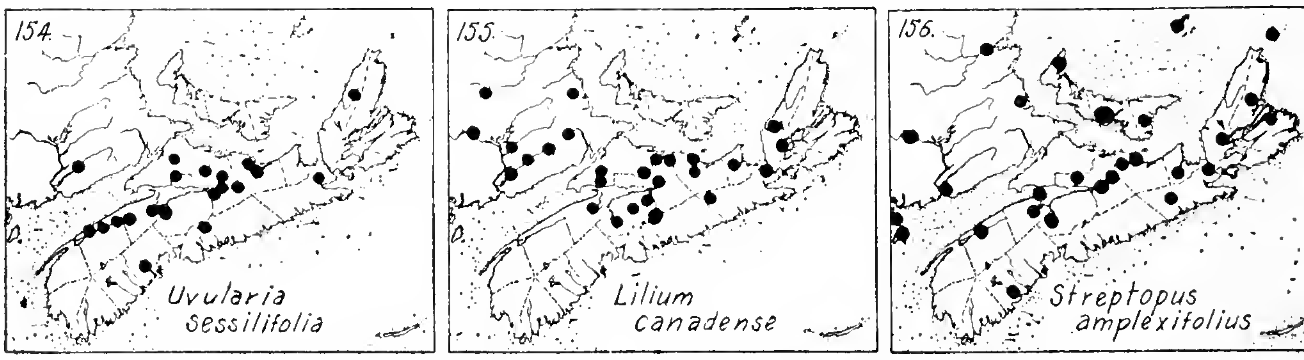
Swamps, wet woods and low pastures; N.B. to B.C. south to Ga. and Minn.

3. **UVULARIA** L.

1 **U. sessilifolia** L. BELLWORT Map. 154. Fig. 36, a.

Rich woodland or alluvial soils, usually in shade but often growing out into open meadows and hay-fields in the center of the province; Annapolis and Cumberland Cos. to C.B., occasionally southward. May 20-June 15. (Oakesia).

N.S. to Minn. south to Ga.



4. **ALLIUM** L. ONION

a. Flowers rose-colored; leaves linear and hollow, present at flowering time. 1. *A. Schoenoprasum*

a. Flowers white; leaves elliptic, 2-5 cm wide, appearing early and disappearing before flowering-time. 2. *A. tricoccum*

1. **A. Schoenoprasum** L., var. **sibiricum** (L.) Hartm. CHIVES.

Prest reports it along wet, low land near the sea-shore or rivers; Macoun found it in meadows near the sea at Yarmouth; and it is occasionally found around the sea-coast elsewhere. The garden plant is the introduced species.

Nfld. to Alaska south to northern N. Eng. & the Great Lakes.

2. **A. tricoccum** Ait. WILD LEEK

Luxuriant, in large crowded beds; rich sugar maple woods on the top of Cape Blomidon and in a rich intervale at Kemptown, Colchester Co.

N.S. to Minn. south to Ga. & Tenn.

5. HEMEROCALLIS L.

1. **H. fulva** L. TAWNY DAY LILY Fig. 36, d.

An occasional escape from gardens; it is found in large clumps along rocky roadsides, especially in the Annapolis Valley; scattered throughout.

Introduced from Eurasia; N.S. to Ont. south to N.C.

6. LILIUM (Tourn.) L.

1. **L. canadense** L. CANADA LILY Map 155. Fig. 37, a.

Meadows from Kings and Cumberland to C.B.; it is common around Truro and Mabou, scattered elsewhere. Early July.

N.S. to Minn. south to Ga.

7. ERYTHRONIUM L.

1. **E. americanum** Ker. DOG'S TOOTH VIOLET Fig. 36, f.

Upland woods of beech and maple and along the edges of intervales; common in Cumberland to C.B.; local in hardwoods on the Annapolis Valley slopes and best known around Gaspereau Valley and on the North Mt. Late May.

N.S. to Minn. south to Fla. & Tex.

8. ORNITHOGALUM (Tourn.) L.

1. **O. umbellatum** L. STAR-OF-BETHLEHEM

This slender garden perennial shows a tendency to escape around Yarmouth and neighboring regions; scattered around old dwellings. Early July.

Native of Eu.

.9. ASPARAGUS (Tourn). L.

1. **A. officinalis** L. ASPARAGUS

Occasionally escaping to roadsides. In the Annapolis Valley it will persist for years in fields or orchards where it was once cultivated.

Native of Eu. and widely introduced.

10. CLINTONIA Raf.

1. **C. borealis** (Ait.) Raf. CLINTONIA Fig. 36, e.
Common throughout; deciduous or mixed woods. Early June.
Lab. to Man. south to N.C.

11. SMILACINA Desf.

a. Flowers numerous, minute, in a panicle; divisions of the perianth 1-2 mm long; plants 4-8 dm high, arching, from stout rootstocks; leaves numerous. 1. *S. racemosa*

a. Flowers few, larger, in a raceme; divisions of the perianth 3.5-5.5 mm long; plants 2-5 dm high, erect, from slender rootstocks.

b. Leaves 7-12, glaucous, broad and sub-clasping at the base; raceme sessile or nearly so. 2. *S. stellata*

b. Leaves 2-4, not glaucous, tapering to a sheathing base; raceme stalked. 3. *S. trifolia*

Fig. 37.—**Lilium.** a, top of plant, x $\frac{1}{4}$. **Medeola.** b, top of plant, x $\frac{1}{2}$. **Smilacina.** c, **S. racemosa,** x $\frac{1}{4}$. **Trillium.** d, **T. erectum,** x $\frac{1}{4}$. e, **T. cernuum,** x $\frac{1}{4}$. f, **T. undulatum,** x $\frac{1}{4}$.

1. **S. racemosa** (L.) Desf. FALSE SOLOMON'S SEAL Map. 157. Fig. 37, c.

Scattered in open deciduous woods, dryish roadsides and edges of thickets; rare in southwestern N.S. frequent northward. Forma **foliosa** Vict., Contrib. Inst. Bot. Univ. Montreal **14**: 15. 1929, is a minor form with the lowest branch of the panicle in the axil of the upper leaf. Bridgewater, and probably throughout the range.

N.S. to B.C. south to Ariz. and Tenn.

2. **S. stellata** (L.)Desf. STARRY FALSE SOLOMON'S SEAL Map. 158.

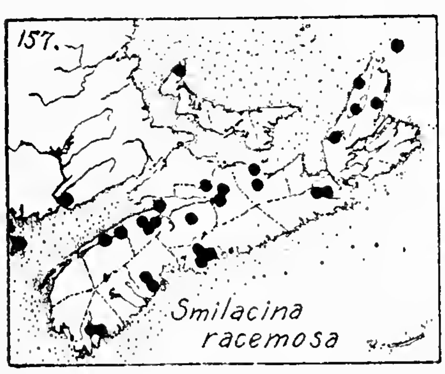
Rather rare around the coast on headlands or in marshes and wet meadows. Early July.

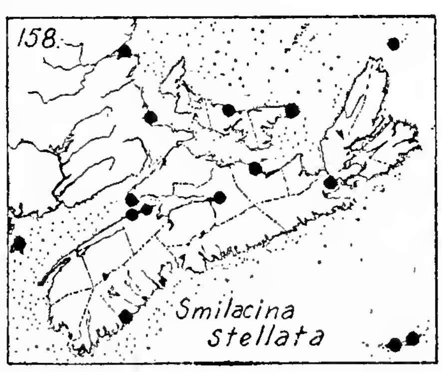
Lab. to B.C. south to Va. and Calif.; Eu.

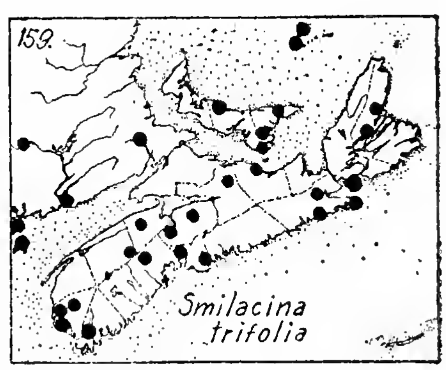
3. **S. trifolia** (L.) Desf. THREE-LEAVED FALSE SOLOMON'S SEAL Map 159. Fig. 38, b.

Common in sphagnous bogs or wet meadows throughout; swamps, wet bogs and sphagnum mats in northern C.B., usually with the base of the plant buried in sphagnum moss; June-July 15.

Lab. to B.C. south to N.J.; Siberia.







12. MAIANTHEMUM Weber.

1. **M. canadense** Desf. WILD LILY-OF-THE-VALLEY. Fig. 38, d.

Common throughout; in a great variety of habitats, one of the first plants to appear under conifers. June.

Lab. to the Mackenzie south to the mts. of N.C.

13. STREPTOPUS Michx.

Fassett, Norman C. A study of *Streptopus*. Rhodora **37**: 88-113. 1935.

a. Nodes glabrous; leaves clasping at base, the margin smooth; flowers greenish-white; peduncles and pedicels smooth. 1. *S. amplexifolius*

a. Nodes fringed; leaves not clasping, the margins finely ciliate;flowers rose-purple; peduncles and pedicels ciliate. 2. *S. roseus*

1. **S. amplexifolius** (L)DC., var. **americanus** Schultes. GREEN TWISTED-STALK. Map 156. Fig. 36, c.

Scattered in moist deciduous or mixed woods, in ravines or on intervales; rare in the southwestern counties, common from Annapolis to northern C.B. June.

Greenland to N.Y. and west around the northern Great Lake region; Alaska to N.M.

2. **S. roseus** Michx., var. **perspectus** Fassett. ROSE TWISTED-STALK. Map 160. Fig. 36, b.

Scattered to common throughout; acid soils, coniferous woods and thickets. June.

Lab. & Nfld. to Mich. south to Penn. & N.C.

14. POLYGONATUM (Tourn.) Hill

1. **P. pubescens** (Willd.) Pursh. SOLOMON'S SEAL. Map 161. Fig. 38, a.

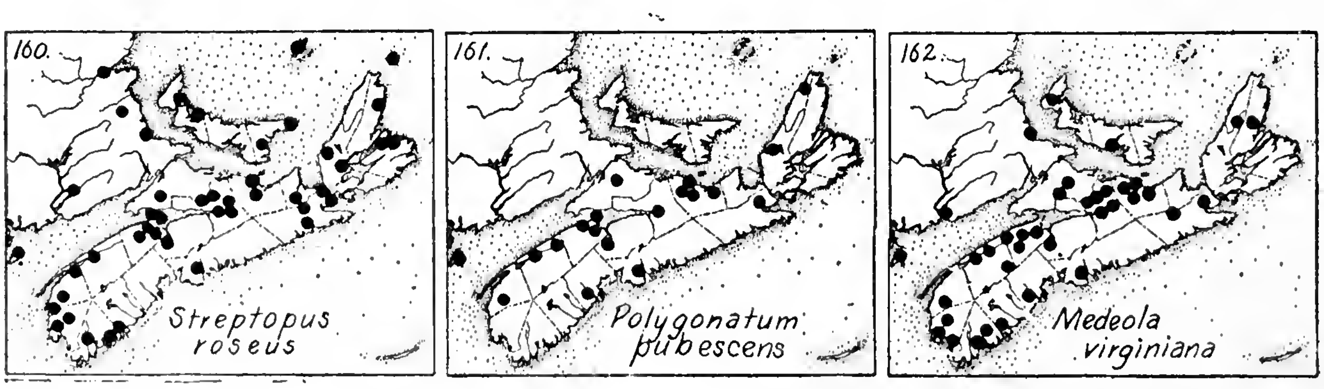
Rich deciduous woods; common from Annapolis to northern C.B.; scattered elsewhere and rare southwestward; intervales, ravines or in the richest thickets. June. (*P. biflorum*(Walt.)Ell.).

N.S. to Mich. south to Fla. & Tex.

15. CONVALLARIA L.

1. **C. majalis** L. LILY-OF-THE-VALLEY. Fig. 38, c.

This introduced garden plant persists or spreads in patches near old houses, cemeteries, or occasionally along roadsides in the more southern parts of the province. May.



16. MEDEOLA (Gronov.) L.

1. **M. virginiana** L. INDIAN CUCUMBER-ROOT. Map 162. Fig. 37, b.

Open deciduous woods or deciduous climax forest; throughout. It is usually scattered and on well-drained slopes, but areas have been seen with thousands of plants. June-July.

N.S. to Minn. south to Fla.

17. TRILLIUM L.

a. Leaflets tapering to the base and sessile, rounded at the tip and abruptly short-pointed.
  b. Flowers erect, dark-purple. 1. *T. erectum*
  b. Flowers recurved down under the leaves on a short stalk, pale pinkish. 2. *T. cernuum*
a. Leaflets with definite petioles about 1 cm long, rounded at the base and tapering to a slender tip; flowers erect, the petals white with pink-striped bases. 3. *T. undulatum*

1. **T. erectum** L. PURPLE TRILLIUM. Map 165. Fig. 37, d.

Common along the hardwood slopes of the Annapolis Valley, east at least to Pictou Co. It was not seen by the Gray Herbarium expedition west of Annapolis; and coll.

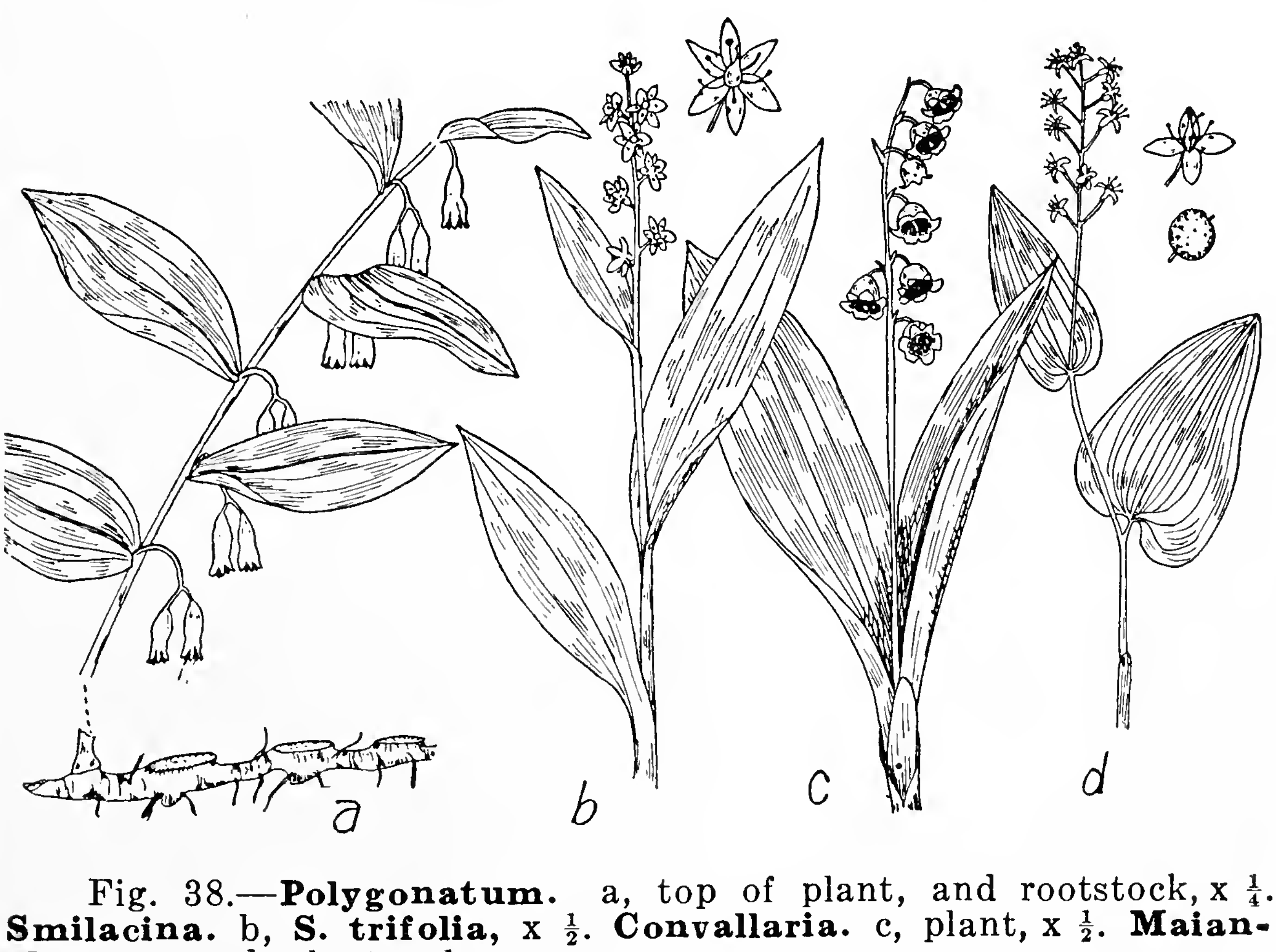


Fig. 38.—**Polygonatum.** a, top of plant, and rootstock, x ¼. **Smilacina.** b, S. **trifolia**, x ½. **Convallaria.** c, plant, x ½. **Maianthemum.** d, plant, x ½.

lections from the rest of the province are exceedingly few. A form with white or cream-colored corolla is named forma **albiflorum** R. Hoffm., Proc. Boston Soc. Nat. Hist. **36**: 244. 1922. The collection by Macoun from the North Mt., Annapolis, reported in his catalog as var. *album* belongs here. Early May.

N.S. to Ont. south to N.C.

2. **T. cernuum** L. NODDING TRILLIUM. Map 163. Fig. 37, e.

Kings and Lunenburg Cos. to Amherst and northern C.B.; alluvial soils, deciduous climax forest and flood plains. It is commonest on the rich intervales of Colchester and Pictou Cos. May 20-June 15.

Nfld. along the Atlantic Coast to Ga. east to Man.

3. **T. undulatum** Willd. PAINTED TRILLIUM. Map 164. Fig. 37, f.

Scattered to common throughout; little collected eastward; open dryish to rather rich woods and intervales. May 20-June 20.

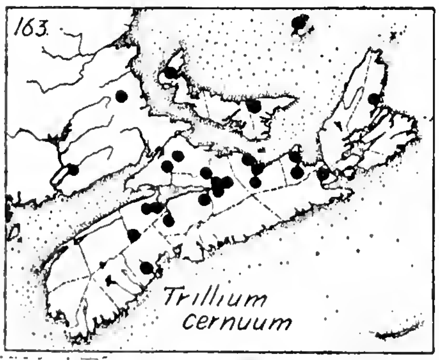
N.S. to Wisc. south to Ga.

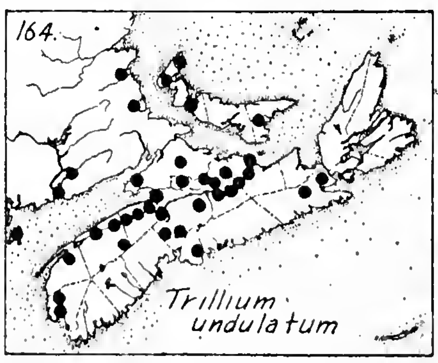
18. SMILAX (Tourn.)L.

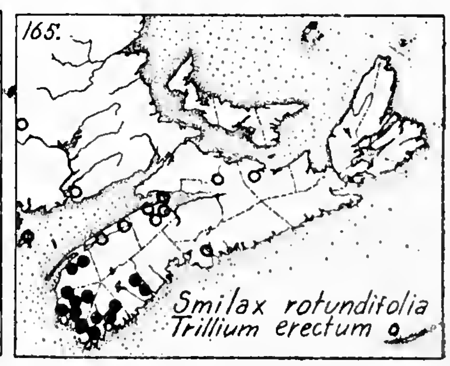
1. **S. rotundifolia** L. GREEN or CAT BRIER. Map 165. Fig. 39, f.

Thickets bordering lakes and rivers, often growing in dense tangles over shrubs; frequent from Weymouth south through Yarmouth Co. and Shelburne; along the Medway in Queens. Var. **quandangularis** (Muhl.) Wood has the margins of the leaf minutely ciliate-spinulose, with the branches more 4-angled. Frequent with the typical form or in separate colonies. Late June.

N.S. to Ga. and west to Minn.







26. HAEMODORACEAE BLOODWORT FAMILY

a. Stamens 3, exserted; ovary inferior; inflorescence hemi-spherical, 3-6 cm wide. 1. *Lachnanthes*

a. Stamens 6, included; ovary nearly superior; inflorescence loosely cymose, 5-10 cm wide, usually longer than wide. 2. *Lophiola*

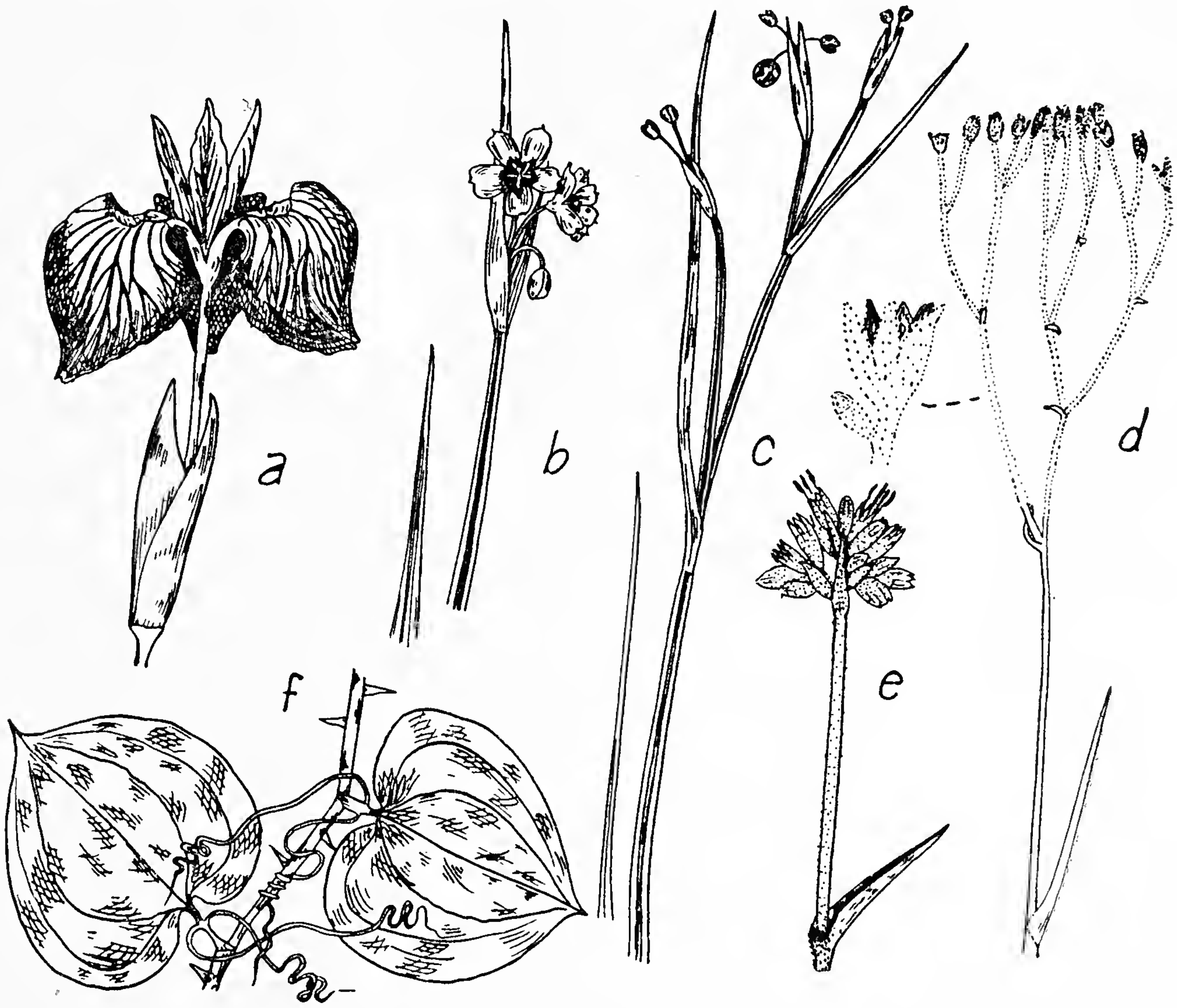


Fig. 39.—**Iris.** a, **I. versicolor,** flower, x 1/3. **Sisyrinchium.** b, **S. angustifolium,** top of plant, x ½. c, **S. atlanticum,** x ½. **Lachnanthes.** e, top of plant, x ½. **Lophiola.** d, top half, x ¼. **Smilax.** f, part of plant, x ½.

1. LACHNANTHES ELL

1. **L. tinctoria** (Walt.) Ell. RED-ROOT. Fig. 39, e.

Very local; known only from the shores of Ponhook and Beartrap Lakes, Queens Co. where it was discovered by Weatherby (Rhodora **44**: 233. 1942). It grew on peaty shores or lake-side marshes on the north side of Ponhook Lake, associated with *Scirpus Longii.* July-Sept.

Sandy swamps: N.S. and Mass. south to Fla. near the coast.

2. LOPHIOLA Ker

1. **L. aurea** Ker-Gawl see Rhodora **24**: 167. 1922, and **45**: 512. 1943. GOLDEN CREST. Fig. 39, d.

Rare, known from but four stations: common in wet savannahs along Little River, west of Tiddville, Digby Neck; scattered in a meadow, southern end of Brier Is.; scattered for miles along the shore of Ponhook L.; Queens Co.; and common in a sphagnous boggy swale bordering Fancy L., Lunenburg Co. Aug.-early Sept. (*L. americana* (Pursh) Wood. *L. septentrionalis* Fern.).

N. S. and the pine barrens of N. J.

27. IRIDACEAE IRIS FAMILY

a. Stems 4-10 dm high, terete or nearly so; flowers 6-12 cm wide; plant with thick rootstocks. 1. *Iris*

a. Stems 1-5 dm high, winged; flowers less than 1 cm wide; plants with fibrous roots only. 2. *Sisyrinchium*

1. IRIS (Tourn.)L. IRIS

a. Flowers yellow; plant 10-15 dm high; capsules 50-70 mm long. 1. *I. pseudoacorus*

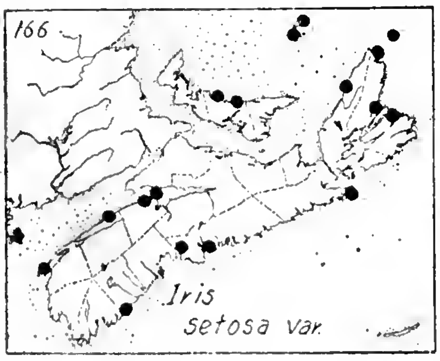
a. Flowers blue; plant 1-8 dm high; capsule shorter.

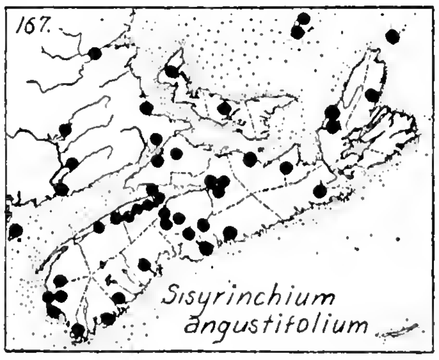
b. Capsule and ovary obtusely angled; leaves 5-30 mm wide; stem stout.

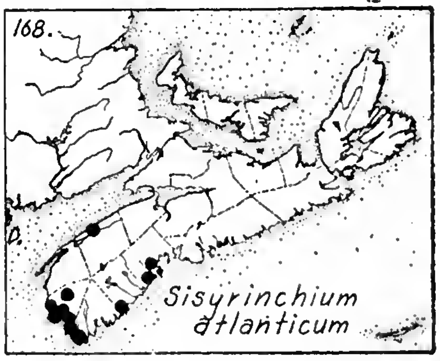
c. Leaves 5-30 mm wide; stem stout, angled on one side; petals flat, half as long as the sepals; capsule stout-beaked; seeds 4-6 mm wide, flattened on the side, raphe not apparent. 2. *I. versicolor*

c. Leaves 5-10 mm wide; stem slender, terete; petals tubular-pointed and one-quarter as long as the sepals; capsule blunt or barely tipped; seeds 2-3.5 mm wide, plump, with a prominent raphe. 3. *I. setosa*

b. Capsule and ovary sharply angled; leaves long and linear, 3-7 mm wide; stem very slender, terete. 4. *I. prismatica*







1. **I. pseudacorus** L. YELLOW IRIS

Well naturalized about pools and ditches near Yarmouth; found at Arcadia over thirty years ago; unknown elsewhere. Late June-July.

Introduced from Eu.; Nfld. to N.J.

2. **I. versicolor** L. BLUE-FLAG Fig. 39, a.

Common throughout; meadows, swamps, along streams and especially common in wet grazed pastures. June-July.

Lab. to Man. south to Fla.

3. **I. setosa** Pall., var. **canadensis** Foster. Map 166.

Found around the coast on beaches, exposed headlands and cliffs; common around C.B. and along the Bay of Fundy and scattered to rare elsewhere. July.

Lab. and Nfld. south to the coast of Me.

4. **I. prismatica** Pursh. SLENDER BLUE FLAG

Reported by Macoun as abundant in meadows at Louisburg; unknown elsewhere.

Wet ground or brackish swamps near the coast; N.S. to Ga.

2. SISYRINCHIUM L. BLUE-EYED GRASS

a. Spathe generally solitary and sessile at the culm; bracts composing the spathe unequal, the outer 2-6.5 cm long, the inner 1-3 cm long; stem 1.5-3 mm wide; pedicels equaling the inner bract or shorter. 1. *S. angustifolium*

a. Spathes generally 2 or more, peduncled from the axil of a leafy bract; bracts of the spathe nearly equal; pedicels longer than the inner bract.

b. Old leaf-bases persisting as tufts of brownish, fibrous bristles; plant stiff, usually blackening in drying; stem 1-3 mm wide. 2. *S. arenicola*

b. Old leaf-bases, if persistent, not forming tufts of fibrous bristles; plants not so stiff, not blackening in drying.

c. Inner bract of the spathe 10-15 mm long; stem slender and narrowly winged, 1-3 mm wide, tall and flexuous. 3. *S. atlanticum*,

c. Inner bract of the spathe 15-30 mm long; stem 2-4 mm wide broadly winged. 4. *S. graminoides*

1. **S. angustifolium** Mill. BLUE-EYED GRASS. Map 167. Fig. 39, b.

Very common throughout; fields, meadows, roadsides and open woods. The stem frequently may be branched. Late May-June. (*S. montanum* Greene, var. *crebrum* Fernald, in Rhodora **48**: 159-160. 1946).

Nfld. to B.C. southward.

2. **S. arenicola** Bickn.

Rare; sandy plains or banks, Yarmouth and Middleton; on the shore of Grand Lake, Halifax Co. (Fernald, 1921).

N.S.; Mass. south along the coast to Va.

3. **S. atlanticum** Bickn. Map 168. Fig. 39, c.

Common from Yarmouth to Lunenburg Cos.; North Mt., Belle Isle, Annapolis Co.; damp, peaty, sandy or gravelly soil in grassy woods or in the open.

N.S to Fla., west to Ind. and Mich.

4. **S. graminoides** Bickn. Map 169.

Common in the same range and situations as the last; abundant and the only member of the genus on Sable Is. Occasionally the plant may have quite simple scapes thus appearing like *S. angustifolium,* but with paler blue flowers (*S. gramineum* in Gray's Man. *S. angustifolium* Mill. acc. to Fernald, Rhodora **48**: 152-158. 1946).

N.S. to Me. and Minn. south to Fla. & Tex.

28. **ORCHIDACEAE** ORCHID FAMILY

a. Flowers showy with the lip moccasin-shaped, 2-5 cm long; fertile anthers 2 (Fig. 40, a). 1. *Cypripedium*

a. Flowers smaller; lip not moccasin-shaped, often fringed; fertile anther 1.

b. Flowers with spurs more than 2 mm long, numerous in erect, loose or dense racemes (Fig. 40, b-d). 2. *Habenaria*

b. Flowers without conspicuous spurs.

c. Flowers showy, pink or rarely whitish, 1.5-4.5 cm long.

d. Leaves elliptical or oval; flowers solitary and terminal (Fig. 41, e). 3. *Pogonia*

d. Leaves linear or reduced to sheaths only.

e. Flowers several in a raceme; perianth-parts separate; leaf solitary, linear (Fig. 41, d). 4. *Calapogon*

e. Flower solitary, terminal; perianth-parts joined at the base; leaves reduced to scales (Fig. 41, c). 5. *Arethusa*

c. Flowers less than 1 cm long, few to many, not normally solitary.

f. Leaves reduced to bracts; plant reddish or yellowish, without chlorophyll (Fig. 41, a, b). 9. *Corallorhiza*

f. Leaves linear to oval; plant with green chlorophyll.

g. Flowers in a narrow, spiral or one-sided raceme, white or greenish; sepals and petals, except the lip, erect and forming a tube.

h. Lip not sac-shaped; leaves not variegated, oval and basal or linear and on the stem (Fig. 42, a, b). 6. *Spiranthes*

h. Lip sac-shaped; leaves basal,ovate to elliptical, variegated with white and green (Fig. 42, c). 7. *Goodyera*

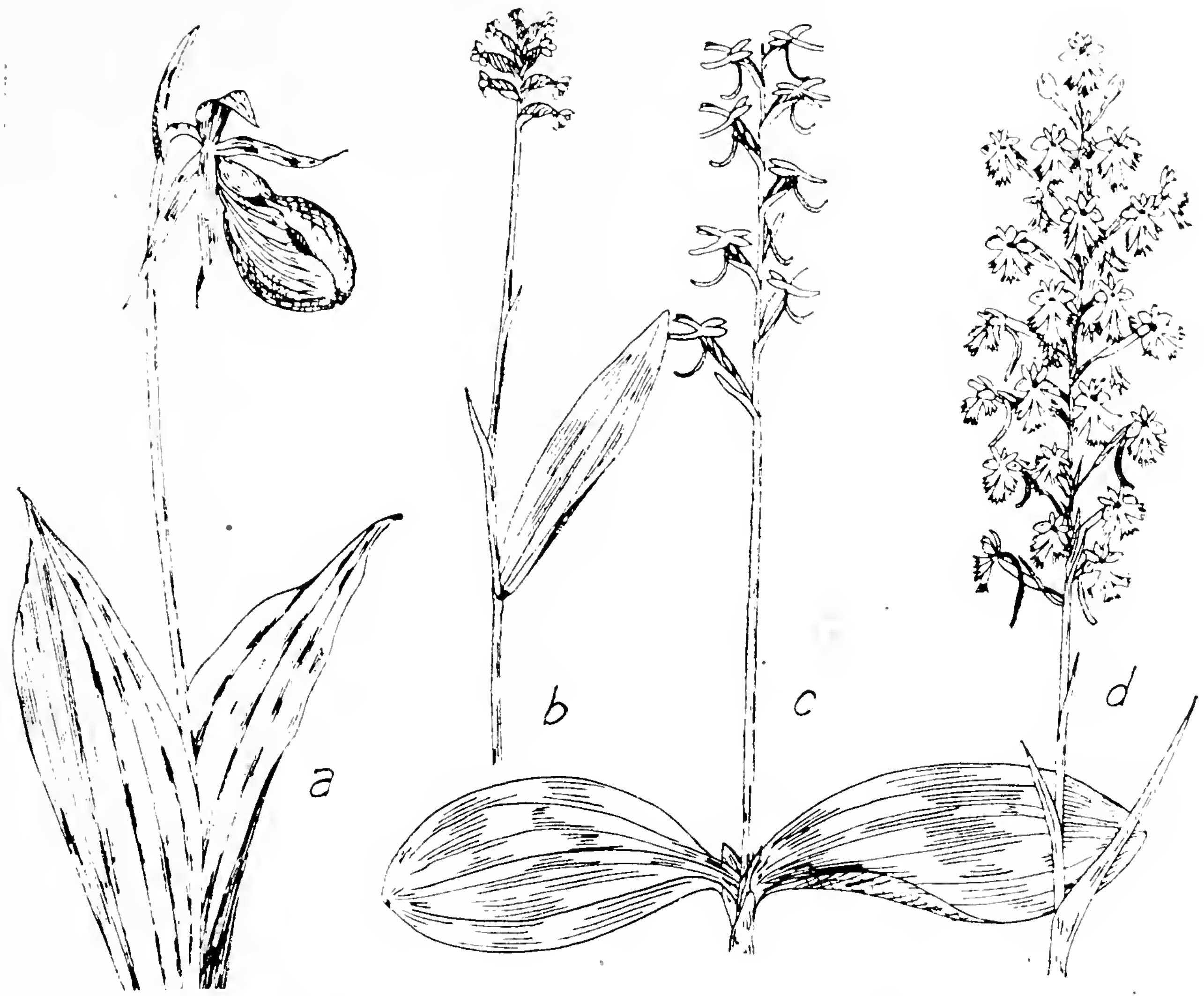


Fig. 40.—**Cypripedium.** a, **C. acaule,** x 1/3. **Habenaria.** b, **H. clavellata,** x 1/3. c, **H. Hookeri,** x 1/3. d, **H. psycodes,** x 1/3.

g. Flowers very small, greenish to pale purplish, in a short open raceme; sepals and petals separate, usually spreading.
i. Leaves two, opposite and conspicuous.
j. Leaves near the top of the stem (Fig. 42, f, g). 8. *Listera*
j. Leaves basal, sheathing the stem (Fig. 42, e). 11. *Liparis*
i. Leaves solitary on the stem, ovate-elliptical (Fig. 42, d). 10 *Malaxis*

1. **CYPRIPEDIUM** L. LADYSLIPPER

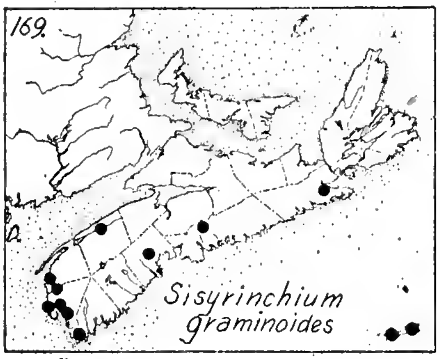
a. Plants leafy-stemmed; flowers 1-2, rarely several; lip with a roundish opening at the top.
b. Lip yellow, shorter than the sepals; sepals and petals linear-lanceolate, brownish and acute.
c. Lip 2-3 cm long; sepals purplish-brown. 1. *C. Calceolus* var. *parviflorum*
c. Lip 3.5-5 cm long; sepals paler and shorter. *C. Calceolus* var. *pubescens*
b. Lip white, flushed with purple; sepals and petals greenish-white, broad and obtuse. 2. *C. reginae*
a. Plant with two basal leaves only; flowers solitary; lip white or pink, split along the top. 3. *C. acaule*

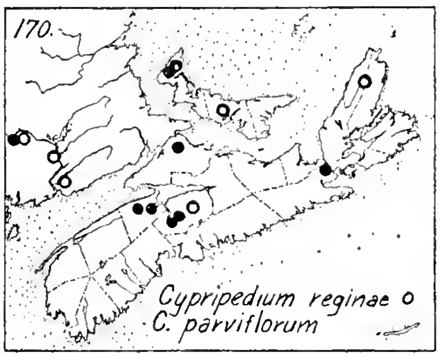
1. **C. Calceolus** L., var. **parviflorum** (Salisb.) Fern., Rhodora **48**:4. 1946. YELLOW LADYSLIPPER. Map 170.

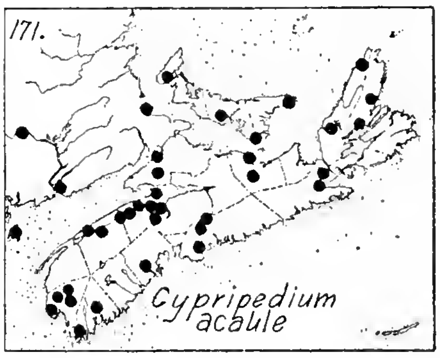
Rare; rich or calcareous soil, often near outcrops of gypsum or limestone sparingly east to C.B. and west to Kings Co. (*C. parviflorum* Salisb.). Nfld. to B.C. south to N. M. and Ga.

Var. **pubescens** (Willd.)Correll is a larger extreme scarcely separable from the species. Most of the specimens examined seem to belong to the smaller plant, but a collection from Gore in Hants Co. is placed here.

N.S.; Me. to Ga. and Mo.







2. **C. reginae** Walt. SHOWY LADYSLIPPER. Map 170.

Rare; reported by MacKay as often abundant in tamarack swamps, Pictou; local in northern C.B., P.E.I. and in N.B. (*C. hirsutum* Mill., *C. spectabile* Swartz.).

Nfld. to Minn. south to Ga. and Mo.

3. **C. acaule** Ait. COMMON LADYSLIPPER. Map 171 Fig. 40, a.

Scattered throughout; often abundant in acid soil in dry or moist woods. It is characteristic of the pine woods of the Annapolis Valley, where scattered individuals are usually present. The wh te-flowered form has been named forma *albiflorum* Rand & Redfield. This is often common. Early June.

Nfld. to Minn. northwestward; south in the mts. to N.C. and Tenn.

2. **HABENARIA** Willd. FRINGED ORCHID

a. Lip not fringed.
 b. Leaves scattered on the stem.
  c. Leaves several to numerous, at least more than 2.
   d. Lip oblong, truncate, the apex with 2 or 3 terminal teeth or smooth; lower bracts of the inflorescence much longer than the flowers.
    e. Lip 3-toothed at the apex; spur 1-3 mm long, shorter than the lip. 1. *H. viridis*

e. Lip truncate; spur slender, 4-6 mm long, longer than the lip.
f. Leaves narrow, attenuate, towards the base of the plant; raceme rather open with the bracts little longer than the flowers. 2. *H. flava*
f. Leaves broader, more elliptic, scarcely attenuate; raceme compact with longer bracts. *H. flava* var. *virescens*
d. Lip lanceolate to linear, the apex entire, subacute or rounded; bracts little, if at all, longer than the flowers.
g. Flowers greenish, scarcely fragrant; lip not dilated at the base. 3. *H. hyperborea*
g. Flowers white, fragrant; lip dilated at the base. 4. H. *dilatata*
c. Stem-leaves 1 or 2; lip truncate, 2-3-toothed at the apex; bract shorter than the 3-16 flowers; raceme short and cylindrical. 5. *H. clavellata*
b. Leaves basal, oblong to orbicular, spread flat on the ground or rising from the base of the plant.
h. Leaf solitary, obovate or oblong; spur about 6 mm long, equal in length to the lip. 6. *H. obtusata*
h. Leaves 2, oval or orbicular; spur nearly twice as long as the lip.
i. Lip lanceolate, 1 cm long; spur 18-20 mm long; scape bractless. 7. *H. Hookeri*
i. Lip linear, 1.5-2 cm long; spur 18-40 mm long; scape bracted; leaves large.
j. Spur 1.8-2.5 cm long; leaves orbicular, 6-19 cm broad. 8. *H. orbiculata*
j. Spur 2.5-4 cm long; leaves larger and more elliptical, the whole plant generally larger. 9. *H. macrophylla*
a. Lip fringed.
k. Body of the lip oblong and fringed along the sides and apex; flowers white. 10. *H. blephariglottis*
k. Body of the lip 3-parted.
l. Flowers greenish or whitish, rarely with a tinge of purple; divisions of the lip cut into capillary segments or finely fringed. 11. *H. lacera*
l. Flowers purple or lilac; divisions of the lip fan-shaped, fringed at the truncate ends.
m. Lip 1-1.2 cm wide; flowers deep purple; lip cut less than one-third their depth. 12. *H. psycodes*
m. Lip 1.8-2 cm wide, more deeply fringed; flowers lilac. 13. *H. fimbriata*

1. **H. viridis** (L.)R.Br., var. **bracteata** (Muhl.) Gray

Rare; found in boggy spots on Sable Is.; characteristic of the richest woods on the mainland and in C.B. See Rhodora **28**: 169-174. 1926. Aug.

Nfld. to B.C. south to N.C. and Iowa; eastern Asia.

Fig. 41.—**Corallorrhiza.** a, **C. maculata,** x 1/3. b, **C. trifida,** x ½. **Arethusa.** c, plant, x ½. **Calapogon.** d, plant, x ½ **Pogonia.** e, plant, x ½. **Habenaria.** flowers, x 2.

2. **H. flava** (L.)Gray

Restricted so far as known to the river systems of the Tusket in Yarmouth and the Medway in Queens; pebbly, sandy or gravelly beaches or wet peaty margins of lakes and rivers in the Tusket Valley (Fernald, 1921); scattered on the pebbly strand of the Medway (Weatherby). Tex and Fla. northward to N.J. and N.S.

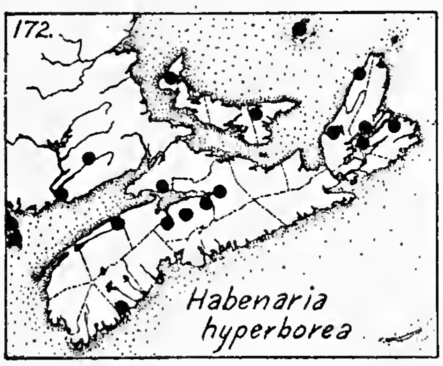
Var. **virescens** (Muhl.) Fern., Rhodora **23**: 148. 1921, is the common inland plant; rare, known only from Boylston, Guysborough Co.

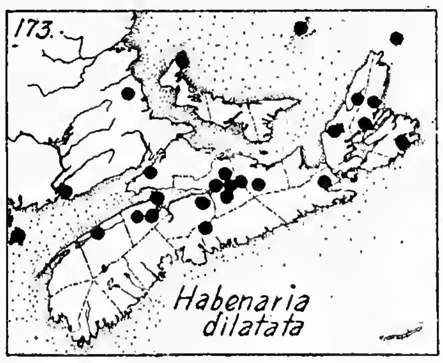
3. **H. hyperborea** (L.)R. Br. GREEN HABENARIA. Map 172.

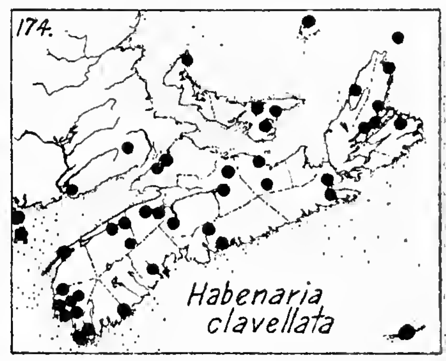
Intervales, wet meadows, bogs and well-drained swamps from Annapolis and Queens Cos. to C.B.; not seen by the

Gray Herbarium Expedition in the southwestern counties; never as common as the next species. Late June-Aug.

Greenland to Alaska south to N.Y., Ill. and Ore.







4. **H. dilatata** (Pursh) Gray. WHITE BOG-ORCHID. Map 173. Fig. 41.

Common and often abundant from Annapolis to northern C. B.; growing in situations similar to the preceeding species. July-Aug.

Lab. to Alaska south to N.J., Mich. and Wash.

5. **H. clavellata** (Michx.)Spreng., var. **ophioglossoides** Fern., see Rhodora **48**: 161. 1946. Map 174. Fig. 40, b.

Common in bogs, poorly or well-drained swamps, and damp soil throughout. Late July.

Nfld. to Minn. south to Fla.

6. **H. obtusata** (Pursh) Richards.

Common in coniferous climax forest, mossy spruce or fir woods; scattered to common in eastern N.S., becoming rarer to Yarmouth Co. July-Aug.

Nfld. to Alaska south to N.Y., Minn. and Colo.

7. **H. Hookeri** Torr. Map 175. Fig. 40, c.

Scattered in most parts of the province, very rare or absent in the southwestern counties; deciduous woods or more frequently under conifers. June-July.

N.S. to Minn. south to Penn. and Iowa.

8. **H. orbiculata** (Pursh) Torr. Map 176.

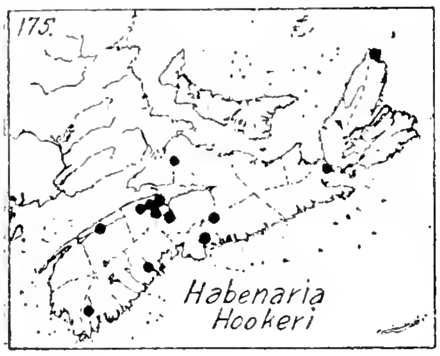
Usually found under conifers; scattered in the northern parts of the province, characteristic of the coniferous climax forest in C.B. Aug.

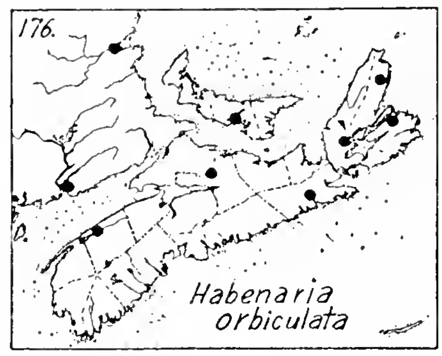
Lab. to Alaska south to Penn. and the mts. of N.C.

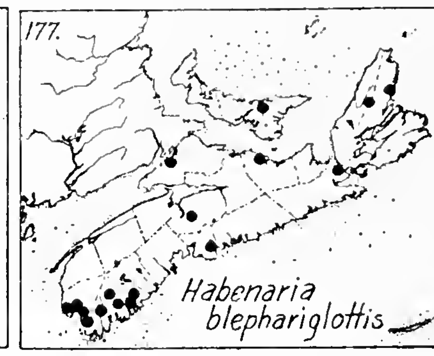
9. **H. macrophylla** Goldie

Rich deciduous or mixed woods; scattered across the northern part of the province and not nearly as common as the preceeding species and perhaps merely a long-spurred extreme of it. Aug.

Nfld. to Ont. south to Conn. and Mich.







10. **H. blephariglottis** (Willd.) Torr. WHITE FRINGED-ORCHID. Map 177. Fig. 41.

Boggy or even dryish barrens, spruce thickets, in peaty hollows or occasionally even on railway embankments; common to abundant in the southwestern counties; characteristic of mature bogs in C.B.; rare through the rest of the province. Fernald states that it occurs over the gold-bearing rocks but not on granitic areas. July-Aug.

Nfld. to Minn. south to N.C.

11. **H. lacera** (Michx.)R. Br. RAGGED FRINGED-ORCHID. Map 178. Fig. 41.

Common throughout; meadows, damp fields, bogs and poorly-drained clay soils; occasional in the damp dune hollows and turfy banks on Sable Is. Some of the plants from C.B. often show a crimson tinge to the flowers and thus are intermediate to var. **terrae-novae,** Fern., Rhodora **28**: 21. 1926. of Nfld. This variety is also said to be the only one on Sable Island (Fernald, in Rhodora **48**: 185. 1946). July-Aug.

Nfld. to Man. south to N.C.

12. **H. psycodes**(L.)Spreng. PURPLE FRINGED-ORCHID. Map 179. Fig. 40, d.

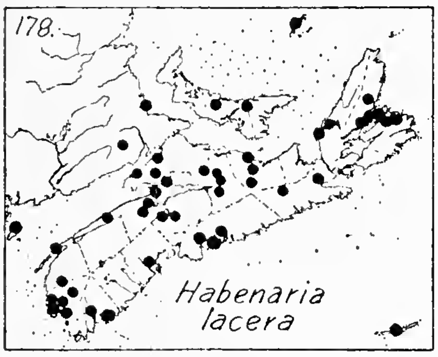
Common in damp meadows throughout, often growing in dense masses. Late July-Aug. Intermediate forms between this and the following species occur.

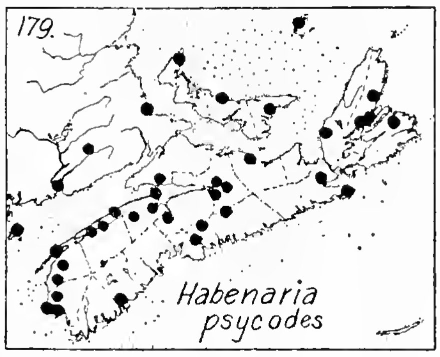
Nfld. to Minn. south to N.C.

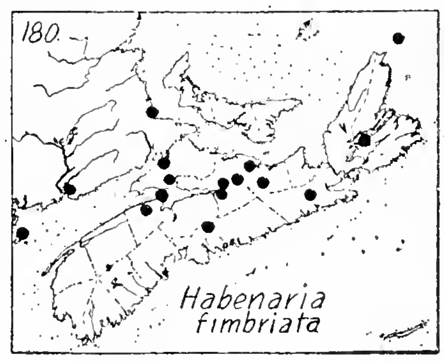
13. **H. fimbriata** (Ait.)R. Br. FRINGED-ORCHID. Map 180. Fig. 41.

Often found growing together with the preceeding, but restricted to rich intervale soils, mostly in the north-central part of the province; wet meadows, borders of swamps and along streams. July-Aug.

Nfld. and Que. south to N.Y. and the mts. of N.C.







3. POGONIA Juss.

1. **P. ophioglossoides** (L.)Ker. ROSE POGONIA. Map 181. Fig. 41, e.

Peat bogs, often growing in profusion in the spruce or mature bogs along the Atlantic Coast and in northern C.B., scattered elsewhere. Var. **brachypogon** Fern., Rhodora **23**: 245. 1921, has the fringe of the lip obsolescent, the segments of the perianth scarcely divergent, and grows more or less in clumps. This is found around the lakes of southern Yarmouth and Digby Cos., in many cases transitional to the typical form; as are also some of the plants of Nfld. and the Magdalens. July.

Nfld. to Minn. south to Fla.

4. CALOPOGON R. Br.

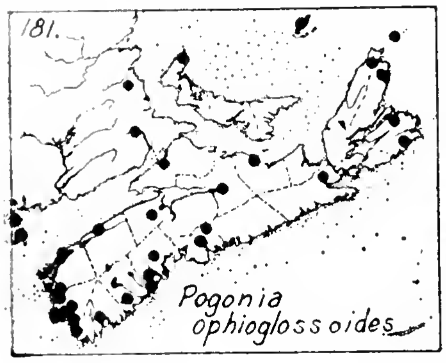
a. Leaves linear, grass-like.
  b. Flowers magenta-crimson. 1. *C. puchellus*
  b. Flowers nearly white. *C. puchellus* forma *albiflorus*
a. Leaves oblong- or elliptical-lanceolate, 7-11 cm long, 1.3-2.8 cm wide. *C. puchellus* forma *laterifolius*

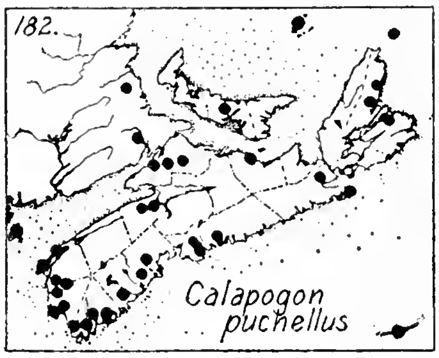
1. **C. puchellus** (Sw.)R.Br. Map 182. Fig. 41, d.

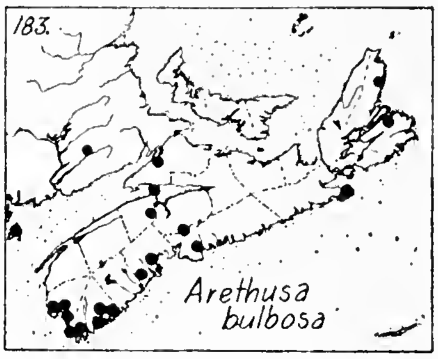
Mature bogs and swamps; one of the most characteristic plants of bogs in the eastern part of the province, even those at the edge of the sea; frequent in dune hollows on Sable Is.; scattered elsewhere and in cranberry bogs in the Annapolis Valley. July.

Forma **albiflorus** (Britt.)Fern. is rare; a single plant is reported from sandy and peaty margin of Lake Annis, Yarmouth Co. (Fernald, 1921). Forma **latifolius** St. John, Proc. Boston Soc. Nat. Hist. 36: 69. 1921. Wet dune hollows, Sable Is.

Nfld. to Minn. south to Fla.







5. ARETHUSA (Gronov.)L.

1. **A. bulbosa** L. ARETHUSA. Map 183. Fig. 41, c.

Much rarer than the two preceeding species; bogs, generally in the most acid peat, around the coast of the province; rarely inland. July.

Nfld. to Minn. south to Penn. and the mts. of S.C.

6. SPIRANTHES Richard LADIES-TRESSES

a. Stem slender, leafless; leaves basal and ovate, soon disappearing; flowers 5 mm long; raceme slender and often one-sided, the flowers in one row. 1. *S. lacera*

a. Stem stout, leafy, at least towards the base; leaves linear to lanceolate; flowers 5-12 mm long; raceme thicker, not one-sided, the flowers in several rows.

b. Lip squarish, blunt, yellow, with small oblong growths on the margin at the base; leaves lanceolate, about 1 cm wide; flowering early July. 2. *S. plantaginea*

b. Lip ovate-oblong, scarcely squarish and less blunt; growths at the base round or nipple-shaped, sometimes lacking; leaves linear or linear-lanceolate.

c. Lip not constricted below; growths at the base prominent; lateral sepals not upturned and the flower-parts therefore not plainly tubular; beak of the stigma very long and slender; flowering late summer.

d. Flowers white; floral bracts exceeding the ovary by about half the length of the perianth; odor fragrant. 3. *S. cernua*

d. Flowers yellowish; floral bracts elongated; odor disgusting; flowering later. *S. cernua* var. *ochroleuca*

c. Lip constricted below the apex; growths minute or lacking; lateral sepals upturned and joined with the petals and upper sepal, so that the perianth parts are tube-like; beak of the stigma short; flowering late August. 4. *S. Romanzoffiana*

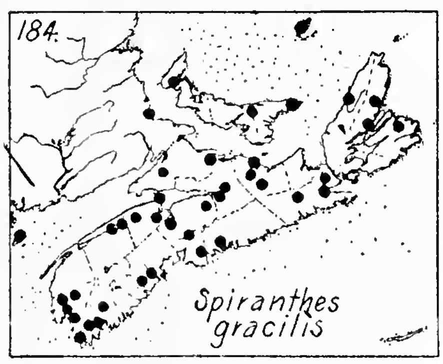
1. **S. lacera** Raf., see Fernald, Rhodora **48**: 5-8. 1946. LADIES'-TRESSES. Map 184. Fig. 42, a.

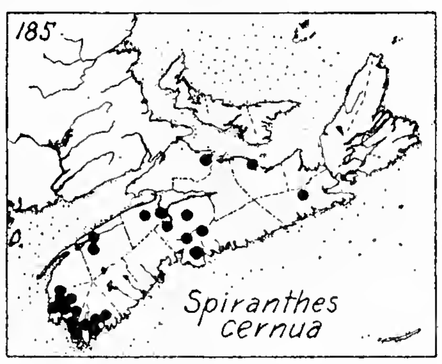
Scattered throughout, more common in sandy or gravelly soil, barrens, railroad cutting, edges of woods, and open coniferous or mixed woods or bush. (*S. gracilis* (Bigel.) Beck).

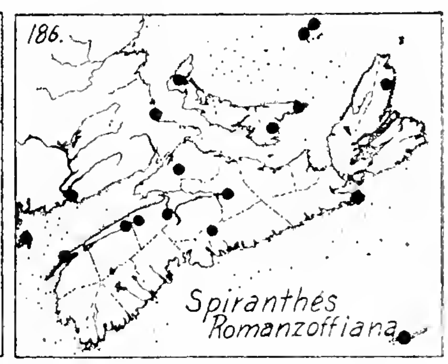
N.S. to Man. south to N.C., Tenn. and Okla.

2. **S. plantaginea** (Raf.) Torr. WILDLEAF LADIES'-TRESSES.

Rare; mentioned by Lindsay from Windsor and Halifax.







Robinson found it between Margaree and Cheticamp; and it was found scattered on the grassy hillsides along Cape George, Antigonish Co., in flower July 11, 1941. (*S. latifolia*, *S. lucida* (H.H.Eaton) Ames).

N.S. to Wisc. south to Va.

3. **S. cernua** (L.) Richard. NODDING LADIES'-TRESSES. Map 185. Fig. 42, b.

Boggy meadows, low hayfields, and seepy slopes and pastures, sandy shores of lakes throughout; generally scattered, but often abundant on seepy slopes of the Annapolis Valley. Late Aug.

Var. **ochroleuca** (Rydb.) Ames is often difficult to separate from the species; characteristic of the dryest of siliceous barrens in southwestern N.S. (Fernald, 1921). It is found in much the same general range as the species.

N.S. to Minn. and Nebr. south to Fla. and Tex.

4. **S. Romanzoffiana** Cham. Map 186.

Rare; scattered in swamps and boggy places from Annapolis Co. & Digby Neck north and east to C.B.; rare in damp boggy spots on Sable Island. Late July-Aug.

Nfld. to B.C. south to Conn., N.Y. and Calif.

Fig. 42.—**Spiranthes.** a, **S. lacera,** x ½. b, **S. cernua,** x ½. **Goodyera.** c, **G. tesselata,** x ½. **Malaxis.** d, plant, x ½. **Liparis.** e, plant, x 1/3. **Listera.** f, **L. cordata,** x ½. g, **L. convallarioides,** part of plant, x ½.

7. **GOODYERA** R.Br.

a. Inflorescence loose; lip sac-like with an elongated tip and flaring or recurved margins; plants rarely over 25 cm high; leaves plainly reticulate-veined with white.

b. Flowers in a 1-sided raceme 3-7 cm long; perianth 4-4.5 mm long; leaves small, 1-3 cm long, widest near the base and often with the sides straight to an acute tip. 1. *G. repens*

b. Flowers in a loose spiral raceme 6-8 cm long; leaves usually rounded-tapering from the middle to each end. 2. *G. tesselata*

a. Inflorescence dense; lip scarcely saccate, elongate with the margins inrolled; plant large, usually 20-40 cm high; leaves green, often with the midrib lined with white, 5-10 cm long. 3. G. *oblongifolia*

1. **G. repens** (L.)R.Br. var. **ophioides** Fern. CREEPING RATTLESNAKE-PLANTAIN.

Mostly rare; it is reported as rather frequent in the dry woods of eastern Halifax and Guysborough Cos. (Rousseau); and is occasional elsewhere in mossy or dryish coniferous woods. Aug. (*Epipactis*).

This var. of the European species ranges from Nfld. to Man. south to N.Y. and Mich. and the mts. of N.C.

2. **G. tesselata** Lodd. RATTLESNAKE-PLANTAIN. Fig. 42, c.

Local or scattered; Greenville, Yarmouth Co. (Fernald, 1921); coniferous or pine woods of the Annapolis Valley; characteristic of the coniferous climax forest of northern C.B. Aug.

Nfld. to Minn. south to Conn. and N.Y.

3. **G. oblongifolia** Raf., see Fernald, Rhodora **48**: 11. 1946. WESTERN RATTLESNAKE-PLANTAIN.

Known only from northern C.B. where it is characteristic of the deciduous climax or rich mixed forests, on slopes and in ravines. [*Epipactis decipiens* (Hook.)Ames].

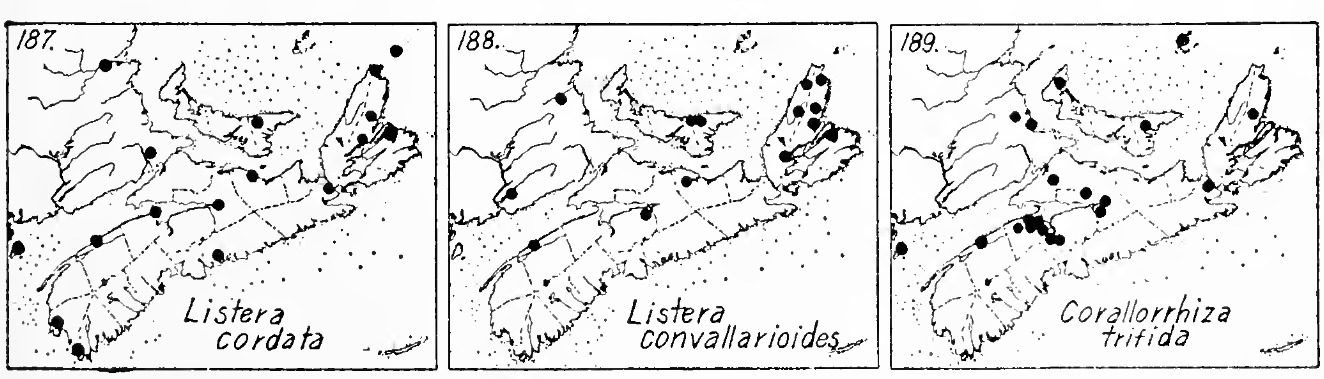
B.C. to Calif.; local across the continent to northern Me., N.B. and C.B.

8. LISTERA R. Br.

a. Flowers small, the lip 3-5 mm long, deeply cleft into two spreading prongs; pedicel shorter than the ovary; leaves 12-25 mm long. 1. *L. cordata*

a. Flowers larger, the lip about 9 mm long, shallowly lobed into rounded lobes; pedicel slightly longer than the ovary; leaves 30-50 mm long. 2. *L. convallarioides*

1. **L. cordata** (L.)R.Br. NORTHERN LISTERA. Map 187. Fig. 42, f.



Occasional in damp woods, in coniferous forests or in wet ravines throughout, becoming commoner to northern C.B.; inconspicuous and often overlooked. July-Sept.

Lab. to N.J. west to Mich.; Calif. northward to Alaska.

2. **L. convallarioides** (Sw.)Torr. LISTERA. Map 188. Fig. 42, g.

Rare from Annapolis to C.B.; common in northern C.B.; rich hardwood slopes, intervales and deciduous climax forest. It is abundant around Pleasant Bay, Inverness Co. July.

Nfld. to Alaska south to N.Y., Minn. and Calif.

9. CORALLORHIZA (Haller)R. Br. CORALROOT

a. Plant yellowish; lip white or very rarely with a few spots.
  b. Plants slender, 4-15 cm high; lateral lobes of lip small; spur very small and obscure. 1. *C. trifida*
  b. Plants large, stout, 2-4 dm high; lateral lobes of lip prominent; spur usually conspicuous. 2. *C. maculata* forma *flavida*
a. Plant madder-purple; lip spotted with purple, otherwise similar to forma *flavida*. 2. *C. maculata*

1. **C. trifida** Chatelain, var. **verna** (Nutt.) Fernald, in Rhodora **48**: 193-197. 1946. EARLY CORALROOT. Map 189. Fig. 41, b.

Scattered in the northern part of the province from Annapolis to C.B.; mostly in coniferous woods, often in dense young growth with little light. June-July. (*C. innata* R.Br. of earlier records).

Nfld. to Alaska south to Penn., N.C. and Minn.; Eurasia.

2. **C. maculata** Raf. SPOTTED CORALROOT. Map 190. Fig. 41, a.

Common from Annapolis to northern C.B.; not seen by the Gray Herbarium Expedition west of Annapolis; scattered elsewhere; rather rich soil in deciduous woods, although it is occasionally found under conifers; mentioned by Nichols as characteristic of the climax forest in northern C.B. (*C. multiflora* Nutt.). Late July onward.

Forma **flavida** (Peck)Farw., Amer. Midl. Nat. **10**: 208. 1927, is one of a number of color forms. This striking yellow one was found during the summer of 1942 to be common on the wooded slopes of the Annapolis Valley, usually growing in mixed woods. This form grew in dense colonies with the roots of many plants tangled together; while the species in the same woods grew as solitary plants or in groups of several plants. Apparently of wide distribution.

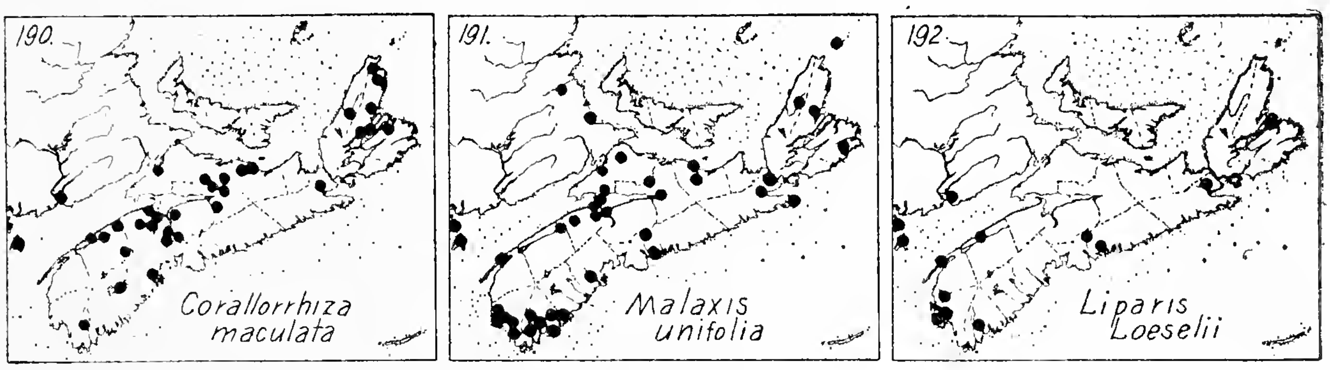
Nfld. west to B.C. south to Penn., N.C. and Calif.

10. **MALAXIS** Soland.

1 **M. unifolia** Michx. ADDER'S MOUTH. Map 191. Fig. 42, d.

Scattered throughout; wet meadows, damp upland pastures and fields, bogs near the coast, poorly drained clay soils, and occasionally in cranberry bogs. July-Aug. [*Microstylis unifolia* (Michx.)BSP.].

Nfld. to Man. south to Fla. and Mo.



11. **LIPARIS** Richard.

1. **L. Loeselii** (L.)Richard TWAYBLADE. Map 192. Fig. 42, e.

Occasional in peaty meadows and cobbly lake shores in Yarmouth and Digby Cos. (Fernald, 1921); scattered eastward near the coast and rather frequent in the bogs from Halifax to C.B. (Rousseau); rare or absent in the more northern region. July-Aug.

N.S. to Sask. south to N.C. and Mo.

29. **SALICACEAE** WILLOW FAMILY

a. Buds with a single scale; scales of the catkins entire or merely toothed; stamens few; flowers with small glands at their base; willows. 1. *Salix*

a. Buds with several scales; scales of the catkins laciniate; stamens numerous; flowers without glands; poplars. 2. *Populus*

1. **SALIX** (Tourn.) L. WILLOW

Willows, in general, comprise one of the most difficult groups to name correctly. Their variability, tendency to hybridize, and their similarity of appearance make considerable field work essential. In most cases pistillate and staminate catkins can be found on neighboring bushes so that two opportunities are given for keying out the species.

In early spring *S. discolor* and *S. humilis* are the commonest kinds. Later, *S. Bebbiana* will comprise the majority of the flowering plants. In central Nova Scotia *S. pyrifolia* will shortly follow, growing mostly in clay or in wet ground. *S. cordata* is common along streams and rivers. *S. lucida* comes still later and grows largely on sand bars. By far the commonest tree willow is the introduced *S. alba:* although *S. purpurea* is common around some of the towns and is distinguished by its dark bluish-green leaves. It is impossible to key out all the forms and variations, but the following will help to determine the main ones at least.

a. Depressed creeping shrubs with small rounded leaves; rare in northern Cape Breton.

Stamen 1; ovary and capsule glabrous or nearly so; young branches and leaves sparingly pubescent to glabrous. 8. *S. Uva-ursi*

Stamens 2; ovary and capsules densely pubescent; young branches and leaves silky villous. 9. *S. cordifolia*

a. Upright shrubs or trees.

b. Stamens 5-12; ovary glabrous with 2 glands; leaves glabrous, bright green beneath, widely lanceolate, glandular-serrate.

Cultivated, or a roadside escape; stalk of the staminate catkin 2 cm long, the bracts more than 1 cm wide; pedicels of the ovaries twice as long as the glands; leaves short acuminate, paler beneath; branches brownish-green. 1. *S. pentandra*

Native on river-shores; stalks of staminate catkin 1 cm long, the bracts less than 1 cm wide; pedicels of the ovaries 3-4 times as long as the glands; leaves very long-pointed; branches yellowish-brown. 2. *S. lucida*

b. Stamens 1-2 (rarely 3-5 in *S. alba*); ovary pubescent or glabrous; leaves various.

c. Catkins present.

d. Catkins staminate.

e. Filaments fused up to the anthers; anthers red; catkins before the leaves, with black scales. 17. *S. purpurea*

e. Filaments not fused; stamens 2, separate.

f. Staminate flower (each 2 stamens) with 2 glands; becoming trees.

Branches not brittle at the base; leaves usually silky beneath when young. 3. *S. alba*

Branches brittle at the base so that they snap off easily; leaves glabrous or very slightly silky beneath when young. 4. *S. fragilis*

f. Staminate flower with 1 gland at the base; shrubs or rarely small trees.

g. Scales of the catkins pale, with pale or but slightly darker tips.

Branches glabrous as are also the new leaves; filaments glabrous.

Shrub 1m or less high; leaves not toothed; anthers reddish when young. 7. *S. pedicellaris*

Shrub, larger and spreading; leaves well developed at flowering time, closely and finely glandular-serrate. 6. *S. pyrifolia*

Branches and leaves dull pubescent; filaments villous at the base; shrubs to small tree. 13. *S. Bebbiana*

g. Scales of the catkins dark.

h. Catkins appearing well before the leaves, sessile or nearly so, with merely a few small bracts at the base, short oval to elliptic.

Twigs glabrous, with a bloom; leaves later linear to lanceolate. 16. *S. pellita*

Twigs without a bloom.

Anthers red when young; twigs dirty pubescent; catkins short, to 3 cm long. 11. *S. humilis*

Anthers yellow; twigs glabrous (pubescent in hybrids between this species and *S. humilis*); leaves later nearly oblong. 10 *S. discolor*

h. Catkins appearing slightly before or with the leaves, with a short bracted or leafy stalk.

Young bracts or leaves glabrous or with dull matted hairs. 5. *S. cordata*

Young bracts and leaves with lustrous fine appressed pubescence.

Branches stout, yellowish; filaments glabrous; cultivated, becoming a tree. 14. *S. viminalis*

Branches slender, reddish-brown; filaments pilose at the base; shrub, rather rare. 12. *S. sericea*

d. Catkins pistillate.

i. Ovary glabrous.

j. Ovary sessile; flower with 1 gland; scales yellow; becoming a tree. (See *S. purpurea* with black scales). 3. *S. alba*

j. Ovary plainly stalked.

k. Scales of the catkin yellowish to yellow-brown, light or but slightly darkened at the apex.

Bush or tree, usually over 1 m high; leaves toothed; stigma sessile or nearly so.

Leaves lanceolate, tapering to the base; twigs brittle at the base; flower with 2 glands, introduced tree with upright branches. 4. *S. fragilis*

Leaves short-oval to widely lanceolate, cordate at the base, closely glandular-toothed when young; shrub with spreading branches. 6. *S. pyrifolia*

Bush, rare and growing in meadows or bogs, less than 1 m high; leaves not toothed. 7. *S. pedicellaris*

k. Scales of the catkin blackish. 5. *S. cordata*

i. Ovary pubescent.

l. Style very short (nearly as long as the stigma in *S. discolor*).

m. Scales yellowish or slightly darker toward the tip; catkin with bracts or leaves at the base; style lacking or very short. 13. *S. Bebbiana*

m. Scales black; catkins sessile or nearly so, appearing with or before the leaves.

n. Ovary sessile; style absent; catkins up to 2 cm long; twigs glabrous. 17. *S. purpurea*

n. Ovary stalked; style longer or distinct.

Style nearly as long as the stigmas; catkins mostly over 2.5 cm long; capsules 7-13 mm long; twigs glabrous as are also the undersides of the leaves in typical forms. 10. *S. discolor*

Style very short; catkins about 2.5 cm long; twigs pubescent; undersides of leaves pubescent.

Capsule tapering to a slender beak 10-15 mm long; leaves with woolly hairs beneath. 11. *S. humilis*

Capsule blunt, about 3.5 mm long; leaves with fine appressed pubescence beneath. 12. *S. sericea*

l. Style longer than the stigmas; catkins with or shortly after the leaves in spring.

o. Twigs finely pubescent, later becoming glabrate, without a bloom; pedicel of the ovary shorter than the gland.

Pedicel about half as long as the glands; style long; introduced tree with narrow leaves. 14. *S. viminalis*

Pedicel finally becoming as long as the gland; tall introduced shrubs, rare. 15. *S. Smithiana*

o. Twigs glabrous with a fine bloom; pedicel of the ovary longer than the gland. 16. *S. pellita*

c. Catkins absent; leaves mature.

p. Leaves entire or nearly so with scattered teeth near the tip, glabrous.

Leaves sub-opposite on the young twigs, bluish-green, very smooth, narrowly lanceolate; becoming trees. 17. *S. purpurea*

Leaves all alternate, not bluish-green, oblong-lanceolate to oblong; shrubs to 1 m high. 7. *S. pedicellaris*

p. Leaves mostly distinctly toothed, or if entire then with some pubescence.

q. Leaves lanceolate, more than 3 times as long as wide, closely and regularly toothed.

r. Leaves slightly pubescent to glabrous beneath, the edges not inrolled.
Trees; leaves long tapering to the base.
Twigs brittle at the base so that they snap off easily; leaves glabrous beneath. 4. *S. fragilis*
Twigs not brittle at the base; leaves glabrous or usually slightly pubescent beneath, at least along the mid-rib. 3. *S. alba*
Shrubs in low or wet areas, widely branching; leaves cordate, rounded or short-tapering at the base. 5. *S. cordata*
r. Leaves densely pubescent beneath, oftener linear, sometimes inrolled.
Hairs on the lower surface silky and closely appressed; margin of leaf not strongly inrolled. 14. *S. viminalis*
Hairs on the lower surface tangled and erect; margin of leaf usually strongly inrolled.
Twigs glabrous, with a bloom. 16. *S. pellita*
Twigs grayish with dirty pubescence. 11. *S. humilis*
q. Leaves wider, averaging less than 3 times as long as wide, often irregularly and shallowly toothed, rarely nearly entire.
s. Leaves glabrous or nearly so beneath.
t. Leaves mostly cordate at the base, closely and regularly toothed.
Leaves sharply cut, prominently reticulated beneath, wholly glabrous. 6. *S. pyrifolia*
Leaves with teeth rather blunt and thick; with thin raised veins beneath but not prominently reticulated, often with a little pubescence. 5. *S. cordata*
t. Leaves tapering to the base, usually widest above the middle, coarsely and irregularly toothed, glabrous. 10. *S. discolor*
s. Leaves prominently pubescent beneath.
Pubescence silky and closely appressed. 12. *S. sericea*
Pubescence matted or woolly.
Twigs reddish with crisp whitish hairs when young; leaves widest above the middle, strongly rugulose. 13. *S. Bebbiana*
Twigs grayish with dirty pubescence; leaves lanceolate, often densely grayish pubescent beneath. 11. *S. humilis*

1. S. pentandra L. BAY WILLOW.

Occasionally planted and found along roadsides in parts of the province. Introduced from Eu. and sparingly escaped in eastern Canada and the U. S.

2. S. lucida Muhl. SHINING WILLOW. Map 193. Fig. 43.

Common along streams, sand bars, and along sandy edges of lakes; commonest from Digby to northern C. B., and scattered elsewhere.

Nfld. to the N. W. Territories south to N. J. & Nebr.

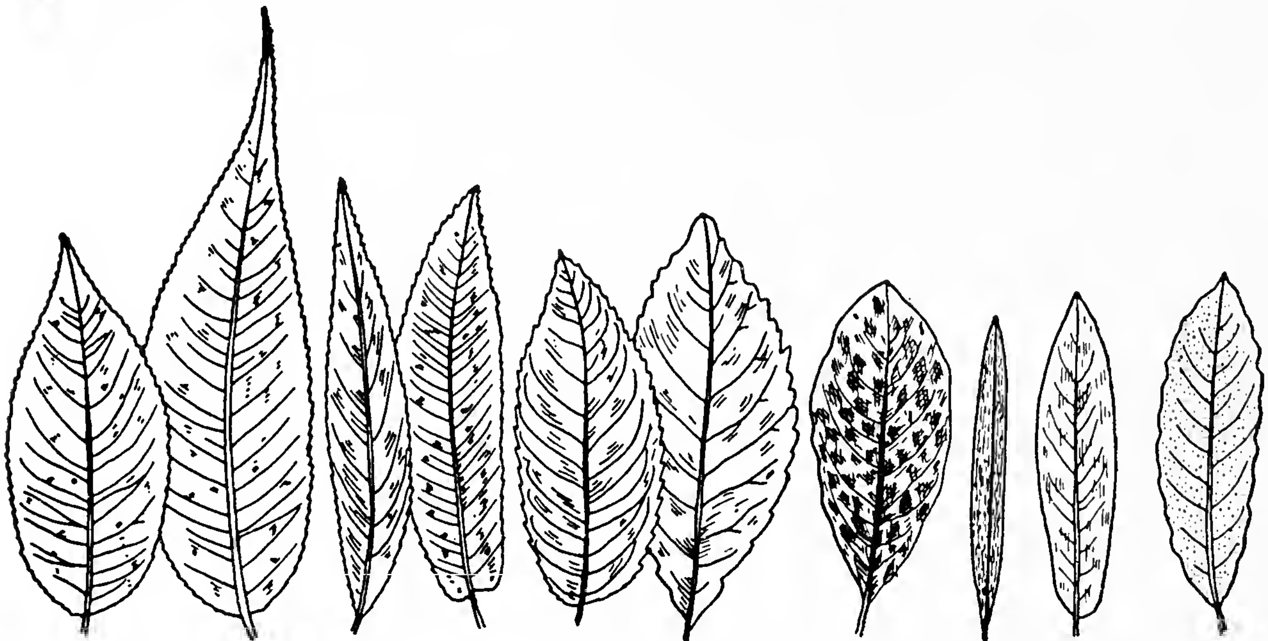


Fig. 43.—**Salix**, typical leaves, x ½.

3. S. alba L. WILLOW.

The "French Willow" is one of the willows which reaches the stature of a large tree. Varieties exist which differ slightly in pubescence of the leaves or color of the branches. The typical form has the branchlets olive-brown, the leaves finely silky beneath. The commonest variety is var. **vitellina** (L) Stokes with yellowish branches and leaves slightly silky beneath. Var. **calva** G. F. W. Mey has the branches dark brown with leaves practically glabrous beneath.

Early introduced from Eu. and widely distributed.

4. S. fragilis L. CRACK WILLOW.

This willow, which also forms a large tree, is occasionally planted in the province, but as yet is much rarer than the preceeding species. It is very similar to *S. alba* in appearance, but it has the branches very brittle at the base so that they snap off very readily when bent downwards.

Eu. and western Asia; long cultivated.

5. S. cordata Michx. HEART-LEAVED WILLOW. Fig. 43.

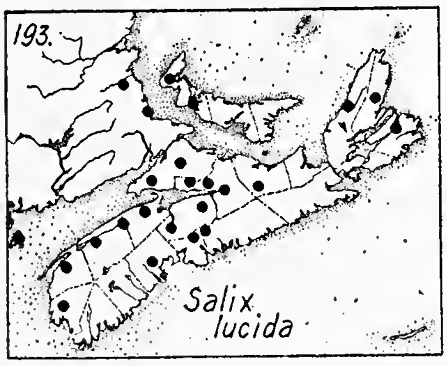
Fernald, Rhodora **48**: 31-38, 1946, separates the plants here included into two species; a relatively northern species *S. cordata*, ranging from Labrador to James Bay and south to New York; and *S. rigida* Muhl., with a range for the most part more southern. An abbreviation of his differences is given here.

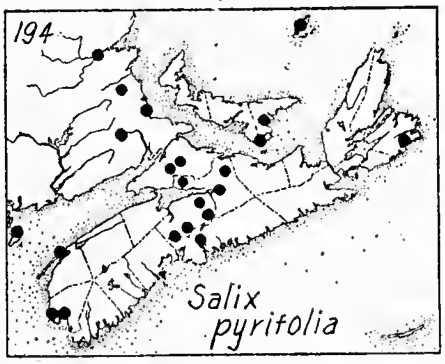
S. cordata: Leaves rather broad, mostly strongly cordate, averaging twice as long as wide; staminate catkins on leafy axillary branches with leaves well developed at flowering; pistillate catkins dense with appressed-ascending ovaries; capsules in fruit crowded on very short pedicels about the length of the bracts.

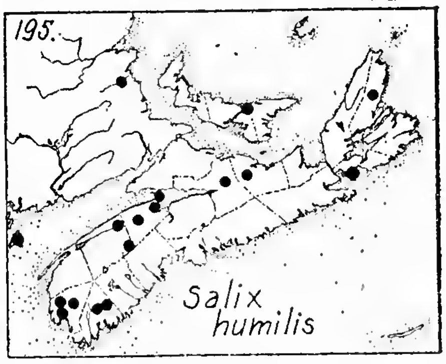
S. rigida: Leaves one eighth to one third as broad as long, rounded or tapering at the base; staminate catkins with short, barely expanded bracts at the base; pistillate catkins with widely spreading ovaries; capsules on pedicels usually much longer than the bracts.

In studying the willows common in the center of the province, they all key out to *S. rigida.* However, numerous collections of *S. cordata* and its variety are cited. Until this group is studied in more detail and over a wider range in the province, I am keeping them all under the above name; and leaving this problem to some-one interested in working out our trees and shrubs.

Lab. and Nfld. to B. C., south to Va. and Calif.







6. S. pyrifolia Anders. BOG WILLOW. Map 194. Fig. 43

Swampy thickets, poorly drained areas, bogs and heavy soils throughout; conspicuous in early spring with its shining twigs and shining glandular-toothed leaves. (*S. balsamifera* Barratt).

Nfld. to the Mackenzie south to N. Y., and Minn.

7. S. pedicellaris Pursh, var. **hypoglauca** Fern., Rhodora **11**: 161. 1909.

Common in a sphagnous swale north of Middlefield, Queens Co., found by Mr. C. A. Weatherby in the summer of 1941. It was also found in 1944 in a meadow at Upper

Musquodoboit where it again was growing luxuriantly over the area; Bass R., N. B.

Nfld. and Que. south to Conn.

8. **S. Uva-ursi** Pursh. BEARBERRY WILLOW.

Collected by Perry and Roscoe on a wind-swept barren, St. Paul Is., 1930.

Lab. to Alaska south to N. S. and the mts. of N. Eng. and N. Y.

9. **S. cordifolia** Pursh, var. **callicarpaea**(Trautv.) Fern., Rhodora **28**: 184-185. 1926.

Like the last this species is known only from a barren on St. Paul Is., northern C. B.

Nfld. & Lab. to the Shickshock Mts. in Que.

10. **S. discolor** Muhl. PUSSY WILLOW. Fig. 43.

Common throughout on low ground, roadsides and edges of swamps; variable and hybridizing to a considerable extent with *S. humilis*. Bushes have also been found with leaves finely pubescent beneath, which seems to be hybrids with *S. Bebbiana*.

Nfld. to Man. south to Va. and Mo.

11. **S. humilis** Marsh. Map 195. Fig. 43.

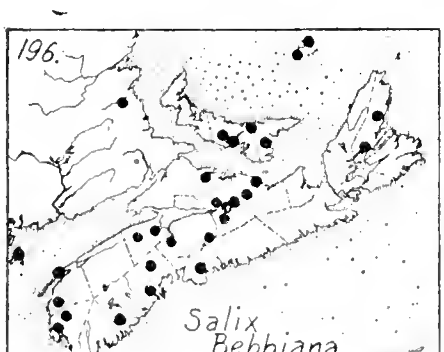
Widely distributed through the province in clayey soils, low ground or even on low fields and old abandoned areas. In south-western N. S. the plant has leaves with a very dense velvety or satiny lustrous pubescence on the under sides. This is var. **keweenawensis** Farw., Mich. Acad. Sci. Ann. Rept. **6**: 206. 1904. Eastward the leaves are whitish or grayish pubescent beneath, with dirty pubescent twigs. Freely hybridizing with *S. discolor*.

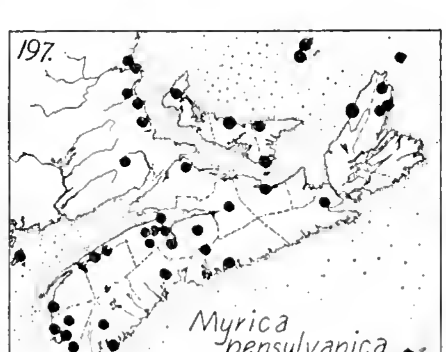
Nfld. to Minn. south to N. C.

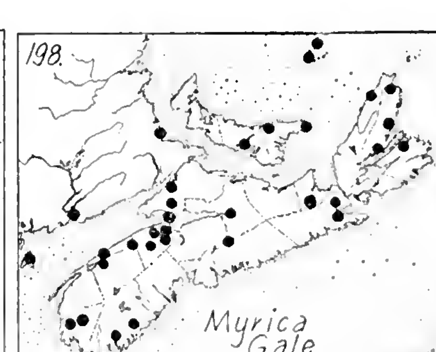
12. **S. sericea** Marsh. SILKY WILLOW.

Rare in western N. S.; scattered east to Grand Lake in Halifax Co.

N. S.; Me. to Mich. south to Va.


196. Salix Bebbiana


197. Myrica pensylvanica


198. Myrica Gale

13. S. Bebbiana Sarg. BEAKED WILLOW Map 196. Fig. 43.

The commonest species of willow in the province, found throughout in many habitats and very variable. Occasionally large shrubs or small trees may be found with the leaves and twigs nearly glabrous and the leaves smooth instead of rugose. This approaches var. *perrostrata* (Rydb.) Schneid. which is a western and northern variety. The opposite extreme with leaves densely tomentose or cinereous-tomentose beneath is var. **capreifolia** Fern., Rhodora **16**: 177. This was reported as small trees in woods and thickets at the margin of Lily Lake, Sandy Cove (Fernald, 1921). (*S. rostrata* Richards.).

Nfld. to Alaska south to Penn. and Calif.

14. S. viminalis L. COMMON OSIER. Fig. 43.

Scattered and an occasional escape from cultivation.

Eurasia; naturalized in N. A.

15. X. S. Smithian Willd.

This hybrid willow is occasionally planted and escapes in some parts of the province. It is naturalized on a clay bank by the sea, Baddeck (Fernald, 1921). It is a tall shrub to 6 m high with widely lanceolate leaves which are grayish soft-pubescent beneath.

16. S. pellita Anders.

Stated by Rousseau to be common in the region of Canso; seen occasionally elsewhere in the interior where it is rare and the distribution very poorly known; north of Five Islands and near Parrsboro.

Nfld. to Lake Winnipeg south to Me., Vt. and Mich.

17. S. purpurea L. PURPLE OSIER. Fig. 43.

Abundantly naturalized around Yarmouth, Wolfville and probably other towns of the province; rare in the country.

Eurasia and Africa; long cultivated.

2. POPULUS (Tourn.) L. POPLAR AND ASPEN

a. Leaves permanently whitish woolly beneath, often palmately lobed; petioles terete; buds tomentose. 1. *P. alba*

a. Leaves glabrous or becoming so, or lightly pubescent on the veins beneath.

b. Leaves without a translucent border.

c. Petioles flattened; buds not very large nor viscous.
d. Leaves ovate, coarsely toothed; winter buds white-pubescent (Fig. 44, g). 2. *P. grandidentata*
d. Leaves usually wider than long, finely toothed or crenate-serrate; winter buds glossy and shiny (Fig. 44, e). 3. *P. tremuloides*
c. Petioles terete, not flattened; leaves whitish beneath; buds very large and sticky-viscous (Fig. 44, f).
e. Branches glabrous; leaves rounded to rarely broad-truncate at the base, rather narrow. 4. *P. balsamifera*
e. Branches pubescent, leaves cordate, slightly pubescent on both sides, and densely so on the veins beneath. 5. *P. candicans*
b. Leaves with a clearly defined translucent border, glabrous; petioles flattened, buds glabrous, rather small.
f. Leaves wedge-shaped at the base; branches strongly ascending; pyramidal introduced tree. 6. *P. nigra*
f. Leaves truncate or broadly cuneate at the base; branches spreading. 7. *P. canadensis*

1. P. alba L. WHITE POPLAR. SILVER MAPLE.

Commonly planted around buildings and along roadsides, almost impossible to eradicate when once established since it produces an abundance of root suckers. Most of the trees recently planted belong to var. **nivea** Ait. with the leaves silvery-tomentose beneath and the blades lobed like a maple leaf.

Eurasia; widely introduced.

2. P. grandidentata Michx. POPLAR. Fig. 44, g.

Common throughout; forming a small part of the original forest but now common on light soils or burnt-over sandy areas; especially abundant in the Annapolis Valley.

N. S. to Minn. south to N. C.

3. P. tremuloides Michx. TREMBLING ASPEN. Fig. 44, e.

Common throughout, mixed with or often growing on wetter ground than the preceeding species. Trees with the leaves prominently cordate at the base and usually thicker in texture are var. **intermedia** Vict., Contrib. Inst. Bot. Univ. Montreal **16**: 8. 1930. This is occasional in Colchester and Kings Co., and probably throughout eastern Canada.

Lab. to Alaska south to Penn. and Calif.

4. P. balsamifera L. BALSAM POPLAR. Fig. 44, f.
See Rouleau, Ernest. Rhodora **48**: 103-110. 1946 for the nomenclature.

Common along streams and open intervales, occasionally seen in the original forest in northern C. B., planted as a shade tree and often seen in clumps or as isolated trees around old houses, deserted cellars or on roadsides throughout; not noted growing native on the mainland. (*P. Tacamahaca Mill.*)

Lab. to Alaska south to N. Y., Mich. and Ore.

5. P. candicans Ait. BALM-OF-GILEAD.

Rare; in Pictou and Kings Co.; very similar in general appearances to the last species. Both of these species make very inferior shade trees and are now being replaced by newer forms of the hybrid populars.

Planted as a shade tree; origin unknown.

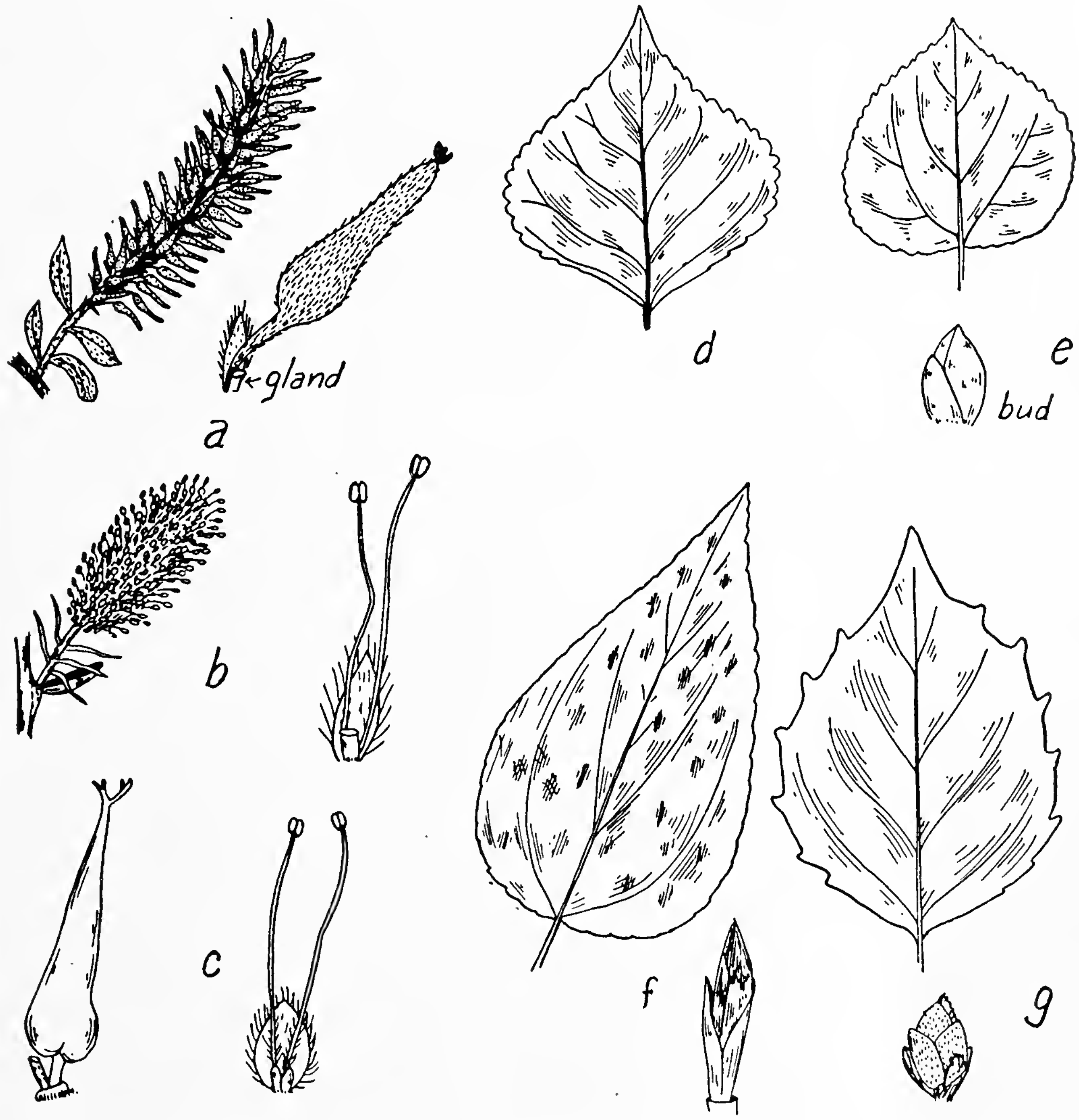


Fig. 44.—**Salix.** a, **S. Bebbiana,** pistillate catkin, x ½, flower, x 5. b, **S. Bebbiana,** staminate catkin, x ½; flower, x 5. c, **S. cordata** pistillate and staminate flowers, x 5. **Populus.** d, **P. canadensis,** leaf. e, **P. tremuloides.** f, **P. balsamifera.** g, **P. grandidentata.**

6. P. nigra L., var. **italica** Moench. LOMBARDY POPLAR.
Commonly planted in the Annapolis Valley; rare elsewhere; near the northern limit of its range in N. S.
Early introduced into N. A.

7. P. canadensis Moench. HYBRID POPLAR.
Various forms and varieties of these hybrid poplars are now being planted in the province along roadsides and especially about towns where they excel because of their fast growing habit and good foliage.

30. MYRICACEAE SWEET GALE FAMILY

a. Leaves deeply and pinnately lobed; bracts at base of the ovary 8; fruit surrounded by a bur. 1. *Comptonia*

a. Leaves merely toothed; bracts at base of the ovary 2–4; bur absent. 2. *Myrica*

1. COMPTONIA L'Her.

1. C. peregrina (L) Coulter. SWEET FERN. Fig. 45, a.
One of the commonest ground shrubs over much of the open sandy or barren soil of the province; abundant on the sands of Kings and Cumberland Cos., and throughout the granitic and quartzite areas in the center of the province, usually associated with pine and wire birch. (*Myrica asplenifolia* L., see Rhodora **40**: 410-411. 1938). May.
N. S. to Man. south to Va. and northern Ga.

2. MYRICA L.

a. Leaves glossy above; nutlets covered with a white wax, 2.5-3 mm in diam.; flowers on the current year's wood, appearing after the leaves (Fig. 45, c). 1. *M. pensylvanica*

a. Leaves dull on both sides; nutlets small, with 2 wing-like bracts; flowers at the ends of last year's branches, appearing before the leaves (Fig. 45, b). 2. *M. Gale*

1. **M. pensylvanica** Loisel. BAYBERRY. Fig. 45, c. Map 197.

Abundant in the southwestern counties; found around the coast on headlands, beaches and occasionally in bogs; scattered in the center of the province on the heavier soils (*M. cerifera* L. of earlier authors, see Rhodora **37**: 423. 1935). June.
Nfld. to western N. Y. and Md., chiefly near the coast.

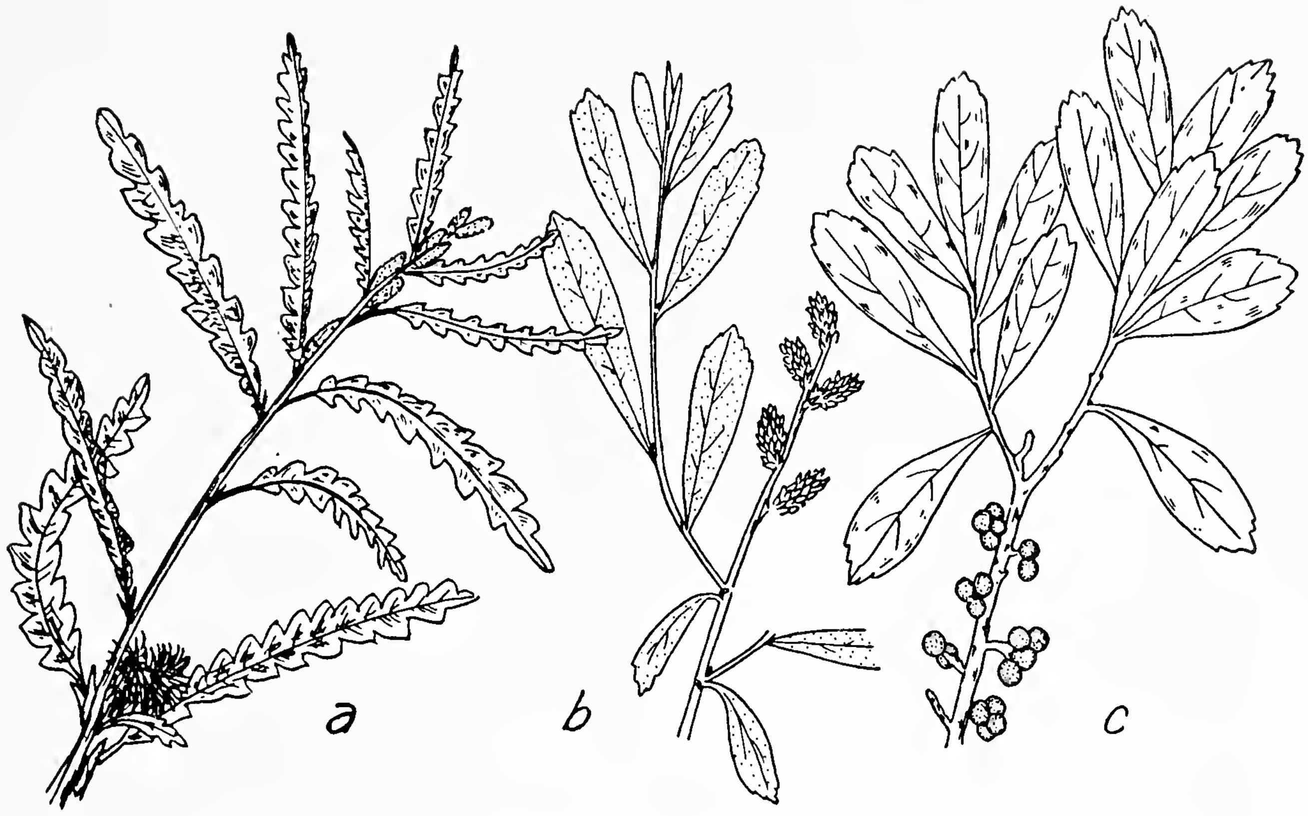


Fig. 45.—**Comptonia.** a, fruiting branch, x ½. **Myrica.** b, **M. Gale,** x ½. c, **M. pensylvanica,** x ½.

2. **M. Gale** L. SWEET GALE. Fig. 45, Map 198.

Common throughout; edges of streams, along still-waters, in ditches and well-drained swamps, or on heaths. Var. **subglabra** (Cheval.) Fern., Rhodora **16**: 167. 1914, with the leaves glabrous or nearly so beneath instead of pubescent, is known from P. E. I. and undoubtedly occurs also in N. S. It is found in the northeastern part of the range of the species.

Lab. to Va. westward; Eurasia.

31. BETULACEAE BIRCH FAMILY

a. Bark of older twigs with conspicuous elongated lenticels, rather easily peeling off; nutlets small, winged, exposed in the axils of the scales of the catkin or spike; stamens 2 or 4; alders and birches.

b. Bark whitish to yellowish; scales of the fertile catkins thin, 3-lobed; stamens 2; fruit with thin wings; birches (Fig. 46). 1. *Betula*

b. Bark brownish, not flaking off; fertile scales woody, forming an erect persistent cone; stamens 4; fruit with thick wings; alders (Fig. 47, a, b). 2. *Alnus*

a. Bark of older twigs and trunk without elongated lenticels and not peeling readily; nutlets or nut not winged, enclosed in a papery or leathery involucre; leaves softly pubescent beneath.

c. Shrub, wiry and stoloniferous; flowers and fruit in small clusters, the mature fruit to 1 cm thick and the involucre with a long beak; leaves with 5-8 pairs of veins; hazelnut (Fig. 47, d). 3. *Corylus*

c. Tree, small and not stoloniferous; flowers and fruit in hanging catkins, the nutlets enclosed in bladdery sacs like a bunch of hops; leaves with 9 or more pairs of veins (Fig. 47, c). 4. *Ostrya*

1. BETULA (Tourn.) L. BIRCH

Fernald, M.L. Notes on Betula in eastern North America. Rhodora **47**: 303-329. 1945. Plates 963-975.

a. Leaves with 9-11 pairs of veins; pistillate catkins oval, 2-3 cm long; staminate catkins stout, several; wing of the fruit narrower than the body (Fig. 46, c).
b. Scales of the fruiting catkin 5-8 mm long, the wedge-shaped basal part 1-2.5 mm long. 1. *B. lutea*
b. Scales of the fruiting catkin 8-13 mm long, the basal part 2.5-6 mm long. *B. lutea* var. *macrolepis*
a. Leaves with 7 or fewer prominent veins; pistillate catkins cylindrical.
c. Trees or large bushes; fruits with wings much wider than the body.
d. Bark chalky- or ashy-white, not flaking off in layers; leaves glabrous with long tail-like tips; staminate catkins usually solitary (Fig. 46, a). 2. *B. populifolia*
d. Bark warm brownish to creamy-white, flaking off easily in most types; leaves acute to acuminate but not long-pointed.
e. Leaves glabrous on both sides, except occasionally in the axils of the veins beneath; young twigs glabrous or with resinous warts.
f. Leaves small, the typical ones 3-7 cm long, the bases wedge-shaped to squarish and not toothed near the petiole; resembling *B. populifolia* in aspect; planted. 3. *B. pendula*
f. Leaves 5-10 cm long, the bases rounded and toothed nearly to the petiole; native tree. 4. *B. caerulea-grandis*
e. Leaves pubescent beneath, at least when young; young twigs pubescent or puberulent.
g. Buds very resinous; leaves rather small, acute, 3-5 cm long; fertile catkin to 3 cm long; introduced tree. 5. *B. alba*
g. Buds scarcely resinous; leaves mostly acuminate, 3-10 cm long (Fig. 46, b); fertile catkins to 6.5 cm long; common. 6. *B. papyrifera*
c. Low shrubs of bogs or heaths, often prostrate; fruits with wings narrower or barely wider than the body.
h. Leaves elliptic to rhombic or ovate, acute, about 4 cm long, sharply toothed; fruits with wings scarcely wider than the body. 7. *B. borealis*
h. Leaves sub-orbicular to widely elliptical, 1-3 cm long, coarsely and bluntly toothed; wing of fruit about half as broad as the body. 8. *B. pumila*

1. **B. lutea** Michx. Fig. 46, c. YELLOW BIRCH.

Throughout; wooded lake margins in the southwestern counties; common to dominant in the hardwood forests eastward. Yellow birch is found in rather poorly-drained soil, on the slopes of the mountains on a lower level than the sugar maple. Common in swampy land in the center of the province.

Var. **macrolepis** Fern., Rhodora **24**: 170. 1922, has much the same range as the species. Scattered in the south-western part of the province, the range eastward and the distinction between this and the typical form unknown. Macoun's records of *B. lenta* apparently belong to this species; as also does *B. lutea* var. *alleghaniensis* (Britt.) Ashe of Britton and Brown.

Nfld. to Man. south to Ga. and Tenn.

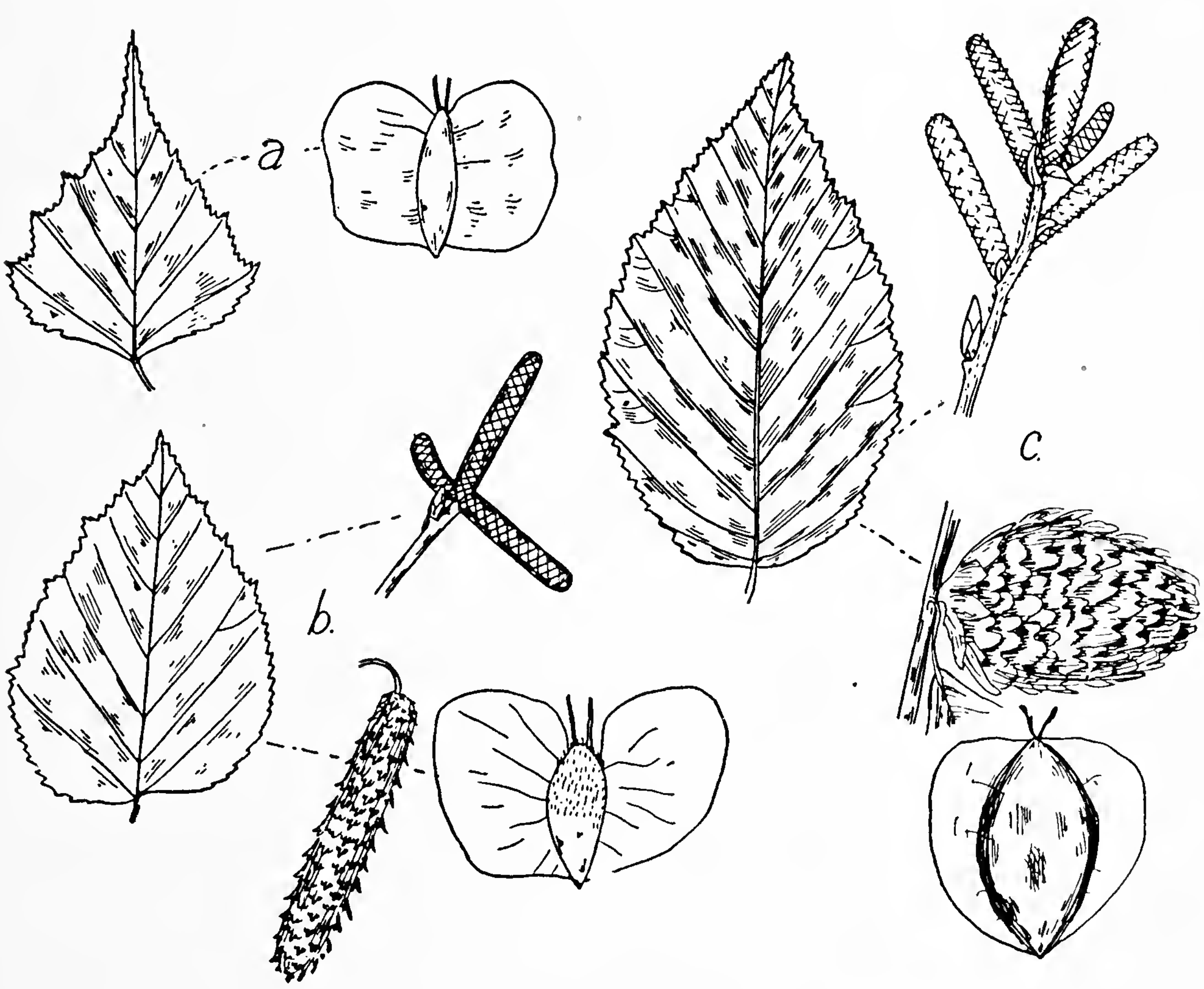


Fig. 46.—**Betula.** a, **B. populifolia**, leaf, x ½; fruit, x 3. b, **B. papyrifera**, leaf, x ½; fruiting catkin, x ½; staminate catkins in winter state, x ½; fruit, x 5. c, **B. lutea**, leaf, fruiting catkin, staminate catkins, and fruit.

2. **B. populifolia** Michx. Fig. 46, a. WIRE OR GRAY BIRCH.

Very common throughout on sandy soils, in pastures, barrens and burnt-over land. It is most prevalent in the western part of the province, and is replaced more or less to the eastward by *B. papyrifera*. It is a very characteristic shrub in the early stages of succession in pastures and barrens.

N. S. to Ont. south to Dela.

3. **B. pendula** Roth

Very commonly planted about towns and dwellings; rarely escaping to roadsides.

N. S. to Ont. south to Penn., Mich. and Iowa.

4. **B. caerulea-grandis** Blanchard

Wooded roadside at Armdale, Halifax; roadside thickets and banks of the Lahave R., Bridgewater; common at Charlottetown, P.E.I. (Fernald, 1922). This tree is said to be an abundant and characteristic tree in parts of P.E.I. (Fernald, l.c.); but in N.S. it has been found only about towns. The different appearance and bluish-green color of the birches of P.E.I. may be due to this element. The fruiting catkins are usually in 2's or 3's and the fruits are nearly glabrous. Hybrids with *B. populifolia* are named *B. caerulea* Blanchard. This has the white bark, but the staminate catkins are usually solitary and the leaves are smaller and more acuminate. Armdale and Dartmouth.

Gaspe south to N.S., northern N. Eng. and northern N. Y.

5. **B. alba** L.

An introduced tree which has become naturalized along roadsides and in thickets. Planted trees along roadsides and dwellings should be checked as for this species.

Introduced from Eu.; Nfld. to Mich. south to Penn.

6. **B. papyrifera** Marsh. Fig. 46, b. Map 199. WHITE, PAPER or CANOE BIRCH.

The white birch is one of the most variable trees of eastern Canada. The following varieties are more or less well-marked.

a. Leaves rounded or tapering to the base.
  b. Mature fertile bracts 3.5-7 mm long; fruits 3.5-5 mm wide.
    c. Branchlets spreading or ascending; leaves broadly ovate, mostly rounded to the base; pistillate catkins mostly solitary.
      d. Bark of mature trunks creamy to pinkish-white, readily flaking off. *Typical form*

d. Bark of mature trunks warm-brownish, the outer layer only tardily flaking off. var. *commutata*

c. Branchlets pendulous; leaves narrowly ovate to nearly lanceolate, tapering to the petiole; pistillate catkins often in clusters of 2-4. var. *pensilis*

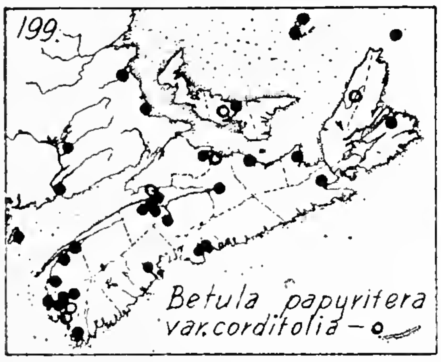
b. Mature fertile bracts 7-10 mm long; fruits 6-8 mm wide. var. *macrostachya*

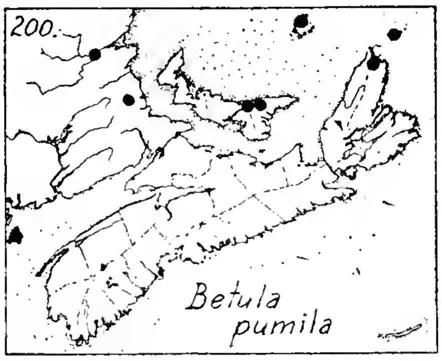
a. Leaves heart-shaped at the base; mature fertile bracts 5-10 mm long; bark of mature trunks varying from a warm brown to a pinkish white. var. *cordifolia*

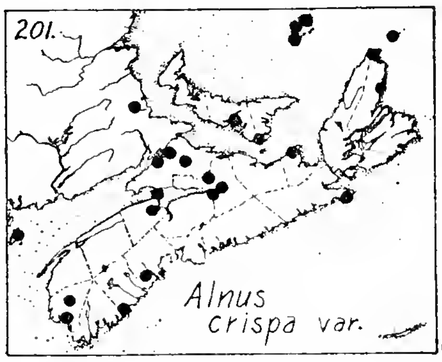
Common throughout; scattered in the original forest but commoner eastward and near the Bay of Fundy. It often comes in almost pure stands after a fire. Lab. to Alaska south to N.Y., Ill., etc.

Var. **commutata** (Regel) Fern. is found near the coast from Lab. to Mass. and in western N.A. south to Ore.

Var. **pensilis** Fern. is scattered through the center of the province, often rather common as along the South Mt. of the Annapolis Valley. "Small tree 10 ft. high, branches drooping," banks of the Lahave R., Bridgewater (Fernald, l. c.). Nfld. to Que. and south to N.Y.







Var. **macrostachya** Fern. The type collection is from dry mixed woods, Hectanooga, Digby Co. Nfld. south to Northern Me. and N. S.

Var. **cordifolia** (Regel) Fern. is scattered throughout near the coast; occasional in Yarmouth Co.; on Cape Blomidon; becoming common eastward and in C.B. Lab. to Ont. south to N.Y. and Wisc.

7. **B. borealis** Spach

The only collection known from the province is from a low thicket in the middle of a peat bog on the top of the plateau about 2 miles north of Bay St. Lawrence, Victoria Co.; Roland, 1941.

Lab. to James Bay south to northern Vt. and N. S.

8. **B. pumila** L. Map 200. BOG BIRCH.

Casual on St. Paul's Is. (Perry, 1931); scattered in bogs and heaths in northern C.B.; also in P.E.I. Macoun's report of "in bogs through N.S." is not substantiated by collections.

Nfld. to Assin. south to N.S., Ohio and Minn.

2. ALNUS B. Ehrh. ALDERS

Fernald, M.L. Eastern North American representatives of *Alnus incana*. Rhodora **47**: 333-360. Plates 976-989. 1945.

a. Buds sessile; pistillate catkins enclosed in the bud during winter; leaves with 6-8 pairs of main veins (Fig. 47, b). 1. *A. crispa*

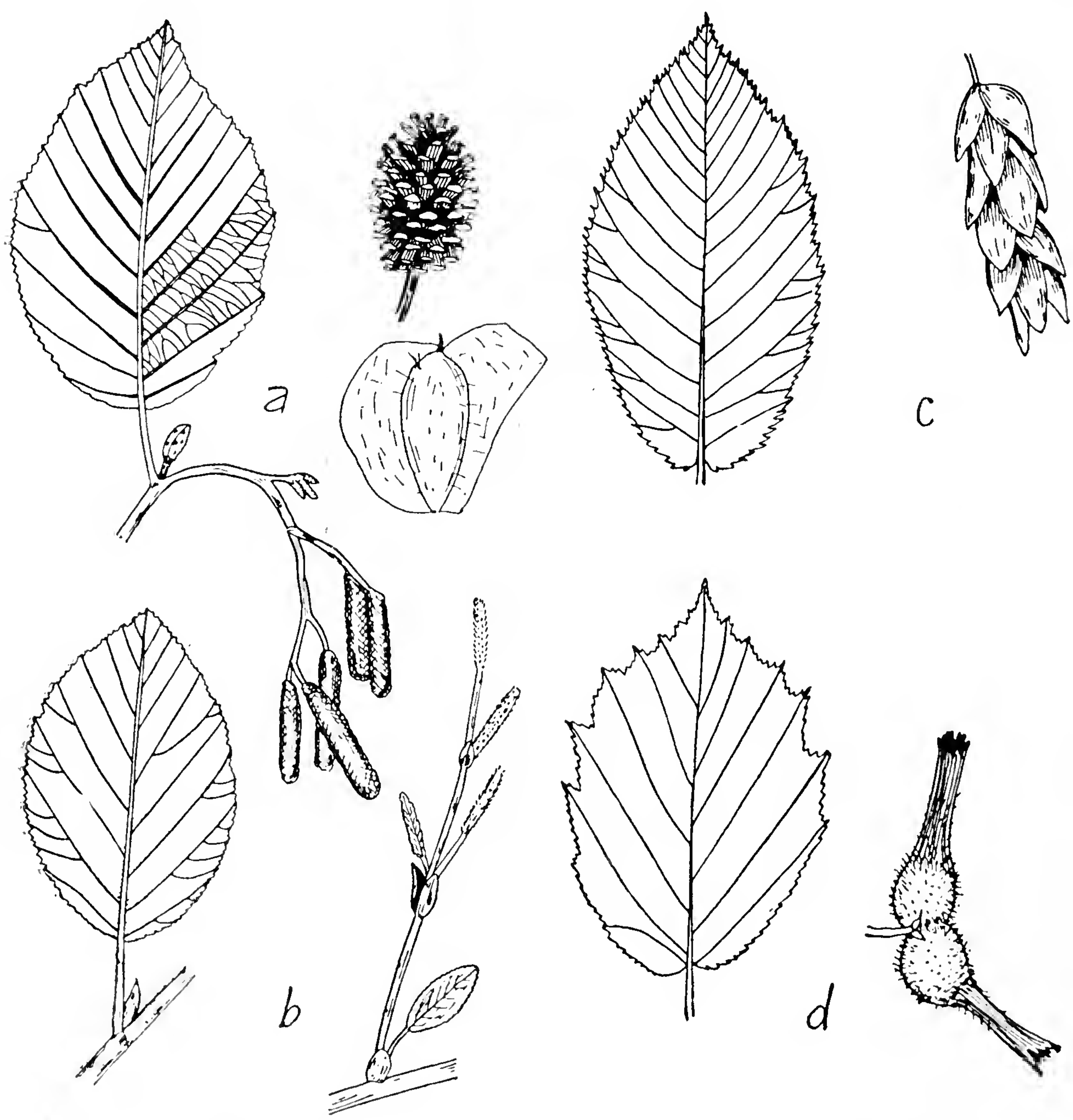


Fig. 47.—**Alnus.** a, **A. incana,** branch in autumn showing leaf, stalked bud, and naked overwintering staminate and pistillate cones, x ½; mature cone, x ½; fruit, x 5. b, **A. mollis,** leaf, and opening bud with pistillate cones, x ½. **Ostrya.** c, leaf and cluster of fruits, x ½. **Corylus.** d, leaf and fruit, x ½.

a. Buds stalked; pistillate catkins naked over winter; leaves with 8-11 pairs of main veins (Fig. 47, a).

b. Leaves broadest near or below the middle, with rounded or cordate bases, often doubly serrate, the mature blades with prominent cross-veins between the main ones. 2. *A. rugosa*

b. Leaves broadest above the middle, wedge-shaped or but slightly rounded at the base, sharply and almost regularly serrulate, the mature leaves finely reticulated with only weak cross-veins. 3. *A. serrulata*

1. **A. crispa** (Ait.) Pursh, var. **mollis** Fern., Rhodora **15**: 44. 1913. Fig. 47, b. Map 201. DOWNY ALDER.

Common throughout, abundant northwards and in C.B.; poorly-drained soils, mountain slopes, sea-shores, bluffs, headlands, deserted pastures and heath associations.

Nfld. to Lake Winnipeg south to Mass.

2. **A. rugosa** (DuRoi) Spreng. Fig. 47, a. SPECKLED ALDERS.

Low ground, the common alder in alluvial soil in the province; common throughout. The typical variety has the leaves greenish and not glaucous beneath. This is rare: Cedar L., Digby Co. and Eel L., Yarmouth Co. (Fernald, l.c.). Forma **Emersoniana** Fern. has the lower surfaces of the leaves permanently soft velvety instead of glabrous. This form is reported from Pleasant Valley, Yarmouth Co.; and from Bridgewater and Italy Cross in Lunenburg Co. N. S. to Mich. south to Penn. and Ind.

Var. **americana** (Regel) Fern. is the common N. S. alder, with the under sides of the leaves whitish and glaucous. Forma **hypomalaca** Fern. is scattered and intergrades. This has the lower surfaces of the leaves soft hairy or pilose instead of nearly glabrous. [*A. incana* (L.) Moench].

3. **A. serrulata** (Ait.) Willd.

Found by Weatherby (1942) growing in thickets on the banks of Cameron and First Christopher lakes, and along the shores of Penhook L., in the center of Queens Co.

N. S.; central Me. to Mo. south to Fla. and La.

3. CORYLUS L. HAZEL

1. **C. cornuta** Marsh. Fig. 47, d. HAZELNUT.

Dry or open woods, generally distributed and often abundant as an understory shrub. In northern C.B. it is found in the climax forest; and is likewise common under pines in the Annapolis Valley. It is common in roadside thickets, along edges of fields or margins of woods (*C. rostrata* Ait.).

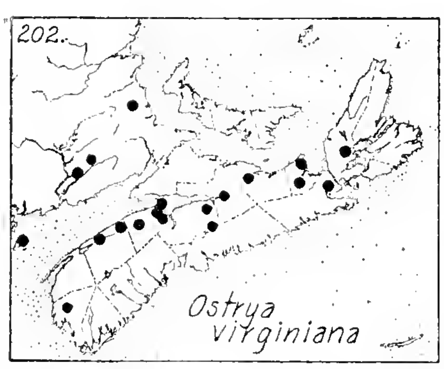
Nfld. to Sask. south to Ga. and Mo.

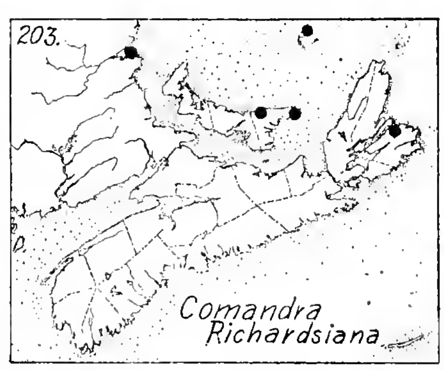
4. **OSTRYA** (Mich.) Scop.

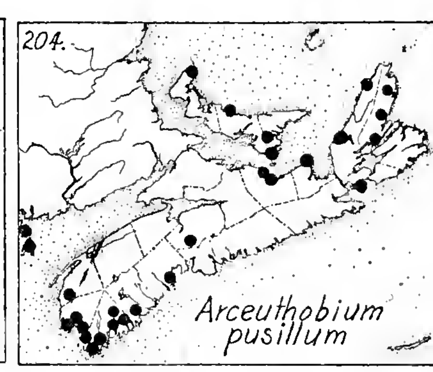
1. **O. virginiana** (Mill.) K. Koch. Fig. 47, c. Map 202. HOP HORNBEAM.

Scattered from Annapolis Co. to C. B. often rather common in the center of the province, growing along the intervales and in alluvial soil; very rare elsewhere, and especially so in the acidic areas and the southwestern counties. Var. **glandulosa** (Spach) Sarg., bearing stalked glands on the young branchlets, petioles and peduncles, is the northern form. The distribution of this has as yet not been worked out.

N. S. to Minn. south to Fla. and Tex.







32. **FAGACEAE** BEECH FAMILY

a. Leaves coarsely serrate to nearly entire; nut triangular, surrounded by a 4-parted involucre. 1. *Fagus*

a. Leaves deeply lobed; nut round, surrounded at the base by a cup-like involucre. 2. *Quercus*

1. **FAGUS** L. BEECH

1. **F. grandifolia** Ehrh. BEECH. Fig. 48, c.

Very common throughout the northern hardwood area from Annapolis to northern C. B. mixed with maples or occurring in pure stands on the drier ridges and hilltops; scattered elsewhere. It is very variable as to the flowers and fruit. Forma **pubescens** Fern. & Rehd. has the leaves more or less pubescent beneath; frequently found.

N. S. to Ont. and Wisc. south to Fla. and Tex.

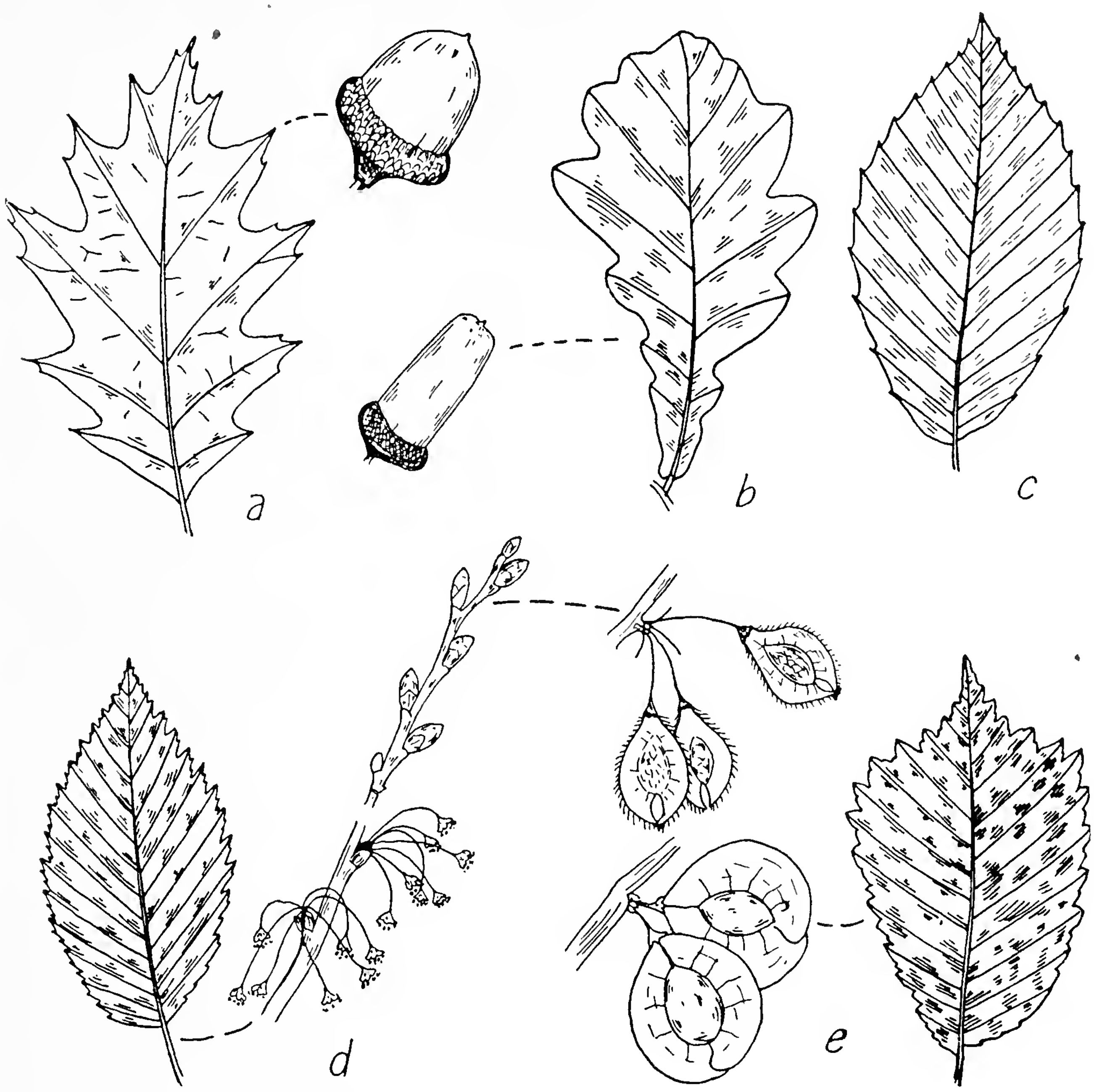


Fig. 48.—**Quercus.** a, **Q. borealis,** leaf, x ½; acorn, x ½. b, **Q. robur,** leaf and acorn, x ½. **Fagus.** c, leaf, x ½. **Ulmus.** d, **U. americana,** leaf, flowers, and winter buds, x ½; fruits, x 1. e, **U. glabra** leaf, and fruits, x ½. (?)

2. QUERCUS L. OAK

a. Lobes of the leaf rounded, not bristle-tipped; acorn oblong to elliptical. 1. *Q. robur*

a. Lobes of the leaf sharp, bristle-tipped; acorns about as wide as long.

b. Cup or involucre of the mature fruit 1.5-2 cm wide, conical at the base. 2. *Q. borealis*

b. Cup or involucre 2.5-3 cm wide, flattened at the base. *Q. borealis* var. *maxima*

1. **Q. robur** L. ENGLISH OAK. Fig. 48, b.

Scattered as a roadside tree, at least from Annapolis to Halifax and Truro; occasionally spreading out into the bushes.

Introduced from Eu.

2. **Q. borealis** Michx. f. RED OAK. Fig. 48, a.

Throughout in light or well-drained soils; scattered in the granitic areas, local on the sands of the Annapolis Valley where it was apparently much commoner in the past; and scattered or local eastward to C. B. In some localities, as at Pleasant Bay and in the vicinity of Cape North, it forms an important constituent of the forest; in other regions it may be absent.

Var. **maxima** (Marsh.) Ashe, the southern extreme, is scattered in southwestern N. S.; dry woods near Canoe L., Yarmouth Co.; woods bordering Boot L., Annapolis Co. (Fernald, 1922).

N. S. to Minn. south to Penn. and Iowa.

33. ULMACEAE ELM FAMILY

1. ULMUS L. ELM

a. Branches soon rough and corky; petioles 5-8 mm long; flowers on pedicels 1-2 cm long, with 7-8 stamens; fruit about 1 cm long, fringed. 1. *U. americana*

a. Branches long remaining smooth, yellowish; petioles 3-6 mm long; flowers in clusters, with 5-6 stamens; fruit broad, 2-2.5 cm long, smooth. 2. *U. glabra*

1. **U. americana** L. AMERICAN ELM. Fig. 48, d.

Scattered throughout on the intervals, best developed along the river valleys of the central and northern counties. It is extensively planted as a shade tree; and these introduced trees are very variable in shape of tree and in the leaves.

Nfld. to Fla. west to the Rockies.

2. **U. glabra** Huds. SCOTCH ELM. Fig. 48, e.

Very common in the towns and villages where it is planted as an ornamental tree. (*U. campestris* L.). Newer species such as the Chinese Elm are now replacing it.

Introduced from Eurasia.

34. URTICACEAE NETTLE FAMILY

a. Leaves opposite.

b. Leaves toothed, not lobed; plants erect, with stinging hairs; flowers clustered in the leaf-axils (Fig. 49, a, b). 1. *Urtica*

b. Leaves deeply and palmately 3-5-lobed; plants twining; fertile flowers in a membranous cone, the seeds invested by scale-like sepals; hop (Fig. 49, d). 2. *Humulus*

a. Leaves alternate; woodland plants with stinging hairs (Fig. 49, c). 3. *Laportea*

1. **URTICA** (Tourn.) L. NETTLE

a. Plants annual, 1-4 dm high, usually much branched; petiole one-half the length of the blade or longer; inflorescence short, open, with widely divergent branches. 1. *U. urens*

a. Plants perennial, 1-3 m high, little or not at all branched; petiole relatively short; inflorescence long, with ascending branches.

b. Leaves plainly cordate at the base, coarsely toothed with 13-18 teeth; lower surface of blades and upper part of the stem densely setulose and very pilose (Fig. 49, a). 2. *U. dioica*

b. Leaves rounded at the base; lower surface of blades and the upper part of the stem sparingly or not at all setulose, glabrous and finely pilose.

c. Petiole slender and elongate, 2-5 cm long; blade averaging 17 pairs of teeth, nearly glabrous beneath, rather thin and wide. 3. *U. gracilis*

c. Petiole stout, 0.5-2 cm long; blade averaging 25 pairs of teeth, cinereous-puberulent beneath, often thickish (Fig. 49, b). 4. *U. procera*

1. **U. urens** L.

Occasionally introduced as a weed about towns and in waste places, especially in the eastern part of the province.

Native of Eu.; widely introduced.

2. **U. dioica** L. STINGING NETTLE. Fig. 49, a.

Waste places and roadsides, mostly near towns; rather common throughout, and the commonest member of the genus.

Introduced from Eu. into eastern U. S. and Can.

3. **U. gracilis** Ait., see Fernald, Rhodora **28**: 191-199. 1926, for discussion of this and the following species.

The status of this northern extreme is uncertain. It may be merely an ecological variation, but in general it appears distinct. Collections by Macoun from Big Intervale, C. B. and by Hamilton from Boylston, Guysborough Co., are placed here. The plant ranges from Nfld, to northern Me. and N. Y. and from Alta. and B. C. southward. (*U. Lyallii* Wats.).

4. **U. procera** Muhl. TALL NETTLE. Fig. 49, b.

Open woods, damp thickets, along roadsides and edges of fields in organic and muck soils where the moisture and fertility is high; scattered throughout, but rarely abundant. (*U. gracilis* of Gray's Manual).

N. S. and Que. to N. D. south to N. C. and La.

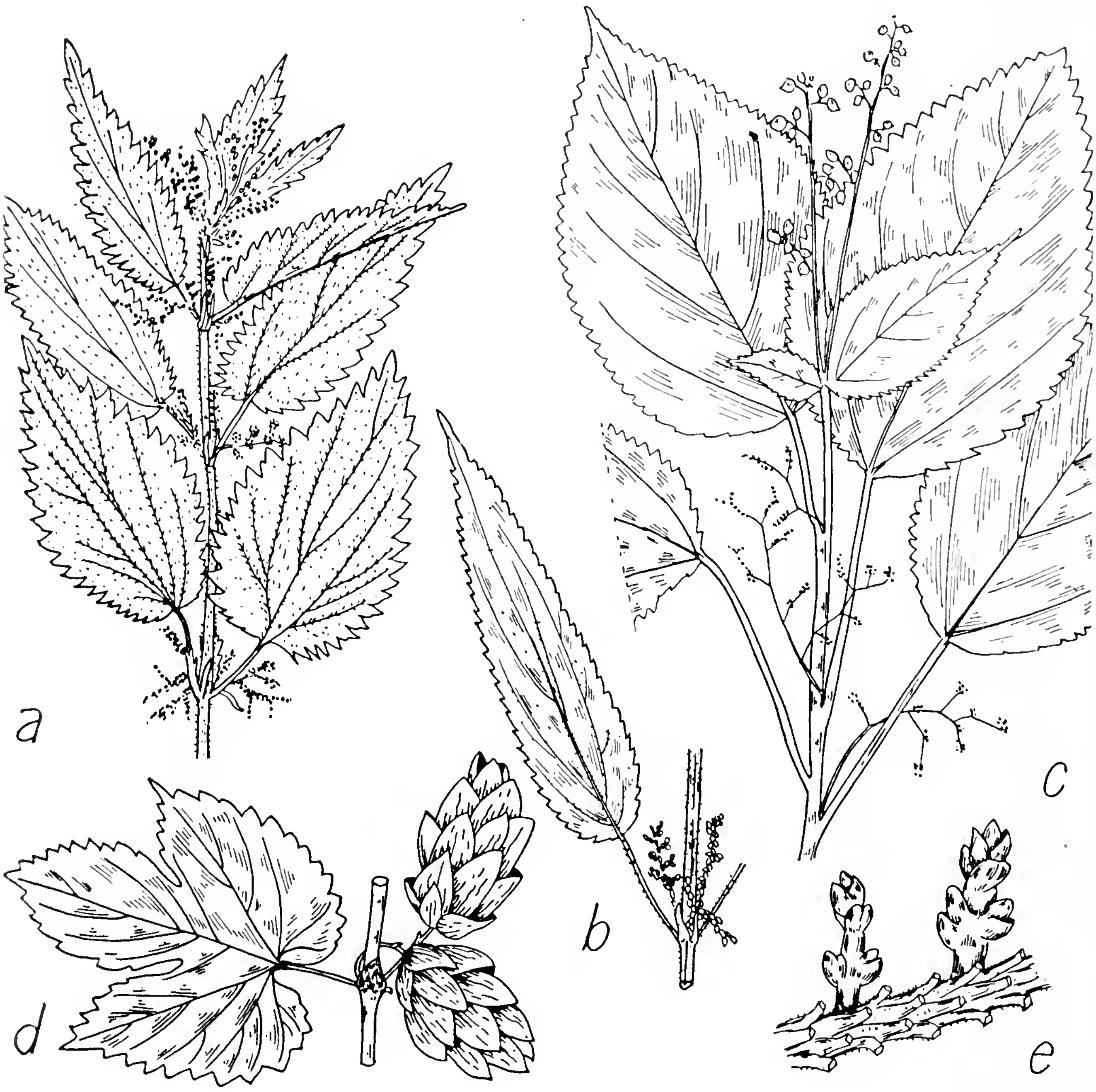


Fig. 49.—**Urtica.** a, **U. dioica,** tip of plant, x 1/3. b, **U. procera,** x ½. **Laportea.** c, top of plant, x ½. **Humulus.** d, leaf and fruit, x ½. **Arceuthobium.** e, plants on black spruce, x 3.

2. **HUMULUS** L. HOP

1. **H. Lupulus** L. COMMON HOP. Fig. 49, d.

Formerly planted; occasionally found around old dwellings, in waste places and rarely as an escape. Two kinds of hops have been introduced into the province for which the following key is given.

Lobes of the leaves short-acute or blunt at the apex, with the terminal lobe nearly as wide as long; blades toothed with the under side sparsely glandular. *H. Lupulus*

Lobes of the leaves attenuate, the terminal one narrowed below the middle and about twice as long as wide; blades more finely toothed and copiously glandular beneath. *H. americana*

3. **LAPORTEA** Gaud

1. **L. canadensis** (L.) Gaud. WOOD NETTLE. Fig. 49, c.

Alluvial woods in Hants Co.; rare in Kings Co.; scattered near Truro; characteristic of the higher parts of flood plains in northern C. B. (Nichols, 1918).

N. S. to Ont. and Minn. south to Fla. and Kans.

35. **SANTALCEAE** SANDALWOOD FAMILY

a. Rootstocks corky or papery; flowers in terminal corymbs or umbels; style filiform and prolonged; fruit a dry and coriaceous nut. 1. *Comandra*

a. Rootstocks smooth and brown; flowers 1-3 in the axils of the middle leaves; style conical and very short; fruit juicy and drupe-like. 2. *Geocaulon*

1. **COMANDRA** Nutt.

1. **C. Richardsiana** Fern. BASTARD TOAD FLAX. Map 203.

Rare: the only specimen seen was collected by Macoun in 1883 in damp sandy soil, Sydney Mines, C. B.

Nfld. to Man. south to Ga.; and B. C. to Calif.

2. **GEOCAULON** Fern.

1. **G. lividum** (Richards.) Fern., Rhodora **30**: 21-24. 1928.

Occasional; marsh, six miles north of Halfway House, C. B., Macoun 1898; sandy shores, Kingston, Kings Co., Macoun 1883; St. Paul Is., Perry and Roscoe, 1930. Bogs, sterile soil, and damp sands.

Lab. to Alaska south to N. S., N. B. and the mts. of N. Eng.

36. **LORANTHACEAE** DWARF MISTLETOE FAMILY

L. **ARCEUTHOBIUM** Bieb.

1. **A. pusillum** Peck. DWARF MISTLETOE. Map 204. Fig. 49, e.

This small parasitic plant seriously injures the trees and forms irregular witches'-brooms on much of the spruce along the Atlantic Coast from Yarmouth to northern C. B.; rarer inland.

Nfld. to Mich. south to Penn.

37. **POLYGONACEAE** BUCKWHEAT FAMILY

a. Sepals 6, the outer reflexed, the inner 3 erect and much enlarged in fruit (except in *R. Acetosella*); stigmas tufted; plants erect with much-branched terminal inflorescence (Fig. 50). 1. *Rumex*

a. Sepals 5 or 4, erect, not enlarging; stigmas not tufted.

b. Flowers axillary or in narrow terminal panicles; leaves not hastate, or else hastate and very prickly; achenes usually enclosed by the sepals (Fig. 51, 52). 2. *Polygonum*

b. Flowers in axillary or terminal panicles; leaves hastate, not prickly; achenes much exserted; buckwheats. 3. *Fagopyrum*

1. **RUMEX** L. SORRELS AND DOCKS

Rechinger, K. H. The North American species of *Rumex*. Field Mus. Bot. Series **17**: **1**: 1-151. 1937. St. John, Harold. *Rumex persicarioides* and its allies in North America. Rhodora **17**: 73-83. 1915.

a. Leaves with flaring or backward-pointing lobes at the base, making them hastate- or halberd-shaped; sorrels.

b. Leaves with the basal lobes flaring outward; plants small, slender to 4 dm high; valves (outer sepals) small, not larger than the achene (Fig. 50). 1. *R. Acetosella*

b. Leaves with the basal lobes not flaring, halberd-shaped; plant to 10 dm high; valves about 5 mm wide (Fig. 50). 2. *R. Acetosa*

a. Leaves tapering or heart-shaped at the base, not lobed: coarse, large plants; docks.

c. Stem with leafy shoots in the axils of the leaves; plants decumbent or ascending with thickish leaves; seashores (Fig. 50). 3. *R. pallidus*

c. Stems without axillary shoots.

d. Valves of the fruit without enlarged tubercles, or with one diminutive one.

e. Basal leaves very large, the blades almost orbicular, broadly rounded at the apex and deeply and broadly cordate at the base. 4. *R. alpinus*

e. Basal leaves smaller, lanceolate.

f. Valves rounded, often broader than long, one sometimes with a diminutive grain. 5. *R. domesticus*

f. Valves round-cordate, longer than wide, never with a suggestion of a grain. 6. *R. occidentalis*

d. Valves of the fruit with at least one distinct grain and usually with 3.

g. Valves not toothed.

h. Leaves broad, flat, the veins nearly at right-angles to the midrib and distinct for half way to the margin; grain longer than broad; pedicel with an obscure joint (Fig. 50). 7. *R. orbiculatus*

h. Leaves lanceolate, crisped and undulate, the veins oblique and soon branching; grain to 1.5 times longer than wide; pedicel with a conspicuous joint (Fig. 50). 8. *R. crispus*

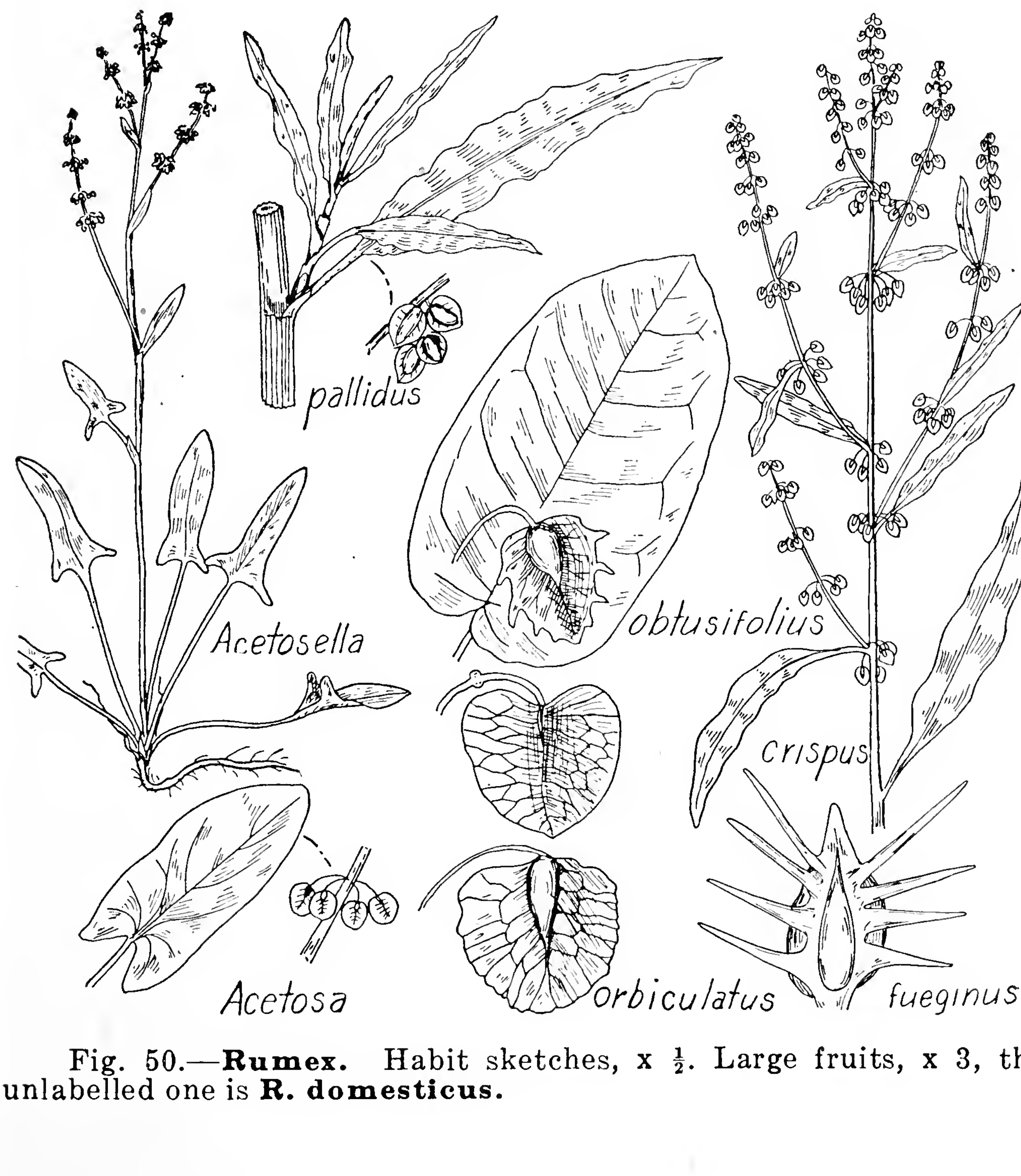


Fig. 50.—**Rumex.** Habit sketches, x ½. Large fruits, x 3, the unlabelled one is **R. domesticus.**

g. Valves of the fruit plainly toothed.
i. Teeth of the valve shallow, much shorter than the width of the central portion; plants tall, common weeds.
j. Lower leaves broad and rather blunt (Fig. 50).
9. *R. obtusifolius*
j. Lower leaves oblong-lanceolate, acute.
R. obtusifolius var. *sylvestris*
i. Teeth of the valves needle-like, several times the width of the central portion; plants usually prostrate, found near salt water (Fig. 50). 10. *R. fueginus*

1 **R. Acetosella** L. SHEEP SORREL. Fig. 50.

Very common throughout in fields, roadsides, burnt lands and even in barrens, apparently growing wherever the competition of other plants is reduced or lacking.

Introduced from Eu.; throughout N. A.

2. **R. Acetosa** L. GARDEN SORREL, SOUR DOCK. Fig. 50.

Thoroughly naturalized and abundant in fields and meadows around Yarmouth, Windsor, Truro and at many other places in the Annapolis Valley and along the South Shore. It is a very conspicuous and rapidly spreading weed. June.

Introduced from Eurasia; locally abundant in northeastern America and scattered elsewhere.

3. **R. pallidus** Bigel. WHITE DOCK. Fig. 50.

Sea-beaches; known from rocky or gravelly beaches in Yarmouth and Shelburne Cos.; about the shores of C. B. and the Bras d'Or Lakes.

Nfld. and Que. to Me.; Bruce Penninsula; Northwest Coast.

4. **R. alpinus** L.

Established in old fields at Rockville, Yarmouth Co.; a local introduction into Pictou Co., looking like a poor quality rhubarb.

Introduced from Eu.; unknown elsewhere in N. A.

5. **R. domesticus** Hartm. Fig. 50.

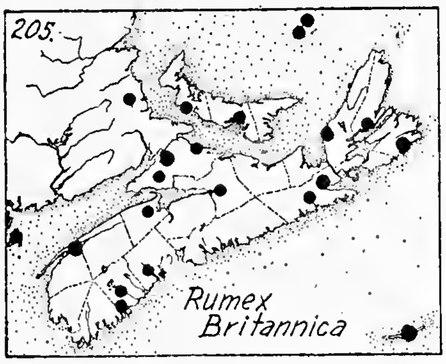
Scattered to rare throughout; about houses, in fields and waste places (*R. Patientia* L.).

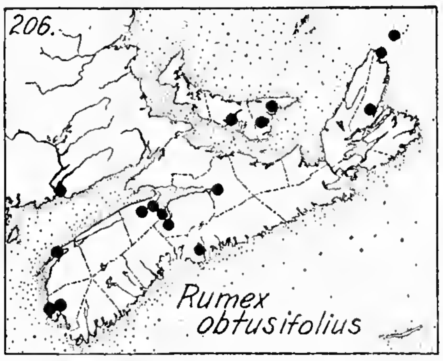
Introduced from Eu.; Nfld. to Me.; Wisc. to Alaska.

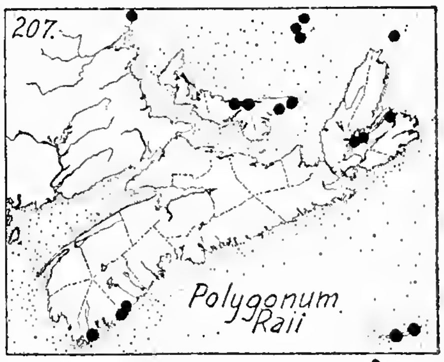
6. **R. occidentalis** Wats.

Scattered, and with the distribution not well known. This species is wide-ranging across Canada and the U. S.

7. **R. orbiculatus** L., see Fernald, Rhodora **47**: 133-137. 1945. Map 205.







Scattered to rather common throughout; swamps, edge of fresh-water ponds, around lake borders, often in cat-tail swales. Ganong places it among the subordinate species in the timothy fields of the dykelands; and Nichols lists it as characteristic of the estuaries of northern C. B.

Rechinger separates the stouter, lower, often thick leaved plants with a compact short inflorescence, growing in northeastern N. S., as var. **borealis** Rech., Field Mus. Nat. Hist. Bot. Series **17:1**: 125. 1937. The only N. S. plant listed is a collection of St. John's; from the swampy edge of a fresh water pond, Sable Is. (*R. Brittanica* L.).

Widespread.

8. **R. crispus** L. CURLED DOCK. Fig. 50.

Common throughout; waste places, cultivated land, along roadsides and about dwellings. *R. elongatus* Guss. is now considered to be but a variation of this species.

Introduced from Eu.; throughout temperate America.

9. **R. obtusifolius** L. BLUNT-LEAVED DOCK. Map 206. Fig. 50.

Rather common as a weed; roadsides, fields and waste places. Var. **sylvestris** (Lam.) Koch was reported (Fernald, 1921) from Sandy Cove, Digby Co.; and from Charlottetown, P. E. I.

Introduced from Eu ; Nfld. to B.C. south to Fla.

10. **R. fueginus** Philippi. Fig. 50.

Rare around the coast in Halifax, Kings and Cumberland Co.; abundant on Sable Is. on the brackish border of Wallace L., and on fields where sea-weed is used as fertilizer. Plants about the Gulf of St. Lawrence with the bristles about equal to the breadth of the valves, and the tubercles turgid, more elliptic and straw-colored have been placed in *R. persicarioides* L. This is common in brackish edges of marshes in P. E. I. and may occur along the North Shore of N. S.

Que. to R. I.; Wisc. to B. C. south to Ill., Kans. and Ga.

2. **POLYGONUM** (Tourn.) L. KNOTWEED

a. Stems not twining.
b. Stems not armed with prickles.
c. Flowers borne in the axils of the leaves (Fig. 51, a).
d. Plant erect, rather sparingly branched with the branches ascending.
Plant 3-9 dm high; leaves narrowly lanceolate to linear, acute to acuminate at both ends; salt marshes (Fig. 51, a). 1. *P. exsertum*
Plant 1-3 dm high; leaves oval to elliptical; yards and roadsides. 9. *P. monspeliense*
d. Plant prostrate or diffusely spreading.
e. Plant very glaucous so that the foliage and stem are whitened; flower petaloid with whitish or pinkish sepals; sea-shores.
Stipules more than 10 mm long, often longer than the internodes; achenes about 3 mm long. 2. *P. glaucum*
Stipules 4-8 mm long, much shorter than the internodes; sepals conspicuously petaloid; achenes 4.5-5.3 mm long (Fig. 51, c). 3. *P. Raii*
e. Plants slightly or not at all glaucous; flowers less petaloid.
f. Achenes smooth and shining, olivaceous; seashores.
Mature achenes 3.5-6 mm long.
Ochrae (leaf sheaths) 10-15 mm long; achenes 6 mm long; leaves linear to oblong-lanceolate, 1-nerved beneath, 2-7 mm wide; sepals prominently petaloid. 4. *P. acadiense*
Ochrae 7-10 mm long; achenes 3.5-4.8 mm long; leaves large, elliptic, 4-15 mm wide, with about 5 pairs of veins; sepals hardly whitened-margined. 5. *P. allocarpum*
Mature achenes up to 4 mm long, very broadly ovate; ochrae 3-6 mm long; leaves narrowly elliptical, smaller and less veiny than the preceeding (Fig. 51, b). 6. *P. Fowleri*
f. Achenes finely striate; plants widely distributed.
Perianth 2.5-3.5 mm long; achenes 2.5-3.5 mm long, acute; leaves 2-4 cm long, oblong-lanceolate; plant stouter (Fig. 51, d). 8. *P. aviculare*
Perianth 2-2.5 mm long; achenes 2-2.5 mm long; leaves mostly less than 2 cm long, linear to linear-lanceolate; plant slender. 7. *P. neglectum*
c. Flowers in terminal spikes or axillary inflorescences.
g. Plants shrubby at the base, 3-15 dm high; leaves large, cordate at the base; ornamentals or escapes.
Flowers in loose axillary racemes; leaves round-ovate (Fig. 51, e). 27. *P. cuspidatum*

Flowers in a dense large terminal compound inflorescence; leaves oblong-lanceolate. 28. *P. polystachyum*

g. Plants little or not at all shrubby at the base; much lower; leaves, rarely cordate.

h. Plants perennial, often trailing for a dm or more; spikes 1-3, very dense, 8-14 mm thick.

Sheaths with a spreading green border at the top. 13. *P. amphibium* var. *stipulaceum*

Sheaths without a green border.

Peduncles smooth; leaves floating, elliptic, obtuse or slightly acute, tapering to the base; spikes 1-5 cm long (Fig. 52, a). 13. *P. amphibium* forma *fluitans*

Peduncles hairy, the hairs often glandular-tipped; leaves lanceolate, acute to long-attenuate nearly glabrous to scabrous; spikes 3-18 cm long.

Leaves harshly scabrous, 1-3 cm wide; petiole 0.5-1 cm long, attached near the top of sheath. 13. *P. amphibium*

Leaves pubescent, 3-6 cm wide; petiole 3-6 cm long, attached near the base of the sheath. 14. *P. coccineum*

h. Perennial or annual plants, usually small and more slender; spikes several to numerous, less than 10 mm thick.

i. Peducles with glands below the spike; sheath not ciliate; stamens 6 (Fig. 52, b).

j. Glands not stalked, appearing gummy, often nearly absent.

Leaves glabrous or scabrous below; peduncles usually smooth or with a few sessile glands; spikes 3-8 cm long, drooping; achenes less than 2 mm wide. 11. *P. lapathifolium*

Leaves, at least the lower ones, with woolly hairs beneath; peduncles with sessile glands; spikes 1-3 cm long, erect; achenes more than 2 mm wide. 12. *P. scabrum*

j. Glands stalked (Fig. 52, e); achenes 2.2-3.5 mm wide.

Leaves copiously strigose-pubescent beneath and often so above; achenes mostly 2.2-2.8 mm wide. 15. *P. pensylvanicum*

Leaves smooth or becoming so; achenes mostly 2.5-3.5 mm wide. *P. pensylvanicum* var. *laevigatum*

i. Peduncles without glands below the spike.

k. Sheaths not ciliate, except rarely the uppermost.

Leaves oblong to obovate, mostly basal; stem-leaves clasping; spike short, thick, erect. 10. *P. Bistorta*

Leaves lanceolate, scattered on the stem; spike long and slender, drooping.

Plants erect.

Leaves glabrous or nearly so beneath. 11. *P. lapathifolium*

Leaves more or less flocculose-woolly beneath.
P. lapathifolium var. *salicifolium*

Plants prostrate, diffusely branched.
P. lapathifolium var. *prostratum*

k. Sheaths ciliate with a row of bristles (except one Sable Is. variety of P. hydropiperoides); Fig. 52, c.

l. Sepals not dotted with dark glands.

m. Upper part of the internodes of the stem usually glabrous; spikes erect, 1-4 cm long, the flowers crowded.

Plant slender, much branched; spikes 4-6.5 mm thick; achenes 2 mm wide; perianth smooth or barely nerved; rare. 19. *P. puritanorum*

Plant stouter; spikes 7-11 mm thick; achenes 2.5-3 mm wide; mature perianth usually reticulated or strongly nerved at the base; common weed. 20. *P. Persicaria*

m. Upper part of the internodes more or less stiff-hairy just below the node; spikes more or less drooping, 5-7 cm long, the flowers loose or dense; plant long-trailing, perennial.

Leaves pubescent on the midrib and margins; sheaths ciliate.

Plant 1-1.5 m high; leaves lanceolate-attenuate, 1-2 dm long; spikes dense, 5-10 mm thick, crowded at the tips of the branches.
P. hydropiperoides var. *digitatum*

Plant 3-10 dm high; leaves lanceolate, shorter; spikes slender, nearly filiform. 21. *P. hydropiperoides*

Leaves glabrous and comparatively short; sheaths smooth, without cilia; Sable Is.
P. hydropiperoides var. *psilostachyum*

l. Sepals dotted with dark glands.

n. Achene rough and dull; plant purplish, the internodes 2-4 cm long; leaves thin; ocreolae of the upper flowers usually not ciliate.

Pedicels hidden in the ocreolae; achenes mostly 3-3.5 mm long (Fig. 52, c). 16. *P. Hydropiper*

Pedicels exserted from the ocreolae; achenes 2-3 mm long. *H. Hydropiper* var. *projectum*

n. Achenes shining; plant yellow-green, with the internodes 3-8 cm long; ocreolae of the upper-most few florets usually ciliate.

Plant annual, not generally prostrate at the base; stamens 3-8; achenes mostly flat on one side and rounded on the other. 17. *P. punctatum*

Plant perennial, the lower nodes prostrate, rooting; stamens 8; achenes mostly 3-angled. 18. *P. robustius*

b. Stem armed with stout recurved prickles.

Leaves sagittate, the basal lobes not flaring outward; peduncle smooth; achenes triangular (Fig. 51, f). 23. *P. sagittatum*

Leaves hastate with wide-flaring lobes; peduncles glandular; achenes lenticular (Fig. 52, g). 22. *P. arifolium*

a. Stems twining.

o. Calyx not prominently keeled in fruit.

p. Seed smooth and shining; sheaths fringed at the nodes with downwardly-pointing hairs (Fig. 52, f).

q. Plant long-trailing; flowers in axillary clusters. 25. *P. cilinode*

q. Plant short and erect; flowers mostly in terminal racemes. P. *cilinode* forma *erectum*

p. Seed dull and minutely striate; sheaths at the nodes not fringed at the base (Fig. 52, d). 24. *P. Convolvulus*

o. Calyx widely keeled in fruit; plant long-trailing; sheath not fringed at the base; seed smooth and shining. 26. P. *scandens*

1. **P. exertum** Small, including *P. ramosissimum* Michx. Fig. 51, a.

Occasional to common near the edges of the salt marshes around the Bay of Fundy and northward.

N. S. to Minn. south to N. J.

2. **P. glaucum** Nutt., see Fernald, Rhodora **15**: 68-73. 1913.

This very glaucous variant of the European *P. maritimum* is found along the coast of eastern N. B. and southward. Its distribution in N. S. is unknown, but it should be looked for along the North Shore.

3. **R. Raii** Babington. Map 207. Fig. 51, c. See Fernald, l. c. 1913.

Damp sands and gravels of the coast in Shelburne and Queens Cos.; through the Bras d'Or Lakes, and one plant found on St. Paul Is.; known from one collection from Sable Is., possibly from brackish dune hollows.

Lab. to southern Me.; coast of the British Isles and Channel Coast of the continent.

4. **P. acadiense** Fern., Rhodora **16**: 188. 1914.

Very rare on the beaches of the Great Bras d'Or Lake at Kidstone Island, and from the original station at Grand Narrows; elsewhere very local in eastern N. S.

5. **P. allocarpum** Blake, Rhodora **19**: 234. 1917. Map 208.

Typical of sand flats and sea-beaches from Queens Co. around the coast to the head of the Bay of Fundy, recognised by its large leaves, lack of glaucosity, and large shiny

Fig. 51.—**Polygonum**, all x ½. a, **P. exsertum.** b, **P. Fowleri.** c, **P. Raii.** d, **P. aviculare.** e, **P. cuspidatum.** f, **P. sagittatum.** g, **P. arifolium.**

achenes. This species should be generally distributed.

Nfld. to P. E. I. and south along the coast to Me.

6. **P. Fowleri** Robinson. Fig. 51, b.

Scattered around the coast, at least from Kings Co. to Yarmouth Co. and to northern C. B.; not known from Sable Is. (St. John).

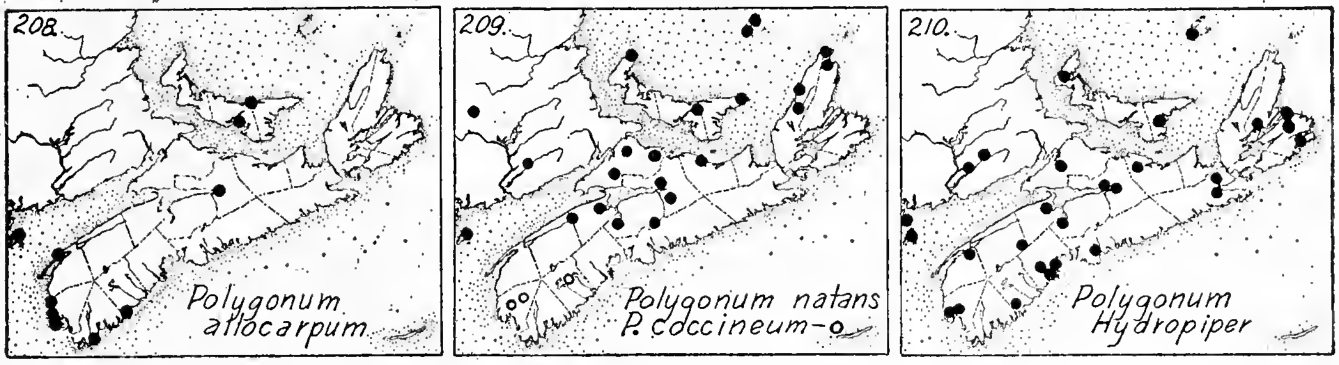
Strait of Belle Isle along the outer coast and the lower St. Lawrence to central Me.

7. **P. neglectum** Besser

The distribution of the species of the section *Avicularia* have been little studied in N. S. Much of the material labelled *P. aviculare* belongs here, so that *P. neglectum* is common around the sea-shores and probably throughout (*P. aviculare* var. *angustissimum* Meisn.).

Native of Eu.; widely distributed.

8. **P. aviculare** L. BARNYARD KNOTWEED. Fig. 51, d.
Common throughout; waste places, along roadsides, yards, etc.
Throughout N. A. and in Eurasia.



9. **P. monspeliense** Thiebaud
Common in much the same situations as the last. (*P. aviculare* var. *vegetatum* of Gray's Man.?).
Introduced from Eu.; becoming common.

10. **P. Bistorta** L. EUROPEAN BISTORT.
Known only from several established clumps in Victoria Park, Truro; introduced.
Eurasia.

11. **P. lapathifolium** L.
Scattered as a weed in cultivated fields and along roadsides. Var. **salicifolium** Sibth. is commoner in the province than the species and is perhaps merely a juvenile form of it. It is common in damp sands and pond-margins in Yarmouth and Shelburne Cos., and scattered elsewhere. Var. **prostratum** Wimmer is known only from brackish beaches on Sable Is.
Throughout temperate N. A.; Eu.

12. **P. scabrum** Moench. Fig. 52, b.
Damp fields and cultivated land; a common weed in the Annapolis Valley and scattered elsewhere (*P. tomentosum* Schrank).
Nfld. to B. C. south to N. J., the Great Lakes and Calif.

13. **P. amphibium** L. WATER KNOTWEED. Fig. 52, a. Map 209. Stanford, Rhodora **27**: 156-166. 1925, for this and the following species. Fernald in Rhodora **48**: 49-53. 1946.
The species is European. A single introduction is known in N. A.; roadside bank in rubbish near railroad, Yarmouth, Sept. 1, 1920 (Stanford, l. c. page 158).

The American plants are placed in var. **stipulaceum** Coleman [Var. *Hartwrightii* (Gray) Bissell]. Th s is the wide-ranging form with the conspicuous spreading green border at the top of the leaf sheath. In N. S. it is found wherever the floating form, which is the commonest one, grows out onto dry land at the side of a pool or river-bank. Occasionally plants growing in swales or meadows do not show the spreading green border and strongly resemble the European plant. These are named forma **simile** Fern. They vary, on the average, by having the leaves less harshly pubescent, the leaves lanceolate and more shortly petioled, and the flowering spikes stouter and shorter. Plants found at the bottom of cat-tail marshes near Pugwash belong here.

Our common floating form is forma **fluitans** (Eaton) Fern. (*P. natans* Eaton). This is found in shallow water in marshes, muddy borders of ponds or lakes, slow streams and bottoms of cat-tail swales: Annapolis Co. to Amherst and northern C. B., becoming more common northwards where it often occurs in large pure colonies at the edges of the ponds or lakes.

Nfld. to Sask. south to Penn.; B. C. to Calif.

14. **P. coccineum** Muhl., forma **terrestre** (Willd.) Stanford, Rhodora **27**: 162. 1925. Map 209.

The terrestrial form of this species is the only one known in the province, while the aquatic form is more southern and sterile. Rocky swales, mucky sloughs, and wet savannahs; scattered in Yarmouth Co.; along the Medway River system in Queens Co. [*P. Muhlenbergii* (Meisn.) Wats.].

N. S. to Wash. south to Va., Ark. and Calif.

15. **P. pensylvanicum** L., see Stanford, Rhodora **27**: 173-184. 1925. Fig. 52, e.

"Exsiccated clay roadway bordering salt marsh, Annapolis Royal; first record from east of Mass., previous records belonging to var. *laevigatum* Fern." (Fernald, 1922). Mass. to southern Ont. south to the Gulf of Mexico.

Var. **laevigatum** Fern., Rhodora **19**: 73. 1917, is a common weed in cultivated fields and gardens. Forma **albineum** Farw. with white flowers, and forma **pallescens** Stanford with pinkish flowers and yellowish glands (See Rhodora **19**: 93. 1917 and Rhodora **27**: 180. 1927) are both present.

N. S. to Colo. southwards.

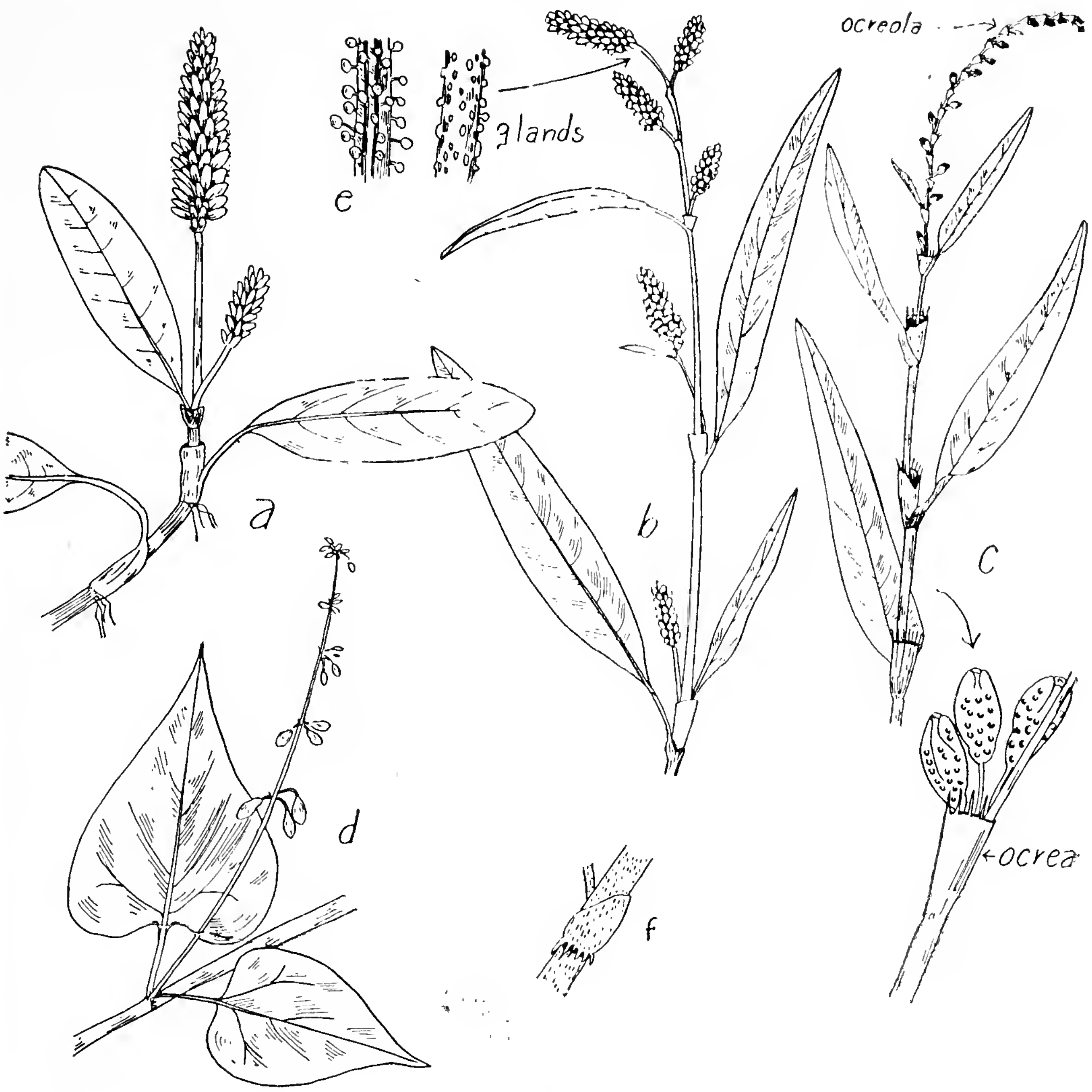


Fig. 52.—**Polygonum.** a, **P. natans,** x 1/3. b, **P. scabrum,** x ½. c, **P. Hydropiper,** x ½. d, **P. Convolvulus,** x ½ e, **P. pensylvanicum,** glands of the peduncle much enlarged. f, **P.. cilinode,** x 1

16. **P. Hydropiper** L. WATER PEPPER. Map 210. Fig. 52, c.

Scattered throughout in low, damp or exsiccated ground. Introduced from Eu.; widely distributed.

Var. **projectum** Stanford, Rhodora **29**: 86. 1927, is common throughout in wet places, damp roadsides, in the shade of buildings, etc. N. S. to Wisc. south to Ga.

17. **P. punctatum** Ell., including var. *leptostachyum* Meisn.

Common throughout; marshes, edges of lakes, along streams, etc. (P. *acre* HBK.).

Widespread and common.

18. **P. robustius** (Small) Fern., Rhodora **23**: 147. 1921. Map 212.

Scattered in the southwestern counties at the edges of lakes and streams; common in the Annapolis Valley along the rivers. The larger size, white flowers and late blooming set it off from the preceeding species.

N. S.; Mass. to the Gulf of Mexico; Mississippi Valley.

19. **P. puritanorum** Fern., Rhodora **21**: 141. 1919.

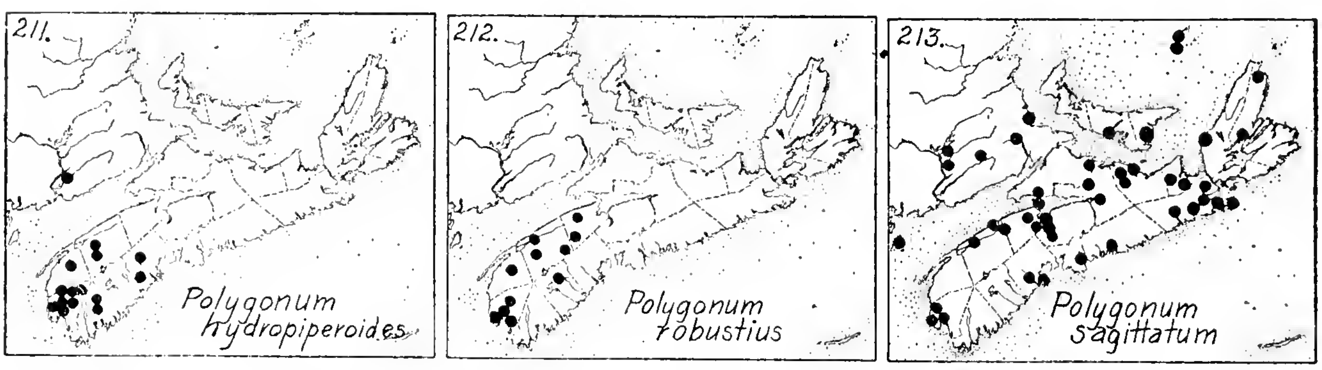
Annapolis Co.; in sand or gravel among granite boulders, beach of Grand Lake; first record outside of southeastern Mass. (Fernald, 1922).

Local; N. S., Me. and Mass.

20. **P. Persicaria** L. LADY'S THUMB.

Common weed in fields and waste places throughout.

Introduced from Eu.; throughout N. A.



21. **P. hydropiperoides** Michx. Map 211.

Common in the southeastern counties east to Annapolis and Lunenburg Co.; lake margins, beaches, and edges of rivers or streams.

Var. **digitatum** Fern., Rhodora **23**: 260. 1921, is found on a boggy savannah bordering St. John Lake, Springhaven, Yarmouth Co.; flowering very late. Var. **psilostachyum** St. John, Proc. Boston Soc. Nat. Hist. 1921: 71, is known only from Sable Is. *P. hydropiperoides* X *P. robustius* is reported (Fernald, 1922) as occurring in great abundance in peat and granite gravel bordering the outlet of Lamb's Lake, Annapolis Co.

N. S. to Minn. and Calif., south to the Gulf of Mexico.

22. **P. arifolium** L., var. **pubescens** (Keller) Fern., Rhodora **48**: 53. 1946. Fig. 51, g.

Scattered to local in rich thickets, usually under alders; Kings, Colchester and Cumberland Cos. (Var. *lentiforme* Fern and Griscom).

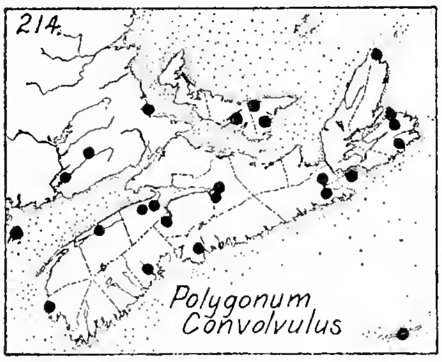
N. S. and P. E. I. south to N. J. and Penn.; the northern variety.

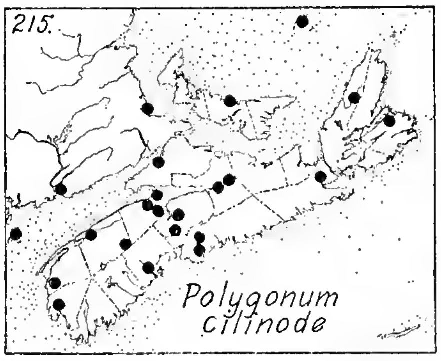
23. **P. sagittatum** L. TEAR-THUMB. Map 213. Fig. 51, f.

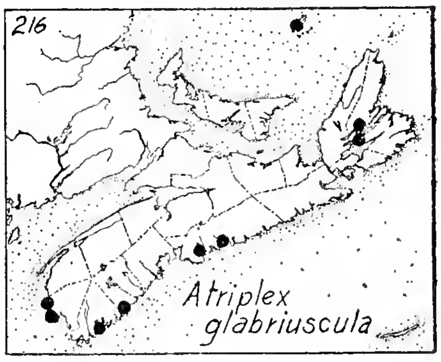
Very common throughout, developing late in the season.

Widespread in N. A.; Asia.

24. **P. Convolvulus** L. BLACK BINDWEED. Map 214. Fig. 52, d.







A common weed in fields, clearings and waste places.

Naturalized from Eu.; widespread.

25. **P. cilinode** Michx. Map 215.

Scattered throughout in clearings, waste ground and low cultivated ground. Forma **erectum** (Peck) Fern., Rhodora **48**: 54. 1946, is a dwarf form occasionally found along roadsides.

N. S. to Minn. and Man. south to N. C.

26. **P. scandens** L.

Local, but probably. widespread; low thickets along river intervales, often becoming luxuriant after woods have been cleared or the ground disturbed.

Widespread; also in Japan.

27. **P. cuspidatum** Sieb. and Zucc. JAPANESE KNOTWEED. Fig. 51, e.

Roadsides and waste ground from Yarmouth to Halifax and Truro; frequently common, freely escaping, and often becoming a noxious weed (*P. Zuccarinii* Small).

Introduced from Asia; widely planted as an ornamental.

28. **P. polystachyum** Wall.

This garden perennial, with its very long caudate-tipped and truncate-based leaves, is beginning to spread to waste lands about Yarmouth (Fernald, 1921). Introduced as an ornamental.

3. FAGOPYRUM (Tourn.) L. BUCKWHEAT

a. Flowers in scattered, elongated, loose racemes; perianth divisions 1-2 mm long, greenish; achenes dull and roughish. 1. *F. tataricum*

a. Flowers crowded in clustered, terminal racemes; perianth divisions 2-3 mm long, whitish, conspicuous; achenes smooth and shining.

1. **F. tataricum** (L.) Gaertn. BUCKWHEAT.

Scattered throughout in fields, waste places and roadsides. It is commonly planted and often persists for a few years and then gradually disappears. It does not seem to persist as a bad weed.

Introduced from Eurasia; common in northeastern N. B., becoming rarer westward.

2. **F. esculentum** Moench.

Frequently planted in the Annapolis Valley; rare elsewhere and unsatisfactory because of its late seed production.

Introduced from Eu.; widespread in N. S.

38. CHENOPODIACEAE GOOSEFOOT FAMILY

a. Plants with wide greenish leaves.
 b. Leaves thickish, fleshy; calyx or fruiting bracts not villous nor pilose; common.
  c. Calyx 3-5 parted; leaves not hastate (Fig. 53, a). 1. *Chenopodium*
  c. Calyx of pistillate flowers absent, the fruit enclosed by two large bracts; leaves often hastate (Fig. 53, b). 2. *Atriplex*
 b. Leaves thin, green, not toothed; inflorescence much branched; calyx segments villous; rare. 3. *Axyris*
a. Plants with the leaves extremely fleshy, bract-like or absent.
  d. Flowers sunken in the fleshy, watery stem; leaves absent; branches opposite; salt marshes (Fig. 54, a). 4. *Salicornia*
  d. Flowers placed in the axils of the lower leaves.
   e. Leaves, stem and calyx-lobes very fleshy (Fig. 54, b). 5. *Suaeda*
   e. Leaves bract-like or linear, much reduced; stem and calyx-lobes not fleshy.
    f. Calyx-lobes appendaged by broad membranous horizontal wings; plants coarse, stiff, much branched (Fig. 54, c). 6. *Sarsola*
    f. Calyx-lobes not appendaged; plants branched only at the base, the stems slender and angled. 7. *Polycnemon*

1. CHENOPODIUM (Tourn.)L. PIGWEED

Aellen, Paul and Theodor Just. Key and synopsis of the American species of the genus *Chenopodium*. Amer. Midl. Nat. **30**: 47-76. 1943.

a. Plants glandular, more or less aromatic; flowers pubescent.
1. *C. Botrys*

a. Plants neither glandular nor pubescent.

b. Leaves green on both sides, triangular to spatulate, often sharply toothed; glomerules of flowers almost without bracts; seeds smooth.

c. Seeds vertical or the terminal ones occasionally horizontally placed in the flowers; plant perennial; style-branches filiform; seeds almost spherical. 2. *C. Bonus-Henricus*

c. Seeds all horizontal; plant annual; style-branches short; seed flattened. 3. *C. urbicum*

b. Leaves smaller, not markedly triangular; glomerules of flowers in the axils of leafy bracts.

d. Leaves green or greenish on both sides, fleshy; seeds vertical or the terminal ones occasionally horizontal in the flowers; sepals 2-4; seed shining. 4. *C. rubrum*

d. Leaves mealy on the lower or on both sides; sepals 4-5.

e. Seeds smooth or lightly marked.

f. Leaves greenish above; seeds both horizontal and vertical, 0.6 mm in diameter; sepals not keeled. 5. *C. glaucum*

f. Leaves mealy on both sides; seeds all horizontal, 1.5 mm in diameter; sepals keeled. 6. *C. album*

e. Seeds deeply pitted, not shining, 2-2.5 mm in diameter.
7. *C. Bushianum*

1. **C. Botrys** L. JERUSALEM OAK.

The only collection seen was collected at Pictou by J. Macoun, July 25, 1883. Widely introduced from Eu.

2. **C. Bonus-Henricus** L. GOOD-KING-HENRY.

Occasional about towns; locally abundant at Annapolis and Sydney.

Introduced from Eu.; N. S., and Que. to Dela. and Iowa.

3. **C. urbicum** L.

Rare; collected by Burgess on ballast heaps at Pictou in 1883.

Adventive from Eu.; N. S. to Ont. south to Md. and Mo.

4. **C. rubrum** L. COAST BLITE.

Common on the brackish beach of Wallace Lake, Sable Is.; scattered around the mainland, often luxuriant on newly reclaimed dykelands.

N. S. to Wash. South to Me. and N. M.

5. **C. glaucum** L. OAK-LEAVED PIGWEED.

Rare; specimens from Annapolis Co., may belong here; the plant has also been collected at Summerside, P. E. I.

Fig. 53.—**Chenopodium.** a, **C. album,** x ½. **Atriplex.** b, **A. patula,** x ½. **Amaranthus.** c, **A. retroflexus,** x ½.

Adventive from Eu. and native; widespread, North and South America.

6. **C. album** L. LAMB'S QUARTERS, PIGWEED. Fig. 53, a.

Very common throughout; waste places, gardens, cultivated fields and roadsides; widespread in North and South America.

7. **C. Bushianum** Aellen, Fedde. Rep. Spec. Nov. **26**: 63. 1929.

Reported by Aellen from Sable Island where it is a weed at the Main Stations, one of the forms of *C. album* mentioned by St. John. Collections from Pembroke Shore, Yarmouth Co., and from Bayfield, Antigonish Co. are placed here.

N. S. and Que. to N. D. south to N. Y., N. C. and Ark.

2. ATRIPLEX (Tourn.)L. ORACH.

a. Foliage green or greenish on both sides, sparsely mealy, sometimes grayish when young.

b. Inflorescence without leafy bracts except at the base; seeds 1-2 mm wide.

c. Bracteoles surrounding the flower 1-5 mm long.

d. Leaves in part triangular-hastate or squarish, with basal angles or lobes; bracts truncate or broadly rounded at the base. 1. *A. patula* var. *hastata*

d. Leaves lanceolate or oblong to linear, not hastate; bracts mostly narrowly rounded or broadly cuneate at the base.

e. Blades of leaves lanceolate to oblong; bracteoles usually smooth on the inner face. 1. *A. patula*

e. Blades of leaves lanceolate to linear; bracteoles tubercled on the inner face. *A. patula* var. *littoralis*

c. Bracteoles up to 10-15 mm long. *A. patula* var. *bracteata*

b. Inflorescence leafy, each glomerule in the axil of a well-developed leaf; leaves small; seeds 2-4 mm wide; fruiting bracteoles 5-12 mm long. 2. *A. glabriuscula*

a. Foliage very gray or whitish, with a fine scurf on at least the lower surfaces.

f. Plant spreading or prostrate; bracteoles 6-9 mm long; leaves rhomboid-ovate; flowers in clusters of 1-6 in the axils of most leaves, not forming spikes. 3. *A. maritima*

f. Plant erect; bracteoles 4-6 or rarely to 8 mm long; flowers in axils of the leaves or in interrupted spikes. 4. *A. rosea*

1. **A. patula** L. ORACH. Fig. 53, b.

Scattered; very variable and grading into the following varieties

Var. **hastata** (L) Gray is common around the whole coast and on Sable Island, on the shoreward reaches of salt marshes, headlands beyond the reach of the waves, packed areas or newly-flooded areas on the dykelands, and the upper edges of sea-beaches. Var. **littoralis** (L) Gray is less common but grows in the same situations. Var. **bracteata** Westlund, Sveriges Atripl. 57. 1861, is an extreme variation of northern Eu. which is known in N. A. from but a single specimen collected in brackish or saline marsh near the mouth of the George R., C. B. (Fernald, 1921).

Nfld. to Ore. south to S. C. and Calif.

2. **A. glabriuscula** Edmonston, Fl. Shetl. **39**: 1845. Map 216.

Scattered around the coast; at least from Yarmouth Co. eastward, and in the Bras d'Or Lakes; sandy or gravelly shores.

Nfld. to Me. and locally to R. I.; northwestern Eu.

3. **A. maritima** E. Hallier, see Blake, Rhodora **17**: 83-86. 1915.

This west European plant is found on gravelly and sandy sea-shores from Que. to N. B., P. E. I. and the Magdalens.

It has not been reported as yet from N. S. but it is to be expected along the North Shore and the Northumberland Strait.

4. **A. rosea** L. RED SCALE.

This western species is sparingly introduced in the east. Macoun reported it from near Halifax, and plants from near Merigomish may belong here. The plant needs further investigation.

3. **AXYRIS** L.

1. **A. amarantoides** L. UPRIGHT AXYRIS

A s ngle plant, roadside at Windsor, July 21, 1921, collected by Fernald, Bartram and Long (Rhodora **29**: 224. 1927).

Man. to N. D. and Mo.; sparingly introduced in the East.

4. **SALICORNIA** (Tourn) L.

1. **S. europaea** L. GLASSWORT, SAMPHIRE. Fig. 54, a.

Common around the coast on salt marshes and tidal flats, usually occupying ground bare of other vegetation. It is one of the first pioneers on mud flats and inundated dykelands, on salt areas and around salt springs. Var. **prostrata** (Pall.) Fern. with branches numerous, and decumbent, spreading or matted, is likewise widely distributed and often conspicuous when growing with the typical upright form.

Seashores; Que. to Ga.; on saline soils inland.

5. **SUAEDA** Forskal. SEA BLITE.

a. Calyx lobes, at least some of them, winged or with horned appendages; spikes slender; seed 1.5-2 mm wide. 1. *S. Fernaldii*

a. Calyx lobes not appendaged nor winged, sometimes more or less hooded or keeled.

b. Plants usually erect, sometimes decumbent, more or less glaucous; sepal lobes rounded or obscurely keeled on the back; seed 2 mm wide. 2. *S. maritima*

b. Plants procumbent; seeds 1-1.5 mm wide.

c. Lower leaves 1.5 cm or less in length, dark green, not glaucous; sepals all rounded on the back. 3. *S. Richii*

c. Lower leaves 2 cm long, becoming a rich purplish-red in color; sepals or one or two of them more or less keeled on the back. 4. *S. americana*

1. **S. Fernaldii** Stanley, Field Mus. Pub. Bot. **4**: 203. 1929.

This plant was described from collections made by Fernald and Wiegand near the brackish mouth of the Salmon R., Truro. Its value or distribution elsewhere is as yet unknown.

2. **S. maritima** (L.) Dumort. SEA BLITE. Fig. 54, b.

Common around the coast on salt marshes, muddy saline shores, and around salt ponds or springs, usually associated with *Salicornia*. Older records of *S. linearis* Torr. belong here.

Anticosti to Conn. and locally to La.; Eurasia.

3. **S. Richii** Fernald, Rhodora **9**: 145. 1907.

This small, dark species of *Suaeda* is rare and not well-known. Plants from Bridgewater and other scattered places on the South Shore have been placed here, and it may possibly be more widespread.

Scattered from Nfld. along the Atlantic Coast to Me.

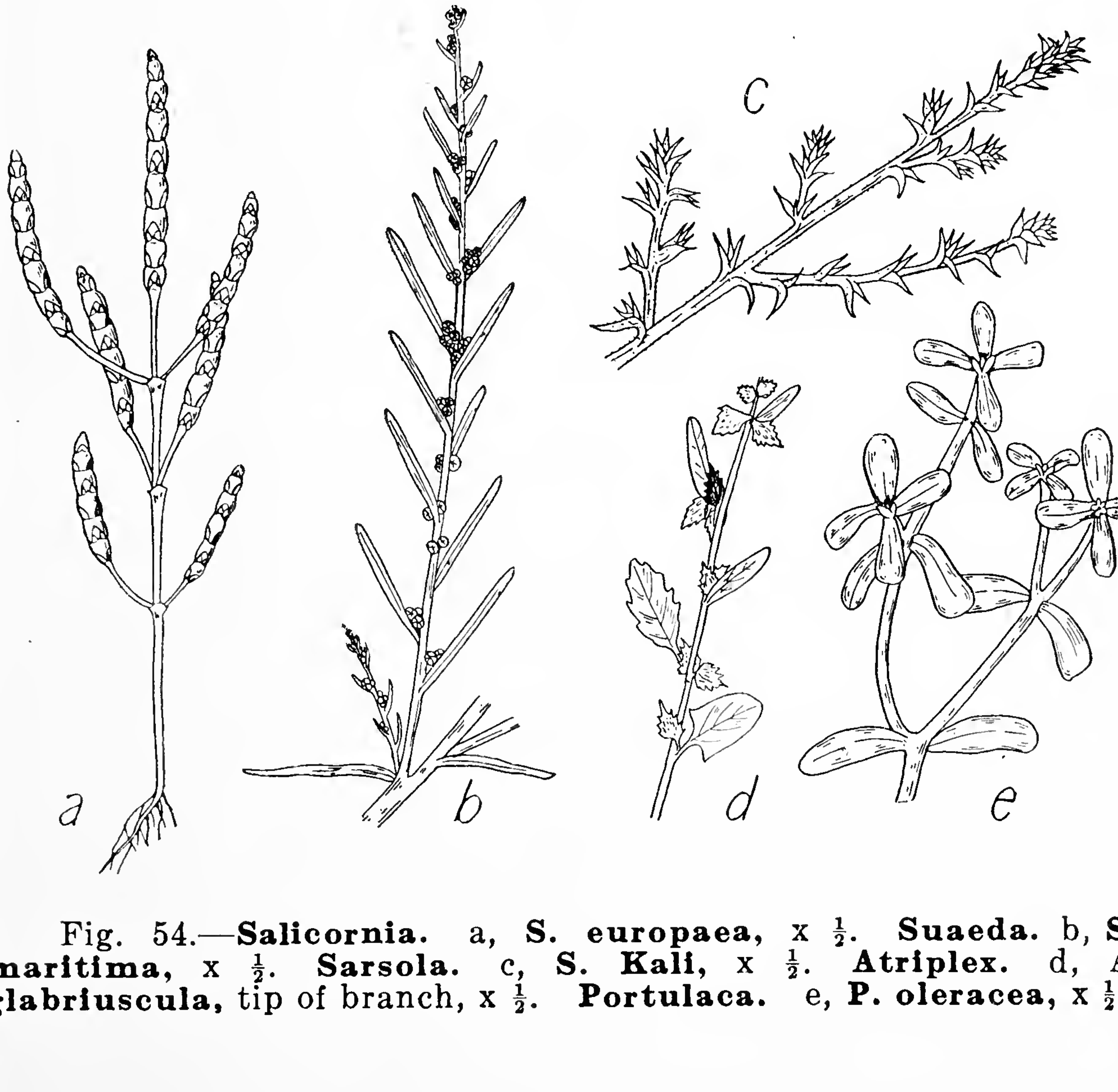


Fig. 54.—**Salicornia.** a, **S. europaea,** x ½. **Suaeda.** b, **S. maritima,** x ½. **Sarsola.** c, **S. Kali,** x ½. **Atriplex.** d, **A. glabriuscula,** tip of branch, x ½. **Portulaca.** e, **P. oleracea,** x ½.

4. **S. americana** (Pers.) Fern., Rhodora **9**: 146. 1907. Map 218.

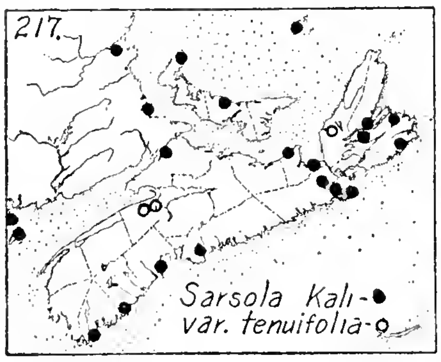
This species is the commonest one on the eastern coast of N. B. and is known at Moncton, Sydney, and at Lower Argyle, Yarmouth Co. It is rare or absent on the Fundy coast; indications are that it should be common from N. B. to Sydney; the distribution on the Atlantic Coast is unknown.

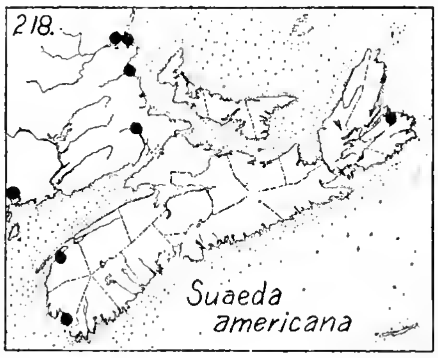
Salt marshes and sandy beaches from the lower St. Lawrence to Me.

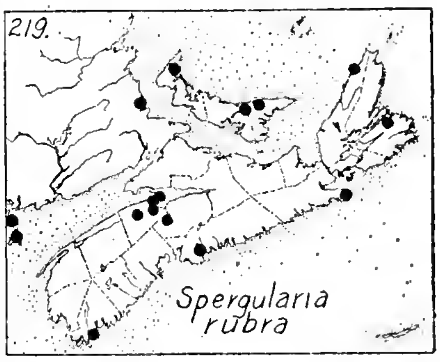
6. SALSOLA L.

a. Plant stout and woody, nearly prostrate; leaves awl-shaped, stiff and prickly, those of the inflorescence much reduced; sea-shores. 1. *S. Kali*

a. Plant slender, much branched and erect or ascending; leaves linear, those of the inflorescence similar; waste places. *S. Kali* var. *tenuifolia*







1. **S. Kali** L. COMMON SALTWORT. Map 217. Fig. 54, c.

Scattered along the sandy and gravelly seashores along the Northumberland Strait, and to C. B. Nfld. to Ga. and saline places inland.

Var. **tenuifolia** G. F. W. Mey. RUSSIAN THISTLE. This inland form of the plant is occasionally found about towns, in waste places and along railroads; found by Groh at Kentville and Port Williams, 1926 and 1930. Sandy soil, becoming introduced from western America.

7. POLYCNEMON L.

1. **P. verrucosum** Lang.

Collected by A. H. McKay near Halifax and sent to J. Macoun for identification. This specimen is in the National Herbarium at Ottawa and is dated Oct. 1896. Introduced from Eu.; no other North American record is known.

39. AMARANTHACEAE AMARANTH FAMILY

1. AMARANTHUS

a. Plants large, erect, 4-10 dm high; flowers in a large terminal inflorescence. 1. *A. retroflexus*

a. Plants prostrate to ascending, 1-4 dm long; flowers axillary. 2. *A. graecizans*

1. **A. retroflexus** L. RED-ROOT PIGWEED. Fig. 53, c.

This recently introduced garden weed is becoming common throughout in gardens, waste ground and cultivated fields and orchards. It is rapidly spreading.

Introduced from tropical America; becoming widespread.

2. **A. graecizans** L. TUMBLE WEED.

Rare, appearing only as a railroad weed; Windsor and Truro.

Western Canada to Mexico; adventive throughout the World.

ILLECEBRACEAE AND AIZOACEAE

Since the main text was written, two small plants have been noted in eastern Canada that may be found occasionally. One is **Scleranthus annuus** L., KNAWEL, a chickweed-like plant with stiff crowded linear leaves and clustered greenish flowers with minute petals or none. This is scattered in the eastern part of P. E. I. and was seen growing along roadsides in the vicinity of Montague.

The other is **Mollugo verticillata** L., CARPET WEED, also a chickweed-like plant, found growing near the railroad at Berwick by Mr. David Erskine. This is a prostrate plant with whorls of leaves and tiny whitish flowers without petals.

40. CARYOPHYLLACEAE CHICKWEED FAMILY

a. Sepals separate, more or less spreading; plants small, often prostrate; flowers less than 1 cm wide.

b. Stipules present.

c. Leaves opposite; styles 3 (Fig. 55 a). 1. *Spergularia*

c. Leaves whorled, filiform; styles 5 (Fig. 55, b). 2. *Spergula*

b. Stipules lacking.
d. Capsule splitting into valves; plant nearly smooth or with a line of hairs present on the stem.
e. Leaves linear-filiform; plants low and tufted; petals entire; styles 4 or 5 (Fig. 55, e. f). 3. *Sagina*
e. Leaves linear or broader; plants larger, styles mostly 3.
f. Petals not divided; stems wiry, round, usually erect (Fig. 55, c). 4. *Arenaria*
f. Petals 2-lobed or absent; stems softer, sometimes 4-angled, diffusely spreading. 5. *Stellaria*
d. Capsule cylindrical and curved, opening by a row of teeth at the apex; petals deeply 2-lobed; plants hairy (Fig. 55, d). 6. *Cerastium*
a. Sepals united and the calyx tubular; plants large and erect with flowers mostly over 1 cm wide.
g. Calyx without an involucre of bracts at the base.
h. Styles 3 or 5; calyx 10-nerved; flowers 2 cm wide or less.
i. Flowers solitary, rose-purple; sepals with long herbaceous tips; styles 5 opposite the petals. 7. *Agrostemma*
i. Flowers in a branching cluster; sepals with tips short, less than 2 cm long; styles alternate with the petals.
j. Styles 5; capsule with 5 two-lobed teeth; staminate, and pistillate flowers present in *L. alba*. 8. *Lychnis*
j. Styles 3; capsule 6-toothed; flowers all perfect. 9. *Silene*
h. Styles 2; calyx obscurely-nerved; flowers showy, 3 cm wide; growing singly or in dense heads; capsule 4-toothed. 10. *Saponaria*
g. Calyx with an involucre of bracts surrounding the base; styles 2; pinks. 11. *Dianthus*

1. SPERGULARIA J. & C. Presl

Rossbach, Ruth P. *Spergularia* in North and South America. Rhodora **42**: 57-83; 105-143; 158-193; 203-213. 1940.

a. Stamens 6-10, usually 10; leaves scarcely fleshy, with long mucronate tips; stipules membranous and conspicuous, 3.5-5 mm long. 1. *S. rubra*
a. Stamens 2-5; leaves fleshy, blunt, or with a short tip; stipules 1-3.5 mm long; plants restricted to near the coast.
b. Capsule subglobose to ovoid, about twice the length of the calyx; sepals at maturity 2.2-3.2 mm long; seeds 0.8-1.4 mm long. 2. *S. canadensis*
b. Capsule equaling or a little exceeding the calyx; sepals at maturity 2.4-5 mm long; seeds 0.6-0.8 mm long. 3. *S. marina*

1. **S. rubra** (L.) J. & C. Presl. SAND SPURREY. Map 219. Fig. 55, a.

Scattered throughout in sandy or gravelly soil around towns, farmyards and waste places. June-Sept.

Nfld. to Mich. south to Md.; Vancouver Is. to Calif.; introduced from Eu.

2. **S. canadensis** (Pers.) Don. SEASIDE SAND SPURREY. Map 220.

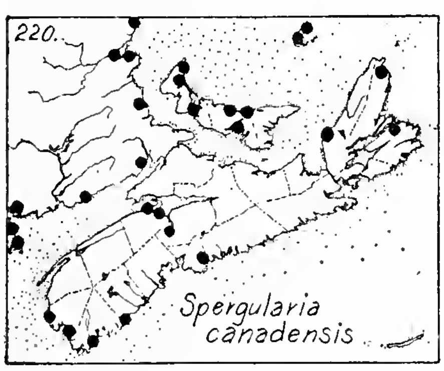
Common around the coast near the upper tide level on muddy shores, brackish marshes and on pans on the salt flats. July-Sept.

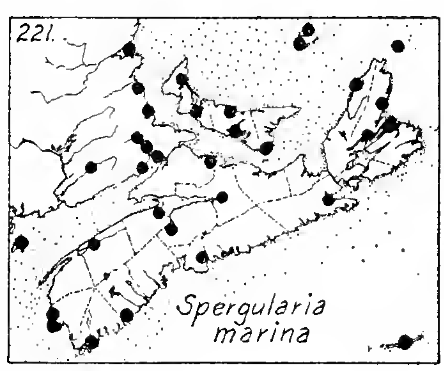
Nfld. and Que. to L. Is.; southern Alaska to B. C.

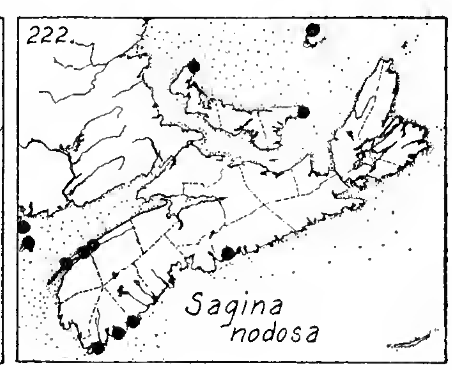
3. **S. marina** (L.)Griseb. Map 221. Fig. 55, a.

Scattered on the salt marshes and upper muddy borders of beaches around the coast, not as common as the preceeding species. [Including *S. salina* J. &. C. Presl with papillose seeds, and *S. leiosperma* (Kindberg) with smooth seeds].

Que. to Fla.; lower Calif. to B. C.; alkaline inland areas.







2 SPERGULA L.

1. **S. arvensis** L. SPURREY, PINEWEED, THOUSAND-JOINT. Fig. 55 b.

One of the commonest weeds throughout; flowers white, from early June to October.

Introduced from Eu.; throughout N. A.

3. SAGINA L.

a. Flower-parts mostly in 4's, the petals shorter than the sepals; upper leaves without reduced leaves in their axils. 1. *S. procumbens*

a. Flower-parts generally in 5's, the petals much longer than the sepals, showy; upper leaves with fasicles of reduced leaves in their axils. 2. *S. nodosa*

1. **S. procumbens** L. PEARLWORT. Fig. 55, e.

Abundant throughout; rock crevices near the coast, damp fields, lawns and roadsides, etc.; frequent in the wet dune hollows on Sable Is. May-Oct.

Greenland to Penn., mostly near the coast; scattered inland near the Great Lakes.

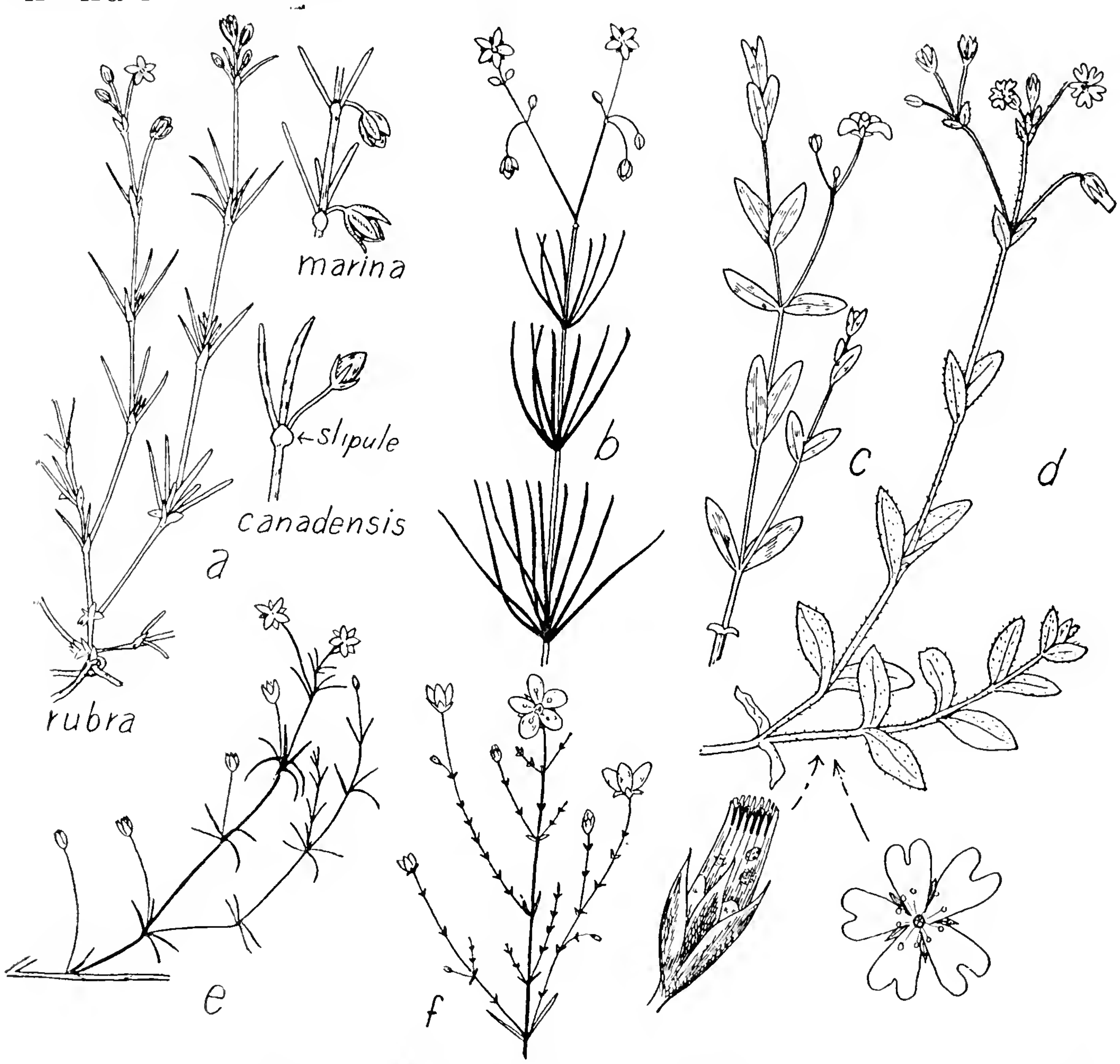


Fig. 55.—**Spergularia.** a, **S. rubra,** x ½; **S. marina** and **canadensis,** x 1. **Spergula.** b, **S. arvensis,** x ½. **Arenaria.** c, **A. lateriflora,** x ½. **Cerastium.** d, **C. vulgatum,** x ½; flower and capsule, x 2. **Sagina.** e, **S. procumbens,** x 1. f, **S. nodosa,** part of plant, x ½

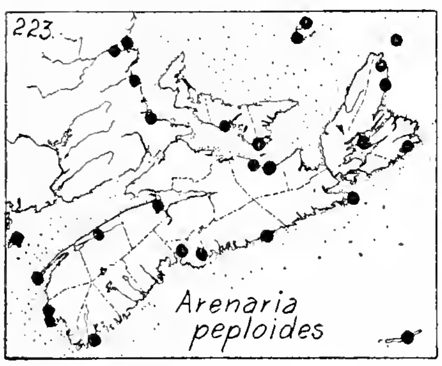
2. **S. nodosa** (L.) Fenzl., var. **pubescens** Mert. & Koch· Map 222. Fig. 55, f.

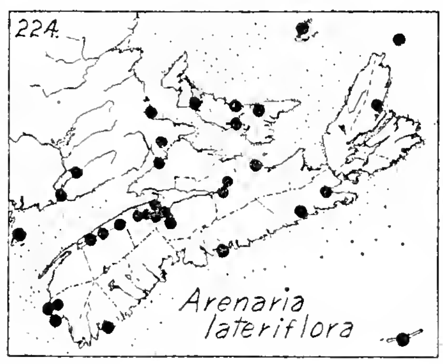
Local; sand flats of Queens and Shelburne Cos.; on the seacliffs of the Bay of Fundy from Digby Neck to north of Annapolis. This rather rare northern plant is very variable about the Maritime Provinces and the Gulf of St. Lawrence.

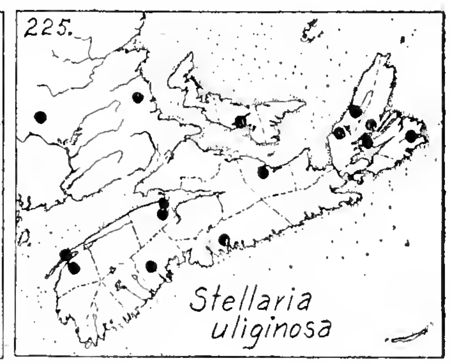
4. ARENARIA L.

a. Plants maritime; leaves elliptical, very fleshy. 1. *A. peploides*
a. Plants not essentially maritime; leaves not fleshy.

b. Leaves round to lanceolate in shape.
c. Leaves with blades less than 1 cm long, acute; petals shorter then the acute sepals; seeds papillose, not appendaged. 2. *A. serpyllifolia*
c. Leaves with blades 1-3.5 cm long, blunt; petals exceeding the blunt sepals; seeds smooth, appendaged at the scar or hilum. 3. *A. lateriflora*
b. Leaves linear and obtuse; petals about twice the length of the nerveless sepals. 4. *A. groenlandica*







1. **A. peploides** L., var. **robusta** Fern., Rhodora **11**: 114. 1909. SEASIDE SANDWORT. Map 223.

Sandy beaches; scattered around the whole coast.

Saguenay Co., Que. to N. J. and Va.

2. **A. serpyllifolia** L. THYME-LEAVED SANDWORT.

Reported earlier from both N. S. and P. E. I., possibly erroneously. A collection from gravelly soil, Kentville, by Fernald in 1902, and labelled var. **tenuior** Mert. & Koch, is in the Gray Herbarium.

Introduced from Eurasia into most parts of N. A.

3. **A. lateriflora** L. SANDWORT. Map 224. Fig. 55, c.

Very common throughout; damp thickets, meadows, exposed headlands, etc. June-Sept.

Arctic America southward.

4. **A. groenlandica** (Retz.) Spreng. MOUNTAIN SANDWORT.

The only record of this arctic plant is from "rocks, North West Arm, Halifax." Fernald, in Rhodora 21: 20. 1919, states that this material is not exactly typical.

Lab. to the mts. of N. C.

5. STELLARIA L.

a. Leaves ovate or oblong-lanceolate.
b. Plants glabrous or nearly so.
c. Leaves 4-6 mm long, fleshy; petals equalling or exceeding the sepals; flowers axillary, 1-3. 1. *S. humifusa*

c. Leaves 10-25 mm long, thickened and veiny; flowers in short lateral scaly-bracted racemes; petals shorter than the sepals. 2. *S. uliginosa*

b. Plant with a line of hairs along one side of the stem. 3. *S. media*

a. Leaves narrow, linear or narrowly lanceolate.

d. Bracts of the inflorescence small and papery; petals longer than the sepals.

e. Leaves narrowly lanceolate, widest above the middle; stem often rough-angled; seeds smooth; inflorescence soon becoming lateral. 4. *S. longifolia*

e. Leaves wider, broadest near the base; stem smooth; seeds rough; inflorescence larger and more commonly appearing terminal. 5. *S. graminea*

d. Bracts of the inflorescence foliaceous and appearing like the upper leaves, the upper bracts often much reduced. 6. *S. calycantha*

1. **S. humifusa** Rottb.

Nichols records this as characteristic of the shoreward reaches of the salt marshes of northern C. B. It is unknown elsewhere in the province.

Greenland near the coast to Me.; northern Eu. and Asia.

2. **S. uliginosa** Murr. MARSH CHICKWEED. Map 225.

Wet sand, springy spots, margins of ponds, ditches and wet banks; common at least from Digby Co. to northern C. B., appearing at times like the preceeding species.

Widespread in the northern Hemisphere.

3. **S. media** (L.)Cyrill. COMMON CHICKWEED. Fig. 56, a.

Common throughout in moist or shady areas or near the coast.

Introduced from Eu. and widely distributed in N. A.

4. **S. longifolia** Muhl. LONG-LEAVED CHICKWEED.

Damp or wet grassy places in sandy to mucky soil; common in large areas on the meadows along the Salmon R., Truro. Both Lindsay and Macoun report this species as common, but their records are apparently based on the introduced *S. graminea*.

Nfld. to Alaska south to Md. and La.; Eu. and Asia.

5. **S. graminea** L. STITCHWORT. Fig. 56, b.

One of the commonest weeds in fields and gardens; throughout.

Introduced from Eurasia; Nfld. to Minn. south to Md. and Iowa.

6. **S. calycantha** (Ledeb.) Bongard. NORTHERN STARWORT.

Scattered in damp thickets, wet woods and ravines from the Annapolis Valley to northern C. B. Various varieties have been described, (Fernald, Rhodora **16**: 144-151. 1914), of which the commonest one in N. S., is var. **floribunda** Fern. with numerous flowers in the inflorescence. (*S. borealis* Bigel., see Fernald, Rhodora **42**: 254-259. 1940).

Nfld. to B. C. southward to N. S.

6. CERASTIUM L.

a. Petals as long or shorter than the sepals; capsules up to 10 mm long. 1. *C. vulgatum*

a. Petals 10 mm long, much longer than the sepals, showy; plants perennial. 2. *C. arvense*

Fig. 56.—**Stellaria.** a, **S. media**, x ½. b, **S. graminea**, x ½. **Lychnis.** c, **L alba**, x ½. d, **L. Flos-cuculi**, x ½. **Silene.** e, **S. Cucubalus**, x ½. **Saponaria.** f, **S. officinalis**, x ½.

1. **C. vulgatum** L., **var. hirsutum** Fries, see Fernald and Wiegand. Rhodora **22**: 169-179. 1920. MOUSE-EAR CHICKWEED. Fig. 55, d.

This is a very common weed throughout.

Throughout temperate N. A.

2. **C. arvense** L. MEADOW CHICKWEED.

Scattered and often abundant locally in fields or meadows where it has been obviously introduced; it is common at Truro, and is scattered in the Annapolis Valley. Lawson (1891) states that the true indigenous form of the plant was collected on the trap cliffs at Blomidon. This plant has not been found there recently.

This variable species and its varieties are found in the northern hemisphere around the world.

7. AGROSTEMMA L.

1. **A. Githago** L. CORN COCKLE.

Occasionally introduced into fields in grain seed; not a permanent weed, and becoming increasingly rare.

Introduced from Eu; widely spread.

8. LYCHNIS (Tourn.) L.

a. Petals divided into shallow lobes; fruiting calyx much enlarged ovoid or globose; plant sticky-pubescent.
  b. Flowers red, opening in the morning; calyx-teeth triangular and acute 1. *L. dioica*
  b. Flowers white or rarely pinkish, opening in the evening; calyx-teeth longer and attenuate. 2. *L. alba*
a. Petals divided into 4 linear lobes, red; fruiting calyx tubular; plant smooth. 3. *L. Flos-cuculi*

1. **L. dioica** L. RED CAMPION.

Lawson reports this plant from Annapolis and Kentville and states that it is probably a remnant of the French occupation. No recent collections have been made, and the plant may now be extinct in the province.

Introduced from Eu. and widely distributed.

2. **L. alba** Mill. WHITE CAMPION, WHITE COCKLE. Fig. 56, c.

Very common around towns, waste places, and along railroads, often becoming a bad weed.

N. S. to Mich. south to N. Y. and Penn.

3. **L. Flos-cuculi** L. RAGGED-ROBIN. Fig. 56, d.

Local; abundant in meadows in parts of Kings Co.; swale near Yarmouth; low field near Brookfield, Colchester Co. When once it is introduced into a meadow it is aggressive and persistent, but spreads very slowly to other areas. Late May.

Introduced from Eu.; N. S. to Penn.

9. SILENE L.

a. Dwarf, tufted alpine plants; flowers solitary. 1. *S. acaulis*

a. Large, erect plants; flowers several to many in each inflorescence.

  b. Calyx more or less inflated, papery and obscurely-ribbed with a network of delicate veins; plant glabrous, perennial. 2. *S. Cucubalus*

  b. Calyx not inflated except by the enlarging capsule; plants hairy and glandular, annuals.

    c. Flowers small, in a one-sided raceme, with very short pedicels; capsule 6-8 mm long. 3. *S. gallica*

    c. Flowers larger, in a terminal much-branched cluster; capsule 15-18 mm long. 4. *S. noctiflora*

1. **S. acaulis** L., var. **excapa** (All.) DC. MOSS CAMPION.

St. Paul Is.; abundant at the southwest end of the island, and also south of N. E. Channel practically at sea level (Perry, 1931). The statement is there made that this is the first record near sea-level southwest of Nfld., but Lawson (1891) says that *S. acaulis* is reported from St. Paul Is. and C. B. Is., and this record is in Macoun's Cat.

Nfld. south to N. S. and the mts. of N. H.

2. **S. Cucubalus** Wibel. BLADDER CAMPION. Fig. 56, e.

Not uncommon in fields and waste places; introduced mostly in grain seed and becoming much more widely distributed in the province, probably destined to be a common weed [*S. latifolia* (Mill.) Britt. and Rendle].

N. S. to Wash. south to N. J. and Mo.

3. **S. gallica** L.

Local; well established around Digby and Deep Brook, where it was known as early as 1902. Adventive from Eu.; local in N. A.

4. **S. noctiflora** L. NIGHT-FLOWERING CATCHFLY.

Common, at least around towns; in waste places, gardens and along roadsides; rare in the country.

Naturalized from Eu.; N. S. to Wash. south to Fla. and Mo.

10. SAPONARIA L.

a. Perennial, in large clumps; leaves tapering at the base; flowers in dense clusters, the calyx not winged. 1. *S. officinalis*

a. Annual, mostly growing singly; leaves clasping at base; flowers in a loose corymbose cyme, the calyx strongly 5-winged. 2. *S. Vaccaria*

1. **S. officinalis** L. BOUNCING BET. Fig. 56, f.

Large clumps of this garden escape may be seen along roadsides, near old houses or in waste places in most parts of the province, and especially from Digby to Pictou. It is very persistent, but not aggressively spreading. Late July-early Aug.

Throughout N. A.; introduced from Eu.

2. **S. Vaccaria** L. SOAPWORT.

Occasional; collected by Groh at Halifax, Aug. 1926; Italy Cross, Lunenburg Co., 1910.

Native of Eu.; N. S. to B. C. south to Fla.

11. DIANTHUS L. PINKS

a. Plants perennial, smooth or roughened; flowers solitary on long pedicels, with two ovate bractlets less than half as long as the calyx. 1. *D. deltoides*

a. Plants annual, more or less hairy; flowers in dense terminal clusters, subtended by numerous hairy bracts equal to the calyx in length. 2. *D. Armeria*

1. **D. deltoides** L. MAIDEN PINK.

Rare and inconspicuous; Meteghan, Digby Co. to the Annapolis Valley, where it is commonly scattered along the North Mt. slope.

Introduced from Eu.; N. S. to Mich. etc.

2. **D. Armeria** L. DEPTFORD PINK.

Scattered as a garden escape; Kentville, Wolfville, Sandy Cove, Canard, Centreville, and probably occurring elsewhere.

Introduced from Eu.; N. S. to Iowa south to Ga.

41. PORTULACACEAE PURSLANE FAMILY

a. Leaves wedge-shaped; garden weed; stamens 7-11; flowers yellow; seeds minute and numerous (Fig. 54, e). 1. *Portulaca*

a. Leaves not wedge-shaped; plants of native habitats; stamens 3-5; flowers not yellow; seeds 2-6.

b. Flowers minute; seeds 2-3; stems from fibrous roots; swampy places. 2. *Montia*

b. Flowers 1-2 cm wide; seeds 3-6; stems from a small deep tuber; rich woods (Fig. 58, a). 3. *Claytonia*

1. PORTULACA (Tourn.)L.

1. **P. oleracea** L. COMMON PURSLANE. Fig. 54, e.

Becoming common in gardens in towns; widespread in the Annapolis Valley on the lighter soils, rapidly spreading to other fields and parts of the province.

Introduced from Eu; widespread in N. A.

2. MONTIA (Mich.) L.

1. **M. lamprosperma** Cham., see Fernald and Wiegand, Rhodora **12**: 138-139. 1912. WATER CHICKWEED.

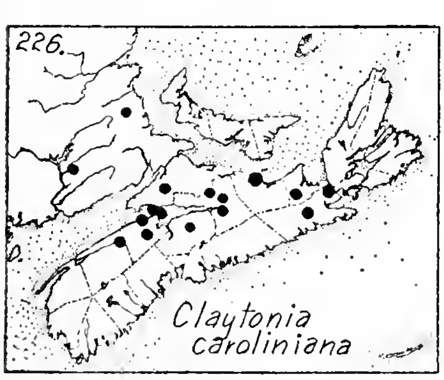
Collected on a grassy bank above the sea, Northwest Arm, Halifax, July 19, 1883 by Macoun and Burgess; also collected at Shediac, N. B. by Fowler.

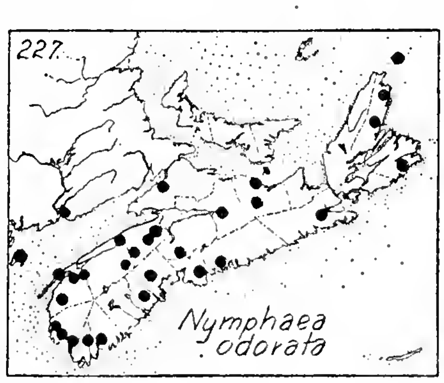
Nfld. and the Gaspe to Me.

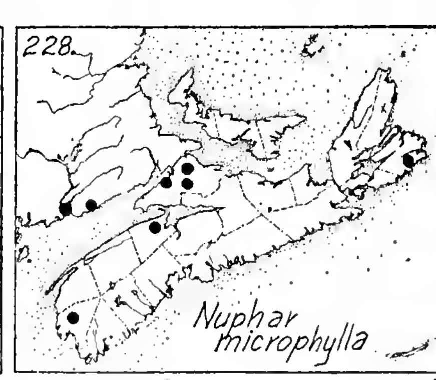
3. CLAYTONIA (Gronov.)L.

1. **C. caroliniana** Michx. SPRING BEAUTY. Fig. 58, a. Map 226.

Rich woods from Annapolis Co. to Amherst and northern C. B.; local in the western part of its range, general







in the Cobequids and on the hardwood hills in central and eastern N. S. May 20-June 15.

N. S. to Minn. south to Ga. and N. C.

42. **CERATOPHYLLACEAE** HORNWORT FAMILY

1. **CERATOPHYLLUM** L.

1. **C. demersum** L. HORNWORT.

Rare; found in the Canard R., Kings Co., above the tide. Common in shallow ponds in eastern P. E. I.

Slow streams and ponds across the continent.

43. **NYMPHAEACEAE** WATER-LILY FAMILY

a. Petiole attached at the summit of a deep notch; stem horizontal under the mud, 5 cm thick.
  b. Flowers white or pinkish; leaves orbicular, with the veins mostly radiating from the summit of the petiole (Fig. 57, a). 1. *Nymphaea*
  b. Flowers yellow; leaves much longer than wide, with the veins coming from the mid rib (Fig. 57, b, c). 2. *Nuphar*
a. Petiole attached to the middle of the un-notched blade, covered with gelatinous slime when young; stem slender and trailing in water; flowers small (Fig. 58, b). 3. *Brasenia*

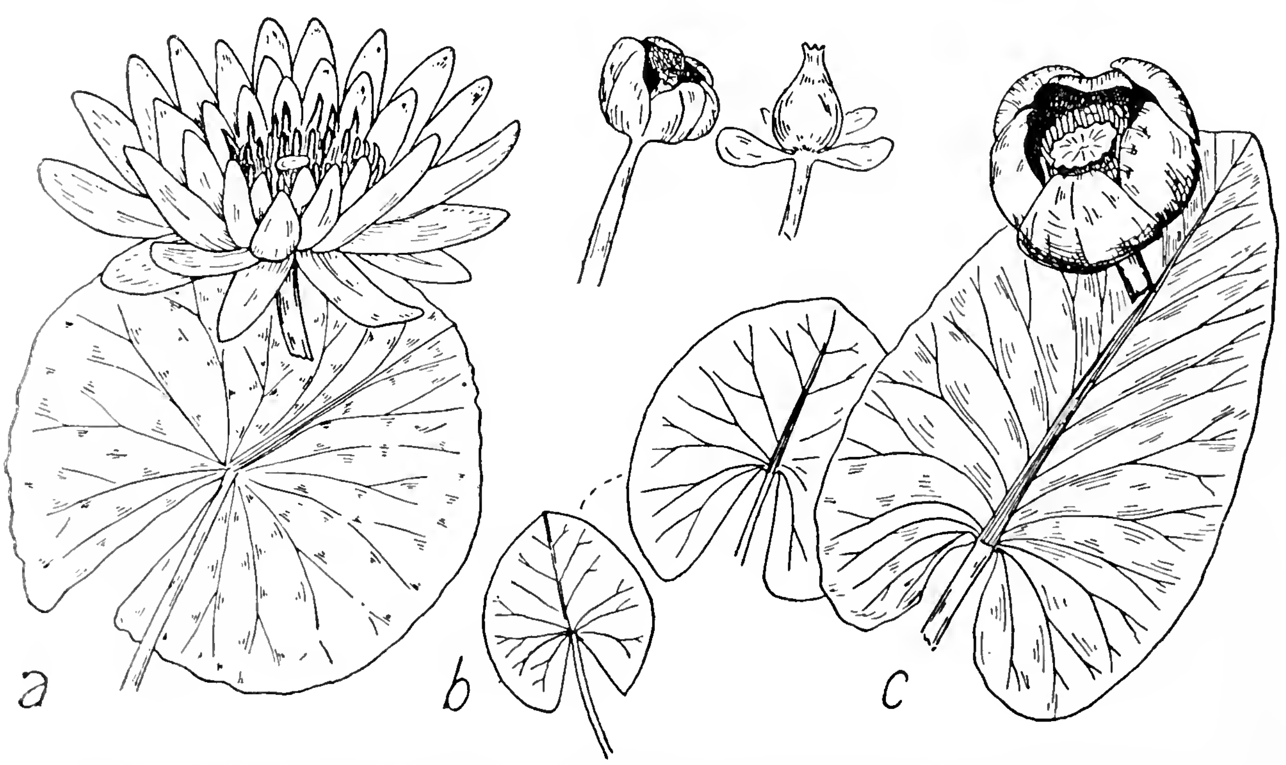


Fig. 57.—**Nymphaea.** a, **N. odorata,** x $\frac{1}{4}$. **Nuphar.** b, **N. microphyllum,** x $\frac{1}{2}$. c, **N. variegatum,** x $\frac{1}{2}$.

1. **NYMPHAEA** L. WATER LILY.

1. **N. odorata** Ait. WATER LILY. Map 227. Fig. 57, a.
Bog pools, lake margins and slow-flowing rivers; very common in the southern regions from Yarmouth to C. B.; rarer northwards and in the sandy areas. (*Castalia* Salisb.).

Var. **rosea** Pursh is reported common in bog-pools and lake-margins of Digby and Yarmouth Cos. (Fernald, 1921); in Halifax Co. (Rousseau, 1935); and on St. Paul Is. This variety is ill-defined, occurs when the plants are growing under dryish conditions, and has smaller and often pinkish petals.

Nfld. to Man. south to Fla. and Kans.

2. **NUPHAR** J. E. Smith. PONDLILY

Miller & Standley. The North American species of *Nymphaea*. Contrib. Nat. Herb. U. S. **16**: 63-108. 1912.

a. Anthers shorter than the filaments; leaf-blades to 20 cm long and 15 cm wide.
  b. Flowers 2 cm or less wide; leaf-blade 3-10 cm long, with a notch two-thirds or more the length of the midrib; young fruit without a ring of decaying stamens. 1. *N. microphyllum*
  b. Flowers 3 cm or more in width; leaf-blades 7-20 cm long, with a notch about one-half the length of the mid-rib; young fruit with a ring of decaying stamens. 2. *N. rubrodiscum*
a. Anthers equalling or longer than the filaments; leaf-blades 17-26 cm long, 11-22 cm wide, with a narrow notch more than half as long as the midrib; flowers 4.5 cm wide. 3. *N. variegatum*

1. **N. microphyllum** (Pers.) Fern. SMALL POND LILY. Map 228. Fig. 57, b.
Local; found in ox-bow ponds and sink-holes in Cumberland Co.; characteristic of ox-bow ponds in northern C. B.; scattered elsewhere (*Nymphaea microphylla* Pers.). Aug.

N. S. to Wisc. south to Penn.

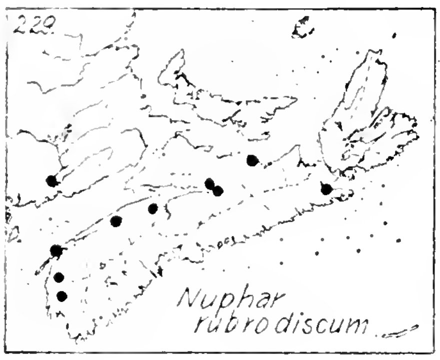
2. **N. rubrodiscum** Morong. YELLOW POND LILY. Map 229.
Lakes and quiet streams, Yarmouth to Pictou and Guysborough Cos., probably throughout; formerly confused with the next species, and probably a hybrid between it and *N. microphyllum* [*Nymphaea rubrodisca* (Morong) Greene].

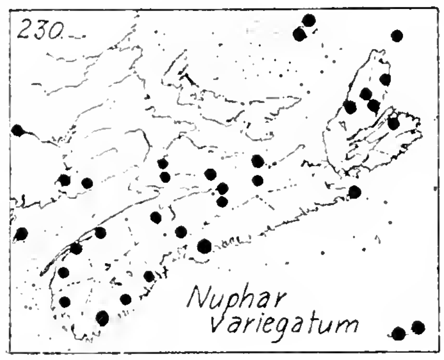
N. S. to Minn. south to Penn.

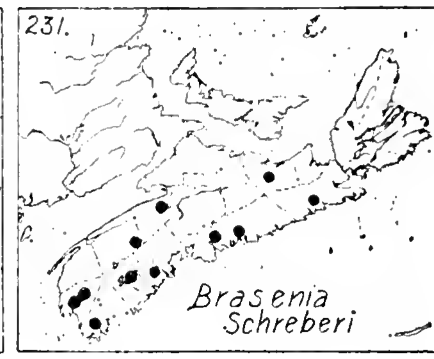
3. **N. variegatum** Engelm. COW LILY. Map 230. Fig. 57, c.

Common throughout; also on Sable Is.; lakes, ponds, quiet streams and still-waters. All early records of *N. advena* Ait. for N. S. belong here.

N. S. to Minn. south to N. J., Ohio and Nebr.







3. **BRASENIA** Schreb.

1. S. Schreberi Gmel. WATER SHIELD. Map 231. Fig. 58, b.

Local; in various lakes of Yarmouth and Shelburne Cos. (Fernald, 1921, 1922); scattered in lakes in Halifax Co. (Lawson, 1891); and reported from various places east to Guysborough Co. (Rousseau, 1935), and Millstream Pictou Co. (Robinson, 1906).

N. S. to Man. south to Fla., Tex. and Nebr.

44. **RANUNULACEAE.** BUTTERCUP FAMILY.

a. Plant a vine, climbing by the bending of the petioles; leaflets 3; flowers in panicles (Fig. 60, a). 5. *Clematis*

a. Plants herbaceous, not climbing.

 b. Leaves reniform or orbicular, toothed or very shallowly lobed.

  c. Leaves mostly basal, 0.5-5 cm wide; fruit achenes; buttercups. 1. *Ranunculus*

  c. Leaves scattered along the stem, reniform, 2-20 cm wide; fruits of many-seeded follicles (Fig. 60, d). 6. *Caltha*

 b. Leaves deeply lobed or compound.

  d. Leaves all basal; plant less than 10 cm high.

   e. Leaves with 3 lobes cut half or two-thirds to the base; flowers blue, subtended by tiny leafy bracts (Fig. 59, d). 3. *Hepatica*

   e. Leaves with 3 toothed leaflets; flowers white, without leafy bracts; rootstocks bright-yellow (Fig. 60, c). 7. *Coptis*

  d. Leaves both basal and scattered on the stem, or all scattered.

   f. Stem leaves 2 or 3, opposite or whorled. 4. *Anemone*

   f. Stem-leaves alternate, often reduced in size.

    g. Leaves deeply cut, or palmately-compound, but once divided. 1. *Ranunculus*

g. Leaves large, ternate, with 3 large leaflets once or twice divided.
h. Plant 10-25 dm high; leaves numerous, sessile or nearly so, the final divisions with 3-5 teeth at the apex; fruit achenes. 2. *Thalictrum*
h. Plant less than 10 dm high; leaves few on the stem, long-petiolate.
i. Leaves 1-2, on the stem only, much-divided with the lobes sharply and acuminately pointed; fruit a berry; flowers small, not spurred, in short racemes. 9. *Actaea*
i. Leaves mostly basal, the stem ones reduced, the ultimate divisions with rounded teeth or lobes; fruit a follicle; flowers large, few, the petals spurred. 8. *Aquilegia*

1. **RANUNCULUS** (Tourn.)L. BUTTERCUP

Benson, L. North American *Ranunculi*. Bull. Torrey Bot. Club **68**: 156-172; 477-490; 640-659. **69**: 296-316; 373-386. 1940-1941. Drew, W. B. The North American representatives of *Ranunculus*, sect. *Batrachium*. Rhodora **38**: 1-47. 1936.

a. Leaves finely cut into thread-like or capillary divisions; plant aquatic or sometimes stranded; flowers white; achenes wrinkled (Fig. 58, c).
b. Receptacle densely hairy, the hairs more or less tufted; achenes 1-1.5 mm long, sometimes hairy. 1. *R. aquatilis* var. *capillaceus*
b. Receptacle smooth or sparsely hairy, the hairs not tufted; achenes 1.5-1.8 mm long, usually smooth. *R. aqualitis* var. *calvescens*
a. Leaves entire, or divided with flattened lobes; flowers yellowish; achenes not wrinkled.
c. Plants of brackish soil, small, scapose, spreading by runners; achenes striate; leaves fleshy, merely toothed, rectangular to reniform; fruiting axis very elongate (Fig. 58, d). 2. *R. Cymbalaria*
c. Plants not in brackish locations; achenes smooth.
d. Leaves linear to broadly lanceolate, entire or nearly so; plant rooting at the nodes, sub-aquatic.
e. Leaves 5-10 mm wide; petals 4-8 mm long; stamens 25-50; achenes 20-50. 3. *R. Flammula*
e. Leaves filiform, 0.5-1.5 mm wide; petals 2-4, rarely to 7 mm long; stamens 5-25; achenes 5-15 (Fig. 58, f). *R. Flammula* var. *filiformis*
d. Leaves orbicular to elliptical, crenate or cut into numerous lobes.
f. Plants weak and slender, aquatic or on wet mud; leaves orbicular and radially cut into numerous segments; flowers about 1 cm wide, the petals slightly exceeding the sepals (Fig. 58, e). 4. *R. Gmelinii*
f. Plants vigorous, erect or creeping, the leaves not floating, irregularly divided and lobed, or orbicular and merely crenate.

g. Leaves orbicular to reniform, crenate, the lower ones occasionally 3-lobed; erect plants on rich soils (Fig. 59, a).
5. *R. abortivus*

g. Leaves irregularly and much divided.

h. Plants bristly or hirsute with stout spreading hairs; plants erect; flowers inconspicuous, the petals about 4 mm long or less.

i. Styles hooked in fruit; heads sub-globose; leaf divisions sessile; petals nearly equalling the sepals (Fig. 59, b).
6. *R. recurvatus*

i. Styles straight or nearly so; heads about 3 times as long as wide; petals half as long as the sepals; terminal divisions of the leaf stalked. 7. *R. pensylvanicus*

h. Plants smooth or with light, soft pubescence; flowers showy, the petals to 10 mm long.

j. Base of plant thickened, bulbous; leaves with the lateral divisions sessile, the terminal one stalked. 8. *R. bulbosus*

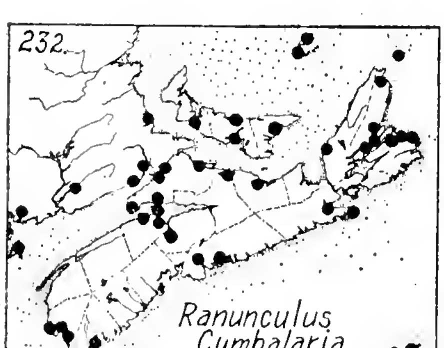
j. Base of the plant not bulbous.

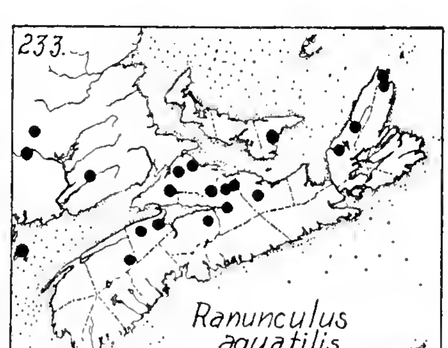
k. Plants erect; style more than 1 mm long; divisions of the leaf all sessile (Fig. 59). 9. *R. acris*

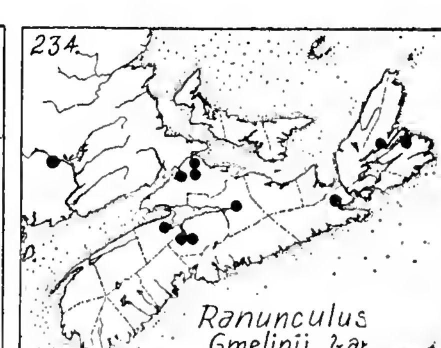
k. Plant usually rooting at the lower nodes, or creeping; style less than 1 mm long; divisions of the leaf stalked, the stalks of different texture than the blade; flowers larger, more orange in color. 10. *R. repens*

1. **R. aquatilis**, var. **capillaceus** DC. WHITE WATER CROWFOOT. Map 233. Fig. 58, c.

Slow-moving streams, lagoons, shallow pools and occasionally in ditches in meadows, associated with mucky soils; scattered from Annapolis to C. B. (*R. trichophyllus* Chaix.) July-Aug. Lab. to Alaska south to N. Y., & Calif.; Eurasia.







Var. **calvescens** (W. Drew)L. Benscn, Bull Torry Bot. Club **89**: 381-384. 1942, is rarer than the above variety. Certain collections from near Truro seem to be near to *R. subrigidus* Drew, Rhodora **38**: 39. 1936, since they have short petioles and the leaf-divisions are stout and rigid. Benson considers this species to be merely plants intermediate between *R. aquatilis* and *R. circinatus* of Que. and New England westward. The N. S. plants may then be considered as extremes of the above variety only.

N. S. to N. England & N. Y. west to Keneewaw Co., Mich.

Fig. 58.—**Claytonia.** a, **C. caroliniana,** x ½. **Brasenia.** b, **B. Schreberi,** x ½. **Ranunculus,** all x ½. c, **R. aquatilis.** d, **R. Cymbalaria.** e, **R. Gmelinii.** f, **R. Flammula** var. **filiformis.**

2. **R. Cymbalaria** Pursh. SEA-SIDE BUTTERCUP. Map 232. Fig. 58, d.

Characteristic of salt marshes and flooded dyke lands throughout; found only near or on saline soil. July-Aug. Lab. south along the coast of N. J.; scattered inland.

Var. **alpina** Hook is a smaller plant with the leaves more rectangular, 4-10 mm long, 2.5-6 mm wide, and 3-toothed at the apex; stamens about 10; achenes 25-60; and the sepals 2-3 mm long. This arctic variety growing from Siberia to Alaska and Nfld. is not well-marked in N. S. but intermediates occur on Sable Is. and from Que. to Nfld.

3. **R. Flammula** L.

Known in the province by but one collection; from a cold spring brook, Tusket, Yarmouth Co. (Fernald, 1921)

The statement by Nichols (1918) that it is characteristic of sandy shores in C. B. must refer to the following variety. Eu.; Nfld., N. S. and Wash. and Ore.

Var. **filiformis** (Michx.) Hook., see Benson,l. c., SMALL SPEARWORT. Fig. 58, f.

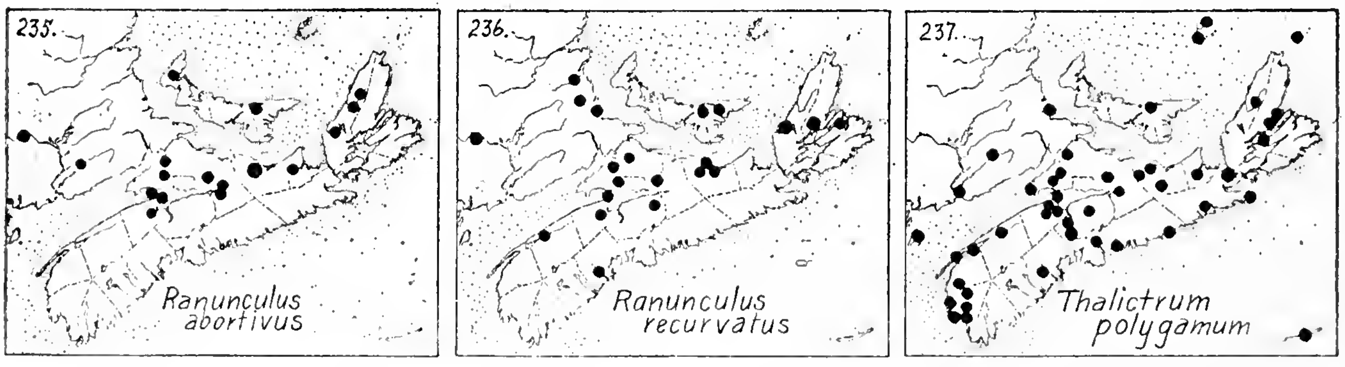
Along rivers, sandy beaches, rocky shores, and swampy edges of rivers and lakes; scattered throughout but commonest from Annapolis and Cumberland Cos. to C. B. The exact identification of the various forms of *R. Flammula* is rather arbitrary. On the West Coast it grades into a smaller, wider-leaved extreme called var. *ovalis* (Bigel.) Benson, which in turn grades into var. *filiformis.* Some of the leaves in some plants in N. S., have the wider width and flat shape so that these plants might almost as well be placed in the var. *ovalis.* (*R. reptans L*). July-Sept.

Eurasia; Alaska to Greenland south to Minn. and Penn.

4. **R. Gmelinii** DC., var. **terrestris** (Ledeb.) L. Benson, Bull. Torrey Bot. Club **69**: 613. 1942. Map 234. Fig. 58, e.

Common in marshes at Kentville, Windsor and Truro and from there to Amherst and northern C. B.; generally growing in shallow water among the bases of swamp plants, occasionally seen in deeper water in slow-moving brooks or sometimes out on sandy shores or dried-up ditches. (R. *Purshii* Richards).

N. S. and P. E. I., to Alaska south to Me., Mich. & N. M.



5. **R. abortivus** L., var. **acrolasius** Fern., see Fassett, Mass Collections: *Ranunculus abortivus* and its close relatives. Amer. Midl. Nat. **27**: 512-522. 1942. Map 235. Fig. 59, a. WOOD BUTTERCUP.

Common on rich wooded hillsides and along river intervales from Annapolis Co. to C. B. Macoun records these plants as var. *micranthus.* Var. **eucyclus** Fern. with leaves orbicular and with a closed or over-lapping sinus, is merely an ecological form in rich locations. This is occasionally seen along the intervales. Diminutive plants bloom in early May. May-June.

Lab. to Alaska south to Conn., Minn. & Colo.

6. **R. recurvatus** Poir. Map 236. Fig. 59, b.

Rich woods along intervales, and seepy hillsides; Annapolis Co., to northern C. B.

Nfld. to Minn. south to Ga. & Okla.

7. **R. pensylvanicus** L. f. BRISTLY CROWFOOT.

Lindsay lists this species from Pictou, collected by A. H. McKay. A specimen was seen from Cumberland Co.

Nfld. to Alaska south to N. S.; in the Rockies to N. M.; and in China.

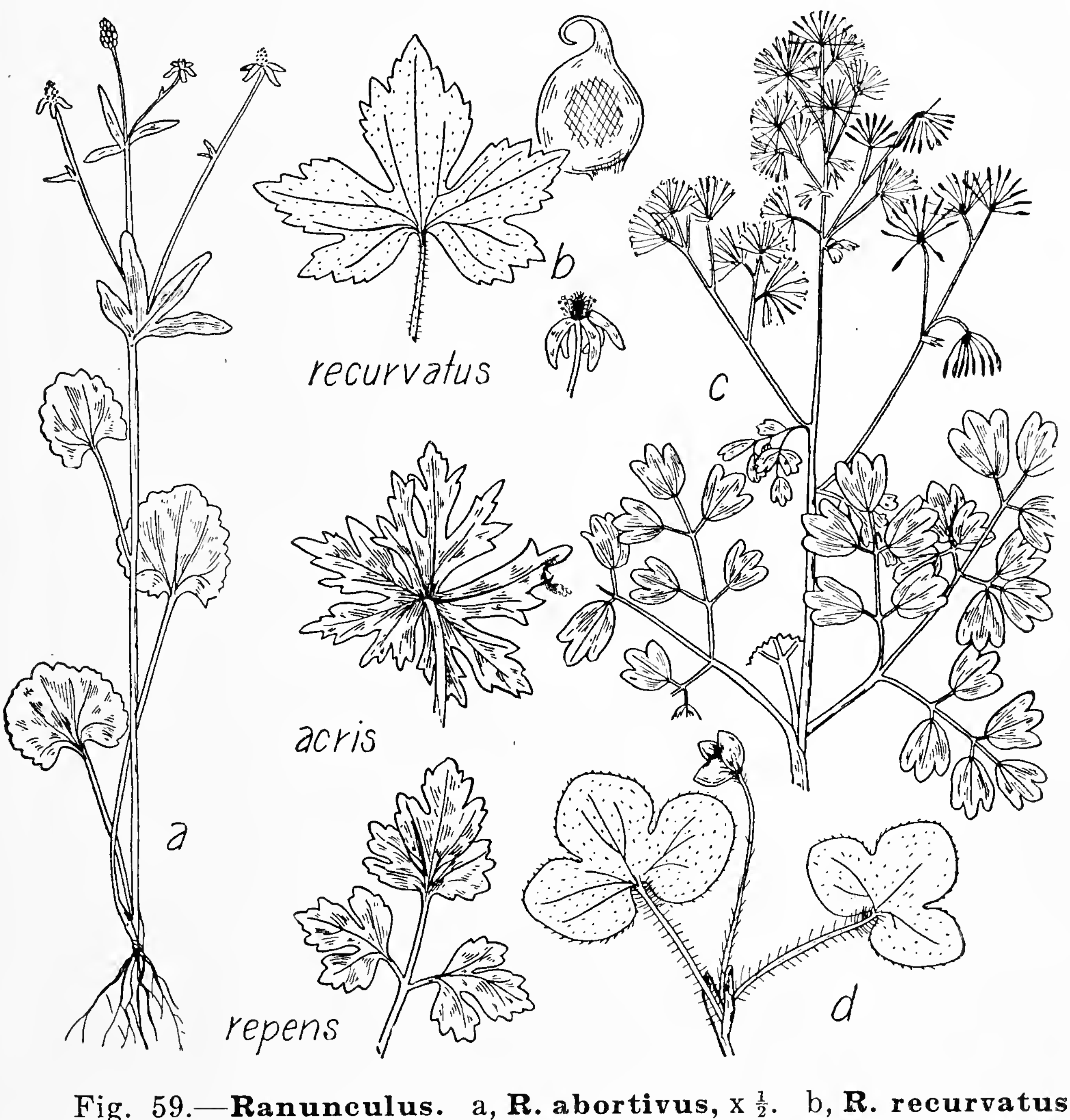


Fig. 59.—**Ranunculus.** a, **R. abortivus,** x ½. b, **R. recurvatus.** leaf, x ½; flower, x 2; achene, x 5. **Thalictrum.** c, **T. polygamum,** x ½. **Hepatica.** d, **H. americana,** x 1/3.

8. **R. bulbosus** L. BULBOUS CROWFOOT.

Common from Barrington to Shelburne; scattered along the South Shore in light soils from Yarmouth to east of Bridgewater; Lawson (1891) reports it as perfectly naturalized in Point Pleasant Park, Halifax; Windsor.

Introduced from Eu.; dry fields and roadsides, Nfld. to B. C., southward.

9. **R. acris** L. FALL FIELD BUTTERCUP. Fig. 59.

Common throughout; fields, meadows and roadsides, chiefly in heavy or moist soils, often a bad weed in low ground. Var. *Steveni* (Andrz.) Lange has less dissected leaves with broadly oblanceolate or cuneate segments. This has a wide range but intergrades so much that it hardly seems desirable to keep it separate. June 15-July.

Introduced from Eu.; Lab. to N. C. and scattered westward.

10. **R. repens** L. CREEPING BUTTERCUP. Fig. 59.

Common throughout in ditches, low ground, meadows, wet woods and elsewhere. It is very variable, and on dry ground often pubescent. Var. **villosus** Lamotte has the pubescence wide-spreading. Var. **erectus** DC., without trailing branches, is found occasionally in Que. and Nfld. A collection from shallow pools in hardwoods at Pleasant Bay, C. B. may belong here. June 20-Aug.

Nfld. & Que. to N. C.; Alaska to Calif., Colo. & Idaho.

2. THALICTRUM (Tourn.)L. MEADOW RUE.

1. **T. polygamum** Muhl., MEADOW RUE. Fig. 59, c. Map 237.

Common throughout in marshes, meadows, ditches and thickets, or even in the climax forest along the flood plains.

Var. **hebecarpum** Fern. has the leaves usually pubescent beneath and the achenes pubescent, plant more robust, and the inflorescence subcorymbose instead of paniculate. This is often abundant and grades into the species in all parts of the province. It is the only form present on Sable Is. (T. Zibellium). July-Aug.

Nfld. to Sask. southward.

3. **HEPATICA** (Rupp.) Mill.

1. **H. americana** (DC.) Ker., see Fernald, Rhodora **19**: 45-46. 1917. Fig. 59, d. HEPATICA.

Rare and very local; Bridgewater, Windsor, Pictou, Stewiacke and Antigonish. Earlier records list it from various intermediate locations. Early May. (The American variant of *H. triloba* Chaix.).

N. S. to Man. & Minn. south to Fla. & Mo.

4. **ANEMONE** (Tourn.) L.

a. Plants 3-12 dm high, stout, generally branched, bearing several flowers. 1. *A. virginiana*

a. Plants 1-2 dm high, slender, generally unbranched, bearing only one flower. 2. *A. quinquefolia*

1. **A. virginiana** L. FALL ANEMONE.

Rare, restricted to intervales or banks of rivers; occasional in Colchester and Pictou Cos.; scattered on some of the intervals of northern C. B. (Nichols, 1918).

N. S. to Minn. south to Ga. & Ark.

2. **A. quinquefolia** L. WOOD ANEMONE.

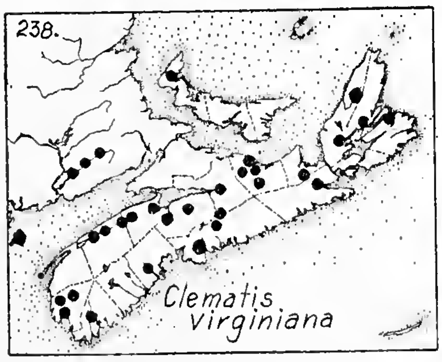
Scattered to rare; north of Bridgetown, Annapolis Co.; Newport, Hants Co.; Middle Stewiacke; and rather common along the St. Andrew's R., Stewiacke and back of Shubenacadie. Mi-dJune.

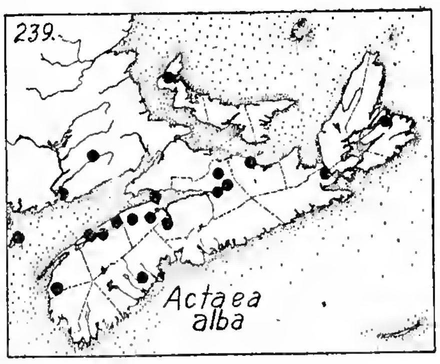
N. S. to Minn. south to Ohio & Iowa.

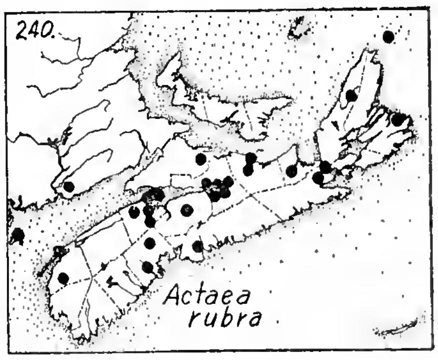
5. **CLEMATIS** L.

1. **C. virginiana** L. VIRGIN'S BOWER. Map 238. Fig. 60, a.

Scattered throughout, commonest in the north-central counties; banks of streams, stony banks, ravines and climbing over bushes of roadside thickets. It is one of the char-







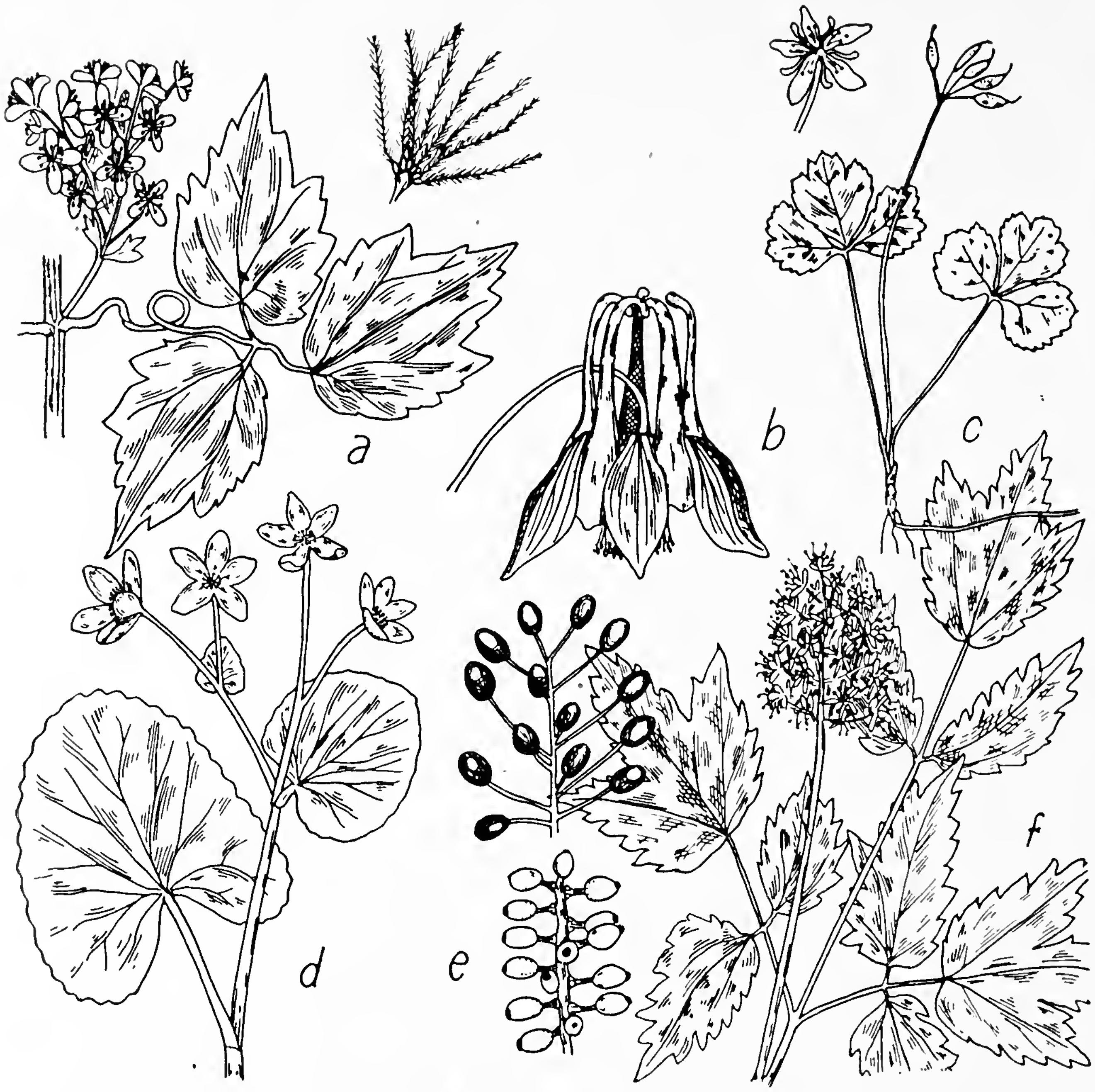


Fig. 60.—**Clematis.** a, **C. virginiana**, x ½; achenes, x 1. **Aquilegia.** b, flower, x ½. **Coptis.** c, fruiting plant and flower, x ½. **Caltha.** d, **C. palustris**, x 1/3. **Actaea.** e, **A. pachypoda**, fruiting raceme, x ⅓. f, **A. rubra** plant and fruiting raceme, x ½.

acteristic intervale plants in eastern N. S.; characteristic of the higher parts of the flood plains in northern C. B. Aug. 1-Aug. 15.

N. S., to Man., south to Ga. and La.

6. CALTHA (Rupp.) L.

1. **C. palustris** L. MARSH MARIGOLD. Fig. 60, d.

Collected at Whycocomagh by Macoun in 1883. Although Lindsay lists it from Mahone Bay, it is known for certainty only from northern C. B. where it is found on the margin of slow streams, on marshes and beside pools. The plant is very abundant and luxuriant on the marshes between Margaree Forks and Margaree Harbour. It is common and widespread in eastern P. E. I. May-June.

Lab. to Sask. south to S. C.

7. **COPTIS** Salisb.

1. **C. groenlandica** (Oeder)Fern., Rhodora **31**: 142. 1929. GOLDTHREAD. Fig. 60, c.

Common throughout; coniferous forests, swamps, bogs, roadside banks, etc. One colony of plants growing in a spruce woods at Bay St. Lawrence was found to have the leaflets finely dissected. May.

Lab. to Alaska south to Md. and in the mts. to Ga.

8. **AQUILEGIA** (Tourn.) L.

1. **A. vulgaris** L. GARDEN COLUMBINE. Fig. 60, b.

A garden escape established in many parts of the province where it has spread to roadsides, fields and damp hollows.

Introduced from Eu.; and widely established.

9. **ACTAEA** L.

a. Leaves glabrous beneath except for a few hairs on the veins; fruit white, the pedicels stout and thickened, 3-10 mm long. 1. *A. pachypoda*

a. Leaves mostly pubescent over the whole surface, occasionally as above; fruit mostly red, the pedicels slender, 8-15 mm long. 2. *A. rubra*

1. **A. pachypoda** Ell., see Fernald, Rhodora **42**: 260-266. 1940. WHITE BANEBERRY. Map 239. Fig. 60, e.

Characteristic of hardwood climax forests and intervales, rocky or open woodlands, around the edges of fields, generally in loamy or somewhat light soils; Annapolis to northern C. B., scattered to very rare elsewhere [A. *alba*(L.) Mill. of other authors]. Late May-early June.

N. S. to Minn. south to Ga. & Mo.

2. **A. rubra** (Ait.) Willd. RED BANEBERRY. Map 240. Fig. 60, f.

In similar situations to the last, although perhaps more restricted to the richer soils and intervales; characteristic of hardwood forests and commonest from Annapolis to northern C. B. May 15-May 30. Forma **neglecta** (Gillman) Robinson has pure white berries. This is common on many of the intervales in Colchester and Kings Cos.

Lab. to S. Dak. south to N. J. & Nebr.

45. BERBERIDACEAE. BARBERRY FAMILY.

a. Plants herbaceous; berries blue. 1. *Caulophyllum*

a. Plants shrubby; berries red. 2. *Berberis*

1. CAULOPHYLLUM Michx.

1. **C. thalictroides** (L)Michx. BLUE COHOSH.

Rare, known from but one place; half a dozen plants exist on the intervale under sugar maple trees at Kemptown, Colchester Co. Early June.

N. S.; N. B. to Man. south to S. C.

2. BERBERIS (Tourn) L. BARBERRY

a. Leaves with a smooth edge; thorns mostly solitary; berries in clusters like gooseberries. *1. B Thunbergii*

a. Leaves with a spiny-toothed edge; thorns mostly in 3's; berries in hanging racemes like currents. 2. *B. vulgaris*

1. **B. Thunbergii** DC. JAPANESE BARBERRY.

Commonly planted as an ornamental shrub; occasionally found as an escape or waif. Native of Japan; widely spread.

2. **B. vulgaris** L. COMMON BARBERRY. Fig. 61, a.

Formerly much planted as an ornamental around driveways and buildings. Scattered bushes still persist, and occasional escapes may be found. This shrub is the alternate host of the black stem rust of cereals and should be exterminated when found. Similar rust-resistant species are now being planted.

Native of Eu.; widely introduced.

46. PAPERAVACEAE POPPY FAMILY

a. Perennial, stemless; juice red; leaves large and palmately lobed; petals 4-12, white (Fig. 61, b). 1. *Sanguinaria*

a. Biennial, tall and branched; juice orange; leaves coarsely pinnatified; petals 4, yellow (Fig. 61, c). 2. *Chelidonium*

a. Annual, low; juice whitish; leaves pinnately-lobed; petals, 4, large reddish to scarlet. 3. *Papaver*

1. SANGUINARIA (Dill.) L.

1. **S. canadensis** L. BLOODROOT. Fig. 61, b.

Low ground near streams and in rich intervales, often just above tide level; Hants Co., rare; Colchester Co., common around Truro and along many of the streams and rivers; scattered elsewhere from Cumberland Co. to northern C. B. This plant is variable, and several dubious varieties have been proposed. Early May.

N. S. to Man. south to Fla.

Fig. 61.—**Berberis.** a, **B. vulgaris,** x ½. **Sanguinaria.** b, flowering plant, x 1/3. **Chelidonium.** c, top of plant, x ½. **Corydalis.** d, part of plant, x ½. **Dicentra.** e, **D. Cucullaria,** x 1/3.

2. CHELIDONIUM (Tourn.) L.

1. **C. majus** L. CELANDINE. Fig. 61, c.

Becoming rather common about towns and villages in southern Digby, Yarmouth and Shelburne Cos. June-Aug.

Introduced from Eu.; N. S. to Ont. south to N. C.

3. **PAPAVER** (Tourn.) L. POPPY.

a. Leaves deeply toothed to lobed, tapering to the base; peduncle bristly hairy, at least below. 1. *P. Rhoeas*

a. Leaves merely toothed, rounded at the base and prominently clasping; peduncle smooth or with but a few scattered hairs. 2. *P. somniferum*

1. **P. Rhoeas** L. CORN POPPY.

Occasional on rubbish dumps, rarely as an escape in fields. Collected by H. Groh from Amherst, Pictou and Sydney; reported by others from near different ports in the northern counties. July-Aug.

Introduced from Eu. and widely distributed.

2. **P. somniferum** L. POPPY.

Occasional on rubbish dumps and in waste places; Sydney, Bridgewater and Yarmouth.

Native of the Mediterranean Region; an ornamental flower.

47. **FUMARIACEAE.** FUMITORY FAMILY.

a. Corolla with the two opposite petals spurred at the base; fruit several seeded.

b. Plant climbing; petals firmly united and the corolla spongy; seeds not crested. 1. *Adlumia*

b. Plant low, erect and scapose; petals slightly united, not spongy; seeds crested (Fig. 61, e). 2. *Dicentra*

a. Corolla with but one of the petals spurred at the base.

c. Fruit oblong, several-seeded; flowers purplish-green or rose colored with yellowish tips, 10-15 mm long (Fig. 61, d). 3. *Corydalis*

c. Fruit round, 1-seeded; flowers deep purple, tipped with crimson, 5-7 mm long. 4. *Fumaria*

1. **ADLUMIA** Raf.

1. **A. fungosa** (Ait.) Greene. CLIMBING FUMITORY.

Formerly planted about gardens and grounds where it may be very persistent, with the seeds retaining their vitality for years; rare, and much less commonly planted than formerly.

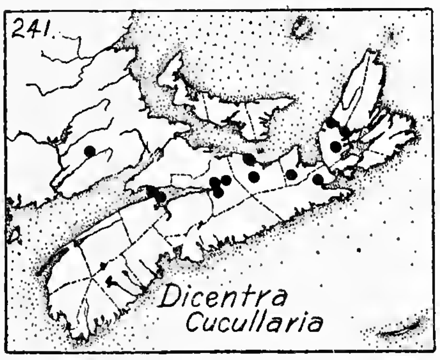
Eastern Que. to Wisc. south to N. C.

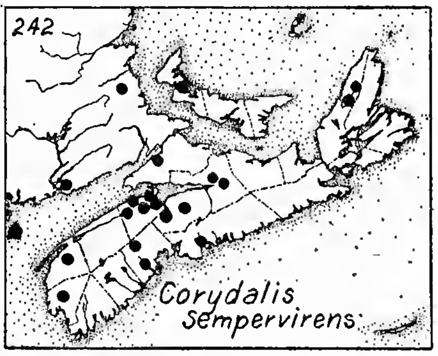
2. DICENTRA Bernh.

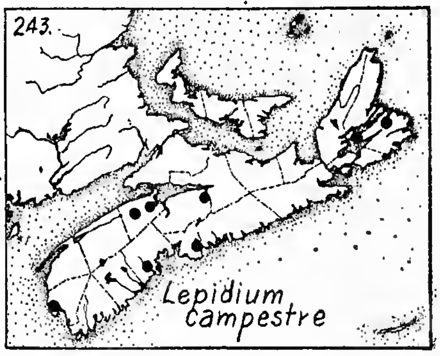
1. **D. Cucullaria** (L) Bernh. DUTCHMAN'S BREECHES. Fig. 61, e. Map 241.

Rich woods, intervales and hardwood hillsides; Cape Blomidon; common in the Cobequid and east to northern C. B. where it is restricted to the intervales. It is best developed on the intervales and hardwood slopes around Truro and central Pictou Co. The plant in Lindsay's herbarium labelled *D. candensis* from Truro is this species. May 20-June 10.

N. S. to Minn., Ga., & Mo.







3. CORYDALIS (Dill.) Medic.

1. **C. sempervirens** (L.) Pers. PINK CORYDALIS. Map 242. Fig. 61, d.

Scattered throughout; rocky places where leaf mould has washed into hollows and pockets; most noticeable the first year on newly-burnt land, where it grows from seeds that have lain dormant. (*C. glauca* Pursh). June-Sept.

Nfld. to Alaska south to Ga., Minn. & Mont.

4. FUMARIA (Tourn.) L.

a. Flowers 4-6 mm long; fruit without a sharp point; leaf-segments flat and not channelled. 1. *F. officinalis*

a. Flowers 4 mm long or less; fruit with a sharp point; leaf-segments very narrow and channelled. 2. *F. parviflora*

1. **F. officinalis** L. COMMON FUMITORY.

Rare; occasionally about old gardens where it is cultivated or is persisting. Lawson (1891) records it as sparingly spontaneous in gardens at Halifax. Specimens have been seen from Kentville, Windsor, and Sydney. July-Aug.

Introduced from Eu.; scattered and widespread.

2. **F. parviflora** Lam.

Sparingly introduced around some of the seaports of the New World (Lawson, 1891); Macoun records it from waste heaps at Bedford, Pictou and North Sydney. No specimens were seen.

48. CRUCIFERAE MUSTARD FAMILY

a. Flowers white, creamy-white, greenish or purple.
 b. Fruit transversely divided into two cells; plants fleshy, found only on sea-shores (Fig. 63, e). 10. *Cakile*
 b. Fruit longitudinally divided into two cells.
  c. Fruit short, less than 3.5 times as long as wide.
   d. Fruit flattened parallel to the partition.
    e. Plant much branched; leaves entire, stem and pods whitish-hairy. 2. *Berteroa*
    e. Plant low and unbranched; leaves toothed; stems and pods green, almost smooth. 1. *Draba*
   d. Fruit flattened at right-angles to the narrow partition or nearly round.
    f. Leaves deeply and irregularly pinnately-lobed.
     g. Fruit wedge- or purse-shaped (Fig. 62, c). 7. *Capsella*
     g. Fruit like two nutlets placed side by side (Fig. 62, e). 5. *Coronopus*
    f. Leaves entire or merely toothed.
     h. Fruit round in outline, flat, often with a margin extending at the tip.
      i. Fruit 10-12 mm wide; plant slightly or not branched (Fig. 62, a.) 3. *Thlaspi*
      i. Fruit 2-4 mm wide; plant generally much branched at the apex (Fig. 62, b). 4 *Lepidium*
     h. Fruit orbicular or oblong-cylindrical.
      j. Fruits perfectly orbicular; leaves widely clasping at the base (Fig. 62, d). 9. *Neslia*
      j. Fruits oval or oblong; leaves linear or wider, not clasping at the base.
       k. Plants found on sandy or gravelly lake-bottoms, 2-8 cm high; leaves basal and thread-like (Fig. 63, a). 6. *Subularia*
       k. Plants growing on dry land; leaves flat or lobed.
        l. Leaves clasping, not toothed. 8. *Camelina*
        l. Leaves not clasping, toothed, 15-30 cm long at the base of the plant. 20. *Armoracia*
  c. Fruits 4 to many times as long as wide.
   m. Stem-leaves 2, opposite, each with 3 leaflets; woodland plants. (Fig. 65, b). 23. *Dentaria*

m. Stem-leaves many, entire or pinnately-cleft.

n. Petals 15-20 mm long, purplish or rarely white; leaves not divided, 8-13 cm long; seeds in one row in each cell. 16. *Hesperis*

n. Petals very small, or if 12 mm long then the leaves pinnately-compound.

o. Leaves lanceolate, finely toothed or entire. 25. *Arabis*

o. Leaves all finely pinnately-lobed.

p. Stems erect, unbranched or branched only near the top, the leaves chiefly basal; pods straight, flattened, the seeds in 1 row in each side or cell (Fig. 64, e; 65, a). 24. *Cardamine*

p. Stems often floating on or in water, much branched, leafy; pods curved and terete; seeds in 2 rows in each cell (Fig. 63, f). 18. *Nasturtium*

a. Flowers yellow or creamy-yellow.

q. Fruit not more than 3 times as long as wide, or less than 6 mm long.

Leaves not toothed, usually clasping.

Fruit globose, roughened (Fig. 62, d). 9. *Neslia*

Fruit ovate, smooth. 8. *Camelina*

Leaves pinnately lobed or finely divided.

Fruit oblong, the surface smooth; leaves with wide lobes; common weeds (Fig. 65, c). 19. *Rorippa*

Fruit like two nutlets side by side, the surface rough; leaves finely divided; rare (Fig. 62, e). 5. *Coronopus*

q. Fruit 4 to many times as long as wide.

r. Fruit not opening, the wall fleshy and becoming hard, formed of many 1-seeded sections; sepals erect and appressed to the petals (Fig. 63, d). 11. *Raphanus*

r. Fruit splitting when ripe into 2 longitudinal halves.

s. Seeds in two rows in each side or cell: rare. 13. *Diplotaxis*

s. Seeds in one row in each cell.

t. Leaves pinnate, or more or less pinnately-lobed.

u. Flowering racemes with leafy bracts. 21. *Erucastrum*

u. Flowering racemes without bracts.

v. Fruits closely appressed to the stem; flowers 3 mm wide (Fig. 64, a). 15. *Sisymbrium*

v. Fruits not closely appressed, or if appearing so then with the flowers much larger.

w. Fruits extremely long and slender, not thicker than their pedicels (Fig. 64, b). 15. *Sisymbrium*

w. Fruits wider than the diameter of the pedicels.

x. Leaves extremely finely divided; pods long, slender and curved. 15. *Sisymbrium*

x. Leaves widely lobed or pinnate.
y. Leaves very glossy and smooth above with mostly rounded lobes; flowering May and early June; beak of fruit less than 4 mm long (Fig. 64, d). 22. *Barbarea*
y. Leaves thin, often hairy, with toothed lobes; flowering later; beak end of the fruit mostly more than 4 mm long; sepals spreading in flower (Fig. 63, c). 12. *Brassica*
t. Leaves entire or merely toothed.
z. Leaves smooth and sagittate at the base. 14. *Conringia*
z. Leaves not sagittate at the base.
Leaves linear or lanceolate, rarely more than 1.5 cm wide (Fig. 64, c). 17. *Erysimum*
Leaves more than 1.5 cm wide, lobed (Fig. 63, c). 12. *Brassica*

I. DRABA (Dill.) L.

a. Lower part of stem and foliage, especially when young, closely and minutely stellate-pubescent; lowest pedicels 3-15 mm long. 1. *D. arabisans*
a. Lower part of stem and foliage with numerous simple or forking, also often a few occasional stellate, long hairs; lowest pedicels 1-5 mm long. 2. *D. norvegica*

1. **D. arabisans** Michx. DRABA.

Collected but once; coniferous slope of Cape Blomidon, where a colony several yards in diameter was growing on the steep basaltic slope. June.

Nfld. through northern N. B., to northern N.Y., west to the north shore of Lake Superior.

2. **D. norvegica** Gunner, see Fernald, Rhodora **36**: 321-326. 1934.

The only record is by Fernald; "crevices of rocks, Big Intervale, Margaree, C. B. Island, J. Macoun, no. 18,987." Several other species found about the Gulf of St. Lawrence may be expected in some of the ravines of northern C. B.

Nfld. and Strait of Belle Isle to C. B., and Hudson Bay.

2. BERTEROA DC.

1. **B. incana** DC. HOARY ALYSSUM.

Local; abundant near Aylesford, Kings Co., and locally southward in the same county; elsewhere unknown. June-Sept.

Introduced from Eu. and locally common in eastern N.A.

3. THLASPI (Tourn.) L.

1. **T. arvense** L. FIELD PENNY CRESS. Fig. 62, a.

Introduced and scattered; mostly about dwellings, along roadsides and in waste places about towns or along railroads, probably introduced mostly in western grains and often seen. It does not seem to persist nor to spread out into the fields. July-Sept.

Eu.; grain fields in western N. A.

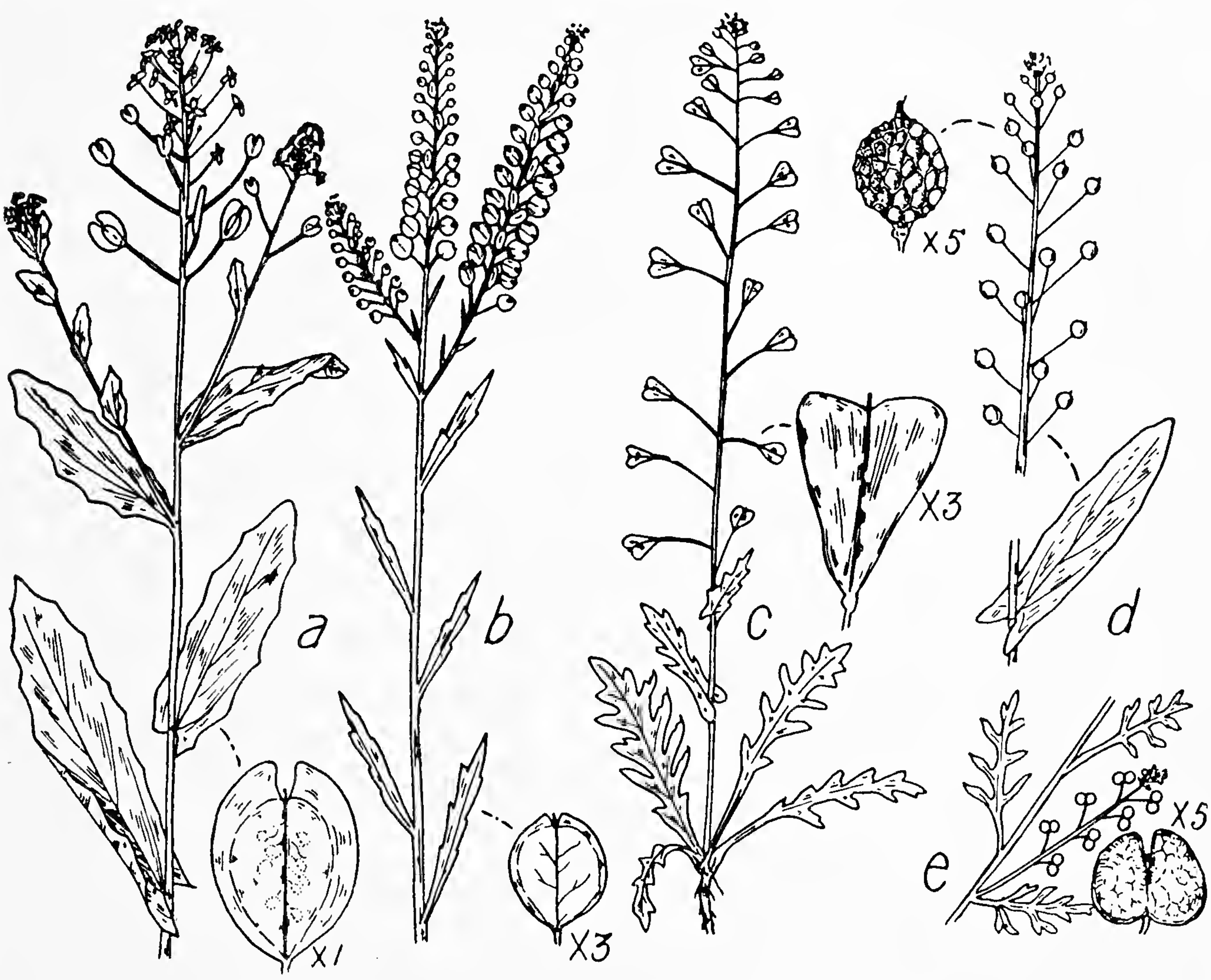


Fig. 62.—**Thlaspi.** a, plant, x ½. **Lepidium.** b, **L. densiflorum,** x ½. **Capsella.** c, small plant, x ½. **Neslia.** d, leaf and inflorescence, x ½. **Coronopus.** e, **C. didymus,** small part of plant, x ½.

4. LEPIDIUM (Tourn.)L. PEPPERGRASS.

a. Stem leaves clasping with the cordate base, grayish-hairy.

b. Fruit ovate or spoon-shaped, surrounded by a wide wing at the tip. 5. *L. campestre*

b. Fruit heart-shaped and thick, tipped with a conspicuous style, not surrounded by a wing. 6. *L. Draba*

a. Stem leaves petioled or sessile, but not clasping.

c. Pod and seeds entirely wingless; leaves twice pinnately-lobed; petals none. 3. *L. ruderale*

c. Pod plainly winged, at least above; leaves entire or lobed; petals present or absent.

d. Pods slightly winged above, orbicular or oval, generally 2-3 mm long; only the lower leaves ever pinnately lobed; stamens usually 2.

e. Petals present, up to 2 mm long; hairs on the main axis of the inflorescence curved and sharp. 1. *L. virginicum*

e. Petals absent or if present very small and narrow; hairs on the main axis of the inflorescence short and stout. 2. *L. densiflorum*

d. Pods widely winged around both sides, generally ovate-orbicular, longer than wide; leaves generally all pinnately lobed; stamens 6. 4. *L. sativum*

1. **L. virginicum** L. PEPPERGRASS. Fig. 62, b.

Collections examined are about equally divided betwen this and the next species. Most of the plants seen were from the center of the province, but the species is undoubtedly present throughout. May-Sept.

Nfld. to Minn. south to Fla.

2. **L. densiflorum** Schrad.

Becoming a common weed, especially on the lighter soils of the Annapolis Valley; scattered by roadsides, towns and railroads elsewhere. May-Sept. (*L. apetalum* Willd.).

N. S. to B. C. south to Tex.; introduced from Eu.

3. **L. ruderale** L. NARROW-LEAVED PEPPERGRASS.

Old records show the plant to be found from Windsor to Sydney; collections have been seen from Windsor, Pictou and Sydney. It is rare.

Introduced from Eu. about seaports from N. S. to Tex.

4. **L. sativum** L. GARDEN CRESS.

Occasionally found as a weed in gardens, or persisting in the autumn; not spreading to native habitats.

Introduced from Eu. and commonly cultivated.

5. **L. campestre** (L.) R. Br. Field Peppergrass. Map 243.

Waste places; Yarmouth and occasionally elsewhere. June-July.

Introduced from Eu. and widespread in eastern America.

6. **L. Draba** L. HOARY CRESS.

Roadsides, waste places and ballast; Yarmouth, scarce (Fernald, 1921); occasionally elsewhere, usually about railroads. June-Aug. [*Cardaria Draba* (L.) Desv., Rhodora **42**: 304. 1940].

Introduced from Eurasia; N. S. and Ont. westward.

5. CORONOPUS Ludwig

a. Fruit notched at the summit, so that the two nutlets are distinct, rough-wrinkled. 1. *C. didymus*

a. Fruit not notched at the summit, so that the two nutlets seem like two halves of a sphere, tubercled. 2. *C. procumbens*

1. **C. didymus** (L.) Sm. SWINE OF CARPET CRESS. Fig. 62, e. Map 244.

Occasional in waste ground, railroad yards and about seaports; rather common in such situations in Digby and Yarmouth Cos. May-Aug.

Introduced from Eurasia; throughout N. A.

2. **C. procumbens** Gilibert.

Rare and infrequently introduced; known from Pictou where it was first recorded by Lawson (1891) as being collected on ballast in 1883. (*C. Coronopus* Karst.).

Rare; introduced from Eu.

6. SUBULARIA L.

1. **S. aquatica** L. AWLWORT. Fig. 63, a. Map 245.

Sandy and gravelly bottoms of lakes; rather common in Digby and Yarmouth Cos.; east to Lunenburg and Halifax Co.; found also in southern Antigonish Co. and at Warren Lake at Ingonish, Victoria Co. Aug.-Sept.

Local; Nfld. to B. C. south to N. Eng. & Calif.

7. CAPSELLA Medic.

1. **C. Bursa-pastoris** (L.) Medic. SHEPHERD'S PURSE. Fig. 62, c.

Common throughout in gardens, cultivated fields and waste places; very variable; early May to Nov.

Introduced from Eu.; throughout N. A.

8. CAMELINA Crantz.

1. **C. microcarpa** Andrz. FALSE FLAX.

Occasional in grain fields and a casual weed around railroad yards. Older records of *C. sativa* (L.) Crantz., a plant with smooth stems, and pods 6-7 mm wide, were made before *C. microcarpa* was recognised as a separate species.

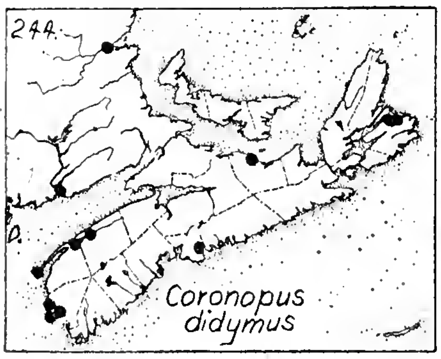
Introduced from Eu.; common in western America and becoming established eastward.

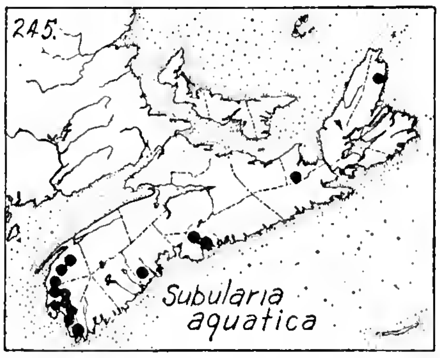
9. NESLIA Desv.

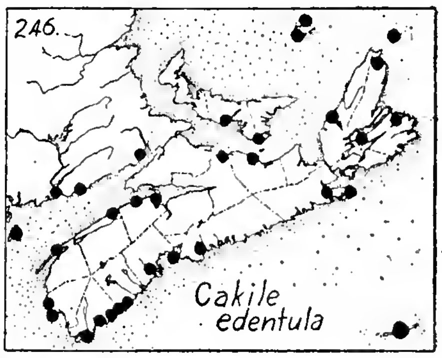
1. **N. paniculata** (L.) Desv. BALL MUSTARD. Fig. 62, d.

Scattered in grain fields, about railroad yards and in waste places. July-Sept.

N. S. to B. C. locally south to Penn.; commoner westward.







10. CAKILE (Tourn.) L.

1. **C. edentula** (Bigel.) Hook. AMERICAN SEA ROCKET. Fig. 63, e. Map 246.

Common around the coast on sandy beaches, dunes and cliffs; in brackish lakes on Sable Is.; and on shingle beaches. July-Sept.

Atlantic Coast from Nfld. to Fla.; on the Pacific Coast, and a variety about the Great Lakes.

11. RAPHANUS (Tourn.) L.

1. **R. Raphanistrum** L. WILD RADISH, CADLOCK. Fig. 63, d.

A common and troublesome weed throughout, but especially so in the Annapolis Valley. It is still actively spreading and increasing in abundance in many areas of the province. June-Sept.

Introduced from Eu.; Nfld. to Ont. south to Penn.

12. **BRASSICA** (Tourn.) L. MUSTARD

a. Upper stem-leaves clasping; plant glabrous. 1. *B. campestris*

a. Upper stem-leaves tapering to the base, little or not clasping.

b. Beak of the pod terete, slender, much narrower than the pod, without seeds in its base.

c. Pods 3-7 cm long, 2-3.5 mm thick, rather 4-sided, spreading, the beak 6-12 mm long; pedicels 7-10 mm long. 2. *B. juncea*

c. Pods 1-2 cm long, about 1 mm thick, appressed to the axis of the inflorescence, the beak 1.5-3 mm long; pedicels 3-6 mm long. 3. *B. nigra*

b. Beak of the pod flattish, about as wide as the pod, often with a seed in the base.

d. Fruiting pedicels 3-7 mm long; pods slender, about 2 mm thick, smooth. 4. *B. arvensis*

d. Fruiting pedicels about 10 mm long; pods 4 mm thick, stiff-hairy. 5. *B. hirta*

1. **campestris** L. FIELD MUSTARD.

B. Occasional as an escape or as a weed in fields. July-Sept.

Widely introduced from Eu. into N. A.

2. **B. juncea** (L.) Cosson. INDIAN MUSTARD.

Becoming a bad weed about towns, and gradually spreading out into the country. Its large size and seed production destine it to be one of the commonest weeds in the future. June-Aug.

Recently introduced from Asia into N. A.; widely scattered.

3. **B. nigra** (L.) Koch. BLACK MUSTARD. Fig. 63, b.

Common about towns, often a troublesome weed in fields and orchards, but as yet rather local. June-Oct.

Widely introduced from Eurasia.

4. **B. arvensis** (L.) Ktze. WILD MUSTARD. Fig. 63, c.

Occasional in orchards and fields; scattered in towns and about ports, much rarer than the other yellow-flowered species of the family. It seems to be rapidly spreading where it is established and to be crowding out the commoner and earlier established wild radish. Late June-

Aug. [*B. kaber* (DC) Wheeler, var. *pinnatifida* (Stokes) Wheeler, Rhodora **40**: 308. *Sinapsis arvensis*].

Widely introduced into N. A. from Eu.

Fig. 63.—**Subularia.** a, plant, x 1. **Brassica.** b, fruits of **B. nigra,** x 1. c, **B. arvensis,** x 1/3. **Raphanus.** d, part of plant, x 1/3. **Cakile.** e, branch of plant, x ½. **Nasturtium.** f, branch of plant, x ½.

5. **B. hirta** Moench. WHITE MUSTARD.

Sparingly introduced in seed, not persisting and no specimens have been seen. Earlier records of *B. alba* belong here. July-Aug.

Introduced from Eu. and appearing locally.

13. DIPLOTAXIS DC.

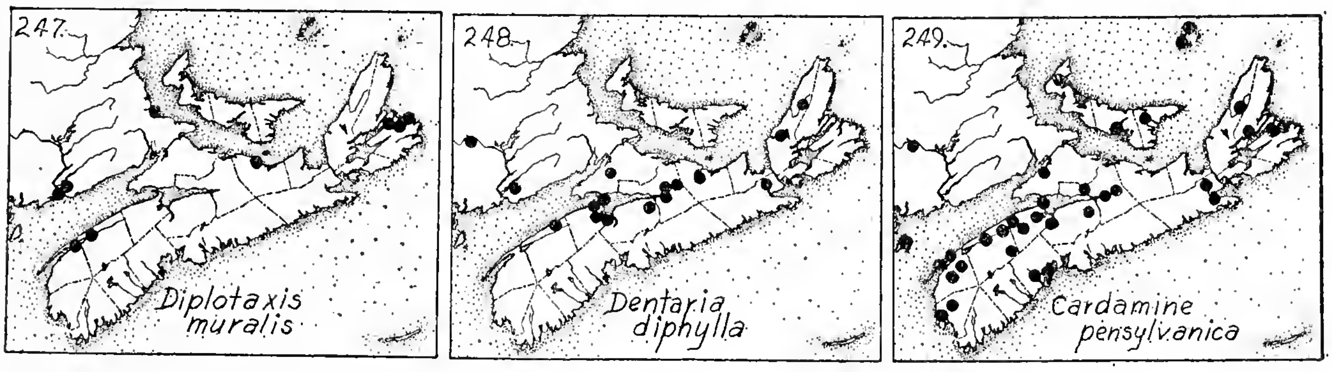
a. Annual; plant branched from near the base, the leaves chiefly basal; fruiting pedicels 5-15 mm long. 1. *D. muralis*

a. Perennial; stem bushy, leafy to the inflorescence; fruiting pedicels 20-30 mm long. 2. *D. tenuifolia*

1. **D. muralis** (L.) DC. SAND ROCKET. Map 247.

Waste places about the ports, rare and little reported; ballast heaps and ballast at Pictou and North Sydney (Macoun); Pictou Landing (Robinson, 1906). June-Aug.

Adventive from Eu.; N. S. to Penn.



2. **D. tenuifolia** (L.) DC. WALL ROCKET.

This species was collected long ago at Pictou and North Sydney in company with the preceeding species; found at Pictou by Fernald and St. John in 1914. June-Aug.

Adventive from Eu. into eastern N. A. & Calif.

14. CONRINGIA (Heist.) Link

1. **C. orientalis** (L.) Dumort. HARE'S-EAR MUSTARD.

Casual around railroads yards; Yarmouth through the Annapolis Valley to Cumberland Co.; probably also elsewhere.

Introduced from Eu.; N. S. to Man. & Ore. south to Dela.

15. SISYMBRIUM (Tourn.)L. HEDGE MUSTARD

a. Leaves coarsely divided with wide lobes; fruits 1-2 cm long, the pedicels 1-2 mm long, closely appressed to the stem (Fig. 64, a).
  b. Fruits and foliage puberulent. 1. *S. officinale*
  b. Fruits and foliage glabrous. *S. officinale* var. *leiocarpum*
a. Leaves finely divided into linear lobes; fruits ascending on widely-spreading pedicels (Fig. 64, b).
  c. Plant 1-2 m high; fruits 6-8 cm long, as wide as the thickened pedicels. 2. *S. altissimum*
  c. Plant 3-6 dm high; fruits about 2 cm long, much wider than the pedicels; leaves very finely divided. 3. *S. Sophia*

1. **S. officinale** (L.) Scop. HEDGE MUSTARD. Fig. 64, a.

Common throughout; waste places about towns, scattered along roadsides, houses, etc. Var. **leiocarpum**

DC. is found in similar habitats and is perhaps more common. July-Sept.

Locally introduced from Eu. into eastern Can. and the U. S.

Fig. 64.—**Sisymbrium.** a, **S. officinale,** x ½. b, **S. altissimum,** leaf and fruit, x ½. **Erysimum.** c, **E. cheiranthoides,** x ½. **Barbarea.** d, plant, x ¼. **Cardamine.** e, **C. pensylvanica,** x ½.

2. **S. altissimum** L. TUMBLE HEDGE MUSTARD. Fig. 64, b.

Common in the Annapolis Valley around towns and spreading rapidly into the country; common in towns throughout and locally elsewhere in light or sandy soils. It is becoming one of the common and important weeds. July-Aug.

Introduced from Eu.; N. S. to B. C. south to Va.

3. **S. Sophia** L. TANSY MUSTARD.

Rare; occasionally seen in waste places, especially in Pictou Co. (*Descurainia Sophia* Webb.).

Introduced from Eu.; N. S. to N. Y. and westward.

16. HESPERIS (Tourn.) L.

1. **H. matronalis** L. ROCKET, DAME'S VIOLET.

Occasional and local along roadsides and about buildings. It is an old garden plant formerly more commonly grown, and still persisting in many places. June-July.

Introduced from Eu.; N. S. to Iowa south to N. C.

17. ERYSIMUM (Tourn.) L.

a. Annual; leaves lanceolate; pods 1-2 cm long on slender pedicels 6-8 mm long. 1. *E. cheiranthoides*

a. Perennial; leaves linear-lanceolate; pods 2.5-6.2 cm long, on stout pedicels about 4-6 mm long. 2. *E. inconspicuum*

1. **E. cheiranthoides** L. WORMSEED MUSTARD. Fig. 64, c

A very common weed throughout, in cultivated places and waste places. June-Sept.

Nfld. to the Pacific south to Tenn.

2. **E. inconspicuum** (Wats.) MacM.

Rare; gravelly railroad yard, Springhill Junction (Fernald, 1921). Earlier records of *E. parviflorum* probably belong here.

Ontario westwards; sparingly introduced in the East.

18. NASTURTIUM R. Br.

1. **N. officinale** R. Br. WATER CRESS. Fig. 63, f.

Common in slow-moving water on the marshes at Truro and in Pictou Co.; very common, often choking the streams above and in the dykelands in Kings Co.; scattered in cold streams or in springs elsewhere in the northern counties. July-Sept.

Introduced from Eu. and widely spread; originally cultivated.

19. RORIPPA Scop.

Marie-Victorin. Le genre *Rorippa* dans le Quebec. Contrib. Inst. Bot. Univ. Montreal **17**: 1930. Butters & Abbe. Rhodora **42**: 25-32. 1940. Fernald, M. L. The eastern American varieties of *Rorippa islandica*. Rhodora **42**: 267-274. 1940.

a. Petiole of the medium leaves auriculate and clasping at the base; fruit 1-4 mm long; plants annual, without creeping rootstocks.
b. Stem and leaves glabrous or nearly so; pods 3-4 mm long. 1. *R. islandica* var. *microcarpa*
b. Stem and leaves more or less pubescent; pods mostly less than 3 mm long. *R. islandica* var. *hispida*
a. Petiole of the medium leaves not auriculate nor clasping at the base; pod linear, to 15 mm long; plants perennial with creeping rootstocks. 2. *R. sylvestris*

1. **R. islandica** (Oeder) Borbas, var. **microcarpa** (Regel) Fern. MARSH CRESS. Fig. 65, c.

Scattered in Kings and Colchester Cos., and occasionally elsewhere, especially about the towns of Windsor, Glace Bay and Halifax. It is a bad weed which may at times occupy part of an orchard or grain field. [*Radicula palustris* (L.) Moench.] July-Sept. Introduced from Eu . and throughout N. A.

Var. **hispida** (Desv.) Butters & Abbe is common in the center of the province in ditches, wet mud, along streams, fields and waste places; scattered elsewhere about towns.

Throughout temperate N. A. and in Eurasia.

2. **R. sylvestris** (L.) Bess. CREEPING YELLOW CRESS.

This introduced species promises to become a pernicious weed. It is known from Pugwash, Lunenburg and Chester. July-Aug.

Sparingly introduced across the continent; from Eu.

20. ARMORACIA Gaertn.

1. **A. rusticana** Gaertn. HORSE-RADISH.

Infrequent around old gardens in rich soil; propagating mainly from rootstocks; rarely flowering. June. [*R. Armoracia* (L) Robinson].

Widely introduced into N. A. from Eu.

21. ERUCASTRUM Presl.

1. **E. gallicum** (Willd.) Schulz. DOG MUSTARD.

Reported only from Coldbrook, Kings Co. (Groh, Scientific Agriculture, **13**: 722-727. 1933).

Common in western America, sparingly found eastward; introduced from Eu. and a bad weed.

22. BARBAREA R. Br.

a. Pedicels ascending to erect; raceme dense; siliques strongly ascending. 1. *B. vulgaris*

a. Pedicels spreading; raceme lax and open; siliques arcuate-ascending to widely spreading. var. *arcuata*

1. **B. vulgaris** R. Br. YELLOW ROCKET. Fig. 64, d.

Common in rich soils, on intervales and often in orchards in the Annapolis Valley; apparently being introduced at the present time in grain or grass seed and appearing as scattered individuals in seeded fields throughout the province. (*B. stricta* Andrz.). Late May-early June. Widely distributed in N. A.

Var. **arcuata** (J. & C. Presl) Fries, see Fernald, Rhodora **45**: 304. 1943, is scattered with the species and often more common. Introduced, like the species, from Eu. and widely distributed.

23. DENTARIA (Tourn.) L.

1. **D. diphylla** Michx. TOOTHWORT. Map 248. Fig. 65, b.

Rich moist soil along brooksides and in low, wet, or rocky woods; general but not abundant from Annapolis Co. eastward to C. B. May 15-June 15.

N. S. to Minn. south to S. C.

24. CARDAMINE (Tourn.) L.

a. Flowers large, 10-15 mm wide, tinged with purple; plant perennial 1. *C. pratensis*.

a. Flowers 5 mm or less wide; plants annual or biennial.

b. Leaves of 2-7 broad segments with the terminal one larger; plants of moist or wet soils. 2. *C. pensylvanica*

b. Leaves of 5-9 narrow segments, the terminal ones scarcely longer; plants of dry or rocky soil. 3. *C. parviflora*

1. **C. pratensis** L. CUCKOO FLOWER. Fig. 65, a.

Common along the Annapolis River system in meadows moist roadsides and low areas; beginning to get established along the Cornwallis River. Late May-early June.

Introduced about 20 years ago in grass seed from Eu.

2. **C. pensylvanica** Muhl. BITTER CRESS. Fig. 64, e. Map 249.

Common in swamps, along streams and mucky areas throughout; often with the base rooting in mud under the surface of the water. May-July.

Lab. to Minn. South to Fla.

3. **C. parviflora** L. var. **arenicola** (Britt.) Schultz., see Rhodora **29**: 192. 1927.

A collection from a dry rocky beach west of Halifax in the Herbarium at the Agricultural College is placed here. Aug.

N. S.; Que. to Ont. south to Ga.

25. ARABIS L.

1. **A. Drummondi** Gray. ROCK CRESS.

Dry ledges, gravelly beaches, rocky streams; rare. It was found once on the sandstone slope of Cape Blomidon; scattered in northern C. B. from Big Intervale at Margaree to Cape North. May-early June.

Nfld. south to N. Y. and west to the Rockies.

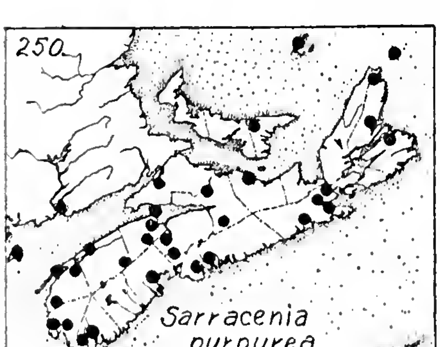
49. SARRACENIACEAE PITCHER-PLANT FAMILY

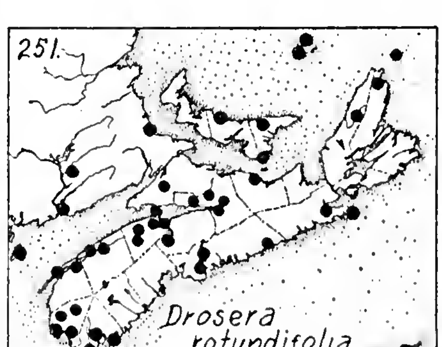
1. SARRACENIA (Tourn.) L.

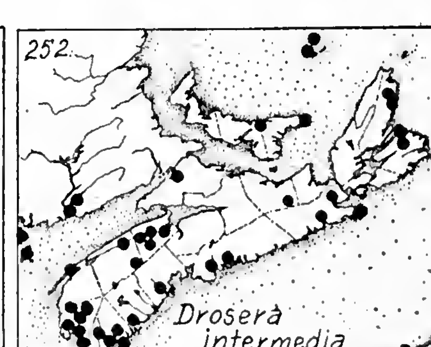
1. **S. purpurea** L. PITCHERPLANT. Fig. 65, f. Map 250.

Bogs and swamps, bog meadows and sphagnous lake margins throughout; commonest in the southwestern counties and in northern C. B.; rather rare in the north-central counties. June 15-July. Forma **heterophylla** (Eaton) Fern., Rhodora **24**: 174. 1922, has greenish-yellow flowers and no purple veins in the foliage. This occurs with the species at Young's Lake, North Mt., Belle Isle, Annapolis Co.

Lab. to Man. south to N. J. & Ill.







50. DROSERACEAE SUNDEW FAMILY

1. DROSERA L.

a. Leaf-blades round or broader than long; petioles hairy.
1. *D. rotundifolia*

a. Leaf-blades spatulate or much longer than wide; petioles smooth.
2. *D. intermedia*

1. **D. rotundifolia** L. ROUND-LEAVED SUNDEW. Fig. 65, e. Map 251.

Abundant throughout; bogs, barrens, lake margins, ditches, and swamps. Plants growing in bog water may be strung out on stems several feet long. July 15-Aug. 15.

Lab. to Alaska south to Calif. & Fla.

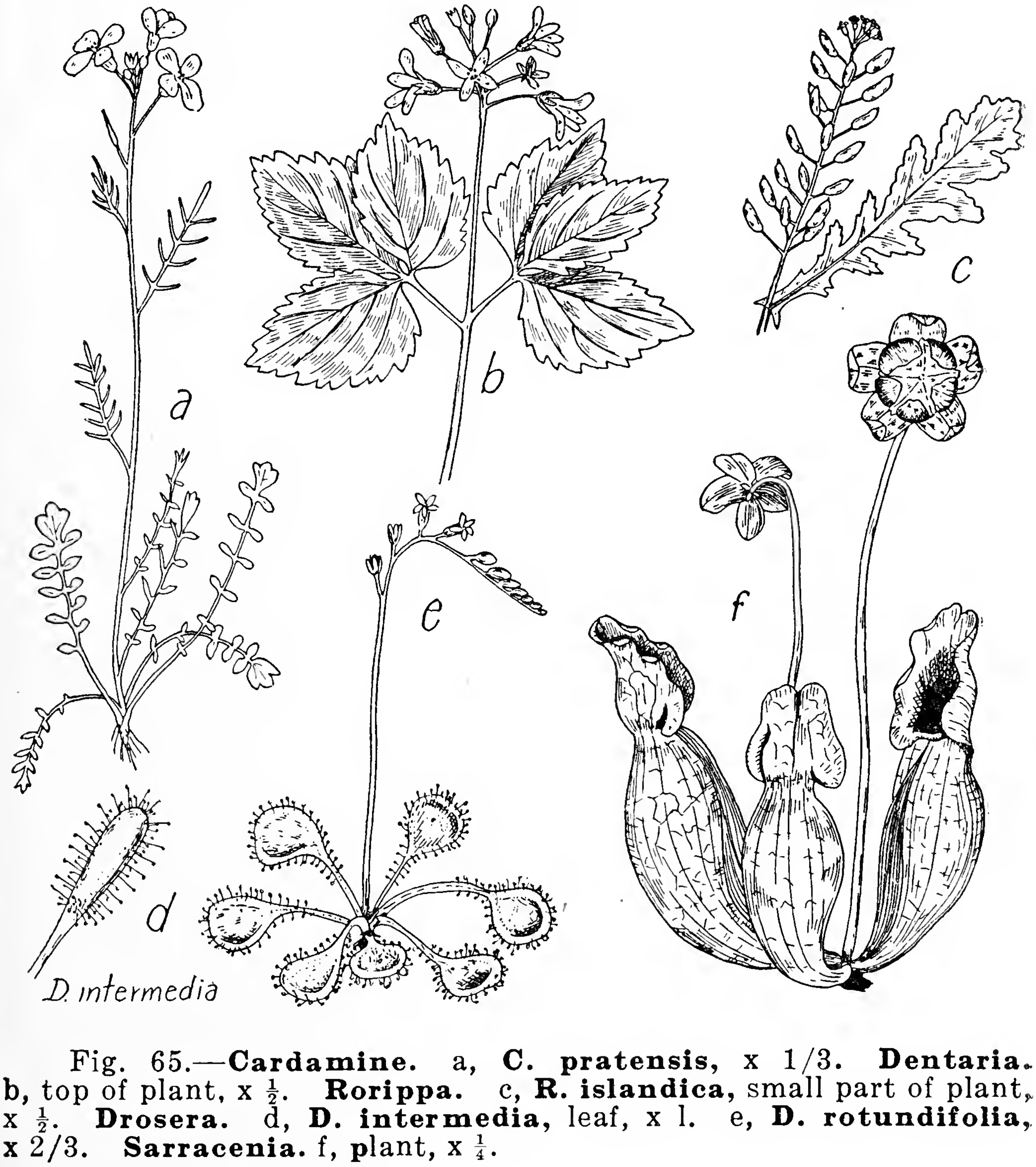


Fig. 65.—**Cardamine.** a, **C. pratensis**, x 1/3. **Dentaria.** b, top of plant, x ½. **Rorippa.** c, **R. islandica**, small part of plant, x ½. **Drosera.** d, **D. intermedia**, leaf, x 1. e, **D. rotundifolia**, x 2/3. **Sarracenia.** f, plant, x ¼.

2. **D. intermedia** Hayne NARROW LEAVED SUNDEW. Fig. 65,d. Map 252.

This species is nearly as common as the last; in boggy depressions, and wet sandy or peaty soil. It is very rare on Sable Is., while the first species is abundant. Fernald (1921) records a hybrid of these two species, and exactly intermediate between them, from a knoll in a wet peaty slough in the barrens at Lower Argyle, Yarmouth Co.

Nfld. to Minn. south to Fla. and La.

51. CRASSULACEAE ORPINE FAMILY

a. Sepals, petals and pistils 4-5 , the stamens 8-10; flowers on a stalked inflorescence, yellow or rose; plants mostly larger than 8 cm high. 1. *Sedum*

a. Sepals, petals and pistils 3-4, the stamens the same number; flowers solitary, nearly sessile, greenish white; plant 1-8 cm high. 2. *Tillaea*

1. SEDUM (Tourn.) L.

a. Leaves nearly terete, small and short; flowers yellow. 1. *S. acre*

a. Leaves broad and flat.

b. Flowers purplish or rose, with both stamens and pistils, the parts mostly in 5's.

c. Stem-leaves alternate or spirally arranged; erect, not forming large patches. 2. *S. triphyllum*

c. Stem-leaves opposite or whorled; plants decumbent with the flowering branches ascending, forming large patches. 3. *S. stoloniferum*

b. Flowers greenish-yellow or turning purplish, with stamens and pistils on separate flowers, the parts in 4's; rocky sea shores. 4. *S. roseum*

1. **S. acre** L. MOSSY STONECROP. Fig. 66, b.

Occasional on ledgy roadsides or moist roadside banks in the southwestern counties and scattered east to Kings and Halifax Cos. July.

Naturalized from Eu. and a local escape; N. S. to Ont. & Ind. south to Va.

2. **S. triphyllum** (Haw.) S. F. Gray. LIVE-FOR-EVER Fig. 66, c.

Scattered throughout; moist areas, often at the edges of thickets. Aug.-Sept. (*S. purpureum* Tausch).

Introduced from Eu.; widely distributed.

3. **S. stoloniferum** Gmel. Map 253.

Spreading to rocky or gravelly roadsides at many points from Kings to Yarmouth and Shelburne Cos.; local east to Pictou. It usually grows in large patches with the matted, prostrate stems on the surface of the ground. Rather rapidly spreading.

Introduced from Asia; local from N. S. to N. Eng.

4. **S. roseum** (L.) Scop. ROSE-ROOT. Fig. 66, d. Map 254.

Crevices of rocky cliffs in the colder parts of the shoreline; scattered along the Bay of Fundy; rare on the Atlantic Coast; common on cliffs in northern C. B. June.

Greenland to Lab. south to the coasts of Me.; locally inland.

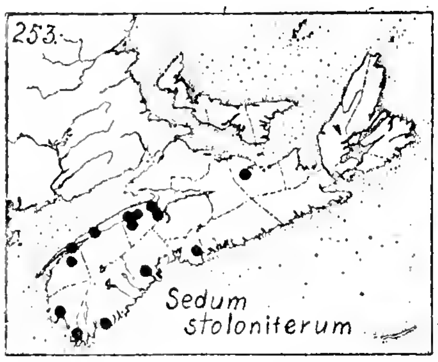
Fig. 66.—**Sedum.** a, flower, x 3. b, **S. acre**, x ½. c. **S. triphyllum**, top of plant, x ½. d, **S. roseum**, leaves, x ½. **Mitella.** e, plant, x ½. **Chrysosplenium.** f, branches, x ½. **Tiarella.** plant, x 1/3.

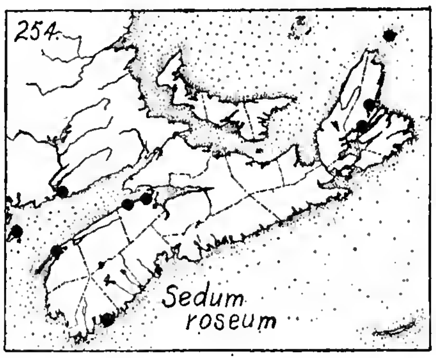
2. TILLAEA (Mich.) L.

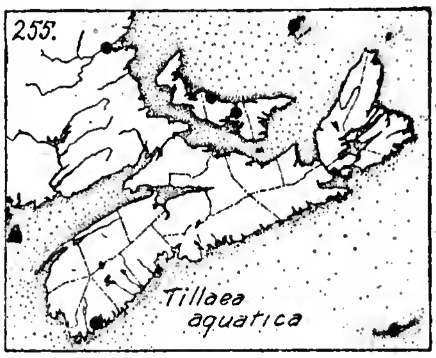
1. **T. aquatica** L. Map 255.

Restricted to brackish muddy shores or sand flats near the coast; sand flats back of the beach at Villagedale, Shelburne Co.; forming pure mats on the wet borders of the fresh-water ponds on Sable Is.

Locally near the coast from Que. to Md. and southward; Pacific Coast; Eu. & N. Afr.







52. SAXIFRAGACEAE SAXIFRAGE FAMILY

a. Low herbs; fruit a capsule or follicle.
  b. Leaves opposite, scattered, flowers less than 2 mm wide; plant forming mats in wet areas. 4. *Chrysosplenium*
  b. Leaves mostly basal; flowers much larger; plants erect.
    c. Basal leaves thick, in a dense rosette, with the teeth lime-encrusted. 1. *Saxifraga*
    c. Basal leaves thin, long-petioled, without encrusted teeth.
      d. Leaves toothed; flowers in a raceme.
        e. Leaf sharply cut into hard teeth; petals not lobed; capsule unequally valved. 2. *Tiarella*
        e. Leaf bluntly and shallowly toothed, the teeth without a hard sharp point; petals finely divided; capsule equally valved. 3. *Mitella*
      d. Leaves not toothed; flowers solitary. 5. *Parnassia*
a. Shrubs; leaves palmately-lobed; fruit a berry; ovary inferior. 6. *Ribes*

1. SAXIFRAGA (Tourn.) L.

1. **S. Aizoon** Jacq. LIVELONG SAXIFRAGE.

Occasional on rocks and coniferous hillsides in northern C. B.; above Cheticamp on a dry mossy hillside by the side of the Cabot Trail. June-July. Lawson also notes that on one of their collecting trips they found the basalt cliffs at Blomidon hanging with dozens of plants in full bloom.

Greenland & Lab. to Sask. locally south to N. S. & N. B.

2. TIARELLA L.

1. **T. cordifolia** L. FALSE MITERWORT. Fig. 66, g.

Typical of the richest hardwoods and intervales in Colchester and Pictou Cos. In many cases the anthers are bright orange instead of yellow. This is forma *allanthera* Vict. & Rousseau, Contrib. Bot. Inst. Univ. Montreal **36**: 20. 1940. May 15-June 15.

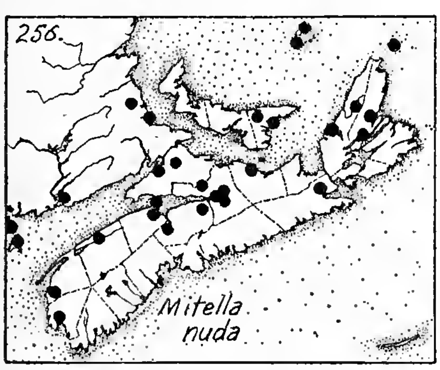
N. S. to Minn. south to Ga. & Ark.

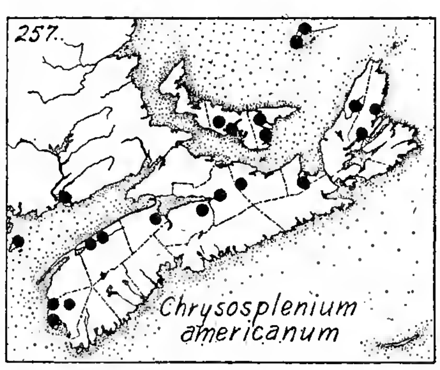
3. MITELLA (Tourn.) L.

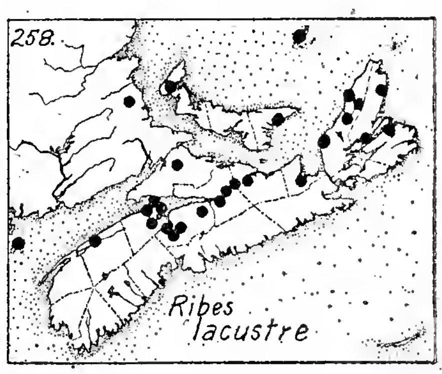
1. **M. nuda** L. MITERWORT. Fig. 66, e. Map 256.

Wooded swamps, rich woods, mossy thickets; common throughout. May 20-June.

Lab. to Alaska south to Conn., Mich. & Mont.







4. CHYRSOSPLENIUM (Tourn.)L.

1. **C. americanum** Schwein. GOLDEN SAXIFRAGE. Fig. 66, f. Map 257.

Common throughout; wet mucky woods, cold springs, over the bottom of small trickling shady rills. Early May, the flowers very small and inconspicuous.

N. S. to Minn. south to Ga.

5. PARNASSIA (Tourn.) L.

1. **P. parviflora** DC. GRASS-OF-PARNASSUS.

Mentioned in Gray's Manual as occurring south to

C. B. No recent collections have been made, and specimens have been seen only from the Magdalen Islands.

Nfld. to Alaska south to C. B., Wisc. & Utah.

6. **RIBES** L. CURRANTS AND GOOSEBERRIES

Besides the species listed below, *R. odoratum* Wend., the Golden Currant, is frequently cultivated as an ornamental; *R. nigrum* L. is the Black Currant of gardens; and various hybrids between *R. sativum* and *R. rubrum* comprise the majority of the cultivated currants.

Berger. A taxonomic review of currants and gooseberries. N. Y. State Agr. Exp. Sta. Tech. Bull. **109**: 1-118. 1924.

a. Flowers in clusters of 1-4; stems with spines at the base of the leaves, and often on the internodes; gooseberries. 1. *R. hirtellum*

a. Flowers in hanging racemes; stems spineless, except in *R. lacustre* which is densely bristly; currants.

b. Canes, at least young ones, densely bristly. 2. *R. lacustre*

b. Canes not bristly.

c. Ovary and fruit glandular-hispid; leaves 5-7-lobed; plant low, reclining, strong-smelling when bruised. 3. *R. glandulosum*

c. Ovary and fruit not hispid; leaves mostly 3-lobed; plant not strong-smelling.

d. Flowers purplish; plant weak and ascending, about 5 dm high; pedicels with pale red glands; leaves with the terminal lobe triangular, as wide or wider then long. 4. *R. triste*

d. Flowers greenish or greenish-yellow; plants erect and stouter; pedicels mostly smooth or with a few not-reddish glands; terminal lobe of the leaf often longer than wide, the base the same width or often narrower than the middle; cultivated. 5. *R. sativum*

1. **R. hirtellum** Michx. GOOSEBERRY. Fig. 67.

Common throughout; pastures, edges of woods, along stone walls, and even occasionally in swamps or bogs. Var. **calcicola** Fern., Rhodora **13**: 76. 1911, is a more pubescent extreme which is probably more common than the glabrous plant in the province. *R. oxyacanthoides* L. is now recognised to be a more western plant. June 1-June 15.

Nfld. to B. C. & Yukon south to Penn. & Dakota.

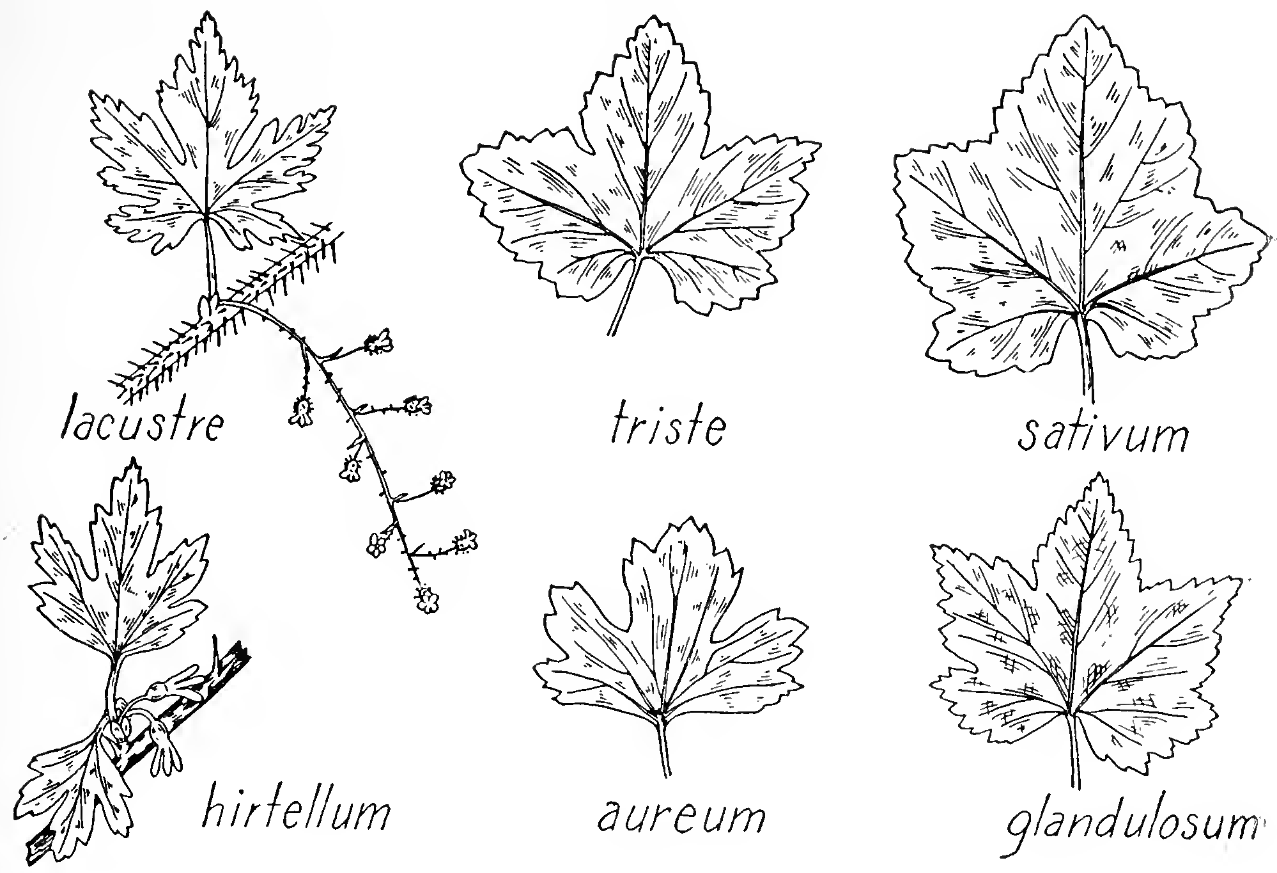


Fig. 67.—**Ribes,** all x 1/3.

2. **R. lacustre** (Pers.) Poir. BRISTLY CURRANT. Fig. 67. Map 258.

Rocky or swampy woods, along stream banks and ravines, scattered in the hardwood forest; Annapolis to northern C. B. It prefers rich moist soil and is frequently common in its habitat. June.

Nfld. to Alaska south to the mts. of Penn. & Colo.

3. **R. glandulosum** Grauer. SKUNK CURRANT. Fig. 67. Map 259.

Common to abundant throughout; open rocky woods, in low alluvial areas, or in sphagnous thickets and wet coniferous forests. May 15-June 15. (*R. prostratum* L'Her.)

Lab. to Athabasca south to N. Eng., N. C., Mich. & Minn.

4. **R. triste** Pall., var. **albinervium** (Michx.) Fern. WILD RED CURRANT. Fig. 67. Map 260.

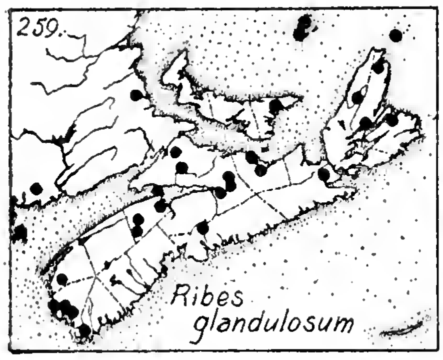
Rich low woods and alluvial ground; rare in the northern counties from Digby and Amherst to C. B.

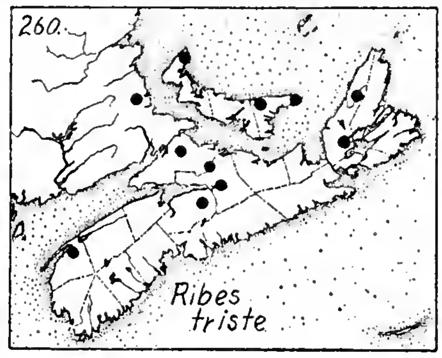
Nfld. to Alaska south to Me. & Wisc.

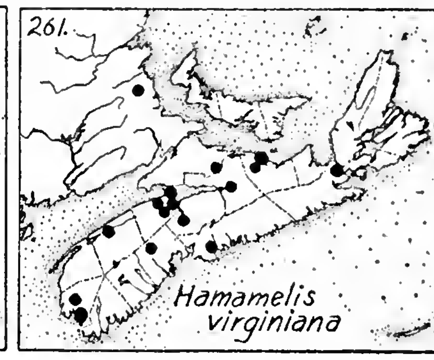
5. **R. sativum** Syme CULTIVATED RED CURRANT.

Occasionally escaped or persisting in semi-domestic areas. *R. vulgare* Lam., also including *R. rubrum* L., and hydrids between them, included by Berger under *R. houghtonianum* Jancz.

Native of Eu.; widely cultivated.







53. HAMAMELIDACEAE WITCH-HAZEL FAMILY

I. HAMAMELIS L.

1. **H. virginiana** L. WITCH-HAZEL. Fig. 68, a. Map 261.

Rocky woods, thickets and near cliffs; common from Kings to Colchester Co.; scattered to Yarmouth, apparently rare eastwards. Forma **parvifolia** (Nutt.) Fern., Rhodora **38**: 233, 1936, with comparatively small, thick, and densely pubescent leaves, was reported from thickets bordering Great Pubnico Lake and the east branch of the Tusket River, Quinan (Fernald, 1921).

N. S. to Minn. south to Fla. & Tex.

54. ROSACEAE ROSE FAMILY

a. Leaves simple, or merely lobed.
  b. Plants herbaceous, small.
    c. Leaves orbicular, shallowly toothed, all basal, to 4 cm wide; flowers solitary, white, long-peduncled. 12. *Dalibarda*
    c. Leaves more or less lobed, larger, scattered on the stem.
      d. Flowers solitary, white, over 1 mm wide; fruit an aggregation of druplets. 11. *Rubus Chamaemorus*
      d. Flowers numerous, yellowish, to 3 mm wide; fruits dry, enclosed in the calyx. 13. *Alchemilla*
  b. Plants woody.
    e. Leaves with 3-7 shallow lobes; flowers large, rose-colored. 11. *Rubus odoratus*
    e. Leaves not lobed.
      f. Plants with thorns; flowers in corymbs; fruit a berry-like pome, with 3-5 large nutlets. 6. *Crataegus*
      f. Plants without thorns; prickles sometimes present.
        g. Flowers 5 mm wide or less, very numerous in conical or narrow terminal inflorescences; pistils 5-6, partly superior; fruits follicles. 1. *Spiraea*

g. Flowers more than 6 mm wide, in umbels, corymbs, or racemes; fruit fleshy.

h. Petals several times longer than broad; ovary inferior, forming a berry-like pome with 10 seeds. 5. *Amelanchier*

h. Petals little if any longer than broad.

i. Ovary superior in a cup-like calyx, forming a drupe with one stone; cherry and plums. 17. *Prunus*

i. Ovary inferior, forming a pome with 2 or more seeds in each of the five cells.

j. Flowers 3-7 cm wide; fruit a fleshy pome; stout shrubs or trees; apples. 2. *Malus*

j. Flowers less than 1 cm wide; fruit small, berry-like, black to red; slender shrubs; leaves with a row of dark glands along the upper side of the mid-rib. 3. *Aronia*

a. Leaves compound.

k. Plants low and herbaceous.

l. Leaves palmately divided.

m. Fruit fleshy; flowers white; plants with long runners; strawberry (*Rubus pubescens* may key here also). 7. *Fragaria*

m. Fruit dry; flowers yellow, or if white with the plant without runners and the leaflets with 3 terminal teeth only. 8. *Potentilla*

l. Leaves pinnately lobed; fruits dry and hard.

n. Calyx of both flowers and fruit with hooked bristles; flowers yellow in a spike-like raceme. 14. *Agrimonia*

n. Calyx without hooked bristles; flowers not in a slender raceme.

o. Flowers in a dense spike-like head; pistils 1-3 enclosed by the calyx. 15. *Sanguisorba*

o. Flowers in an open inflorescence; pistils numerous, not tightly enclosed.

p. Styles long-plumose or hairy, hooked near the middle, the upper half deciduous in fruit; terminal leaflet several times larger than the others, irregularly lobed or compound. 10. *Geum*

p. Styles not plumose nor hairy, nor hooked near the middle; terminal leaflet little if any larger than the lower ones. 8. *Potentilla*

k. Plants woody, at least at the base.

q. Plants tree-like; flowers small, in a large cyme; fruit a small red berry-like pome. 4. *Sorbus*

q. Plants sub-herbaceous, or low and shrubby.

r. Plant sub-herbaceous, little branched; flowers very numerous and small; stem never prickly.

s. Flowers in a dense crowded spike; plant 1-6 dm high, erect; leaflets stalked, merely toothed. 15. *Sanguisorba*

s. Flowers in a diffuse inflorescence; plants taller; leaflets sessile, irregularly cut or dissected.
9. *Filipendula*

r. Plant low, shrubby and diffusely branched or else forming canes, often long-trailing and semi-herbaceous; flowers 1-5 cm wide, few to several in the inflorescence.

t. Leaflets pinnately compound; plant much branching.

u. Leaflets 3-7, not toothed; flowers yellow; fruit of numerous achenes.
8. *Potentilla fruticosa*

u. Leaflets usually more numerous; finely toothed; flowers rose; fruit orbicular to elliptical, fleshy, enclosing the pistils and achenes.
16. *Rosa*

t. Leaves palmately compound; plants of upright or trailing canes; fruit of numerous drupelets upon a common receptacle; raspberries and blackberries. 11. *Rubus*

1. SPIRAEA (Tourn.)L.

a. Leaves smooth beneath or nearly so; flowers white or pale pinkish.
1. *S. latifolia*

a. Leaves densely rusty-woolly beneath; flowers rose. 2. *S. tomentosa*

1. **S. latifolia** Borkh. MEADOW-SWEET, HARDHACK. Fig. 68, c. Map 262.

Very common throughout; in wet land, ditches, swamps, meadows and low pastures, especially in wet mucky soil where it replaces the heath plants. July.

Nfld. to Sask. south to Va.

2. **S. tomentosa** L. STEEPLEBUSH. Fig. 68, b. Map 263.

Common in poorly drained and acid soils, low pastures and barrens with clayey soils, becoming less common east to C. B. It is abundant along the North Shore in areas of heavy or poorly-drained soils. July-Aug.

N. S. to Minn. south to Ga.

2. MALUS Mill.

1. **M. pumila** L. APPLE.

A common escape in the Annapolis Valley, and scattered elsewhere in the southern or central parts of the province wherever apples are grown. (*Pyrus Malus* L.) Late May-early June.

Eu. and Asia; long cultivated.

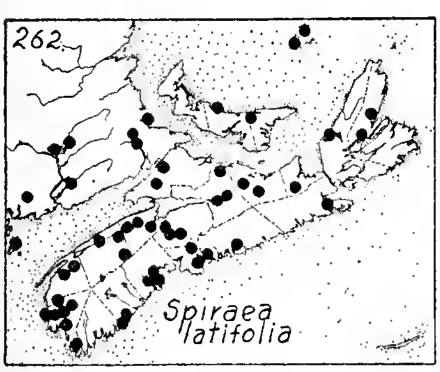
3. **ARONIA** Medic.

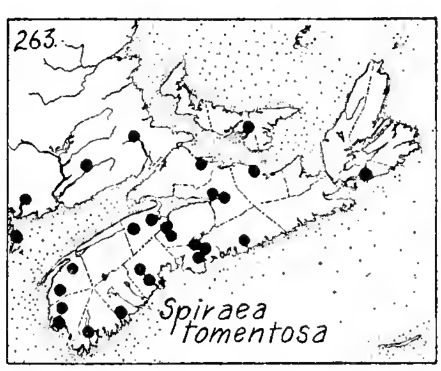
a. Twigs, lower surface of the leaves, pedicels and calyx more or less white-woolly at flowering time, some of the tomentum persisting to maturity.
 b. Fruit 6-7 mm thick, maturing late in the summer, becoming cherry red; mostly rare. 1. *A. arbutifolia*
 b. Fruit 8-10 mm thick, maturing in mid-summer, becoming purplish black; common throughout. 2. *A. prunifolia*
a. Twigs, leaves and calyx glabrous or nearly so at flowering time, entirely without wool at maturity. 3. *A. melanocarpa*

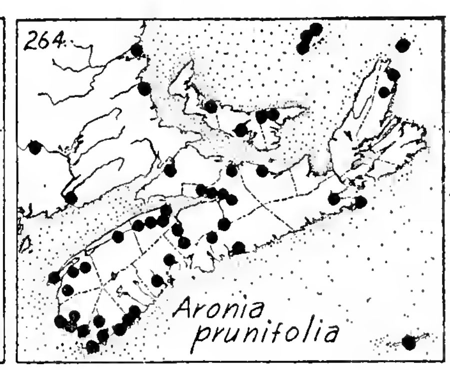
1. **A. arbutifolia** (L.) Elliott. RED CHOKEBERRY.

Scattered in Yarmouth Co.; found in thickets at Harper L., in Shelburne Co.; at Lily L. in Kings Co.; and about Halifax; sterile meadows, thickets and near lake shores. June. [*Pyrus arbutifolia* (L.) L. f.].

N. S.; Mass. to Minn. southward.







2. **A. prunifolia** (Marsh.) Rehd., Journ. Arnold Arb. **19**: 74. 1938. CHOKEBERRY. Fig. 68, d. Map 264.

Common throughout; meadows, swamps, barrens and even in bogs. It flowers in mid-May and produces dark fruit by the end of July. [*Pyrus arbutifolia* var. *atropurpurea* (Britt.) Robinson].

Nfld. to Mich. south to Fla.

3. **A. melanocarpa** (Michx.) Elliott. BLACK CHOKEBERRY.

Rarer than the preceeding in the province, but scattered throughout and more common in the eastern regions. Mid-June.

Nfld. to Mich. south to Fla.

Fig. 68.—**Hamamelis.** a, **H. virginiana,** fruiting twig and flowers, x ½. **Spiraea.** b, **S. tomentosa,** x 1/3. c, **S. latifolia,** x 1/3. **Aronia.** d, **A. prunifolia,** flowering twig, leaf and fruit, x 1/3. **Rosa.** e, **R. nitida.** f, **R. virginiana.**

4. **SORBUS** (Tourn.)L.

Jones, George Neville. A synopsis of the North American species of *Sorbus.* Journ. Arnold Arb. **20**: 1-43. 1939.

a. Winter buds densely and long white-hairy; branches of the inflorescence, pedicels and calices whitish-hairy at flowering time; leaflets small, blunt, 3-5 cm long. 1. *S. Aucuparia*

a. Winter buds shiny and sparsely hairy; inflorescence not so whitish-hairy; leaflets 4-9 cm long, more pointed to acute.

b. Flowers 5-6 mm wide; fruit 4-6 mm thick; leaflets 3.5-5 times as long as wide, long pointed, each with 50-75 teeth running to or nearly to the base. 2. *S. americana*

b. Flowers about 10 mm wide; fruit 8-10 mm thick; leaflets short-pointed, 2-3 times as long as wide, each with 30-45 teeth which are found chiefly above the middle. 3. *S. decora*

1. **S. Aucuparia** L. ROWAN TREE. Fig. 69.

Common as an escape along roadsides, especially in the center of the province from Halifax to Amherst and Antigonish; scattered and often planted elsewhere. June.

Introduced from Eu.; widely naturalized.

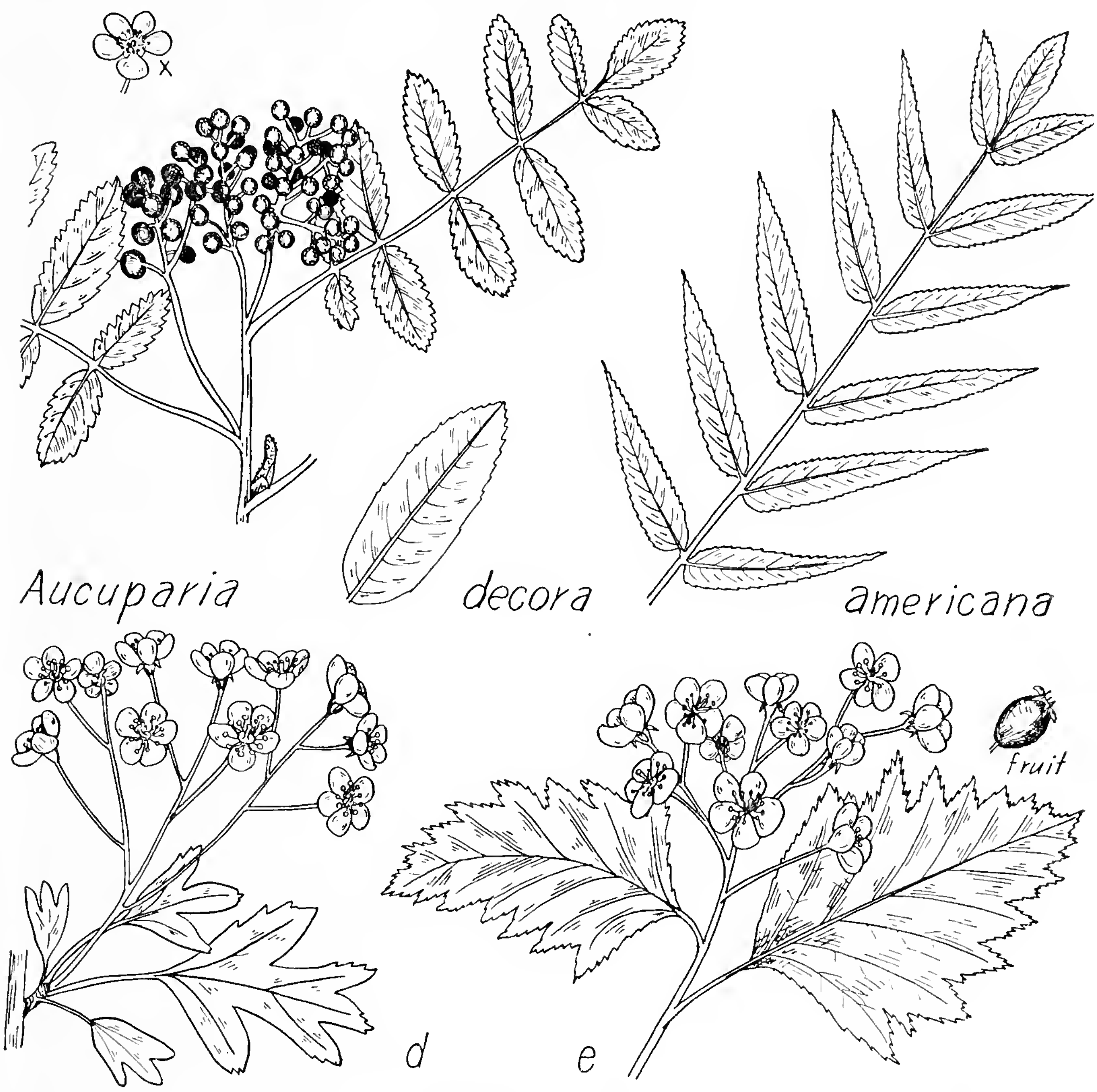


Fig. 69.—**Sorbus.** a, **S. Aucuparia,** fruiting branch, x $\frac{1}{2}$; flower, x 1. b, **S. decora,** leaflet, x $\frac{1}{2}$. c, **S. americana,** leaf, x $\frac{1}{2}$. **Crataegus.** d, **C. monogyna,** x $\frac{1}{2}$. e, **C. macrosperma** var. **acutiloba.**

2. **S. americana** Marsh. MOUNTAIN ASH. Fig. 69. Map 265.

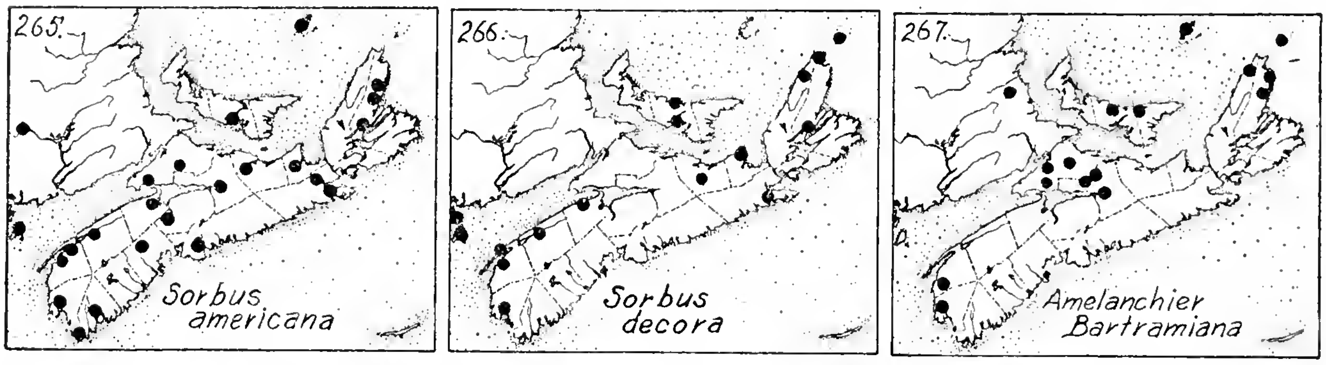
This is the commonest species in N. S. and is frequent from Yarmouth to C. B. in open woods, hillsides and along roadsides. It flowers in June; and the small fruits ripen in late August or September and persist into the winter.

Nfld. to northern Minn. south to Tenn. & N. C.

3. **S. decora** (Sarg.) Schneid., Bull. Herb. Boissier **6**: 313. 1906. Map 266.

Scattered throughout, less common than the last in most areas of the province, but becoming common in the poorly-drained soils and swamps on the tablelands of northern C. B. The clusters of bright large fruits are conspicuous in early autumn. [*Pyrus sitchensis* (Roem.) Piper of Gray's Man. *Pyrus dumosa* (Greene) Fern. and *Pyrus sambucifolia* Cham. & Sch. of other authors]. June.

Hybrids are occasionally found between this species and *Aronia prunifolia:* St. Paul Is., frequent (Perry, 1931). This is known as *Sorbaronia Arsenii* (Britt.) Jones.



5. **AMELANCHIER** Medic. SHADBUSH, WILD PEAR

Wiegand, K.M. *Amelanchier* in eastern North America. Rhodora **14**: 117-161. 1912.

a. Flowers several to many, in racemes; leaves folded when young, mostly round to cordate at the base; fruit mostly globular; ovary summit rounded.

b. Tall shrubs or trees, not stoloniferous; leaves acute to acuminate, oblong to oval, with 11-17 pairs of primary veins, and 30-70 teeth on each side.

c. Young leaves more or less whitish-tomentose, greenish, still folded at the beginning of flowering; lower pedicels about 15 mm long; ovary-summit usually woolly, but sometimes nearly or quite glabrous. 1. *A. Wiegandii*

c. Young leaves glabrous or merely with a few silky hairs beneath, mostly bronze-purple, soon opening flat; lower pedicels 15-30 mm long; ovary-summit glabrous. 2. *A. laevis*

b. Low shrubs, up to 1.5 dm high, stoloniferous and forming colonies or patches; leaves oval to obovate, round at the tips or barely acute.

d. Ovary-summit tomentose; fruit dark-purple and succulent.

e. Leaves glabrous and green from the first; calyx-tube 5 mm wide; low shrubs to 6 dm high, loosely stoloniferous. 3. *A. Fernaldii*

e. Leaves densely tomentose beneath when young, dull when older; calyx-tube 3-4 mm wide; erect much branched shrubs to 1.5 m high; of sandy soils. 4. *A. stolonifera*

d. Ovary-summit glabrous or practically so; older leaves thick, and shining above; fruit smaller and not so succulent. *A. stolonifera* var. *lucida*

a. Flowers 1-3, in the axils of the leaves; leaves flat when young, nearly glabrous, mostly tapering to the base, pale beneath; fruit ellipsoid-ovoid; ovary-summit woolly, pointed. 5. *A. Bartramiana*

1. **A. Wiegandii** Niels., Amer. Midl. Nat. **22**: 180. 1939. Fig. 70, b. SHADBUSH, WILD PEAR, BILBERRY.

Common throughout, extremely variable as to pubescence, length of petals, and other characteristics. Reports of *A. canadensis* are placed here, as most of the Nova Scotian plants have woolly summits to the ovary and do not fit the description of *A. canadensis*. The few collections with glabrous ovary seem to be mere variations. *A. intermedia* Spach. is a puzzling plant reported from southwestern N. S. and from P. E. I. (Rhodora **23**: 103). A number of collections sent to Wiegand from Kings Co. to northern N.S. were all identified as *A. Wiegandii*. Whether there is one variable species in the province or several closely related species is yet to be settled. Hybrids often occur with *A. Bartramiana* and show varying intermediate characters. Not X *A. neglecta*.

N. S. to Minn. south to N. Y.

2. **A. laevis** Wieg., Rhodora **14**: 154-158. 1912. SHADBUSH. Fig. 70, a.

Common throughout; conspicuous in flower by its bronze foliage and its loose racemes of large flowers. This species also hybridizes with *A. Bartramiana* and also apparently with *A. Wiegandii*. Open clearings and pastures often contain a multitude of forms that cannot be satisfactorily named. (*A. canadensis* in Gray's Man.). Forma **nitida** Wieg., Rhodora **14**: 155. 1912, has the leaves thicker, deep green and glossy above. Common in many places. May 10-early June.

Nfld. to Mich. & Kans. south to Ga. & Ala.

3. **A. Fernaldii** Wieg., Rhodora **22**: 149. 1920.

Rare in eastern N. S. and in C. B.; little known in the province and needing further collecting. It was reported from the margin of Ethyl L., St. Paul Is. (Perry, 1931).

Nfld., N. S., the Magdalens & Gaspe.

4. **A. stolonifera** Wieg., Rhodora **14**: 144-147. 1912.

Rather local; scattered in Yarmouth Co. and becoming common in thickets and boggy depressions of the sand plains of the Annapolis Valley. This plant flowers a week or ten days later than the previous species and the fruits are large, purple and of good quality. (*A. spicata* of some authors). Nfld. to Me. and Va., sparingly inland to Mich.

Var. **lucida** Fern., Rhodora **23**: 267. 1921, is found on sandy areas, rocky barrens, roadsides, and edges of thickets; common from Yarmouth to Halifax and Cumberland Cos.; the eastern distribution is unknown. *A. laevis* in this part of its range often becomes lower and more stoloniferous, and may be confused with this variety. The leaves of *A. stolonifera* should have more oval leaves, only 7-11 pairs of primary veins and with 20-28 teeth along one side of the leaves. Described from N. S.

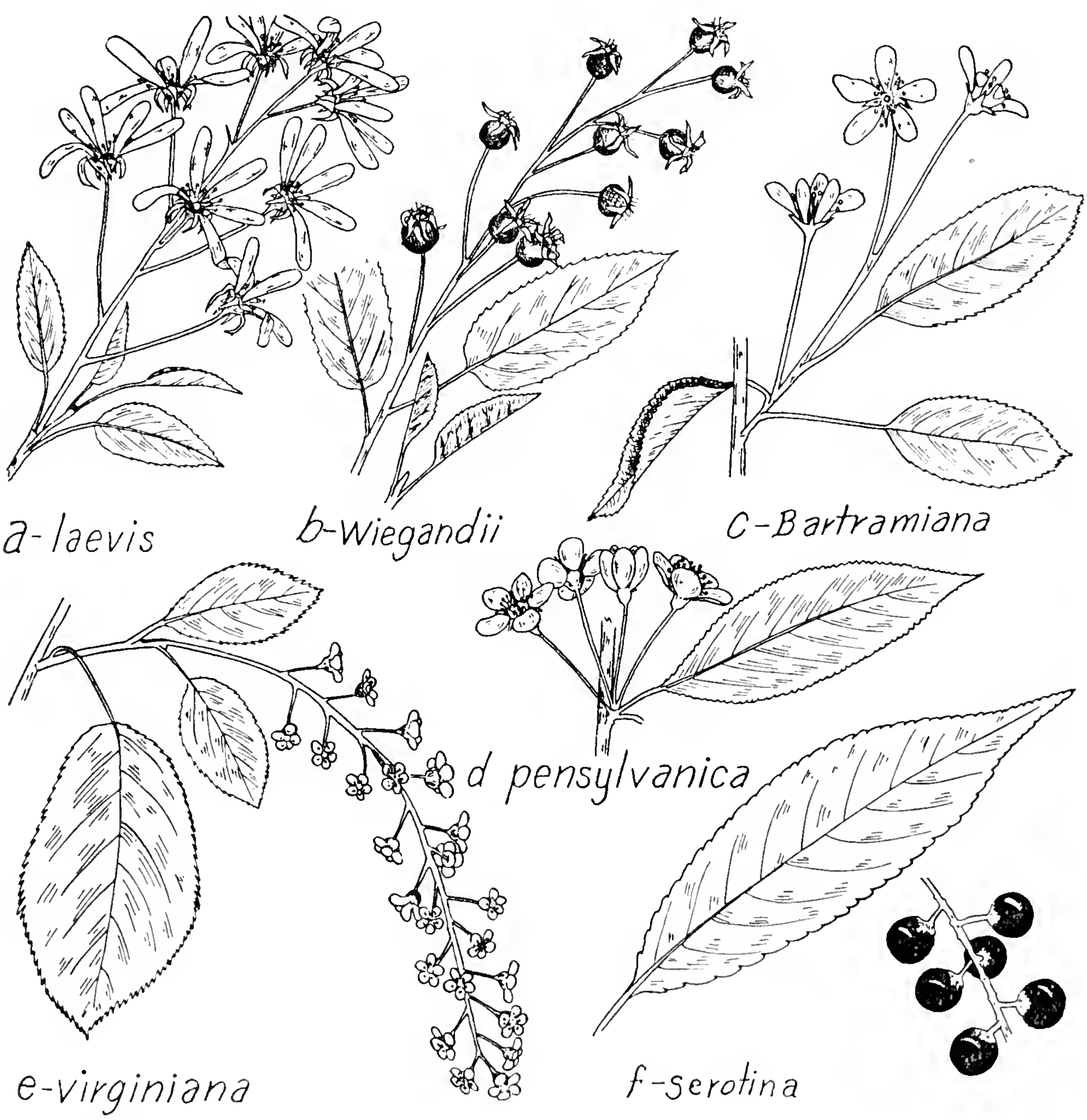


Fig. 70.—**Amelanchier.** a, b, c, all x ½. **Prunus.** d, e, f, x ½.

5. **A. Bartramiana** (Tausch) Roem., see Wiegand, Rhodora **14**: 158-161. 1912. Fig. 70, c. Map 267.

Scattered in the more acid regions or colder areas of the province; scattered in the southwestern counties; common from Truro north through Cumberland Co. and to northern C. B.; acid, poorly-drained soils, bogs and wet thickets. Intermediates with the flowers in short racemes, but with the leaves resembling this species, are often found around the edges of bogs, especially in northern C. B. (*A. oligosperma* (Michx.) Roem.).

Lab. to Mich. and Minn. south to the mts. of Mass., N. Y. & Penn.

6. CRATAEGUS L. HAWTHORN*

a. Leaves deeply cut, the lowest incisions often extending more than half way to the midrib; veins running both to the sinuses and to the points of the lobes; nutlet usually single (Fig. 69, d).
1. *C. monogyna*

a. Leaves serrate, dentate or more or less lobed, but not deeply cut; veins running only to the points of the lobes; nutlets 2-5 (Fig. 69, e).

b. Sepals entire or sometimes with a few minute teeth or glands; nutlets not conspicuously pitted on the inner surface; fruit glabrous; nutlets 2-4, rarely 5.

c. Flowers 1.3-2.2 cm wide; fruit usually over 1 cm long, or if shorter, with a sessile calyx.

d. Leaves attenuate to the base, the terminal often 8-10 cm long; flowers 1.8-2.2 cm wide, in loose villous corymbs; fruit oval or ovoid, 1.5-1.6 cm long. 2. *C. Jonesae*

d. Leaves cuneate or rounded at base, the terminal seldom over 7 cm long.

e. Leaves mostly elliptic or oblong-ovate, cuneate, or on the terminal shoots rounded to subcordate at base.

f. Leaves sharply and conspicuously lobed, broadly ovate to suborbicular on terminal shoots; mature fruit usually 1-1.3 cm wide.

g. Petioles and inflorescence more or less villous.
3. *C. chrysocarpa*

g. Petioles and inflorescence glabrous.
C. chrysocarpa var. *phoenicea*

f. Leaves with small spinulose lobes, ovate to broadly oblong-ovate on terminal shoots.

h. Stamens 5-10, usually less than 10; leaves mostly entire below the middle. 4. *C. Brainerdi* var. *Egglestoni*

h. Stamens 8-15, usually 10 or more; leaves lobed to below the middle. *C. Brainerdi* var. *scabrida*

*Text written by Mr. Ernest J. Palmer of the Arnold Arboretum. General range according to Rehder's Manual.

e. Leaves mostly ovate, the terminal ones broadly rounded, truncate or rarely subcordate at the base.

i. Lobes of the leaves broad and shallow with spreading tips. 5. *C. macrosperma*

i. Lobes of the leaves deeper and sharper, often with recurved tips. *C. macrosperma* var. *acutiloba*

c. Flowers 0.8-1 cm wide; fruit oval or obovoid, 1 cm or less long, with slightly elevated calyx. 6. *C. Robinsoni*

b. Sepals deeply glandular-serrate.

j. Flowering corymbs densely tomentose; nutlets usually 5, not pitted on the inner face; fruit minutely pubescent near the base. 7. *C. submollis*

j. Flowering corymbs but slightly hairy; nutlets conspicuously pitted on the inner face; fruit glabrous. 8. *C. succulenta*

1. **C. monogyna** Jacq. ENGLISH OR EUROPEAN HAWTHORN. Fig. 69, d.

Commonly planted and occasionally escaping to thickets and roadsides. Collections are known from Pictou, Colchester, Halifax and Hants Cos.; and it is common throughout the Annapolis Valley and to Yarmouth.

Europe; widely introduced.

2. **C. Jonesae** Sarg.

A shrub or small tree growing along banks of streams or of inlets, often near salt water. This is a handsome and distinct species on account of its large flowers and large brightly colored fruit. Found in Pictou, Colchester, Kings, Queens, and in Yarmouth and Digby Cos.

N. S. and Me.

3. **C. chrysocarpa** Ashe.

A thorny much-branched shrub in thickets and open ground. The fruit with relatively large seeds and thin flesh ripens late in the season, becoming dark red. The typical variety has been found only in Pictou Co. (*C. rotundifolia* Moench, in part, not Lam. *C. rotundifolia* var. *pubera* Sarg.).

Var. **phoenicea** Palmer differs from the last variety in its entirely glabrous inflorescence and petioles. It grows in similar situations and is more abundant, having been found in Pictou, Colchester, Hants, Lunenburg, Annapolis, Queens, and Yarmouth counties. (*C. rotundifolia* Moench, in part, not Lam.).

N.S. to Sask. south to Penn. and Mich.

4. C. **Brainerdi** Sarg.

The typical variety has not been found in N. S., but is represented by the following:

Var. **Egglestoni** (Sarg.) Robinson is usually shrubby with a narrow top of erect or ascending thorny branches. It grows in thickets and borders of woods, in Pictou and Colchester Counties. N. S. to N. Y.

Var. **scabrida** (Sarg.) Eggl. is found in similar situations to the last, from which it can be distinguished only by slight differences in the leaves, flowers and fruit. It is more abundant and has been found in Pictou, Colchester Hants, Halifax, Lunenburg and Annapolis Counties. N.S. to Penn.

5. C. **macrosperma** Ashe

A shrub or small tree with spreading or ascending branches and slightly scaly bark. The trunk and larger branches are often angular or irregular in cross-section. The small fruit becomes bright red and soft when fully ripe. Found in thickets, borders of woods, rocky pastures and along roadsides in Halifax, Lunenburg, Queens, Yarmouth and Hants counties. N. S. to Minn. south to N.C. & Ill.

Var. **acutiloba** (Sarg.) Eggl. (fig. 69, e) is the commonest and mostly widely distributed thorn in N.S., found in similar situations to the last from Richmond to Yarmouth and Shelburne counties. It is well marked by its large, thin, sharply lobed leaves with reflexed tips. Very common through the Annapolis Valley. N. S. and N. Eng.

6. C. **Robinsoni** Sarg.

This rather distinct shrub with very small flowers and fruit is known from a few plants found near Loch Broom and Rustico, Pictou Co. Its rarity and the characters of the leaves, flowers and fruit suggest that it may be a hybrid, possibly between *C. chrysocarpa* and a variety of *C. Brainerdi*.

7. C. **submollis** Sarg.

This species is well distinguished by its densely tomentose inflorescence and young leaves, and by the highly-flavored, early-ripening, edible fruit. It is known only from Halifax Co.

N. S. to Que. south to Mass. & N. Y.

8. **C. succulenta** Link, var. **macracantha** (Lodd.) Eggl.

A thorny shrub found infrequently in thickets and along small streams in Pictou, Hants, Halifax and Kings counties. The small fruit, usually with two or three nutlets, remains hard and green until late in the season, but becomes bright red and succulent when fully ripe. The leaves are rather thick and glossy and have the veins deeply impressed on the upper side.

N. S. to N. Y. & Penn.

7. **FRAGARIA** (Tourn.) L. STRAWBERRY

a. Fruiting stems shorter than the leaves; seeds embedded in pits on the fruit; sepals appressed; leaves firm, often rugose.

b. Hairs of the peduncles and petioles spreading; those of the pedicels appressed. 1. *F. virginiana*

b. Hairs of the peduncles and petioles ascending or appressed. *F. virginiana* var. *terrae-novae*

a. Fruiting stems longer than the leaves; seeds borne on the unpitted surface of the fruit; sepals reflexed; leaves thin, often rather folded or plicate. 2. *F. vesca*

1. **F. virginiana** Duchesne. STRAWBERRY.

Common throughout; open woodlands, pastures, barrens, fields, etc. May-June. Nfld. to Dakota south to Fla. & Okla.

Var. **terrae-novae** (Rydb.) Fern., Rhodora **13**: 106. 1911, is a common form in exposed places, about the headlands of northern C. B. and scattered east and south. It seems distinct northwards, but in the central part of N. S. it grades into the species and both types can often be found in the same patch or field.

Lab. & Gaspe to the coast of Me. and the Mts. of Vt.

2. **F. vesca** L., var. **americana** Porter. Fig. 71. Map 268.

Scattered from Kings Co. to northern C.B.; occasionally found along the sides of ravines in the Annapolis Valley; frequent in open woods, ravines or banks in the gypsum areas, often growing in dense patches with the slender plants freely producing runners.

Nfld. to Ind. south to Penn. & Ky.

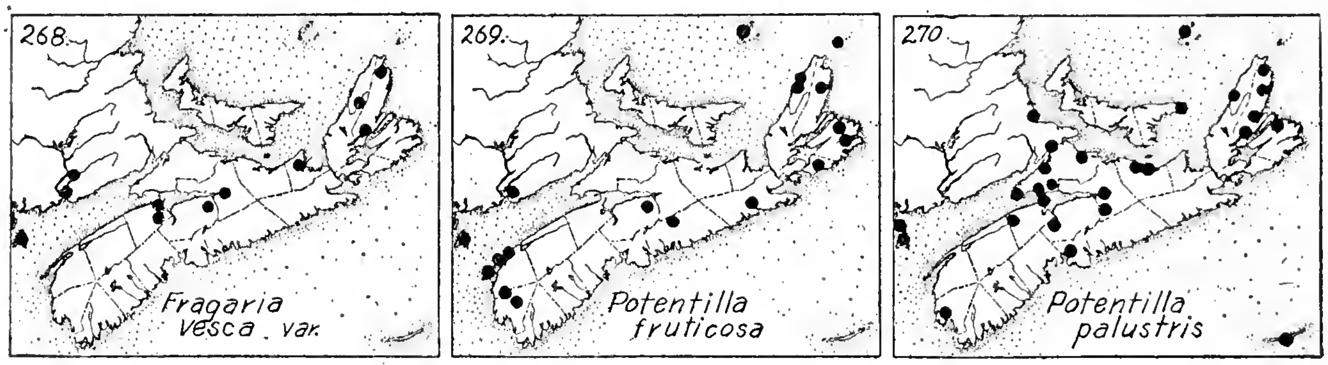
8. **POTENTILLA** L. CINQUEFOIL

a. Stem shrubby and diffusely branched; flowers yellow; leaves pinnately-compound with 5-7 leaflets. 1. *P. fruticosa*

a. Stem herbaceous, not shrubby.
b. Leaves pinnately compound, the leaflets not attached at any one point.
c. Leaflets 3-7, on a very short axis; flowers several in the inflorescence.
d. Leaflets deeply lobed; sepals green; petals yellow; rare on the northern coast. 2. *P. pectinata*
d. Leaflets finely toothed; sepals purplish; petals purple; marshes and ponds. 3. *P. palustris*
c. Leaflets 7-25, on a long axis, very small towards the base of the leaf; flowers usually solitary.
e. Achenes rounded on the back and not grooved; plants little-trailing, the leaves erect. 4. *P. pacifica*
e. Achenes grooved on the back; plants long-trailing, the leaves spreading. 5. *P. Anserina*
b. Leaves palmately compound, all leaflets attached at one place.
f. Leaflets 5-9, oblanceolate, prominently toothed; flowers large, sulphur-yellow. 6. *P. recta*
f. Leaflets 3 or 5.
g. Leaflets 3.
h. Flower parts in 5's; flowers numerous in a terminal inflorescence.
i. Flowers white; leaflets each with 3 teeth at the tip, and wedge-shaped. 7. *P. tridentata*
i. Flowers yellow; leaflets toothed around the entire margin, oval. 8. *P. norvegica*
h. Flower parts in 4's; flowers mostly solitary; leaflets coarsely toothed, chiefly so above the middle. 9. *P. procumbens*
g. Leaflets in 5's, finely toothed to near the base.
j. Leaflets silvery-silky beneath; plant erect or becoming prostrate, not trailing; flowers numerous in a terminal inflorescence. 10. *P. argentea*
j. Leaflets not silvery-silky beneath; plant trailing; flowers solitary in the axils of the leaves.
k. Flowers small, 6-16 mm wide; stems erect at first; later procumbent, much branched; leaflets with the stalks separate to the petiole.
l. Plant small, the stems thread-like, 0.3-1 mm thick at flowering time; first flower borne in the axil of the leaf from the first well-developed node when the stem is 1-1.5 dm high. 11. *P. canadensis*
l. Plant larger, the trailing stems 1-3 mm thick at the base; first flower borne from the second well-developed node when the plant is 1-4 dm high.
m. Stem, especially when young, long-hairy with spreading or somewhat appressed hairs. 12. *P. simplex*
m. Stem smooth, or with short stiff appressed hairs. *P. simplex* var. *calvescens*

k. Flowers 20-30 mm wide, deep yellow; stems long and trailing, often rooting at the nodes and unbranched; leaves with the pairs of lateral leaflets having their stalks united for a short distance at the base. 13. *P. reptans*

1. **P. fruticosa** L. SHRUBBY CINQUEFOIL. Fig. 71. Map 269.



Common in southern Digby and Yarmouth Counties in spruce bogs and wet savannahs; usually around gypsum or limestone in the center of the province; scattered eastward and common in northern C. B., where again it is found on alkaline soils or in mountain swamps. Aug.-Sept.

Greenland to Alaska south to Penn.; Eurasia.

2. **P. pectinata** Raf. Fig. 71.

Known only from a small, sandy beach north of Cheticamp where the Cabot Trail begins to skirt the side of the mountains. This northern plant is found on the coast of Nfld., the Gaspe, and scattered from Lab. to Hudson Bay and south to N. H. & Me.

3. **P. palustris** (L.) Scop. MARSH CINQUEFOIL. Fig. 71. Map 270. See Fernald and Long. The American variations of *Potentilla palustris*. Rhodora **16**: 5-11. 1914.

Rare in the southwestern counties; scattered in the center of the province; becoming common northward to Cumberland Co. and east to C. B. It is found on muddy shores, in swamps above the river estuaries, or in undrained ponds. The plants are very variable. When growing on exsiccated places or towards the end of summer the leaflets may be densely silky-hairy. This phase is designated forma **subsericea** (Becker) Wolf. Plants with the petioles, peduncles and bractlets densely hairy and glandular, and the leaflets hairy, is var. **villosa** (Pers.) Lehm.

Lab. to Alaska south to N. J., Penn. & Calif,; Eurasia.

4. **P. pacifica** Howell

Common around the coast, especially on the marshes about the Bay of Fundy; on sand marshes and along shore-lines, generally growing in muddy or poorly-drained areas, often in large colonies. June-Aug. (*P. Egedii* var. *groenlandica* (Tratt.) Polunin, in Rhodora **41**: 40. 1939.

Greenland to Conn., Alaska.

5. **P. Anserina** L. SILVER-WEED. Fig. 71.

Growing around the sea-coast, growing in drier places than the preceeding, often at considerable distances from the salt marshes; more characteristic of sandy beaches or low areas of dunes where drainage is good. Forma **sericea** (Hayne) Fern., Rhodora **35**: 273. 1933, has the leaflets silvery-pubescent. June-Aug.

Arctic America south to N. J.; inland about the Great Lakes and westward; Eurasia.

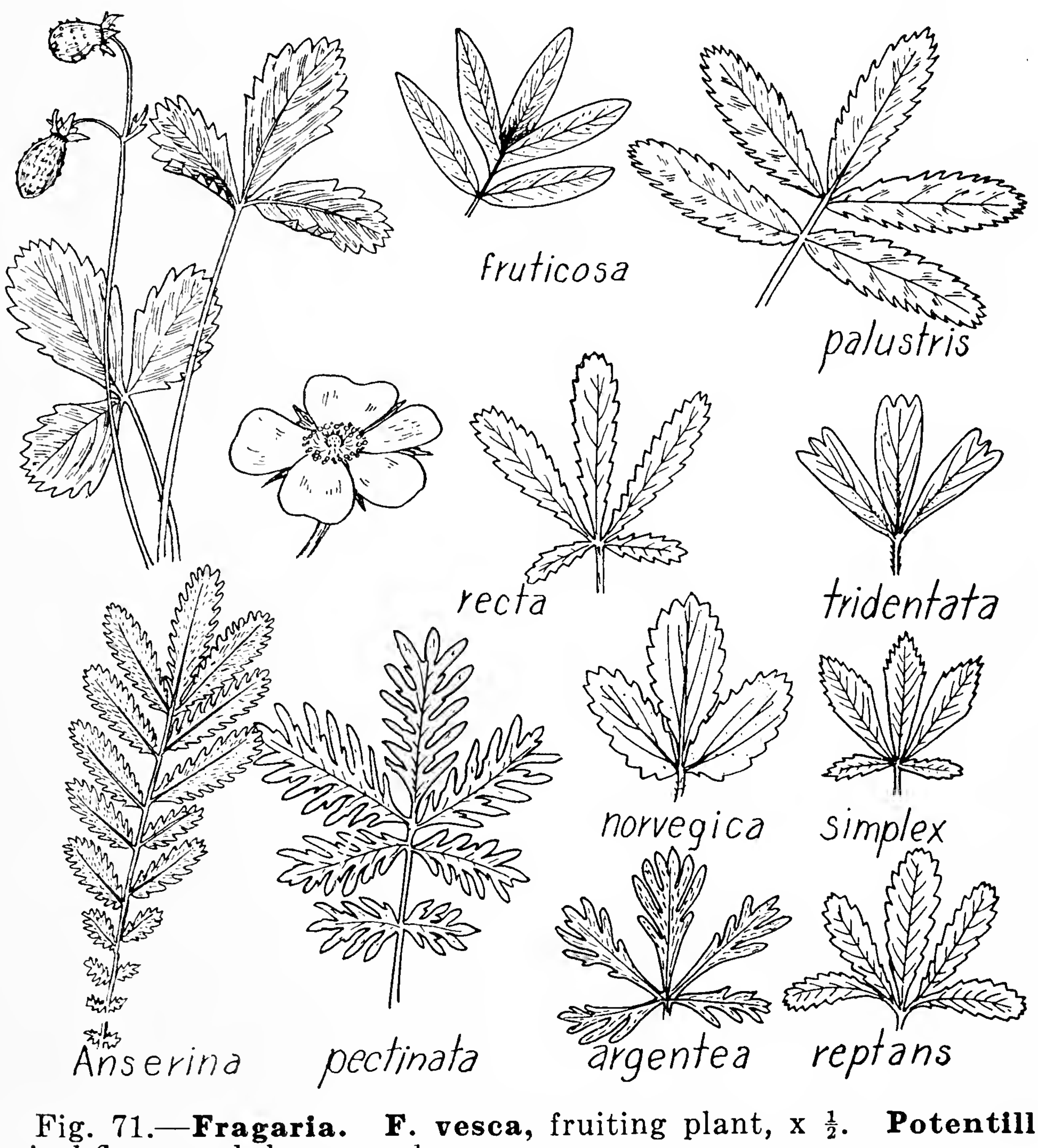


Fig. 71.—**Fragaria. F. vesca,** fruiting plant, x ½. **Potentilla.** Typical flower, x 1; leaves, x ½.

6. **P. recta** L. Fig. 71.

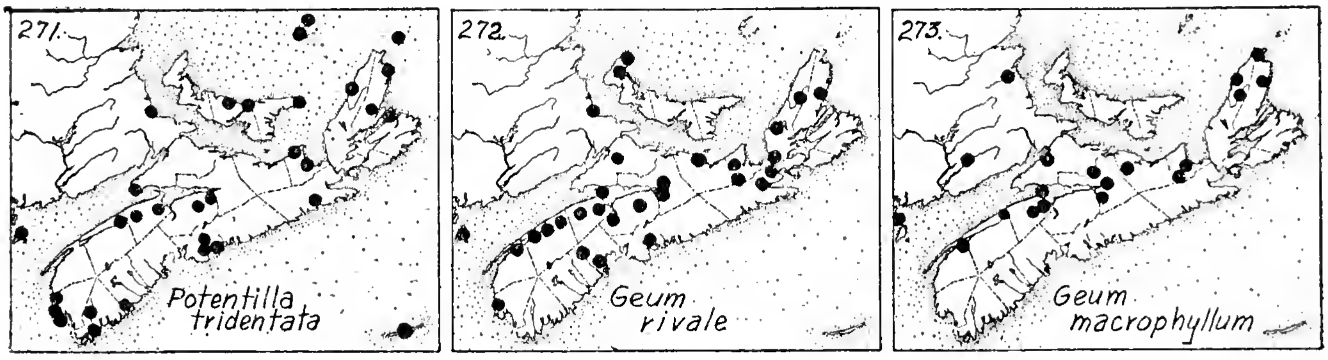
Becoming introduced into the province; scattered in the Annapolis Valley and in Hants Co.; found in a large area above Parrsboro; seems to be becoming more common. June 20-July.

Introduced from Eu.; N. S. to Mich. south to Va.

7. **P. tridentata** Ait. Fig. 71. Map 271.

Common around the coast in exposed and rocky situations; found on sandy soil in the center of the Annapolis Valley, and about cliffs or bare rock outcrops inland; scattered elsewhere and very variable. Rousseau (1938) discusses this variation. Forma **hirsutifolia** Pease has the leaves hirsute both above and beneath, while the typical form has the leaves smooth or shining above; gravelly shore at Guysborough (Rousseau, 1938). June-Aug.

Lab. to N. Eng. and west around the Great Lakes.



8. **P. norvegica** L., var. **hirsuta** (Michx.) Lehm. NORWAY CINQUEFOIL. Fig. 71.

A common weed in fields, roadsides and gardens, practically always present, but rarely in any numbers; throughout. June-Sept.

Lab. to Alaska south to the middle states; Asia.

9. **P. procumbens** Sibth.

Sparingly introduced into the province; along a path in spruce and alder thicket, Lower Argyle, Yarmouth Co.; grassy road through spruce and fir woods, Baddeck (Fernald, 1921).

Eu.; Nfld. & N. S.

10. **P. argentea** L. SILVERY CINQUEFOIL. Fig. 71.

Rather common weed in most parts of the province; in gardens, dry fields, waste ground and roadsides; scattered throughout but not aggressively spreading.

Introduced from Eu.; widespread in eastern N. A.

11. **P. canadensis** L.

Rare on dryish soil or barren areas; Yarmouth, Shelburne and Point Pleasant Park, Halifax.

Me. to Minn. south to Ga.; sparingly introduced northwards.

12. **P. simplex** Michx., see Fernald Rhodora **33**: 180-191. 1931. FIVE FINGER, CINQUEFOIL. Fig. 71.

Rather rare; central N. S. and southern N. B. to Minn. south to N. C. and Okla. The record for *P. pumila* Poir for Bridgewater belongs here (Fernald, l. c.).

Var. **calvescens** Fern. is found everywhere throughout the province; roadside banks, on poor or leached soils, pastures, open woods and worn-out fields.

Nfld. to Minn. south to S. C. & Ill.

13. **P. reptans**. L. Fig. 71.

Sparingly found in the country and about the wharves of Yarmouth Co.

Introduced into N. A. locally about seaports, the European parallel of *P. simplex*.

9. FILIPENDULA (Tourn.) Hill

a. Leaflets of 12 or more pairs, each leaflet about 3 cm long, all similar in shape. 3. *F. hexapetala*

a. Leaflets few and large, the terminal one much the largest and palmately lobed.

b. Flowers white; leaves white-woolly beneath; lateral leaflets not lobed; plant tall, shrubby. 1. *F. Ulmaria*

b. Flowers pink; leaves green on both sides; lateral leaflets lobed; plant low, herbaceous. 2. *F. rubra*

1. **F. Ulmaria** (L.) Maxim. QUEEN-OF-THE-MEADOW. Fig. 74, b.

Abundantly naturalized in the southwestern counties and common at least to Pictou Co.; in low areas, around buildings, roadsides and waste places. Late July-Aug.

Introduced from Eu.

2. **F. rubra** (Hill) Robinson. QUEEN-OF-THE-PRAIRIE, MEADOWSWEET.

Rare; planted as a garden ornamental and occasionally escaped in Yarmouth Co. Late July-Aug.

Native of Penn. and south and west.

3. **F. hexapetala** Gilib. MEADOWSWEET.

Rare as a garden escape in Yarmouth Co.; introduced from Eu. and Asia.

10. GEUM L. AVENS

a. Sepals purplish, erect; corolla greenish or purplish-cream colored; upper joint of the style plume-like and the lower long-hairy; flowers nodding. 1. *G. rivale*

a. Sepals green, spreading or reflexed; corolla white or yellow; upper joint of the style hairy and the lower smooth or nearly so.

b. Terminal segment of the basal leaves much larger than the lateral lobes, heart-shaped at the base, almost round and finely toothed; lower stem-leaves 3-parted, with the lobes rounded; petals yellow, longer than the sepals. 2. *G. macrophyllum*

b. Terminal segment of the basal leaves much more divided, the divisions sharp-pointed and coarsely toothed; stem-leaves sharply lobed and toothed.

c. Petals whitish or greenish; stipules 7-15 mm long; some of the basal leaves usually unlobed or else 3-parted; head of fruits round.

d. Plant slender; lower part of the stem smooth or sparingly hairy with hairs 1 mm long; receptacle of the fruit densely bristly; achenes densely bristly; petals exceeding or equalling the sepals, white.

e. Achenes 30-60 in a head, broadly ovate, 2.5-3 mm long; peduncles finely velvety; leaves thin. 3. *G. canadense*

e. Achenes 60-160 in a head, narrower to wedge-shaped, 3-4 mm long; peduncles with longer hairs; leaves firmer. *G. canadense* var. *camporum*

d. Plant stout, bristly-hairy, with hairs 2 mm long; receptacle smooth or nearly so; petals cream-colored, narrow, about half the length of the sepals.

f. Achenes smooth. 4. *G. laciniatum*

f. Achenes bristly bear the apex. *G. lanciniatum* var. *trichocarpum*

c. Petals bright-yellow, about as wide as long, longer than the sepals; stipules 15-40 mm long; leaves all pinnate; head of the fruits obovoid with the receptacle downy; achenes hispid. 5. *G. aleppicum*

1. **G. rivale** L. PURPLE AVENS. Fig. 72, a. Map 272.

Common throughout; meadows, edges of swamps and springy places. June 20-July 10.

Lab. to Sask. south to Penn.; also in Eu.

2. **G. macrophyllum** Willd. Map 273. Fig. 72, b.

Wet ground, damp woods and along streams, usually in rich or mucky soils; Annapolis Co. and Amherst to northern C. B. It is common eastward along the river intervales. May 20-June 15.

Nfld. to the Great Lakes; also on the Pacific Coast.

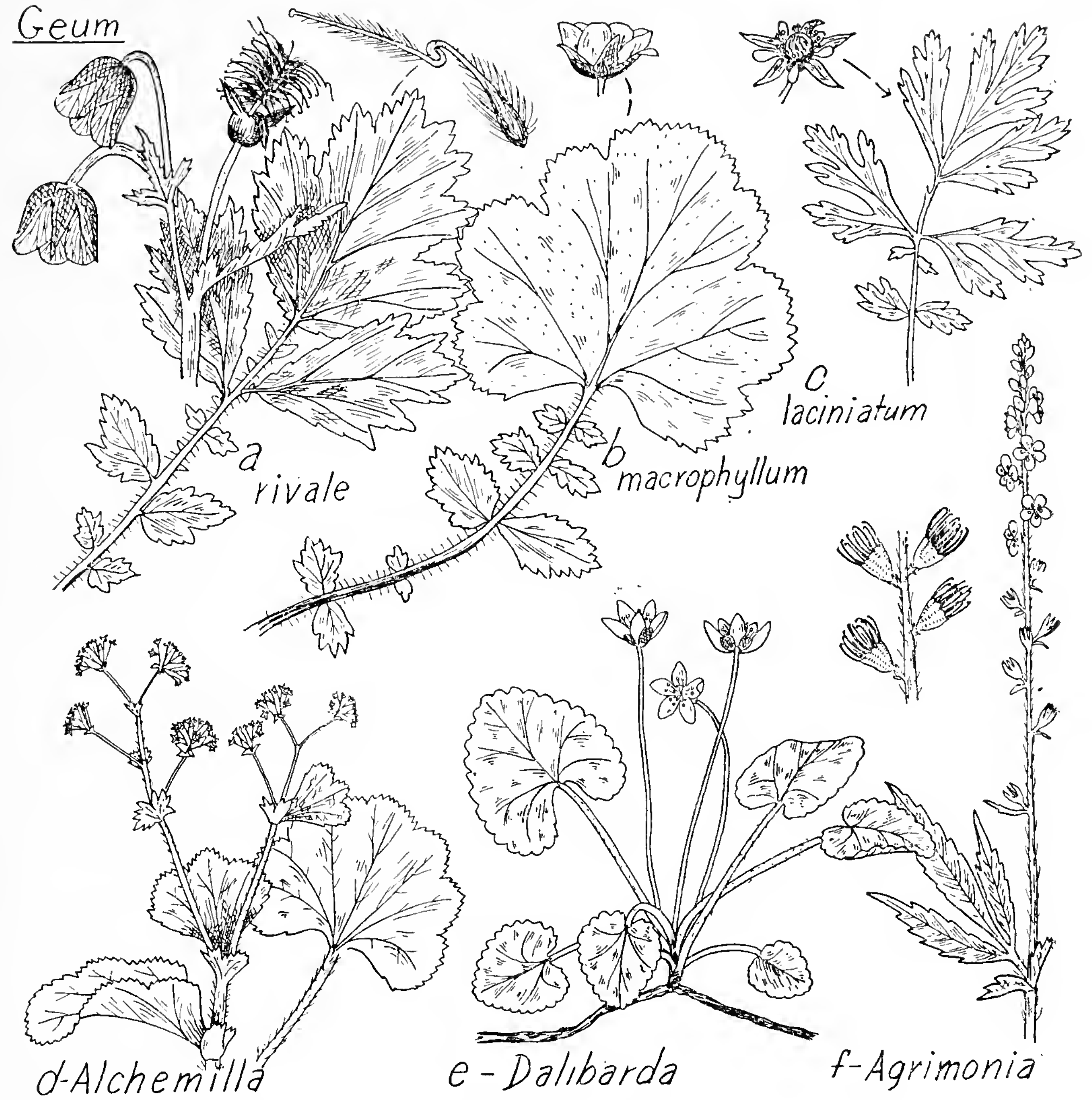


Fig. 72.—**Geum.** a, **G. rivale,** leaf and flowers, x ½; fruit showing hooked style, x 3. b, **G. macrophyllum,** basal leaf and flower, x ½. c, **G. laciniatum,** lower leaf and flower, x ½. **Alchemilla.** d, **A. pratensis,** upper part of plant, x ½. **Dalibarda.** e, **D. repens,** x ⅓. **Agrimonia.** f, **A. striata,** flowers and fruits, x ½.

3. **G. canadense** Jacq. WHITE AVENS. Map 274.

Along the intervales in the center of the province as at Ste. Croix and Five-mile R. in Hants Co.; scattered elsewhere. June 15-July 15. N. S. to Minn. south to W. Va.

Var. **camporum** (Rybd.) Fern. & Weatherby, Rhodora **24**: 49. 1922, is a common weed about towns, at the edges of woods, and along intervales throughout.

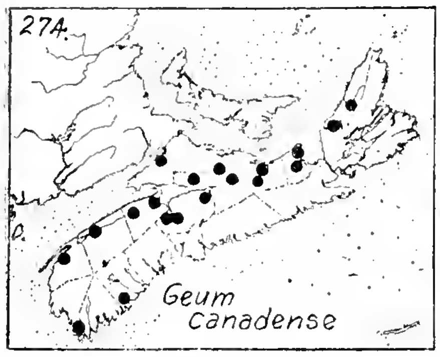
N. S. to N. D. south to Mass., N. Y. & Ala.

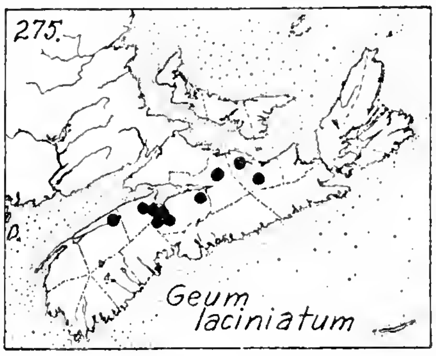
4. **G. laciniatum** Murr., see Fernald, Rhodora **37**: 292-294. 1935. Map 275. Fig. 72, c.

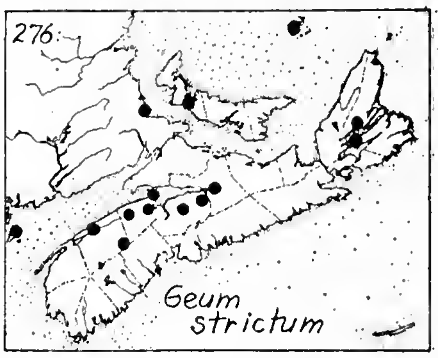
Scattered along the intervales and at the borders of rich woods; Annapolis Co. east to Pictou Co. and probably beyond (*G. virginianum* var. *Murrayanum* Fern.; probably *G. album* of Macoun). July-Aug. N. S. to Ont. south to N. Y. & Mass.

Var. **trichocarpum** Fern., Rhodora **37**: 293. 1935, is very rare in the province and grows in the same habitat; near Windsor.

N. S.; Mass. to Ont. south to Penn. & Mo.







5. **G. aleppicum** Jacq., var. **strictum** (Ait.) Fern., Rhodora **37**: 293-294. 1935. Map 276.

Rather common from Annapolis Co. east to C. B.; rich soil, along river banks, waste places, and occasionally as a weed about buildings. July-Aug. (*G. strictum* Ait.).

Nfld. to B. C. south to Penn,; closely related to the *G. aleppicum* of Eurasia.

11. RUBUS L. RASPBERRY, BLACKBERRY

Bailey, L. H. The genus *Rubus* in North America. Gentes Herbarum, Vol. V: 1-918. 1941-1945. The blackberries of Nova Scotia are in a very unsettled state as to nomenclature and distribution. Bailey has critically examined the identities of the older species and named many new forms. All records and collections should be re-examined in the light of this study, and many years' field study will be needed before any comprehensive idea of the brambles of this province can be obtained. This treatment includes only those species admitted to the province by Bailey. Other species have been recorded and may be present, particularly in southwestern N. S. The habit of the blackberry is of great importance in identification and both first and second year canes should be collected. The young canes are called primocanes; the second year ones that produce flowers and fruit are called floricanes. As a reference aid the number of the species in Bailey's treatment is also included.

a. Leaves simple, merely 3-5-lobed; prickles absent.
  b. Herbaceous, low; lobes of the leaf rounded; flower solitary, white; fruit yellowish. 1. *R. Chamaemorus*

b. Woody and bush-like, to 1.5 m high; lobes of the leaf sharp; flower rose-purplish; fruit small, purplish. 2. *R. odoratus*

a. Leaves compound, with 3-7 leaflets.

c. Plant trailing, essentially herbaceous, unarmed; leaves with mostly three thin leaflets; fruit red, not separating easily from the receptacle. 3. *R. pubescens*

c. Plant trailing or erect, woody, often armed with bristles or prickles.

d. Leaves pinnately 3-7-lobed; fruit red, easily separating from the receptacle; raspberries.

e. Corolla 3-4 cm wide; fruit oblong, to 3 cm long; petals large, as broad as long; leaves often with 7 leaflets. 4. *R. illecebrosus*

e. Corolla smaller with the petals inconspicuous, much narrower than long; leaflets mostly 3, whitish beneath.

f. Plant glandless; inflorescence with relatively short, stout pedicels; drupelets firmly united in fruit, the remaining core elongated; unripe fruit commonly conic and gray-pubescent. 5. *R. idaeus*

f. Plant with stalked glands on some or all of its axes; pedicels slender; drupelets easily separating, leaving a short, broad core on the cane; unripe fruit not conic nor pubescent. 6. *R. strigosus*

d. Leaves palmately divided with 3-5 leaflets; petals showy; fruit black, not easily separating from the receptacle or core; blackberries.

g. Canes trailing or arching with the tips rooting.

h. Plants with hispid hairs or bristles on the canes and usually in the inflorescence, without prickles; leaves firm and often glossy, glabrous, or sparingly pubescent on the veins beneath. (*hispidi*)

i. Foliage deep glossy-green, thick and persisting over winter; flowers mostly less than 16 mm wide; trailing, common. 7. *R. hispidus*

i. Foliage larger and duller, not persisting over winter; flowers mostly over 20 mm wide.

j. Primocane leaflets broad, the main ones two-thirds or more as wide as long; primocane stout and shaggy, glandular; pedicels with long bristles and glandular hairs. 8. *R. provincialis*

j. Primocane leaflets barely more if any than one-half as wide as long; plants arching.

k. Axis of the canes sparingly setose, not glandular; pedicels not glandular. 9. *R. segnis*

k. Axis of the primocane shaggy-glandular; pedicels glandular. 10. *R. adjacens*

h. Plants prickly, sometimes with bristles mixed with the more or less hooked prickles (*Flagellares*).

l. Leaves sparsely pubescent or glabrous on the lower surface.

m. Glands absent on axes, petioles, pedicels and calyx.

n. Foliage with the forking veins prominently elevated on the upper surface giving a ruffled look on the margin; primocane leaflets slightly pubescent beneath. 13. *R. plicatifolius*

n. Foliage not plicate nor ruffled.

o. Canes reddish, very abundantly branching and trailing; leaves shiny, glabrous, resembling *R. canadensis*; stipules narrow. 22. *R. russeus*

o. Canes not prominently reddish nor branching; stipules and floral bracts prominent and wide; northern C. B. 12. *R. bretonis*

m. Glands present on some of the parts, at least on the pedicels.

p. Glands mostly on the calyx or pedicels only; leaflets mostly 3, the terminal one wide. 14. *R. particeps*

p. Glands common among the prickles on the primocanes; leaflets mostly in 5's. 15. *R. biformispinus*

l. Leaves velvety pubescent beneath, the leaflets 5; primocane and pedicels densely glandular. 16. *R. adenocaulis*

g. Canes upright or highbush, sometimes arching and touching the ground, but not truly tip-rooting

q. Canes and pedicels bristly with the prickles none or very few; leaves glabrous beneath; fruit small (*Setosi*). 11. *R. Grautianus*

q. Canes and pedicels not bristly, usually stout and tall; fruit often attractive.

r. Inflorescence and petioles prominently glandular; leaves usually softly pubescent beneath (*Allegheniensis*).

s. Primocane axis nearly or quite devoid of stalked glands.

t. Teeth of the leaflets not deeply cut; prickles common but not unusually large. 17. *R. allegheniensis*

t. Teeth of the leaflets deeply dentate or incised, some 3-5 mm long; prickles very many and effective. 18. *R. pennus*

s. Primocane axis with abundant glandular hairs. 20. *R. acadiensis*

r. Inflorescence and petioles without or with but a very few scattered glands.

u. Leaves pubescent on the lower surface.

v. Pubescence of the leaves light; axis of the inflorescence and the pedicels prominently hairy-pubescent; leaves dull above. 19. *R. orarius*

v. Pubescence of the leaves dense, obscuring the lateral veins; axis of the inflorescence and pedicels lightly pubescent; leaves shining above. *R. canadensis* var. *pergratus*

u. Leaves shiny above and glabrous beneath; canes with scattered and short dull straight prickles. 21. *R. canadensis*

1-1. **R. Chamaemorus** L. Fig. 73. Map 277. CLOUDBERRY, BAKEAPPLE.

Sphagnum bogs, barrens, meadows near the coast and on headlands; common in C. B. and eastern N. S. where considerable quantities are gathered; scattered and becoming rarer westward and inland, rarely flowering or fruiting in the more inland locations.

Nfld., & Greenland across the continent south to Me. and N. H.

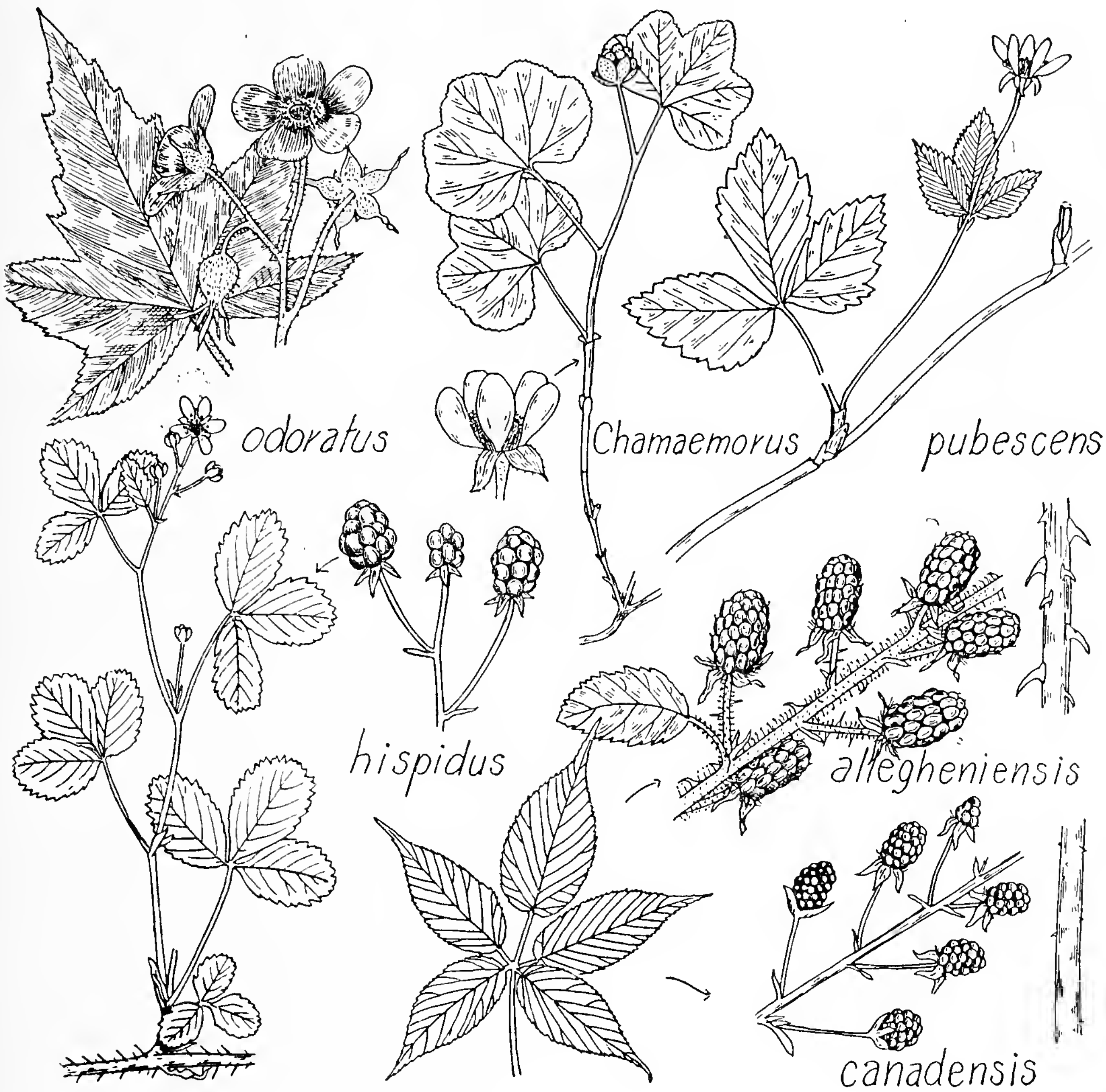


Fig. 73.—**Rubus.**

2-385. **R. odoratus** L. Fig. 73. FLOWERING RASPBERRY.

Scattered as an old-fashioned garden plant, and often found along roadsides or around old houses in the Annapolis Valley; doubtfully native. Fernald (1922) reports a collection from a thicket, Belleville, Yarmouth Co. as the type of var. *malachophyllus* Fern. This has the leaves densely pilose or almost velvety on both surfaces, with the upper surfaces of the young leaves and the veins beneath black-glandular.

N. S. to Mich. and Ind. south to Tenn. and Ga.

3-7. **R. pubescens** Raf. Fig. 73. Map 278. DEWBERRY.

Common throughout; in low and boggy land, swamps, mucky soils, over talus slopes and along intervales, in open sunlight or often luxuriantly under bushes or in open woods. (*R. triflorus* Richards.). Nfld. to Alaska south to N. J., and Iowa.

Var. **scius** Bailey is a compact plant forming mats and extensively stoloniferous, with the leaflets short and broad, 4-5 cm long and nearly as broad. The type is from Cheticamp, in great mats in open sun; also collected by Bailey from the Look-off near Cape Blomidon, Kings Co. N. S., Que. and Nfld.

4-.**R. illecebrosus** Focke. STRAWBERRY RASPBERRY.

An ornamental plant sparingly introduced from Japan for its large fruits; occasionally escaping. Fernald (1922) states that this plant is tending to escape from cultivation at Annapolis Royal. (Page 900 in Bailey).

5-369. **R. idaeus** L. EUROPEAN OR GARDEN RASPBERRY.

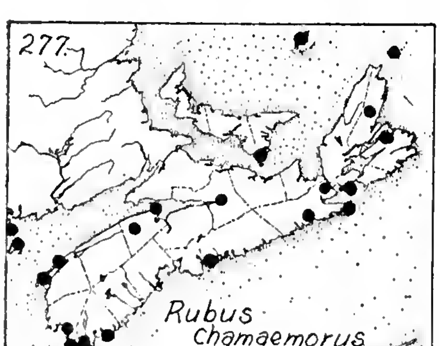
This is the cultivated raspberry best representated in the pomological red varieties; persisting or sometimes tending to escape; well established as a garden escape about Yarmouth (Fernald, 1921).

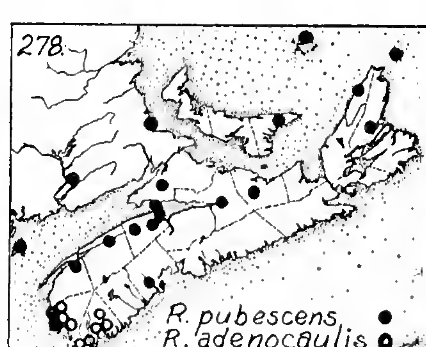
Introduced from Eu.; widely cultivated.

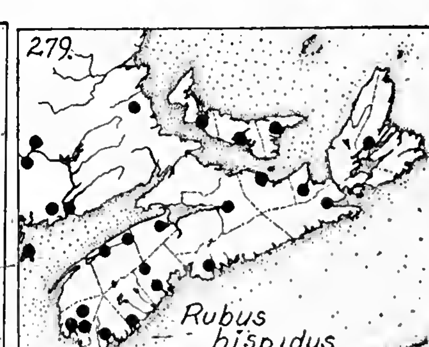
6-370. **R. strigosus** Michx. WILD RASPBERRY.

Common throughout; roadsides, barrens, clearings, after burns, on talus slopes and on rocky ground. The young canes vary greatly in their armature, but these variations do not seem to be very consistent nor to have different geographical ranges (See Fernald, Rhodora **21**: 96. 1919).

Nfld. to Alaska south to N. S., Mex. and Calif.







7-16. **R. hispidus** L. Fig. 73. Map 279. TRAILING BLACKBERRY.

This slender trailing plant with the rather evergreen glossy leaves is one of the commonest blackberries of old fields, roadsides and open coniferous woods. Widespread on acid or mossy soil from N. S. to Wisc. south to N. C. & Tenn.

Var. **culpifer** Bailey has the flowers larger, 18-24 mm wide instead of 10-15 mm, the corolla cup-shaped, and the petals broad. The type is from the Look-off, near Cape Blomidon, Kings Co.; also in low land, Queensville, Inverness Co.

Var. **obovalis** Fern., in Rhodora **42**: 281. 1940, is a slender form with the primocane axis usually less than 2 mm thick, without or with few bristles, the leaves smaller and more rounded, to 4.5 cm long. Apparently commoner than the species in southwestern N. S. and grading into it. Widespread.

8-19. **R. provincialis** Bailey

The type is from dry land, Pictou; specimens were formerly confused with *R. arcuans*. Found also along the roadsides between Stewiacke and Truro. *R. arcuans* Fern. & St. John was described from Dundee, P. E. I., and may be confined to that province. The pedicels are glandiferous, but the leaflets are about half as wide as long, with some of the primocanes prickle-like. The *R. arcuans* reported from Sable Is. is related to *R. vigoratus* Bailey, l. c. page 111.

9-21. **R. segnis** Bailey.

Type from near Pictou, heavily foliaged colony on dryish land.

10-25. **R. adjacens** Fern., in Rhodora **42**: 290. 1940. Map 280.

Rocky or gravelly slopes, thickets, railroad embankments and woods in dry or moist soils; scattered in southwestern N. S. west to Lunenburg and into southern N. B. Records of *R. jacens* mostly belong here.

N. S. to Que. south to Me. & Mass.

11-66. **R. Grautianus** Blanchard

All the material of the section *Setosi*, plants with erect, setose canes which do not root at the tips, are here placed in this species. This plant is scattered throughout the peninsula in moist thickets, damp roadsides, edges of roads and along railroad embankments, often growing in large colonies. At least three closely related species are reported for southern N. B.; and the section is undoubtedly more diverse in N. S.

N. S. to Conn. and northern N. Y.

12-138. **R. bretonis** Bailey

Described by Bailey from Cape Breton: Dingwall, Cape North region, Victoria County, on dry land in woodsy partially shaded places, where it was abundant, and showy in bloom on the 9th of July, 1937.

13-140. **R. plicatifolius** Blanchard

Light usually sandy land, N. B., N. S., Maine to R. I., and N. Y.; Wisc.; swampy woods and wet thickets by Eel Lake, Yarmouth Co. (Fernald, 1921); scattered elsewhere.

14-176. **R. particeps** Bailey

On sandy land at Kingston, Kings Co.; type collected by Bailey.

15-181. **R. biformispinus** Blanchard

One of the most characteristic coarse trailers of the sandy roadsides and railroad embankments in southern Yarmouth and Shelburne Cos. (Fernald, 1922); very common along roadsides and in light soils through the Annapolis Valley; scattered eastward.

N. S. & Maine.

16-188. **R. adenocaulis** Fern., in Rhodora **42**: 288. 1940. Map 278.

Damp to dryish roadside thickets, embankments, swamps and open woods; rather common in southwestern N. S., scattered eastward at least to Kings Co. *R. arcuans* and *R. abbreviatus* Blanchard mostly of earlier records.

Southwestern N. S.

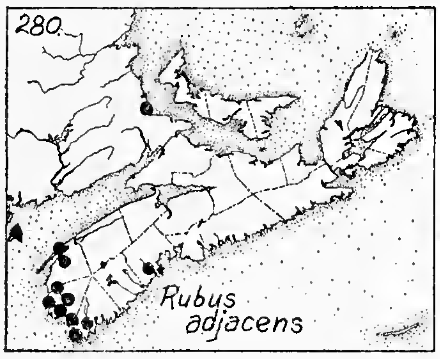
17-224. **R. allegheniensis** Porter. Fig. 73. Map 282. HIGHBUSH BLACKBERRY.

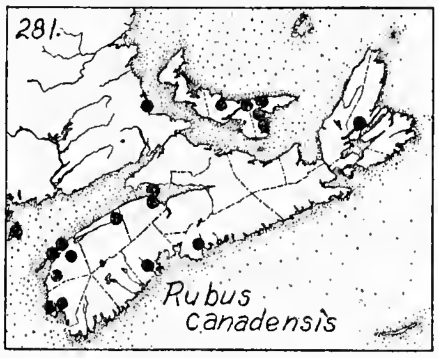
The majority of the edible blackberries of the province are gathered from this species. The plant is characteristic of roadsides, clearings and burns, along fences and in thickets and open woodlands throughout; very variable in habit and habitat. (*R. nigrobaccus* Bailey). N. S. to Minn. south to N. C. & Mo.

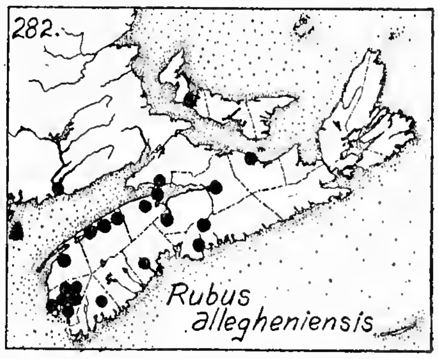
Var. **neoscoticus** (Fern.) Bailey is a closely related form with the primocanes bearing pinhead glands, the inflorescence more hidden in the foliage and with the pedicels stouter and the fruit shorter and less thimble-shaped. (*R.*

glandicaulis Blanchard, var. *neoscoticus* Fern., Rhodora **23**: 268. 1921). Best developed and most characteristic in N. S.

N. S. to southern Me., & northern N. Y.







18-228. **R. pennus** Bailey.

This large very thorny briar was described from dry land on Digby Neck, Digby Co., west of Sandy Cove, in a considerable area. A roadside clump of a thorny type seen on the mountain slope north of Annapolis probably belongs to this same species.

19-236. **R. orarius** Blanchard

This erect large blackberry is much like *R. allegheniensis* except that the leaves are much less pubescent beneath and glands are sparingly present and inconspicuous. This species, or at least a plant very closely related to it, is reported by Fernald (1921) as frequent in damp thickets of Digby, Yarmouth and Shelburne Counties.

N. S.; southern Me. & Cape Cod.

20-258. **R. acadiensis** Bailey

Type from a dry bank among grass and low brush, near Hardwood Lands post-office, Hants Co., N. S.; also collected by Bailey from Havelock, N. B., and by Atwood from south of Fredericton.

21-207. **R. canadensis** L. Fig. 73. Map 281.

Common throughout; roadsides, thickets, clearings and open woods. N.S. to Minn. south to Tenn. & Ga.

Var. **pergratus** (Blanchard) Bailey has the leaves softly pubescent underneath with the lateral ribs more or less obscured. Scattered from P.E.I. and N. S. to Penn. *R. canadensis* is very variable. Many forms can be found and Bailey has described several related species from neighboring regions. One of these, *R. quaesitus* Bailey, has the type from Miscouche in P. E. I., and is reported from Dorchester, Westmoreland Co., in N. B. This has the inflorescence broad, partly hidden in the leaves, and the pedicels few and widely spreading.

22-221. **R. russeus** Bailey

Type from Waverley, Halifax Co., on high open land, trailing flat on the ground, the woody stems red in the sun; also from Middlefield, Queens Co.; Sandy Cove, and from Springhill. This species is very vigorous, roots commonly at the tips, and the primocanes are extensively branching. It is found along the roadsides between Bedford and Waverley.

12. DALIBARDA Kalm

1. **D. repens** L. DALIBARDA. Fig. 72, e. Map 283.

Scattered to local in dry woods; it is commonest in the southwestern counties, becoming rarer to Pictou Co. Aug.

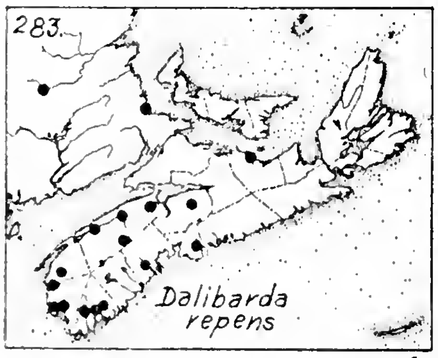
N. S. to Ont. south to N. J., Ohio & Mich.

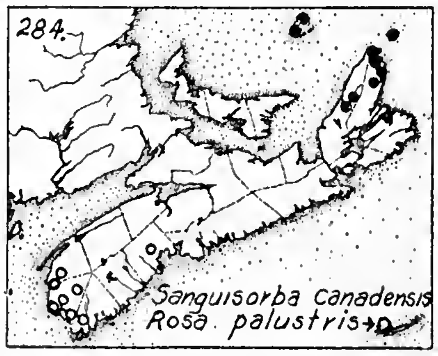
13. ALCHEMILLA L.

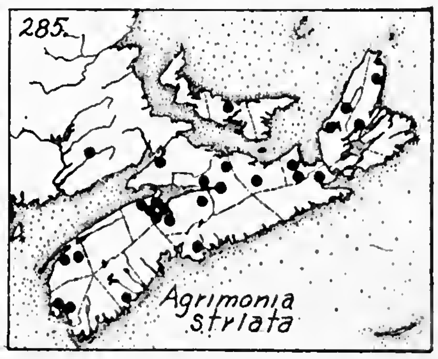
1. **A. pratensis** F. W. Schmidt. LADY'S MANTLE. Fig. 72, d.

This weed is abundant and very aggressive from Digby around the coast to Yarmouth and Shelburne Cos.; scattered east to Halifax and Sydney. It was first found in Halifax about 1884; at Digby in 1879; and Macoun and Burgess noticed it growing in great abundance at Yarmouth in 1883. It is now a serious weed in the southwestern counties, but has not spread to any extent into the Annapolis Valley in spite of the fact that it was early present at Digby. The N. S. plants are introduced from Eu. and differ from the native species and varieties further north. For a discussion of this species see Fernald and Wiegand, Rhodora **14**: 229-234. 1912. (*A. vulgaris* L. of some authors).

Sparingly introduced into N. S. and Me. to N. Y.







14. AGRIMONIA (Tourn.) L.

a. Axis of the inflorescence with open, spreading long hairs and numerous short-stalked glands; bristles of the fruit spreading, the longest over 3 mm long. 1. *A. gryposepala*

a. Axis of the inflorescence downy with appressed hairs and often with longer spreading ones, without glands; bristles of the fruit about 2-2.5 mm long, ascending. 2. *A. striata*

1. **A. gryposepala** Wallr. AGRIMONY.

Scattered in rich woods and thickets along the intervales and rich slopes from Annapolis and Digby Cos. to C. B.; rare in the Atlantic regions of the province. July-Aug.

N. S. to Minn. & Calif. south to N. C., Tenn. & Mo.

2. **A. striata** Michx. Map 285. Fig. 72, f.

Common throughout; thickets along roadsides, stonewalls, fences, and waste places or cut-over areas. July-Aug.

Nfld. to Sask. south to Va., Ill. & N. M.

15. SANGUISORBA (Rupp.)L.

a. Plants 3-15 dm high; leaflets 2-5 cm long; flowers in long spikes; stamens 4. 1. *S. canadensis*

a. Plants 3-5 dm high; leaflets 8-15 mm long; flowers in short ovoid spikes; flowers pinkish-green; stamens 12 or more. 2. *S. minor*

1. **S. canadensis** L. CANADA BURNET, SANGUISORBA. Fig. 74, a. Map 284.

Bogs, wet meadows and well-drained swamps; common in C. B. and often abundant near the coast. It has been reported from Pictou, Truro and from near Halifax, but I believe that all these stations represent introductions, as the plant has not been seen recently on the mainland side of the Strait of Canso. Var. *latifolia* Hook., an Alaskan variety known in the east from the north shore of the St. Lawrence and from Anticosti, has been reported from St. Paul Island, C. B. (Perry 1931). These plants, however differ but very slightly from the other collections from C. B. Aug.

Lab. to Man. south to the mts. of Ga.

2. **S. minor** Scop. GARDEN BURNET.

Known only from near Windsor, where it may have been introduced in grass seed.

Eurasia; introduced from N. S. to Md.

16. **ROSA** L. ROSE

The native species of rose are extremely variable in the shape and size of the prickles, abundance of bristles, shape of the fruit, position of the achenes on the wall of the fruit and in the height and habit of the bush. Some species easily hybridize and form fertile hybrids; and progeny from the same plant may differ widely. Erlanson, Eileen Whitehead. Experimental data for a revision of the North American Roses. Bot. Gaz. **96**: 197-259. 1934.

a. Twigs, prickles and bristles finely pubescent; twigs stout, very prickly; leaves large, thick and rugose; corymbs of flowers small, the fruit usually pendent; cultivated or escapes. 1. *R. rugosa*

a. Twigs, prickles and bristles not pubescent.

b. Flowers double, solitary with large ovate bracts upon the peduncles; twigs slender, cinnamon-colored; leaves pale and pubescent beneath; infra-stipular prickles stout and curved. 2. *R. cinnamomea*

b. Flowers single, very rarely solitary; bracts of the peduncle not wide and ovate, green.

c. Stem low, densely bristly throughout; flowers in 1's to 3's; leaflets about 2 cm long, rather narrow; bogs. 6. *R. nitida*

c. Stems various, with stout infrastipular prickles or smooth and without bristles; sterile canes sometimes bristly at the base.

d. Leaves glandular beneath, often doubly serrate with gland-tipped teeth.

e. Leaves glandular above; styles pubescent. 3. *R. Eglanteria*

e. Leaves not glandular above; styles glabrous or nearly so. 4. *R. micrantha*

d. Leaves not glandular beneath, nor glandular-toothed.

f. Sepals pinnately lobed; fruit ellipsoid, the pedicels naked; flowers 1-3; prickles stout, hooked; leaves glabrous or nearly so. 5. *R. canina*

f. Sepals not lobed.

g. Leaflets with 5-30 (averaging 13) teeth on each side; stamens less than 150; leaves glabrous beneath.

h. Stem stout, much branched; suckers few, rarely flowering the first season; prickles mostly flattened, sometimes absent; bristles often at the base of the plant. 7. *R. virginiana*

h. Stem low and slender; suckers many, often flowering the first season; prickles, if present, small, straight and terete; bristles often scattered to the tip. 8. *R. carolina*

g. Leaflets averaging 26 teeth on each side; stamens over 200; leaves mostly more or less pubescent beneath. 9. *R. palustris*

1. **R. rugosa** Thunb. ROSE.

Commonly cultivated; becoming established as an escape about Yarmouth. Introduced from eastern Asia.

2. **R. cinnamomea** L. CINNAMON ROSE. Fig. 74, e.

Common about buildings, around old houses and farmsteads, and along roadsides from Yarmouth Co. east at least to Pictou Co. (*R. spinosissima* L. in part).

Eurasia; widely introduced and escaping.

3. **R. Eglanteria** L. SWEET-BRIER, EGLANTINE. Fig. 74, d.

Scattered around old houses, in gardens, and occasionally as an escape. Most of the material examined seems to be closely allied to the next species, or to grade into it (*R. rubiginosa* L.).

Eu.; widely naturalized in N. A.

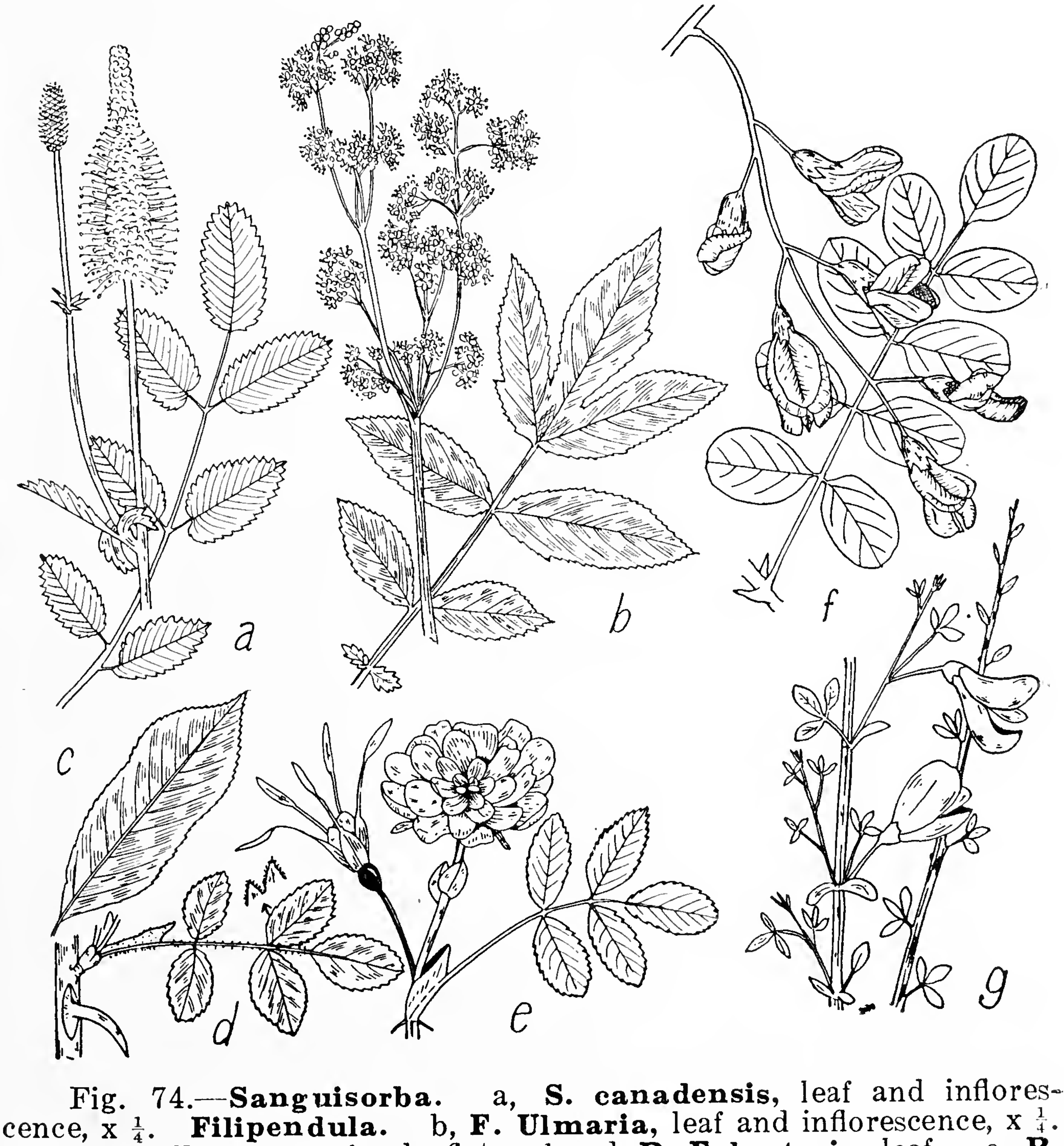


Fig. 74.—**Sanguisorba.** a, **S. canadensis,** leaf and inflorescence, x $\frac{1}{4}$. **Filipendula.** b, **F. Ulmaria,** leaf and inflorescence, x $\frac{1}{4}$. **Rosa.** c, **R. palustris,** leaflet, x $\frac{1}{3}$. d, **R. Eglanteria,** leaf. e, **R. cinnamomea,** x $\frac{1}{4}$. **Robinia.** f, flowers and leaf, x $\frac{1}{2}$. **Cytisus.** g, **C. scoparius,** twigs and flowers, x $\frac{1}{2}$.

4. **R. micrantha** Sm.

Rather frequent as an escape or an ornamental, growing in situations similar to those of the last species.

Eu.; a common escape throughout N. A.

5. **R. canina** L. DOG ROSE.

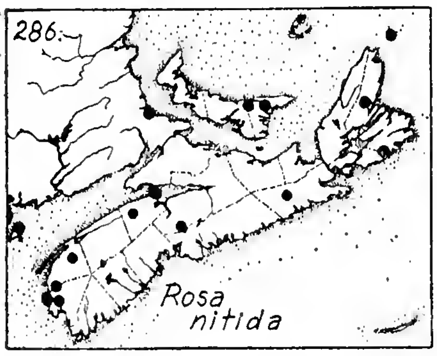
Rare; occasionally seen as an escape in the south-western part of the province. Since it was used as a stock for grafting, it may be expected wherever roses are grown in the province.

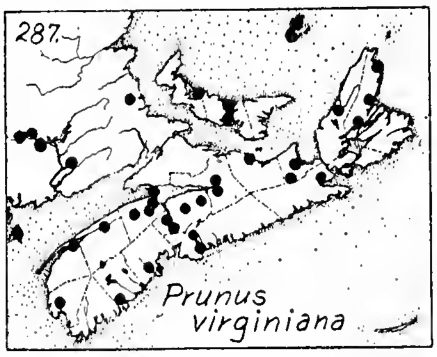
Eu.; occasionally naturalized in N. A.

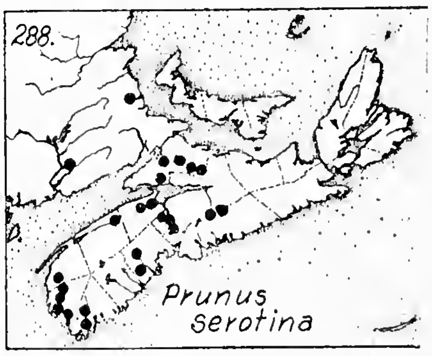
6. **R. nitida** Willd. SWAMP ROSE. Fig. 68, e. Map 286.

Scattered throughout, becoming common eastward to C. B.; bogs, spruce swamps, sphagnum mats, and swampy thickets, especially near the coast. Hybrids with other species are occasionally found. *R. nitida X. R. virginiana* was found at the border of a spruce swamp, Markland, Yarmouth Co. (Fernald, 1922); and a collection from Tidnish is placed here. *R. nitida X. R. palustris* is reported from a wet rocky thicket bordering Sparrel L., southwest of Hasset, Digby Co. (Fernald. 1922).

Margins of swamps; Nfld. to N. Eng.







7. **R. virginiana** Mill. COMMON WILD ROSE. Fig. 68, f.

Common throughout, extremely variable in all characters and grading into, or hybridizing with the next species; wet pastures, thickets, and common along the heads of the salt marshes, dykelands and swamps.

Hybrids between this and *R. carolina,* intermediate in character, have been assigned to *R. obovata* Raf. by Erlanson. These luxuriant plants with larger leaflets and flowers may be the same as the *R. obovata* (See Rydberg, N. A. Flora **22**. 499, 1918) that was reported by Fernald from south-western N. S., in Rhodora **24**: 176. 1922. *R. Bicknelli* of Rydberg is a form with pyriform fruit.

Nfld. & Que. to N. Y. & Penn.

8. **R. carolina** L., see Rydberg in Bull. Torrey Bot. Club **47**: 51. 1920.

Scattered throughout; dry pastures, roadsides, uplands and light soil; characteristic in its habitat but grading into *R. virginiana* on the lower ground. (*R. humilis* Marsh. of Gray's Man.) *R. gemella* Willd. is placed here.

Nfld. to Minn. south to Fla. & La.

9. **R. palustris** Marsh., see Fernald, Rhodora **20**: 91. 1918. Fig. 74, c. Map 284.

Scattered at the edges of ponds, wet thickets and in swamps; Digby, Yarmouth and Shelburne Cos., scattered east to Lunenburg Co. Records of *R. carolina* may belong here, but in most cases they are based on luxuriant plants of *R. virginiana* or of the hybrid *R. obovata*. (*R. carolina* of Gray's Man.).

N. S. to Minn. south to Fla. & Miss.

17. **PRUNUS** (Tourn.) L. PLUMS and CHERRIES

Groh, Herbert and Harold A. Senn. Prunus in eastern Canada. Can. Jour. Res. C. **18**: 318-346. 1940.

a. Flowers few, in an umbel or short corymb.
  b. Plums; fruit large, with a bloom, and a deep groove along one side.
    c. Leaves rolled in the bud; flowers 1-2 per cluster.
      d. Shrub; distinctly spiny; leaves 2-4 cm long; flowers usually solitary with pedicels glabrous; fruit round, mostly less than 1 cm thick. 1. *P. spinosa*
      d. Shrubs or small trees, unarmed or nearly so; leaves 4-10 cm long; flowers 1-2, with the pedicels often pubescent; fruit more than 1 cm thick.
        e. Leaves 5 cm long or longer, with closely and irregularly toothed margins; flowers 1.5-2.5 cm wide, with rarely pubescent pedicels; fruit 3-4 cm long. 2. *P. domestica*
        e. Leaves 2.5-4 cm long, with closely serrate margins; flowers 0.8-1.5 cm wide, with pubescent pedicels; fruit 1.2-2 cm long. 3. *P. insititia*
    c. Leaves folded in the bud; flowers usually 3 or more per cluster, 2-3 cm wide, white to pinkish; branches becoming spiny when older. 4. *P. nigra*
  b. Cherries; fruit round, smooth without a bloom; leaves folded in the bud; flowers several to numerous.
    f. Flowers 2-3 cm wide; fruit 15-20 mm thick; involucral bracts of the inflorescence persistent; leaves coarsely and bluntly toothed; cultivated trees.

g. Leaves thin, hairy on the veins when young, with 10-14 pairs of veins; flower-spurs leafless, the buds-scales enlarged to 10-15 mm long, becoming recurved; calyx-lobes smooth edged. 5. *P. avium*

g. Leaves firm, waxy, smooth or nearly so; flower-spurs leafy, the bud-scales erect and scarcely enlarged; leaves with 6-8 pairs of veins; calyx-lobes round-toothed. 6. *P. Cerasus*

f. Flowers 1-1.5 cm wide; fruit 7-8 mm thick, the involucral bracts of the inflorescence deciduous; leaves with sharp inturned teeth; native tree. 7. *P. pensylvanica*

a. Flowers numerous in an elongated, drooping, leafy raceme (Fig. 70, e. f).

h. Leaves thin, with sharp teeth, smooth on the mid-rib beneath; sepals plainly glandular-serrate, disappearing in fruit; shrubs. 8. *P. virginiana*

h. Leaves thick and waxy, with inturned teeth, often with the mid-rib fringed with rusty hairs on the under side; sepals obscurely glandular, persisting on the fruit; trees. 9. *P. serotina*

1. **P. spinosa** L. BLACKTHORN, SLOE.

Rare; collected at Wolfville, and at Summerville Beach in Queens Co. Probably irregularly scattered. Late May.

Eurasia; introduced and long cultivated.

2. **P. domestica** L. GARDEN PLUM.

Commonly planted; escaping to roadsides and thickets.

3. **P. insititia** L. BULLACE PLUM.

This form generally appears when cultivated plums grow up from the rootstocks, and is to be expected wherever cultivated plums are grown in the province. Late May.

Eurasia; long cultivated.

4. **P. nigra** Ait. CANADA PLUM.

Scattered at various places in the Annapolis Valley; Wolfville, Gaspereau, Church St.; and at Landsdowne in Digby Co. This species has been introduced also in the form of rootstocks for cultivated varieties of plums.

Central and northeastern Canada and the U. S.; introduced into N. S.

5. **P. avium** L. MAZZARD OR SWEET CHERRY.

Grown throughout the Annapolis Valley; common as an escape, especially in the western part. Middle and late May.

Eurasia.

6. **P. Cerasus** L. SOUR CHERRY.

Frequently found in orchards, often persisting or as an escape along roadsides or fence-rows; commonest in the southwestern counties and in the Annapolis Valley; rarer eastwards. Late May.

Eurasia; escape and cultivated tree in eastern N. A.

7. **P. pensylvanica** L. f. BIRD OR PIN CHERRY. Fig. 70, d.

Common throughout; barrens, sandy soil, burnt-over land, thickets and edges of fields. May 25- June 20.

Lab. to B. C. south to Penn.

8. **P. virginiana** L. CHOKE CHERRY. Fig. 70, e. Map 287.

Common throughout; a weed shrub around fields, along stone walls, and in sandy, barren or waste land. It is especially common along the edges of the intervale meadows throughout the center of the province, and along the edges of thickets near rocky lake shores. June 10-25.

Nfld. to S. Dak. south to Fla.

9. **P. serotina** Ehrh. WILD BLACK CHERRY. Fig. 70, f. Map 288.

Common in the southwestern counties; characteristic of most of the rich or silty intervales from Kings Co. to Colchester and Cumberland Co.

N. S. to Dakota south to Fla.

55. **LEGUMINOSAE** PEA or LEGUME FAMILY

a. Trees or shrubs.
  b. Large trees with spines or thorns; leaves pinnately compound.
    c. Flower regular; leaves once or twice compound; spines long and branched; flowers greenish. 1. *Gleditsia*
    c. Flowers pea-like; leaves once compound; short stipular thorns present; flowers whitish to pink. 7. *Robinia*
  b. Low shrub about 1 m high, with stiff, green squarish branches, leaves small, mostly with three leaflets; spines and thorns absent; flowers bright yellow. 2. *Cytisus*
a. Herbaceous plants.
  d. Leaves pinnately compound.
    e. Terminal leaflets of the leaves modified to tendrils.
      f. Flowers 1-3, sessile. 10. *Vicia*
      f. Flowers several to numerous on a stalked inflorescence.
        g. Blades of the leaflets less than 2 cm long; styles filiform with a tuft of hairs at the summit; wings of the flower coherent with the keel. 10. *Vicia*
        g. Blades of the leaflets more than 2 cm long; styles flattened and bearded down the inner face; wings nearly free. 11. *Lathyrus*

e. Terminal leaflets not modified to tendrils.
h. Leaflets 13-19; plants low and tufted; rare in C. B. 8. *Oxytropis*
h. Leaflets 5-7; plants long-trailing or twining. 12. *Apios*
d. Leaves palmately compound.
i. Leaves with numerous leaflets; lupines. 3. *Lupinus*
i. Leaves with 3 leaflets.
j. Plant not slender and twining, at most prostrate or creeping.
k. Leaflets not toothed; flowers purplish, in long narrow racemes; pod made up of separate joints which easily separate; plants tall and erect. 9. *Desmodium*
k. Leaflets toothed or serrulate.
l. Flowers in a dense head; fruit straight and membranous; clovers. 4. *Trifolium*
l. Flowers in a short spike or in long racemes.
m. Flowers in very short spike; pods coiled; terminal leaflet stalked; plants 1-10 dm high. 6. *Medicago*
m. Flowers in tall racemes; pods straight, 1-2-seeded; plants 1-2 m high. 5. *Melilotus*
j. Plants slender and twining; leaflets with a smooth edge; flowers purplish. 13. *Amphicarpa*

1. GLEDITSIA L.

1. **G. triacanthos** L. HONEY LOCUST.

Occasionally planted and persisting in hedges, around old habitations or along roadsides. June.

Penn. to Iowa south to Tex.; introduced northwards.

2. CYTISUS (Tourn.) L.

1. **C. scoparius** (L.) Link. SCOTCH BROOM. Fig. 74, g.

Long known from Shelburne Co., and still spreading in the open ground along the roadsides, into pastures and open woods between Jordan Falls and Shelburne and especially in the vicinity of Swanburg L.; formerly gathered to some extent for the drug market. This plant does not seem to be able to persist in the colder regions inland or northward. July.

Locally introduced into N. A. mostly near the east and west coasts.

3. LUPINUS (Tourn.) L.

a. Leaflets 6-9, widest near the tip, blunt. 1. *L. nootkatensis*
a. Leaflets 10-17, widest near the middle and narrowed to each end. 2. *L. polyphyllus*

1. **L. nootkatensis** Donn.

Abundantly naturalized at Chebogue Point along the Lupine Trail, Yarmouth. June 15-July.

Introduced in Nfld. & N. S.; Alaska to Vancouver Island.

2. **L. polyphyllus** Lindl. GARDEN LUPINE.

Frequently grown as an ornamental and occasionally escaping to become a weed; very common along the Salmon River and the dykelands at Truro; common at Chebogue Point; occasionally seen elsewhere. June 15-July.

Introduced into N. S. & P. E. I.; native from B. C. to Calif.

4. TRIFOLIUM (Tourn.) L. CLOVER

a. Flowers in dense heads, sessile, pinkish to purple.
  b. Calyx-teeth silky-plumose and longer than the corolla; corolla whitish; head much longer than thick. 1. *T. arvense*
  b. Calyx-teeth ciliate-hairy or smooth, not longer than the corolla; corolla purplish; heads round to ovoid. 2. *T. pratense*
a. Flowers stalked, in looser heads; flowers nearly white to yellow.
  c. Corolla whitish to purple-tinged.
    d. Stems loosely creeping and rooting; flower-stalks arising from the surface of the ground; flowers white; tip of the leaflets usually notched (Fig. 75). 3. *T. repens*
    d. Stems erect or ascending, not rooting at the nodes; flowers larger, pinkish-tinged; leaflets blunt to rounded at the apex. 4. *T. hybridum*
  c. Corolla yellow; plants and leaves small.
    e. Terminal leaflet sessile. 5. *T. agrarium*
    e. Terminal leaflet stalked.
      f. Plants large; heads densely flowered; corolla conspicuously striate with age. 6. *T. procumbens*
      f. Plants small and slender; heads loosely flowered, short with few flowers; corolla not striate. 7. *T. dubium*

1. **T. arvense** L. RABBIT-FOOT CLOVER.

Local; a weed in sandy, stony or dry soil; known from Halifax, and scattered about Wolfville; occasionally seen elsewhere.

Introduced from Eurasia; N. S. & Ont. to Mo. and south to Fla.

2. **T. pratense** L. RED CLOVER. Fig. 75.

Common in fields and meadows throughout; rarely persisting except in limited amount along roadsides or dwellings. Fernald, Rhodora **45**: 331. 1943, separates the coarser, longer-lived cultivated plant as var. **sativum** (Mill.) Schreb. Var. **frigidum** Caudin, a dwarf variety with stems to 2 dm high, and very small leaves with rounded obovate leaflets only 0.5-1.5 cm long, is reported from a seepy open slope near Yarmouth (Fernald, 1921).

Widely naturalized from Eurasia.

3. **T. repens** L. CREEPING WHITE CLOVER. Fig. 75.

Common throughout in pastures, roadsides, fields and acid soils. It is the first legume found growing on acid, wet or eroded soils. In natural areas it is found mixed with brown top, *Agrostis tenuis*, in hollows or along moister places in pastures and meadows.

Widely naturalized from Eu.

4. **T. hybridum** L. ALSIKE CLOVER. Fig. 75.

Extensively planted as a forage crop, especially on the wetter soils; often found naturalized in meadows and waste places. More slender plants with smaller heads, leaves and flowers, have been segregated as var. **elegans** (Savi)Boiss, see Fernald, Rhodora **43**: 331. 1941.

Widely naturalized from Eu.

5. **T. agrarium** L. YELLOW OR HOP CLOVER. Fig. 75.

Occasional throughout in gravelly neutral or slightly acid soils; generally less common than the next species.

Introduced from Eu.; Nfld. to Ont. & Iowa south to Ga.

6. **T. procumbens** L. HOP CLOVER. Fig. 75.

Common throughout; along roadsides, old fields, waste places and in towns.

Introduced from Eu.; N. S. to Wash. south to Ga. & Miss.

7. **T. dubium** Sibth. LITTLE HOP CLOVER.

Common in southern Yarmouth and through Digby Co.; spreading into the Annapolis Valley, where it is found at Coldbrook and near Windsor.

Native of Eu.; N. S.; Mass. to Miss.; B. C. southward.

5. MELILOTUS (Tourn.) Mill. SWEET CLOVER.

a. Corolla yellow; flowers 4-7 mm long, the wings and keel as long as the standard; calyx-tube rounded at the base.
 b. Ovary and pod glabrous; pod strongly reticulated and cross-ribbed. 1. *M. officinalis*
 b. Ovary and pod pubescent; pod weakly reticulated, not cross-ribbed. 2. *M. altissima*
a. Corolla white; flowers 3-5 mm long; calyx-tube narrowed evenly to the base; pod glabrous. 3. *M. alba*

1. **M. officinalis** (L.) Lam. YELLOW SWEET CLOVER.

Yellow sweet clovers are much less common than are white species in the province. This species is abundant along roadsides near coal-mining towns, and in alkaline soils as around Windsor. July 15-Aug.

Introduced from Eu.; widely naturalized in N. A.

2. **M. altissima** Thuill.

The distribution of this species is unknown but it is probably nearly as common as the last species. It is known from Annapolis, and from Brooklyn in Hants Co. July-Aug.

Introduced from Eu.; widely naturalized.

3. **M. alba** Desr. WHITE SWEET CLOVER. Fig. 75, b.

A common weed in every town, and often along roadsides in the country. It has been little grown as a forage crop, but has nevertheless become well established in many regions, especially about ports and in limestone or gypsum areas. Very common from Pictou to Halifax and Annapolis; scattered elsewhere. It has spread rapidly along the new roadside embankments where roads have been paved. July-Aug.

Introduced from Eu. and widespread.

6. MEDICAGO (Tourn.) L.

a. Perennial; flowers bluish-purple; pods spirally twisted; plant mostly erect; alfalfa. 1. *M. sativa*
a. Annuals; flowers yellow; pods curved or tightly twisted; plants small, usually prostrate. 2. *M. lupulina*

1. **M. sativa** L. ALFALFA. Fig. 75, c.

Planted as a forage crop, occasionally persisting for a time; found along roadsides and in waste places in limited amounts. As yet alfalfa is little known, and is rather rare on the prevailing acid or wet soils. July.

Native of Eu.; widespread.

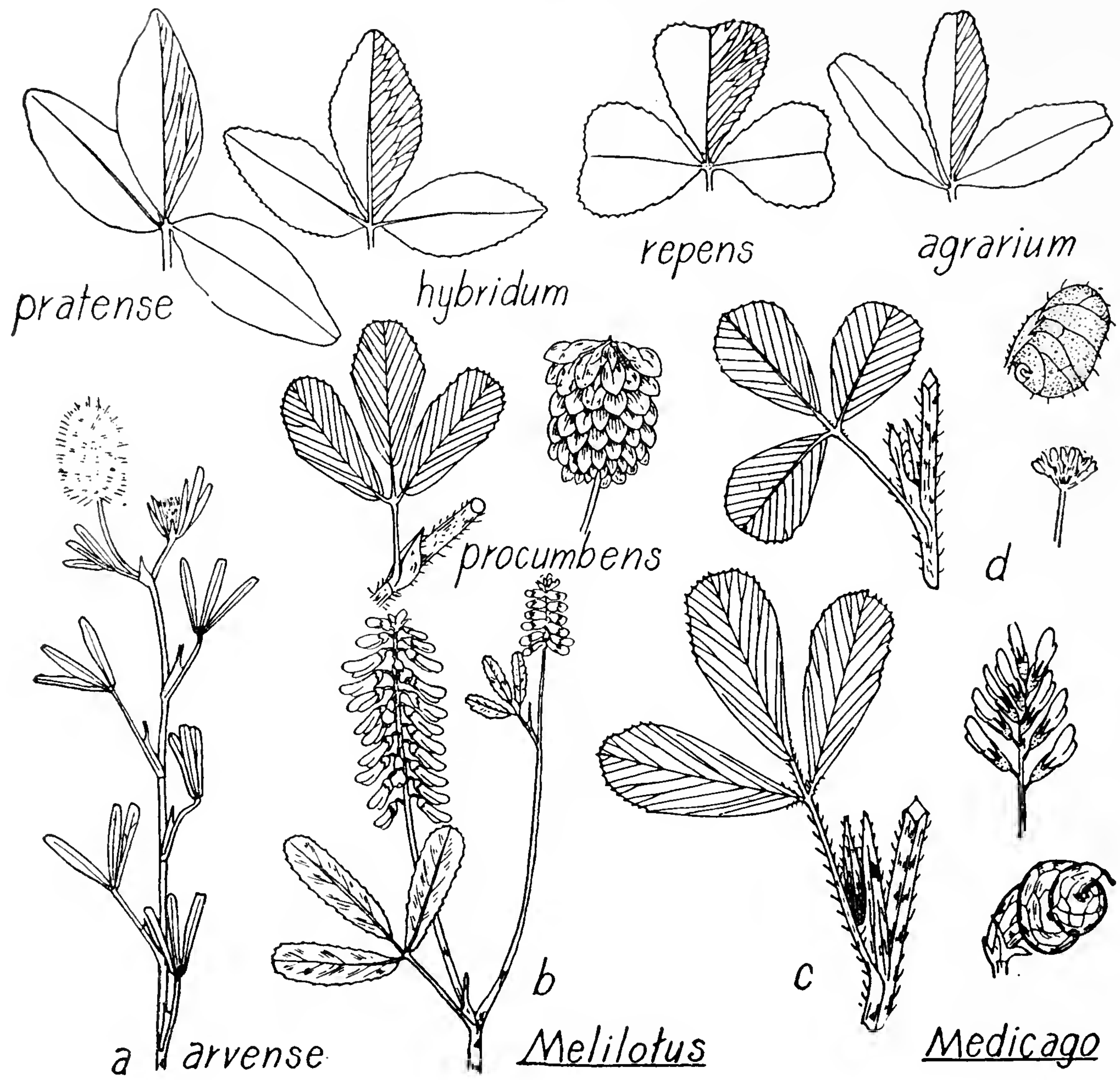


Fig. 75.—**Trifolium.** a, leaves and flowering-heads of various species, x ½. **Melilotus.** b, **M. alba,** top of plant, x ½. **Medicago.** c, **M. sativa,** leaf, flowers and fruit, x 1. d,**M. lupulina,** leaf,and flowers, x 1; fruit, x 4.

2. **M. lupulina** L. BLACK MEDICK. Fig. 75, d.

Common throughout; especially in the Annapolis Valley where it is found along roadsides, in lawns, waste places and occasionally in cultivated fields. This plant is easily confused with the clovers but the teeth of its leaves are not bristly and the stalks of the leaflets are pubescent instead of glabrous. June-Aug.

Native of Eu.; widely introduced.

7. ROBINIA L.

a. Branchlets, petioles and flowers smooth; flowers white. 1. *R. Pseudo-Acacia*

a. Branchlets, petioles and flowers glandular-pubescent; flowers pinkish. 2. *R. viscosa*

1. **R. Pseudo-Acacia** L. BLACK LOCUST. Fig. 74, f.

Occasionally planted as an ornamental tree; rarely found as an escape, but sometimes occurring along roadsides or on hillsides where it has spread out from the original trees. Rarely fruiting in the province. June.

Introduced; native from Penn. to Ind. south to Ga. & Okla.

2. **R. viscosa** Vent. CLAMMY LOCUST.

Common along roadsides, growing in large clumps or thickets, often like a weed in the Annapolis Valley; scattered elsewhere. June.

Introduced; native in the mts. of Va. to Ga.

8. OXYTROPIS DC.

1. **O. johannensis** Fern., Rhodora **30**: 143. 1928.

Abundant at the northeast end of St. Paul Island, C. B. (Perry, 1931). It was reported from the same island in Macoun's Catalog as *O. arctica* as being collected by McKay.

Western Nfld., eastern Que. south to northern Me. and the St. John Valley in N. B.

9. DESMODIUM Desv.

a. Leaflets 3, ovate and pointed; leaves clustered at the top of the stem; raceme terminal and long-stalked. 1. *D. acuminatum*

a. Leaflets 3, oblong-lanceolate and obtuse; leaves scattered on the stem; racemes not long-stalked. 2. *D. canadense*

1. **D. acuminatum** (Michx.) DC., see Fassett, Rhodora **38**: 96-97. 1936.

Known only from the edge of beech woods along the Gaspereau R., about two miles above White Rock, Kings Co. Local. July. [*D. grandiflorum* (Walt.) DC.].

N. S. to N. D. south to Fla. & Tex.

2. **D. canadense** (L.) DC. CANADA TICKCLOVER.

Collections of this plant exist from along the river above Truro, where it is either very rare or extinct. Robinson (1902, 1906) reports it from each of the three Pictou rivers. Late July. [*Meibomia canadensis* (L.) Kuntze].

N. S. to Man. south to N. C. & Okla.

10. **VICIA** (Tourn.) L. VETCH

a. Flowers sessile or nearly so in the axils of the upper leaves.
  b. Flowers 1-3 in a place; plants annual; calyx-teeth about equal to the tube in length.
    c. Flowers 2-3 cm long; pods 4-6 cm long, pubescent and pale tawny at maturity. 1. *V. sativa*
    c. Flowers 1-1.8 cm long; pods 3-4 cm long, smooth and black at maturity. 2. *V. angustifolia*
  b. Flowers 2-5, in a nearly sessile raceme; plant perennial; calyx-teeth much shorter than the tube. 3. *V. sepium*
a. Flowers in a one-sided spike or raceme with a well-developed peduncle.
    d. Flowers 1-6, small, 2-4 mm long; pods short, with 2-4 seeds.
      e. Pods hairy, 2-seeded; leaf with 6-8 pairs of leaflets. 4. *V. hirsuta*
      e. Pods smooth, 4-seeded; leaf with 4-6 pairs of leaflets. 5. *V. tetrasperma*
    d. Flowers numerous, much larger and 12-15 mm long; pods with 6-10 seeds.
      f. Flowers narrow, at least 5 times as long as broad; calyx-teeth with thread-like hairy lobes; plant with spreading whitish hairs. 6. *V. villosa*
      f. Flowers about 4 times as long as broad or less; calyx-teeth short, the lower long-triangular; plant with appressed pubescence. 7. *V. Cracca*

1. **V. sativa** L. CULTIVATED VETCH.

Occasional along roadsides and in fields where it has been planted, not persisting.

Naturalized from Eurasia and North Africa; wide spread.

2. **V. angustifolia** L. WILD VETCH. Fig. 76, a.

Common throughout, especially about towns, seashores, dykelands and railroads. It is extremely variable and is often included as a variety of the preceeding species. The following three varieties are reported. The typical variety has leaflets about 5 mm wide and tapering to a pointed tip. Var. **segetalis** (Thuill.) Koch is very common and has leaflets of about the same width but truncate at the apex and with a tiny mucronate tip. Var. **uncinata** (Desv.) Rouy & Foucaud has very narrow, elongate-linear leaflets which are truncate and mucronate at the apex. In extreme forms the leaves may be less than 1 mm wide. This is found around seaports from Nfld. to Me.

Native of Eurasia; widely introduced in eastern N. A.

3. **V. sepium** L. BUSH VETCH.

Very local; reported from a field at Annapolis (Fernald, 1922). Naturalized from Eu.; N. S. to Ont. southward.

4. **V. hirsuta** (L.) S. F. Gray.

Rare, occasionally found about the edge of the dykelands, and to be expected about towns and seaports.

Introduced from Eu.; scattered from N. S. to Fla., occasionally inland.

5. **V. tetrasperma** (L.) Moench. SLENDER VETCH. Fig. 76, e.

Frequent in the Annapolis Valley and often a bad weed in orchards, gardens, strawberry patches and fields; scattered and becoming more common elsewhere. July.

N. S. to Ont. south to Fla.

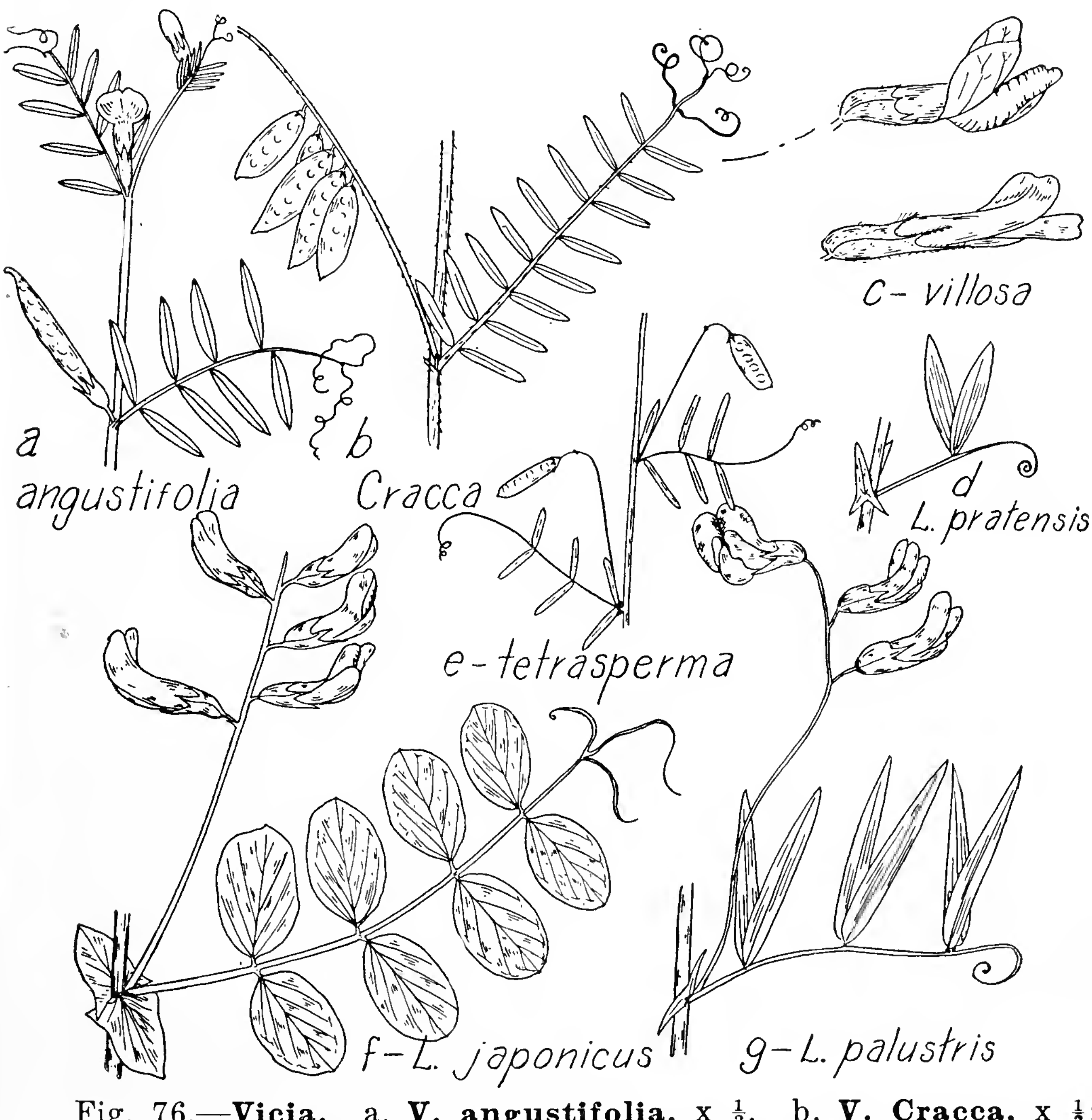


Fig. 76.—**Vicia.** a, **V. angustifolia,** x $\frac{1}{2}$. b, **V. Cracca,** x $\frac{1}{2}$; flower, x 2. c, **V. villosa,** x 2. e, **V. tetrasperma,** x $\frac{1}{2}$. **Lathyrus.** d, **L. pratensis,** showing leaf and stipules, x $\frac{1}{3}$. f, **L. japonicus,** x $\frac{1}{2}$. g, **L. palustris** var. **pilosus,** leaf and flowers, x $\frac{1}{2}$.

6. **V. villosa** Roth. HAIRY OR WINTER VETCH. Fig. 76, c.

Frequently sown, and persisting for a time in open or sandy soil. Occasional throughout Kings Co.; scattered elsewhere. June-Sept.

Native of Eurasia; widely introduced.

7. **V. Cracca** L. TUFTED VETCH. Fig. 76, b.

This is the commonest vetch of the province and is abundant along roadsides throughout; scattered elsewhere in waste places, cultivated ground and about towns. June-Aug.

Nfld. to Minn. southward.

11. **LATHYRUS** (Tourn.)L. PEA

a. Leaves with but a single pair of leaflets above the stipules.
- b. Petiole widely winged; flowers purplish. 1. *L. sylvestris*
- b. Petiole not winged; flowers yellow (Fig. 76, d). 2. *L. pratensis*

a. Leaves with 2-6 pairs of leaflets; plants native, growing near the sea-shore.
- c. Stipules like an arrow-head, with 2 basal lobes; leaflets 8-12, oval; flowers 7-25 on each peduncle (Fig. 76, f).
  - d. Plant glabrous or nearly so. 3. *L. japonicus* var. *galber*
  - d. Plant densely pubescent with fine short erect pubescence. *L. japonicus* var. *pellitus*
- c. Stipules with but one basal lobe (Fig. 76, g).
  - e. Mature leaflets 7-23 mm wide, 2-3.5 times as long as wide.
    - f. Mature leaflets nearly glabrous. 4. *L. palustris*
    - f. Mature leaflets finely pubescent. *L. palustris* var. *macranthus*
  - e. Mature leaflets 3-9 mm wide, 5-15 times as long as broad, finely pubescent. *L. palustris* var. *pilosus*

1. **L. sylvestris** L. EVERLASTING PEA.

Cultivated as an ornamental; occasionally escaping to roadsides; several large perennial clumps have been found at South Berwick. July.

Introduced from Eu.; N. S. to Wisc. south to D. C.

2. **L. pratensis** L. YELLOW VETCHLING.

Rare; found sparingly along the North Shore at the edge of fields or along roadsides where it may be locally abundant; Wallace, Springhill Junction, and near Merigomish. July.

Nfld. to N. Y. & Ont.

3. **L. japonicus** Willd., var. **glaber** (Seringe) Fern, see Fernald, Rhodora: **34**: 177-187. 1932. Fig. 76, f.

Common around the coast, usually growing in company with the following variety; found along the strand line, mostly in light or sandy soil. Occasionally, however, as in northern C. B., it may invade fields or grow along the waste places and streets of towns. July and late June. Nfld. south along the coast to N. J.; inland around the Great Lakes; B. C. to Calif. [L. *maritimus* (L.) Bigel.].

Var. **pellitus** Fern. differs from the last only in its pubescence, and is usually found growing mixed with it. Nfld. to Que. & N. J.; northern N. Y. and found about the top of L. Michigan.

4. **L. palustris** L. WILD PEA. See Fernald, Rhodora **13**: 47-52. 1911. Fig. 76, g.

Damp thickets or edges of marshes near the shore, southwestern N. S. and in C. B. Nfld. to Man. south to N. Y. & Mo.; B. C. & Ore. northwards.

Var. **macranthus** (White) Fern. is found on grassy slopes, headlands or wet areas near the coast; around the province and common on Sable Island. Nfld. to Cape Cod, scattered inland across the continent.

Var. pilosus (Cham.) Ledeb. (Map 289) is common around and on the dykelands, along sea-shores and in sea-side swamps and meadows around the whole coast. June 20-July. Lab. to N. Y. and scattered to the West Coast. Var. *linearifolius* Seringe is similar to this variety except that the leaves are glabrous. This has been found on P. E. I. but is as yet unknown from N. S.

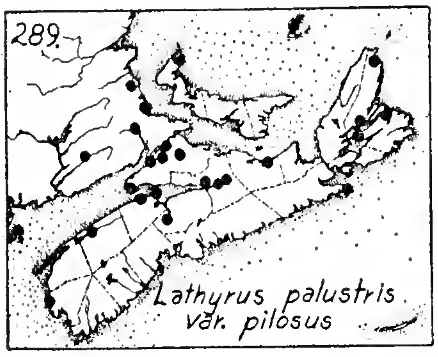
Var. **retusus** Fern. & St. John, Boston Proc. Nat. Hist. **36**: 81-82. 1921, differs from all other varieties in having the leaflets broadest near the tip and tapering to a cuneate base. Known only from Sable Island.

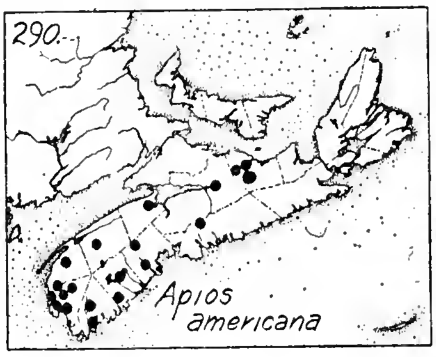
12. **APIOS** (Medik.) Ludwig

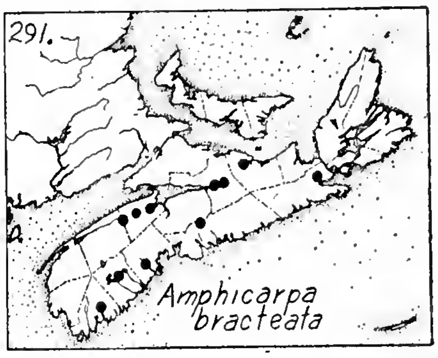
1. **A. americana** Medik. GROUND NUT. Fig. 77, b. Map 290. See Rehder, in Rhodora **36**: 88-90. 1934.

Common in thickets in southwestern N. S.; scattered along rivers in the central district east to Pictou Co. Prest (1905) says that he never saw it east of Halifax, but it occurs in alluvial soil to some extent. Late July. (*A. tuberosa* Moench.).

P. E. I., N. S. to Minn. south to the Gulf of Mexico.







13. AMPHICARPA Ell.

1. **A. bracteata** (L.) Fern., Rhodora **35**: 267. 1933. Fig. 77, a. Map 291.

Moist thickets and river banks, abundant locally from Yarmouth to Pictou and Guysborough Co.; scattered in the Annapolis Valley, and rather common along the intervales of Colchester and Pictou Cos. August. [*A. monoica* (L.) Ell.].

N. S. to N. Dak. south to the Gulf of Mexico.

56. LINACEAE FLAX FAMILY

a. Flower-part in 5's; plants more than 10 cm high; capsules obscurely 10-celled, with 10 seeds; flax. 1. *Linum*

a. Flower-part in 4's; plants about 3 cm high; capsules with 4 nearly 2-celled carpels, each carpel with 4 seeds. 2. *Radiola*

1. LINUM (Tourn.)L. FLAX.

a. Petals blue, 1 cm long or longer; plant 2-6 dm high; leaves 10-30 cm long. 1. *L. usitatissimum*

a. Petals white, 4-8 mm long; plant 8-20 cm high; leaves 4-10 mm long. 2. *L. catharticum*

1. **L. usitatissimum** L. COMMON FLAX.

Formerly planted but not persisting, now rarely seen except where planted or occasionally in waste ground. July-Aug.

Introduced from Eu.; widely distributed.

2. **L. catharticum** L. DWARF FLAX. Fig. 77, c. Map 292.

Scattered on grassy hillsides, roadside banks, or in fields; Cape Breton west to Pictou Co. It has been introduced from Eu.; or it may possibly be native to C. B.

N. S. to Ont.

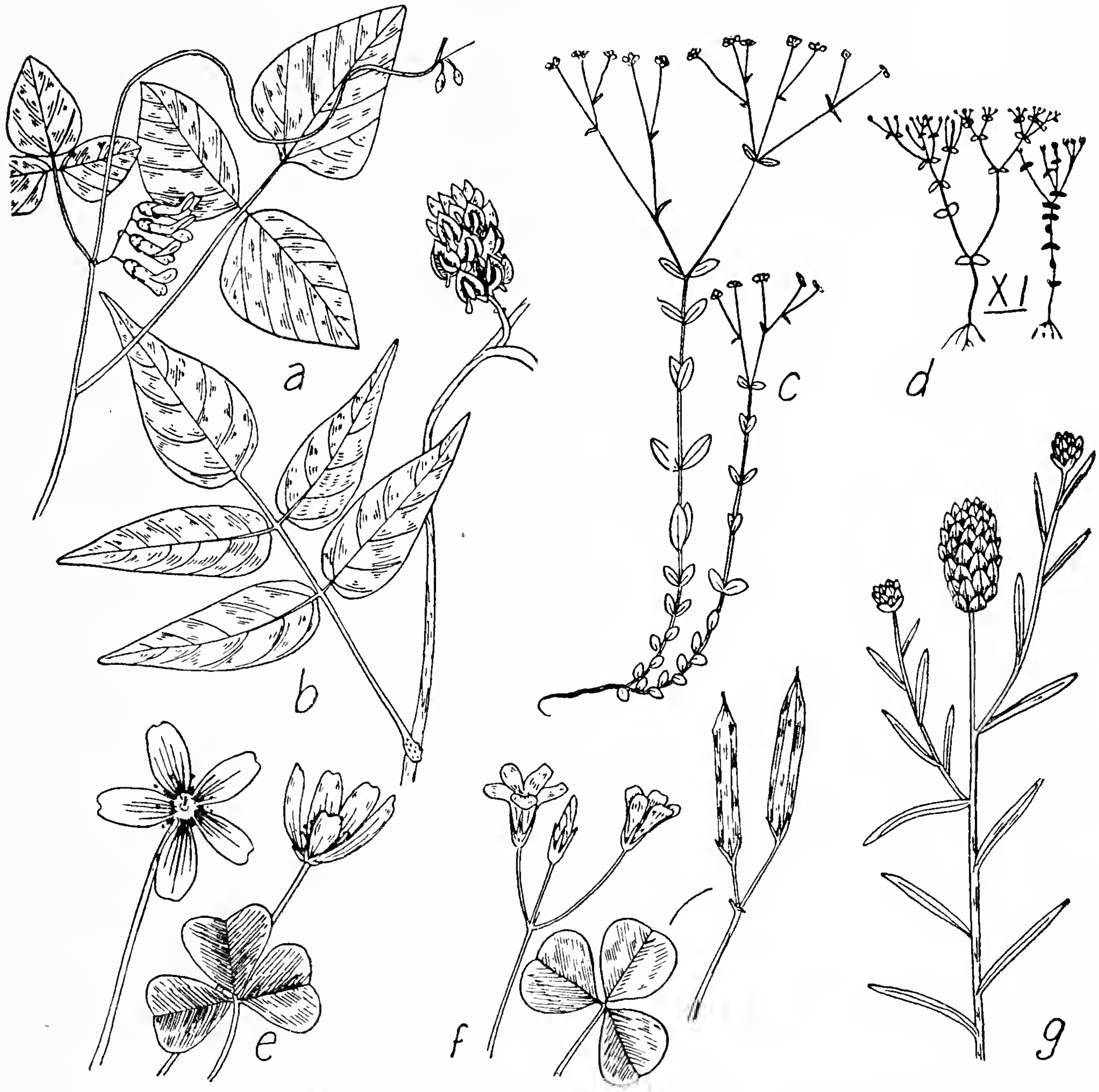


Fig. 77.—**Amphicarpa.** a, **A. bracteata,** x ½. **Apios.** b, **A. americana,** x ¼. **Linum.** c, **L. catharticum,** x ½. **Radiola.** d, **R. linoides,** x 1. **Oxalis.** e, **O. montana,** x ½. f, **O. europea,** leaf and flower, x ½; fruit, x 1. **Polygala.** g, **P. sanguinea,** x ½.

2. **RADIOLA** Roth

1. **R. linoides** Roth. TINY ALL-SEED. Fig. 77, d.

Discovered at Louisburg by John Macoun over 40 years ago; now scattered along the coast as far as Shelburne Co.; abundant along the shore east of Halifax, where it often grows like grass over some of the wet pasture slopes close to the sea. July-Aug. (*Millegrana* Adans.).

Introduced from Eu.; known only in N. S. in America.

57. **OXALIDACEAE** WOOD SORREL FAMILY

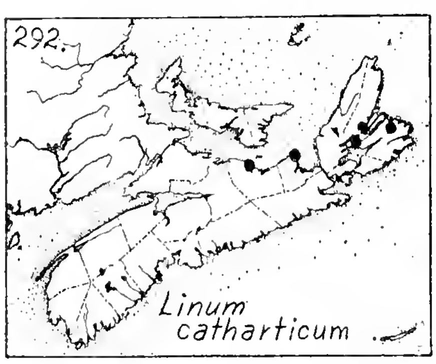
1. **OXALIS** L.

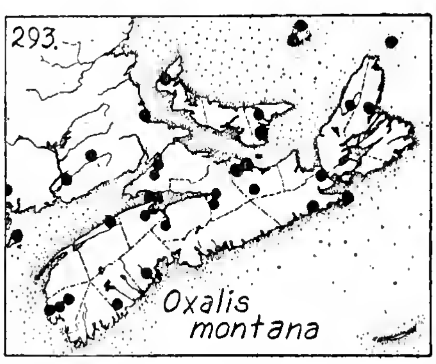
a. Plant stemless; flowers with petals white, veined with rose or purple. 1. *O. montana*
a. Plant with leafy stems; flowers small, yellow.
 b. Flowers umbellate or solitary with the fruiting pedicels usually horizontally deflexed; capsules crisp-hairy, 15-25 mm long; sepals 4-7 mm long; rarely with rootstocks or stolons. 2. *O. stricta*
 b. Flowers cymose; fruiting pedicels spreading or ascending; capsules with scattered spreading hairs or glabrate, 8-12 mm long; sepals 3-5 mm long; plants producing slender horizontal rootstocks or runners. 3. *O. europaea*

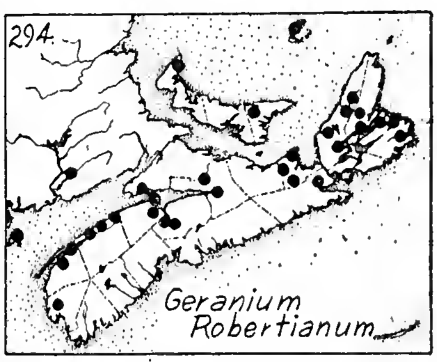
1. **O. montana** Raf., see Rhodora **22**: 143-144. 1920. Fig. 77, e. Map 293. WOOD SORREL.

Common throughout, Damp woods, mossy banks, along ravines or in wooded swamps. Early June-July. (*O. Acetosella* L. of Gray's Man.).

N. S. to Sask. south to N. Y. and N. C.







2. **O. stricta** L.

Two varieties of this species are known northeastward to P. E. I. However, neither one has as yet been definitely found in N. S. although both probably occur.

P. E. I. to B. C. south to Fla. & Mex.

3. **O. europaea** Jord. YELLOW WOOD SORREL. Fig. 77, f.

Common throughout the province; along roadsides, in thickets, waste ground, fields and near dwellings. Numerous varieties and forms have been described on the basis of the pubescence of the stems and pedicels. (See Wiegand, in Rhodora **27**: 113-130: 133-139. 1925). The commonest form in N. S. is forma **villicaulis** Wieg.

N. S. to N. D. south to Ga. & Ariz.

58. GERANIACEAE GERANIUM FAMILY

a. Leaves palmately lobed or divided; anther-bearing stamens 10; tails of the carpels or seeds not bearded. 1. *Geranium*

a. Leaves pinnately and finely divided; anther-bearing stamens 5; tails of the carpels bearded on the inner face. 2. *Erodium*

1. GERANIUM (Tourn.) L.

a. Flowers large, the petals 15-20 mm long, purplish, much exceeding the calyx; plant perennial with thick crowns and stout rhizomes. 1. *G. pratense*

a. Flowers smaller, the petals less than 10 mm long, shorter to slightly exceeding the calyx; plants annual or biennial, with tap roots.

b. Outer sepals 6-10 mm long, with slender awns.

c. Leaves divided, with the terminal division stalked, and all divisions with broad mucronate lobes; beak of the fruit smooth. 2. *G. Robertianum*

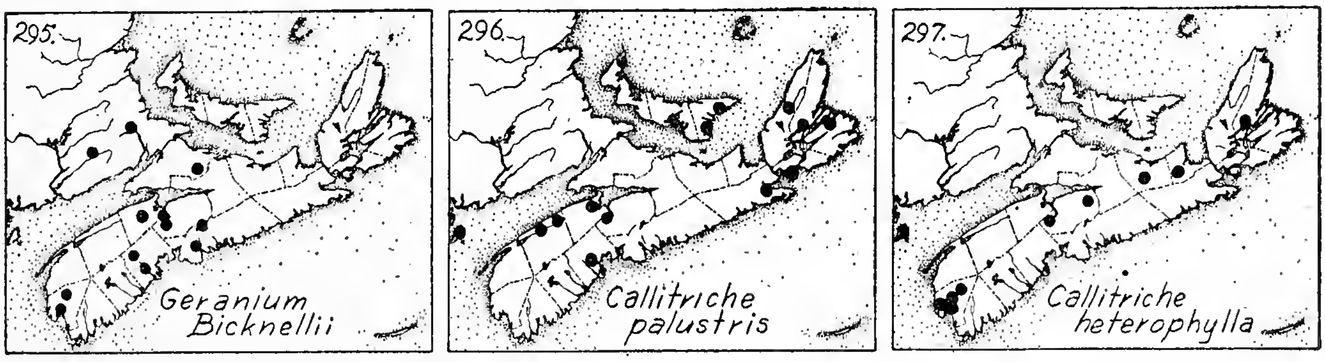
c. Leaves merely cleft, the divisions narrowly divided with acute lobes; beak of the fruit pubescent. 3. *G. Bicknellii*

b. Outer sepals 2.5-4 mm long, awnless; leaves orbicular in outline, mostly less than 3 cm wide. 4. *G. molle*

1. **G. pratense** L. MEADOW GERANIUM. Fig. 78. c.

Often grown as a garden plant, scattered as an escape in various places in the province; Yarmouth, Bridgewater, Wallace, Pictou and Springville. June-Aug.

Introduced from Eurasia; Nfld. to Me., Mass. & N. Y.



2. **G. Robertianum** L. HERB ROBERT. Fig. 78, a. Map 294.

Common from Digby northeastward to northern C. B.; cold ravines, rocky woods, talus slopes, and rich woods. It is growing mostly on rather rich soil or in alkaline areas. It is abundant along the North Mt. in the Annapolis Valley, and in rich hardwoods eastward. June-Sept.

Nfld. to Man. south to Penn.; Eurasia and Africa.

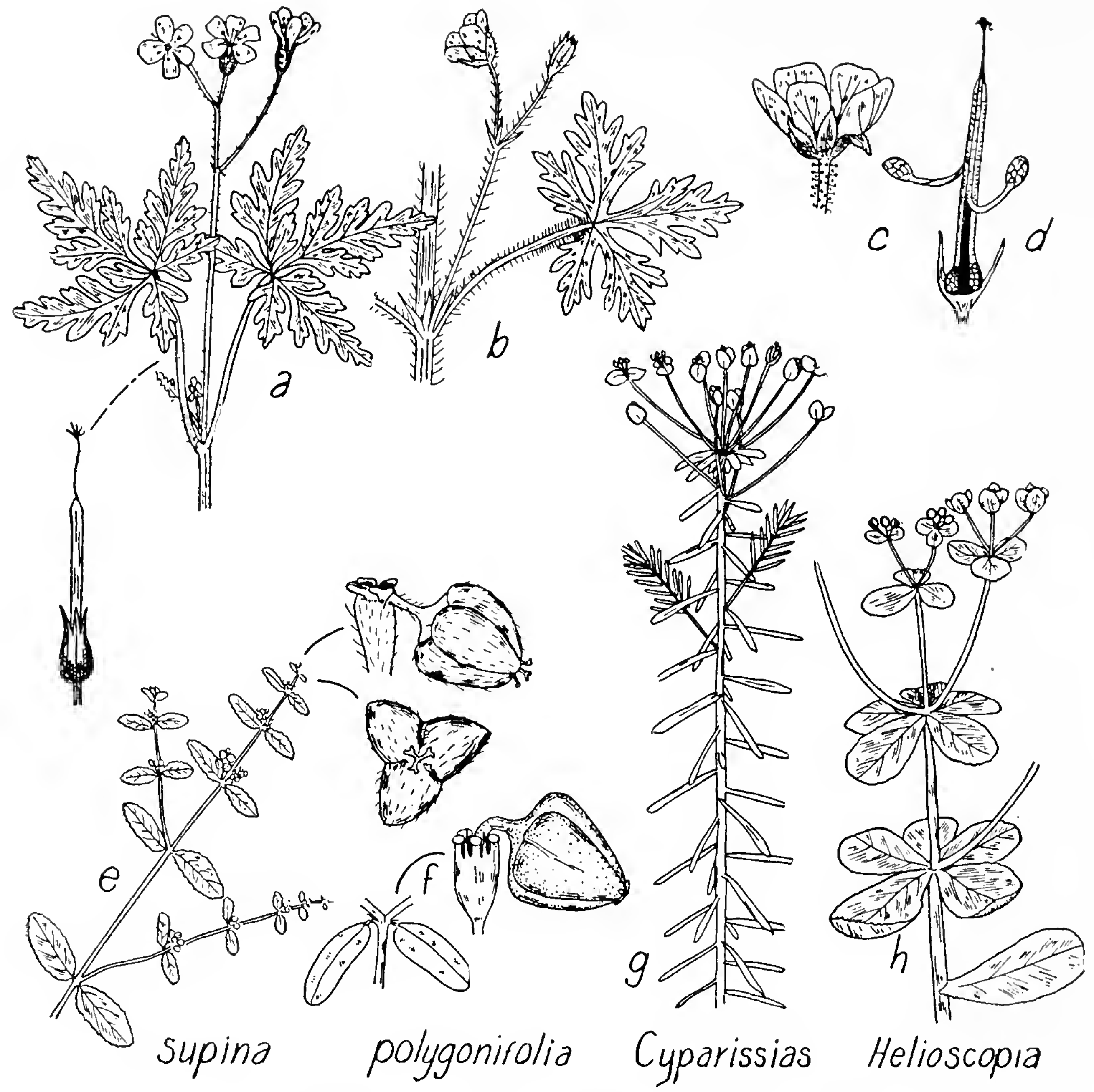


Fig. 78. **Geranium.** a, **G. Robertianum,** x ½; fruit, x ½. b, **G. Bicknellii,** x ½. c, **G. pratense,** flower. d, representative mature flower to show the fruits twisting off. **Euphorbia.** e, **E. supina,** x 1/3; fruits, x 5. f, **E. polygonifolia,** leaves, x ½; fruit, x 5. g, **E. Cyparissias,** x ½. h, **E. Helioscopia,** tip of branch, x ½.

3. **G. Bicknellii** (Britt.) Fern., see Rhodora **44**: 92. 1942. Fig. 78, b. Map 295.

Rather rare, usually found in recently-burnt or cleared areas from Yarmouth east to Halifax and Cumberland Cos. Late June-July.

Nfld. to B. C. south to N. Eng., N. Y. & Utah.

4. **G. molle** L.

The only collection seen from northeastward of Mass. was one from Annapolis, collected by Geo. Morris, July 30, 1902.

Introduced from Eu.; N. S. to B. C. & southward.

2. ERODIUM L'Her.

1. **E. circutarium** L'Her. STORKSBILL.

Centreville, Kings Co., scattered in sandy ground. June-Sept.

N. S. to Ont. south to Texas, often a bad weed.

59. POLYGALACEAE MILKWORT FAMILY

1. POLYGALA (Tourn.) L.

a. Flowers in an erect raceme, short-pedicelled; upper part of the underground rootstocks covered with cleistogamous flowers. 1. *P. polygama*

a. Flowers in a dense globular to broadly oblong head; rootstocks without cleistogamous flowers. 2. *P. sanguinea*

1. **P. polygama** Walt., var. **obtusata** Chodat., see Rhodora **42**: 258-259. 1940. MILKWORT.

Very rare, probably introduced; Halifax and Clementsvale in Annapolis Co.

N. S. to Man. south to Fla. & Tex.

2. **P. sanguinea** L. Fig. 77, g.

Occasional in the northern part of Hants and Cumberland Cos.; poor or acid fields, damp slopes and in open woods or bush.

N. S.; Ont. to Minn. south to N. C. & Kans.

60. EUPHORBIACEAE SPURGE FAMILY

a. Flowers not enclosed in an involucre, with a true calyx; plants large, erect, with thinnish leaves on long petioles.

b. Staminate flowers in a terminal interrupted bractless spike; leaves opposite. 1. *Mercurialis*

b. Staminate and pistillate flowers in the axils of the leaves, usually inclosed in a large palmately-lobed bract; leaves alternate. 2. *Acalypha*

a. Flowers included in a cup-shaped small involucre, the staminate consisting of a single stamen, and the pistillate of a 3-lobed pistil, the whole group often similar to a single flower in appearance (Fig. 78, e-h). 3. *Euphorbia*

1. MERCURIALIS (Tourn.) L.

1. **M. annua** L. HERB MERCURY.

Rare, doubtfully persisting; Pictou, ballast heaps, collected by Macoun, July 23, 1883.

Introduced from Eu.; N. S. to Fla.

2. ACALYPHA L.

1. **A. rhomboidea** Raf., see Weatherby, Rhodora **39**: 14-16. 1937. THREE-SEEDED MERCURY.

Along stones and grass along roadsides, Clearland, Lunenburg Co.; the only collection known for the province.

Abandoned fields, N. S. to Minn. south to Fla. & Kans.

3. EUPHORBIA L. SPURGE.

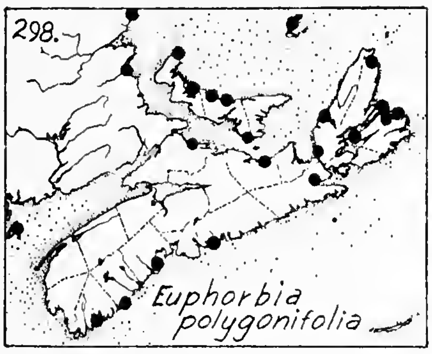
Wheeler, Louis Cutter. *Euphorbia* subgenus *Chamaesyce* in Canada and the United States exclusive of southern California. Rhodora **43**: 97-154; 168-205; 223-286. 1941.

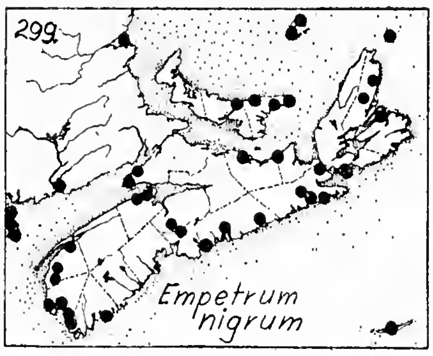
a. Flowers axillary or on short leafy branches; leaves opposite, 6-12 mm long; plants low and prostrate (Fig. 78, e).
  b. Plant glabrous throughout; leaves not toothed, rather thick and shiny; seeds smooth. 1. *E. polygonifolia*
  b. Plant pubescent to long-hairy; leaves smooth to minutely toothed; seeds minutely roughened or wrinkled.
    c. Ovary and capsule hairy with incurved hairs; leaves sub-entire; seeds about 1 mm long, whitish-brown. 2. *E. supina*
    c. Ovary and capsule glabrous; leaves finely toothed; seeds 1.1-1.3 mm long, smooth to slightly wrinkled, grayish-brown. 3. *E. vermiculata*
a. Flowers forming a sort of umbel at the top of the erect stems; lower leaves all alternate, serrate or entire; plants 1-10 dm high.
  d. Plant perennial; leaves entire, linear or nearly so; seeds smooth dark-colored.
    e. Stem-leaves 4-12 mm wide. 4. *E. Esula*
    e. Stem-leaves 1-3 mm wide. 5. *E. Cyparissias*
  d. Plants annual or biennial; leaves ovate to obovate; seeds pitted or reticulated, light to ash-colored.
    f. Leaves finely serrate. 6. *E. Helioscopia*
    f. Leaves entire. 7. *E. Peplus*

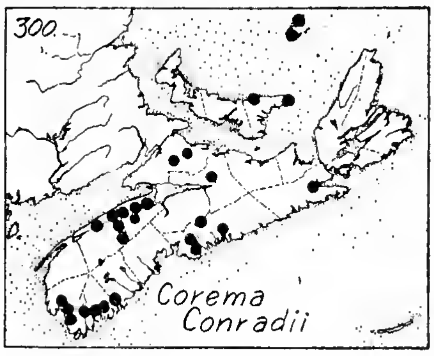
1. **E. polygonifolia** L. SEASIDE SPURGE. Fig. 78, f. Map 298.

Sandy beaches above high tide level, samp dunes and sand flats; on the South Shore from Shelburne to Lunenburg Co.; scattered through C. B. and along Northumberland Strait.

Magdalen Islands south to Ga.; shores of the Great Lakes.







2. **E. supina** Raf., see Rhodora **43**: 254. 1941. CREEPING SPURGE. Fig. 78, e.

Occasionally introduced and spreading; along the Salmon R. above Truro; a weed at Kentville; occasionally elsewhere.

N. S.; Que. & Ont.; general in the eastern States.

3. **E. vermiculata** Raf. HAIRY SPURGE.

Sparingly introduced, and as yet found only around railroad stations: Windsor, Weymouth and North Sydney. Reported as *E. hirsuta* (Torr.) Wiegand.

N. S. to Ont. & Mich. south to Penn.; B. C. to N. M.

4. **E. Esula** L., including *E. virgata* Wald. & Kit.

Collected by H. Groh at Wilmot, June 26, 1928; and at Annapolis on the same date. June-July.

N. S. to Mich. south to N. J.

5. **E. Cyparissias** L. CYPRESS SPURGE. Fig. 78, g.

Scattered as an escape from gardens; often seen around cemetaries, along roadsides and in waste places. Generally the plants do not set seed; but on one farm near West R., Pictou Co., both staminate and pistillate plants were present, and the weed had over-run the fields and was becoming almost impossible to control. June-Aug.

N. S. to Colo. south to Va.; native of Eu.

6. **E. Helioscopia** L. SUN SPURGE. Fig. 78, h.

Waste places and roadsides, occasional throughout, but rarely in any abundance.

Introduced from Eu. and escaped from old gardens.

7. **E. Peplus** L. PETTY SPURGE.

Occasional in towns and waste places as an introduction; collected long ago in the streets of Pictou; collected by H. Groh at Windsor, July 8, 1930.

Native of Eu.; N. S. to Iowa south to Penn.

61. CALLITRICHACEAE WATER-STARWORT FAMILY

1. CALLITRICHE L.

a. Fruit longer than broad, slightly notched, each half with the two lobes sharply keeled or narrowly winged, and separated by a wide groove. 1. *C. palustris*

a. Fruit as broad as long or broader, widely notched, each half with the lobes obtusely keeled and separated by narrow groove. 2. *C. heterophylla*

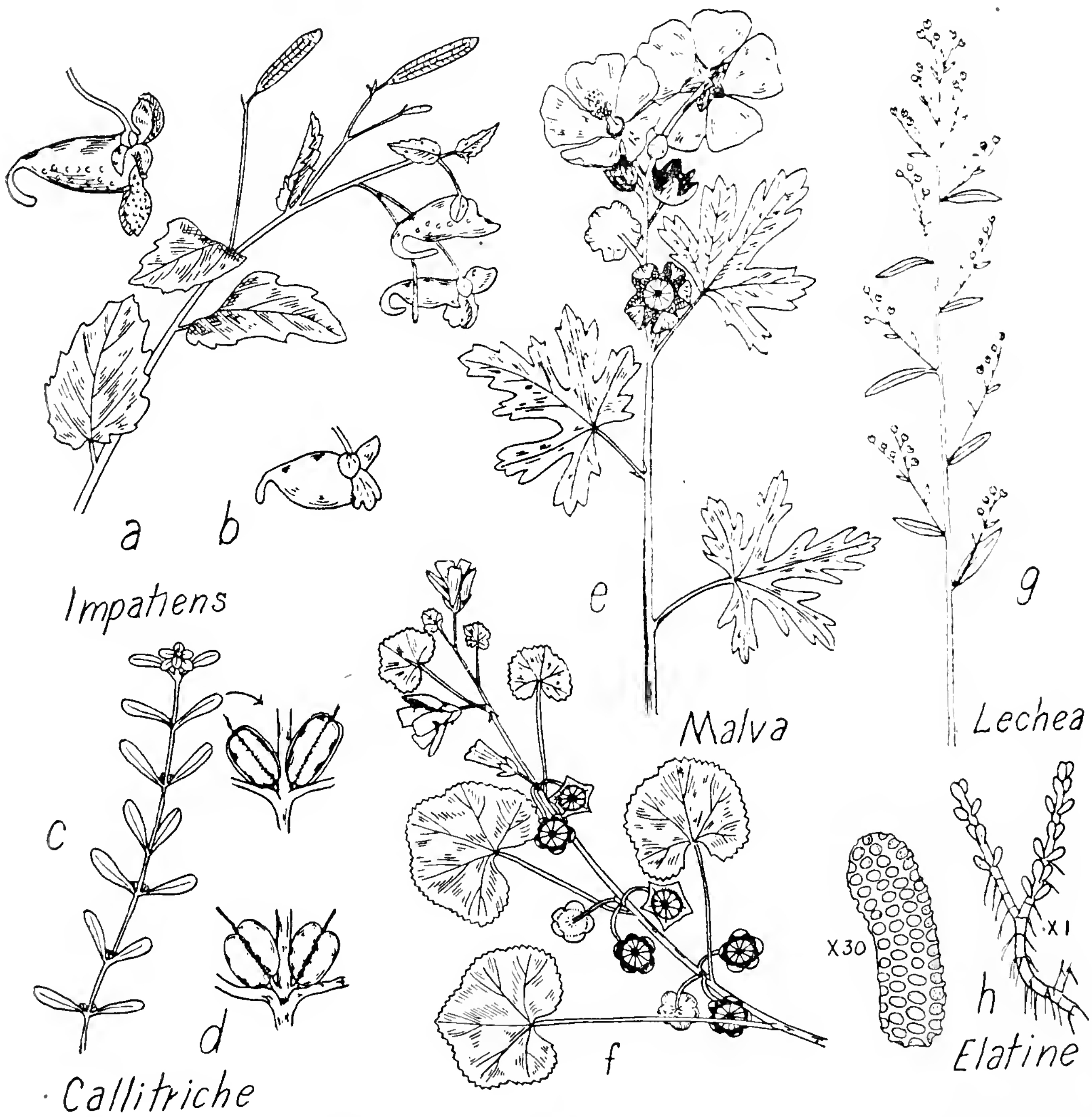


Fig. 79.—**Impatiens.** a, **I. biflora,** x ½. b, **I. pallida,** flower, x ½. **Callitriche.** c, **C. palustris,** x ½. fruits, x 10. d, **C. heterophylla,** fruits, x 10. **Malva.** e, **M. Moschata,** x ¼. f, **M. neglecta,** x ½. **Lechea.** g, **L. intermedia,** x ½. **Elatine.** **E. minima,** plant and seed.

1. **C. palustris** L. Fig. 79, c. Map 296. WATER-STARWORT. Common in ponds, along streams and on wet mud

from Annapolis County and Lunenburg to C. B.; probably absent from most of the acidic regions. Common throughout N.A.; & Eu.

2. **C. heterophylla** Pursh. Fig. 79, d. Map 297.

The only species seen by the Gray Herbarium expedition in the southwestern counties; scattered through the province on habitats similar to the preceeding.

Nfld. to Man. south to Fla. & Colo.

62. EMPETRACEAE. CROWBERRY FAMILY

a. Plants prostrate or extensively trailing; flowerers scattered, solitary in the axils of the leaves; fruit a berry; bogs and seacoasts. 1. *Empetrum*

a. Plants bushy and erect, 1-6 dm high, in extensive mats or clumps; flowers in terminal heads; fruit dry, with 3 nutlets; sandy or rocky barrens. 2. *Corema*

1. EMPETRUM. (Tourn.)L. CROWBERRY

Fernald, M.L. & K.M. Wiegand. The genus *Empetrum* in North America. Rhodora **15**: 211-217. 1913.

a. Branches minutely hairy or smooth; leaves reflexed with age; berries black, about 5 mm thick. 1. *E. nigrum*

a. Branches whitish-woolly; leaves not reflexed with age; berries reddish.

b. Leaves loosely divergent, loosely woolly on the margins, those of the leading shoots with blades 4.5-6.5 mm long; fruit red to tomentose on the margins, 2.5-4 mm long; fruit pinkish or light purplish black, 5-7 mm thick. 2. *E. atropurpureum*

b. Leaves ascending, becoming only slightly divervent, white tomentose on the margins, 2.5-4 mm long; fruit pinkish or light reddish, becoming translucent, 4-5 mm thick. 3. *E. Eamesii*

1. **E. nigrum** L. Fig. 80. Map 299. BLACK CROWBERRY.

Bogs, acid barrens, sea-cliffs and headlands around the whole province; in places in the southern region of acidic rocks it is one of the predominant plants in bogs; inland and northward it is rarer and confined to more exposed locations; characteristic of cliffs along the Bay of Fundy; abundant in northern C. B. and on Sable Is.

Greenland to Alaska south to Me. and to the mts. of N. Eng.

2. **E. atropurpureum** Fern. & Wieg. PURPLE CROWBERRY.

A collection made by Macoun, 1883, from Point Pleasant, Halifax Co., belongs to this species. It is scattered along the North Shore of P.E.I., and grows in mats in the hollows of the sand hills at Bothwell. [E. *nigrum* var. *andinum* (Philippi) DC.].

P.E.I. south to Me. & N.H., and probably of scattered distribution along the coast or on the outer islands.

3. **E. Eamesii** Fern. & Wieg.

Rare, but like the last it may prove to be relatively common along the outer Atlantic Coast. Fernald (1925) reports it from the northeastern tip of the province; and it was collected by Dore on the headlands of Halifax Co.

Common in Nfld. and adjacent Lab.; St. Pierre & Miquelon.

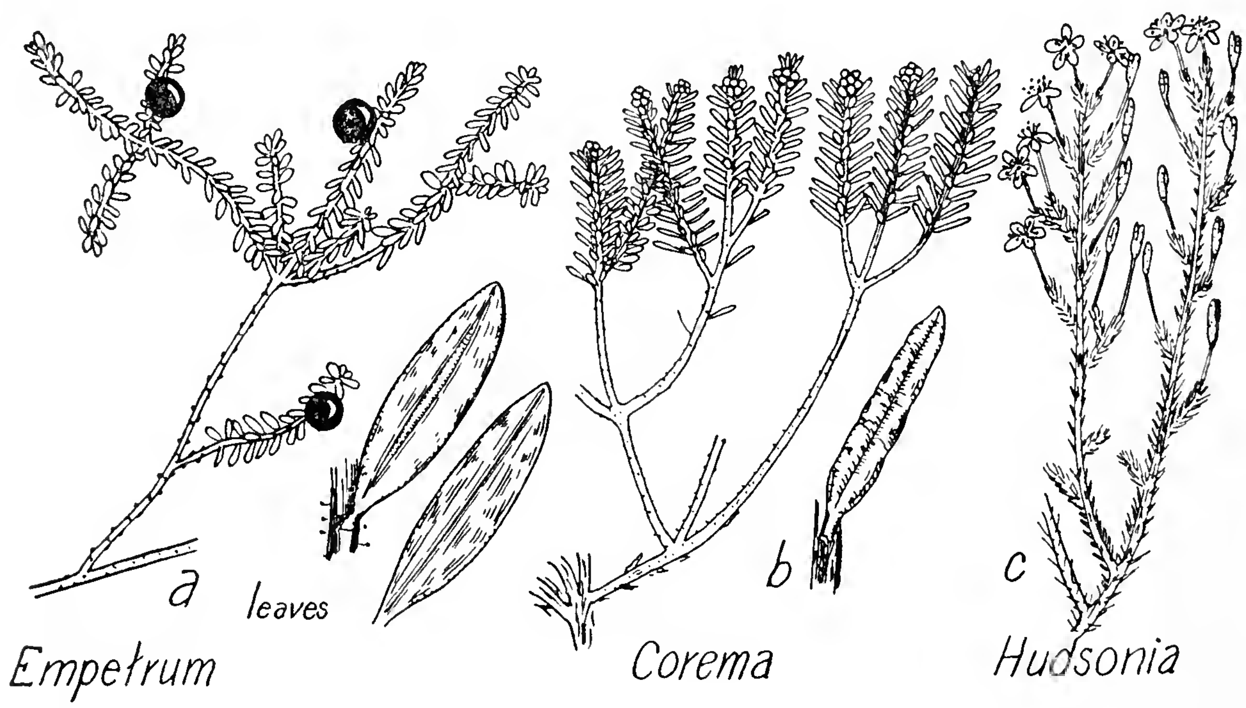


Fig. 80.—**Empetrum.** a, **E. nigrum,** x $\frac{1}{2}$; leaves showing the lower sides, x 5. **Corema.** b, **C. Conradii,** x $\frac{1}{2}$, leaf, x 5. **Hudsonia.** c, **H. ericoides,** x $\frac{1}{2}$.

2. **COREMA** D. Don.

1. **C. Conradii** Torr. Fig. 80. Map 300. BROOM CROWBERRY.

Sandy or rocky soils; scattered in southern Yarmouth and Shelburne Cos.; common on the sand plains of the Annapolis Valley, and in Colchester and Cumberland Cos. on the sandiest soils; on the rocky barrens of Halifax Co., and scattered east to Guysborough.

Nfld. south to N.J. near the coast.

63. ANACARDIACEAE. SUMACH FAMILY

1. RHUS L.

a. Leaves pinnate compound, with numerous leaflets; tall erect shrubs. 1. *R. typhina*

a. Leaves with 3 leaflets; low shrubs, often prostrate.

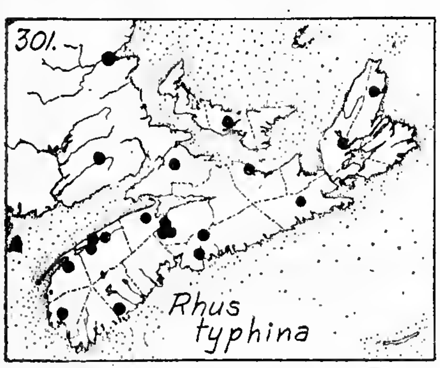
b. Stems strongly woody; plants much branched; erect, trailing or climbing; with aerial roots; leaves alternately scattered along the branches, glabrous. 2. *R. radicans*

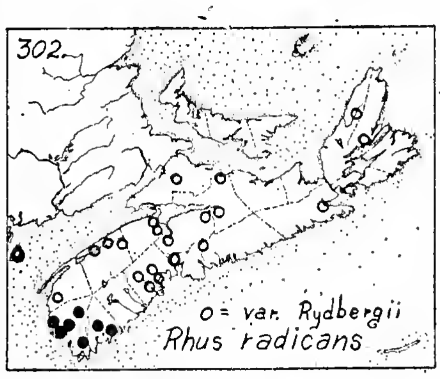
b. Stems woody only near the creeping base; plant simple, or very sparingly branched, without aerial roots; leaves aggregated near the top of the stem, often stiffly hairy on the veins beneath. *R. radicans* var. *Rydbergii*

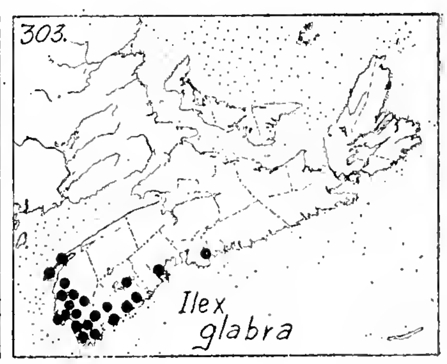
1. **R. typhina** L. Fig. 82, a. Map 301. STAGHORN SUMACH.

Abundant in the southwestern counties, becoming rarer to northern C.B.; edges of woods, in dry or rocky soil, along roadsides, or open areas on hillsides. The pubescence is very variable and may at times be almost lacking [*R. hirta* (L.)Sudworth].

N.S. to S.D. south to Ga. & Miss.







2. **R. radicans** L. Fig. 82, b. Map 302. POISON IVY. See Fernald in Rhodora **43:** 589-599. 1941.

Restricted to the southwestern counties; thickets, open woods, along roadsides or damp areas, scattered and rarely becoming obnoxious. (*R. toxicodendron* of earlier manuals). N.S. and southern Que. to Minn. south to Fla. & Ky.

Var. **Rydbergii** (Small)Rehd. is scattered throughout the province on stony land, rocky woods, wet roadsides, around lakes and in damp shady spots. It is rarely common although specimens are present from most areas. In central N.S. it is seen but once or a few times a year; along the North Shore it is scattered along roadsides; luxuriant on some of the gypsum hillsides near Windsor.

N.S. & Gaspe south to Tex. and west to the West Coast.

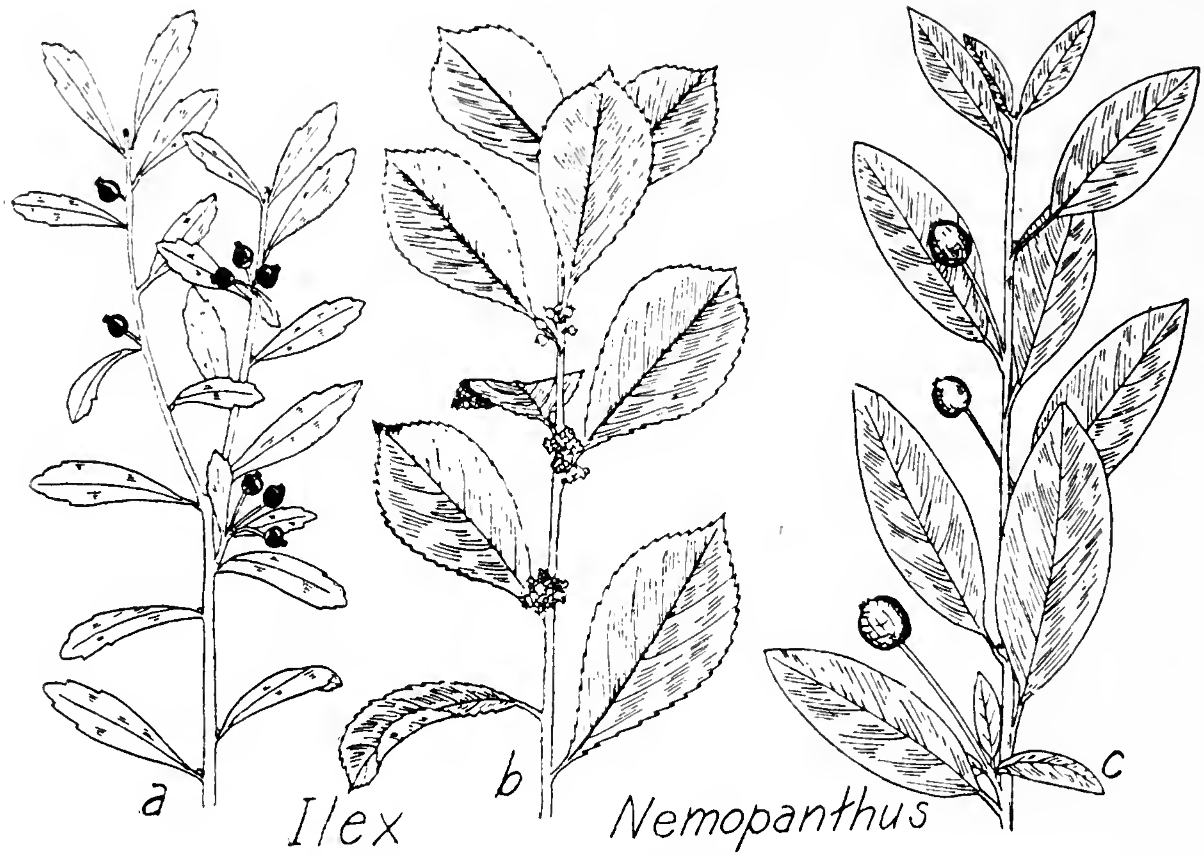


Fig. 81.—**Ilex.** a, **I. glabra,** with young fruits, x ¼. b, **I. verticillata** in flower, x ¼. **Nemopanthus.** c, **N. mucronata,** x 1/3.

64. AQUIFOLIACEAE HOLLY FAMILY

a. Leaves never entire; petals united at the base; pedicels of the fruit less than 1 cm long; flowers mostly in clusters (Fig. 81, a, b). 1. *Ilex*

a. Leaves entire, or rarely with a few teeth; petals not united; pedicels of fruits more than 1 cm long; flowers solitary, or a few together (Fig. 81, c). 2. *Nemopanthus*

1. ILEX L. HOLLY

a. Leaves leathery, bluntly toothed near the end, smooth and shining green, turning black when pressed; fruit black. 1. *I. glabra*

a. Leaves thinner, toothed, dull and veiny; fruit red. 2. *I. verticillata*

1. **I. glabra** (L.)Gray. INKBERRY. Fig. 81, a. Map 303.

Common to local in Digby and Yarmouth Cos., becoming rarer east to Halifax Co.; rocky barrens, swamps, dense spruce woods or dry hillsides. Mid-July.

N. S.; Mass. south to Fla.

2. **I. verticillata** (L.)Gray. BLACK ALDER, CANADA HOLLY. Fig. 81, b.

Common throughout, often fruiting abundantly with the hard red berries persisting after the leaves fall in autumn. Very variable and grading into the following varieties. Var.

tenuifolia (Torr.)S. Wats. is a woodland form with the leaves larger and thinner, obovate, and with the flowers tending to be solitary. Damp woods, Windsor Junction; moist, rocky wooded slope, Tusket; and Deception L., Shelburne Co. (Fernald, 1922). Var. **padifolia** (Willd.) Torr. & Gray has the leaves tomentulose over the whole surface beneath. Wet, boggy thickets near Louis L., Port Joli, Shelburne Co. (Fernald, 1921). Var. **fastigiata** (Bickn.) Fern. has dense ascending branches; leaves mostly oblong-lanceolate and only 2-4 cm long, acuminate and cuneate at the base. Spruce woods, thickets and wet woods, scattered in Yarmouth and Shelburne Cos. (Fernald, 1921, 1922). Mid-July.

Nfld. to Wisc. south to Fla.

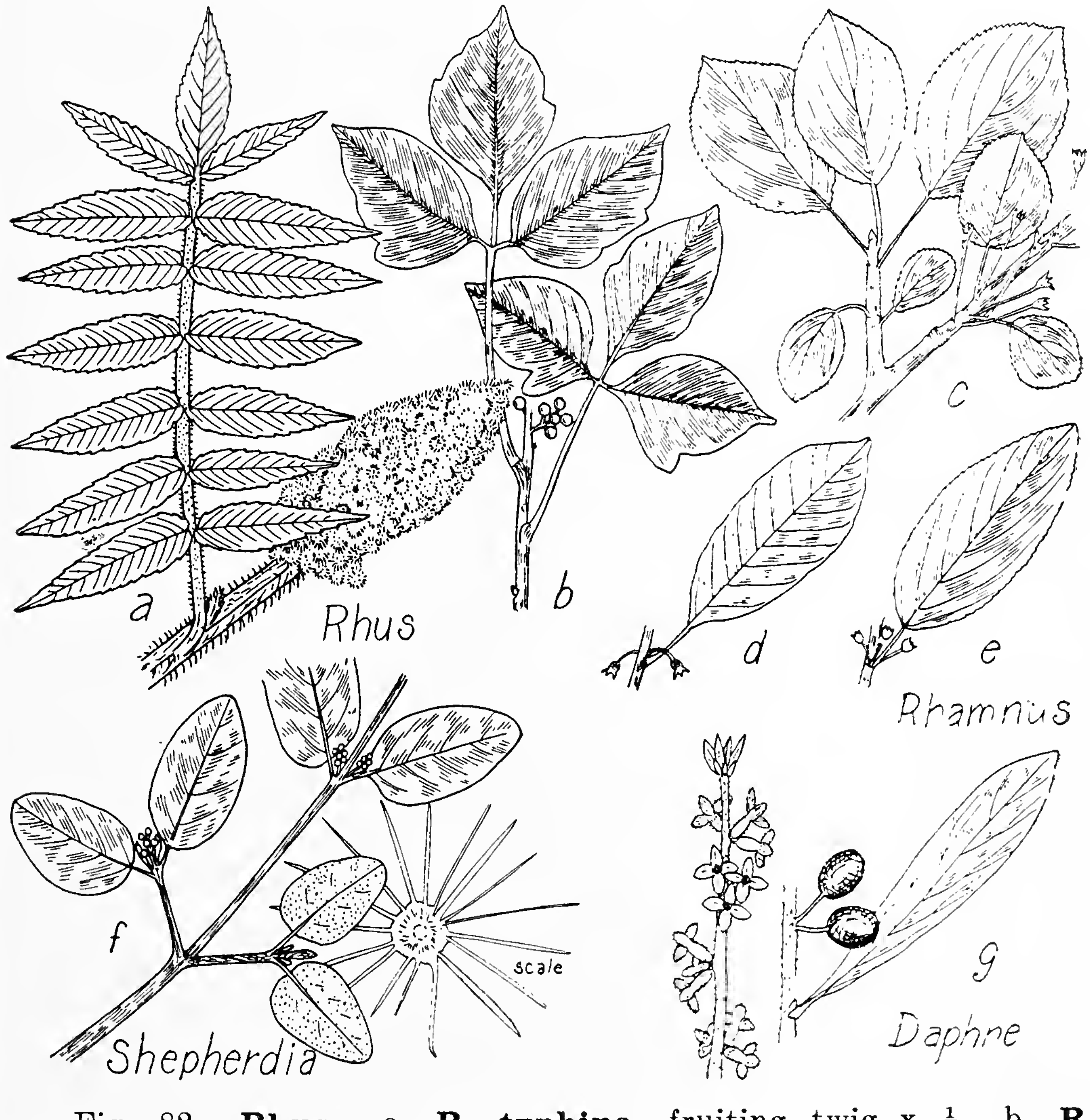


Fig. 82.—**Rhus.** a, **R. typhina,** fruiting twig, x $\frac{1}{4}$. b, **R. radicans,** x $\frac{1}{4}$. **Rhamnus.** c, **R. cathartica,** x $\frac{1}{3}$. d, leaf and flowers of **R. Frangula,** x $\frac{1}{3}$. e, **R. alnifolia,** x $\frac{1}{3}$. **Shepherdia.** f, **S. canadensis,** twig, and leaf-scale much enlarged. **Daphne.** g, **D. Mezereum,** flowering branch, x $\frac{1}{2}$; fruiting twig, x $\frac{1}{2}$.

2. NEMOPANTHUS Raf.

1. **N. mucronata** (L.)Trel. FALSE HOLLY. Fig. 81, c.

Common throughout; wet woods, edges of bogs, and in low barrens, rarely absent in the proper habitat. June 1.

Nfld. south to the mts. of Va. west to Wisc.

65. ACERACEAE MAPLE FAMILY

1. ACER Lindl. MAPLE

a. Leaves pinnately divided; flowers appearing with the leaves, without petals; wings of the fruit stout and incurved, the two halves almost separate. 1. *A. Negundo*

a. Leaves palmately lobed only.

b. Leaf-margins not finely toothed, with large lobes only; flowers before or with the leaves.

c. Flowers drooping on long pedicels, without petals; wings of the fruit scarcely divergent; leaves thinnish with long pointed lobes. 2. *A. saccharum*

c. Flowers erect in a stout corymb, with large petals; wings of the fruit large, widely spreading; leaves thick, dark green, with short lobes. 3. *A. platanoides*

b. Leaf-margins finely toothed.

d. Flowers in dense clusters, appearing before the leaves; leaves whitened beneath firm, not soft hairy; trees.

e. Petals none; fruit woolly when young; leaves closely serrate only on the upper part of the long lobes; wings of fruit wide, incurved. 4. *A. saccharinum*

e. Petals present; fruit smooth, with narrower lobes; leaves evenly serrate around the whole margin. 5. *A. rubrum*

d. Flowers in racemes, appearing after the leaves; leaves green beneath, thin, and soft hairy.

f. Racemes drooping; petals about 5 mm long; leaf finely serrate, almost fringed; bark of young growth striped with white; wings of fruit widely spreading. 6. *A. pensylvanicum*

f. Racemes erect in flower and fruit; petals about 2 mm long; leaf coarsely serrate; bark of young branches reddish, not striped; wings of fruit scarcely spreading. 7. *A. spicatum*

1. **A. Negundo** L. BOX ELDER, MANITOBA MAPLE. Fig. 83.

This rapidly growing tree is frequently planted about towns and along roadsides, often escaping. It is well established above Bridgewater, and is often seen as an escape in the Annapolis Valley.

Introduced from further west.

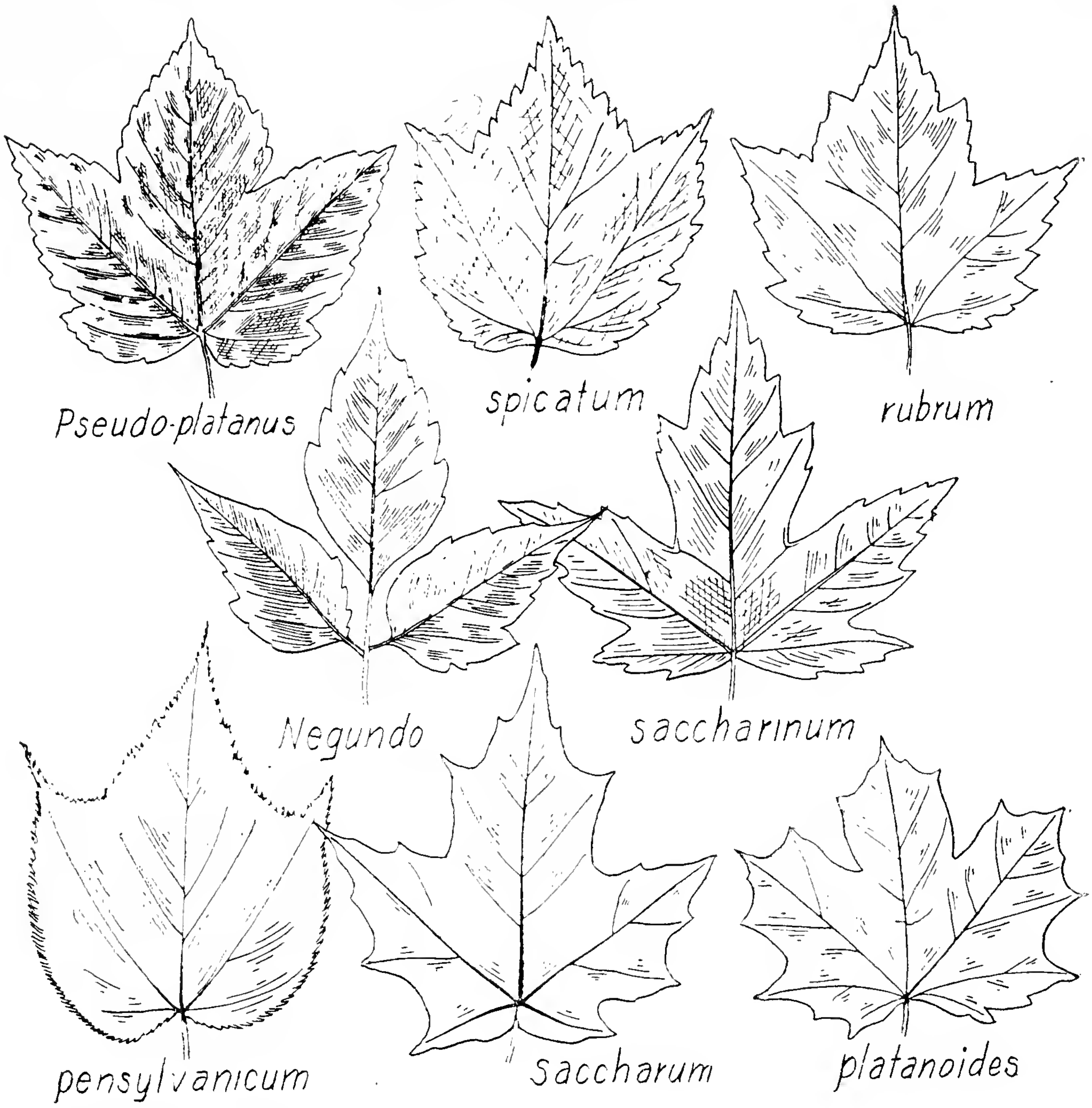


Fig. 83.—**Acer**; leaves, x $\frac{1}{3}$.

2. **A. saccharum** Marsh. SUGAR MAPLE. Fig. 83.

Found throughout; commonest and best developed in well-drained soils and on the slopes of hills in the Cobequids and east to northern C.B. It is also planted extensively as a shade tree. Early May.

Nfld. to Man. south to Fla.

3. **A. platanoides** L. NORWAY MAPLE. Fig. 83.

Often planted as a shade tree or ornamental, occasionally found on roadsides. Forms with reddish leaves, var. **Schwedleri** Nichols., are frequent.

Introduced from Eu.; and widely planted.

4. **A. saccharinum** L. SILVER MAPLE. Fig. 83.

Occasionally planted as a shade tree, but the trees are usually much split and torn by the wind and snow. It is not native to the province and earlier records usually belong to *A. saccharum.* Early May.

N.B. to Dakota south to Fla.

5. **A. rubrum** L. RED OR SWAMP MAPLE. Fig. 83.

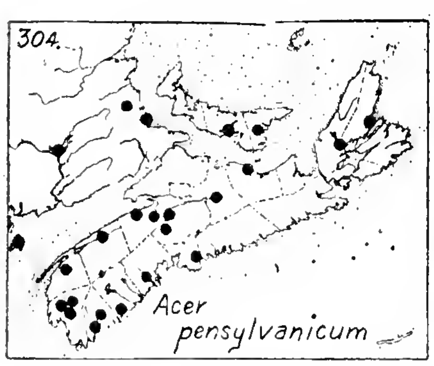
Very common throughout, and becoming increasingly abundant in cut-over areas, burnt land and in barrens. The tree is rather small in general, much branched, and of inferior quality. Var. **tomentosum** (Desv.)K. Koch has the leaves whitish-pubescent or soft tomentose beneath. The maples of the province are very variable in this respect, and show all intermediates between a glabrous and a tomentose condition. Var. **trilobum** K. Koch, (Var. *tridens* Wood), has the leaves rounded at the base and with only three terminal lobes. This is occasional from Yarmouth to northern C.B. along lake margins or wet thickets. In many places, as about Halifax, it grades into the species. Early May or late April.

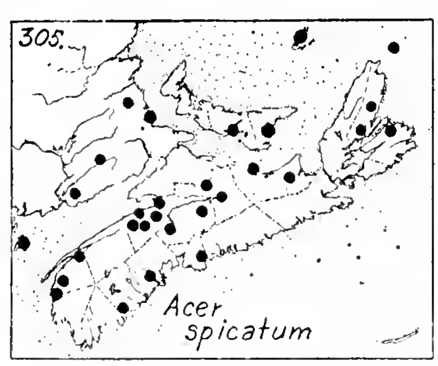
Nfld. to Man. south to Fla.

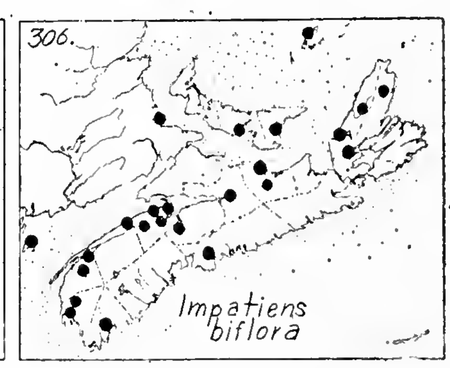
6. **A. pensylvanicum** L. STRIPED MAPLE. Fig. 83. Map 304.

Throughout, rarely abundant; rocky woods, along streams, in rich hardwoods, and wooded slopes. June.

N.S. to Ont. south to the mts. of Ga.







7. **A. spicatum Lam.** MOUNTAIN MAPLE. Fig. 83. Map 305.

Common throughout; characteristic of high banks or near the tops of ravines, along rivers or brooks, wet thickets or moist roadsides, rare in dense woods. It is especially abundant on the highlands of northern C.B. June.

Nfld. to Man. south to Conn. and the mts. of Ga.

66. **BALSAMINACEAE** TOUCH-ME-NOT FAMILY

I. **IMPATIENS** (Riv.)L.

a. Flowers pale yellow, sparingly dotted; sac broader than long; spur short, at right angles to the sac (Fig. 79, b). 1. *I. pallida*

a. Flowers orange, thickly spotted with reddish-brown; sac longer than broad, spur long and strongly incurved (Fig. 79, a). 2. *I. biflora*

1. **I. pallida** Nutt. PALE TOUCH-ME-NOT. Fig. 79, b.

Rich alluvial soil, damp thickets or along river intervales; rather rare from Kings Co. to northern C.B.,becoming more common eastwards.

N.S. west to Sask, south to Ga.

2. **I. biflora** Walt. SPOTTED TOUCH-ME-NOT. Fig. 79, a. Map 306.

Common throughout the northern region from Yarmouth to C.B.; moist open places, wet ground, along brooks and ditches and in wet thickets. It prefers alluvial ground where the organic matter and nitrogen is high and is much commoner than the preceeding species. Numerous color forms have been described, but only occasionally are plants with paler flowers seen. Although the map shows a limited distribution, there seems to be no good reason why this plant has not been collected throughout. July-Aug.

Nfld. to Sask. south to Fla. & Nebr.

67. RHAMNACEAE BUCKTHORN FAMILY

I. RHAMNUS (Tourn.)L.

a. Leaves not toothed, with 7-8 pairs of veins straight nearly to the margins; nutlets smooth. 3. *R. Frangula*

a. Leaves serrate, with 2-5 pairs of veins curving towards the tip; nutlets grooved.

b. Flowers with parts in 4's; petals present; leaves blunt or with a short sharp point, with 2-3 pairs of main veins; introduced. 1. *R. cathartica*

b. Flowers with parts in 5's; petals absent; leaves acute, with 4-5 pairs of main veins. 2. *R. alnifolia*

1. **R. cathartica** L. COMMON BUCKTHORN. Fig. 82, c.

Formerly planted for hedges and as an ornamental shrub throughout the province, now persisting in many places, or locally common as an escape. It is common in many places in the Annapolis Valley and about Pictou. This and the next species are alternate hosts for the crown rust of oats; and leaves of both species are found with abundant infection during June. Late May-June.

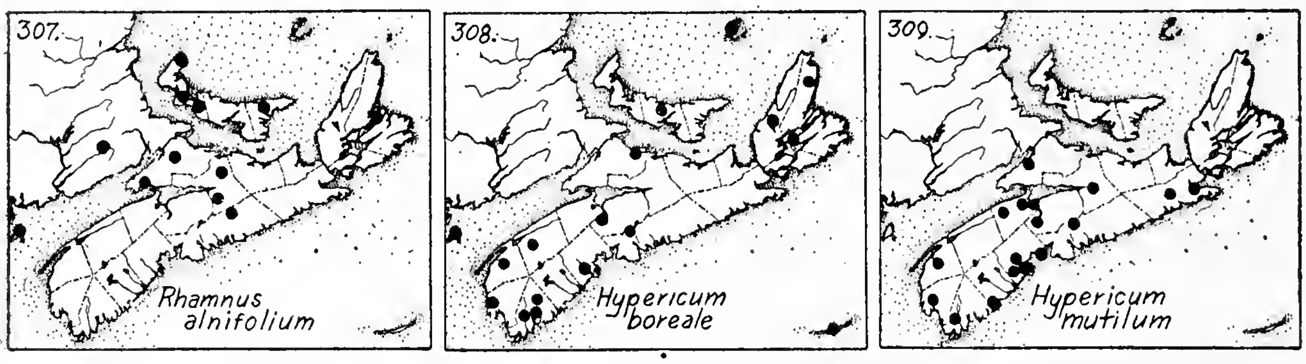
Introduced from Eu.; formerly widely planted.

2. **R. alnifolia** L'Her. ALDER-LEAVED BUCKTHORN. Fig. 82, e. Map 307.

Swampy woods and boggy meadows from Hants Co.

to northern C.B.; on intervales on alluvial soil, or on alkaline soil or near marl. Nichols (1918) says that it is characteristic of poorly-drained swamps in northern C.B. May 15-June.

Nfld. to B.C. south to N.J. & Calif.



3. R. Frangula L. Fig. 82, d.

Scattered shrubs are found about some of the towns, as Wolfville and Truro. South of Amherst it occurs along the roadside and has spread into a pasture where it grows like alder bushes. June.

Introduced from Eu.; locally naturalized.

68. VITACEAE GRAPE FAMILY

I. PARTHENOCISSUS Planch.

a. Tendrils with 5-8 branches, ending in adhesive tips; cymes of flowers mostly forming terminal panicles. 1. *P quinquefolia*

a. Tendrils with 3-5 branches, rarely with an adhesive disk; cymes solitary on peduncles 3-7 cm long. 2. *P. inserta*

1. **P. quinquefolia** (L.)Planch. VIRGINIA CREEPER, BOSTON IVY.

Fernald, Rhodora **41:** 430. 1939, states that all material of the genus from the Maritime Provinces belonged to *P. inserta*(Kern.)K. Fritsch. The introduced form, however, is mostly *P. quinquefolia* and it is very commonly cultivated and found around old houses, and escaping or persisting along roadsides.

N. Eng. to Wisc. south to Fla. & Mex.; introduced.

2. **P. inserta** (Kern.)K. Fritsch, Journ. Arnold Arb. **20:** 419. 1939.

Occasional from Annapolis to Yarmouth, seen along the roadside near the river at Stewiacke, Colchester Co., clambering over low shrubs and stone walls; doubtfully native.

Eastern Can. to Man. south to N.Y., Kans. & Tex.

69. MALVACEAE MALLOW FAMILY

a. Plants 6-12 dm high, stout; leaves heart-shaped and acuminate; calyx without involucral bracts. 1. *Abutilon*
a. Plants 1-8 dm high; leaves lobed, or rounded at the tip; calyx with involucral bracts.
b. Corolla yellow; involucral bracts 6 or more; column of stamens bearing anthers for a considerable part of its length. 2. *Hibiscus*
b. Corolla pink or white; involucral bracts 2 or 3; column of stamens with anthers only at the top. 3. *Malva*

1. ABUTILON (Tourn.)Mill.

1. **A. Theophrasti** Medic. VELVET LEAF.

Rare; collected near Kentville.

Naturalized from India; occasionally seen in eastern Amer.

2. HIBISCUS L.

1. **H. Trionum** L. FLOWER-OF-AN-HOUR.

Occasionally seen as a garden escape or about greenhouses.

Native of southern Eu.; widely introduced.

3. MALVA (Tourn.)L.

a. Flowers sessile or very short-pedicelled in the axils of the leaves; plants erect; leaves shallowly lobed, with angular teeth, often crisped. 1. *M. verticillata*
a. Flowers and fruits long-pedicelled;
b. Stem leaves deeply lobed or cut; petals 6-8 times as long as the calyx; plants erect. 2. *M. moschata*
b. Stem leaves with shallow rounded lobes; petals about twice as long as the calyx; plants prostrate. 3. *M. neglecta*

1. **M. verticillata** L. WHORLED MALLOW.

Waste places or as a weed about towns, rare: Windsor. Various mallows were formerly cultivated as ornamentals and have been reported from the province, but it is questionable whether they exist as escapes.

Adventive from Eu.; N.S. to S.D. south to Penn.

2. **M. moschata** L. MUSK MALLOW. Fig. 79, e.

Common in waste places, roadsides, and old gardens in many parts of the province. In the Annapolis Valley it is often showy along roads or in old hay-fields; rather local. Late June-July.

Native of Eu.; Nfld. to B.C. south to N.J., Va. & Wisc.

3. **M. neglecta** Wallr. DWARF MALLOW, CHEESES. Fig. 79, f.

Becoming a weed in many parts of the Annapolis Valley; scattered elsewhere in towns and waste places. June-Oct. (*M. rotundifolia* in part of most authors). The various species of small-flowered mallows are keyed out in Rhodora **39:** 98-99. 1937. This is the only one observed so far in N.S., although other ones have been seen from neighboring regions.

Introduced from Eu.; widely distributed.

70. HYPERICACEAE ST. JOHN'S WORT FAMILY

1. HYPERICUM (Tourn.)L. ST. JOHN'S WORT.

a. Plant stout, woody at the base, much branched, 4-10 dm high; stamens numerous in 3-5 clusters; weed. 1. *H. perforatum*

a. Plant slender, not woody, 0.5-4, rarely to 5 dm high; native plants of low ground.

b. Leaves with 3-7 strong veins from the base, or narrow and with a mid-rib only; stamens 5-12.

c. Leaves about twice as long as broad, their bases clasping the stem.

d. Upper flowers with reduced but rounded leaves at the base; branches of the inflorescence appearing like continuations of the stem. 2. *H. boreale*

d. Upper flowers with narrow pointed scale-like leaves at their base 3. *H. mutilum*

c. Leaves 3 or more times as long as broad; leaf-bases not clasping the stem.

e. Leaves 1-4 mm wide, 1-3 veined; fruits 3.5-5.5 mm long. 4. *H. canadense*

e. Leaves 2-6 mm wide, 3-5 veined; fruits 2-4 mm long. 5. *H. dissimulatum*

b. Leaves pinnately-veined, with veins coming at intervals from the mid-rib.

f. Petals yellow; leaves less than 1 cm wide; stamens numerous. 6. *H. ellipticum*

f. Petals purplish; leaves 1.5 cm or more in width.

g. Styles on the mature fruit 2-3 mm long; sepals pointed and 5-7 mm long. 7. *H. virginicum*

g. Styles on the mature fruit 0.5-1 mm long, rarely to 2 mm; sepals mostly blunt, 2.5-5 mm long. *H. virginicum* var. *Fraseri*

1. **H. perforatum** L. COMMON ST. JOHN'S WORT. Fig. 84, a.

Scattered throughout the province; abundant in the

Annapolis Valley; mostly on light or sandy soil, on the gravelly borders of rivers, or on well-drained roadsides. July 10-Aug.

Introduced from Eu.; widely naturalized.

2. **H. boreale** (Britt.) Bickn. Map 308. Fig 84, d.

Common throughout and on Sable Is.; low ground, edges of ponds, etc. July-Aug.

Nfld. to Ont. south to Ind. & Va.

3. **H. mutilum** L., var. **parviflorum** (Willd.) Fern., Rhodora **41**: 549. 1939. Map 309. Fig. 84, c.

Common throughout the peninsula, but not collected on C.B. Island; swamps, borders of ponds, river shores, and wet areas. July-Aug.

N. S. to Man. southward.

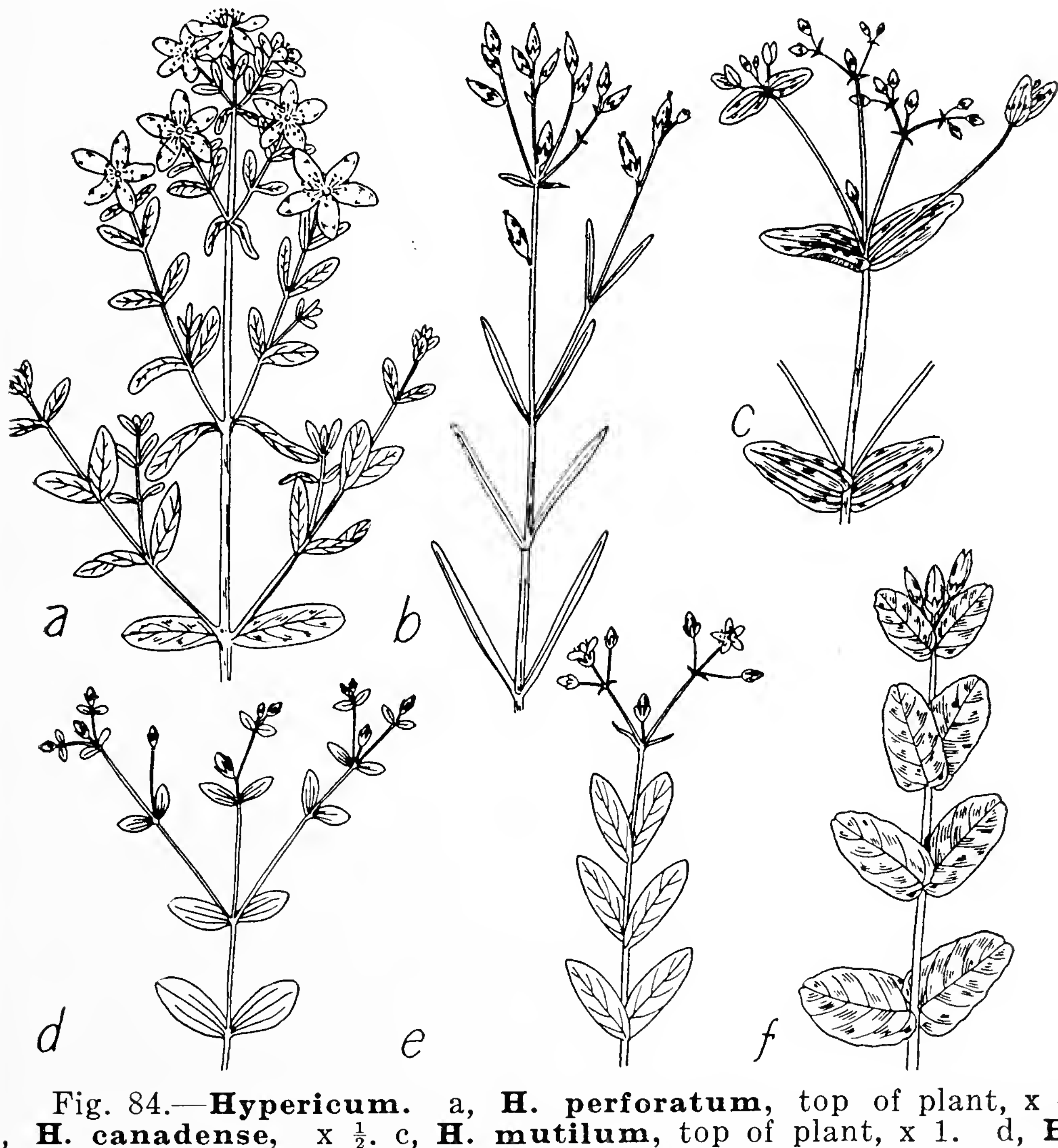


Fig. 84.—**Hypericum.** a, **H. perforatum,** top of plant, x $\frac{1}{3}$. b, **H. canadense,** x $\frac{1}{2}$. c, **H. mutilum,** top of plant, x 1. d, **H. boreale,** x 1. e, **H. ellipticum,** x $\frac{1}{2}$. f, **H. virginicum,** x $\frac{1}{2}$.

4. **H. canadense** L. Map 310. Fig. 84, b.

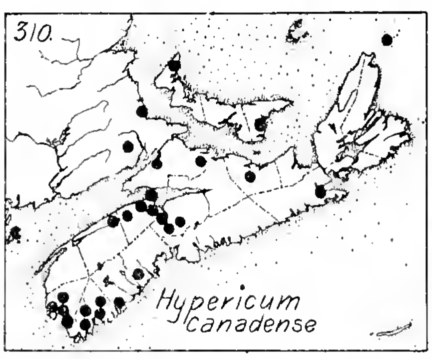
Common throughout in swamps, wet meadows, brook-sides, edges of lakes, etc. Forma *minimum* (Choisy)Rousseau seems to be merely a much-reduced ecological form. July-Aug.

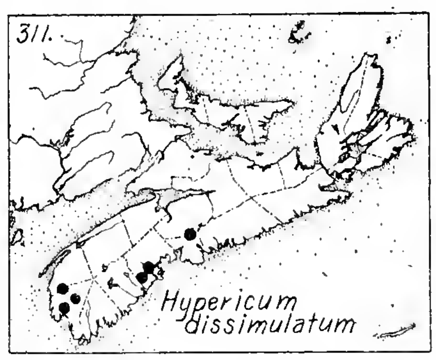
Nfld. to Man. south to Ga. & Wisc.

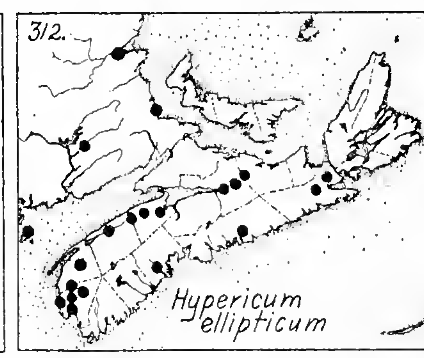
5. **H. dissimulatum** Bickn., Bull. Torrey Bot. Club **40**: 610. 1913. Map 311.

Scattered in swales, wet moss and on lake beaches from Digby around the coast to Halifax Co. It is much rarer than the preceeding species and is closely related to them.

N.S.; Mass. south to N.C. near the coast.







6. **H. ellipticum** Hook. Map 312. Fig. 84, e.

Common in swamps and on borders of streams and lakes. Like several of the preceeding species, it has been little collected in eastern N.S. July-Aug.

N.S. to Man. south to Penn.

7. **H. virginicum** L. Map 313. Fig. 84, f.

Common on muddy shores, boggy margins of lakes, beaches, and low areas; the exact distribution is unknown but it is at least common in the southwestern counties. N.S. to Ind. south to Fla.

Var. **Fraseri** (Spach) Fern., Rhodora **38:** 434. 1936, is more common than the species, and is perhaps the only form present eastward. July-Aug.

Nfld. to Man. south to Penn. & Iowa.

71. ELATINACEAE WATERWORT FAMILY

1. ELATINE L.

Fassett. ELATINE in North America. Rhodora **41:** 367-376. 1939.

a. Seed-coat with pits rounded at the ends, their ends not extending between the ends of pits in adjacent rows; pits scarcely reduced in size towards the ends of the seed; carpels usually 2. 1. *E. minima*

a. Seed-coat with pits 6-sided, angled at their ends, their ends extending between the ends of pits in adjacent rows; pits somewhat narrower and less distinct towards the ends of the seed; carpels 3. 2. *E. triandra*

1. **E. minima** (Nutt.)Fisch. & Meyer. WATERWORT. Map 314. Fig. 79. h.

Shallow water at sandy, muddy or gravelly margins of lakes or rivers: common in Digby, Yarmouth and Shelburne Cos.; scattered east to Lunenburg and Hants Cos. (Fernald, 1921, 1922). It sometimes fruits when only a few mm high.

Nfld. to Minn. south to Dela.

2. **E. triandra** Schkuhr. var. **americana** (Pursh)Fassett

Not yet collected in N.S.; found on various muddy tidal shores in the southeastern part of N.B. to Que. & N.Y.;Mo.

72. CISTACEAE ROCKROSE FAMILY.

a. Plants herbaceous; leaves 10-30 mm long, spreading.
 b. Petals 5, showy, yellow; primary capsules about 6 mm long with smaller secondary ones present; pubescence stellate. 1. *Helianthemum.*
 b. Petals 3, minute, purplish; capsule about 2 mm long; pubescence of simple hairs. 3. *Lechea.*
a. Plants shrubby, low; leaves 1-3 mm long, awl-like, closely overlapping. 2. *Hudsonia*

1. HELIANTHEMUM (Tourn.)Mill.

1. **H. canadense** (L.) Michx. ROCKROSE.

Rare and local; in small numbers on the sand plains between Aylesford and Middleton; reported by Weatherby (1942) from Queens Co.: a large colony on the border of dry mixed woods, Greenfield, associated with *Aster undulatus.* June 15.

N. S. to Wisc. south to N.C.

2. HUDSONIA L.

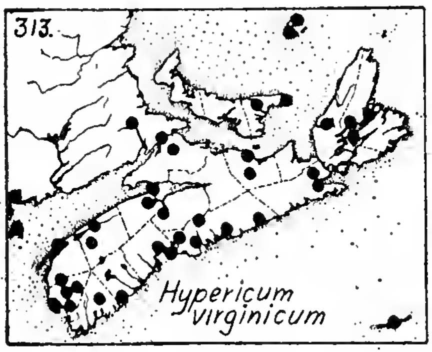
a. Flowers on slender naked pedicels; leaves awl-like, spreading to loosely appressed; plants greenish. 1. *H. ericoides*
a. Flowers nearly sessile; leaves small, densely appressed; plant densely whitish-pubescent. 2. *H. tomentosa*

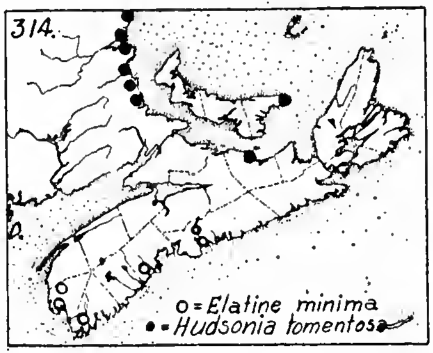
1. **H. ericoides** L. HUDSONIA. Map 315. Fig. 80, c.

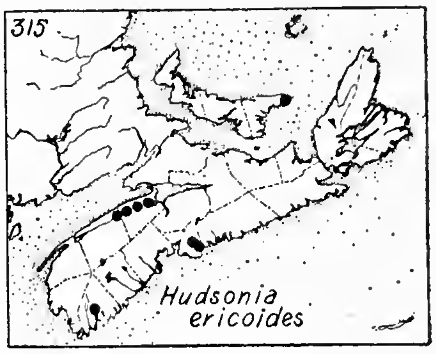
Dry, rocky and sandy barrens about Shelburne;

scattered on rocky soil near Halifax; abundant on the sandy soils of the Annapolis Valley on recently disturbed areas, often invading cultivated land, orchards, and becoming abundant in plowed areas reverting to native vegetation. Early June.

Nfld. to Va.







2. **H. tomentosa** Nutt. WOOLLY HUDSONIA. Map 314.

King's Head, Pictou; reported in Lindsay's Catalog from North West Arm, Halifax. This last record probably refers to the previous species. This plant is found along the sand dunes about the Gulf of St. Lawrence and south to N.C. west to the Mackenzie and Wisc.

3. LECHEA (Kalm)L.

Hodgdon, A.R. A taxonomic study of *Lechea*. Rhodora **40**: 29-69; 87-131. 1938.

a. Inner sepals broader and more obtuse, equal to or shorter than the depressed-globose capsule; basal leaves darker green, decidedly oblong, often purplish. 1. *L. intermedia*

a. Inner sepals narrowly ovate and acute to subacute, exceeding the globose capsule; basal leaves bright-green, narrowly lanceolate. *L. intermedia* var. *juniperina*

1. **L. intermedia** Leggett PINWEED. Fig. 79, g.

Common in dry open soils, open woods and sterile fields, in rocky, siliceous or sandy regions of the province. In the northern part of the province and around the sea-coast it is largely replaced by the following very similar variety. P. E. I. and N. S. to Minn. south to Va.

Var. **juniperina** (Bickn.)Robinson intergrades with the species. It is found mostly around the coast from Halifax to northern C.B., where it becomes common in the lea of the dunes and back of the sandy beaches. C.B. to southern N.H., mostly along the coast.

73. VIOLACEAE VIOLET FAMILY

1. VIOLA (Tourn.)L.

a. Plants stemless; leaves and flowers-stalks directly from the rootstocks or from runners (Fig. 85).
b. Rootstock short and stout, 3-10 mm thick; flowers blue.
c. Leaves heart-shaped, with the margins rounded-toothed.
d. Beard of the lateral petals, or part of it, with strongly club-shaped hairs; flowers usually on peduncles longer than the leaves; spurred petal shorter than the lateral ones, glabrous. 1. *V. cucullata*
d. Beard of the lateral petals long, not club-shaped; flowers on peduncles usually equalling or shorter than the leaves; spurred petal as long as the lateral, glabrous or hairy.
e. Plant essentially glabrous. 2. *V. nephrophylla*
e. Plant hairy, with the sepals ciliate. 3. *V. septentrionalis*
c. Leaves ovate or widely lanceolate. 4. *V. sagittata*
b. Rootstocks slender, 2-4 mm thick near the top, often long and creeping.
f. Style scarcely enlarged above, hooked; flowers large, fragrant, blue or whitish; gardens. 5. *V. odorata*
f. Style enlarged above and beaked at the summit in front; flowers comparatively small.
g. Flowers light-blue; spur two-thirds as long as the limb of the petal; sinus of the leaf very deep, the lobes overlapping; leaf with short stiff hairs above. 6. *V. Selkirkii*
g. Flowers white; spur one-quarter as long as the limb; leaves with the basal sinus shallower, the lobes not overlapping.
h. Leaves widely heart-shaped or narrower, usually pointed at the tip, generally dull, relatively small.
i. Leaves glabrous on both sides; cleistogamous capsules green, on erect peduncles; flowers on peduncles usually longer than the leaves.
j. Leaves lanceolate or linear-lanceolate. 7. *V. lanceolata*
j. Leaves ovate, acute at the tip with a squarish or tapering base. 8. *V. primulifolia*
j. Leaves heart-shaped, small. 9. *V. pallens*
i. Leaves pubescent on one side; peduncles longer than the leaves; cleistogamous capsules ovoid, usually purplish, erect only when ripe.
k. Leaves pubescent beneath and on the petioles. 10. *V. incognita*
k. Leaves pubescent above, glabrous beneath and on the petioles. *V. incognita* var. *Forbesii*
h. Leaves orbicular to reniform, large, usually rounded at the tip, waxy-glossy; lateral petals beardless.
l. Leaves pubescent on both sides. 11. *V. renifolia*

l. Leaves glabrous above, pubescent beneath. *V. renifolia* var. *Brainerdii*

a. Plant leafy-stemmed, with axillary flowers (Fig. 86).
m. Flowers violet-like; stipules entire or finely toothed.
n. Style capitate, beakless, bearded at the summit; spur short; stipules nearly or quite entire; plants large.
o. Petals yellow; stipules narrowly ovate; capsule 9-13 mm long, glabrous. 12. *V. pensylvanica*
o. Petals white within, violet without; stipules lanceolate, white, scarious; capsule 4-6 mm long, downy or puberulent. 13. *V. canadensis*
n. Style slender, the tip bent downwards, slightly pubescent at the summit; spur twice or more as long as wide; stipules slightly toothed; petals blue.
p. Stipules ovate-lanceolate, bristly serrate; leaves often 4-5 cm wide. 14. *V. conspersa*
p. Stipules linear with a tooth or two at the base; leaves not more than 2 cm wide. 15. *V. labradorica*
m. Flowers pansy-like; stipules large, leaf-like, and pinnatifid; style much enlarged above into a round hollow summit with a wide opening on the lower side.
q. Petals seldom longer than the sepals; flowers small and pale yellow. 16. *V. arvensis*
q. Petals 2-3 times longer than the sepals; flowers large. 17. *V. tricolor*

1. **V. cucullata** Ait. BLUE VIOLET. Fig. 85.

Common throughout in wet fields, swamps, rocky beaches and meadows. May-June. N. S. to Ont. south to Ga.

Forma **prionosepala** (Greene) Brainerd, Rhodora **15:** 112. 1913, has the leaves more hairy, and the margins of the sepals often interruptedly serrate and ciliate. It is commoner than the glabrous form, in similar situations.

Var. **microtitis** Brainerd, Rhodora **15**: 112-116, 1913, has the auricles of the sepals 1-2 mm long, much shorter than the above two varieties. Rare; reported from mixed woods at Hectanooga, Digby Co., and from wet thickets at Yarmouth (Fernald, 1921).

2. **V. nephrophylla** Greene. Map 317. Fig. 85.

Cold mossy bogs, borders of streams, damp woods; rare in the eastern regions of N.S.

Nfld. south to Conn. and west to the Rockies.

3. **V. septentrionalis** Greene. Map 316.

Common throughout; open woods, often under conifers, along roadsides and on light soils, one of the earliest of the blue violets to flower.

N. S. & P. E. I. to Ont. south to Penn.

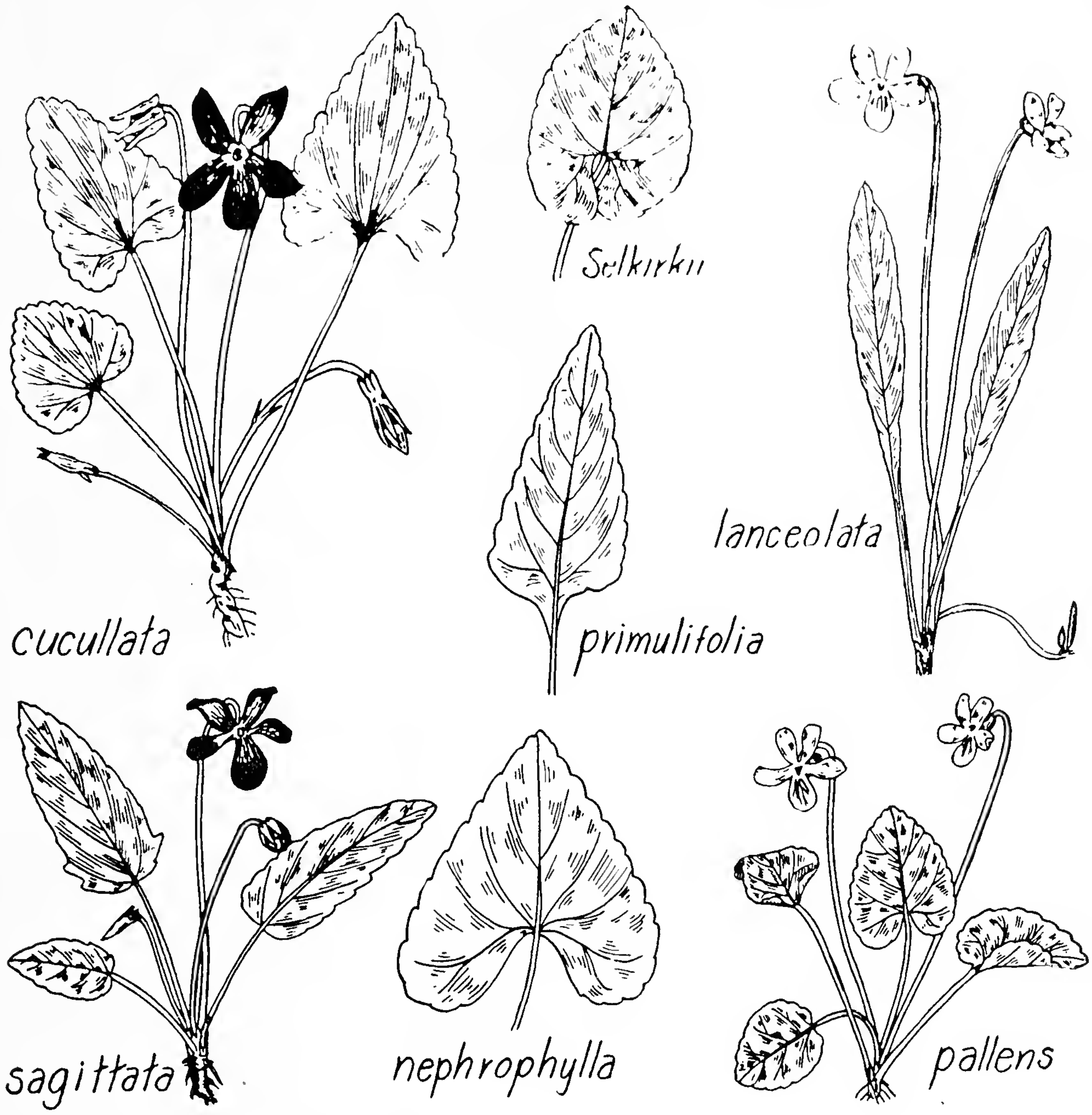


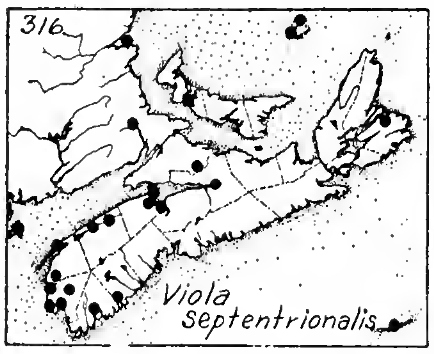
Fig. 85.—**Viola,** all x ½.

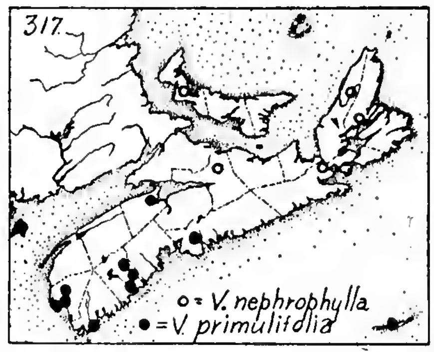
4. **V. sagittata** Ait., var **ovata** (Nutt.) Torr. & Gray. Map 321. Fig. 85.

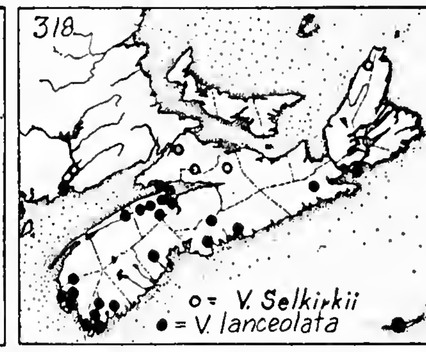
Common on open soil from Yarmouth to Halifax and Kings Co., not collected eastward. (*V. fimbriatula* Sm.). On some of the dry hillsides of the Annapolis Valley, and particularly on the south slope of the ridge above Wolfville occurs a form with deeply toothed leaves and early flowering season. The shape of the leaves shows a tendency towards *V. sagittata*, but it does not have the smoother leaves of that species. Specimens collected at Point Pleasant Park, Halifax, likewise seem to be a variation of this variety. Var. *ovata* often hybridizes with *V. septentrionalis*, and the resulting plants are large, with elongated leaves, and ciliate sepals.

This cross is especially abundant in the Annapolis Valley, and on the slopes of Cape Blomidon. Early May to June.

In various forms south to the Gulf of Mexico.







5. **V. odorata** L. ENGLISH OR SWEET VIOLET

Occasionally planted in gardens and persisting for a short time. Introduced from Eu.

6. **V. Selkirkii** Pursh Map 318. Fig. 85.

Characteristic of rich hardwood forests from Kings and Cumberland Cos. to northern C.B.; local, usually occurring in small numbers.

Nfld. to Penn. and Lake Superior northwestward.

7. **V. lanceolata** L. Map 318. LANCE-LEAVED VIOLET Fig. 85.

Common in the western half of the province, becoming rarer eastward. It is found on the edges of pools, around lakes, on mud flats and in boggy places; abundant on Sable Island, and in grassy fields or on headlands around the mainland.

N.S. to Minn. south to the Piedmont.

8. **V. primulifolia** L. Map 317. Fig. 85.

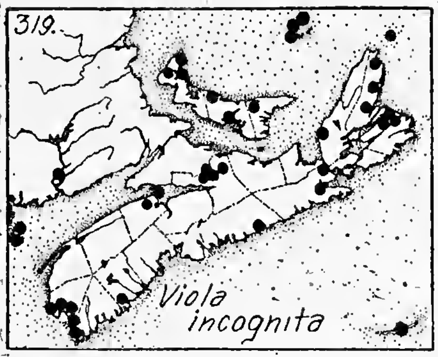
Damp sand, gravel and peat; Yarmouth to Halifax; rare on sandy banks on Sable Is.; plants from wet fields in Kings Co. probably belong here. It is local to rare except in the southwestern counties, where it is found around the lakes or in the river gravels.

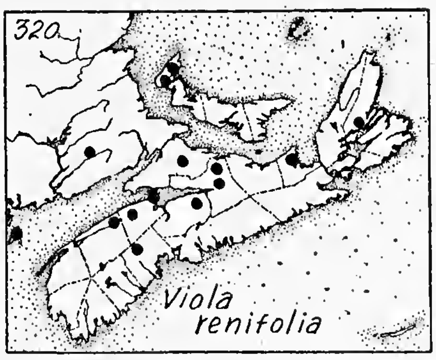
N.S. to Fla. & Tex.; scattered inland to Minn.

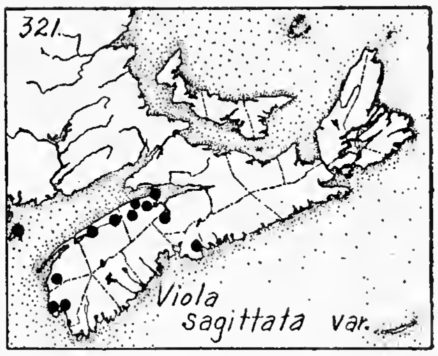
9. **V. pallens** (Banks) Brainerd. SMALL WHITE VIOLET Fig. 85.

Very common throughout in moist ground, meadows, bogs, borders of lakes, wet thickets, etc. Var. *subreptans* Rousseau, Nat. Canad. **65**: 306. 1938, is a form with the stolons bearing cleistogamous flowers; scattered in the range of the species. May-early June.

Lab. to Alberta south to S.C. & Colo.







10. **V. incognita** Brainerd HAIRY WHITE VIOLET. Map 319.

Common in wet woods and thickets throughout. Lab. to N.D. south to Tenn.

Var. **Forbesii** Brainerd, Bull. Torrey Bot. Club **38**: 8. 1912, is common, usually in drier or more upland woods than the preceeding. Both this variety and the species are more common in thickets than is *V. pallens.* Collected by Güssow on Sable Is.

N.S. to Wisc. south to Tenn.

11. **V. renifolia** Gray. Map 320. Fig. 86.

Rare; occasionally seen in rich woods or on slopes in the center of the province. N.S. south to Penn. westward.

Var. **Brainerdii** (Greene) Fern., Rhodora **14**: 88. 1912, is rather common in rich calcareous woods, on hillsides, under coniferous trees and on gypsum; Annapolis Co. to C.B., where Nichols lists it as characteristic of wooded swamps.

Lab. & Nfld. to Alaska southward.

12. **V. pensylvanica** Michx., var. **leiocarpa** (Fern. & Wieg.) Fern., Rhodora **43**: 617. 1941. YELLOW VIOLET Map 322.

Edges of woods, rich banks, and along shady streams or rich intervales, usually in calcareous soils. In the Annapolis Valley it is common along the North Mt., and very rare and local on the South Mt.; it is common along the intervales in the north-central part of the province; characteristic of rich hardwoods from Cumberland Co. to northern C.B. Early May. (*V. eriocarpa* Schwein., var.).

N. S. to Minn. southward.

13. **V. canadensis** L. CANADA VIOLET.

Very rare; known only from Newport, Hants Co., near the plaster quarries. The report of Nichols from northern C.B. belongs to the previous species.

N.S. to Sask. south to Ala. & Ariz.

14. **V. conspersa** Reichenb. DOG VIOLET Map 323. Fig. 86.

Digby Neck to C.B.; frequent in alluvial meadows in the Annapolis Valley, and along the North Mt.; frequent in Cumberland and Colchester Co.; characteristic of mountain swamps in northern C.B. Late May-June.

N.S. to Minn. south to Ga.

15. **V. labradorica** Schrank. Map 324. Fig. 86.

Rare; in ravines, along spring brooks or in cold woods from Annapolis Co to northern C.B.

Greenland and Lab. south to Me. & northern N.Y.

16. **V. arvensis** Murr. FIELD PANSY Fig. 86.

Occasional in old fields and seeded ground. It is probably introduced in clover seed; persisting but a short time.

Introduced from Eu.; Nfld. to Ont. and southward.

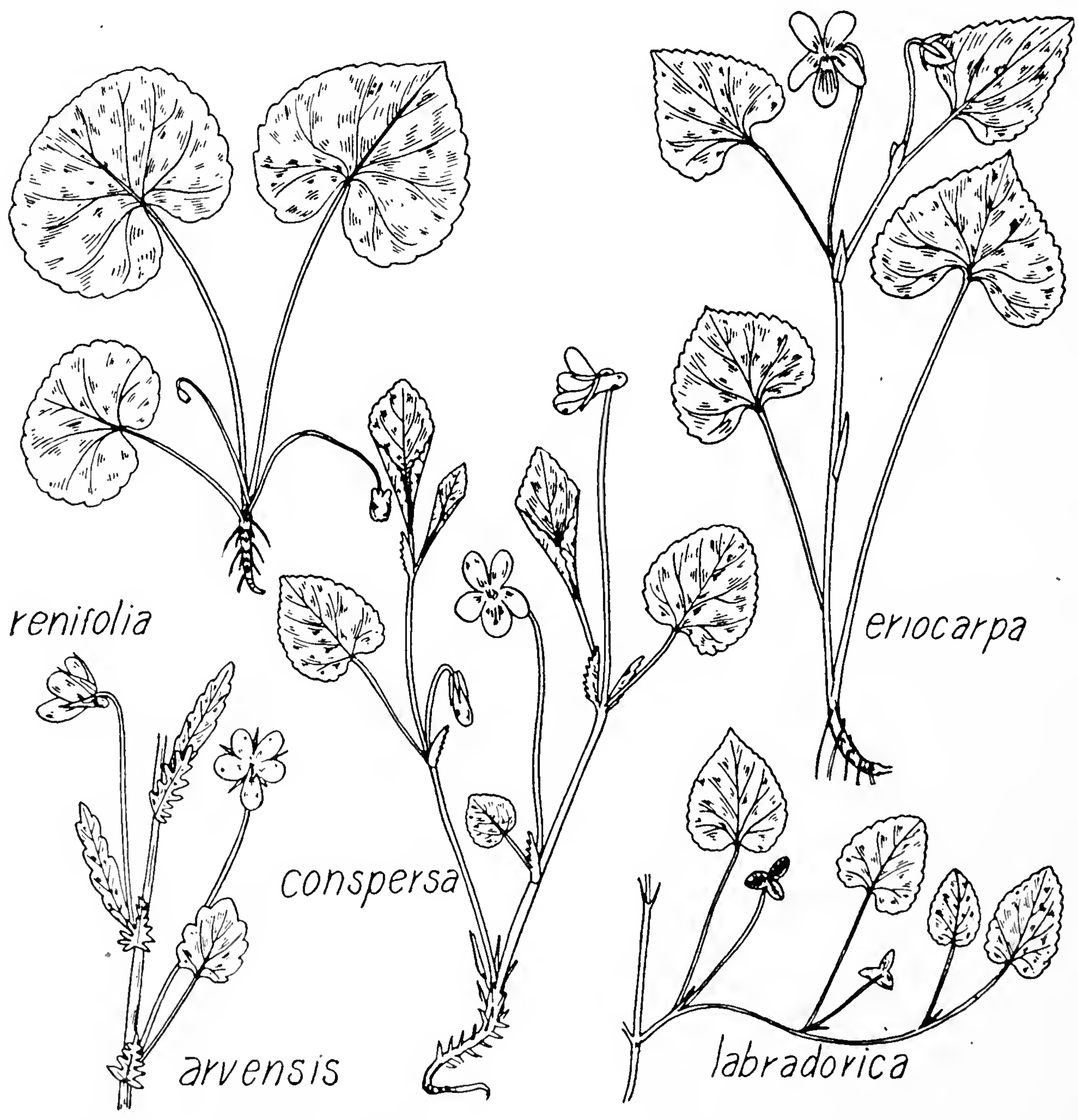


Fig. 86.—**Viola,** all x ½.

17. **V. tricolor** L. PANSY, JOHNNY JUMP-UP

This tiny pansy is occasionally found as an escape to roadsides, fields or around old gardens. Introduced from Eu.

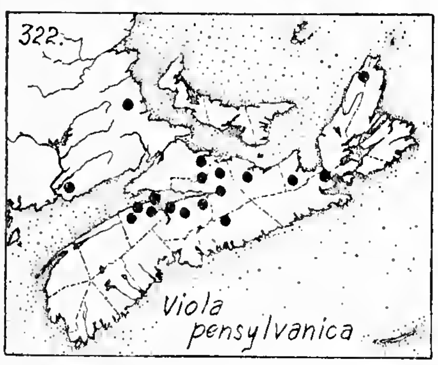
74. THYMELAEACEAE MEZEREUM FAMILY

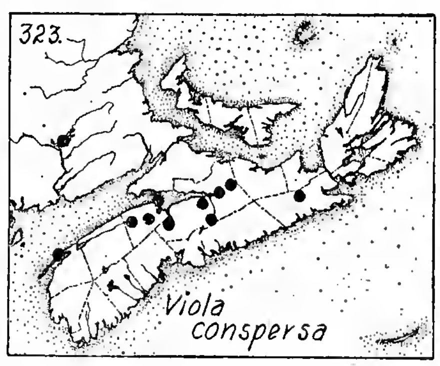
1. DAPHNE L.

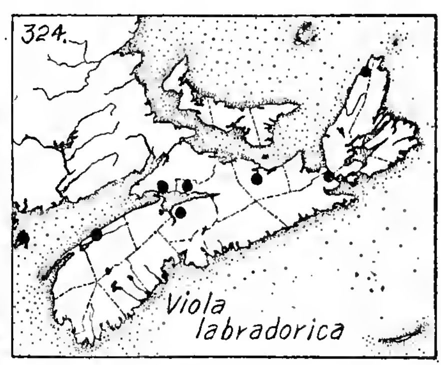
1. **D. Mezereum** L. DAPHNE. Fig. 82, g.

Introduced by the French and locally established at Annapolis, Grand Pre, Louisburg, and at scattered places elsewhere in the province. It occurs in abundance along the roadsides and in thickets in parts of Kings Co., the pale rose flowers appearing in late April or early May before the leaves unfold. The berries are deadly poisonous.

N.S. to Ont., locally southward; Eu.







75. ELAEAGNACEAE OLEASTER FAMILY

1. SHEPHERDIA Nutt.

1. **S. canadensis** (L.) Nutt. SHEPHERDIA. Map 325. Fig. 82, f.

Local, but usually abundant where found. In Hants Co. it is abundant on gypsum between Windsor and Brooklyn; and in C.B. it is found on gypsum or on talus slopes growing with plants like *Potentilla fruticosa* and *Senecio pauperculus*. Early June.

Nfld. to Alaska south to N.S., Me., Ind. & N.M.

76. LYTHRACEAE LOOSESTRIFE FAMILY

a. Leaves tapering to the base, sometimes in 3's; stems prostrate at the base and often spongy; calyx about as wide as long. 1. *Decodon*

a. Leaves cordate at the base, opposite or the upper alternate; stems erect, not spongy at the base; calyx much longer than wide. 2. *Lythrum*

1. DECODON J. F. Gmel.

1. **D. verticillatus** (L.)Ell., var. **laevigatus** Torr. & Gray, see Rhodora **19**: 154. 1917. SWAMP LOOSESTRIFE. Map 325.

Quaking margins of ponds or lakes, or sphagnous borders; rare. It is scattered in Shelburne Co., and found at New Tusket, Digby Co.

N. S., Me. to Wisc. south to Va. & Tenn.

Fig. 87.—**Circaea.** a, **C. alpina**, x ½. **Oenothera.** b, **O. muricata**,top of plant, x ⅓. c, **O. perennis**, x ⅓. **Panax.** d, **P. trifolium**, x ⅓.

2. LYTHRUM L.

1. **L. Salicaria** L. PURPLE LOOSESTRIFE. Fig. 88, a.

Low ground, marshes and ditches; local: rare near Yarmouth; along the Annapolis River above Middleton; very common in the marshes about Truro; and in small numbers at several other places in the province. July 15, early Aug.

Introduced from Eu.; N.S. to Ont. & Wisc. south to D.C.

77. MELASTOMACEAE MELASTOMA FAMILY

1. RHEXIA L.

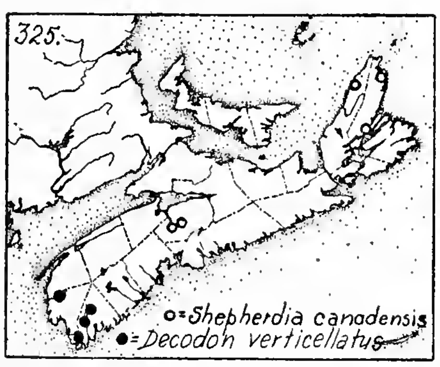
1. **R. virginica** L. MEADOW BEAUTY. Map 326. Fig. 88, g.

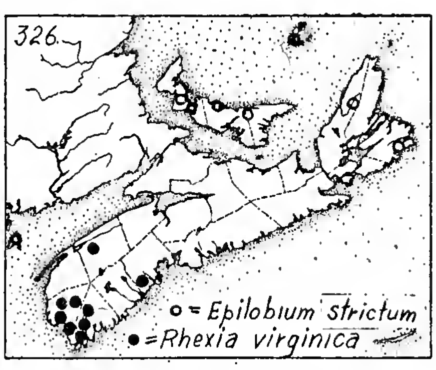
Wet thickets, peaty swales and lake margins; scattered in the southwestern counties north to the lakes of Annapolis Co., and west to Bridgewater. July-Aug.

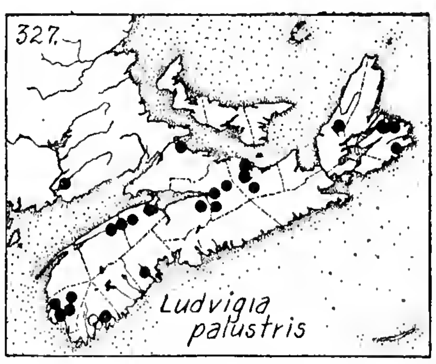
N.S.; Me. to Fla.; scattered inland to Ont. & Ind.

78. **ONAGRACEAE** EVENING PRIMROSE FAMILY

a. Flower-parts in 4's or more numerous; fruit without hooked hairs.
 b. Plant prostrate and rooting at the nodes; petals absent, or minute and reddish; leaves opposite; fruit to 4 mm long (Fig. 88, h). 1. *Ludvigia*
 b. Plant erect; petals conspicuous; leaves mostly alternate; fruit long, cylindrical to linear.
  c. Flowers purplish to white; calyx-tube scarcely prolonged beyond the ovary; seeds tufted with white hairs (Fig. 88, b-f). 2. *Epilobium*
  c. Flowers yellow; calyx-tube conspicuously prolonged; seeds without hairs (Fig. 87, b-c). 3. *Œnothera*
a. Flower parts in 2's; flowers minute, white; fruit with hooked hairs; plants thin-leaved, delicate (Fig. 87, a). 4. *Circaea*







1. **LUDVIGIA** L.

1. **L. palustris** (L)Ell., var. **americana** (DC). Fern. & Grisc., Rhodora **37**: 176. 1935. MARSH PURSLANE. Map 327. Fig. 88, h.

Common throughout, on wet shores, bottoms of ditches, and shallow water at the edges of lakes or streams. Forms found in deep water, with limp stems and broad, thin distinctly-petioled leaves, belong to forma *elongata* Fassett.

N. S. to Man. & Ore. south to Fla. & Calif.; Bermuda, etc.

2. **EPILOBIUM** L. WILLOW-HERB

Fernald M. L., The identities of *Epilobium lineare, E. densum* and *E. ciliatum.* Rhodora **46**: 377-386. 1944.

a. Petals 10-20 mm long; stigma 4-lobed; plant 3-30 dm. high.
1. *E. augustifolium*

a. Petals 10 mm long or less; stigmas entire.

b. Stem round, with no lines running down from the bases of the leaves; leaves entire or nearly so, with inrolled margins.

c. Capsules and stems velvety with spreading hairs; leaves 4-8 mm wide; petals 7-9 mm long. 2. *E. strictum*

c. Capsules and stems glabrous to crisp-pubescent with sub-appressed or inturned hairs.

d. Upper part of the stem and upper surface of leaves densely pubescent; tips of the stem or branches, and buds before flowering, arching or ascending.

e. Plant usually much branched; petals 4-6.5 mm long; calyx 4.5-7 mm long; capsules not glandular. 3. *E. leptophyllum*

e. Plant usually simple or little branched towards the top; petals 7-8 mm long; calyx 3-4.5 mm long; capsule very glandular; Sable Island. 4. *E. nesophilum*

d. Upper part of stem and upper surface of leaves with scattered hairs, or becoming glabrous; stem-tips, and pedicels before flowering, nodding.

f. Leaves thin, the middle ones 3-6 cm long and 4-10 mm wide.
5. *E. palustre*

f. Leaves thickish, the middle ones 1-3 cm long and 4 mm wide.
E. palustre var. *monticola*

b. Stem angled, with lines running down from the bases of the leaves; leaves toothed, flat, the margins not inrolled.

g. Seeds 1.5 mm long, not striate, beakless; hairs of the seeds bright-tawny to dirty-white; leaves closely and irregularly serrate, with more than 35 serrations on each side; mature fruit erect or nearly so. 6. *E. coloratum*

g. Seeds 1 mm long or less, distinctly striate, with a very short beak; hairs white; leaves more remotely serrate; mature fruit spreading.

h. Plant little or not branched: middle leaves sessile, 4-9 cm long, 8-22 mm wide, widest and rounded near the base and evenly tapered to a long tip; plant usually reddish.
7. *E. glandulosum* var. *adenocaulon*

h. Plant much branched, bushy; leaves 2-5 cm long, 8-15 mm wide, tapering and slightly rounded at the base; plant green. *E. glandulosum* var. *occidentale*

1. **E. angustifolium** L. FIREWEED, LARGE WILLOW-HERB. Fig. 88, b.

Common and conspicuous in burnt-over areas, along roadsides, fence-rows, edges of thickets, etc.; throughout. July 10-Aug.

Greenland to Alaska south to N.C. and Calif.; Eurasia.

Fig. 88.—**Lythrum.** a, **L. Salicaria,** x $\frac{1}{3}$. **Epilobium.** b, **E. angustifolium,** flowers and leaf, x $\frac{1}{3}$. c, **E.** stem showing pubescence, x 1. d, **E. strictum,** stem, x 1. e, **E. palustre,** x 1. f, **E. glandulosum,** x $\frac{1}{2}$. **Rhexia.** g, **R. virginica,** x $\frac{1}{2}$; stem and flower enlarged. **Ludvigia.** h, **L. palustris.** x 1.

2. **E. strictum** Muhl. Map 326. Fig. 88, d.

Rare in the northern part of the province; Louisburg and Big Intervale, collected by Macoun. Records from other parts of the province are considered doubtful. (*E. molle* Torr.).

N. S. to Minn. South to Va., Ind. and Ill.

3. **E. leptophyllum** Raf. BOG WILLOW-HERB. Map 328. Fig. 88, c.

Scattered to common in swales, wet meadows, bogs and lake and stream margins throughout. (*E. densum* Raf.). July-Sept.

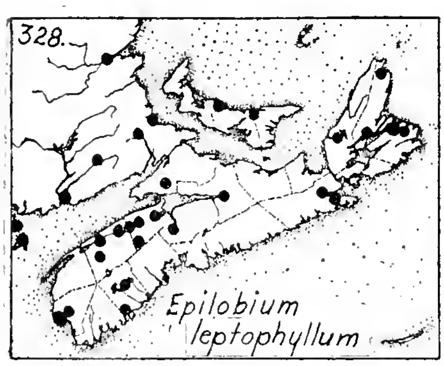
N. S. to Alta. south to Va. Ind. and Colo.

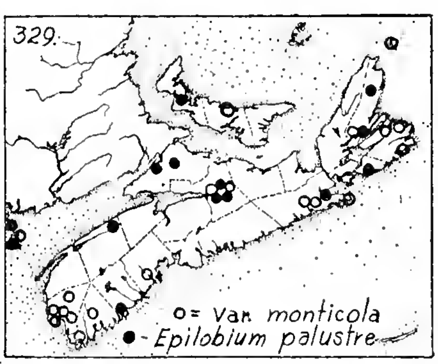
4. **E. nesophilum** Fern., var. **sabulonense**, Fern., see Rhodora **20**: 31. 1918, & **46**: 383. 1944. This is the only *Epilobium* found upon Sable Is., and has as yet been found nowhere else. (*E. molle* var. *s*).

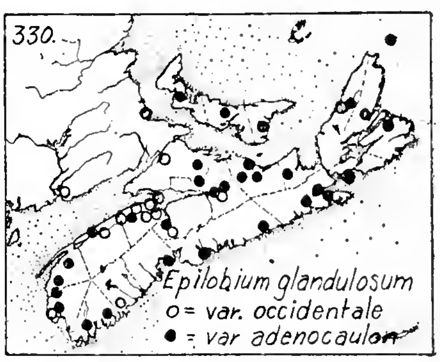
5. **E. palustre L.** Map 329. Fig. 88, e.

Wet thickets, swales and moist areas; scattered throughout, but more common in the northern regions of the province. July-Sept. Nfld. to Alaska south to N. Eng. & Lake Superior.

Var. **monticola** Haussk. is found in open bogs and damp peaty barrens, more characteristic of the Atlantic Region of the province. Nfld. to Man. south to Penn. & the Great Lakes.







6. **E. coloratum** Muhl.

Open spot near the railway station at Weymouth. "First east of the Penobscot region, the earlier records from eastern Canada resting on *E. glandulosum* vars. *adenocaulon* (Haussk.) Fern. and *occidentale* (Trel.)Fern.", (Fernald, 1922.)

N.S., Me. to Wisc. south to S.C. & Kans.

7. **E. glandulosum** Lehm., var. **adenocaulon** (Haussk.) Fern., Rhodora **20**: 35. 1918. WILLOW-HERB. Map 330. Fig. 88, f.

Rich damp soil, commonly in dried-out muddy spots; throughout. July-Aug. Nfld. to B.C. south to Va. & Calif.

Var. **occidentale** (Trel.)Fern., Rhodora **20**: 35. 1918, is rare in the southwestern counties, commoner eastward to C.B.; cultivated land, thickets, rich soil, etc., grading into the last in general appearance. Nfld. to the West Coast south to N. Eng. & N.Y.

Small plants related to this variety but with slender stems, often alternate petioled, leaves which are wider and thinner, and small pale flowers, may be separated off as

E. ciliatum Raf. A northern form extending south to N.S., Penn. & N.M.

3. **OENOTHERA** L. EVENING PRIMROSE

a. Plants slender, 1-5 dm high; capsule winged on the angles.
  b. Buds and tip of the inflorescence erect; petals mostly about 10 mm long; inflorescence in fruit much less than half the length of the plant. 1. *O. tetragona*
  b. Buds and tip of the inflorescence nodding; petals 5-10 mm long; inflorescence in fruit about half the length of the plant. 2. *O. perennis*
a. Plants stout, erect, more than 5 dm high; capsules not winged on the angles.
  c. Petals obovate, nearly as wide as long.
    d. Petals 5-8 mm long. 3. *O. parviflora*
    d. Petals 10-23 mm long.
      e. Petals 10-16 mm long; capsules 25-40 mm long. 4. *O. muricata*
      e. Petals 18-23 mm long; capsules very long, to 60 mm long. 5. *O. ammophiloides*
  c. Petals linear, 5-12 mm long. 6. *O. cruciata*

1. **O. tetragona** Roth, see Munz, Bull. Torrey Bot. Club. **64**: 287-306. 1937, for this and the following species.

Scattered at various places in Digby Co.; old fields, edges of thickets and roadsides in dry, open sandy soil; unknown elsewhere. (*O. hybrida* Michx., and possibly *O. fruticosa* L. of earlier records).

N. S. to Ga. & Tenn.

2. **O. perennis** L. SUNDROPS. Fig. 87, c.

Common in light soils or in sandy places throughout; collected but rarely in the Atlantic coastal region. July-Sept. (*O. pumila* L.). Var. **rectipilis** Blake, Rhodora **25**: 47. 1923, with the stem having short spreading hairs instead of appressed stiff ones, is scattered near the coast of New Brunswick on the Gulf of St. Lawrence but has not yet been collected in northern N.S.

N.S. to Man. south to Ga. & Kans.

3. **O. parviflora** L.

Rousseau (1938) states that this plant is rare near Arichat, Ile Madame, growing on the rocks with *Empetrum nigrum*. The length of the petals of the Nova Scotian plants of this group vary greatly in length, but rarely are they found as short as characterizes this extreme.

N.S. to Me.; Que. etc.

4. **O. muricata** L. COMMON EVENING PRIMOSE. Fig. 87, b.

This is the common plant throughout the province. It is a complex type and different variations exist in the color of the plant, the shape of the leaves, position of the sepals, size and shape of fruit, etc. which have not been studied throughout the province. *O. novae-scotiae* Gates, Trans. N.S. Inst. Sci. **14**: 141-145. 1916, was separated on the basis of the rosette leaves being nearly smooth and with relatively narrow, pale pink midribs; stems red, with leaves tapering at both ends and bracts somewhat curled; buds green and petals about 15 mm long. It was described from plants grown from seed collected near the reservoir on the North Mountain above Middleton. Other plants in the same general region seem to be as distinctive as this segregate.

N.S. to Sask. south to Colo.

5. **O. ammophiloides** Gates & Catcheside, Journ. Linn. Soc. London **49**: 180-181. 1933.

This species was described from plants grown from seed collected in the neighborhood of Guysborough by Jacques Rousseau. The plant grows there in the region of the bay; and is now known to be common also in the halophytic zone or near it on the shores of the St. Lawrence River in Que.

6. **O. cruciata** Nutt.

Occasional on the slopes of the dry dunes on Sable Island (St. John).

N. S.; Me. to western Mass. & N.Y.

4. **CIRCAEA** (Tourn.)L. ENCHANTER'S NIGHT-SHADE

Fernald, M. L. The identity of *Circaea canadensis* and *C. intermedia*. Rhodora **19**: 85-88. 1917.

a. Leaves firm, shallowly undulate-dentate; mature pedicels strongly reflexed; disk of flower cup-shaped, prolonged about 0.5 mm above the petals; anthers 0.7-1 mm long; stigma shallowly 2-lobed; mature fruit with strong-hooked bristles, 3.5-5 mm thick.
1. *C. quadrisulcata*

a. Leaves flaccid, coarsely sharp-dentate; mature pedicels spreading or only slightly reflexed; disk of flower inconspicuous; stigma deeply cleft; mature fruit with soft hairs, 1-3 mm thick.

b. Rhizome slender, scarcely tuberous-thickened; anther 0.5-0.8 mm long; petals 2.3-3.5 mm long; fruit unequally 2-celled, 1.5-3 mm thick.
2. *C. canadensis*

b. Rhizome tuberous-thickened; anthers 0.2-0.3 mm long; fruit 1-celled, 1-1.5 mm thick. 3. *C. alpina*

1. **C. quadrisulcata** (Maxim.) French. & Sav., var. **canadensis** (L.) Hara, Rhodora **41**: 386. 1939. LARGE ENCHANTER'S NIGHTSHADE.

Scattered in rich or alluvial woods in the center of the province. July-Sept. (*C. lutetiana* of Amer. authors).

N. S. to Minn. south to N. C. & Okla.

2. **C. canadensis** Hill

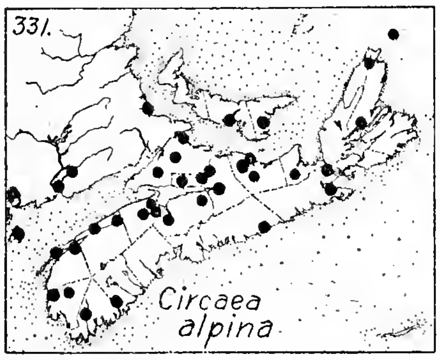
Alluvial woods and rich wooded slopes in central N. S. to northern Cape Breton, rather rare. July-Aug. (*C. intermedia* Ehrh.).

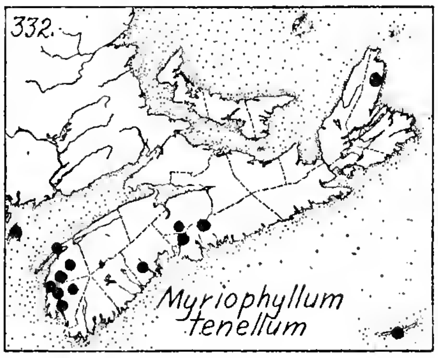
N. S. to eastern Que. south to N. Y.; Eu.

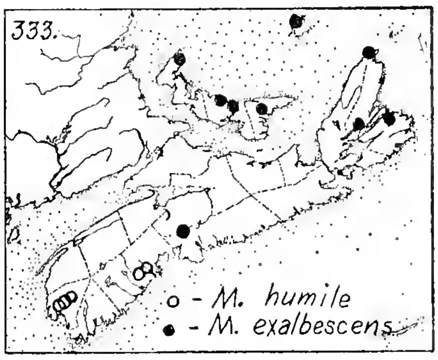
3. **C. alpina** L. SMALL ENCHANTER'S NIGHTSHADE. Map 331.

Common in rich or wet woods, ravines, dripping slopes and borders of wooded streams and swamps, throughout. This is one of the commonest plants in its habitat, often carpeting the ground. July-Aug.

Lab. to Alaska south to Ga. & S. D.; Eurasia.







79. HALORAGIDACEAE WATER-MILFOIL FAMILY

a. Leaves whorled, or irregularly crowded on the stem.
b. Leaves pinnately divided into linear segments (Fig. 89, a-d). 1. *Myriophyllum*
b. Leaves ribbon-like, entire, 1-10 cm long (Fig. 89, h). 3. *Hippuris*
a. Leaves not crowded, alternate.
c. Leaves about 1 cm long or longer, toothed to lobed (Fig. 89, e-g). 2. *Proserpinaca*
c. Leaves about 1 mm long (Fig. 89, a). 1. *Myriophyllum*

1. MYRIOPHYLLUM (Vaill.) L.

a. Leaves small, inconspicuous, to 1 mm long. 1. *M. tenellum*

a. Leaves deeply lobed, or cut into narrow or linear segments.
  b. Foliage leaves all whorled.
    c. Floral bracts mostly scattered, shorter than the flowers; leaves 5-12 mm long, the rachis and segments thread-like. 2. *M. alterniflorum*
    c. Floral bracts whorled; leaves 10-30 mm long.
      d. Floral bracts sparingly dentate or serrate; rarely as long as the flowers or fruit; rachis of the leaves terete, of nearly equal diameter throughout, the segments not broadened at the base. 3. *M. exalbescens*
      d. Floral bracts deeply lobed, about twice as long as the flowers or fruit; rachis of the leaves flattened, much broader towards the base, the segments also broadened at the base. 4. *M. verticillatum*
  b. Foliage leaves partly whorled and partly scattered.
      e. Flowers and fruit borne below the surface of the water in the axils of ordinary leaves; leaves filiformly divided, the segments about 0.1 mm wide at base and tapering to the tip; fruits 2-2.5 mm long, the carpels with prominent tubercles along the dorsal ridge. 5. *M. Farwellii*
      e. Flowers and fruit borne mostly above the surface of the water; leaves coarser; fruit 0.7 mm long, plump, without a ridge or tubercles on the back. 6. *M. humile*

1. **M. tenellum** Bigel. Map 332. Fig. 89, a.

Shallow water on the sandy or peaty lake-margins from Digby and Yarmouth to Grand Lake, Halifax Co., varying greatly in stature; abundant at the borders of fresh-water lakes on Sable Is. Nichol's record of *M. humile* from C. B. belongs here (Fernald, 1921).

Nfld. & N. S. to Wisc. south to Penn. & N. J.

2. **M. alterniflorum** DC., var. **americanum** Pugsley, Journ. Bot. **76**: 51-53. 1938. Fig. 89, c.

Occasional in slow streams or shallow pools; Salmon River, Truro; in Pictou Co.; along the Margaree R., C. B.

Nfld. to Wisc. south to Conn. & Vt.

3. **M. exalbescens** Fern., Rhodora **21**: 120. 1919. Map 333. Fig. 89, d.

Brackish water, northern C. B.; Sydney Mines, Baddeck and Bay St. Lawrence. (*M. spicatum* L.).

Nfld. to Wash. south to Conn., N. Y. & Calif.

4. **M. verticillatum** L., including var. **pectinatum** Wallr.

Spring pools south of Amherst (Fernald, 1921); mentioned by Nichols as characteristic of ox-bow ponds in northern C. B.

Nfld. to B. C. south to N. Y., Ill. & Utah.

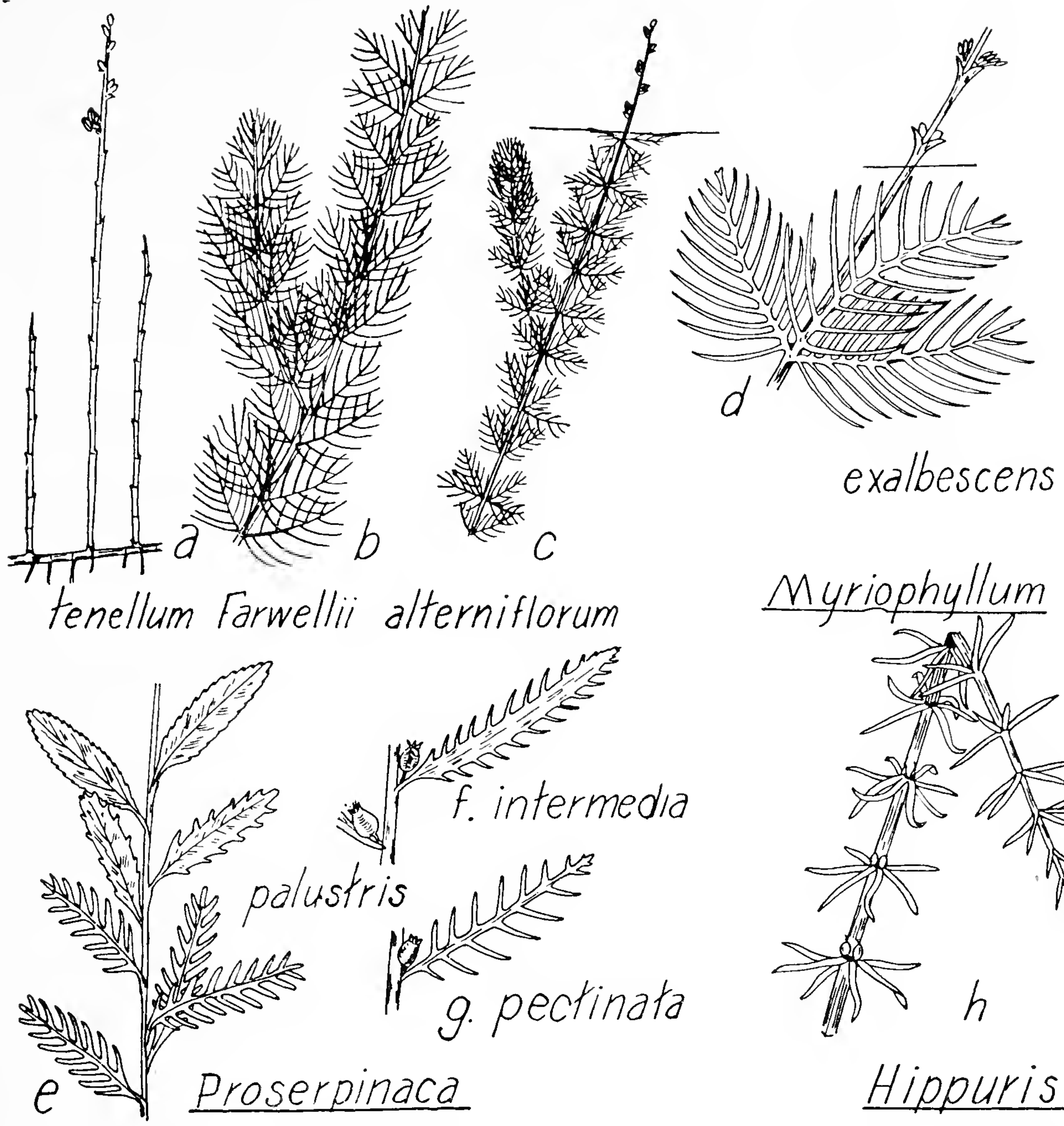


Fig. 89.—**Myriophyllum,** all x 1. **Proserpinaca,** x 1. **Hippuris vulgaris,** x $\frac{1}{3}$.

5. **M. Farwellii** Morong. Fig. 89, b.

Muddy cove in Lily Lake, Sandy Cove, Digby Neck. (Fernald, 1921).

N. S. & Que. to Wisc. south to Me., N. H., Vt. & N. Y.

6. **M. humile** (Raf.) Morong. Map 333.

Peaty, sandy or muddy shores from Yarmouth Co. to Hants Co.; local; passing in deep water to forma *natans* (DC.) Fern., with the stems erect and floating in the water instead of growing on the bottom.

N. S. to Vt. west to Ill.

2. PROSERPINACA L. MERMAID-WEED

a. Leaves of two types, the submersed ones deeply lobed, those above water merely toothed; flowers in the axils of the unlobed leaves; fruit with calyx lobes as broad as long. 1. *P. palustris*

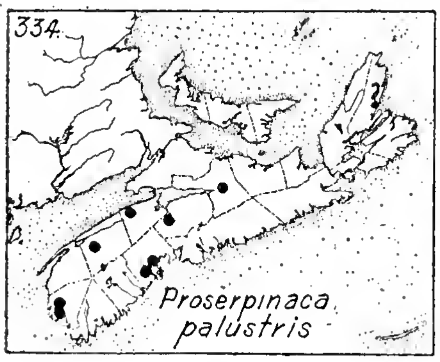
a. Leaves all alike, deeply lobed; fruit with the calyx lobes longer than broad.

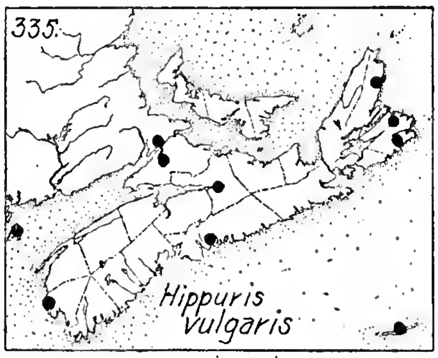
b. Leaves with the rachis narrow, about as broad as the segments are wide. 2. *P. pectinata*

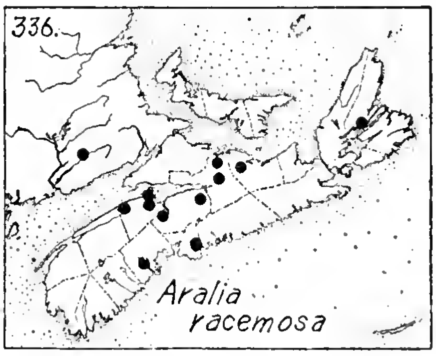
b. Leaves with the rachis wide, about as broad as the segments are long. 3. *P. intermedia*

1. **P. palustris** L., var. **crebra** Fern. & Grisc., Rhodora **37**: 177. 1935. Map 334. Fig. 89, e.

Boggy swales, savannahs, wet marshes and edges of streams; scattered throughout? In Lunenburg Co. it sometimes reaches a remarkable development, up to 15 dm high, with emersed leaves up to 8.5 cm long and 1.3 cm wide (Fernald, 1922). The variety is the more northern one, ranging from N. S. to Wisc. south to Ga. & Okla.







2. **P. pectinata** Lam. Map 341. Fig. 89, g.

Yarmouth east to central Lunenburg Co.; wet savannahs, peaty or muddy pond-holes, sphagnous swales, and sandy, gravelly or muddy borders of lakes or ponds. Rather common in the Medway Valley, Queens Co., generally growing in dense mats.

N. S.; Mass. to Fla. & La.

3. **X. P. intermedia** Mack., Torreya **10**: 250. 1910. Fig. 89, f.

Boggy savannah by Butler's Lake, Gavelton, Yarmouth Co., filling small depressions. Growing with *P. palustris* and *P. pectinata* and probably a hybrid between them.

N. S.; eastern Mass. to Ga.

3. HIPPURIS L.

1. **H. vulgaris** L. MARE'S-TAIL. Map 335. Fig. 89, h.

Local, but probably widely scattered; shallow pools, slow-moving streams and edges of ponds; swampy margins of a few of the larger fresh-water ponds on Sable Is.; luxuriant in the sink-holes near gypsum about Amherst. Forma **fluviatilis** (Hoffm.) Cosson & Germain is a submersed form with long stems and weak trailing leaves; occasionally found.

Lab. to Alaska south to N. Y., Minn. & N. M.

80. ARALIACEAE GINSENG FAMILY

a. Plants woody below; leaves with three main divisions, each further divided; inflorescence compound (Fig. 90). 1. *Aralia*

a. Plants herbaceous, low; leaves palmately compound, with 3-5 leaflets; inflorescence a simple umbel (Fig. 87, d). 2. *Panax*

1. ARALIA (Tourn.) L.

a. Stem almost absent; umbels 3, stalked on a naked scape. 1. *A. nudicaulis*

a. Stem woody, 8-20 dm high, much branched; umbels in a dense panicle on a zig-zag axis. 2. *A. racemosa*

a. Stem 4-8 dm high, woody and bristly below; umbels in a simple or much-branched corymb. 3. *A. hispida*

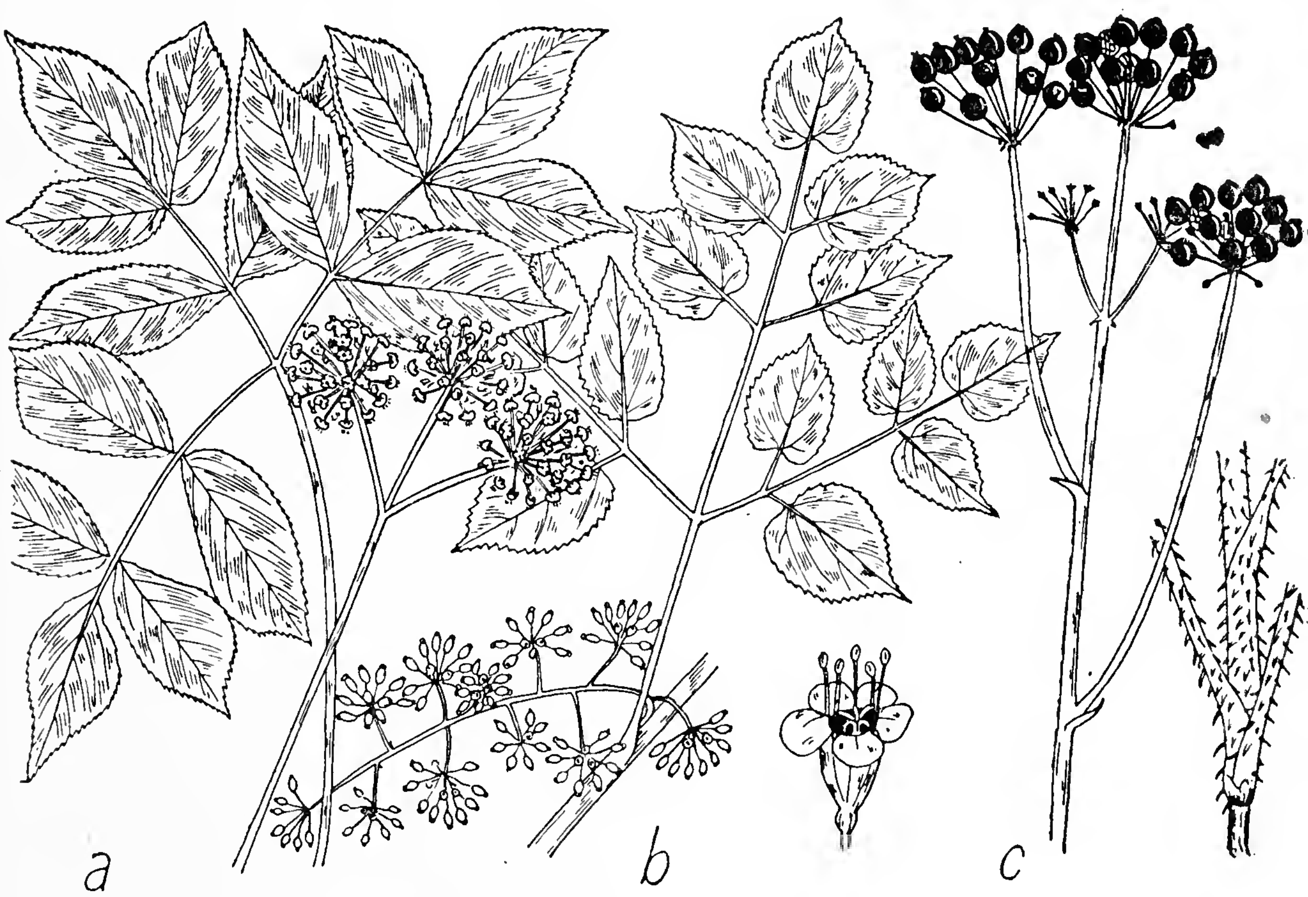


Fig. 90.—**Aralia.** a, **A. nudicaulis,** x $\frac{1}{3}$. b, **A. racemosa,** x $\frac{1}{3}$. c, **A. hispida,** inflorescence and stem, x $\frac{1}{3}$; flower, x 3.

1. **A. nudicaulis** L. WILD SARSAPARILLA. Fig. 90, a.

Common throughout; dry woodlands and old forests. May 25-June.

Nfld. to Man. south to Ga. & Colo.

2. **A. racemosa** L. AMERICAN SPIKENARD. Map 336. Fig. 90, b.

Rich or calcareous wooded slopes; occasional from Annapolis and Lunenburg Cos. to C. B., usually as solitary plants.

N. S. to Minn. south to Ga.

3. **A. hispida** Vent. BRISTLY ARALIA. Map 337. Fig. 90, c.

Common in burnt areas, recently cut forest land, around saw-mills, and in light soil; throughout.

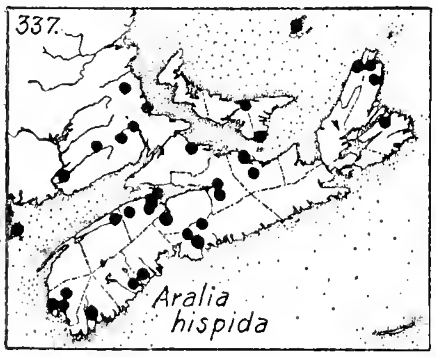
Nfld. to Hudson Bay south to N. C. & Minn.

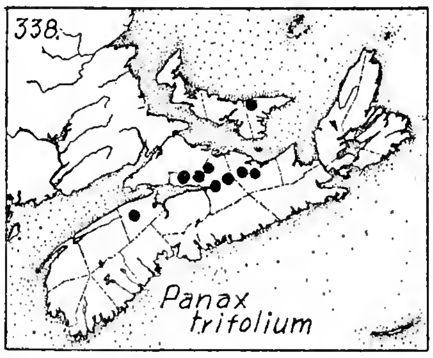
2. PANAX L.

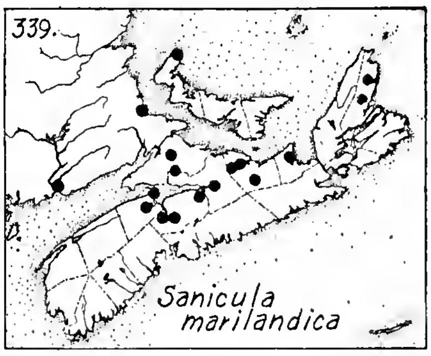
1. **P. trifolium** L. DWARF GINSENG, GROUND-NUT. Map 338. Fig. 87, d.

Rich deciduous woods or open woodlands, local; Kings Co., beech woods at Morristown; common on the intervales of northern N. S., from Cumberland Co., east at least to Pictou, growing with a number of other typical intervale plants. June.

N.S. & P.E.I., to Minn. south to Dela., Iowa, and the mts. of Ga.







81. UMBELLIFERAE PARSLEY FAMILY

a. Ovary and fruit densely prickly or bristly.
  b. Leaves palmately compound, the divisions simple (Fig. 91, f). 1. *Sanicula*
  b. Leaves pinnately compound, the divisions filiformly divided (Fig. 91, a). 19. *Daucus*
a. Ovary and fruit not bristly.
  c. Leaves simple.
    d. Leaves orbicular; plants small, creeping (Fig. 91, g). 2. *Hydrocotyle*
    d. Leaves reduced to thickened petioles. 9. *Lilaeopsis*
  c. Leaves compound.
    e. Leaves pinnately-compound with sessile leaflets (Fig. 91, b-e).

f. Leaflets less than 5 mm wide; each half of the fruit almost terete; flowers white.

g. Leaflets divided into numerous filiform divisions; bulblets absent; a common weed (Fig. 91, e). 7. *Carum*

g. Leaflets little or not divided; bulblets sometimes found in the upper axils; marsh plants (Fig. 91, h). 6. *Cicuta*

f. Leaflets more than 5 mm wide, coarsely cut or toothed.

h. Leafllets narrowly lanceolate, the upper not lobed nor cut; each half of the fruit nearly terete; flowers white (Fig. 91, c). 8. *Sium*

h. Leaflets elliptical, often nearly as wide as long, the upper often lobed or deeply cut; flowers yellow (Fig. 91, b). 14. *Pastinaca*

e. Leaves more or less palmately compound, with stalked leaflets.

i. Divisions of the leaf less than 4 mm wide; flowers white;

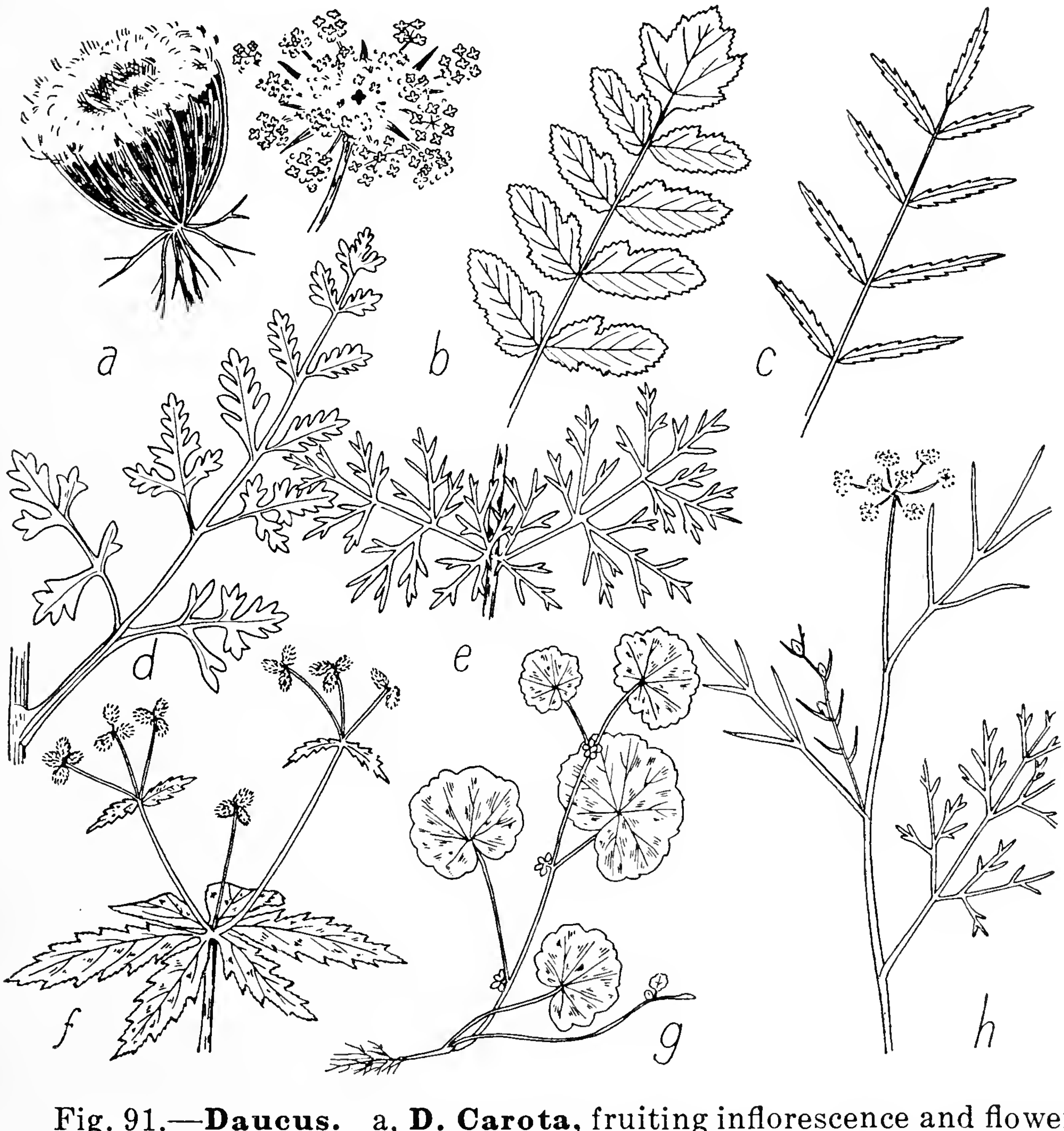


Fig. 91.—**Daucus.** a, **D. Carota,** fruiting inflorescence and flowering umbel, x $\frac{1}{3}$; d, leaf, x $\frac{1}{4}$. **Pastinaca.** b, **P. sativa,** leaf, x $\frac{1}{4}$, **Sium.** c, **S. suave,** leaf, x $\frac{1}{4}$. **Carum.** e, **C. Carvi,** leaf divisions. x $\frac{1}{2}$. **Sanicula.** f, **S. marilandica,** inflorescence, x $\frac{1}{2}$. **Hydrocotyle.** g, **H. americana,** x $\frac{1}{3}$. **Cicuta.** h, **C. bulbifera,** tip of plant, x $\frac{1}{4}$.

fruit (except in *Conioselinum*) with the halves little flattened.

j. Involucre, at the base of the umbel, of many persistent bracts; plant 1-2 m high; leaves large. 4. *Conium*

j. Involucre absent, or 1 tc a few bracts.

k. Divisions of the leaf long and ribbon-like, coarsely toothed; bulblets appearing in the axils of the upper leaves (Fig. 91, h). 6. *Cicuta*

k. Divisions of the leaf short and lanceolate, irregularly toothed or cut; bulblets absent.

l. Involucels (at the base of the tiny umbels) long and conspicuous, exceeding the flowers and fruit. 12. *Aethusa*

l. Involucels much shorter than the flowers or fruit.

m. Basal leaves coarsely divided; upper leaves with filiform divisions; fruit subglobose. 11. *Coriandrum*

m. Basal and upper leaves both ternately compound with the divisions 2-4 mm wide; fruit flattened. 17. *Conioselinum*

i. Divisions of the leaf more than 5 mm wide.

n. Umbels with 2-8 rays, fruit linear with stout appressed hairs (Fig. 92, a). 3. *Osmorhiza*

n. Umbels with more than 10 rays; fruit not linear nor with stout appressed hairs.

o. Leaves rather fleshy, smooth with anastomosing veins, the teeth few, averaging 5 mm long or more (Fig. 92, d).

p. Involucre of numerous conspicuous bracts; fruit strongly flattened; introduced and rare. 15. *Levisticum*

p. Involucre of a few linear deciduous bracts or absent; fruit almost round; native seashore plant. 10. *Ligusticum*

o. Leaves thinner, the teeth close and numerous, averaging 2 mm long or less (Fig. 92, c, e).

q. Upper leaf-sheaths much inflated, over 15 cm long (Fig. 92, e).

r. Leaves downy beneath; fruit pubescent, and strongly flattened; petals of the outer flowers irregularly enlarged. 16. *Heracleum*

r. Leaves glabrous to finely pubescent beneath; fruit glabrous; outer flowers not enlarged.

s. Fruit much flattened; involucels of few bracts or none; tall coarse plants of C. B. 18. *Angelica*

s. Fruit terete; involucels of numerous bracts; plants short and stout. 13. *Coelopleurum*

q. Upper leaf-sheaths little inflated, less than 12 mm long; fruit with each half nearly terete.
  t. Leaves and stem glabrous; plant not spreading by rootstocks; plant 1-2 mm high, in marshes. 6. *Cicuta*
  t. Leaves and stem downy to pubescent; plant 2-10 dm high, spreading by stout rhizomes to make large patches in dry ground. 5. *Aegopodium*

1. SANICULA (Tourn.) L.

a. Flowers greenish-white; sepals lanceolate, 1.5-5 mm long; fruit 6-7 mm long. 1. *S. marilandica*

a. Flowers yellowish-green; sepals obtuse and ovate, 0.7-0.9 mm long; fruit 3-4 mm long. 2. *S. gregaria*

1. **S. marilandica** L. BLACK SNAKEROOT. Map 339. Fig. 91, f.

Scattered to common in heavy soils from Annapolis Co. to northern C. B.; rich woods and borders of thickets. June-Aug.

N. S. to Alta. south to Ga. & N. M.

2. **S. gregaria** Bickn. SANICLE.

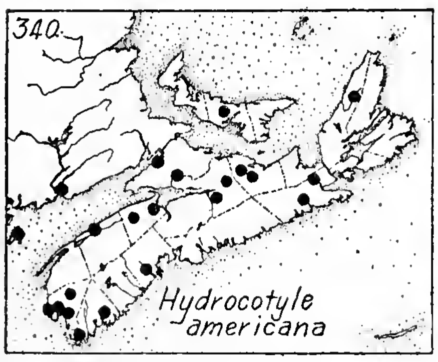
Rarer than the preceeding, growing only in rich alluvial woods and along intervales: Five-Mile R., Hants Co., and West River, near Pictou. July-Aug.

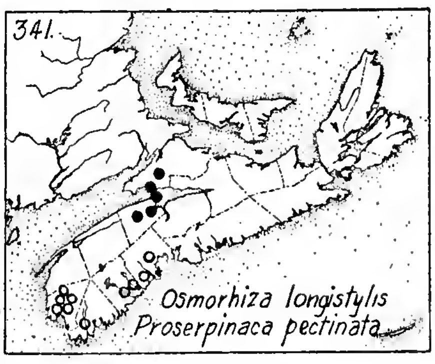
N. S. to Minn. & S. D. south to Ga. & La.

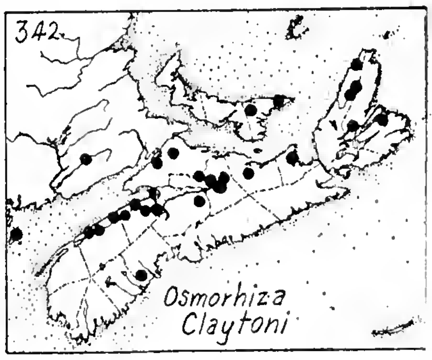
2. HYDROCOTYLE (Tourn.)L.

a. Leaves cordate, the petiole attached at a notch in the blade; umbels sessile, 1-5-flowered, in the leaf axils. 1. *H. americana*

a. Leaves peltate, the petiole attached to the center of the blade; umbels many-flowered, long stalked. 2. *H. umbellata*







1. **H. americana** L. WATER PENNYWORT. Map 340. Fig. 91, g.

Common throughout; moist half-shaded places, bottom

of depressions, bordering brooks, ditches, etc. July-Aug.
N. S. to Minn. south to N. J., N. C. & Ohio.

2. **H. umbellata** L.

Very rare; known only from the wet sandy and gravelly margin of St. John (Wilson's) Lake, Yarmouth Co. "Very rare and local and appearing like a waif washed down from some as yet undiscovered station farther up the valley of the Tusket," (Fernald, 1922).

N. S.; Mass. south along the coast to Fla. & Tex.; occasionally inland; Ore. & Calif.

3. OSMORHIZA Raf.

a. Involucre of several persistent leafy bracts.
  b. Styles and their bases 2-4 mm long.
    c. Stems glabrous or nearly so. 1. *O. longistylis*
    c. Stems puberulent with short spreading hairs. *O. longistylis* var. *brachycoma*
  b. Styles and their bases 0.5-1 mm long. 2. *O. Claytoni*
a. Involucre absent; style 0.5-1 mm long; fruiting pedicels strongly ascending. 3. *O. divaricata*

1. **O. longistylis** (Torr.) DC. SWEET ANISE. Map 341.

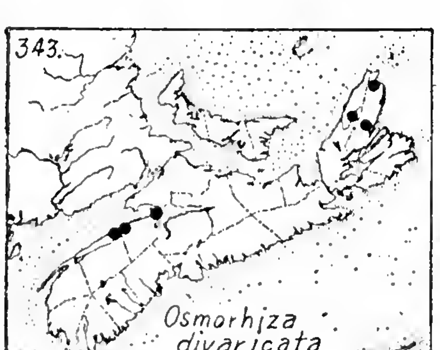
Rather common in rich woods and on intervales from Annapolis Co. east to Pictou Co. and probably to C. B. Robinson, 1906, states that it is a much commoner intervale plant in eastern N. S. than is usually supposed. June.
N. S. to Sask. southward.

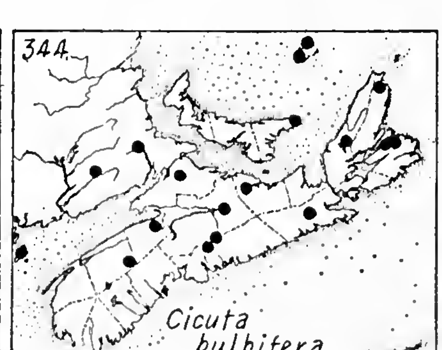
Var. **brachycoma** Blake, Rhodora **25**: 110. 1923, was collected along the edge of the intervale at Halfway R., Cumberland Co. N. S.; Ont. to Ohio & Ind.

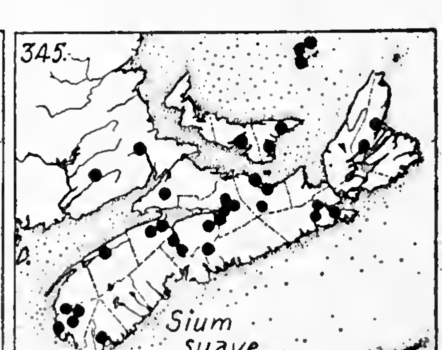
2. **O. Claytoni** (Michx.) Clarke. HAIRY SWEET CICELY. Map 342. Fig. 92, a.

Rich, alluvial or calcareous woods from Annapolis Co. to northern C. B.; also near Bridgewater; rather common in upland hardwoods and along intervales. June 1-30.

N. S. to Dak. south to Ala. & Kans.







3. **O. divaricata** Nutt. Map 343.

Local and restricted to mixed or open hardwoods; along the North Mt. from Blomidon to Annapolis Co.; characteristic of climax hardwoods, and intervales in northern C. B. June-July.

Nfld., N. S., Gaspe & N. Eng.; B. C. to Calif.

4. CONIUM L.

1. **C. maculatum** L. POISON HEMLOCK.

Introduced and rare; found in waste places and dumps, Weymouth and Digby; deadly poisonous. July-Aug.

Europe; widely introduced.

5. AEGOPODIUM L.

1. **A. Podagraria** L. GOUTWEED. Fig. 92, b.

This weed is common around Boylston and Guysborough and frequent around Halifax, usually growing near buildings or along roadsides in large patches. A large form with green leaves has become an almost uneradicable weed in Guysborough Co. A smaller type with variegated leaves is less persistent and rarely fruits. June-July.

Introduced from Eu.; becoming common in northeast N. A.

6. CICUTA L.

a. Leaves lanceolate, 5-10 mm wide; fruit 3-3.5 mm long; without bulblets. 1. *C. maculata*

a. Leaves with divisions linear, 1 mm or less in width; fruit 1.5-2 mm long; upper leaf-axils with bulblets in autumn. 2. *C. bulbifera*

1. **C. maculata** L. WATER HEMLOCK. Fig. 92, c.

Marshes, swamps, ditches and wet pastures in mucky or alluvial soil; general from Yarmouth to C. B.; becoming more abundant northwards and eastward; common on wet marshes about the head of the Bay of Fundy. July.

N. S. to Man. south to Fla. & Tex.

2. **C. bulbifera** L. BULBOUS WATER HEMLOCK. Map 344. Fig. 91, h.

Scattered from Annapolis Co. to northern C. B.;

usually growing in shallow water, at the edge of ponds, or in wet cat-tail marshes. Aug.

Nfld. to B. C. south to Md. & Ore.

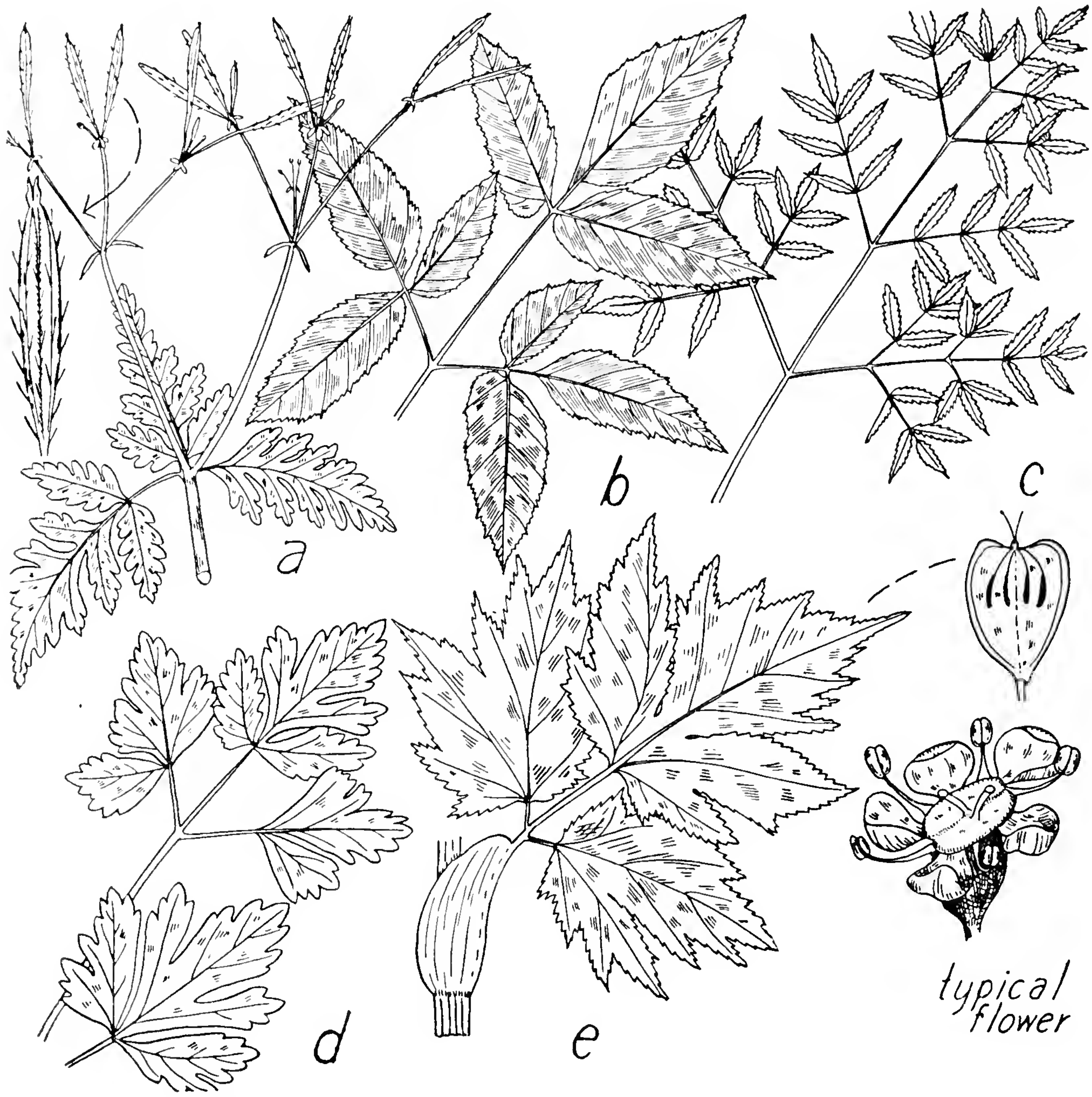


Fig. 92.—**Osmorhiza.** a, **O. Claytoni,** inflorescence, x 1; ripe fruit, x 2. **Aegopodium.** b, **A. Podagraria,** typical leaf, x $\frac{1}{3}$. **Cicuta.** c, **C. maculata,** leaf, x 1/10. **Ligusticum.** d, **L. scothicum,** leaves x $\frac{1}{3}$. **Heracleum.** e, **H. lanatum,** leaf showing the large sheath, x $\frac{1}{4}$.

7. CARUM L.

1. **C. Carvi** L. CARAWAY. Fig. 91, e.

Common throughout; damp fields, around houses and along roadsides. June 15-July 15. Forma **rhodochranthum** A. H. Moore, with delicate pink flowers, was found scattered among the typical whitish-flowered plants at Advocate.

Introduced from Eu.; widespread.

8. SIUM (Tourn.) L.

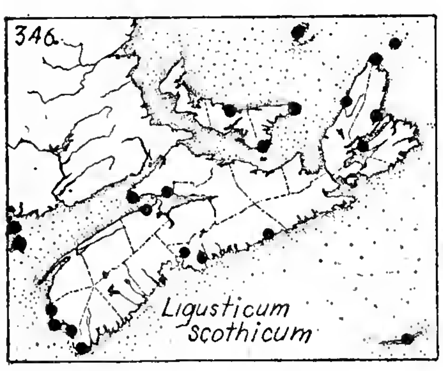
1. **S. suave** Walt. WATER PARSNIP. Map 345. Fig. 91, c.
Common throughout; muddy shores of rivers and lakes, ditches and marshes. Submersed leaves are often finely dissected. July 15-Aug. (*S. cicutaefolium* Schrank).
Nfld. to B. C. south to Fla. & Calif.

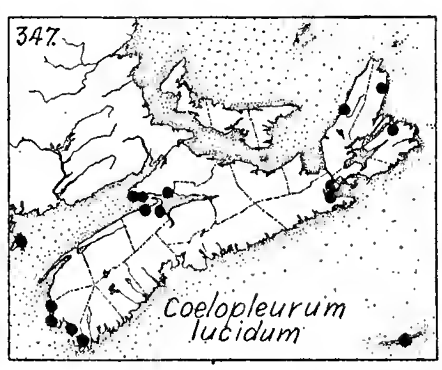
9. LILAEOPSIS Greene

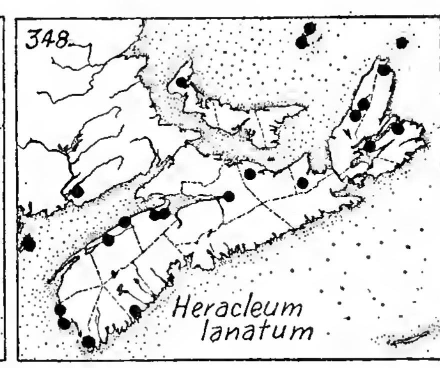
1. **L. lineata** (Michx.) Greene.
Known in Canada only from the muddy and rocky tidal banks of the Tusket R., at Tusket. July-Aug.
N. S. to Fla. west to Miss.; along the coast.

10. LIGUSTICUM L.

1. **L. scothicum** L. SCOTCH LOVAGE. Map 346. Fig. 92, d.
Scattered around the coast; rocky cliffs, sea-shores, and headlands. July-Aug.
N. Y. northwards along the coast; also on the West Coast.







11. CORIANDRUM (Tourn.) L.

1. **C. sativum** L. CORIANDER.
Waste places, rarely introduced and not persisting.
N. S. southward and westward; adventive from Eu.

12. AETHUSA L.

1. **A. Cynapium** L. FOOL'S PARSLEY.
Rare; waste ground in barnyard, Shelburne.
Introduced from Eu.; N. S. to Minn. south to Penn.

13. COELOPLEURUM Ledeb.

1. **C. lucidum** (L.) Fern., Rhodora **21**: 146. 1919. Map 347.
Scattered on gravelly sea-shores and headlands around the coast; infrequent on the slopes of the turf-covered dunes on Sable Is. (*C. actaeifolium* (Michx.) C. &. R. of earlier authors). July-Aug.
Sea-coast; Greenland to Long Is., N. Y.

14. PASTINACA L.

1. **P. sativa** L. WILD PARSNIP. Fig. 91, b.
Escaped from cultivation and a common weed in parts of the province; most often seen in the Annapolis Valley, scattered elsewhere; roadsides, old fields and orchards. July.
Naturalized from Eu.; widely distributed.

15. LEVISTICUM (Riv.) Hill

1. **L. officinale** (L.) Koch. LOVAGE.
Rare; railway bank, Lake Annis, Yarmouth Co. (Fernald, 1921).
Introduced from southern Eu.; N. S., to Penn.

16. HERACLEUM L.

a. Leaves woolly beneath, large, divided into three main divisions which are irregularly and sharply cut. 1. *H. lanatum*
a. Leaves pubescent beneath only, pinnately divided, the division rather bluntly-lobed and toothed. 2. *H. Sphondylium.*

1. **H. lanatum** Michx. COW PARSNIP. Map 348. Fig. 92, e.
Wet meadows and brooksides in alluvial soil; scattered throughout; a common intervale plant in eastern N. S.; common on sea-bluffs in northern C. B. Early July.
Nfld. to the Pacific south to N. C. & Kans.

2. **H. Sphondylium** L.
Common along roadsides and vacant lots in Truro.
Introduced from Eu.; chiefly about ports in N. A.

17. CONIOSELINUM Fisch.

1. **C. chinense** (L.) BSP. HEMLOCK PARSLEY.
Scattered in swamps, mossy coniferous woods or swales near the coast; common on St. Paul Is., rare on the mainland and in C. B. Aug.-Oct.
Nfld. to Minn. south to N. Y., N. C. & Ind.

18. ANGELICA L.

a. Plant puberulant or minutely pubescent above and on the upper surface of the leaves; leaflets less than 4 cm wide; uppermost leaves reduced mostly to inflated petioles; fruits 5-6 mm long. 1. *A. sylvestris*

a. Plant glabrous throughout; leaflets 3-7 mm wide; uppermost petioles not so prominent; fruit 6-8 mm long. 2. *A. atropurpurea*

1. **A. sylvestris** L. ANGELICA.
Common around Sydney; introduced into old fields and along roadsides at Louisburg; probably somewhat general in this part of C. B. July-Sept.
Introduced from Eu.; local.

2. **A. atropurpurea** L. PURPLE ANGELICA.
Rare near the coast; Shelburne, Mabou and Bay St. Lawrence; swamps, low ground, along streams.
Nfld. to Minn. south to Dela. & Iowa.

19. DAUCUS (Tourn.) L.

1. **D. Carota** L. WILD CARROT, QUEEN ANNE'S LACE. Fig. 91, a, d.
A too common weed in hay fields and along roadsides from Yarmouth to Hants Co.; spreading rapidly in Pictou Co.; local in a few other regions of the province. It is distinguished from caraway by the hairy leaves and stem; the leaflets are also less crowded on the leaf-rhachis. July-Sept.
Introduced from Eu., throughout N. A.

82. CORNACEAE DOGWOOD FAMILY

1. Cornus (Tourn.) L.

a. Low herbs, the flowers in a head surrounded by a 4-leaved white petaloid involucre.

b. Leaves more or less whorled near the top of the stem; flowers (not the involucral bracts) whitish-green. 1. *C. canadensis*

b. Leaves all opposite; flowers deep violet. 2. *C. suecica*

a. Shrubs.

c. Leaves alternate, clustered toward the ends of the twigs; berries deep blue. 3. *C. alternifolia*

c. Leaves opposite.

d. Leaves ovate to lanceolate with appressed hairs beneath, or smooth; branches not normally speckled, bright red the first year; berries white. 4. *C. stolonifera*

d. Leaves oval, thinly woolly beneath, with 7-9 pairs of veins; branches rather pale, speckled or streaked with purple; berries light blue or almost white. 5. *C. rugosa*

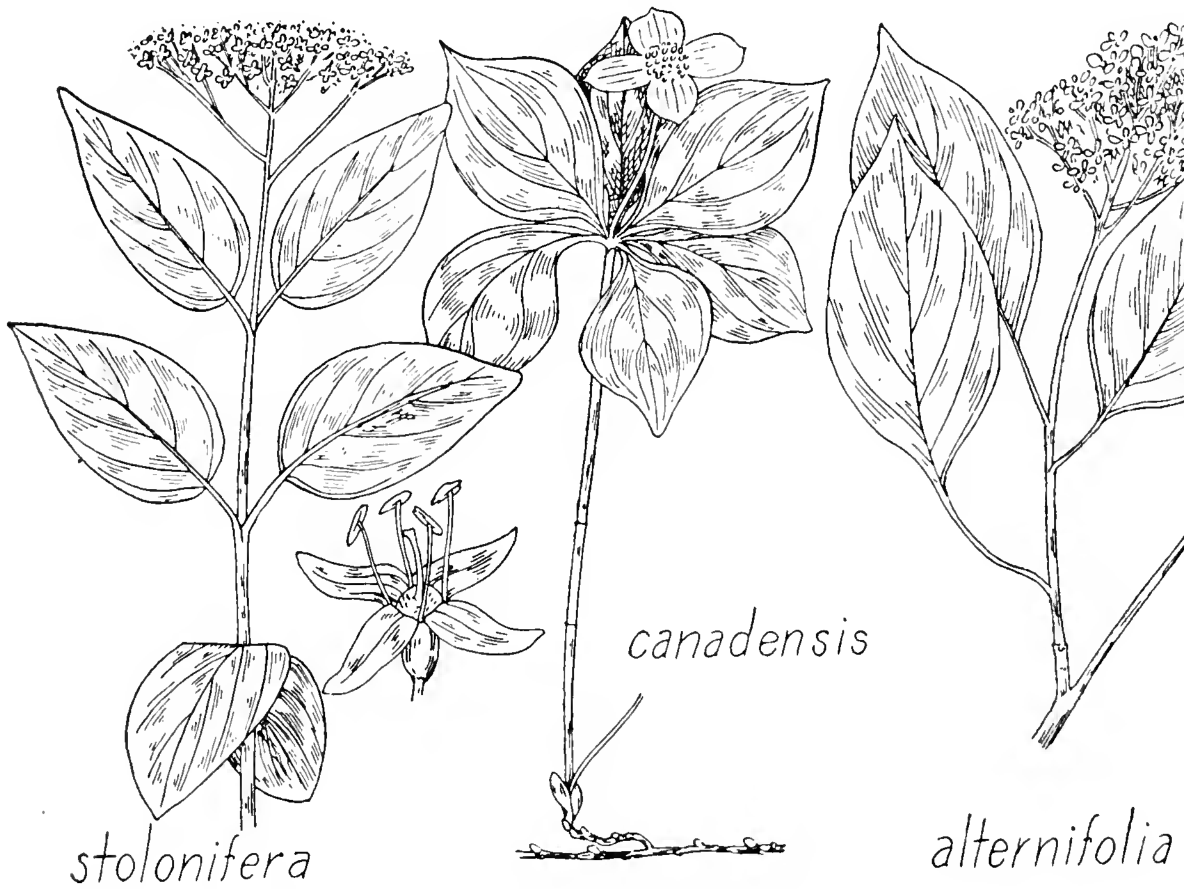


Fig. 93.—**Cornus**, all x $\frac{1}{3}$.

1. **C. canadensis** L. BUNCHBERRY. Fig. 93.

Common throughout; heaths, barrens, woodland pioneer, edges of thickets, mature bogs, etc. June. Forma *elongata* Peck, with the leaves in two or more whorls or often the lower ones opposite, is occasionally seen. (Reported as var. *intermedia* Farr. in Rhodora **40**: 274. 1938).

Lab. to Alaska south to N. J., Ind. & Calif.

2. **C. suecica** L.

Sphagnous depressions in barrens, St. Paul Is., gravelly shore at Canso, growing with *Empetrum nigrum* (Rousseau, 1935).

Greenland & Nfld. south around the Gulf St. Lawrence; Alaska; rare.

3. **C. alternifolia** L. f. ALTERNATE-LEAVED DOGWOOD. Map 350. Fig. 93.

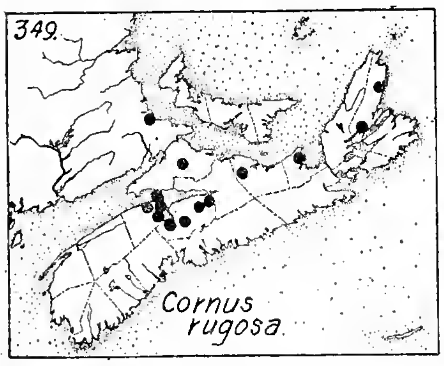
Rare in Yarmouth Co.; common from northern Digby Co. to northern C. B., where Nichols reports it as scattered in the climax forest; rich woods, ravine slopes and intervales. June 15-July 15.

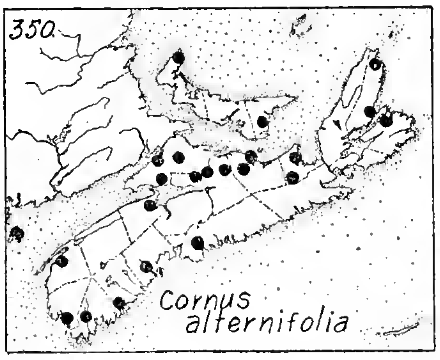
Nfld. to Minn. south to Ga. & Mo.

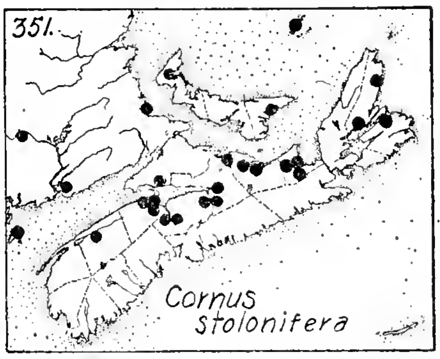
4. **C. stolonifera** Michx. RED OSIER DOGWOOD. Map 351. Fig. 93.

Common from Annapolis to C. B.; edges of intervales, brook-sides and wet meadows. June.

Lab. to MacKenzie south to Va. & Calif.







X. C. acadiensis Fern., Rhodora **43**: 411-412. 1941, is considered a hybrid of the previous two species, and has the leaves crowded near the tips of the branches as in *C. alternifolia,* but opposite and more like the outline of those of *C. stolonifera.* This is the shrub reported from a cold brook at the head of Baddeck Bay as *C. Amomum*, Rhodora **23**: 278. 1921. *C. Amomum* is not known to occur east of southwestern Maine (Fernald, l. c.).

5. **C. rugosa** Lam. ROUND-LEAVED DOGWOOD. Map 349.

Open woods, ravines, and talus of cliffs in nearly neutral or alkaline areas. It is always found near the gypsum areas; common on the side of Cape Blomidon on the basic trap rock; and scattered elsewhere from Kings Co. to C. B. Early July. (*C. circinata* L'Her.).

N. S. to Man. south to Va., Ill. & N. D.

83. ERICACEAE HEATH FAMILY

a. Ovary superior.

b. Plants saprophytic, without green color; pollen-grains separate;

anthers opening by slits; fruit a capsule.
1. INDIAN PIPE SUBFAMILY

b. Plants with green leaves; pollen grains in 4's.

c. Petals separate or nearly so; low, evergreen herbs; fruit a capsule.
2. WINTERGREEN SUBFAMILY

c. Petals united to form a tube; plants various, often shrubby; fruit a capsule or berry. 3. HEATH SUBFAMILY

a. Ovary inferior, so that the sepals form a blow-end on the tip of the berry-like fruit; pollen grains in 4's; sepals and petals in 4's nearly separate, or else in 5's and united to form a tube.
4. BLUEBERRY SUBFAMILY

1. INDIAN PIPE SUBFAMILY

a. Flowers 10-25 mm long, the petals separate; stem-leaves scale like (Fig. 94, a b). 1. *Monotropa*

2. WINTERGREEN SUBFAMILY

a. Leaves scattered on the stem, lanceolate; flowers in a terminal short inflorescence; styles very short (Fig. 94, c). 2. *Chimaphila*

a. Leaves mostly basal, almost round; flowers solitary, or in an erect narrow raceme.

b. Flowers solitary (Fig. 94, d). 3. *Moneses*

b. Flowers numerous (Fig. 94, f-k). 4. *Pyrola*

3. HEATH SUBFAMILY

a. Leaves 5 mm long or longer, not scale-like.

b. Leaves densely rusty-woolly beneath, the edges strongly inrolled; flowers irregular, white, with petals separate (Fig. 95, b).
5. *Ledum*

b. Leaves greenish or whitish beneath; petals united.

c. Plants erect and shrubby; fruit a capsule.

d. Leaves with the margin nearly or entirely without teeth; flowers pinkish or flesh-colored.

e. Flowers before the leaves unfold; corolla funnel-form, split irregularly to the base; fruit a capsule 3 times as long as thick; leaves oval, with scattered brownish hairs beneath, smooth above (Fig. 95, c). 6. *Rhododendron*

e. Flowers after the leaves appear; corolla saucer- or bell-shaped, the petals united; fruit almost round; leaves shiny above, whitish beneath or with very short hairs.

f. Flowers saucer-shaped; leaves flat or with the margins very slightly inrolled, white and powdery beneath, the tips blunt (Fig. 95, f). 8. *Kalmia*

f. Flowers vase- or bell-shaped; leaves inrolled so that they are almost linear, finely pubescent beneath, with a sharp prickle at the tip (Fig. 95, a). 9. *Andromeda*

d. Leaves with the margins coarsely toothed; flowers white, vase-formed, in a slender raceme (Fig. 95, d). 10. *Chamaedaphne*

c. Plants low, prostrate or trailing, more or less woody; leaves thick and evergreen; fruit a berry or capsule.

g. Leafy branches prostrate and trailing; leaves not toothed.

h. Leaves glabrous, the veins obscure or only the mid-rib prominent, tapering to the base; flowers in June-July.

i. Margin of leaves not involute; flowers vase-shaped; fruit a red mealy berry. 11. *Arctostaphylos*

i. Margin of leaves strongly involute; flowers funnel-shaped; fruit a capsule. 7. *Loiseleuria*

h. Leaves hairy beneath, oval, cordate at the base, the veins prominent; flowers in late April or early May, tubular, woolly in the throat. 12. *Epigaea*

g. Leafy branches small and erect; leaves toothed, often reddish; fruit a berry with fleshy calyx (Fig. 94, e). 13. *Gaultheria*

a. Leaves 1-2 mm long, scale-like; introduced. 14. *Calluna*

4. BLUEBERRY SUBFAMILY

a. Plants small, trailing, with leaves less than 10 mm long; corolla deeply 4-cleft; berry with 5 cavities.

b. Leaves almost round, 3-6 mm wide, with a sharp point; flower bell-like, 4 mm long; berry white. 15. *Chiogenes*

b. Leaves 2-3 times longer than wide, 1-6.5 mm wide; corolla almost flat or with long flaring or reflexed lobes, 1.2-2 cm wide; berry red or brownish. 17. *Vaccinium*

a. Plants mostly erect, much-branched, shrubby; leaves more than 10 mm long; corolla 4- or usually 5-lobed, bell-shaped.

c. Berry 4- or 5-celled, many-seeded; leaves not resinous-dotted beneath. 17. *Vaccinium*

c. Berry 10-celled, 10-seeded; leaves resinous-dotted beneath (Fig. 95, e). 16. *Gaylussacia*

1. MONOTROPA L.

a. Flowers solitary, white, turning blackish. 1. *M. uniflora*

a. Flowers several, yellowish, usually pubescent. 2. *M. Hypopitys*

1. **M. uniflora** L. INDIAN PIPE. Map 352. Fig. 94, a.

General throughout; thickets, climax or old coniferous forest, and also common in mixed or deciduous growth. July-Aug.

Nfld. to B. C. south to Fla. & Mex.; Asia.

2. **M. Hypopitys** L., var. **rubra** (Torr.) Farw., Amer. Midl. Nat. **10**: 39. 1926. PINESAP. Map 353. Fig. 94, b.

Found throughout, but not as abundant as the preceeding and usually in coniferous woods; scattered in pine woods in the Annapolis Valley; in fir and spruce woods eastward; occasionally in older mixed woods. July-Aug. (*M. Hypopitys* L. of Gray's Man.).

N. S. to B. C. south to Fla. & Mex.

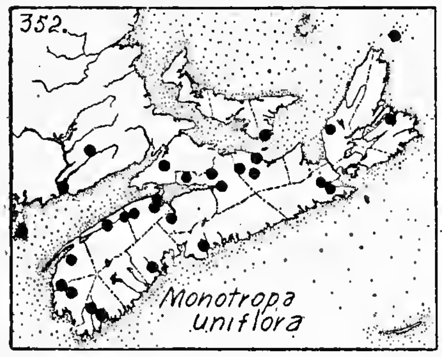
Fig. 94.—**Monotropa.** a, **M. uniflora**, x $\frac{1}{3}$. b, **H. Hypopitys**, inflorescence, x $\frac{1}{3}$. **Chimaphila.** c, **C. umbellata**, x $\frac{1}{3}$. **Moneses.** d, **M. uniflora**, x $\frac{1}{3}$. **Gaultheria.** e, **G. procumbens**, x $\frac{1}{2}$. **Pyrola.** f, **P. elliptica**, x $\frac{1}{3}$. g, **P. rotundifolia** var. **americana**, leaf, x $\frac{1}{3}$. h, **P. secunda**, leaf, x $\frac{1}{3}$. i, **P. asarifolia**, leaf, x $\frac{1}{3}$. j, bracts on the stems of **P. elliptica** and **P. rotundifolia**, x 3.

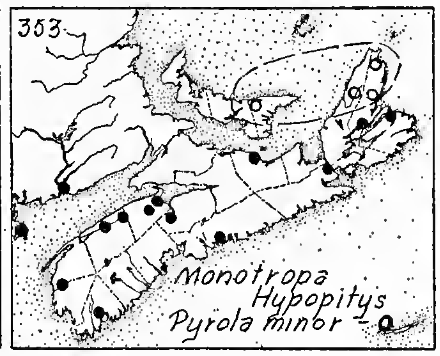
2. CHIMAPHILA Pursh

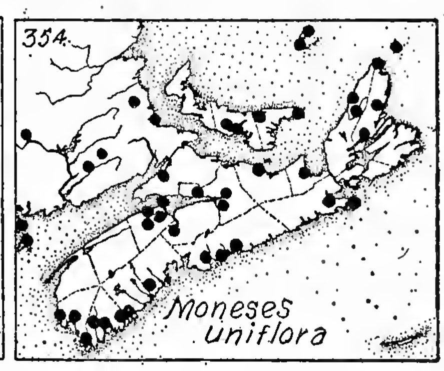
1. **C. umbellata** (L.) Bart., var. **cisatlantica** Blake, Rhodora **19**: 241. 1917. PRINCE'S-PINE. Fig. 94, c.

Scattered throughout; in dryish soil, deciduous or sometimes in spruce or fir woods. Mid-July.

N. S. to Ga. west to the Pacific.







3. MONESES Salisb.

1. **M. uniflora** (L.) Gray. ONE-FLOWERED SHINLEAF. Map 354. Fig. 94, d.

Found throughout, often rather rare; deciduous or sometimes in coniferous woods; characteristic of both hardwoods and coniferous forests in northern C. B. June 20-July 20. Var. *reticulata* (Nutt.) Blake, Rhodora **17**: 28. 1915, is a western form which has been collected once in eastern America: St. Paul Is., northern C. B. This form has the leaves more ovate, usually acute, coarsely dentate and strongly veined. (See Porsild, Rhodora **41**: 271. 1939).

Lab. to Alaska south to Penn. & Minn.; Eurasia.

4. PYROLA (Tourn.)L. WINTERGREEN, SHINLEAF

a. Styles and stamens straight, extending outward; petals touching each other, forming a tube.
  b. Style shorter than the petals; flowers placed all around the axis of the raceme; the bracts intermingled with the leaves at the base crowded, usually 1 cm long or longer, often grading into the leaves. 1. *P. minor*
  b. Style longer than the petals; flowers forming a one-sided raceme; bracts at base of the stem 2-4 mm long, often absent, distinct from the leaves.
    c. Flowers 7-15, in a long raceme; leaves narrowed to a pointed tip, 1.5-6 cm long; stem leafy, elongated and trailing. 2. *P. secunda*
    c. Flowers 3-8, clustered; leaves rounded at the tip, 0.8-3 cm long; stem short with few leaves. *P. secunda* var. *obtusata*
a. Styles and stamens bent downward with the tips upwardly curved; petals wide and spreading so that the flower is saucer-shaped.
  d. Bracts on the stem none or 1-3, narrowly lanceolate and long-

tipped, not sheathing the stem at their base; sepals little or not at all longer than broad.

e. Blades of the leaves oval, 3-8 cm long, longer than the petioles; anthers blunt; bracts mixed with the leaves at the base numerous, usually 1 cm long, often grading into leaves, obtuse to truncate. 3. *P. elliptica*

e. Blades of the leaves almost round, 1-3 cm long, shorter than the petioles; anthers with a neck or point; basal bracts 2-4 mm long, distinct from the leaves, acute to acuminate.

f. Leaves rounded at the base and top, 1.5-3.4 cm wide, 4-11 in a rosette. 4. *P. virens*

f. Leaves wedge-shaped at the base and squarish at the tip, 0.7-2.5 cm wide, 0-7 in a rosette. *P. virens* forma *paucifolia*

d. Bracts on the stem 1-5, ovate-lanceolate, their bases somewhat sheathing the stem; sepals at least a half longer than wide.

g. Sepals oblong, blunt or sharp, very variable, twice as long as wide; flowers white, leaves not cordate.

h. Petals 6.5-10.5 mm long; plant larger; leaves 2.5-8 cm long; raceme 5-20-flowered, 2.5-20 cm long at flowering time. 5. *P. rotundifolia* var. *americana*

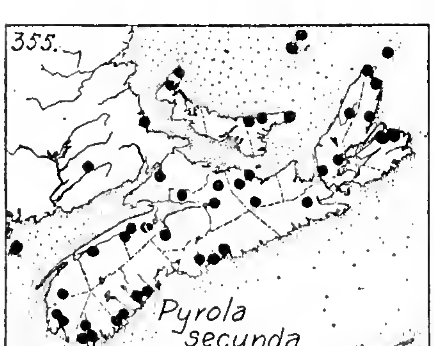
h. Petals 5-7 mm long; leaves 1.8-5 cm long; raceme 3-12-flowered, 2-9 cm long at flowering time. *P. rotundifolia* var. *arenaria*

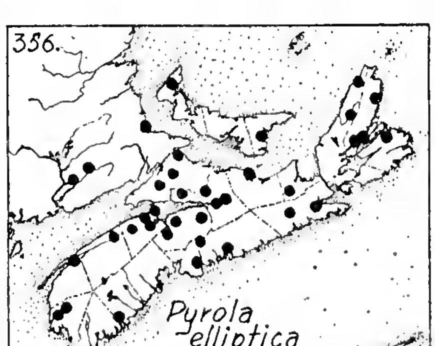
g. Sepals triangular, sharp-pointed, about 1.5 times as long as wide; petals pink, about 5 mm long; leaves cordate at the base. 6. *P. asarifolia*

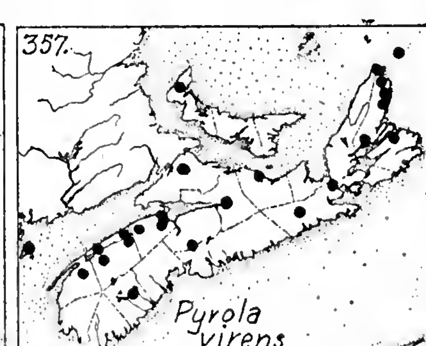
1. **P. minor** L. SMALL WINTERGREEN. Map 353.

Rare in cold woods; characteristic of maturer coniferous woods in northern C. B. (Nichols); scattered west to Colchester Co. July-Aug.

Greenland to Alaska south to northern N. Eng. & Minn.







2. **P. secunda** L. ONE-SIDED WINTERGREEN. Map 355. Fig. 94, h.

Scattered to common throughout; coniferous or mixed woods, and in newly-cleared pastures. July. Lab. to Alaska south to Md., Mich & Calif.

Var. **obtusata** Turcz., see Porsild in Rhodora **41**: 274.

1939, is rarer than the species. It was reported by Fernald from a sphagnous spruce swamp at Hectanooga, Yarmouth Co. (1921); and specimens are at Truro from a cool damp wood, Nuttby, Colchester Co.

N. S. to Penn. westward.

3. **P. elliptica** Nutt. SHINLEAF. Map 356. Fig. 94, f.

Common throughout; open woods, roadsides, open pastures and hillsides on light soils. July-Aug. 10.

Nfld. to B. C. south to DC., Iowa & N. Mex.

4. **P. virens** Schweigg. See Rhodora **43**: 167. 1941. GREEN-FLOWERED WINTERGREEN. Map 357.

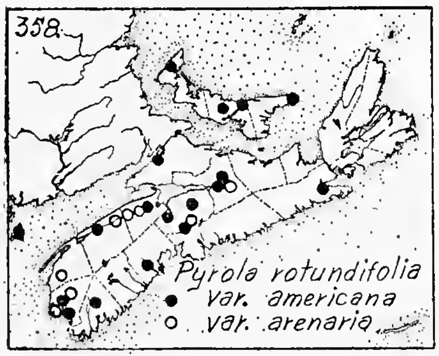
Dry or sandy woods, generally under conifers but also in mixed or deciduous woods. Forma *paucifolia* Fern. is the commonest form, but is hardly worth maintaining. Practically all of the N. S. collections show rosettes with few blunt-pointed leaves. Rare in the southwestern counties; scattered from Digby to Hants Co.; common to northern C. B. July-Aug. (*P. chlorantha* Sw.).

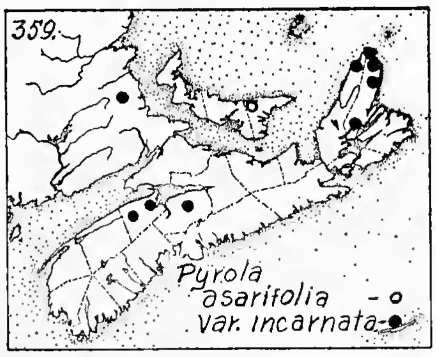
Nfld. to B. C. south to N. S., N. Eng. & Ariz.

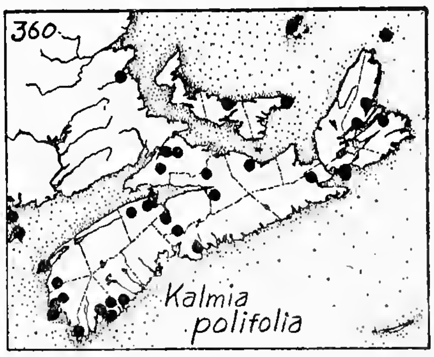
5. **P. rotundifolia** L., var. **americana** (Sweet) Fern., Rhodora **22**: 121-122. 1920. ROUND-LEAVED PYROLA. Map 358. Fig. 94, g, k.

Scattered on the peninsula; open or rich woods, and on hillsides; commoner in the center of the province. July. N. S. to S. Dak. south to Ga.

Var. **arenaria** Mert. & Koch is found in dry places, open pastures, sandy plains and barrens from Yarmouth Co. east at least to Colchester Co. It is a smaller European form that is found in America from Greenland & Nfld. south to the Maritime Provinces.







6. **P. asarifolia** Michx. Map 359. Fig. 94, i.

Rare; found in rich hardwoods and in intervales; common in northern C. B., becoming rarer westward to Kings Co. June 15-July.

N. S. to the Yukon south to N. S. and northern N. Eng. etc.

5. LEDUM L.

1. **L. groenlandicum** Oeder. LABRADOR TEA. Fig. 95, b.

Common throughout; bogs, wooded swamps, wet barrens and poorly-drained opens and pastures. June 10-30.

Arctic America south to Penn., Minn. etc.

6. RHODODENDRON L.

a. Shrub, to 1 m high; leaves thin, deciduous, dull; corolla 2-lipped, less than 2 cm wide. 1. *R. canadense*

a. Shrub 2 to 5 m high; leaves thick and smooth, 8-20 cm long; corolla bell-shaped, 3.5-5 cm wide. 2 *R. maximum*

1. **R. canadense** (L.) BSP. RHODORA. Fig. 95, c.

Very common throughout; swamps, rocky barrens, poorly-drained soils and around the edges of bogs. May 20-June 20. Forma **viridifolium** Fern., in Wilson & Rehder, Mon. Azal. 122. 1921, has the leaves and twigs lacking the grayish bloom which characterizes the species. Occasionally seen in wet areas in Yarmouth Co.

Nfld. to Que. south to N. J. & Penn.

2. **R. maximum** L. GREAT LAUREL

Collected over 50 years ago near Beaver Dam Gold Mines, Sheet Harbour, and unknown in the province since that time. An article in the Proc. N. S. Inst. Sci. (Lawson, 1887) gives an interesting account of the discovery and location of this plant.

N. S.; Me. south through the Alleghenies to Ga.

7. LOISELEURIA Desv.

1. **L. procumbens** (L.) Desv. ALPINE AZALEA.

Collected by Howe and Lang on dry humus, Kingsport, July 8 & 9, 1901. This is the only record known for the province.

Mts. of N. H., Me. & Que., and N. S. to Nfld. and northward.

8. KALMIA L.

a. Leaves smooth beneath, flat; twigs terete; flower-clusters lateral. 1. *K. angustifolia*

a. Leaves finely whitish-pubescent beneath, the edges inrolled; flowers terminal. 2. *K. polifolia*

1. **K. angustifolia** L. SHEEP LAUREL, LAMBKILL Fig. 95, f.

Very common throughout; pastures, barrens, roadsides, and open thickets everywheres. It is characteristic of dryish or run-out soils; found also in bogs; poisonous to cattle. June 20-early July.

Lab. to Ont. south to Ga. & Mich.

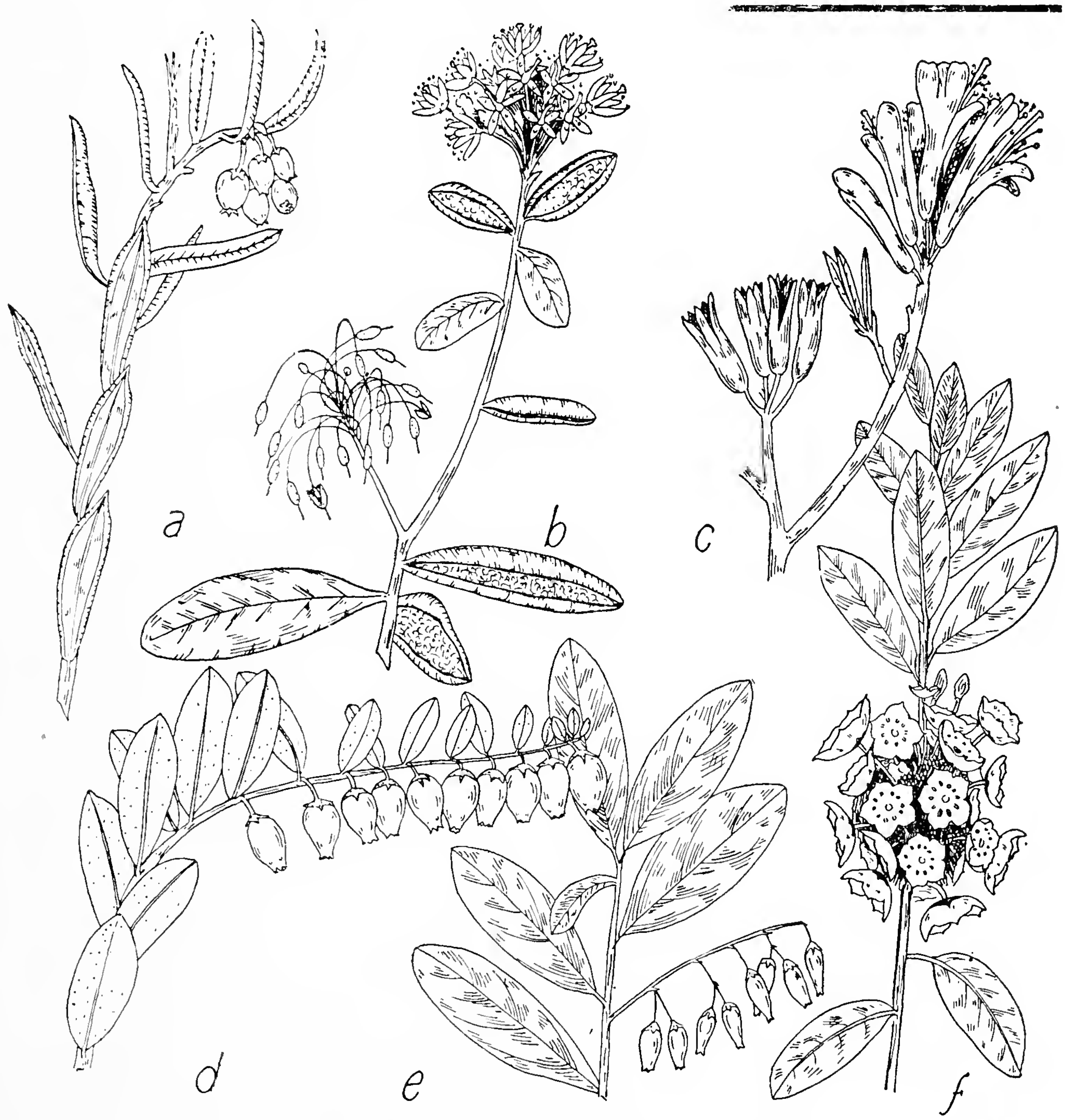


Fig. 95.—**Andromeda.** a, **A. glaucophylla,** x ½. **Ledum**· b, **L. groenlandicum,** x ½. **Rhododendron.** c, **R. canadense,** x ½. **Chamaedaphne.** d, **C. calyculata,** x ½. **Gaylussacia.** e, **G. baccata,** x ½. **Kalmia.** f, **K. angustifolia,** x ½.

2. **K. polifolia** Wang. PALE LAUREL. Map 360.

Scattered in peat bogs throughout; apparently much commoner eastward, where bog conditions are more often found. Mid-June.

Lab. to Alaska south to Penn., Mich. & Calif.

9. ANDROMEDA L.

1. **A. glaucophylla** Link. Map 361. Fig. 95, a.

Peat bogs throughout; rather common in its habitat. Plants reported as *A. polifolia* belong here. Early June.

Lab. to Man. south to Penn. & Minn.

10. CHAMAEDAPHNE Moench.

1. **C. calyculata** (L.) Moench. LEATHER LEAF, CASSANDRA. Fig. 95, d.

Common throughout, found nearest the center of bogs or marshes or next to bog lakes; it is occasionally found on lake margins or in poorly-drained soil. May 15-June 10.

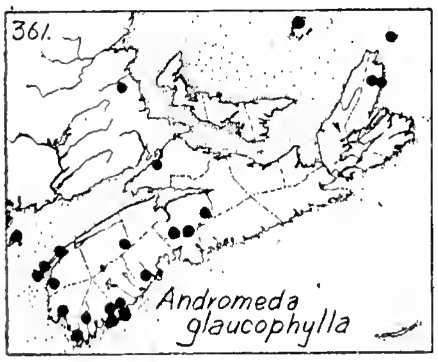
Lab. to Alaska south to Ga.; Eurasia.

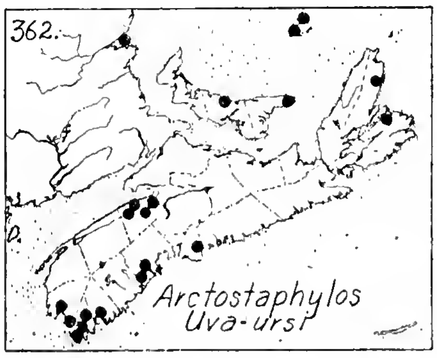
11. ARCTOSTAPHYLOS Adans.

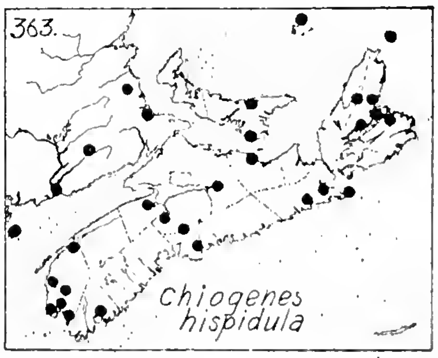
1. **A. Uva-ursi** (L.) Spreng., var. **coactilis** Fern. & MacBride, Rhodora **16**: 212. 1914. BEARBERRY. Map 362.

Common on the sandy barrens of Kings and Annapolis Cos.; scattered in dry areas from Yarmouth to Halifax Co.; local east to northern C. B. Early June.

Arctic regions south to Penn., Va. & Calif.







12. EPIGAEA L.

1. **E. repens** L., var. **glabrifolia** Fern., Rhodora **41**: 446. 1939. MAYFLOWER, TRAILING ARBUTUS.

Rather common; pastures, hillsides, barrens, open woods and on sandy soils, throughout. April 15-May 15.

Lab. to Sask. south to Va.

13. GAULTHERIA (Kalm) L.

1. **G. procumbens** L. TEABERRY, CHECKERBERRY. Fig. 94, e.

Very common throughout; woods, barrens, pastures, mostly in the open or nearly so, frequently the common plant of the ground cover over considerable areas. Late July-Aug.

Nfld. to Man. south to Ga.

14. CALLUNA Salisb.

1. **C. vulgaris** (L.) Hull. LING, HEATHER.

Growing in scattered places from Halifax and Pictou to C. B., probably scattered elsewhere. All records are probably of early introductions. Aug.

Introduced from Eu.; local.

15. CHIOGENES Salisb.

1. **C. hispidula** (L.) Torr. & Gray. SNOWBERRY, TEABERRY. Map 363.

Scattered throughout, often abundant on mossy woodland knolls, barrens and mature bogs; appearing like a tiny cranberry with rounded instead of narrow leaves. June.

Lab. & Nfld. to B. C. south to N. C.

16. GAYLUSSACIA HBK.

a. Leaves thin, oblong, acute and tapering similarly to both ends; ovary and fruit smooth. 1. *G. baccata*

a. Leaves thick, oval, rounded at the apex with a prominent short point formed by the extension of the mid-rib; ovary and fruit bristly-hairy. 2. *G. dumosa*

1. **G. baccata** (Wang.) K. Koch. HUCKLEBERRY. Map 364. Fig. 95, e.

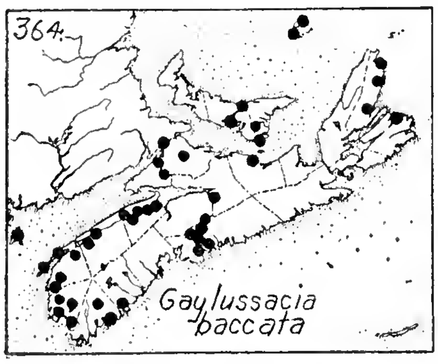
Rather general throughout, often common; rocky pastures, barrens, and mature bogs, sometimes in light soil, or on sand, but also in wet soil or on bogs; occasionally seen heavily fruiting. Early June.

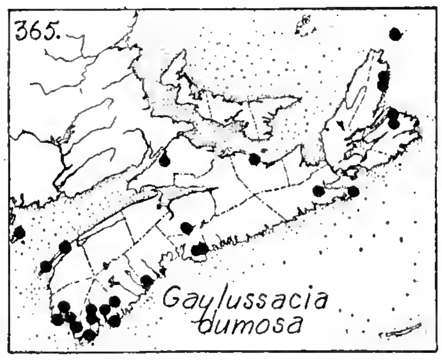
Nfld. to Man. south to Ga.

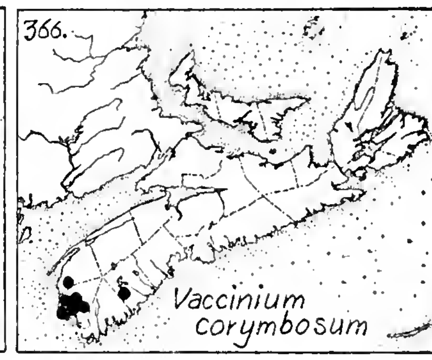
2. **G. dumosa** (Andr.) Torr. & Gray., var. **Bigeloviana** Fern., Rhodora **13**: 99. 1911. BOG HUCKLEBERRY. Map 365.

Common in boggy barrens and sphagnous bogs from Yarmouth to Halifax Co.; scattered elsewhere. Early June.

Nfld. south to N. J. near the coast.







17. VACCINIUM L. BLUEBERRY, FOXBERRY, CRANBERRY.

Camp, W. H. The North American blueberries with notes on other groups of Vacciniaceae. Brittonia **5**: 203-275. 1945. Porsild, A. E. The Cranberry in Canada. Can. Field Nat. **52**: 116-117. 1938.

a. Plants erect; leaves thin, deciduous; corolla bell-shaped, shallowly lobed; fruit blue to black.
  b. Tall shrubs; leaves 3-8 cm long; corolla white, 6-12 mm long; Halifax to Yarmouth along the South Shore. 1. *V. corymbosum*
  b. Low shrubs, less than 1 m high, and usually only 1-4 dm; leaves 2-4 cm long or less; corolla white to rose.
    c. Leaves smooth, or pubescent on the mid-rib beneath; twigs hairy only in lines.
      d. Leaves green beneath, finely toothed with bristle-pointed teeth; fruit with a bloom.
        e. Plant dwarf, to 2 dm high; leaves 7-25 mm long, 3-8 mm wide; corolla 3-6 mm long. 2. *V. angustifolium*
        e. Plant erect, 2-6 dm high; leaves 15-35 mm long, 8-15 mm wide; corolla 4-8 mm long. *V. angustifolium* var. *laevigatum*
      d. Leaves whitish beneath, the edges smooth or finely toothed.
        f. Leaves oblong or elliptical, tapering to each end, finely and bristly toothed; fruit without a bloom or nearly so.
          g. Leaves greenish, without a whitish bloom. *V. angustifolium* var. *nigrum*
          g. Leaves with a noticeable whitish bloom. 3. *V. Brittonii*
        f. Leaves oval or broadly oblong, often blunt at the end, with the edge smooth or very rarely finely toothed; fruit with a bloom. 4. *V. pallidum*

c. Leaves downy, at least on the under side; margins always smooth; twigs densely and finely hairy; fruit with a bloom. 5. *V. myrtilloides*

a. Plants creeping or prostrate; leaves evergreen; corolla 4-lobed or 4- parted; fruit black or red.

h. Leaves oval, thick, with scattered black-pointed hairs beneath; corolla bell-shaped to round, shallowly lobed.

i. Fruit black; leaves slightly hairy beneath; plants woody, bushy and much branched, more or less prostrate. 6. *V. uliginosum*

i. Fruit red; leaves finely dotted with black hairs beneath; plants with short semi-woody erect branches. 7. *V. Vitis-Idaea*

h. Leaves oblong to linear, shining above and glaucous beneath; corolla deeply 4-parted with the lobes recurved; cranberries.

j. Leaves acute; stem slender and thread-like, not usually growing beyond the flowers and fruit; pedicels with two small reddish linear bracts; berry brownish-dotted.

k. Leaves 1-3 mm wide; flowers 1-4; corolla-lobes 5-8 mm long; berry 6-8 mm thick. 8. *V. Oxycoccos*

k. Leaves 3-6.5 mm wide; flowers 2-10; corolla-lobes 6-8 mm long; berry 8-10 mm thick. *V. Oxycoccos* var. *intermedium*

j. Leaves oblong and blunt; pedicels with wider, green bracts; corolla lobes 6-10 mm long; berry 10-20 mm thick, red. 9. *V. macrocarpon*

1. **V. corymbosum** L. HIGHBUSH BLUEBERRY. Map 366.

Southwestern counties from Digby Co. around to Halifax; bogs, upland rocky barrens, dry soil and along lake-margins. The plants are very variable, with the progeny from a single bush showing variable combinations in regard to pubescence, size and bloom of berry, habit of bush, etc. The typical form of the species, with the leaf-margins nearly smooth and the leaves more or less pubescent beneath, is rarely seen: thickets bordering Goven L., Yarmouth Co. Forma **albiflorum** (Hook) Camp, Amer. Midl. Nat. **23**: 177. 1940, with toothed leaves and the blades green on both surfaces, is the commonest form. (Var. *amoenum* (Ait.) Gray). This is found in bogs, on lake margins, thickets, swampy spruce woods, and new clearings. Forma **glabrum** (Gray) Camp, l. c. 1940, is much rarer than the preceeding form but is occasionally found in wet woods and swampy thickets. (Var. *pallidum* (Ait.) Gray). June.

N. S. & Me. to Minn. south to Fla. & Tex.

2. **V. angustifolium** Ait. LOWBUSH BLUEBERRY

This dwarf form is found on exposed heaths, headlands and mountain tops in C. B. It grades into the following variety in appearance, but plants of the eastern part of the province are noticeably smaller and have narrower leaves than those of the southwestern regions. In pastures, as around Truro, some clones may show plants as small and dwarf as those typical of the species. Nfld. to Minn. south to N. J. and W. Va.

Var. **laevifolium** House, Bull. N. Y. State Mus. **61**: 243-244. 1923, is our common low-bush blueberry. Common throughout; old fields, bogs, sandy barrens, beaches and headlands, generally preferring open areas with sunlight, gradually disappearing in thickets or in pastures growing up to bushes. (*V. pensylvanicum* Lam.). Camp finds that the more northern *V. angustifolium* has only half the number of chromosomes found in the relatively more southern var. *laevifolium,* and that the two do not hybridize. Consequently he has put the variety into a separate species with the name *V. Lamarckii* Camp, Bull. Torrey Bot. Club **71**: 180. 1945.

Var. **nigrum** (Wood) Dole, Fl. Vermont, ed. **3**: 212. 1937, is found mixed with the previous variety. It is supposed to be a hybrid with *V. Brittonii* Porter, and many variations occur. The taxonomic situation for the blueberries is very complex; and the occurrance of tetraploids and hybrids is the rule. The more vigorous plants are apparently tetraploids. These may further cross with the highbush blueberries to produce half-high bushes. Hybrids may also occur with *V. Brittonii* and *V. myrtilloides.*

Nfld. to Minn. south to N. C.

3. **V. Brittonii** Porter, Bull. Torrey Bot. Club **41**: 420. 1914.

Common throughout the western half of the province, probably throughout. In the southwestern counties it makes up about one-tenth of the blueberry population. It is usually found on light soil, and seems to grow in mild shade as well as in full sunlight. In the Annapolis Valley it frequently becomes dominant in open second growth on sandy soils. N. S. to N. Eng.

4. **V. pallidum** Ait. DRYLAND BLUEBERRY.

Rare; recorded with doubt by Lindsay from Halifax. It is reported by Fernald (1921) as dominant on the upper border of the cobble-beach of Butler's L., Gavelton, Yarmouth Co. This station is now under water, due to the building of a power dam. However, the plant should be found elsewhere in the southwestern counties. (*V. vacillans* Kalm ex Torrey).

Dry soil; N. S. & Me. to Ga. inland to Ind.

5. **V. myrtilloides** Michx. CANADA BLUEBERRY.

Common throughout; sterile and dry soils, rocky barrens, roadside thickets and open woods, sometimes associated with conifers, and not growing well in open sunlight. The fruit is rather small, with a heavy bloom, and is generally of inferior quality. (*V. canadense* Kalm).

Lab. to Man. south to the mts. of Va. & to Ill.

6. **V. uliginosum** L., var. **alpinum** Bigel., see Malte, Rhodora **36**: 183. 1934. BOG WHORTLEBERRY.

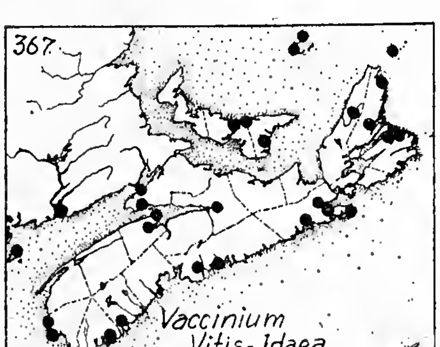
Nichols (1918) reports it from the top of Mount Franey, C. B., and says that it is characteristic of the dwarf-shrub heath in northern C. B.; Miss Perry (1930) reports it from the upper slope of headland, West Point, and South West Light on St. Paul Is. Prest (1905) says that it is found on barrens with blueberries, very rarely in swampy land. Not plentiful. Grows chiefly in the western and northern counties. It is not clear just what plant Prest is here referring to. The true status of the variety is also doubtful.

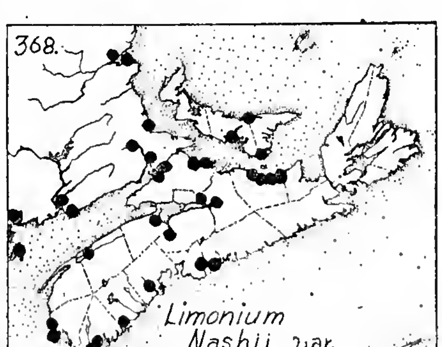
Circumboreal; ranging south to Me. and the mts. of N. Eng.

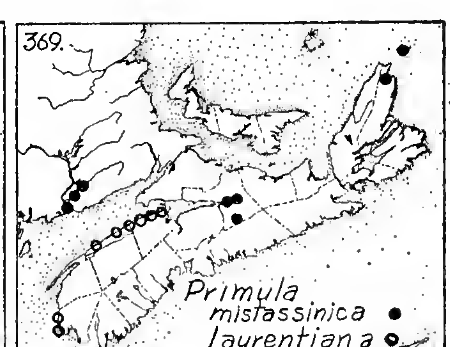
7. **V. Vitis-Idaea** L., var. **minus** Lodd. FOXBERRY. Map 367.

Common in any of the cooler regions of the province; bare headlands, barrens or other exposed situations generally near the sea; occasional on barrens or heaths inland. It is most abundant in Guysborough Co. and around C. B. June.

Artic America south to Mass. & L. Superior.







8. **V. Oxycoccos** L. SMALL CRANBERRY.

Found throughout; in moderately wet, open bogs or poorly-drained swamps, almost always associated with *Sphagnum* since the plants are sensitive to the amount of water present. It is most abundant on lake margins of the Atlantic coastal region and in C. B. June 20-July 15. [*Oxycoccus quadripetalus* Gilib., var. *microphyllus* (Lange) M. P. Porsild]. Arctic America south to Penn. & Wisc.

Var. **intermedium** Gray is rare; spruce bog at Yarmouth, collected by Bissell and Long, 22,230; edge of cliffs on St. Paul Is., C. B. (*O. quadripetalus* Gilib.). Found through much the same range as the species.

9. **V. macrocarpon** Ait. LARGE CRANBERRY.

Frequent to abundant in meadows, along brooks, on sphagnum mats around lakes, in poorly drained swamps, or bogs, in meadows covered by spring tides, and often growing into dryish fields or along the edge of salt marshes. On Sable Is. it is very abundant in most of the dune hollows. The virus disease causing false blossom is often found in old cultivated bogs, but has not been found in isolated native plants in the province. Mid-July. [*Oxycoccus macrocarpus* (Ait.) Pers.].

Nfld. to Wisc. south to Ark. and N. J.

84. PLUMBAGINACEAE LEADWORT FAMILY

1. LIMONIUM (Tourn.) Hill

1. **L. Nashii** Small, var. **trichogonum** Blake, Rhodora **25**: 58. 1923. SEA LAVENDER. Map 368. Fig. 96, a.

Salt marshes and around sea-shores; common on the marshes about the head of the Bay of Fundy; an early pioneer on salt marshes in northern C. B.; scattered elsewhere. July 20-Sept. [*L. carolinianum* (Walt.) Britt.].

Lab. to N. J. along the coast, grading into the southern *L. Nashii*.

85. PRIMULACEAE PRIMROSE FAMILY

a. Plant stemless; leaves smooth to mealy beneath, in a basal rosette (Fig. 96, b). 1. *Primula*

a. Plant with a leafy stem; leaves not mealy beneath.

b. Leaves alternate; plants rare.

c. Ovary joined at base to the base of the calyx; flowers stalked in erect racemes. 2. *Samolus*

c. Ovary wholly separate from the calyx; flowers small, sessile in the axils of the leaves. 7. *Centunculus*

b. Leaves opposite or whorled.

d. Flowers yellow, 1-2 cm wide; leaves numerous, scattered; plants 2-8 dm high (Fig. 96, c-g). 3. *Lysimachia*

d. Flowers scarlet, pinkish, lavender or white.

e. Leaves in a single whorl at the top of the stem; plant 10-15 cm high; flowers white (Fig. 98, b). 4. *Trientalis*

e. Leaves in numerous whorls or pairs; plants low.

f. Plants erect, 1-2 dm high, with oblong thickish leaves; flowers 3 mm wide; sea coast (Fig. 98, a). 5. *Glaux*

f. Plants trailing, with acute thin leaves; flowers 10-12 mm wide. 6. *Anagallis*

Fig. 96.—**Limonium.** a, **L. Nashii,** x ¼. **Primula.** b, **P. laurentiana,** x ⅓. **Lysimachia.** c, **L. terrestris** top of plant, x ⅓. d, **L. thrysiflora,** x ⅓. e, **L. Nummularia,** x ½. f, **L. punctata,** x ⅓. g, **L. ciliata,** x ⅓.

1. PRIMULA L.

Fernald, M. L. *Primula* Section *Farinosae* in America. Rhodora **30**: 59-77; 85-104. 1928.

a. Plant smooth; flowers white to pale lilac; calyx less than 7 mm long.
 b. Leaves mealy-whitened beneath; plant 1.4-5 dm high, with leaves 2.5-10 cm long; capsule 9-12 mm long. 1. *P. laurentiana*
 b. Leaves scarcely or not mealy beneath; plant 0.5-2 dm high, with leaves 1-4 cm long; capsule 5-8 mm long. 2. *P. mistassinica*
a. Plant soft-hairy; flowers deep yellow or rarely purplish; calyx more than 10 mm long. 3. *P. veris*

1. **P. laurentiana** Fern., Rhodora **30**: 68. 1928. PRIMROSE. Map 369. Fig. 96, b.

Scattered along the Bay of Fundy on dripping cliffs and basaltic headlands; not known from the northern part of the province. Late June (*P. farinosa* var. *macropoda* Fern.).

Southern Lab. to N. S. and Central Me.

2. **P. mistassinica** Michx. Map 369.

Springy banks of streams and dripping ledges; above Truro, where it is common; Upper Stewiacke; and in northern C. B. May 20-June 10.

Lab. to the Yukon south to N. S., northern Wisc. & B. C.

3. **P. veris** L. COWSLIP.

Commonly found as an ornamental in old gardens and around dwellings; reported by Macoun as well-established in meadows about a mile inland from North Sydney, as *P. officinalis* L. Introduced from Eu., and widespread.

2. SAMOLUS (Tourn.) L.

1. **S. pauciflorus** Raf., see House, Bull. N. Y. State Mus. **254**: 558. 1924. WATER PIMPERNEL, BROOK-WEED. Map 370.

Rather rare; brackish meadows, tidal banks, and edges of salt marshes from the Tusket R. in Yarmouth to Bridgewater; Antigonish. July-Sept. (*S. floribundus* HBK.).

N.S. to B.C. south into South America.

3. **LYSIMACHIA** (Tourn.) L. LOOSESTRIFE

a. Flowers 1 cm or more wide, not in stalked axillary heads; stems square in cross-section.

b. Plants tall, erect; leaves lanceolate to ovate-lanceolate, 25-80 mm long or more; flowers numerous.

c. Petioles of the leaves narrowly winged, the two edges fringed with hairs; flowers with 5 slender sterile stamens between the anther-bearing ones. 1. *L. ciliata*

c. Petioles of the leaves with the margins not fringed; flowers without sterile stamens, numerous.

d. Plant usually densely glandular-pubescent; flowers large and showy, the petals wide, and plain yellow; garden escapes.

e. Calyx 4-5 mm long, with dark margin; flowers 1.5-2 cm broad, in terminal leafy panicles. 2. *L. vulgaris*

e. Calyx 7-10 mm long, green throughout; flowers similar, but mostly whorled in the axils of the upper leaves. 3. *L. punctata*

d. Plant smooth, as is also the calyx; flowers smaller, the petals lanceolate and dark-lined; inflorescence a terminal raceme 0.5-2 dm long; native to wet habitats. 4. *L. terrestris*

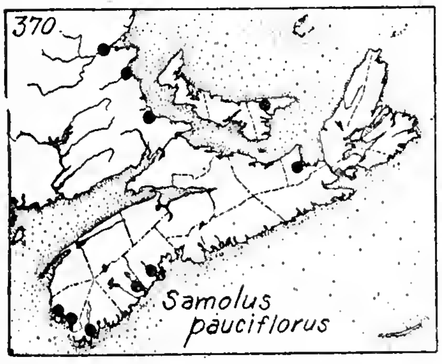
b. Plants trailing, smooth; leaves orbicular, 10-25 mm wide; flowers large, cup-shaped, scattered in 1's or 2's in the axils of the leaves. 5. *L. Nummularia*

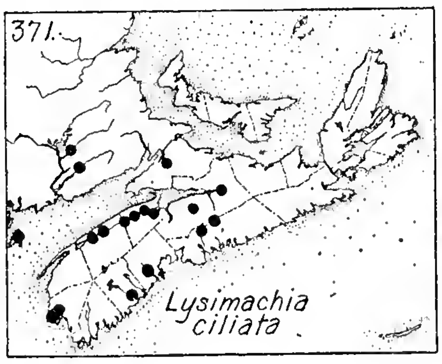
a. Flowers very small, crowded into dense, long-stalked, oval heads in the axils of the middle leaves; stems round in cross-section. 6. *L. thyrsiflora*

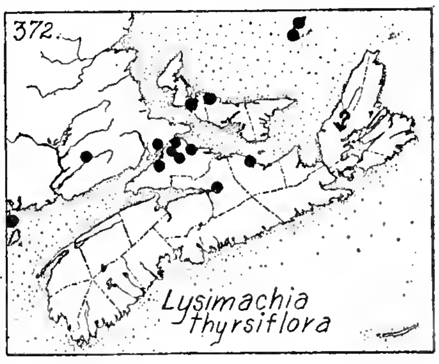
1. **L. ciliata** L. FRINGED LOOSESTRIFE. Map 371. Fig. 96, g.

Low and damp ground and thickets; rare in the south-western part of the province, scattered to Halifax and Cumberland Cos.; rather common in the Annapolis Valley. Late July. [*Steironema ciliatum* (L.) Raf.].

N. S. to B. C. south to Ga., Kans. & N. M.







2. **L. vulgaris** L. GARDEN LOOSESTRIFE.

Occasional about gardens or as an escape; collections have been seen from Pictou and Charlottetown. July-Sept.

Introduced from Eu.; N. S. to Ontario southward.

3. **L. punctata** L. FRINGED OF GARDEN LOOSESTRIFE. Fig. 96, f.

This garden plant is thoroughly naturalized along roadsides and marshes in many parts of the province; especially common about Truro. July-Aug. 15.

N. S. south to Penn.; naturalized from Eu.

4. **L. terrestris** (L.) BSP. LOOSESTRIFE. Fig. 96, c.

Common throughout; boggy thickets, meadows and marshes. July.

Nfld. to Man. south to Ga. & Ariz.

5. **L. Nummularia** L. MONEYWORT. Fig. 96, e.

Common, at least from Yarmouth to Truro, probably throughout. This garden escape is found mostly near old gardens, or in wet fields and meadows near habitations. July.

Introduced from Eu.; Nfld. to Wisc. south to N. J., Va. & Ill.

6. **L. thyrsiflora** L. WATER LOOSESTRIFE. Map 372. Fig. 96, d.

Cold swamps, along brooks or growing in shallow water in muck. Common in marshes about Truro and scattered east to Pictou and northwards in Cumberland Co. June 15-July.

N. S. & Que. to Alaska south to Penn., Mo. & Calif.; Eurasia.

4. TRIENTALIS (Rupp.) L.

1. **T. borealis** Raf., see Rhodora **11**: 236. 1909. STAR-FLOWER. Fig. 98, b.

Coniferous or hardwood forests, and a forest pioneer; rather common throughout, and one of the better-known woodland plants. Mid-June. [*T. americana* (Pers.) Pursh].

Lab. to Man. south to Va. & Ill.

5. GLAUX (Tourn.)L.

a. Plant diffusely branched with loosely ascending or prostrate branches; leaves crowded, oblong. 1. *G. maritima*

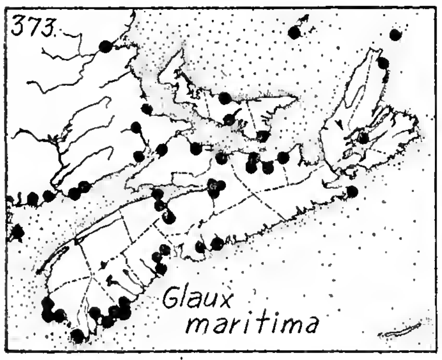
a. Plant unbranched or with a few erect branches; leaves broadly oval. *G. maritima* var. *obtusifolia*

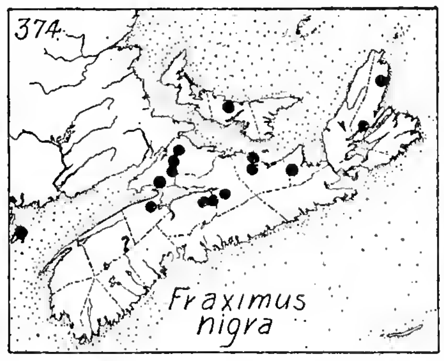
1. **G. maritima** L. MILKWORT. Map 373. Fig. 98, a.

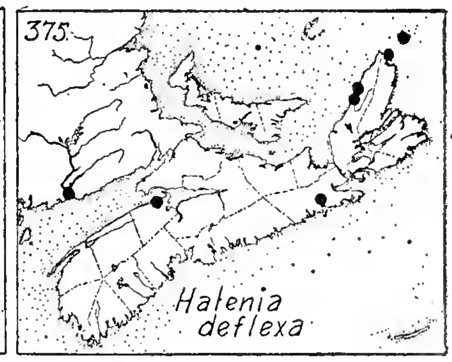
Rather rare; specimens from a gravelly beach, Shelburne Co., and from near Truro, belong here. Cape Cod northward; subalkaline soil Man. to Minn. westward.

Var. **obtusifolia** Fern. is common around the coast in salt meadows, on sandy shores, or near the upper limits of the dykelands. June 15-July 20.

N. J. northward; also on the Pacific Coast and in Asia.







6. ANAGALLIS (Tourn.) L.

1. **A. arvensis** L. COMMON PIMPERNEL, POOR-MAN'S WEATHERGLASS.

Sandy beaches, fields and waste places; scattered from Digby and Bridgewater to Pictou, and probably elsewhere. Late summer and early fall.

Naturalized from Eu.; Nfld. to Fla. west to the Pacific.

7. CENTUNCULUS (Dill.) L.

1. **C. minimus** L. CHAFFWEED.

The only record for N. S. is that of St. John from Sable Is.; locally found on bare sand flats which are occasionally flooded by the sea.

N. S.; P. E. I., central and southern U. S.; in Eu.

86. OLEACEAE OLIVE FAMILY

1. FRAXINUS (Tourn.) L. ASH

a. Lateral leaflets short-stalked, commonly 6; anthers linear; fruit terete, tapering to the tip; calyx present.
  b. Petioles and shoots smooth. 1. *F. americana*
  b. Petioles and shoots velvety pubescent; body of the fruit wing-margined. 2. *F. pensylvanica* var *Austini*

a. Lateral leaflets sessile, rounded at the base, commonly 10; anthers short-oblong; fruit flattened, not tapering to either end; calyx absent. 3. *F. nigra*

1. **F. americana** L. WHITE ASH. Fig. 97, a.

Throughout; rather common in the center of the province; intervale forests, low ground and open woods. Late May.

N. S. to Minn. south to Fla. & Tex.

2. **F. pensylvanica** Marsh., var. **Austini** Fern., Rhodora **40**: 452. 1938.

Rather rare in bogs, near the margins of lakes and streams in the center of the province. Reports of Macoun of *F. pubescens* from Halifax, and the species listed by Nichols as characteristic of wooded and poorly-drained swamps in northern C. B., probably belong here. Found at Lakelands, Hants Co.

N. S. to Man. south to N. Y. & Mass.

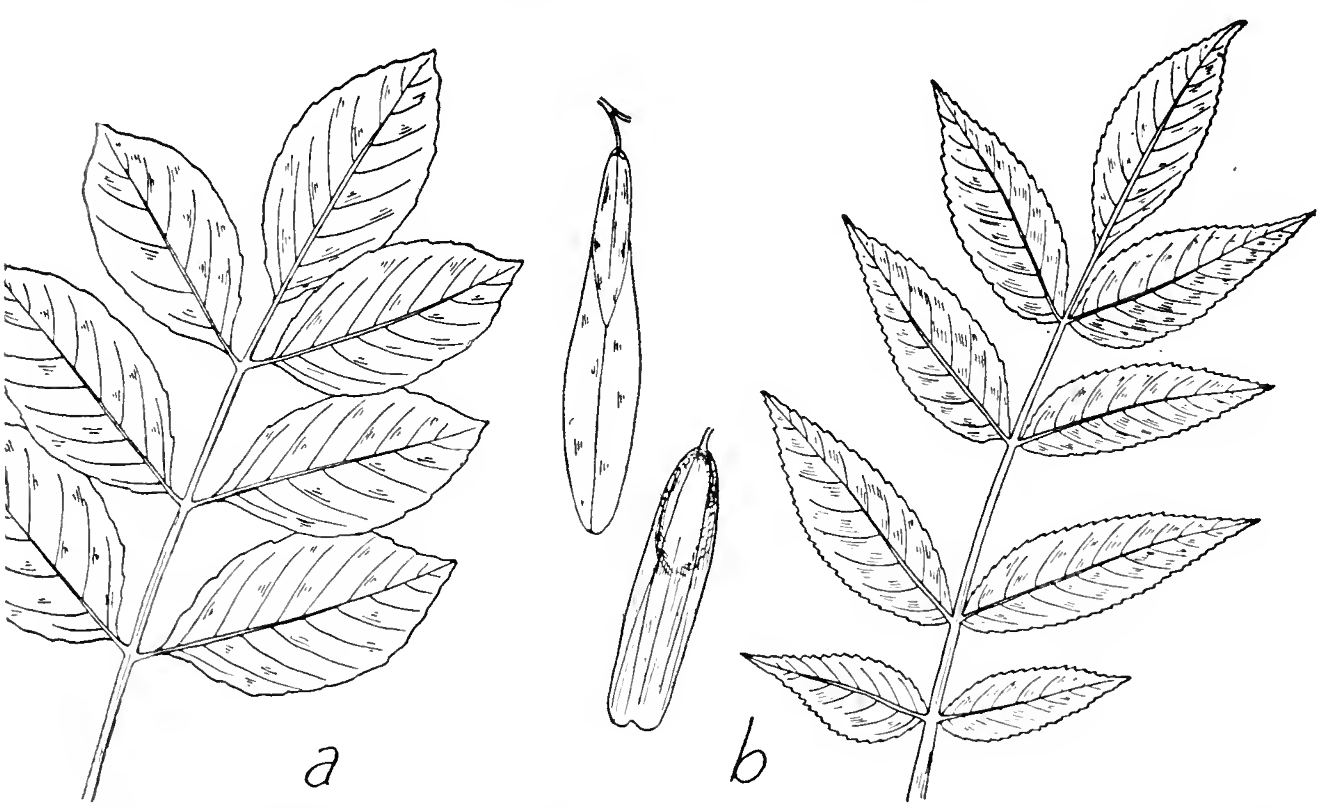


Fig. 97.—**Fraxinus.** a, **F. americana,** leaf, x $\frac{1}{4}$; fruit, x $\frac{1}{2}$. b, **F. nigra,** leaf, x $\frac{1}{4}$; fruit, x $\frac{1}{2}$.

3. **F. nigra** Marsh. BLACK ASH Map 374. Fig. 97, b.

Low ground, damp woods and swamps; rather common through the central and northern parts of the province, probably scattered throughout this region. (*F. sambucifolia* Lam.).

Nfld. to Man. south to W. Va., Ind. & Ark.

87. GENTIANACEAE GENTIAN FAMILY

a. Leaves not typically lily-like, nor floating; marsh or land plants.
  b. Leaves opposite, sessile, simple and untoothed.
    c. Leaves of normal size, green; corolla large.
      d. Style long and thread-like; petals not spurred, rose-purple.
        e. Corolla with a very short tube, with 5-12 lobes; flowers peduncled (Fig. 98, c). 1. *Sabatia*
        e. Corolla with a long tube, usually with 5 lobes, about 10 mm wide; flowers mostly sessile. 2. *Centaurium*
      d. Style short or none; petals 4, mostly prominently spurred at the base, yellowish-purple; flowers all peduncled, 4-5 mm wide (Fig. 98, f). 3. *Halenia*
    c. Leaves reduced to scales; petals 4, 3-4 mm long, greenish; plants wiry, insignificant (Fig. 98, e). 4. *Bartonia*
  b. Leaves alternate, stalked, with 3 leathery leaflets (Fig. 98, d). 5. *Menyanthes*
a. Leaves lily-like, round with a v-shaped notch at the base; floating on the surface of quiet waters (Fig. 98, g). 6. *Nymphoides*

1. SABATIA Adans.

1. **S. Kennedyana** Fern., Rhodora **18**: 150. 1916. PLYMOUTH GENTIAN. Fig. 98, c.

Known only from the Tusket Valley, Yarmouth Co., where it is common to rare on the sandy and cobbly beaches and peaty margins of river, lakes and boggy savannahs. Aug. Two variations occur with the same general distribution as the species. Forma **candida** Fern., Rhodora **24**: 180. 1922, has the flowers-white; forma **eucycla** Fern., l. c., has the lobes of the corolla broadly obovate and more or less overlapping. Both forms are rare.

Southern N. S.; Mass. & R. I.

2. CENTAURIUM Hill

1. **C. umbellatum** Gilib. CENTAURY.

Found in the Maritimes only on Sable Is., where it is common in the wet dune hollows and sandy borders of fresh-water ponds; reported erroneously in Gray's Man. from waste grounds, N. S.

Sparingly introduced from Eu.; N. S., Mass. to Mich.

3. HALENIA Borkh.

a. Plant 10-90 cm high; stem simple or branched above; flowers numerous, short-stalked, in a loose cyme. 1. *H. deflexa*

a. Plants 3-15 cm high; stem much branched; flowers in a 3-flowered cyme, the central one long-stalked. *H. deflexa* var. *Brentoniana*

Fig. 98.—**Glaux.** a, **G. maritima,** plant, x $\frac{1}{2}$; flower, x 2. **Trientalis.** b, **T. borealis.** x $\frac{1}{4}$. **Sabatia.** c, **S. Kennedyana,** x $\frac{1}{2}$. **Menyanthes.** d, **M. trifoliata,** x $\frac{1}{4}$. **Bartonia.** e, **B. virginica,** x 1. **Halenia.** f, **H. deflexa,** x $\frac{1}{2}$. **Nymphoides.** g, **N. cordatum,** x $\frac{1}{3}$.

1. **H. deflexa** (Sm.) Griseb. SPURRED GENTIAN. Map 375. Fig. 98, f.

Damp soil, exposed places and sea-bluffs; rare on the peninsula and found only at Hall's Harbour and near Sherbrooke; common on bleak exposed headlands around northern C. B. Late flowering colonies occasionally bear flowers without spurs. These belong to forma **heterantha** (Griseb.) Fern., Rhodora **40:** 340. 1938.

Var. **Brentoniana** Gray, see Allen, Ann. Missouri Bot. Garden **20:** 167. 1933, is a dwarf form found around northern C. B., the Magdalen Islands, and northward.

Lab. south to N. Y. west to B. C. & Mont.; central Mex.

4. BARTONIA Muhl.

Fernald's key to the varieties of *B. paniculata*, Rhodora **23**: 287. 1921, is largely followed here.

a. Corolla-lobes oblong or gradually widening to a rounded summit, blunt and usually toothed at the apex; stigma columnar, about 1 mm long. 1. *B. virginica*

a. Corolla-lobes lanceolate to oblong or obovate, blunt or acutish; stigma 0.5 mm long or less.

b. Calyx cleft nearly or quite to the base, the lobes lanceolate or narrowly oblong, acuminate or at least acute.

c. Plant yellowish-green, rarely purplish; flowers 2.5-5 mm long; corolla-lobes mostly creamy-white, 0.7-1.5 mm wide; anthers mostly yellowish. 2. *B. paniculata*

c. Plant purplish or fulvous; flowers 3.8-6 mm long; corolla-lobes lobes purple-tipped or watery-white, 1.2-2 mm wide; anthers purplish. *B. paniculata* var. *intermedia*

b. Calyx cleft, at least on one side, only two-thirds or three-fourths to the base; the lobes herbaceous, oblong to ovate; corolla-lobes 1-2 mm long.

d. Flower-stalks club-shaped; two or three calyx-lobes cut to the base; corolla 3-5 mm long, creamy-white; anthers mostly yellowish. *B. paniculata* var. *sabulonensis*

d. Flower-stalks thread-like; calyx-tube 1-2 mm long; corolla 4-7 mm long, often purple-tinged; anthers mostly purple. *B. paniculata* var. *iodandra*

1. **B. virginica** (L.) BSP. BARTONIA. Map 376. Fig. 98, e.

Beaches, sandy and peaty bogs, even into dry barrens; rather common in southwestern N. S., becoming rarer to Bridgewater and Middleton. Late July-Sept.

N. S. to Minn. south to Fla. & La.

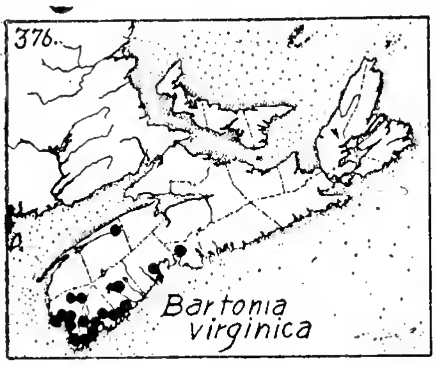
2. **B. paniculata** (Michx.) Robinson. Map 377.

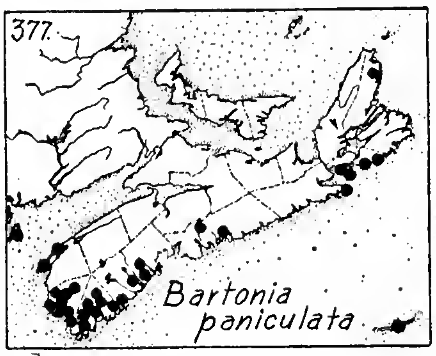
Wet bogs, quagmires, peaty and cobbly shores; common in Yarmouth Co., found to Halifax and Digby, grading into the following varieties. N. S. south along the coast to Fla. & La.

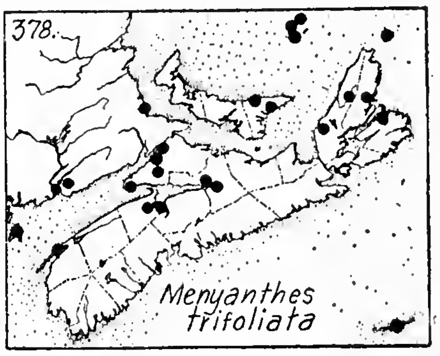
Var. **intermedia** Fern., Rhodora **23**: 287. 1921, is widely distributed in the province, in similar situations to the species, from Yarmouth and southern Digby Cos. to Richmond Co.

Var. **sabulonensis** Fern., Proc. Boston Soc. Nat. Hist. **36**: 89. 1921, was first described from Sable Is. It is usually more branched, with 4-30 flowers; rare in swales, sandy shores, and cobbly margins in southern Yarmouth, Shelburne and Lunenburg Cos.

Var. **iodandra** (Robinson) Fern., Rhodora **23**: 288. 1921, is reported only from Nfld. and as represented in C. B. by the transitional var. *intermedia.* However, much of the material from Isle Madame and northern C. B. seems to resemble this variety.







5. **MENYANTHES** (Tourn.) L.

1. **M. trifoliata** L., var. **minor** Raf. see Fernald, Rhodora **31**: 195-198. 1929. BUCKBEAN. Map 378. Fig. 98, d.

Stagnant pools, bogs, often with the roots covered with water and dominant in its particular habitat; common in the marshes at Truro, Kentville, Advocate, and Amherst and to northern C. B., rare or absent southward; found but once on Sable Is. June.

Lab. to Alaska south to N. J., the Great Lakes, Iowa, etc.

6. **NYMPHOIDES** (Tourn.) Hill

1. **N. cordatum** (Ell.) Fern., Rhodora **40**: 338. 1938. FLOATING HEART. Map 379. Fig. 98, g.

Common in lakes and ponds throughout; most numerous in the southern or western part of the province. July-Aug. [*N. lacunosum* (Vent.) Fern.].

N. S. to Fla. west to Ont., Minn. & La.

88. **APOCYNACEAE** DOGBANE FAMILY

a. Plant slender and trailing; flowers blue. 1. *Vinca*

a. Plant stout, erect or prostrate; flowers white to pink. 2. *Apocynum*

1. VINCA L.

1. **V. minor** L. MYRTLE, PERIWINKLE. Fig. 99, e.

A garden plant, often planted around cemeteries, shady lawns or roadsides, occasionally spreading and persistent. May to early June.

Naturalized from Eu.; N. S. to Ont. southward.

2. APOCYNUM (Tourn.) L.

Woodson, Robert E., Jr. A Monograph of the Genus *Apocynum* Ann. Missouri Bot. Gard. **17**: 41-156. 1930.

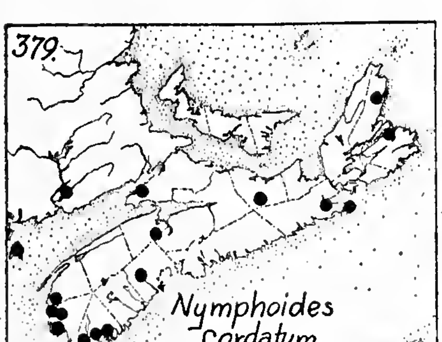
a. Leaves dropping or spreading, hairy beneath; corolla at least twice the length of the calyx-lobes; hair of the seeds pale-tawny.
 b. Leaves drooping; corolla at least 3 times the length of the calyx-lobes, 5-10 mm long; seeds 2 mm long, the hairs 1.5-2 cm long. 1. *A. androsaemifolium*
 b. Leaves spreading or ascending-spreading; corolla about twice the length of the calyx- lobes, 4-5 mm long; seeds about 4 mm long, the hairs pale-tawny, 2 cm long. 2. *A. medium*

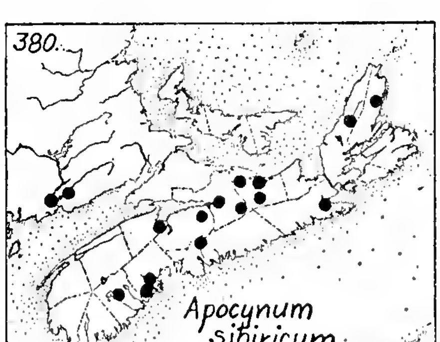
a. Leaves ascending, nearly or quite unstalked, smooth or glaucous beneath; corolla with erect lobes, barely exceeding the calyx, 2.3-5 mm long; follicles straight, 4-10 cm long; seeds 3.5-4 mm long with hairs 8-12 mm long. 3. *A. sibiricum*

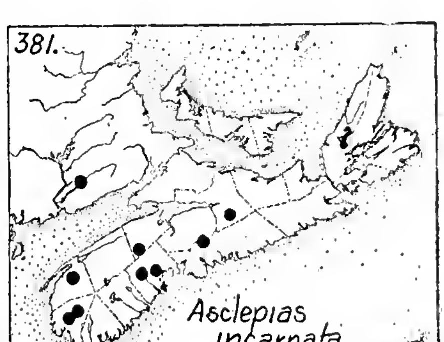
1. **A. androsaemifolium** L. See Rhodora **34**: 30-31. 1932 as to nomenclature. SPREADING DOGBANE. Fig. 99, a.

A weed in the Annapolis Valley and along roadsides in the central part of the province; common along streams and intervales in eastern N. S.; scattered through the rest of the province, often on sandy or light soils. July-Aug.

Nfld. to B. C. south to Ariz. & Ga.







2. X **A. medium** Greene

Reported by Woodson from the cobbly border of Shubenacadie Grand Lake, and the edge of Wentzell L., Lunenburg Co. This has been found to be a fertile hybrid of the preceeding and following species, and may be expected where these two species grow together. See Anderson, Ann. Missouri Bot. Gard. 23: 159-168. 1936.

N. S. to Nebr. south to Fla. & Tex.

3. **A. sibiricum** Jacq. INDIAN HEMP. Map 380. Fig. 99, b.

Gravelly beaches and cobbly or sandy banks of streams; Kings Co. to northern C. B.; commonest in Colchester and Pictou Cos., becoming rarer to Queens Co. along the south shore. Most of the plants are prostrate rather than erect. This is forma **arenarium** (Gates) Fern., Rhodora **37**: 327-328. 1935. [*A. cannabinum* L., var. *hypericifolium* (Ait.) Gray]. July-Aug.

Nfld. to Dak. south to Tex.

89. ASCLEPIADACEAE MILKWEED FAMILY

1. ASCLEPIAS (Tourn.) L.

a. Leaves oval, 12-20 cm long, closely and regularly veined, densely woolly beneath. 1. *A. syriaca*

a. Leaves smaller, tapering to an acute tip, irregularly veined, smooth or finely pubescent beneath.

b. Plants with 11-21 pairs of leaves which are pubescent beneath and 8-18 cm long. 2. *A. incarnata* var. *pulchra*

b. Plants with 7-11 pairs of leaves which are almost smooth beneath and 4.6-6.5 cm long. *A. incarnata* var. *neoscotica*

1. **A. syriaca** L. COMMON MILKWEED.

Sparingly introduced as a weed in light soil; at scattered places in the Annapolis Valley; near Mabou, C. B. July.

N. S. to Sask. south to Fla. & Ariz.; introduced eastwards.

2. **A. incarnata** L., var. **pulchra** (Ehrh.) Pers. SWAMP MILKWEED. Map 381. Fig. 99, g.

Rare, in wet or rocky thickets; scattered in the center of the province in the western area. N. S. to Ga. west to Minn.

Var. **neoscotica** Fern., Rhodora **23**: 288. 1921, is very rare: gravelly beach along the Shubenacadie Grand Lake, and along the Tusket Lakes in Yarmouth Co. Known only from N. S.

90. CONVOLVULACEAE BINDWEED FAMILY

a. Plants with green leaves; corolla large, showy; plants with stout rootstocks; leaves sagittate. 1. *Convolvulus*

a. Plants without green leaves, yellowish, parasitic; corolla small, short, whitish. 2. *Cuscuta*

1. CONVOLVULUS (Tourn.) L

Tryon, R. M., Jr. The varieties of *Convolvulus spithamaeus* and *C. sepium*. Rhodora **41**: 415-423. 1939.

a. Calyx enclosed by two large green bracts; stigma oval or oblong; corolla 3-5 cm long.
  b. Flowers white. 1. *C. sepium*
  b. Flowers pinkish. *C. sepium* var. *americanus*
a. Calyx not enclosed by green bracts; style filiform; leaf-blades 3-5 cm long; corolla about 2 cm long. 2. *C. arvensis*

Fig. 99.—**Apocynum.** a, **A. androsaemifolium,** x $\frac{1}{2}$. b, **A. sibiricum,** leaves, fruits and flowers, all x $\frac{1}{2}$. **Convolvulus.** c, **C. sepium,** x $\frac{1}{3}$. d, **C. arvensis,** x $\frac{1}{3}$. **Vinca.** e, **V. minor,** x $\frac{1}{3}$. **Cuscuta.** f, **C. Gronovii,** x $\frac{1}{3}$. **Asclepias.** g, **A. incarnata,** flower much enlarged; fruit with seeds, x $\frac{1}{3}$.

1. **C. sepium** L. BINDWEED, MORNING-GLORY. Fig. 99, c.

Sparingly introduced; more or less scattered along the sea-shore, probably also in waste ground or about towns. Nfld. to N. S & N. B.; introduced from Eu.

Var. **americanus** Sims. Common along the coast, often a bad weed in towns, waste places, roadsides and spreading into fields and orchards. Other varieties have been described which may range into the province, but the plant is so variable in its diagnostic characters that it seems preferable not to attempt the separation at the present time. [Var. *pubescens* (Gray) Fern.]. July-Aug.

Nfld. south along the coast; also about the Great Lakes.

2. **C. arvensis** L. FIELD BINDWEED. Fig. 99, d.

Rare; occasionally found in fields and along roadsides in the Annapolis Valley; seen at Truro, Macoun reports it from ballast heaps at Pictou, and Robinson found it at Pictou Landing in 1906.

Introduced from Eu.; throughout N. A. and a bad weed westward.

2. **CUSCUTA** (Tourn.)L. DODDER

Yuncker, T. G. The genus *Cuscuta*. Mem. Torrey Bot. Club **18**: 113-331. 1932.

a. Corolla-lobes obtuse, ovate and spreading; capsule globose-conic or depressed-globose.
  b. Calyx-lobes shorter than the corolla-tube; corolla lobes mostly shorter than the campanulate tube. 1. *C. Gronovii*
  b. Calyx-lobes mostly equalling the shallowly-campanulate corolla-tube; corolla-lobes about equal to the tube. *C. Gronovii* var. *latifolia*

a. Corolla-lobes acute, lanceolate to triangular, the tips often re-flexed inwardly; capsule globose or depressed globose.
  c. Clayx-lobes broadly overlapping at the sinuses to form angles; flowers 1.5-2 mm long. 2. *C. pentagona*
  c. Calyx-lobes not overlapping; flowers mostly 2-3 mm long. 3. *C. campestris*

1. **C. Gronovii** Willd. COMMON DODDER. Map 382. Fig. 99, f.

Scattered along the borders of lakes, back of brackish shores, or in wet thickets; rather common, and found on a variety of hosts, mostly plants of wet habitats. N. S. to Man. south to Fla. & Ariz.

Var. **latifolia** Engelm. was reported to be rather common on damp shores, and thickets, in the Tusket Valley, Yarmouth Co. (Fernald, 1922). This variety is of slight value and is perhaps not worth recognising. Yuncker places the N. S. collections with the species. Widespread.

2. **C. pentagona** Engelm. (*C. arvensis* Beyrich of Gray's Man.).

Dodder is occasionally introduced into the province with garden seeds. This species is one of the most frequent in eastern N. A. and may be expected. It is not known to persist.

Mass. to Fla. west to Calif.

3. **C. campestris** Yuncker. CLOVER DODDER.

Native, and widespread on clover and alfalfa, and a wide variety of other hosts. Clover dodder is rarely seen in the province. A collection exists from Lawrencetown, Annapolis Co. U. S., W. I.; & S. A.

91. POLEMONIACEAE PHLOX FAMILY

a. Leaves not divided nor toothed; plants of dryish soil.
 b. Leaves opposite; flowers showy; garden escape. (Fig. 100, a). 1. *Phlox*
 b. Leaves mostly alternate; flowers small, slender and insignificant; scattered weed (Fig. 100, b). 2. *Collomia*
a. Leaves pinnately divided with 3-21 leaflets; swamps, rare. 3. *Polemonium*

1. PHLOX L.

a. Plants erect; leaves flat, wide. 1. *P. paniculata*
a. Plants creeping; leaves needle-like, rigid. 2. *P. subulata*

1. **P. paniculata** L. GARDEN PHLOX.

This old-fashioned garden plant is occasionally found along roadsides, in waste places or thickets; very variable.

Introduced from southeastern U. S.; widespread.

2. **P. subulata** L GROUND PINK, MOSS PINK. Fig. 100, a.

Much planted; occasionally escaping, or persisting in former locations. May.

Naturalized from southward.

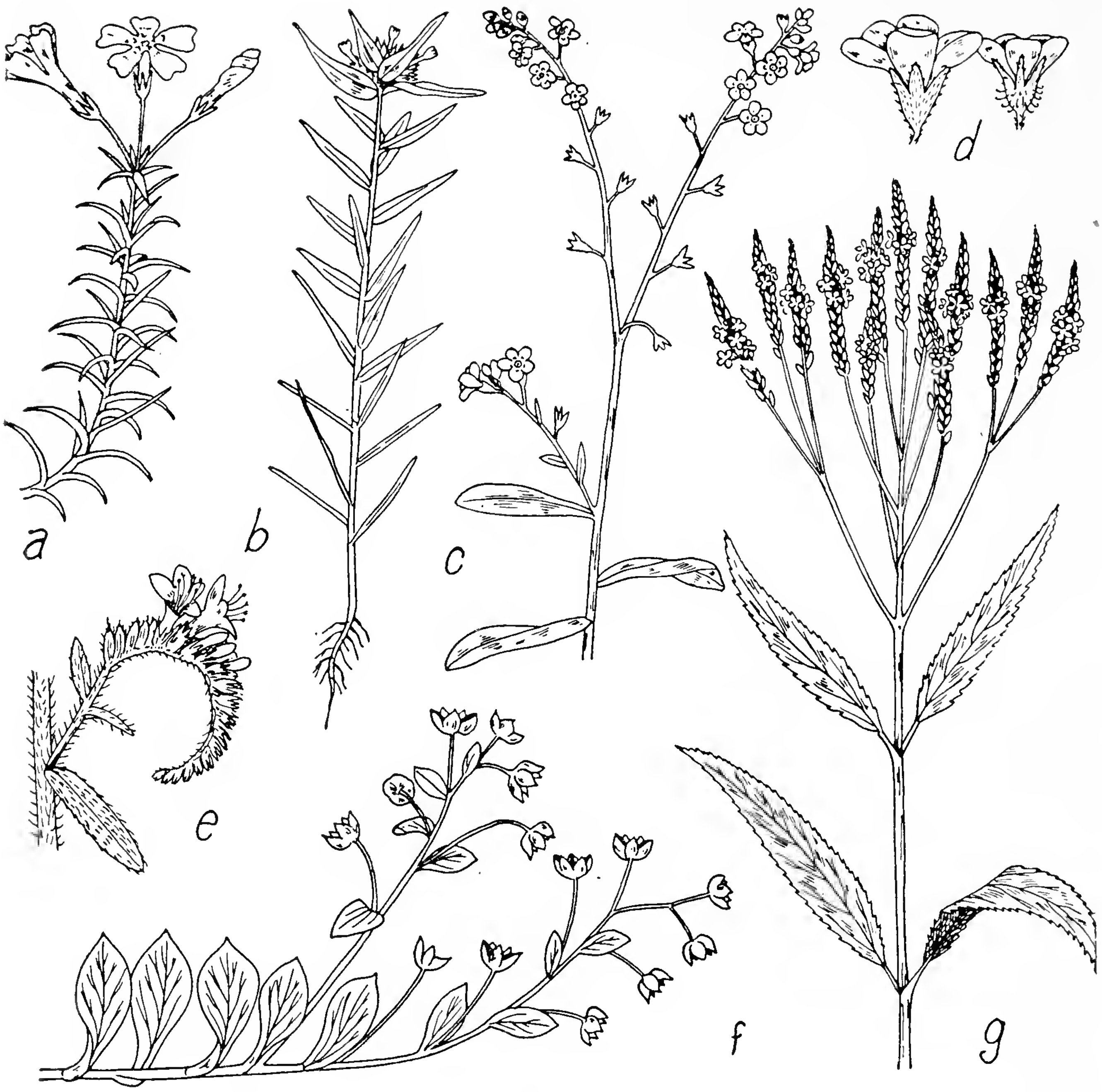


Fig. 100.—**Phlox.** a, **P. subulata,** x $\frac{1}{3}$. **Collomia.** b, **C. linearis,** x $\frac{1}{3}$. **Myosotis.** c, **M. laxa,** x $\frac{1}{2}$. d, flowers of **M. laxa** and **M. arvensis,** x 3. **Echium.** e, **E. vulgare,** branch of the inflorescence, x $\frac{1}{2}$. **Mertensia.** f, **M. maritima,** x $\frac{1}{3}$. **Verbena.** g, **V. hastata,** top of plant, x $\frac{1}{4}$.

2. COLLOMIA Nutt.

1. **C. linearis** Nutt. Fig. 100, b.

Scattered near the railroad north from Truro, carried south from the Bay of Chaleur region where abundant and perhaps native. July-Aug. [*Gilia linearis* (Nutt.) Gray].

N. S. to B. C. south to Calif.

3. POLEMONIUM (Tourn.) L.

1. **P. Van-Bruntiae** Britt. GREEK VALERIAN.

Sent in for identification from swamps at Middle Musquodoboit, Halifax Co. No specimens exist. July.

Swamps, Vt. to N. Y. & Md.

92. BORAGINACEAE BORAGE FAMILY

Johnson, I. M. A synopsis of the American native and immigrant borages of the subfamily Boraginoideae Contrib. Gray Herb. Harvard Univ. **70:** 1-55. 1924.

a. Corolla regular or nearly so.
 b. Corolla rotate (like the flower of the potato), bright blue, 1 cm wide or wider; stamens large, exserted, surrounding the pistil. 1. *Borago*
 b. Corolla tubular, or if flattish much less than 1 cm wide.
  c. Nutlets armed with barbed prickles; throat of the corolla closed by 5 scales.
   d. Leaves 5-15 cm long, lanceolate to ovate; nutlets flattened and horizontal, covered with prickles; stem simple. 2. *Cynoglossum*
   d. Leaves less than 5 cm long, lanceolate to linear; nutlets erect, barbed on the margins or back. 3. *Lappula*
  c. Nutlets unarmed.
   e. Plants coarse and stout, 5-10 dm high, much-branched; throat of the corolla closed by scales (Fig. 103, a). 4. *Symphytum*
   e. Plants weak or trailing, up to 6 dm high.
    f. Corolla slightly irregular, the throat closed by scales and the tube funnel-shaped; plant very bristly-hairy; racemes leafy-bracted. 5. *Lycopsis*
    f. Corolla regular, throat not closed by scales.
     g. Plants not fleshy; racemes without bracts; flowers 8 mm or less wide, the corolla-tube very short; leaves up to 1 cm wide (Fig. 100, c. d). 6. *Myosotis*
     g. Plants fleshy, smooth, of sea-shores; racemes with leafy bracts; flowers 10-15 mm wide; leaves 1-3 cm wide (Fig. 100, f). 7. *Mertensia*
a. Corolla very irregular, the throat spreading, not closed; stamen exserted on long filaments; plants large and coarse (Fig. 100, e). 8. *Echium*

1. BORAGO (Tourn.) L.

1. **B. officinalis** L. BORAGE.

Introduced and occasionally seen about old gardens or in waste places, doubtfully persisting. Native of the Mediterranean and sparingly introduced into many parts of America.

2. CYNOGLOSSUM (Tourn.) L.

1. **C. boreale** Fern., Rhodora **7:** 250. 1905. WILD COMFREY.

Rare in open beech woods or on gypsum; found only near Kentville and Windsor. June.

N. S. to Que. south to N. Y. and northern Mich.; B. C.

3. LAPPULA (Rivin.) Moench.

1. **L. echinata** Gilib. STICKSEED.

Waste land, railroad yards, etc; scattered throughout, never common. June-Sept.

Naturalized from Eu.; N. S. to B. C. south to N. J., & Calif.

4. SYMPHYTUM (Tourn.) L.

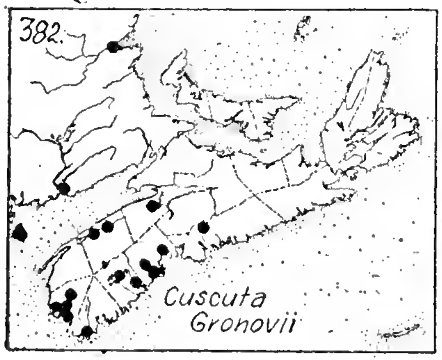
a. Plants rough-hairy; leaves decurrent and forming broad wings down the stems; flowers usually cream-colored; tips of the corolla-lobes recurved. 1. *S. officinale*

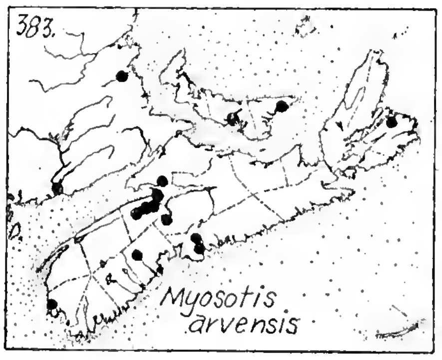
a. Plants with stout, prickly recurved hairs; leaves very slightly decurrent; flowers usually purple; tips of the corolla-lobes erect. 2. *S. asperum*

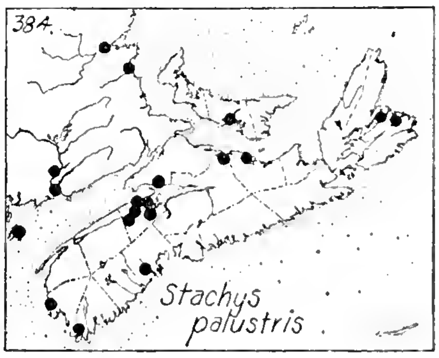
1. **S. officinale** L. COMMON COMFREY.

Waste land, a garden escape; scattered, probably throughout; commonest in Kings and Pictou Cos. June 15-July.

Naturalized from Eu.; Nfld. to Minn. south to La.







2. **S. asperum** Lep. ROUGH COMFREY. See Rhodora **18**: 23. 1916. Fig. 103, a.

Dry and sandy fields and waste places, rare; reported from Pictou (Macoun); abundant at Grand Pre and Yarmouth. June 15-July.

Introduced from Eu.; P. E. I., N. S., & Que. to Mich. south to Md.; B. C.

5. LYCOPSIS L.

1. **L. arvensis** L. SMALL BUGLOSS.

Dry sandy fields and waste places; rare, reported by Macoun from Pictou.

Adventive from Eu.; N. S. to Minn. south to Va.; Calif.

6. MYOSOTIS (Rupp.)L. FORGET-ME-NOT

a. Flowers blue; pedicels much longer than the calyx.
 b. Hairs of the calyx straight; stems and leaves with stiff appressed hairs.
  c. Corolla 5-8 mm wide; calyx-lobes shorter than the tube. 1. *M. scorpioides*
  c. Corolla 2-4 mm wide; calyx-lobes as long as the tube. 2. *M. laxa*
 b. Hairs of the calyx hooked; stems and leaves densely hairy. 3. *M. arvensis*
a. Flowers yellow when young; pedicels shorter than the calyx. 4. *M. versicolor*

1. **M. scorpioides** L. FORGET-ME-NOT.

Common in wet muddy places on the peninsula and probably throughout; occasionally grown as an ornamental. June 1-July.

Nfld. to Mich. south to La.; B. C.

2. **M. laxa** Lehm. SMALL FORGET-ME-NOT. Fig. 100, c, d.

Throughout; wet muddy places, edges of streams, ditches and meadows. June-July.

Nfld. to Ont. south to Ga.; B. C. to Calif.; Chile.

3. **M. arvensis** (L.) Hill. ROUGH FORGET-ME-NOT. Map 383. Fig. 100, d.

Wet runs and moist places, or sometimes growing on dryish soils; common in the Annapolis Valley, scattered elsewhere.

Introduced from Eu.; Nfld. south to R. I. & Ont.; B. C. to Ore.

4. **M. versicolor** (Pers.) Sm.

This species is known only from dryish to moist hillsides along the Gaspereau road, on the ridge above Wolfville. Early May-June.

Sparingly introduced from Eu.; N. S. to Que. south to Dela.; B. C. to Ore.

7. **MERTENSIA** Roth

1. **M. maritima** (L.) S. F. Gray. SEA LUNGWORT. Fig. 100, f.

Common around the province, on sandy beaches, dunes and shore-lines just above high tide level; flowers blue. Forma **albiflora** Fern., Rhodora **23**: 289. 1921, is a white-flowered form found on various beaches of Yarmouth Co. June 15-Aug.

Mass. north along the coast; Eurasia.

8. **ECHIUM** (Tourn.) L.

1. **E. vulgare** L. BLUE DEVIL, VIPER'S BUGLOSS. Fig. 100, e.

Rare or local; a weed of waste places and roadsides. It has been found at Truro, New Glasgow and above Parrsboro, where it is abundant for some distance along the road. June-Sept.

Introduced from Eu. and widely spread in N. A.

93. **VERBENACEAE** VERVAIN FAMILY

1. **VERBENA** (Tourn.) L.

1. **V. hastata** L. BLUE VERVAIN. Fig. 100, g.

Rare; in river bottoms, or in rich or mucky soil; scattered from Kings Co. and Cumberland Co. east to C. B.

N. S. to B. C. south to Fla. & Ariz.

94. **LABIATAE** MINT FAMILY

a. Corolla with the upper lip apparently absent, the lower one 5-lobed, 12-18 mm long; flowers purplish in an interrupted terminal spike (Fig. 101, a). 1. *Teucrium*
a. Corolla regular, or with both upper and lower lips.
 b. Calyx with a swelling on the upper side; flowers blue, solitary or in one-sided axillary panicles (Fig. 101, b. c). 2. *Scutellaria*
 b. Calyx without such a swelling.
  c. Calyx strongly 2-lipped; leaves entire, or rarely toothed.
   d. Flowers in dense terminal spikes.
    e. Corolla strongly 2-lipped, closed at maturity; stamens with anthers 4; calyx naked in the throat (Fig. 101, e). 4. *Prunella*

e. Corolla weakly 2-lipped, open at maturity; stamens with anthers 2; calyx hairy in the throat (Fig. 101, f). 11. *Thymus*

d. Flowers in axillary clusters, to half way down the plant (Fig. 101, h). 9. *Hedeoma*

c. Calyx not strongly 2-lipped; leaves toothed, nearly entire in *Satureja*.

f. Calyx 3.8-12 mm long; corolla more or less 2- lipped.

g. Flowers on short branches, the true pedicels thread-like with thread-like basal bractlets.

h. Corolla strongly 2-lipped, the upper lip arched; leaves kidney or heart-shaped, deeply crenate (Fig. 101, d). 3. *Nepeta*

h. Corolla weakly 2-lipped, the upper lip not arching; leaves tapering to the base, not crenate (Fig. 101, g). 10. *Satureja*

g. Flowers on unbranched pedicels attached directly to the stem or branch, without basal bractlets.

i. Leaves palmately veined.

j. Leaves deeply and sharply lobed (Fig. 102, h). 7. *Leonurus*

j. Leaves roundish; flowers scattered in the axils of the leaves. 6. *Lamium*

i. Leaves pinnately veined.

k. Calyx-teeth prominently spine-tipped; flowers in dense clusters in the axils of the upper leaves (Fig. 102, a). 5. *Galeopsis*

k. Calyx-teeth pointed but not spine-tipped; flowers in interrupted spikes at the ends of the branches (Fig. 102, e). 8. *Stachys*

f. Calyx 1.5-3.5 mm long; corolla regular, not 2-lipped.

l. Stamens with anthers 2; plants smooth, not aromatic; flowers sessile in the leaf axils (Fig. 102, f, g). 12. *Lycopus*

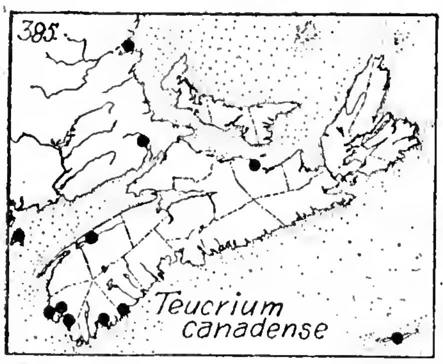
l. Stamens with anthers 4; plant often hairy, aromatic; flowers with pedicels 0.5-2 mm long by flowering time, in terminal spikes or in the axils of the leaves in glomerules (Fig. 102, b-d). 13. *Mentha*

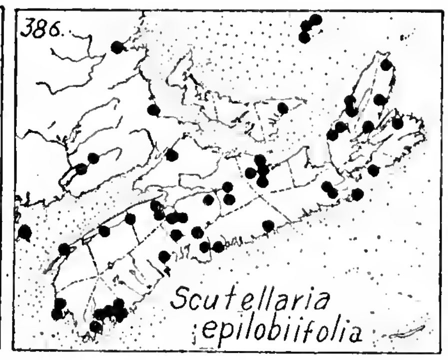
1. TEUCRIUM (Tourn.) L.

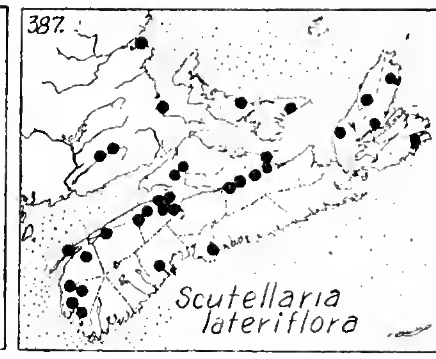
1. **T. canadense** L., see Rhodora **35**: 395. 1933. AMERICAN GERMANDER. Fig. 101, a.

Gravelly sea-coasts, generally found at the crests of the beaches beyond the reaches of the tide; rather rare, Annapolis to Shelburne Co.; Sable Is.; Pictou. July-Aug. [*T. canadense* var. *littorale* (Bickn.) Fern.].

N. B. & P. E. I. south to Fla. along the coast.







2. SCUTELLARIA L.

a. Flowers in axillary one-sided racemes, 3-8 mm long; middle stem-leaves with petioles 3-8 mm long. 1. *S. lateriflora*

a. Flowers solitary in the axils of the upper leaves, 17-22 mm long; middle stem-leaves nearly sessile. 2. *S. epilobiifolia*

1. **S. lateriflora** L. SKULLCAP. Fig. 101, c.

Common throughout; marshes, along streams, lakes, borders, river thickets, and rich ground. July-Aug.

Nfld. to B. C. south to Fla. & N. M.

2. **S. epilobiifolia** Hamil., see Fernald, Rhodora **23**: 85-86. 1921. Fig. 101, b.

Common throughout, in much the same situations as the preceeding species. July 15-Aug. (*S. galericulata* L. of some authors).

Nfld. to B. C. south to N. C., Ohio, & Ariz.

3. NEPETA L.

a. Plant creeping; flowers axillary, blue.

b. Corolla 1.6-2.2 cm long; leaves green. 1. *N. hederacea*

b. Corolla 1-1.5 cm long; leaves reddish. *N. hederacea* var. *parviflora*

a. Plant erect; flowers in terminal and axillary spikes, pale purplish or white, dotted with dark dots. 2. *N. Cataria*

1. **N. hederacea** (L.) Trev. GROUND IVY, GILL. Fig. 101, d.

Rare, and only occasionally seen, generally growing in shady, rather rich soil; Arcadia, Yarmouth Co.; Earltown, Colchester Co., abundant in rich thickets. (*Glecoma hederacea* L.) Introduced from Eu.; scattered in eastern N. A.

Var. **parviflora** (Benth.) Druce, see Fernald, Rhodora **23**: 289. 1921, is a very common weed around buildings, often in shady places, on roadsides and in fields. It is mostly a weed around habitations where it forms large patches almost impossible to eradicate. May 1-Aug.

Nfld. to Minn. & Ore. south to Ga., Kans. & Colo.; introduced from Eu.

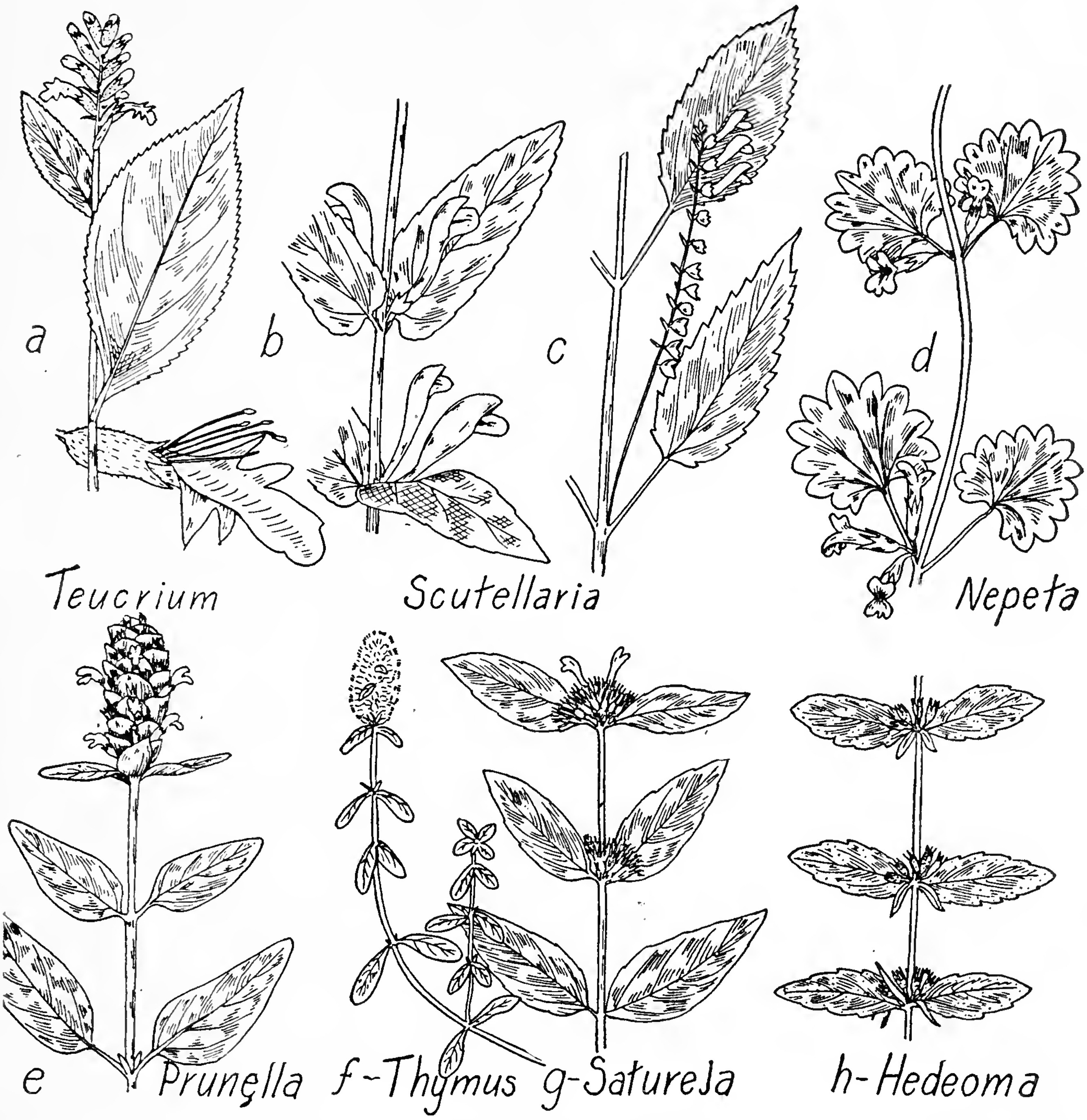


Fig. 101.—**Teucrium.** a, **T. canadense,** x $\frac{1}{3}$: flower enlarged. **Scutellaria.** b, **S. epilobiifolia,** part of plant, x 1. c, **S. lateriflora,** x $\frac{1}{2}$. **Nepeta.** d, **N. hederacea,** x $\frac{1}{2}$. **Prunella.** e, **P. vulgaris,** x $\frac{1}{2}$. **Thymus.** f, **T. Serpyllum,** x $\frac{1}{2}$. **Satureja.** g, **S. vulgaris,** x $\frac{1}{2}$. **Hedeoma.** h, **H. pulegioides,** one third of plant, x 1.

2. **N. Cataria** L. CATNIP.

Waste places throughout; rare, usually in small patches near dwellings and showing little tendency to spread. Above Cheticamp, northern C. B., it is found spreading along roadsides and over the talus of cliffs. July-Sept.

Naturalized from Eu.; Nfld. to Ore. south to Ga., Kans. & Utah.

4. **PRUNELLA** L.

Fernald, M. L. The indigenous varieties of *Prunella vulgaris* in North America. Rhodora **15:** 179-186. 1913.

a. Principal and median stem-leaves ovate or ovate-oblong, rounded at the base, two-fifths to two-thirds as broad as long. 1. *P. vulgaris*

a. Principal and median stem-leaves lanceolate to oblong, gradually narrowed or cuneate at the base, one-fifth to one-half as broad as long. *P. vulgaris* var. *lanceolata*

1. **P. vulgaris** L. HEAL-ALL, SELF-HEAL. Fig. 101, e.

Scattered, usually in shady places and thickets, in rich soil or rarely as a weed in fields or gardens. Introduced from Eu.; Nfld. to Minn. south to N. C.; Mex.

Var. **lanceolata** (Barton)Fern. is considered to be native; common throughout, often a weed; fields, roadsides pastures and thickets. Forma **candida** Fern., l. c., with white corollas, is scattered on the west coast of C. B., and common around Pleasant Bay. **Forma iodocalyx** Fern., with the calyx purplish, seems to be merely a sun form. Most of the records for *P. vulgaris* belong to the variety rather than the species.

Nfld. to Minn. & B. C. south to Fla. & Ariz.

5. GALEOPSIS L.

1. **G. Tetrahit** L., var. **bifida** (Boenn.) Lej. & Court,. see Rhodora **12**: 141-142. 1910. HEMP NETTLE. Fig. 102, a.

Very common throughout, and a bad weed of gardens. The typical variety with flowers commonly white, larger corolla and calyx, and leaves rounded at the base instead of cuneate, has not been collected in the province although it is occasionally introduced from Nfld. to Ont. & Me. July-Sept.

Introduced from Eu.; Nfld. to Alaska south to N. C. & Mich.

6. LAMIUM L.

a. Upper leaves petioled, crowded. 1. *L. purpureum*

a. Upper leaves sessile and clasping. 2. *L. amplexicaule*

1. **L. purpureum** L. HENBIT, RED DEAD NETTLE.

Occasionally found on waste ground or ballast heaps; North Sydney, Pictou; and Quoddy, Halifax Co. July-Aug.

Introduced from Eurasia; scattered.

2. **L. amplexicaule** L. HENBIT NETTLE.

Known only from Bridgewater where it was collected by Groh in waste ground. A small cleistogamous form exists around the Agricultural College at Truro and continues to flower until winter. This is forma **clandestinum** (Reichenb.) G. Beck.

Introduced from Eurasia; N. S. to B. C. south to Fla. & Calif.

7. LEONURUS L.

1. **L. Cardiaca** L. MOTHERWORT. Fig. 102, h.

Scattered around old houses and gardens, rarely becoming a weed in cultivated land and showing little tendency to spread.

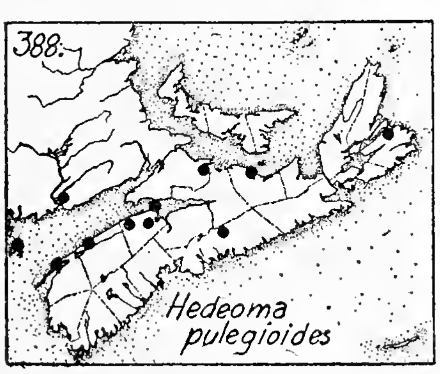
Introduced from Eu.; N. S. to N. Dak. & Utah south to N. C. & Kans.

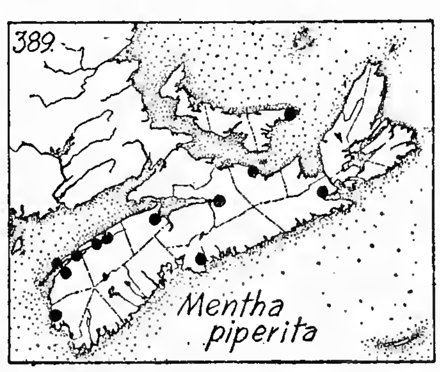
8. STACHYS (Tourn.) L.

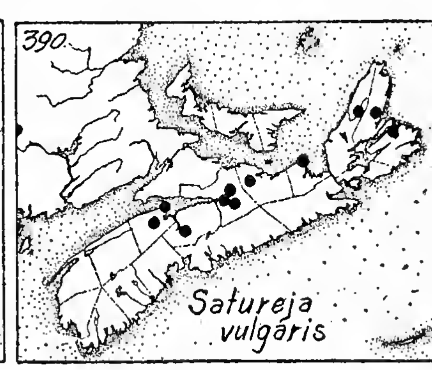
1. **S. palustris** L. WOUNDWORT, HEDGE NETTLE. Map 384. Fig. 102, e.

Roadside ditches and rich thickets or orchards, around sea-ports and shores in many parts of the province; luxuriant in some of the orchards of the Annapolis Valley, scattered elsewhere. July-Aug.

Introduced from Eu.; Nfld. to Ottawa south near the coast to N. J.







9. HEDEOMA Pers.

1. **H. pulegioides** (L.) Pers. AMERICAN PENNYROYAL. Map 388. Fig. 101, h.

This aromatic plant is characteristic of stony soil and upland pastures throughout the northern part of the province; occasional near the sea-shores. Aug.

N. S. to N. D. south to Fla., Ala. & Ark.

10. SATUREJA (Tourn.)L.

1. **S. vulgaris** (L.) Fritsch., var. **neogaea** Fern., Rhodora **46**: 388. 1944. BASIL, CALAMINT. Map 390. Fig. 101, g.

Characteristic of grassland, pastures and borders of woods, usually on hillsides; Annapolis Co. to northern C. B., unknown in the southwestern counties. July-Aug. The American variety.

Nfld. to Man. south to Va. & Ind.

11. THYMUS (Tourn.) L.

1. **T. Serpyllum** L. THYME. Fig. 101, f.

This plant, reported from Cumberland Co. by Macoun over forty years ago, is now a common weed throughout the northern part of the county, where it forms large colonies and frequently covers roadsides, pastures and waste places. July-Aug.

N. S. to N. Y. & N. C.; introduced from Eu.

12. LYCOPUS (Tourn.) L.

a. Calyx-teeth tipped with spines, surpassing the nutlets; leaves usually lobed halfway to the middle. 1. *L. americanus*

a. Calyx-teeth short and triangular, not tipped, shorter than the mature nutlets.

b. Leaves thin, shallowly toothed, the lower lanceolate to lance-oblong. 2. *L. uniflorus*

b. Leaves thick, somewhat fleshy, the lower ovate and sparingly or not at all toothed. *L. uniflorus* var. *ovatus*

1. **L. americanus** Muhl. WATER HOREHOUND. Fig. 102, f.

Common throughout; wet meadows, swamps, and sometimes brackish places, along brooks and in the margin of the sphagnum mat of ponds. July-Sept.

Nfld. to B. C. south to Fla., Tex. & Calif.

2. **L. uniflorus** Michx. BUGLE-WEED. Map 391. Fig. 102, g.

Common throughout in swamps, wet ditches, low ground and along streams, showing great variation in habitat and habit. Plants growing in shady places, with leaves larger and thinner, have been named *L. membranaceus* Bickn. Plants in sterile uplands and sandy areas are small, have thick leaves, and are often sterile. A form with the main stem and branches recurved and rooting at the tip was described from the sandy and cobbly margin of Pottle's Lake, North Sydney, and is also known from Maine. This is forma *flagellaris* Fern., Rhodora **23**: 290. 1921.

Var. **ovatus** Fern. & St. John, Proc. Boston Soc. Nat. Hist. **36**: 92, 1921, was described from Sable Island, and was later reported from the upper cobble-beach of Salmon L., Greenville, Yarmouth Co. (Fernald, 1921).

Nfld. to B. C. south to Va., Minn. & Ore.

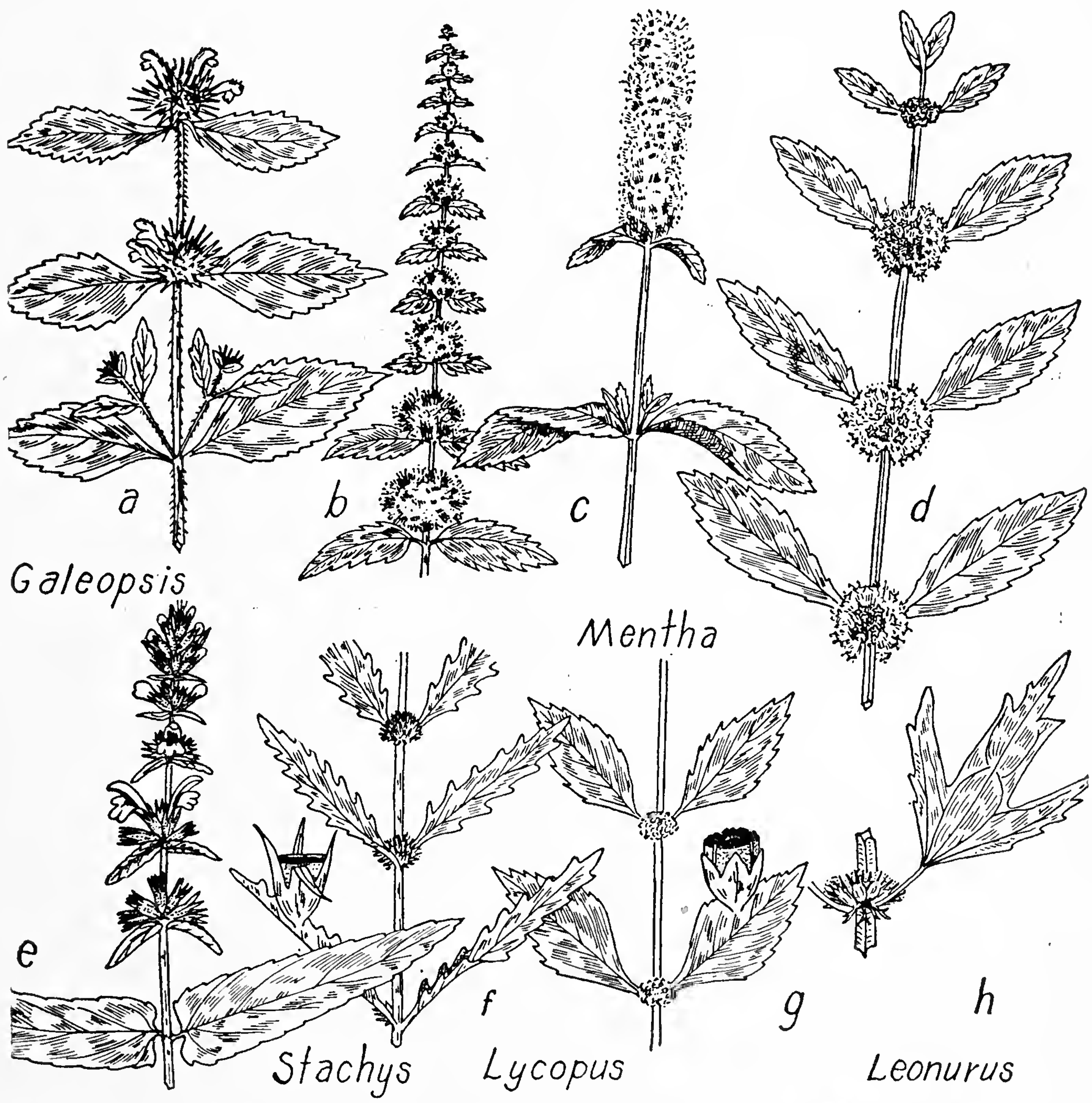


Fig. 102.—**Galeopsis.** a, **G. Tetrahit,** x $\frac{1}{3}$. **Mentha.** b, **M. spicata,** top of plant, x $\frac{1}{2}$. c, **M. piperita,** x $\frac{1}{2}$. d, **M. arvensis,** x $\frac{1}{2}$. **Stachys.** e, **S. palustris,** top of plant, x $\frac{1}{2}$. **Lycopus.** f, **L. americana,** x $\frac{1}{2}$; flower enlarged. g, **L. uniflorus,** x $\frac{1}{2}$; flower enlarged. **Leonurus.** h, **L. Cardiaca,** node, x $\frac{1}{3}$.

13. MENTHA (Tourn.) L. MINT

Stewart, Sara R. *Mentha arvensis* and some of its North American Varieties. Rhodora **46**: 331-335. 1944.

a. Flower-clusters separated, not aggregated into definite spikes; middle and upper leaves twice or more as long as the clusters; leaves appearing above the uppermost flowers.

b. Upper leaves but little smaller than the lower ones; calyx regular, smooth or but weakly pubescent in the throat; leaves with 3-6 pairs of veins.

c. Leaves, in region of infloresecences, ovate to elliptic, with more or less rounded bases.

d. Angles of stems more pubescent than sides; petioles, lower surfaces of leaves and stem slightly to very pubescent. 1. *M. arvensis*

d. Angles and sides of stem more or less equally pubescent with spreading hairs 1-3.5 mm long; petioles and lower sides of the leaves more or less densely pubescent. *M. arvensis* forma *lanta*

c. Leaves, in region of inflorescences, lanceolate, with more or less cuneate bases.

e. Stem, in region of first-flowering inflorescence, pubescent on sides and angles. *M. arvensis* var. *villosa*

e. Stem, in region of first-flowering inflorescence, glabrous on sides, minutely pubescent on angles. *M. arvensis* var. *villosa* forma *glabrata*

b. Upper leaves reduced in size, usually about twice as long as the flower-clusters; calyx weakly 2-lipped, bearded in the throat; leaves with only 2-3 pairs of veins. 2. *M. Cardiaca*

a. Flower-clusters in a loose spike, or aggregated in an oblong or orbicular head at the top of the plant; uppermost leaves reduced to bracts, or absent at the upper node.

f. Spikes short, oblong to globular, the lower flower-clusters usually slightly separated.

g. Leaves more than twice as long as wide; stem and leaves nearly glabrous; flowers in an oblong, slightly interrupted head. 3. *M. piperita*

g. Leaves less than twice as long as wide; stem and leaves more or less hairy; flowers in a rather wide orbicular head. 4. *M. aquatica*

f. Spikes narrow, long, interrupted, of numerous globular clusters; leaf-petioles less than 2 mm long. 5. *M. spicata*

1. **M. arvensis** L. FIELD MINT. Fig. 102, d.

Throughout; most frequent in the Annapolis Valley where it is common in orchards, cultivated fields and low ground. Widely distributed; partly introduced and partly apparently native. Forma **lanata** (Piper) Stewart is scattered in eastern America.

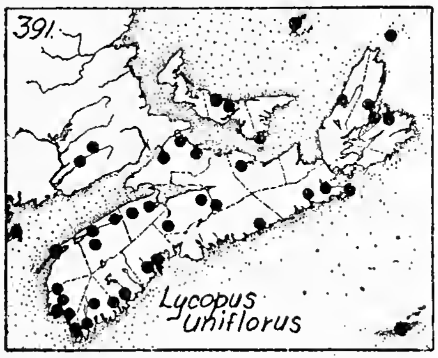
Var. **villosa** (Benth.) Stewart, is the common native plant; common along brooks, in ditches, swamps, along lake margins or outlets throughout, often affected by the rust *Puccinia Menthae*. Nfld. to Alaska south to Va., N.

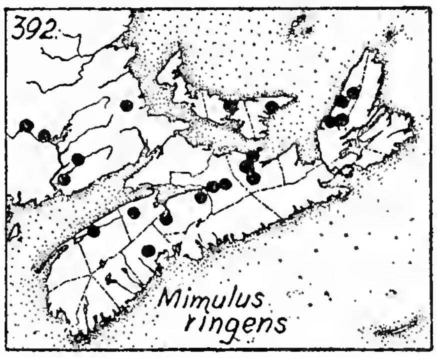
M. and Calif. Forma **glabrata** (Bentham) Stewart is also widely ranging.

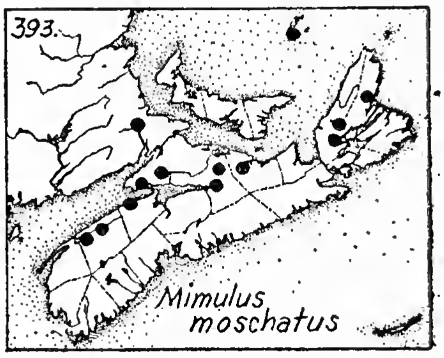
2. **M. Cardiaca** Gerarde

Probably common in the province; ditches, low ground around shallow ponds near habitations at least in the north-central part of the province.

Introduced from Eu.; N. S. to Penn.







3. **M. piperita** L. PEPPERMINT. Map 389. Fig. 102. c.

Scattered and rather local; wet places, along streams near open or cultivated areas.

Introduced from Eu.; N. S. to Minn. south to Fla.; etc.

4. **M. aquatica** L. WATER MINT.

Reported from Pictou by Lindsay and from Truro by Macoun; not observed in recent years. Besides this one several closely related species may be introduced; and the mints as a whole present a very varied and, for this province, little understood complex.

Introduced from Eu.; N. S. to Ga.

5. **M. spicata** L. SPEARMINT. Fig. 102, b.

Common along brooks, in wet areas, meadows and along ditches; like the other species it has been introduced from Europe and has escaped in many places throughout the province.

N. S. to Wash. south to Fla. & Calif.

95. **SOLANACEAE** NIGHTSHADE FAMILY

a. Plant woody, climbing, with long drooping branches, without thorns; fruit a dryish orange-red berry; leaves not lobed; flowers about 1.5 cm wide. 4. *Lycium*

a. Plants herbaceous (or partly woody and climbing, with lobed leaves in *S. Dulcamara*); fruit a fleshy berry or large capsule.

b. Corolla wheel-shaped (rotate) like that of a potato flower; anthers touching, opening by terminal pores; fruit a berry, not enclosed by the calyx (Fig. 103, b, d). 1. *Solanum*

b. Corolla funnel-form; anthers opening by longitudinal slits.
c. Corolla yellow, 1.5-2.5 cm wide; flowers pendulous; calyx much inflated; fruit a 2-celled berry (Fig. 103, e). 2. *Physalis*
c. Corolla white, strongly veined with purple, or purple, 3-5 cm wide; flowers not pendulous.
d. Plant clammy-pubescent; corolla and stamens slightly irregularly placed; corolla greenish-yellow; capsule opening by a lid. 5. *Hyoscyamus*
d. Plant not clammy; corolla and stamens regular.
e. Calyx deeply 5-parted; corolla purplish-blue; fruit a pulpy berry. 3. *Nicandra*
e. Calyx merely 5-toothed; corolla white to purplish; fruit a prickly capsule, opening by teeth at the apex (Fig. 103, c). 6. *Datura*

1. SOLANUM (Tourn.) L.

a. Plant erect, 1-6 dm high; flowers white; berries black. 1. *S. nigra*
a. Plant trailing or climbing, 1-3 m long; flowers bluish-purple; berries red.
b. Leaves smooth or but slightly pubescent. 2. *S. Dulcamara*
b. Leaves velvety or long pubescent. *S. Dulcamara* var. *villosissima*

1. **S. nigra** L. BLACK NIGHTSHADE. Fig. 103, d.
Scattered around the coast on sandy sea-beaches; thoroughly established in gardens at Sable Is. July-Aug.
Introduced and cosmopolitan.

2. **S. Dulcamara** L. BITTERSWEET. Fig. 103, b.
Scattered throughout; thickets, along roadsides, and alluvial woods, often in low ground along streams. July-Sept. N. S. to Minn. south to Ga.
Var. **villosissima** Desv., see Rhodora **24**: 202. 1922, is a villous extreme to which some of the collections from Digby Co. to C. B. may belong.
Nfld. to Que. & Mass.

2. PHYSALIS L.

1. **P. heterophylla** Nees. GROUND CHERRY. Fig. 103, e.
Occasionally seen in orchards in the Annapolis Valley, becoming a persistent weed. July-Aug.
Probably introduced; N. S. to Sask. south to Fla. & Tex.

Fig. 103.—**Symphytum.** a, **S. asperum,** branch, x $\frac{1}{3}$. **Solanum.** b, **S. Dulcamara,** in fruit, x $\frac{1}{3}$; flower, x 2. d, **S. nigra**, x $\frac{1}{2}$. **Datura.** c, **D. Stramonium,** flowers, leaf and fruit, x $\frac{1}{3}$. **Physalis.** e, **P. heterophylla,** top of branch, x $\frac{1}{2}$. **Chaenorrhinum.** f, **C. minus,** x $\frac{1}{2}$.

3. NICANDRA Adans.

1. **N. Physalodes** (L.) Pers. APPLE-OF-PERU.

Found occasionally in waste ground near dwellings; Windsor. It is rare and probably does not persist.

Introduced from Peru; N. S. to Ont. south to Fla.

4. LYCIUM L.

1. **L. halimifolium** Mill. MATRIMONY VINE.

Occasionally found about old gardens or dwellings; Digby, McKinnon, July 1, 1933; Port Mouton, Bissel & Graves, 1920; Sable Is.

Introduced from Eu.; N. S. to Minn. south to Va. & Kans.

5. HYOSCYAMUS (Tourn.) L.

1. **H. niger** L. BLACK HENBANE.

Occasional about old dwellings and gardens; reported as a garden escape by Lindsay, and from the ramparts of the old fort at Annapolis by Macoun; collected at Annapolis in 1902.

Naturalized from Eu.; N. S. to Mich. south to N. Eng.

6. DATURA L.

1. **D. Stramonium** L. JIMSON WEED, THORN APPLE. Fig. 103, c.

Formerly common; now only occasionally seen about buildings, towns, waste places and roadsides. The plant, and especially the fruit, is deadly poisonous and should be exterminated wherever it grows as a weed.

Introduced from Asia; N. S. to Minn. south to Fla.

96. SCROPHULARIACEAE FIGWORT FAMILY

Pennell, Francis W. The *Scrophulariaceae* of eastern temperate North America. Monograph no. 1. Acad. Nat. Sci. Philadelphia. xiv-650 pp. 1935.

a. Stamens 5; corolla saucer-shaped; plants tall, the flowers in a tall spike or loose raceme; leaves alternate. 1. *Verbascum*

a. Stamens 2 or 4; leaves various; corolla shallowly cup-shaped to long-tubular.

  b. Corolla spurred or sac-like, or distinctly swollen on the lower side at the base; leaves entire.

    c. Corolla spurred; leaves linear.

      d. Flowers in terminal racemes, blue or yellowish; stem smooth (Fig. 104, a). 2. *Linaria*

      d. Flowers solitary in the axils of the leaves, pink; stem glandular-pubescent (Fig. 103, f). 3. *Chaenorrhinum*

    c. Corolla merely sac-like or swollen at the base; leaves lance-oblong. 4. *Antirrhinum*

  b. Corolla neither spurred, sac-like, nor swollen at the base.

    e. Leaves deeply and pinnately lobed. 16. *Pedicularis*

    e. Leaves entire or merely toothed.

      f. Corolla yellow.

g. Calyx 4-toothed, much inflated in fruit; corolla very prominently 2-lipped, with the upper lip arching; plant erect (Fig. 106, c). 17. *Rhinanthus*

g. Calyx 5-toothed, not inflated; corolla not prominently 2-lipped, the throat open; plant prostrate, or creeping at the base.

h. Leaves sessile, nearly glabrous, with minute dark glands, narrow (Fig. 104, e). 10. *Gratiola*

h. Leaves petioled, ovate-oblong, villous and viscid (Fig. 104, c). 7. *Mimulus*

f. Corolla white, often with dark lines, or blue or purplish.

i. Plant erect, 3-15 dm high, stout; median stem-leaves 6-25 cm long, serrate.

j. Stem round; flowers in spike-like terminal racemes; leaves short-petioled, not clasping.

k. Flowers white, 2-3 cm long, few (Fig. 104, b). 6. *Chelone*

k. Flowers blue, less than 1 cm long, numerous (Fig. 105). 11. *Veronica*

j. Stem square; flowers long-pedicelled, in an open inflorescence.

l. Leaves sessile, clasping; flowers 2-3 cm long (Fig. 104, f). 7. *Mimulus*

l. Leaves petioled; flowers about 1 cm long; corolla with the upper lip 4-lobed (Fig. 106, g). 5. *Scrophularia*

i. Plants mostly under 3 dm high, slender, often prostrate at the base.

m. Plants small, without ascending stems; leaves in a basal rosette, filiform to linear; flowers solitary, erect, whitish. (Fig. 104, d). 8. *Limosella*

m. Plants with ascending stems; leaves not all in basal rosettes.

n. Calyx 5-toothed; corolla 2-lipped, or nearly regular.

o. Fertile stamens 2; plants prostrate at base, or creeping.

p. Sterile stamens none; fertile ones much exserted; capsule flattened and notched at the apex (Fig. 105). 11. *Veronica*

p. Sterile stamens 2; fertile ones not exserted beyond the upper lobe of the corolla; capsule ellipsoid, not notched. 9. *Lindernia*

o. Fertile stamens 4; plants small, erect, not prostrate nor creeping.

q. Leaves linear, entire; corolla rose-purple (Fig. 106, a). 12. *Gerardia*

q. Leaves lanceolate or wider, entire or with several coarse projections near the base; flowers yellowish to greenish-purple (Fig. 106, b). 13. *Melampyrum*

n. Calyx 4-toothed.

r. Leaves nearly round, often with deeply-cut teeth;flowers prominently marked with purple or violet veins; upper lip of corolla 2-lobed (Fig. 106, e, f). 14. *Euphrasia*

r. Leaves lanceolate with shallow teeth; flowers an even rose color; upper lip of corolla entire (Fig. 106, d).
15. *Odontites*

1. VERBASCUM (Bauhin) L.

a. Plant densely woolly; flowers in a dense cylindrical spike.
1. *V. Thapsus*

a. Plant pubescent, but not woolly; flowers in an open inflorescence.
2. *V. virgatum*

1. **V. Thapsus** L. COMMON MULLEIN.

Throughout, usually on light soil, roadsides, hillsides, gravel plains or sandy pastures; a common weed. July-Aug.

Introduced from Eu.; throughout N. A.

2. **V. virgatum** Stokes. MOTH MULLEIN.

The only record of this plant is by Macoun; roadside near Mira Bay, C. B. Co. It has not been collected since; and this collection seems to be the only basis for the range given in Gray's Manual for roadsides, Cape Breton.

Introduced from Eu.; now doubtfully present.

2. LINARIA (Bauhin) Hill

a. Flowers yellow, 2-4 cm long; plant stout. 1. *L. vulgaris*

a. Flowers pale blue, less than 1 cm long; plant very slender.
2. *L. canadensis*

1. **L. vulgaris** Hill. BUTTER AND EGGS, YELLOW TOADFLAX. Fig. 104, a.

Very common around towns and along roadsides throughout, spreading out into the country especially in sandy ground. Forma **leucantha** Fern., Rhodora **23**: 290. 1921, with the corolla milky-white except for the yellow palate, is common in the north-central part of the province.

Introduced from Eu.; Nfld. to B. C. south to Fla., Tex. & Calif.

2. **L. canadensis** (L.) Dumort.

Found only as a railroad weed; sparingly introduced, Halifax to Yarmouth.

Introduced; N. S. to S. D. south to Fla. & Tex.; B. C. to Calif.

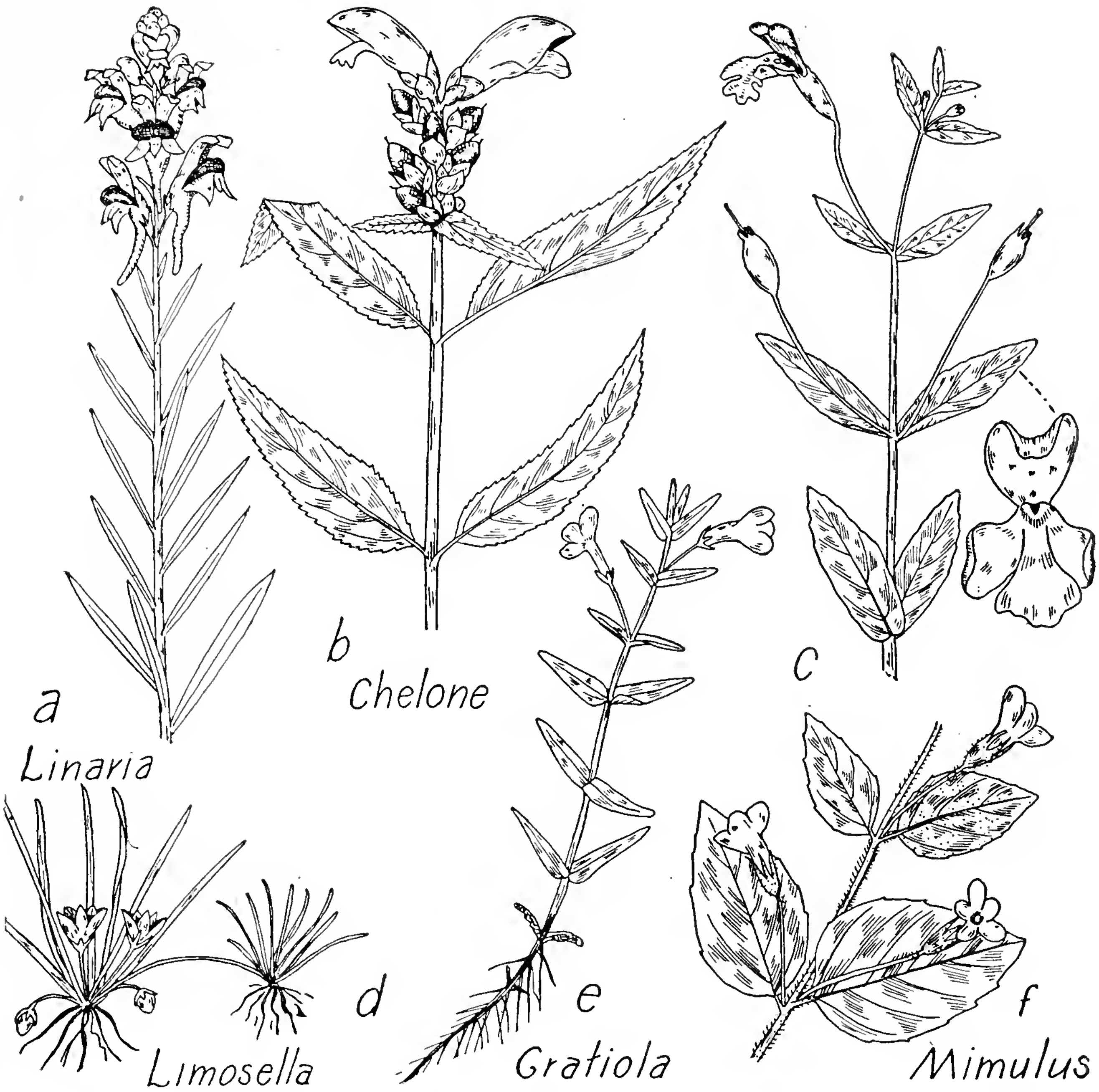


Fig. 104.—**Linaria.** a, **L. vulgaris,** x $\frac{1}{3}$. **Chelone.** b, **C. glabra,** top of plant, x$\frac{1}{2}$. **Mimulus.** c, **M. ringens,** top of plant x$\frac{1}{2}$;, flower enlarged. f, **M. moschatus,** x $\frac{1}{3}$. **Limosella.** d, **L. subulata,** x 1. **Gratiola.** e, **G. aurea.** x $\frac{1}{3}$.

3. CHAENORRHINUM Reich.

1. **C. minus** (L.) Lange. SMALL SNAPDRAGON. Fig. 103, f.

This is a characteristic railroad weed from Halifax northwards; found scattered in other towns and along lines throughout the province but nowheres abundant. July-Aug.

Native of the Mediterranean region; N. S. to Wisc. south to N. J. & Ill.

4. ANTIRRHINUM (Tourn.)L.

1. **A. majus** L. GARDEN SNAPDRAGON.

Commonly cultivated, occasionally persisting for a season. Macoun reports that it was well established in a meadow near North Sydney. Introduced from Europe as a garden plant.

5. **SCROPHULARIA** (Tourn.) L.

1. **S. lanceolata** Pursh, see Torreya **22:** 81. 1922. FIGWORT. Fig. 106, g.

Rather rare; in open woods or dryish thickets. It is known from but three widely separated places; growing around the bases of apple trees in an orchard, Harmony, Kings Co.; Boylston, Guysborough Co.; and near Baddeck, Victoria Co. June-July. (*S. leporella* Bickn. of Gray's Man.)

N. S. to B. C. south to N. C. & Calif.

6. **CHELONE** (Tourn.) L.

1. C. glabra L. TURTLEHEAD, BALMONY. Fig. 104, b.

Scattered throughout, rather common in the northern part of the province; swamps, wet roadsides, along streams, meadows and estuarine rivers above the influence of the salt water. Forma **tomentosa** (Raf.) Pennell, Torreya **19:** 117, 1919, a form with the leaves tomentose beneath, is represented by a collection from Sandy Cove, Digby Co., Fernald & Long, 22, 413.

Var. **dilatata** Fern. & Wieg., Rhodora **14**: 226. 1912, is the more northern extreme with the leaves little if at all smaller towards the top of the stem and rounded to the petioles. This is common from Kings Co. to northern C. B., while the southwestern plants have the leaves much reduced upwards and tapering to the petiole. July 15-Aug.

Nfld. to Minn. south to Ga. & Ala.

7. **MIMULUS** L.

a. Plant erect, smooth; flowers violet-purple; leaves sessile, clasping, lanceolate. 1. *M. ringens*

a. Plant prostrate, soft-hairy; flowers yellow; leaves short-petioled, ovate. 2. *M. moschatus*

1. **M. ringens** L. MONKEY FLOWER. Map 392. Fig. 104, c.

Moist ground, around lakes or along stream bottoms, occasionally in marshes or wet meadows; scattered from

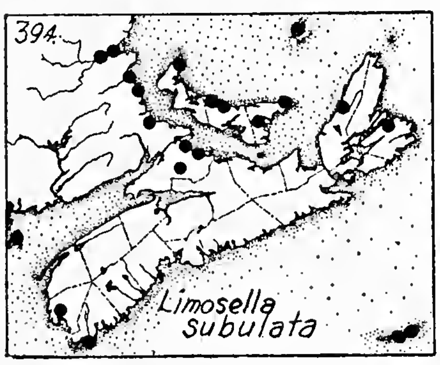
Annapolis and Lunenburg Cos. to northern C. B. July-Aug.

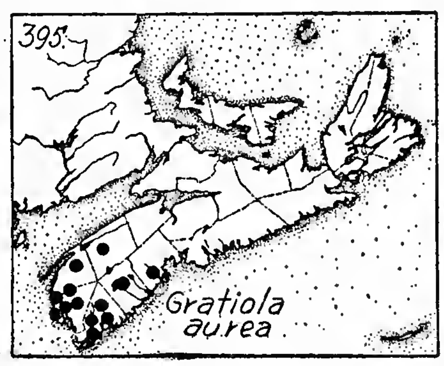
C. B. to Man. south to Ala. & Colo.

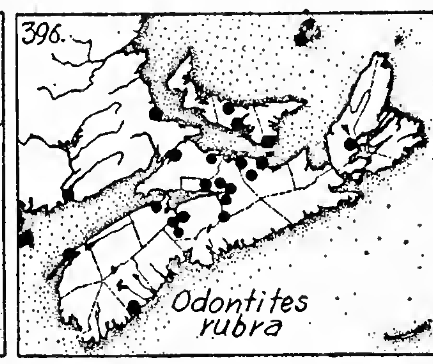
2. **M. moschatus** Dougl. MUSK FLOWER. Map 393. Fig. 104, f.

Scattered from Annapolis to northern C. B.; often forming dense mats on springy hillsides or over wet areas, perhaps introduced but often with the appearance of a native plant. July-Aug.

Mont. to B. C. south to Calif.; widely introduced eastward; Nfld. south to N. S.







8. LIMOSELLA L.

1. **L. subulata** Ives MUDWORT. Map 394. Fig. 104, d.

Scattered near the coast of Yarmouth and Shelburne Cos.; C. B. and along the Northumberland Strait; abundant on the brackish beach and sand flats near Wallace L., on Sable Is. The species shows two extremes. Those growing on tidal shores are coarse; those on the sandy margins of pools further back in the sand dunes usually have blacker capsules on more recurved pedicels, sepals less acute and leaves more slender. This is forma *maritima* (Raf.) Pennell (l. c. page 169). *L. aquatica* is maintained as mostly European & western.

Lab. to N. J. near the sea.

9. LINDERNIA ALL.

1. **L. dubia** (L.) Pennell, see Rhodora **44**: 441-446. 1942.

The only collection made in the province is at Sheffield Mills, Kings Co., by Fernald; wet areas and edges of streams. [*Ilysanthes dubia* (L.) Barnhart.]

N. S. to Minn. south to Fla. & La.; Wash. & Ore.

10. GRATIOLA L.

1. **G. aurea** Muhl. Map 395. Fig. 104, e.

Common in Yarmouth and Shelburne Cos; scattered east to Annapolis Co. and Bridgewater; often in mats on the slatey lake shores, low areas, and even onto dryish savannahs in the moister areas. Forma **leucantha** Bartlett, Rhodora **9**: 123. 1907, with the corolla pure white except for a yellowish tinge on the inside of the throat, forms pure colonies on the pebbly strand of Ponhook L., Queens Co. (Weatherby, 1942); and from Mass. to Dela. July-Aug. (*G. lutea* of recent authors).

N. S. & Nfld. south along the coastal plain of N.J.; scattered inland to the Great Lakes and beyond.

11. VERONICA (Bauhin) L. SPEEDWELL

a. Main stem terminating in an inflorescence, in all cases the upper bract leaves alternate.
  b. Plant perennial from rhizomes; flowers crowded in definite racemes.
    c. Racemes dense, spike-like; plants erect, 5-15 dm high. 1. *V. longifolia*
    c. Racemes loose; plant creeping and ascending at the tips, 5-15 cm high. 2. *V. serpyllifolia*
  b. Plants annual, fibrous rooted; flowers in the axils of most of the leaves.
    c. Plants erect, very hairy; flowers with the pedicels shorter than the sepals, in the axils of reduced leaves; seeds less than 1 mm long, smooth. 3. *V. arvensis*
    c. Plants creeping with the tips ascending; flowers with pedicels longer than the ovate sepals, in the axils of ordinary leaves; seeds 1.3-3 mm long, roughened.
      d. Capsule lobes rounded in profile; style shorter than the capsule; sepals ovate; corolla scarcely exceeding the sepals; capsule slightly and narrowly notched. 4. *V. agrestis*
      d. Capsule lobes acutish in profile; style as long as the capsule; sepals narrowly ovate; corolla much exceeding the sepals; capsule widely notched. 5. *V. persica*
a. Main stem never terminating in an inflorescence; leaves opposite throughout; flowers in axillary racemes.
  f. Plant pubescent, of dryish soil.
    g. Leaves sessile; plants creeping; corolla 3-4 mm long; pedicels much shorter than the bracts.
      h. Upper leaves 25-40 mm long, 15-28 mm wide, rounded at the tip. 6. *V. officinalis*

h. Upper leaves 15-30 mm long, 7-15 mm wide, acute. *V. officinalis* var *Tournefortii*

g. Leaves narrowed to the petiole; plants erect, 1-3 dm high; corolla 5-6 mm long; pedicels much exceeding the bracts. 7. *V. chamaedrys*

f. Plants smooth or nearly so; swamp or aquatic plants.

i. Leaves linear to lanceolate, with a few fine points for teeth, tapering to a long tip. 8. *V. scutellata*

i. Leaves oblong or ovate, coarsely toothed, with a rounded tip. 9. *V. americana*

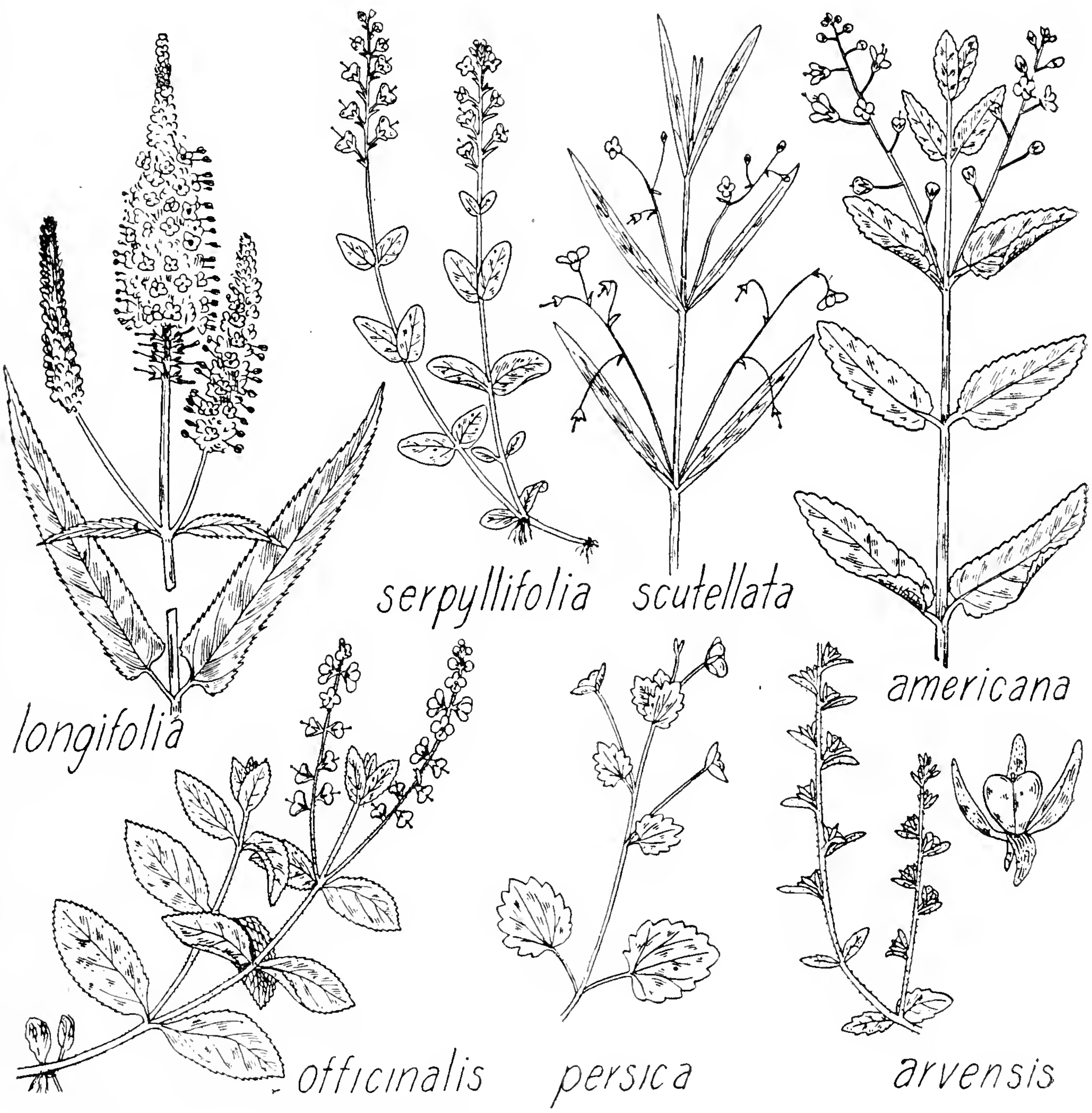


Fig. 105.—**Veronica,** all x ½.

1. **V. longifolia** L. GARDEN SPEEDWELL. Fig. 105.

Commonly planted in gardens; an abundant roadside escape in roadside thickets through Yarmouth, Digby and Annapolis Cos.; scattered to Pictou and Amherst. July-Aug.

Introduced from Eu.; N. S. to N. Y.

2. **V. serpyllifolia** L. THYME LEAVED SPEEDWELL. Fig. 105.

Common throughout; in moist soils, pastures, and damp runs. May 15-Oct.

Introduced from Eurasia; Nfld. to Minn. south to Ga.; B. C. to Calif.

3. **V. arvensis** L. FIELD SPEEDWELL. Fig. 105.

Dry fields, on slopes and open woods, usually growing on dry and often very sandy soils; rather common from Yarmouth through the Annapolis Valley, often in large colonies. May-June.

Nfld. to Minn. south to Ala. & Tex.; B. C. to Calif.; introduced from Eurasia.

4. **V. agrestis** L.

Waste grounds and sandy fields, rare: Windsor, Halifax and Boylston; collected at Windsor by Howe, and from waste ground at Dartmouth by Fernald in 1922.

Introduced from Eu.; N. S. to La.

5. **V. persica** Poir. Fig 105.

Fields, lawns or open woods; not uncommon about Truro, and found at scattered places from Yarmouth to C.B. Reported by Macoun, under the name *V. Buxbaumii* Tenore as very sparingly naturalized at North Sydney and Pictou. June 15-Sept. (*V. Tournefortii* C. C. Gmel.). Introduced from Eurasia.

Nfld. to Man. and southern Alaska south to Fla. and Calif.

6. **V. officinalis** L. COMMON SPEEDWELL. Fig. 105.

Roadsides, shady places and as a weed of cultivated fields, usually in richer and more shaded places than the variety. June-Aug. Probably introduced from Eu.; Nfld. to Dakota southward.

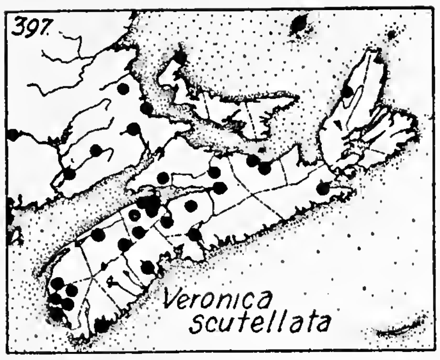
Var. **Tournefortii** (Villars) Reich., see Fernald, Rhodora **35**: 282. 1933, is found everywhere in the province in open fields, roadsides, lawns and thickets.

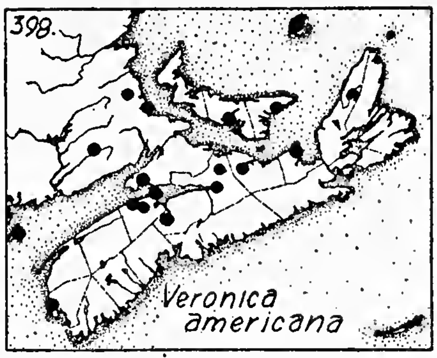
Introduced from Eurasia; P.E.I. and Nfld. to Me.; Ore.

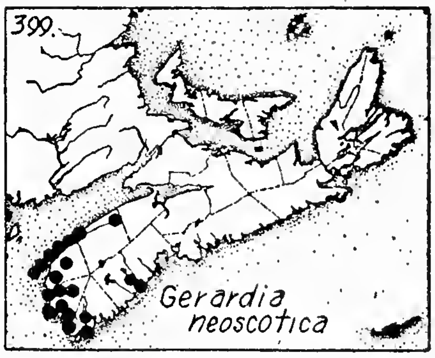
7. **V. chamaedrys** L. BIRD'S EYE.

Very rarely introduced about some of the towns; collections were seen from Yarmouth, Windsor and Truro; Macoun reports it as sparingly naturalized at Windsor and Halifax.

P. E. I. to Ont. & Mich. south to W. Va. & Ohio.







8. **V. scutellata** L. MARSH SPEEDWELL. Map 397. Fig. 105.

Scattered throughout; shallow water, or more often at the base of rushes and cattails, in partly dried-out ponds and in swamps! June 15-Sept.

Nfld. to the Mackenzie, south to Va., Colo. and Calif.

9. **V. americana** (Raf.) Schwein. AMERICAN BROOKLIME. Map 398. Fig. 105.

Rather common in cold streams, springs, margins of rivers and along shaded ditches and swamps from Annapolis Co. to C. B.; Yarmouth. June-Sept.

Nfld. to Alaska south to N.C., Mex. and Calif.

12. GERARDIA (Plumier) L.

a. Calyx teeth as long as the tube, green and sharp-pointed; fruiting pedicels usually not longer than the calyx; plant not fleshy. 1. *G. neoscotica*

a. Calyx teeth much shorter than the tube and blunt; fruiting pedicels usually twice as long as the calyx; plant somewhat fleshy. 2. *G. maritima*

1. **G. neoscotica** Greene, Leaflets, **II**:106. 1910. Map 399. Fig. 106, a.

Common in damp or exsiccated sandy or peaty open soil in Yarmouth and Digby Cos., found along the Bay of Fundy into Annapolis Co., and in the Annapolis Valley to Middleton; scattered east to Queens Co. July-Sept (*Agalinis neoscotica* (Greene) Fern.). N. S. only.

2. **G. maritima** Raf. SEASIDE GERARDIA.

Local; known only from salt marshes along the Argyle R., at Argyle Head, Yarmouth Co. (Fernald, 1922).

Fla. north along the coast to southern Me.; N. S.

13. MELAMPYRUM (Bauhin) L.

a. Stem simple or nearly so, 0.5-2 dm high; foliage leaves and bracts linear, 1-5 mm wide, entire or the uppermost bracts rarely toothed at the base. 1. *M. lineare*

a. Stem bushy-branched, 2-5 dm high; foliage leaves 2-10 mm wide; bracts up to 20 mm wide, some or all sharply toothed at the base. *M. lineare* var. *americanum*

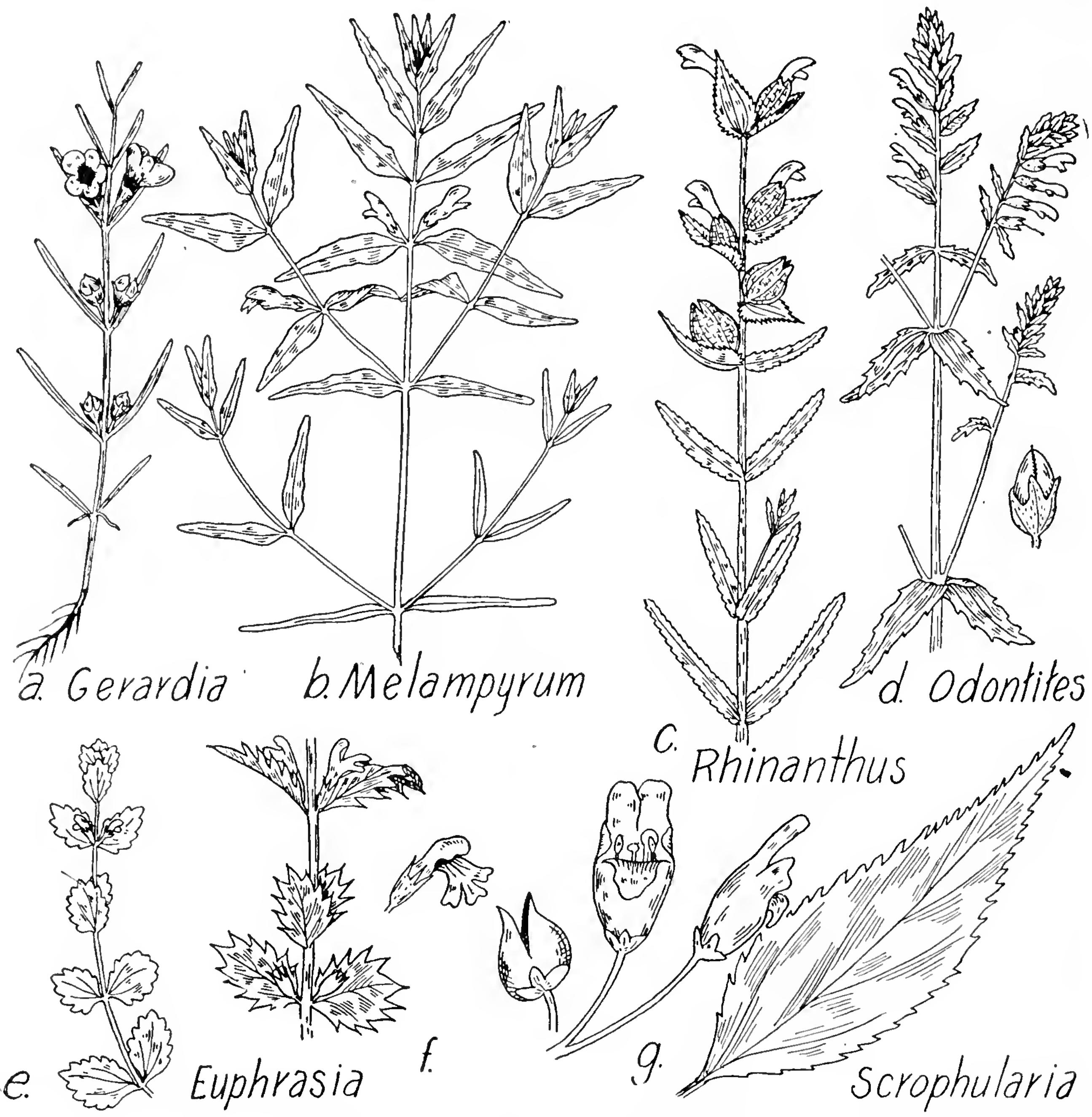


Fig. 106.—**Gerardia.** a, **G. neoscotica,** x $\frac{1}{3}$. **Melampyrum.** b, **M. lineare,** x $\frac{1}{2}$. **Rhinanthus.** c, **R. Crista-galli,** x $\frac{1}{2}$. **Odontites.** d, **O. rubra,** x $\frac{1}{2}$. **Euphrasia.** e, **E. Randii,** x $\frac{1}{2}$. f, **E. americana,** x $\frac{1}{2}$. **Scrophularia.** g, **S. lanceolata,** leaf, x $\frac{1}{4}$; flowers, x 1.

1. **M. lineare** Desr. COW WHEAT. Fig. 106, b.

Bogs, heaths, peaty or rocky barrens in rather exposed situations; rather common throughout. In northern C.B. it is characteristic of dwarf shrub, sedge and other heath associations. Nfld. and southern Lab. to B. C. south to N. S., northern N. Eng. & Wisc.

Var. **americanum** (Michx.) Beauv., see Fernald, Rhodora **44**: 446-452. 1942, is found on more favorable situations and soils, especially on sands. This includes the more northern element of Pennell's spp. *latifolium*(Muhl.) Beauv.

Dry woods, Anticosti to Minn. south to N. S., Md. & Mont.

14. EUPHRASIA (Tourn.) L. EYEBRIGHT

Fernald, M.L. and K.M. Wiegand. *Euphrasia* in North America. Rhodora **17**: 181-201. 1915.

a. Flowers 2.2-4 mm long; lower lip not exceeding the upper, scarcely fan-shaped.
  b. Leaves more or less pubescent on both surfaces.
    c. Leaves sparingly hairy, 5-18 mm long; corolla deep-purple, rarely white, with dark lines. 1. *E. Randii*
    c. Leaves very densely hairy, 2-7 mm long; corolla generally whitish, rarely purple. *E. Randii* var. *Farlowii*
  b. Leaves smooth on both surfaces; flowers deep-purple to cream-colored. *E. Randii* var. *Reeksii*
a. Flowers 4-10 mm long; lower lip generally exceeding the upper, spreading and conspicuous.
  d. Corolla 5-6.5 mm long, with pale-lavender or bluish lines, the lower lip with the lateral lobes not strongly spreading; spikes comprising the larger part of the plant. 2. *E. canadensis*
  d. Corolla 6-9 mm long, with dark-purple lines, the lower lip with wide-spreading lateral lobes.
    e. Corolla 6-8 mm long; spikes occupying the larger part of the plant; flowering bracts ascending. 3. *E. rigidula*
    e. Corolla 7-9 mm long; spikes occupying the upper half or third of the stem and branches; flowering bracts more or less spreading. 4. *E. americana*

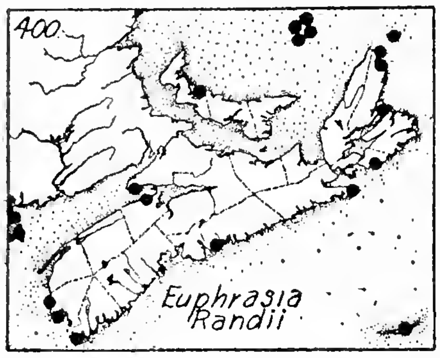
1. **E. Randii** Robinson, see Fernald, Rhodora **45**: 112. 1943. SMALL EYEBRIGHT. Map 400. Fig. 106, e.

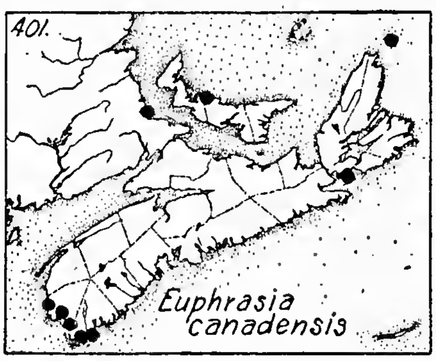
Common on turfy soil and sea-cliffs along the Atlantic Coast and the Bay of Fundy. This is the commonest type and is occasionally very abundant in wet pastures near the coast. Forma **albiflora** (Fern. and Wieg.) Fern., with the lobes of the corolla whitish, is often common. Forma **iodantha** (Fern. & Wieg.) Fern., with the lobes of the corolla purple, is reported by Rousseau (1935) from pastures at Fourchu, C.B. (*E. purpurea* var. *Randii*). Lab. to the Gaspe and Me.

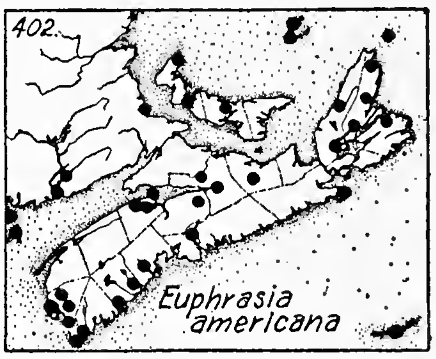
Var. **Farlowii** Robinson occupies much the same range. It is found around C.B., and is often characteristic of bleak exposed headlands.

Var. **Reeksii** Fern. is rather rare and northern; scattered around the northern coast of C.B., Nfld. south to

N. B. and N. S. (*E. purpurea* Reeks). A form with the lobes of the corolla whitish, forma **candida** (Fern. and Wieg.) Fern., is known from the Magdalen Islands, but has not yet been found in N. S.







2. **E. canadensis** Townsend. EYEBRIGHT, EUPHRASIA. Map 401.

Open barren fields and roadsides, usually near the coast and rather rare; Yarmouth and Shelburne Cos.; Isle Madame and St. Paul Is. in C. B.

Que., the Maritime Provinces and northern N. Eng.

3. **E. rigidula** Jord., see Rhodora **35**: 399. 1933.

Scattered in dry fields, grassy roadsides, and pastures; mostly rare, although Rousseau (1935) states that it is frequent in fields and pastures west of Halifax to Guysborough and C.B. (*E. stricta* Host.).

Nfld. to Me. and northern N.Y.; Eu.

4. **E. americana** Wettst. COMMON EYEBRIGHT. Map 402. Fig. 106, f.

Common throughout; along roadsides and in sterile fields, often found inland in lawns and open pastures. It is by far the commonest species of the genus in N. S.

Nfld., the Maritimes and Me.

15. ODONTITES (Riv.) Ludwig

1. **O. rubra** Gilib. RED BARTSIA, RED EYEBRIGHT. Map 396. Fig. 106, d.

Scattered in C. B.; common along the North Shore and becoming rarer to Hants and Kings Co; fields and waste places, in moist soil, usually near the coast. July-Sept.

Introduced from Eurasia; N. S. to Que. south to Me. and northern N. Y.

16. PEDICULARIS (Tourn.) L.

1. **P. palustris** L. SWAMP LOUSEWORT.

Rare; a collection by Dr. A. H. MacKay is simply labelled western N. S., June 1908; another collection was made by Dr. A. G. Huntsman, C. B. Is., July 1917; there is a good specimen collected in flower by Miss Margaret S. Brown in a marsh, Bay St. Lawrence; and specimens have been seen from Guysborough Co. July.

Eastern Que., N. S. and Nfld. northwards.

17. RHINANTHUS L.

Chabert, Alfred. Etude sur le Genre *Rhinanthus* L. Bull. de l'Herbarier Boissier **7**: 497-517. 1899. The whole group in eastern N.A. need further study, and the following key is merely provisional.

a. Plant with branches of the stem, when present, short and much reduced at flowering time; if elongating later, with only reduced flowers; strongly blackening in drying.
- b. Stems lacking black lines; upper lip without any violet coloring. 1. *R. Crista-galli.*
- b. Stem strongly black-lineolate; teeth of the upper lip of the corolla violet. *R. Crista-galli* var. *fallax*

a. Plant simple, or if branched with the branches strongly developed and ascending, bearing flowers similar to those of the primary inflorescence.
- c. Stem strongly black-lineolate; bracts and calyx purplish; teeth of the upper lip of the corolla bluish-grey. 2. *R. stenophyllus*
- c. Stem not black-lineolate; bracts and calyx greenish; teeth of the upper lobe of the corolla light yellowish; plants not strongly blackening in drying.
  - d. Plant 3-7 dm high; bracts scabrous; calyx minutely pubescent, the margin ciliolate but not glandular; corolla 8-13 mm long, with the tube exceeding the calyx. 3. *R. Kyrollae*
  - d. Plant 2-3.5 dm high; bracts glabrous; calyx glabrous, the margin finely glandular-ciliate; corolla about 15 mm long, the tube included within the calyx. 4. *R. groenlandicus*

1. **R. Crista-galli** L. YELLOW RATTLE. Fig. 106, c.

Exceedingly rare; it is known from the coast of Maine and St. John states that the *R. oblongifolius* Fern. of Macoun's list from Sable Is. belongs here. Rousseau's report from eastern N. S. probably belongs to the following variety. Introduced from Eu.

Var. **fallax** (Wimmer and Grab.) Druce is one of the commonest weeds of the province; found throughout in neglected fields, where it is often more abundant than the grass, along roadsides and in waste places. Introduced from Eu. and possibly native northwards. Nfld. & Que. to Conn.

2. **R. stenophyllus** (Schur) Schinz & Thellung.

This little-known plant is mentioned in Gray's Manual as occurring in boggy meadows and shores near the Gulf of St. Lawrence and from Gaspe Co., Que. to N. S. The N.S. record apparently rests upon a collection made at Canso by J. Fowler, July 8, 1901.

3. **R. Kyrollae** Chabert.

Chabert, in his original description, mentions a specimen from Annapolis. Collections in the herbarium of the Experimental Farm at Ottawa resemble this. Eastern Que., along the St. John R., to N. S. and northern Me.; Washington.

4. **R. groenlandicus** Chabert.

Collected but once in the province; Perry and Roscoe, near the ruins of an old house, Trinity Cove, St. Paul Is. This boreal species is found in the east from Greenland south to Saguenay Co., Que., Anticosti and N. S.

97. LENTIBULARIACEAE BLADDERWORT FAMILY

a. Leaves small and linear, or large and divided into capillary lobes; bladder usually present. 1. *Utricularia*

a. Leaves elliptical to ovate, in a basal rosette, 2-4 cm long; bladders absent. 2. *Pinguicula*

1. UTRICULARIA L. BLADDERWORT

Rossback, George B. Aquatic Utricularias. Rhodora **41**: 113-128. 1939.

a. Stems erect, from a base definitely anchored in the sand, mud or bog; bladders absent or poorly-developed.

b. Flowers purple, solitary, facing upwards; bracts on the scape below the flowers in pairs and united to form a tube; leaves small and with few lobes. 1. *U. resupinata*

b. Flowers yellow, several at the top of the scape; bracts not in pairs; stems solitary; leaves very small and narrow, seldom seen.

c. Stems very slender, the inflorescence zig-zag; pedicels of the flowers filiform, 1-2 cm long. 2. *U. subulata*

c. Stems stout, the inflorescence with a straight rachis; pedicels very short so that the flowers appear sessile. 3. *U. cornuta*

a. Stems floating in the water, or creeping over the wet mud; branched leaf-like stems or divided leaves conspicuous; bladders well-developed.

d. Divisions of the leaves flattened, with a midrib and parallel sides; plants small, generally less than 15 mm wide, the leaves with 4-10 short often overlapping lobes; bracts of scape with basal lobes.

e. Margins of the terminal divisions of the leaf minutely and sharply serrate; spur about as long as the lower lip and close to it; pedicels ascending in fruit.

f. Bladders borne on separate leafless branches; apices of the terminal divisions rounded, except for delicate plants in deep water, and mucronate. 4. *U. intermedia*

f. Bladders borne on both leafless branches and on the branched leaves; terminal divisions of the leaves acuminate; leaves and their teeth larger. 5. *U. ochroleuca*

e. Margins of the leaf-divisions entire except sometimes at the tip; bladders on most of the leaves, not on special leafless branches; spur very short; pedicels curved downwards in fruit. 6. *U. minor*

d. Divisions of the leaves capillary, without a midrib and gradually tapering to the tip; plants various.

g. Plants small and slender, with short branches creeping over the mud or in shallow water; scape less than 10 cm high, with 1-2 flowers; leaves with 2-5 rather long, capillary, not overlapping divisions. 7. *U. gibba*

g. Plants large and stout, 3-10 dm long, free-floating in the water; scape 10 cm or more high, with 2-20 flowers; leaves many times divided.

h. Leaves, or much divided branches, in whorls; flowers purple. 8. *U. purpurea*

h. Leaves scattered, not in whorls; flowers yellow.

i. Leaves rather regularly divided so as to possess a zig-zag axis with three orders of divisions; flowering scape without inflated branches.

j. Leaves with a bristly margin when seen under the microscope, the outline elliptical; basal leaf-divisions .50-.75 mm wide; scape 6-12-flowered, with 1-5 scales, the bracts with basal lobes. 9. *U. vulgaris*

j. Leaves without spines except at the tips of the divisions, the outline circular or nearly so; basal leaf-divisions about .25 mm wide; scapes without scales, 2-5-flowered, the bracts without basal lobes. 10. *U. geminiscapa*

i. Leaves irregularly branched, with 4, and commonly 5 or 6 orders of division, the axis not apparent on secondary divisions; flowering scape with a whorl of inflated leaf-like branches half way to the top. 11. *U. inflata*

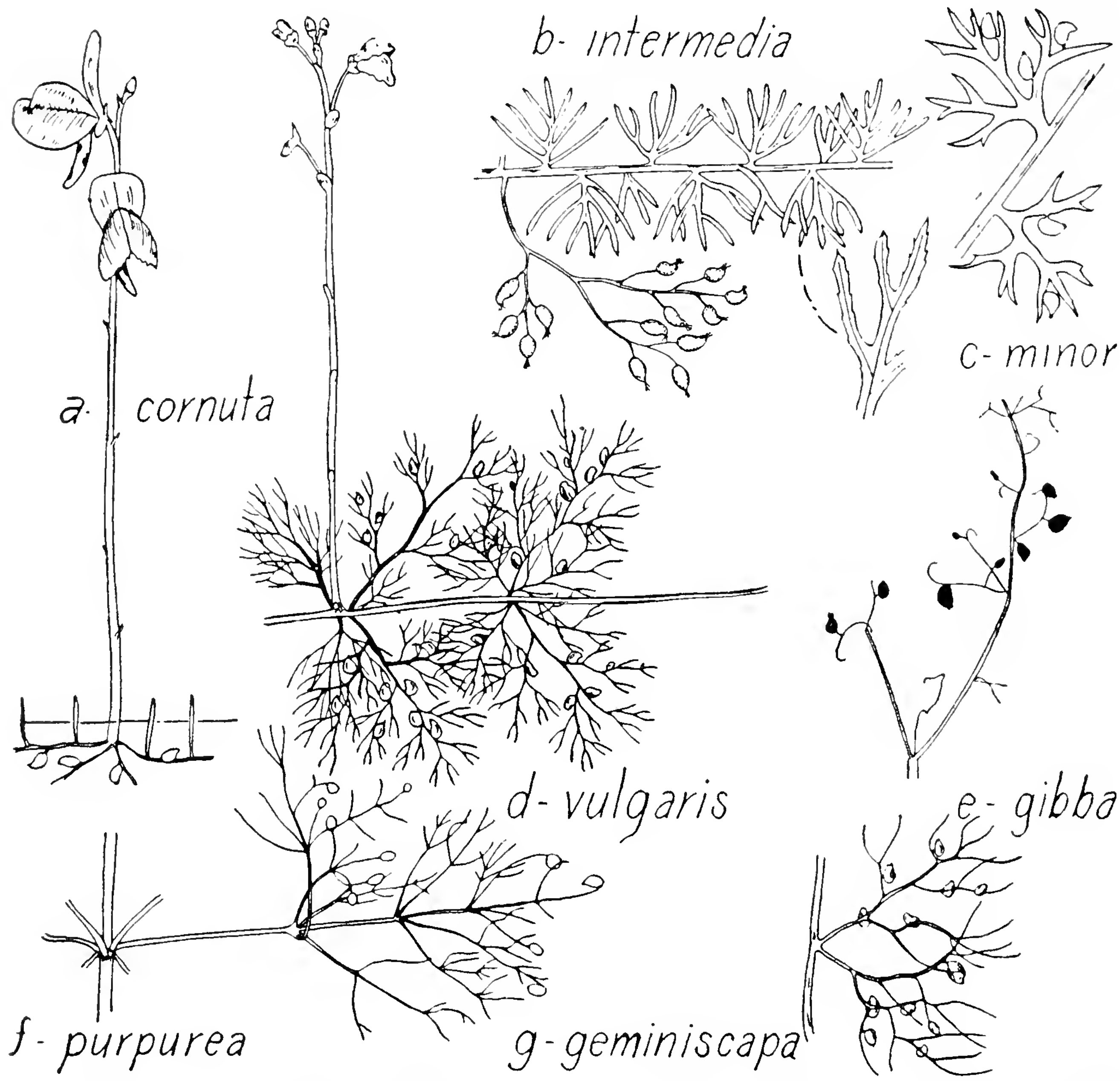


Fig. 107.—**Utricularia.** a, **U. cornuta,** x ½. b, **U. intermedia,** x 1. c, **U. minor,** x 1½. d, **U. vulgaris,** x ½. e, **U. gibba,** x 2. f, **U. purpurea,** x 1. g, **U. geminiscapa,** x 1. (c, e, f and g redrawn after Rossbach).

1. **U. resupinata** B. D. Greene.

Digby Co.: muddy margin of Midway L. at Centreville on Digby Neck (Fernald, 1921).

N. S. to Fla. west to Ont. & Ill.

2. **U. subulata** L. Map 403.

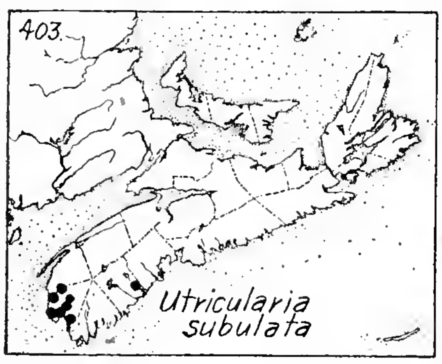
Characteristic of wet, sandy and peaty lake margins of Yarmouth and southern Digby Cos., always growing with and clearly passing into forma *cleistogama* (Gray) Fern., Rhodora **23**: 108-109. 1921. All gradations between the smallest extreme with cleistogamous flowers with tiny creamy or milk-white, spurless corollas sometimes not larger than a pinhead, and the typical *U. subulata* can be found at most of the stations in the province, [Fernald, 1921). *U. cleistogama* (Gray) Britt.].

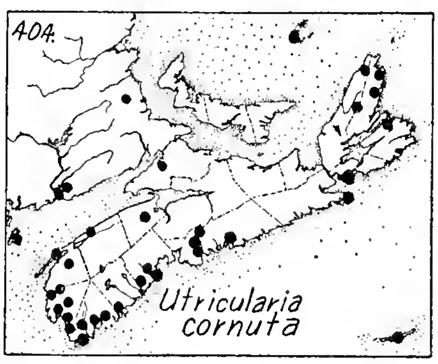
N. S.; Mass. to Fla. & Tex.

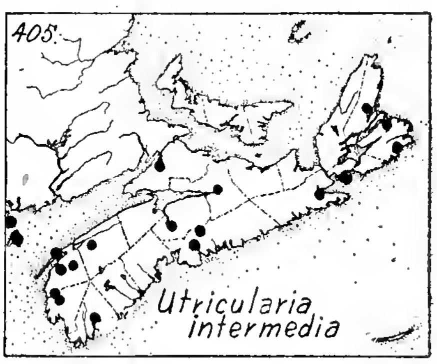
3. **U. cornuta** Michx. Map 404. Fig. 107, a.

Common throughout; exposed sand around the lake margins, in peat, mucky areas or in boggy depression and peat bogs from Yarmouth to C. B. In some places the brilliant yellow flowers will form carpets over considerable areas. Fernald (1922) mentions a colony at Rhodenizer Lake, Lunenburg Co., with stems forking into 2 or 3 long branches.

Nfld. to Minn. south to Fla. & Tex.







4. **U. intermedia** Hayne. Map 405. Fig 107, b.

Common throughout; characteristic of the bottoms or marshes, lake shores and often in wet hollows in peat bogs, creeping over the wet substratum of muck or peat and very rarely flowering.

Greenland & Nfld. to B. C. south to Penn. and Calif.; Eu.

5. **U. ochroleuca** R. Hartm.

The only collection of this plant from eastern Canada is by Perry and Roscoe from St. Paul Island, northern C. B. The plants were sterile.

Common in northern Eu.; reported from two localities in Greenland.

6 **U. minor** L. Map 406. Fig. 107, c.

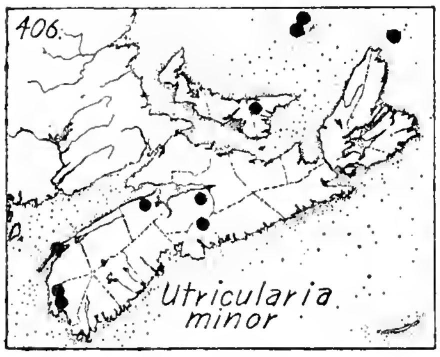
Scattered in shallow pools or films of water, lake margins and wet mud; probably throughout. When the plant creeps out upon the mud the leaves tend to be somewhat larger and more flattened than in the typical form, and the bladders are larger (Perry, 1931).

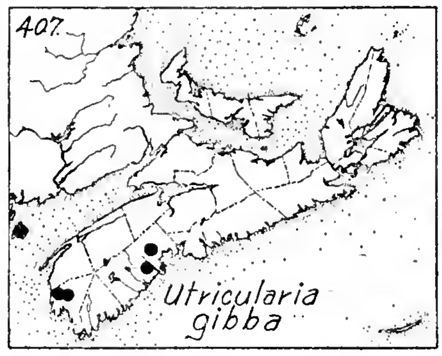
Greenland to Mackenzie south to Conn. and Calif.

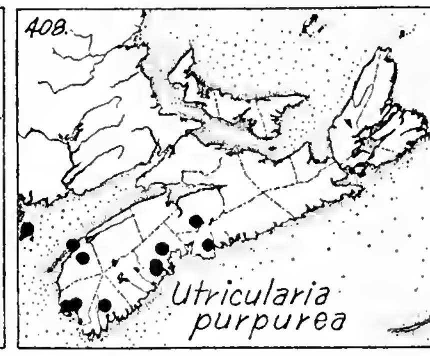
7. **U. gibba** L. Map 407. Fig. 107, e.

Rare in Yarmouth and Lunenburg Cos.; shallow margins of lakes, small pools and in small ponds in quagmires or peaty locations (Fernald, 1921, 1922).

N. S. & Que. to Fla. west to the Great Lakes; Calif.; W. I.







8. **U. purpurea** Walt. Map 408. Fig. 107, f.

Frequent to common from Yarmouth through Lunenburg Co. to Hants Co.; deep water, quiet pools or pond-holes (Fernald, 1921, 1922).

N. S. to southern Que. & Minn. south to Cuba and Central America.

9. **U. vulgaris** L., see Rhodora **43**: 642-645. 1941. Map 409. Fig. 107, d.

Common throughout; pools, lake shores, oxbow ponds, in sink-holes and slow streams.

Lab. to Minn. and Alaska south to Fla. & Tex.; circumboreal.

10. **U. geminiscapa** Benj. Map 410. Fig. 107, g.

Common in bog-pools and peaty quagmires in barrens from Yarmouth Co. along the southern region to northern C.B. (*U. clandestina* Nutt.)

Nfld. to Dela. & Va. west to Mich. & Wisc.

11. **U. inflata** Walt., var **minor** Chapm.

Discovered by Miss Margaret S. Brown in full flower, Aug. 31, 1939, in Lake Sawlor, near Hubbard, Halifax Co. She states that the water level of the lake was exceptionally low at the time of collecting. (Can. Field-nat. **54**: 44. 1940). (*U. radiata* Small).

N. S. southern Me. to N. J.; Fla., Ark.; S. A.

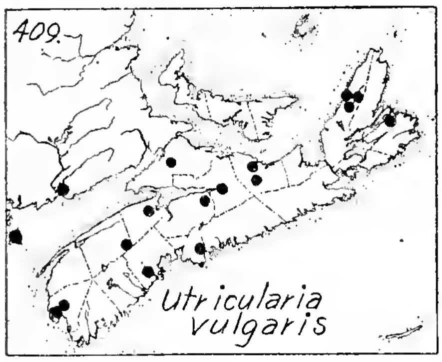
2. PINGUICULA (Tourn.) L.

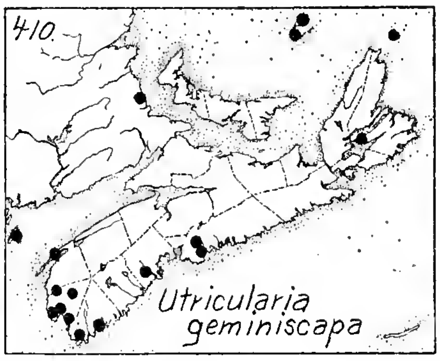
1. **P. vulgaris** L. BUTTERWORT.

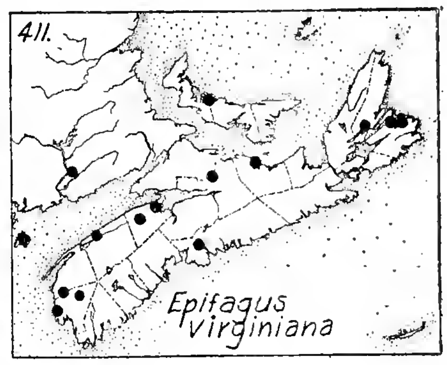
Bank of a streamlet between Petrie's Pond and White

Spring on St. Paul Is., C. B.; found also on C.B. but not elsewhere in the province (Perry, 1931).

N. S. & N. B. to northern N. Y. and Minn. and far northwards.







98. OROBANCHACEAE BROOMRAPE FAMILY

a. Flowers numerous in racemes or spikes; plants nearly glabrous.
  b. Plant dry and slender, branched, with loose racemes of flowers; parasitic on beech roots. 1. *Epifagus*
  b. Plants thick and fleshy, consisting mostly of large thick roots and unbranched dense cone-like spikes of flowers. 2. *Conopholis*
a. Flowers solitary, a terminal one for each stem; plant unbranched except at the base, glandular-pubescent. 3. *Orobanche*

1. EPIFAGUS Nutt.

1. **E. virginiana** (L.) Bart. BEECH-DROP. Map 411. Fig. 108, a.

Frequent throughout, wherever beech occurs; especially common from Annapolis to northern C. B.

N. S. to Wisc. south to Fla. and La.

2. CONOPHOLIS Wallr.

1. **C. americana** (L. f.) Wallr. CANCER-ROOT.

Known only from "dry pine and oak woods on steep slopes along the Lahave R., Bridgewater; locally abundant, many stems springing from deep-seated bases attached to oak-roots" (Fernald, 1922).

N. S., southern Me. to Mich. south to Fla.

3. OROBANCHE (Tourn.) L.

1. **O. uniflora** L. BROOMRAPE. Fig. 108, b.

Scattered from Kings Co. to Pictou, and probably beyond; habitat various. In the Annapolis Valley it has been found on the sandy plains; but in Colchester and Pictou Cos., it is usually found along che river intervales or on grassy slopes, growing in large clumps.

Nfld. to Ont. westward, south to Ga. and Calif.

99. PLANTAGINACEAE PLANTAIN FAMILY

a. Flowers solitary or in pairs; plants small, with leaves linear, 2-7 cm long. 1. *Littorella*

a. Flowers numerous in spikes or elongated heads; plants much larger than the preceeding; common. 2. *Plantago*

1. LITTORELLA Bergius

1. **L. americana** Fern., Rhodora **20**: 61-62. 1918.

Known only from the sandy shores of Shubenacadie Grand Lake, where it is abundant along the side next to the main road. The plant was first collected here by Mrs. Britton in 1902. Fernald (1922) notes that owing to the high water in 1920 it did not flower; but in 1921 it formed freely flowering carpets on the sandy and shingly beach. The plant is the American variant of the European *L. uniflora* (L.) Asch.

Rare from Nfld. to Me. & Minn.

2. PLANTAGO (Tourn.) L. PLANTAIN

Fernald, M.L. The maritime plantains of North America. Rhodora **27**: 93-104. 1925. Pilger, Robert. Plantaginaceae. Das Pflanzenreich, IV. 269. 1937.

a. Leaves ovate to lanceolate, thin and strongly ribbed; weeds or occasionally growing in brackish soils.

b. Leaves broad-elliptic to ovate; spikes long and slender; seeds plump.

c. Sepals and bracts broad, and blunt at the end; capsule ovate and circumscissile near the middle; base of the petiole rarely reddish; seeds about 1 mm long. 1. *P. major*

c. Sepals and bracts narrow and pointed; capsule opening much above the middle, elliptic-oblong; base of the petiole purplish; seeds 1-1.5 mm long. 2. *P. Rugelii*

b. Leaves narrow, mostly lanceolate; spikes short, roundish or conical when young; seeds hollow on the face.

d. Spikes at the beginning of flowering ovoid and tapering to the tip; flowering stems to 8 dm high. 3. *P. lanceolata*

d. Spikes then globose and rounded at the tip; flowering stems to 4.5 dm high. *P. lanceolata* var. *sphaerostachya*

a. Leaves linear, to occasionally wide-lanceolate, fleshy with the nerves obscure; plants near the coast only.

e. Bracts and calyx-segments mostly hairy and minutely ciliolate; spikes usually dense to the base; seeds oblong to narrowly oval, 1.2-2.3 mm long.

f. Leaves linear and not toothed, erect or nearly so, mostly shorter than the scapes.

g. Scapes 0.5-2.3 dm high; spikes 2-10 cm long. 4. *P. juncoides* var. *decipiens*

g. Scapes up to 1.7 dm high; spikes only 0.5-2 cm long. *P. juncoides* var. *glauca*

f. Leaves lanceolate or wider, wide-spreading and often toothed, commonly equalling or exceeding the scapes. *P. juncoides* var. *laurentiana*

e. Bracts and calyx-segments smooth or nearly so; mature seeds oblong-linear, 2-3 mm long; spikes often remotely flowered at the base; leaves very fleshy, often exceeding the scapes.

h. Leaves nearly erect, to 12 mm wide; spikes 3-20 cm long, usually remotely flowered at the base. 5. *P. oliganthos*

h. Leaves loosely spreading or arching, 1.5-4 mm wide; spikes 0.5-7 cm long, usually densely-flowered and depressed. *P. oliganthos* var. *fallax*

1. **P. major** L. BROAD-LEAVED PLANTAIN. Fig. 108, e.

Very common throughout and very variable; lawns, road-sides, dooryards and in waste places, not uncommon in pastures, and the edges of thickets. Plants found on the brackish marshes are often finely pubescent. Various forms and varieties have been named. July-Sept.

Introduced and cosmopolitan.

2. **P. Rugelii** Dcne. RUGEL'S PLANTAIN. Fig. 108, f.

Common in the Annapolis Valley, scattered around Truro, apparently rare elsewhere and much less common than the preceeding species in most areas. Perennial in lawns, along roadsides and in fields and pastures.

N. S. to N. D. south to Fla. & Tex.

3. **P. lanceolata** L. RIB-GRASS, ENGLISH PLANTAIN. Fig. 108, c.

Common throughout, especially in hay fields in late July and Aug. Fernald (1922) mentions a locally abundant variant with the spikes branching, sometimes with a few, often with many, short and densely crowded branches.

Var. **sphaerostachya** Mert. & Koch, see Fernald, Rhodora **24**: 204. 1922, has characteristic very short spikes. It is occasionally seen in the Annapolis Valley and in the southwestern counties on light soils. Forma *eriophora* (Hoffm. and Link) Beck von Man. has the upper leaf-surfaces gray with abundant long hairs.

Native of Eurasia; Nfld. to B.C. south to Fla. and Kans.

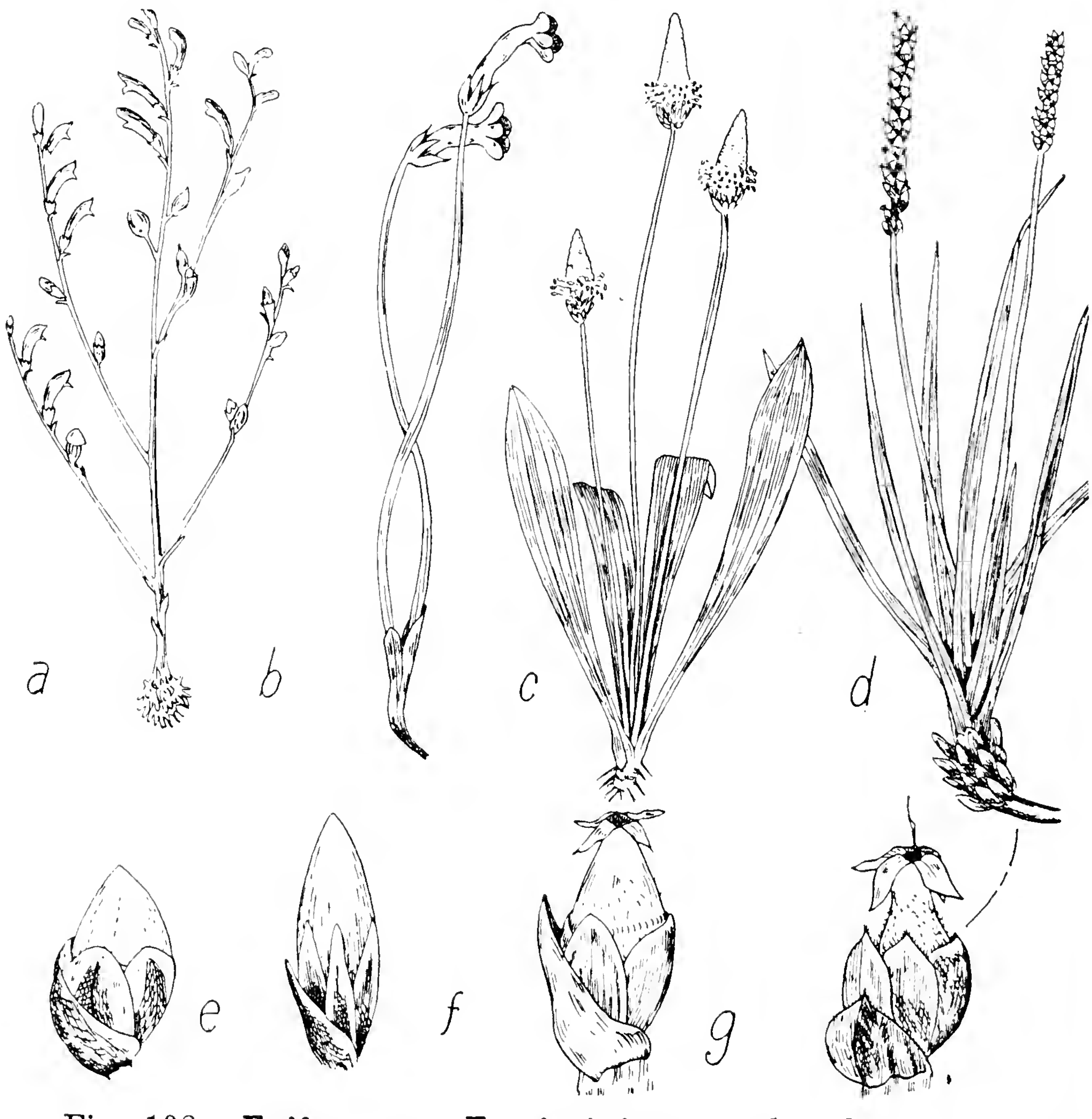
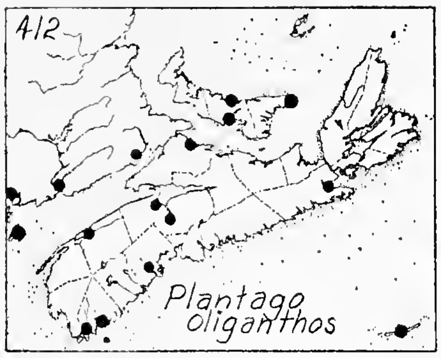
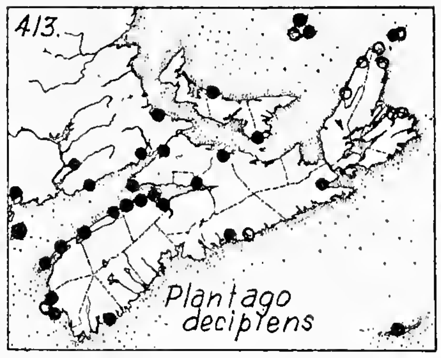


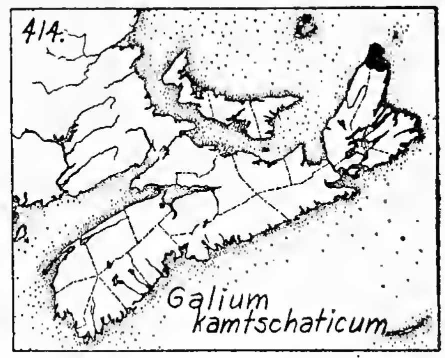
Fig. 108.—**Epifagus.** a, **E. virginiana,** x $\frac{1}{3}$. **Orobanche.** b, **O. uniflora,** x $\frac{1}{2}$. **Plantago.** c, **P. lanceolata,** x $\frac{1}{4}$. d, **P. juncoides,** x $\frac{1}{3}$; flower, x 4. e, **P. major,** flower. f, **P. Rugelii,** flower and fruit. g, **P. oliganthos,** flower.

4. **P. juncoides** Lam., var. **decipiens** (Barn.) Fern. SEASHORE PLANTAIN. Map 413. Fig. 108, d.

Common around the whole coast; edges of salt marshes and dykelands, sea-cliffs, and beaches. This species in places may hybridize with the next; and northward it passes into the following variety. July-Sept. Lab. to N. J.







Var. **glauca** (Hornem.) Fern. is a dwarf variety found around northern C. B. Greenland to Keewatin south to Me.; northern Eu.

Var. **laurentiana** Fern. is likewise common around northern C. B., where all gradations in degree of leaf width and type of spreading may be found. Nfld., Magdalens, P.E.I. & N. S.

5. **P. oliganthos** Roem. & Schultes. SEASHORE PLANTAIN. Map 412. Fig. 108, g.

Much less common than the preceeding, scattered around the coast and largely restricted to salt marshes and tidal flats. Que. to N. J. on brackish shores; Man.

Var. *fallax* Fern. has not yet been reported for the province, but it is found from Lab. & Nfld. to N. B. and eastern Me. and presumably also occurs in N. S.

100. RUBIACEAE MADDER FAMILY

a. Leaves in whorls; plants herbaceous; fruit of two nutlets joined side by side.
 b. Corolla funnel-shaped; calyx lobes lanceolate; flowers nearly sessile in leafy-bracted heads. 1. *Sherardia*
 b. Corolla flat with wide-flaring lobes; calyx lobes absent; flowers on slender pedicels (Fig. 109). 2. *Galium*
a. Leaves opposite, or sometimes in 3's; fruit not as above.
 c. Tall shrubs; flowers in showy globular heads (Fig. 111, a). 3. *Cephalanthus*
 c. Low herbs; flowers few or in pairs.
  d. Plants erect; leaves lanceolate, small; flowers bluish, solitary; fruit a top-shaped capsule (Fig. 110, a). 4. *Houstonia*
  d. Plants trailing; leaves orbicular; flowers pinkish-white, in pairs with one united ovary; fruit berry-like (Fig. 110, d). 5. *Mitchella*

1. SHERARDIA (Dill.) L.

1. **S. arvensis** L. BLUE FIELD MADDER.

Listed in Lindsay's Catalogue from Tatamagouche, Colchester Co. Nothing else is known of this plant in the province.

Waste places and lawns; N. S. to Ont., Ohio and N. J.; introduced.

2. **GALIUM** L. BEDSTRAW

a. Ovary and fruit covered with hooked or inturned hairs.
  b. Leaves prominently 3-nerved, firm, linear-lanceolate; stem smooth; rare. 1. *G. boreale*
  b. Leaves 1-nerved.
    c. Stem very prickly; plants annual. 2. *G. Aparine*
    c. Stem smoothish; plants perennial.
      d. Plants short and erect; leaves widely ovate, in 4's. 3. *G. kamtschaticum*
      d. Plants usually prostrate; leaves lanceolate, in 6's. 4. *G. triflorum*
a. Ovary and fruit smooth or almost so.
  e. Flowers yellow; stem smooth. 5. *G. verum*
  e. Flowers white.
    f. Stem smooth or nearly so; plants large, nearly erect, with very large decompound inflorescences.
      g. Branches of the inflorescence, and the pedicels, wide-spreading. 6. *G. Mollugo*
      g. Branches of the inflorescence and the pedicels ascending. 7. *G. erectum*
    f. Stems more or less prickly, or if smooth then with the plants very small and slender; plants matted, reclining or ascending, rather slender.
      h. Leaves with a sharp pointed tip; plants very rough, often rather coarse. 8. *G. asprellum*
      h. Leaves blunt; plants usually slender.
        i. Flowers numerous in branched inflorescences, 2-3 mm wide, with 4 acute petals. 9. *G. palustre*
        i. Flowers solitary, or in 2's or 3's.
          j. Corolla commonly with 3 blunt lobes; flowers 1.5 mm wide; fruit 1.25-2.25 mm wide.
            k. Pedicels straight and smooth, mostly 2-6 mm long; flowers mostly in 2's or 3's. 10. *G. tinctorium*
            k. Pedicels slender and arcuate, mostly 5-10 mm long; flowers mostly solitary.
              l. Leaves, stems and pedicels with minute prickles; mature fruit 1.25-1.50 mm thick. 11. *G. trifidum*
              l. Leaves, stems and pedicels smooth; mature fruit 1.5-1.75 mm thick. *G. trifidum* var. *halophilum*
          j. Corolla commonly with 4 acute lobes; flowers 2-2.5 mm wide.
            m. Leaves ascending, 1.5-2.5 cm long; inflorescence mostly terminal; fruit 2.5-3.5 mm thick. 12. *G. obtusum*

m. Leaves mostly reflexed, 0.5-1.5 cm long; inflorescence finally lateral; fruit 1-1.5 mm thick, on short pedicels.
13. *G. labradoricum*

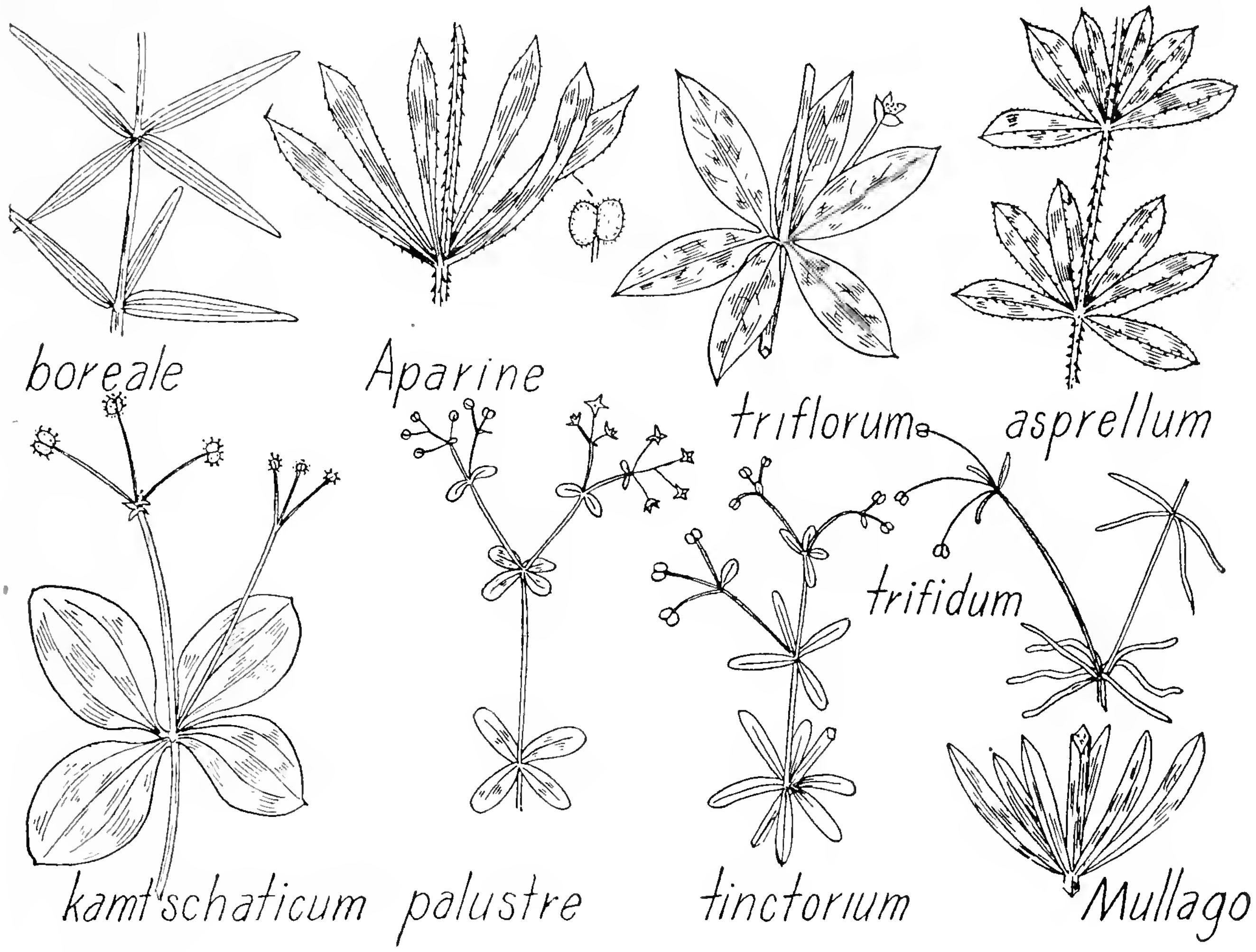


Fig. 109.—**Galium**, all x ½.

1. **G. boreale** L., var. **intermedium** DC., see Fernald, in Rhodora **30**: 106-107. 1928. NORTHERN BEDSTRAW. Fig. 109.

Known only from the top of Cape Blomidon where it is local around the edges of woods and in grassy places. Aug.

N. S. to Ont. south to Dela. and Ind.

2. **G. Aparine** L. CLEAVER'S, GOOSE-GRASS. Fig. 109.

Sparingly introduced; Macoun lists it from ballast heaps and waste places at Pictou and North Sydney; and it is occasionally found elsewhere.

N. S. to B. C. south to Fla. & Calif.; Eurasia.

3.. **G. kamtschaticum** Steller. NORTHERN WILD LIQUORICE. Map 414. Fig. 109.

Scattered and local in rich woods and ravines in northern C. B., often growing in colonies along wet runs.

C. B., Nfld. & Que. south to northern N. Eng.; the Aleutians and eastern Asia.

4. **G. triflorum** Michx. SWEET-SCENTED BEDSTRAW. Map 415. Fig. 109.

Scattered throughout and common from Annapolis to northern C. B.; mixed or deciduous woods. July-Aug.

Greenland to B. C. south to Fla. and Calif.

5. **G. verum** L. YELLOW BEDSTRAW.

Rather rare; seen as an occasional escape along roadsides and near dwellings.

Recently introduced from Eu.; N. S. to Ont. south to Penn.

6. **G. Mollugo** L. CLEAVERS.

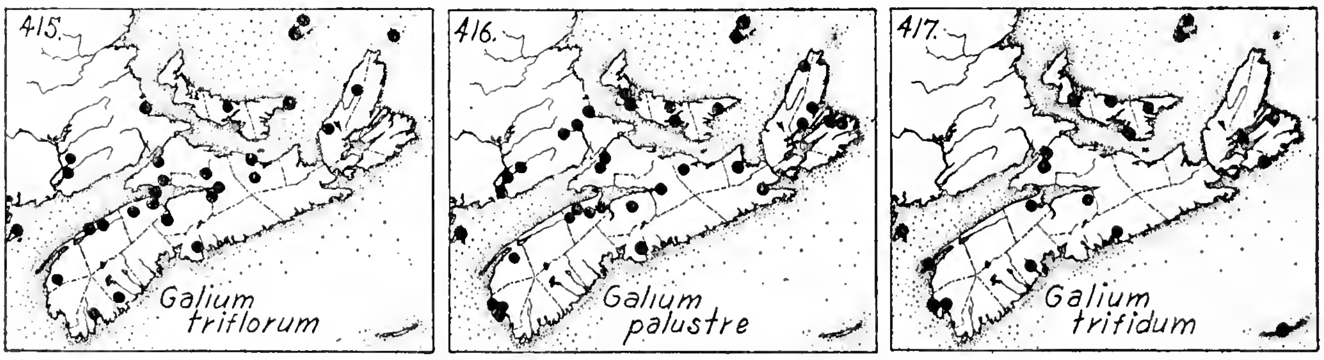
This species was reported from Truemanville, Cumberland Co., by Macoun over 40 years ago. Since that time it has spread and become a bad weed along roadsides and occasionally in fields in the northern part of the province; local elsewhere. July-Aug.

Native of Eu.; Nfld. to Vt., Va. and Ohio.

7. **G. erectum** Huds.

Various collections seem to belong to this species. Its distribution in the province is unknown, but it may be rather common, especially in the north-central counties. July-Aug.

N. S. to Que. & Conn.



8. **G. asprellum** Michx. ROUGH BEDSTRAW. Fig. 109.

Very common, the tangled rough masses are found clambering over bushes and underbrush, roadside weeds, and the sides of ditches; in low pastures, along brooksides, etc. throughout. July-Sept.

Nfld. to Minn. south to N. C.

9. **G. palustre** L. COMMON OR MARSH BEDSTRAW. Map 416. Fig. 109.

Very common throughout; ditches, low ground, along streams and in alluvial soils. It is common on intervale meadows where it grows among the grasses and along the stream-banks. July-Aug.

Nfld. to Mich. south to Conn.

10. **G. tinctorium** L. SMALL BEDSTRAW. Fig. 109.

Low areas, along brooks, marshes and bogs; common throughout, flowering several weeks later than the preceeding species. (*G. Claytoni* Michx., not *G. tinctorium* of Gray's Manual, see Fernald, Rhodora **37**: 443-445. 1935.) Hara, Rhodora **41**: 387-388. 1939, further places this and the following plant into one circumboreal species connected by the following variety. Nfld. to Nebr. south to Fla. & Tex.

Var. **subbiflorum** (Wieg.) Fern., Rhodora **39**: 320. 1937, is mostly a western variety intermediate between this and the next species. In the northeast it is more closely connected with, and grades into *G. tinctorium*. It differs mainly in a tendency towards solitary flowers on longer, sometimes slightly prickly pedicels. Pebbly lake shore, North Sydney, Howe and Lang, no. 752; see Rhodora **12**: 230. 1910.

11. **G. trifidum** L. Map 417. Fig. 109.

Springy and boggy places, local throughout and much less common than the preceeding two species, usually growing in rich alluvial soils along stream bottoms; common on Sable Is. in wet dune hollows and along swampy borders of fresh-water ponds.

Var. **halophilum** Fern. and Wieg., Rhodora **12**: 78. 1910, is found on brackish shores and borders of salt marshes; Yarmouth Co. and C. B., probably around the whole coast. July 15-Aug.

Nfld. to B. C. south to N. Eng., N.Y. and Calif.

12. **G. obtusum** Bigel., see Rhodora **37**: 443-445. 1935.

Rare, with earlier records belonging to *G. palustre*. It is found in boggy swales and wet thickets in the Tusket Valley, Yarmouth Co.; perhaps elsewhere. July. (*G. tinctorium* in Gray).

N. S. to Mich. & Nebr. south to N. C.

13. **G. labradoricum** Wieg.

This slender smooth plant with thread-like rootstocks is found from Nfld. to Wisc. south to N. Y., growing in moss under white cedar or larch woods. No specimens or records have been seen from the province, but it is apparently overlooked.

3. CEPHALANTHUS L.

1. **C occidentalis** L BUTTONBUSH. Map 418. Fig. 111, a.

Local; rare in Shelburne Co.: rocky shore of Deception Lake, and among granite boulders at Lake John (Fernald, 1921), at both stations rare and local; Queens Co.; found first in the province by R. H. Wetmore at Cameron L., and later found to be common along the Medway R. and about the lakes near its head (Weatherby, 1942). July 15-Aug. 15.

N. S. to Ont. & Calif. south to Fla. & Tex.; east Asia.

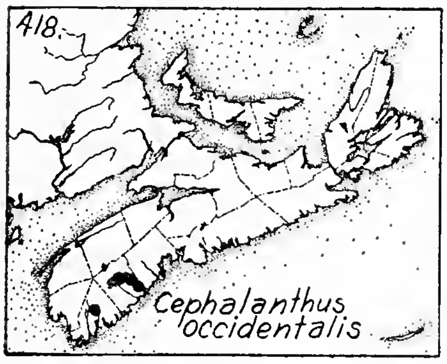
Fig. 110.—**Houstonia.** a, **H. caerulea**, x ½. **Linnaea.** b. **L. borealis**, x ½. **Triosteum.** c, **T. aurantiacum**, x ½. **Mitchella**, d, **M repens**, x ½; flower, x 1. **Echinocystis.** e, **E. lobata**, x ⅓. **Valeriana.** f, **V. officinalis**, flower much enlarged.

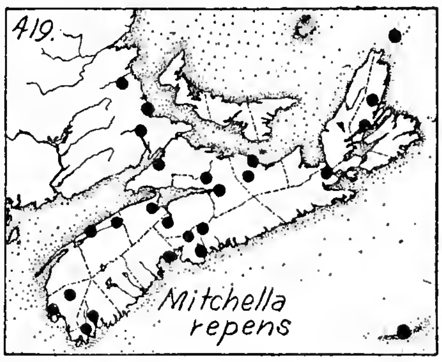
4. HOUSTONIA L

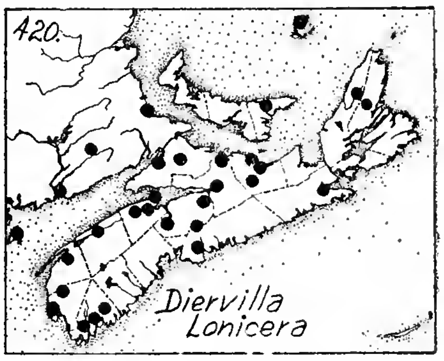
1. **H. caerulea** L. BLUETS. Fig. 110, a.

Open grassy places, damp fields, meadows and occasionally on drier hillsides; scattered throughout, and abundant in deserted fields or pastures in the Annapolis Valley and the north-central counties. Early May-June.

N. S. to Wisc south to Ga. & Mo.







5. MITCHELLA L.

1. **M. repens** L. PARTRIDGE BERRY. Map 419. Fig. 110, d.

Common throughout; shady and mossy woods, moist banks, and hummocky pastures; characteristic of deciduous climax forest in northern C. B.; uncommon and local on turf-covered dunes on Sable Is. It is mostly found in moist places where it does not have to meet competition of more vigorous herbs or grasses. July.

Nfld. to Minn. south to Fla., Ark. and Tex.

101. CAPRIFOLIACEAE HONEYSUCKLE FAMILY

a. Shrubs.
  b. Leaves simple, or merely palmately lobed.
    c. Leaves finely and sharply toothed; fruit a capsule; flowers yellow; shrubs in low clumps (Fig. 112, a). 1. *Diervilla*
    c. Leaves entire, or obscurely and bluntly toothed; fruit a berry; flowers pinkish to cream-colored.
      d. Flowers solitary or in axillary clusters; shrubs mostly less than 1.5 m high.
        e. Corolla irregular, funnel-form; berry red or blue, 2-3-celled, several-seeded (Fig. 112, b, c). 2. *Lonicera*
        e. Corolla regular and bell-shaped; berry white, waxy, 4-celled, 2-seeded (Fig. 112, d). 3. *Symphoricarpos*
      d. Flowers small and numerous, in an erect compound inflorescence or cyme; shrubs mostly over 1.5 m high (Fig. 113). 4. *Viburnum*

b. Leaves pinnately compound, the leaflets toothed (Fig 111, b, c). 5. *Sambucus*

a. Herbs or trailing semi-woody plants.

f. Plant trailing, partly woody; flowers in pairs on an upright stalk, bell-like, pink (Fig. 110, b). 6. *Linnaea*

f. Plant erect, herbaceous; flowers axillary, sessile, reddish (Fig. 110, c). 7. *Triosteum*

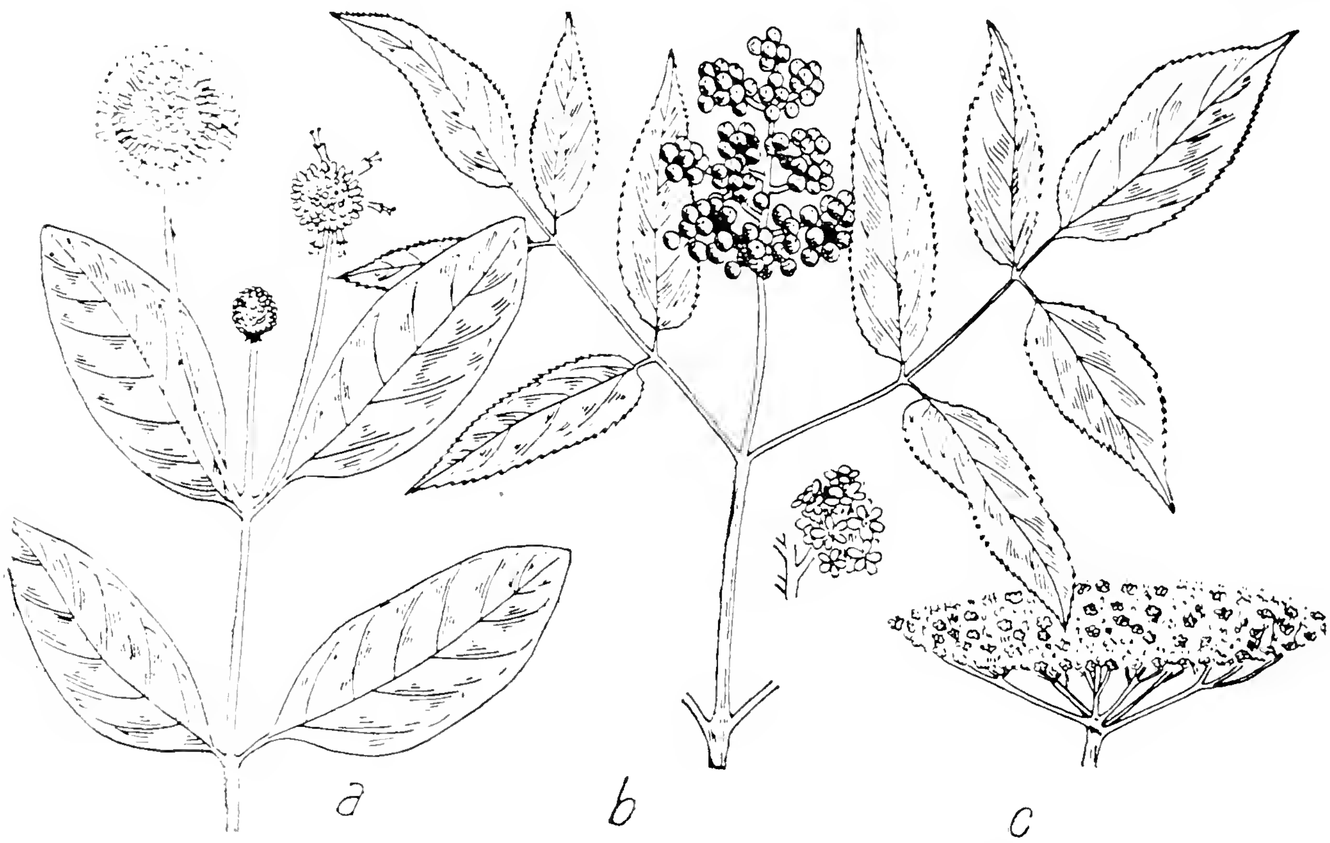


Fig. 111.—**Cephalanthus.** a, **C. occidentalis**, x ½. **Sambucus.** b, **S. pubens**, fruiting twig, x ½; flower, x 1. c, **S. canadensis**, inflorescence, x ¼.

1. DIERVILLA (Tourn.) Mill.

1. D. Lonicera Mill. BUSH HONEYSUCKLE. Map 420. Fig. 112, a.

Common throughout; sandy or stony ground, thickets, dry plains, roadsides and pastures; on very light soil it usually grows in the shade, but otherwise it shows a wide range of habitats. June 20-July.

Nfld. to N. Eng., Ga. & Wisc.

2. LONICERA L. HONEYSUCKLE

a. Flowers in pairs or rarely solitary; plants bush-like, erect, native.

b. Leaves elliptical, 2-4 cm long, thick and veiny; flowers yellow, on stalks 3-7 mm long, crowded; fruit blue, the two ovaries united to form one berry. 1. *L. villosa*

b. Leaves ovate, thin, smoothish and much larger; flowers greenish-yellow, on stalks 14-30 mm long; fruit red, the two berries nearly separate. 2. *L. canadensis*

a. Flowers in a dense head; plant twining; garden escape.
3. *L. Periclymenum*

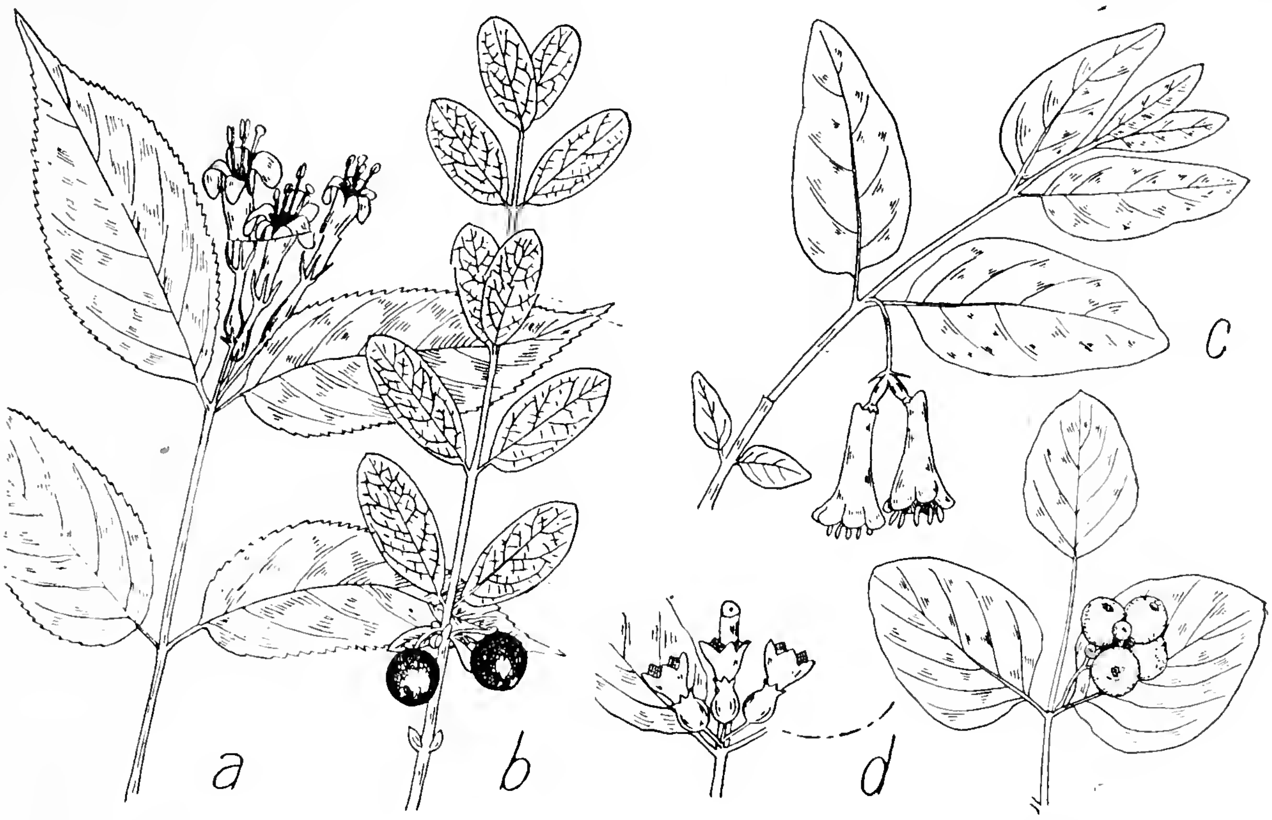


Fig. 112.—**Diervilla.** a, **D. Lonicera,** x $\frac{1}{3}$. **Lonicera.** b, **L. villosa,** x $\frac{1}{3}$. c, **L. canadensis,** x $\frac{1}{3}$. **Symphoricarpos.** d, **S. rivularis,** fruiting twig, x $\frac{1}{3}$; flower, x 1.

1. **L. villosa** (Michx.) R. & S., see Fernald, Rhodora **27**: 1-11. 1925, for nomenclature and varieties. MCUNTAIN FLY HONEYSUCKLE. Map 421. Fig. 112, b.

Typical *L. villosa* has not been found in the province, but it is represented by the three following varieties, which in N. S. at least, appear more like forms. (*L. caerulea* L. in Gray's Man.).

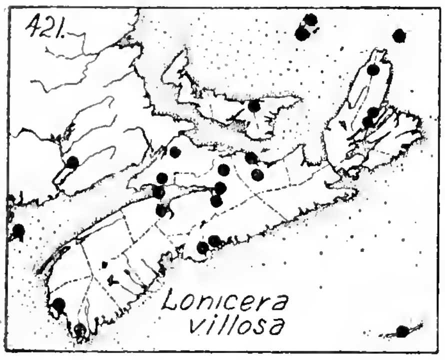
Var. **Solanis** (Eaton) Fern. has the young branches covered with fine short hairs mixed with longer ones, and the leaves pilose beneath. Yarmouth and Cumberland Cos. to C. B. in bogs, wet pastures and boggy thickets. Var. **calvescens** (Fern. & Wieg.) Fern. has the young twigs with only fine short hairs or puberulence. Common from Halifax to C. B. Var. **tonsa** Fern. has the branches glabrous, and the leaves glabrous or nearly so. Common in pastures above Parrsboro. The fruit of this species is said to be delicious in flavor and should be an article of diet in parts of the province. May.

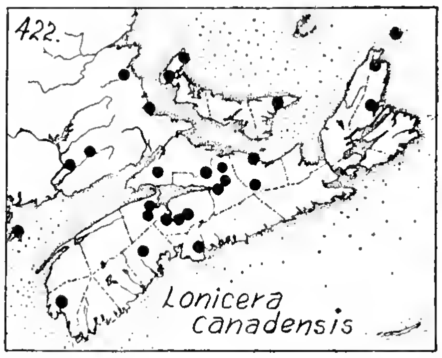
Lab. to Man. south to Mass., Mich., & Minn.

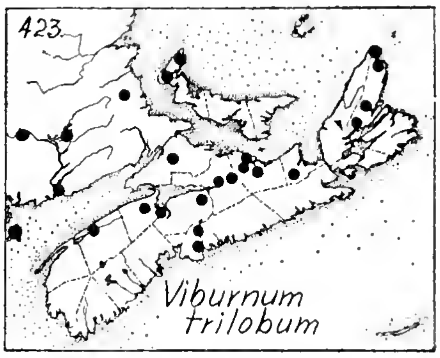
2. **L. canadensis** Marsh. AMERICAN FLY HONEYSUCKLE. Map 422. Fig. 112, c.

Common throughout, especially from Annapolis Co. to northern C. B.; light or rocky woods, ravine banks, and characteristic of hardwood forests. Early May.

N. S. to Sask. south to Penn. & Minn.







3. **L. Periclymenum** L. WOODBINE.

Fernald (1921) reports this common garden shrub as becoming naturalized along roadside fence-rows about Yarmouth.

3. SYMPHORICARPOS (Dill.) Ludwig

1. **S. rivularis** Suksdorf, see Jones, Journ. Arnold Arb. **21**: 209-214. 1940. SNOWBERRY, WAXBERRY. Fig. 112, d.

Frequently planted around buildings and in gardens, occasionally escaping to roadsides. July. (*S. racemosus* var. *laevigatus* Fern.).

Alaska to Calif. & Mont.; introduced eastwards.

4. VIBURNUM (Tourn.) L.

a. Leaves 3-lobed, palmately veined.
  b. Leaves with large conspicuous glands near the top of the petiole, deeply lobed; cyme 4-6 cm wide, the marginal flowers large and showy.
    c. Leaves downy beneath; petiole with a deep narrow groove along the top, and large dish-shaped glands; stipules near the base of the petiole mostly thread-like and tapering to the end. 1. *V. Opulus*
    c. Leaves smooth beneath except the veins; petioles with a wide and shallow groove above, and smaller club-shaped glands; stipules clavate, or with club-shaped thickened tips. 2. *V. trilobum*
  b. Leaves without glands at the top of the petiole, slightly and shallowly lobed, glabrous beneath except for a conspicuous band of hairs along the main veins; cyme 1-4 cm wide, the flowers small and all alike. 3. *V. edule*
a. Leaves not lobed, pinnately veined.
  d. Cyme sessile, the marginal flowers large and showy; leaves large, heart-shaped; leaves, twigs and flowering-stalks softly brown-scurfy. 4. *V. alnifolium*

d. Cyme stalked, the flowers all small; leaves not heart-shaped; leaves, twigs and flower-stalks only minutely brownish-dotted.
5. *V. cassinoides*

1. **V. Opulus** L. EUROPEAN CRANBERRY BUSH.

Frequently planted and occasionally escaping along roadsides and intervales, especially in the north-central counties. Var. **roseum**, with all the flowers in the cyme with showy rays, is the common snowball of the gardens. June 15-July 15.

Widely introduced from Eu.

2. **V. trilobum** Marsh. HIGHBUSH CRANBERRY. Map 423. Fig. 113, a.

This American variant of *V. Opulus* is found from Annapolis and Cumberland Cos. to northern C.B.; occasional in the Annapolis Valley and becoming common along the intervales of eastern N. S. (*V. Opulus* var. *americanum* Mill.)

Nfld. to B. C. south to N. Y., S. D. & Ore.

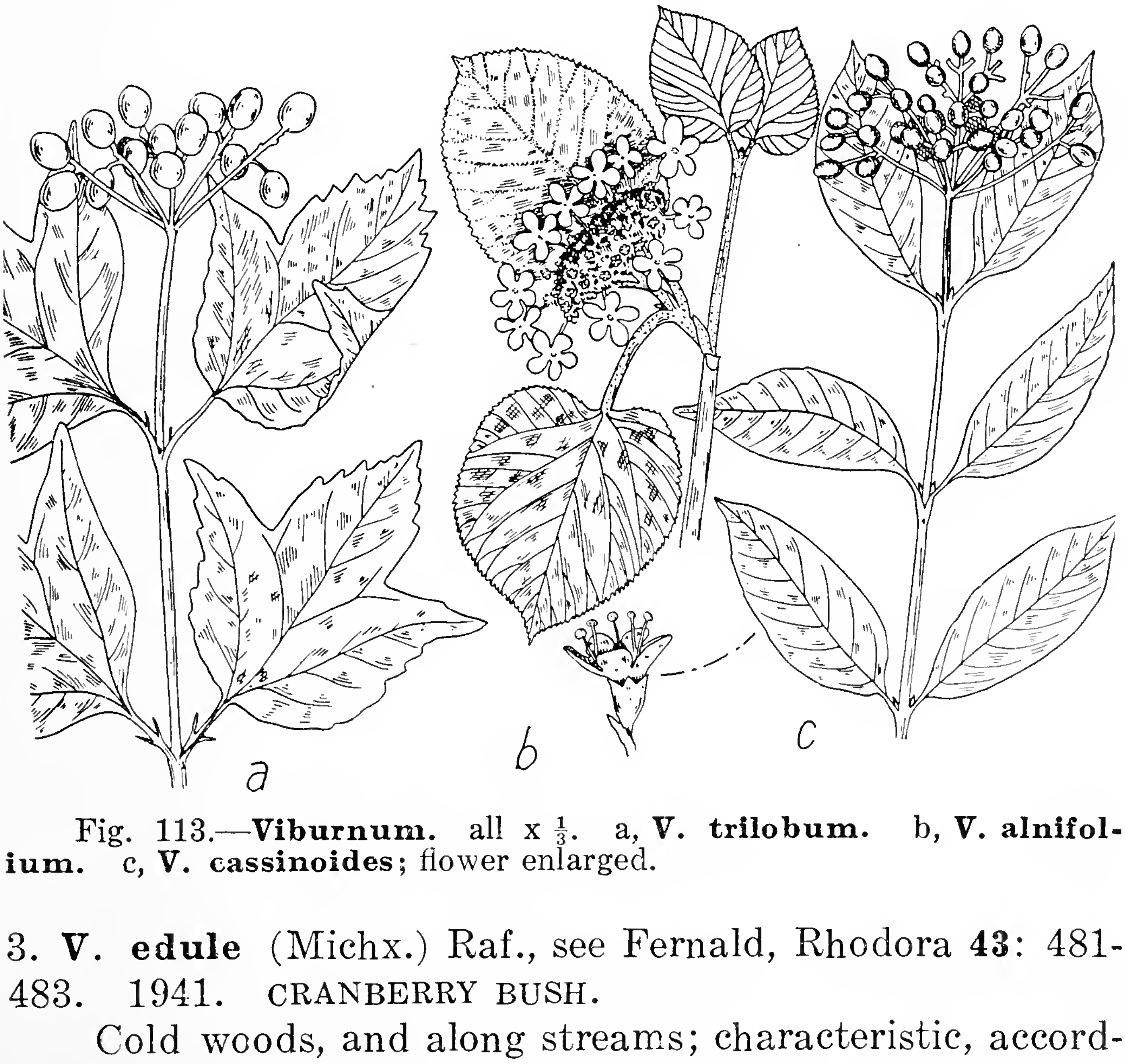


Fig. 113.—**Viburnum.** all x $\frac{1}{3}$. a, **V. trilobum.** b, **V. alnifolium.** c, **V. cassinoides**; flower enlarged.

3. **V. edule** (Michx.) Raf., see Fernald, Rhodora **43**: 481-483. 1941. CRANBERRY BUSH.

Cold woods, and along streams; characteristic, according to Nichols, of the coniferous climax forest in northern C. B.; unknown elsewhere in the province. (*V. pauciflorum* Pylaie).

Nfld. to Alaska south to Me. and in the Rockies.

4. **V. alnifolium** Marsh. HOBBLE BUSH. Map 424. Fig. 113, b.

Scattered in rich woods, shaded ravines and characteristic of rich hardwoods; rare in the southwestern counties, becoming frequent in Digby Co. and along the northern counties to northern C. B. May 15-June 15. (*V. lantanoides* Michx.)

N. S. to Mich. south to Penn.

5. **V. cassinoides** L. WITHE-ROD, VIBURNUM. Fig. 113, c.

Common throughout, often abundant in swamps, wet barrens, open low lands, and in all types of locations from peaty barrens to dry open areas and pastures. June 20-July 15.

Nfld. to Man. south to N. J., Fla & Ala.

5. **SAMBUCUS** (Tourn.) L. ELDER

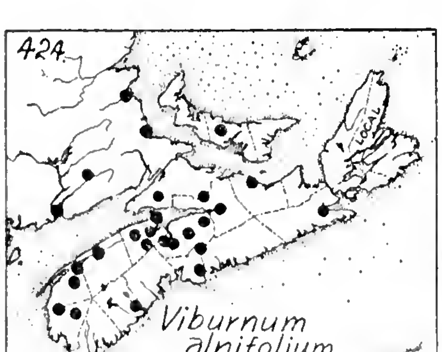
a. Flowering June 1-June 20; inflorescence pyramidal-shaped; corolla lobes reflexed in drying; fruit red; young pith reddish-brown. 1. *S. pubens*

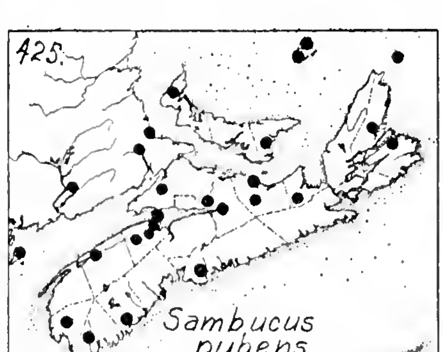
a. Flowering July 15-Aug.; inflorescence almost flat; corolla lobes spreading when dried; fruit dark-purple; pith of the young twigs whitish. 2. *S. canadensis*

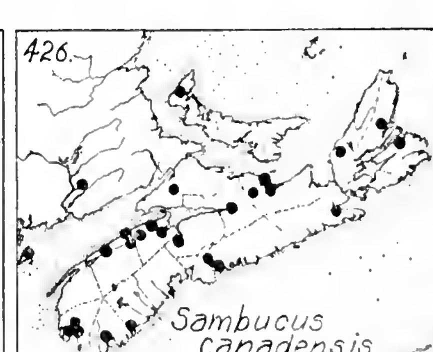
1. **S. pubens** Michx., see Fernald, Rhodora **35**: 310. 1933. RED-BERRIED ELDER. Map 425. Fig. 111, b.

Common in wet places, rocky hillsides, or along streams; throughout, occurring as scattered plants in the climax forest in northern C. B. June 1-June 20. (*S. racemosa* L. of earlier authors).

Nfld. to B. C. south to Penn., Ga. & Calif.







2. **S. canadensis** L. COMMON ELDER. Map 426. Fig. 111, c.

Common in rich soil, open woods, around old fields and along brooks, especially in the center of the province; in wet flood-plains and meadows in northern C. B.; not as common in the Annapolis Valley as the preceding species. July 15-Aug.

N. S. to Man. south to Fla., Kans., & Ariz.

6. LINNAEA (Gronov.) L.

1. **L. borealis** L., var. **americana** (Forbes) Rehd. TWIN-FLOWER Fig. 110, b.

Common throughout; characteristic of wooded swamps, spruce bogs and coniferous forests, often occurring in dense mats. It is especially common eastwards; also on Sable Is. Late June.

Lab. & Nfld. to Alaska south to Md., Ind. & Minn.

7. TRIOSTEUM L.

1. **T. aurantiacum** Bickn. FEVERWORT, HORSE GENTAIN. Fig. 110, c.

Local; intervales or rich soil along the rivers: above Truro, near New Glasgow, and characteristic of intervales in northern C. B., in one place growing on limestone cliffs. July.

N. S. to Ont. and Wisc. south to Va. and Ill.

102. VALERIANACEAE VALERIAN FAMILY

1. VALERIANA (Tourn.) L.

1. **V. officinalis** L. GARDEN HELIOTROPE Fig. 110, f.

This old-fashioned garden plant is found occasionally as an escape or persisting for a time along roadsides, not spreading. July 15-June.

Introduced from Eurasia and widely distributed.

103. DIPSACACEAE TEASEL FAMILY

1. SUCCISA (Rupp.) Neck.

1. **S. pratensis** Moench. DEVIL'S-BIT. Fig. 114, e.

Common about Louisburg where it grows about dwellings, along roadsides, in fields and waste places; not known from any other region in eastern Can. Aug.-Sept.

Introduced from Eu.

104. CUCURBITACEAE GOURD FAMILY

This family is represented by the garden squash (*Cucurbita maxima* Duchesne), the pumpkin (*C. Pepo* L.), and the cucumber (*C. sativus* L.). The following is the only member growing without cultivation in the province.

1. ECHINOCYSTIS Torr. & Gray

1. **E. lobata** (Michx) Torr. & Gray. WILD CUCUMBER. Fig. 110, e.

This climbing plant, used as a cover for fences and walls, often escapes to waste places and persists on rich river bottoms in the central and southern parts of the province. July-Sept.

N. S. to Man. south to Penn., Ga. & Tex.

105. CAMPANULACEAE BLUEBELL FAMILY

1. CAMPANULA (Tourn.) L.

a. Plant 6-10 dm high; flowers numerous in an erect terminal spike; stem-leaves wide, toothed. 1. *C. rapunculoides*

a. Plant 1-6 dm high, weak; flowers few; stem-leaves linear, except var *alaskana*) mostly untoothed.

b. Stem weak and filiform, very rough and clambering; corolla white, 6-10 mm long. 3. *C. aparinoides*

b. Stem erect, smooth above; corolla blue, 15-25 mm long.

c. Stem leaves linear.

d. Base of the stem pubescent all over for at least 10 cm. 2. *C. rotundifolia*

d. Base of the stem bristly pubescent only on the angles, or smooth. *C. rotundifolia* var *intercedans*

c. Stem leaves lanceolate to oblong or narrowly obovate. *C. rotundifolia* var. *alaskana*

1. **C. rapunculoides** L. BELL-FLOWER, BLUEBELLS. Fig. 114, a.

Commonly planted and very persistent in old gardens, often escaping to fields and roadsides. July 15-Aug.

Introduced from Eurasia; Nfld. to Ont. south to Penn. & Ind.

Fig. 114.—**Campanula.** a, **C. rapunculoides**, top of plant, x ⅓. b, **C. rotundifolia**, x ⅓; basal leaves, x ⅓. c, **C. aparinoides**, x ½. **Lobelia.** d, **L. inflata**, top of plant, x ⅓. f, **L. Dortmanna**, x ⅓. **Succisa.** e, **S. pratensis**, inflorescence and leaf, x ½.

2. **C. rotundifolia** L. HAREBELL. Map 427. Fig. 114, b.

This typical Eurasian plant is rare in North America, from the Arctic Regions south to N. J., the Great Lakes and Texas. The only N. S. collection seen that approached this variety was from gypsum cliffs, 5-Mile R., Hants Co.

Var. **intercedans** (Witasek) Farw. is common around the coast and in colder parts of the province; it is often abundant near the sea, in meadows, on damp cliffs, and occasionally on cliffs along streams inland. June 15-Sept. Eastern and interior N. A. See Malte, Rhodora **36**: 188-190. 1934, for discussion of the status of the plant.

Var. **alaskana** Gray, see Rhodora **35**: 310. 1933, has been collected upon St. Paul Is., C. B. (Perry, 1931). This intergrading variety is western, collected east of B. C. only in N. S., the Gaspe and Nfld.

3. **C. aparinoides** Pursh. MARSH HAREBELL Fig. 114, c.

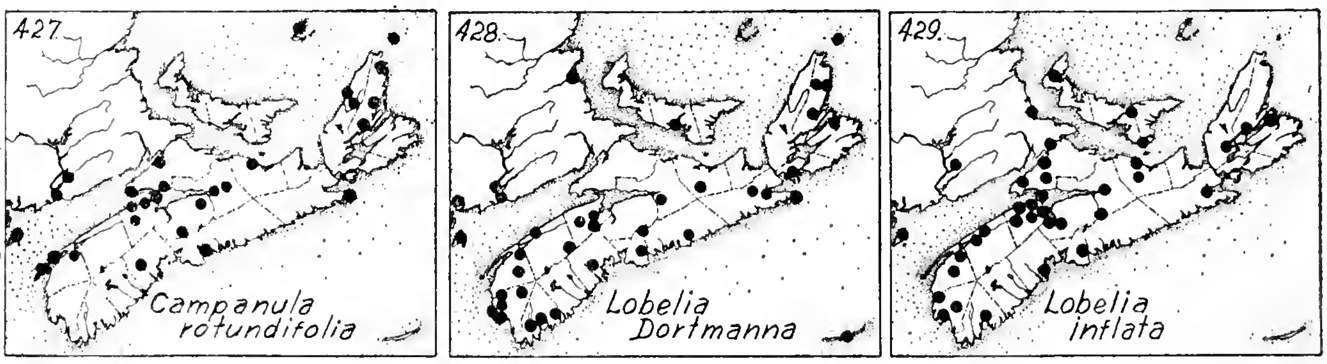
Collected along ditches in a meadow north of Auburn, Kings. Co., August 1942; Ganong reports it as a minor form in the wet marsh about the head of the Bay of Fundy. Aug.

N. S. to Colo. south to Ga. & Ky.

106. LOBELIACEAE LOBELIA FAMILY

McVaugh, Rogers. Studies in the taxonomy and distribution of the eastern North American species of *Lobelia*. Rhodora **38**: 241-263; 276-298; 305-329; 346-362. 1936.

a. Stem leafy; leaves flat; plants of dry or moist habitats.
 b. Stem slender, unbranched, the flowers scarcely stalked; fruit not inflated nor enlarged. 1. *L. spicata*
 b. Stem becoming much branched, the flowers long-stalked or several on slender branches.
  c. Leaves wide, oblong, toothed; plants often rough-hairy; fruit oval, soon much swollen; common. 2. *L. inflata*
  c. Leaves narrow to linear; plants smooth or nearly so; fruit not swollen; rare. 3. *L. Kalmii*
a. Stem naked, hollow; leaves in a basal rosette, the blades oval in cross-section, rolled to resemble two united cylinders; water plants. 4. *L. Dortmanna*



1. **L. spicata** Lam. BLUE LOBELIA

Rare in the Maritimes; local and weedy on the top of Cape Blomidon in Kings Co. July-Aug.

P. E. I. to Sask. south to Fla.

2. **L. inflata** L. INDIAN TOBACCO Map 429. Fig. 114, d.

Common throughout; dry pastures, run-out fields and thickets. July-Aug.

Lab. to Sask. south to Ga. & Fla.

3. **L. Kalmii** L. Map 441.

Rare; known only from dripping cliffs or meadows in northern C. B.; usually found in calcareous or marly places. July-Sept.

Nfld. to B. C. south to Ohio & Mo.

4. **L. Dortmanna** L. WATER LOBELIA Map 428. Fig. 114, f.

Common around lakes and ponds in the southern or acid regions of the province, rarer northward and in sandy areas. It grows at the edges of the water with the rosette of leaves submersed and the height of the stem varying with the depth of the water. Aug.

Nfld. to Lake Superior south to N.J.; B.C. to Ore.

107. COMPOSITAE COMPOSITE FAMILY

Flowers composite, composed of many florets grouped on a common *receptacle,* surrounded by one to several rows of bracts making up the *involucre.* Scales growing on the receptacle among the florets are called *chaff.* If chaff is absent, the receptacle is said to be naked. The flower-heads may have two kinds of florets: tubular ones or *disk florets,* and ones with the corolla drawn out into a ray or ligule which are called *ray* florets. If the flowers are *discoid,* the florets are all disk florets; if the flowers are called *ligulate,* then all the florets are ray florets as in the dandelion; if the flower is *radiate,* then the inner florets are disk florets and the outer ones ray florets, as in the daisy. Each floret is like an individual flower with an inferior ovary. The calyx, however, is reduced to scales, teeth or bristles or may be absent. This reduced calyx is called the *pappus,* and is most conspicuous after the fruits are formed.

a. Flower-heads discoid or radiate.

b. Staminate and pistillate florets separated in very different-appearing heads on the same plant; heads discoid; involucre of the pistillate flowers closed and indurated, with 1-2 florets; staminate heads numerous in terminal or axillary racemes.

Pistillate heads small, in the axils of leaves at the base of the staminate racemes, with a few acute tubercles at the apex; leaves opposite, or alternate and pinnately divided (Fig. 121, a). 11. *Ambrosia*

Pistillate heads forming conspicuous oblong to oval burs covered with hooked spines; leaves rough, alternate and cordate. (Fig. 120, e). 12. *Xanthium*

b. Staminate and pistillate flowers not in very different-appearing heads; involucre of the fertile flowers not woody, with the bracts more or less separate.

c. Heads discoid, without rays.
d. Involucral bracts hooked at the tip, forming a bur; pappus of scales; burdock. 29. *Arctium*
d. Involucral bracts not hooked at the tip to form a bur.
e. Bracts of the involucre ovate, at least the outer with the margins deeply lobed; flowers blue to reddish (Fig. 125, a). 34. *Centaurea*
e. Bracts of the involucre not deeply lobed on the margins.
f. Pappus composed of capillary bristles.
g. Involucral bracts papery throughout; plants more or less whitish-woolly; stem-leaves scale-like to linear.
Basal leaves larger than the stem-leaves, forming a rosette; stem-leaves much reduced (Fig. 119, e, f). 6. *Antennaria*
Basal leaves similar to the stem-leaves or absent; stem-leaves long and linear.
Involucre papery white, the bracts finely striate, spreading; plants forming colonies by underground rootstocks (Fig. 120, a). 7. *Anaphalis*
Involucre yellowish-white or brownish, the bracts not striate, rather appressed; plants not forming clumps (Fig. 120). 8. *Gnaphalium*
g. Involucral bracts not wholly thin and colorless, if partly so than the plants not whitish-woolly nor the stem leaves linear.
h. Involucral bracts in one row, often with minute bractlets at the base.
Flowers in early spring, on bracted stems; green leaves in summer basal, reniform, deeply and palmately 5-7-lobed (Fig. 123, c). 26. *Petasites*
Flowers on green leafy stems, appearing in summer or autumn.
Leaves simple; heads 15-20 mm long, the marginal florets all pistillate (Fig. 124, a). 27. *Erectites*
Leaves, at least the stem-leaves, deeply lobed; heads 7-10 mm long, the flowers all perfect (Fig. 124). 28. *Senecio*
h. Involucral bracts in 2 to many rows.
i. Leaves and stem bristly or spiny (thistles).
j. Flowers white to purple; pappus of a single row of similar hairs or bristles.
k. Pappus with the capillary hairs plumose (with very fine branches); thistles. 31. *Cirsium*
k. Pappus of unbranched capillary hairs.
l. Receptacle densely bristly, the bristles scattered among the florets.
Involucral bracts linear to lanceolate; stamen filaments hairy, separate. 30. *Carduus*
Involucral bracts large and ovate; flower-heads solitary; filaments smooth, united into a tube. 33. *Silybum*

l. Receptacle honey-combed, not bristly; leaves cottony-woolly. 32. *Onopordum*

j. Flowers yellow; pappus of 10 short teeth, 10 long bristles, and 10 shorter ones in an inner row. 35. *Cnicus*

i. Leaves and stem neither bristly nor spiny.

Corolla deeply lobed; involucral bracts lobed; receptacle bristly (Fig. 125, a). 34. *Centaurea*

Corolla merely toothed; involucral bracts not lobed; receptacle without any chaff (Fig. 115, a, b). 1. *Eupatorium*

f. Pappus not composed of capillary bristles.

m. Pappus of short, often barbed awns, often one awn prominent at each end or corner of the flattened achene; leaves opposite, usually compound.

Plants rooted in soil, more or less erect; leaves not very finely divided (Fig. 121, e). 16. *Bidens*

Plants aquatic, floating; submersed leaves with very fine capillary division (Fig. 122, a). 17. *Megalodonta*

m. Pappus none, or a mere crown of short bristles or scales.

Flowers purplish; corolla large, deeply lobed; involucral bracts usually lobed on the margins (Fig. 125, a). 34. *Centaurea*

Flowers yellow to yellowish-white; corollas very small, slightly toothed.

Leaves not lobed; receptacle chaffy; plant of salt marshes or sea-shores; woody at base. 10. *Iva*

Leaves finely divided; receptacle not chaffy.

Plant 1-3 dm high, strong-smelling; receptacle strongly conical, dull-green (Fig. 122, d). 21. *Matricaria*

Plant over 3 dm high, not strong-smelling; receptacle flat or slightly convex.

Heads in a flat-topped inflorescence, bright-yellow and button-like, erect (Fig. 122, e). 23. *Tanacetum*

Heads paniculate, racemose or spicate, dingy-yellowish, chiefly nodding, small (Fig. 123, a). 24. *Artemisia*

c. Heads radiate, with both disk and ray flowers.

n. Pappus of capillary bristles; receptacle not chaffy.

o. Flowers on bracted stems, appearing before the typical green leaves, in early spring.

Heads solitary like a tiny dandelion; flowers yellow; summer leaves heart-shaped and angled (Fig. 123, b). 25. *Tussilago*

Heads numerous, whitish; later leaves reniform, deeply lobed (Fig. 123, c). 26. *Petasites*

o. Flowers on leafy plants.

p. Flowers yellow (cream-colored in one goldenrod-*Solidago*).

Involucral bracts in one series, often with minute bractlets at the base (Fig. 124). 28. *Senecio*

Involucral bracts in three to many series.

Flower-heads large, 2.5-10 cm wide (Fig. 120, f). 9. *Inula*

Flower-heads 5-15 mm wide; goldenrods (Fig. 115-116). 2. *Solidago*

p. Flowers blue, violet or white.

Involucral bracts in one to two series; peduncles of the flowers without leaves (Fig. 119, a-c). 5. *Erigeron*

Involucral bracts in three to five series, often very unequal; peduncles leafy-bracted (Fig. 117-118). 4. *Aster*

n. Pappus of scales, awns, a mere crown or absent, not of capillary bristles.

q. Stem leafless; flowers solitary, white to purplish. 3. *Bellis*

q. Stem more or less leafy.

r. Leaves finely and several times divided.

Plants aquatic; leaves of two kinds, the submersed ones finely divided and the exposed ones merely lobed; pappus of awns (Fig. 122, a). 17. *Megalodonta*

Plants terrestrial; leaves all similar; pappus absent or a mere crown.

Receptacle not chaffy; flowers daisy-like. 21. *Matricaria*

Receptacle chaffy.

Flower-heads 3-5 cm wide; rays white, conspicuous (Fig. 122, c). 20. *Anthemis*

Flower-heads 3-7 mm wide; rays small (Fig. 122, b). 19. *Achillaea*

r. Leaves widely lobed, or toothed or entire.

s. Receptacle not chaffy; rays white; heads 4-6 cm wide; Daisy. 22. *Chrysanthemum*

s. Receptacle chaffy; flowers yellow or pink, or very small and grayish.

t. Leaves linear; flowers pink; Yarmouth Co. 15. *Coreopsis*

t. Leaves wider, toothed or lobed.

Flower-heads very small with 4-5 grayish rays; plants low and weak. 18. *Galinsoga*

Flower-heads more than 1 cm wide; rays yellowish.

Pappus of awns which are persistent on the top of the flattened achene (Fig. 121, d, e). 16. *Bidens*

Pappus absent, or a mere crown, or of scales which usually disappear.

Plants 1-2 m high; leaves entire, widely lanceolate or ovate. 14. *Helianthus*

Plants various; 3-6 dm high, with narrow lanceolate leaves, or tall and slender with leaves 3-5-parted (Fig. 121, b, c). 13. *Rudbeckia*

a. Flower-heads with the florets all ligulate; juice of the plant usually milky.

u. Leaves chiefly in a basal rosette.

v. Flowers small, less than 10 mm wide; pappus absent; plants wiry, 1-3 dm high; rare. 37. *Arnoseris*

v. Flowers 1.5-4 cm wide; pappus of bristles; plants larger and stouter.

w. Leaves lanceolate, not toothed (Fig. 127). 46. *Hieracium*
w. Leaves toothed, or more or less lobed.
Flower-heads solitary; bristles of the pappus simple; achenes spiny near the summit; Dandelions. 42. *Taraxacum*
Flower-heads several to numerous; achenes not spiny.
Pappus bristles plumose; plants low, mostly less than 3 dm high; leaves all basal, lanceolate.
Receptacle chaffy;inner achenes long-beaked;leaves coarse and stiffly hirsute or hairy. 39. *Hypochaeris*
Receptacle not chaffy; inner achenes not long-beaked; leaves smoothish to finely pubescent (Fig. 125, c). 40. *Leontodon*
Pappus bristles simple; plants stout, more than 3 dm high; leaves elliptical to ovate, often 1 or 2 near the base of the stem (Fig. 127). 46. *Hieracium*
u. Leaves mainly scattered along the stem.
x. Pappus of small scales, or else absent.
Flowers small, to 10 mm wide, yellow; pappus absent; plants slender, little branched (Fig. 125, f). 36. *Lapsana*
Flowers large, more than 4 cm wide; pappus of scales; plants coarse, woody, much branched (Fig. 125, e). 38. *Cichorium*
x. Pappus of capillary bristles.
y. Flowers yellow, white or blue, erect with many florets.
z. Achenes long-beaked.
Plant usually not branched; leaves linear; flower-heads 4-5 cm wide; achenes 10-15 mm long; pappus bristles plumose. (Fig. 125, b). 41. *Tragapogon*
Plant much branched in the inflorescence; flower heads and achenes very much smaller; pappus bristles simple (Fig. 126, c). 44. *Lactuca*
z. Achenes not beaked. (*Lactuca biennis* may key out here).
Achenes flattened;pappus bristles shining white;leaves smooth and glaucous; plants succulent (Fig. 126, a). 43. *Sonchus*
Achenes not flattened; pappus bristles tawny; leaves firm, rarely glaucous; plants stiff (Fig. 127). 46. *Hieracium*
y. Flowers pale purplish-white, brownish or cream-colored, bell-like, hanging with few florets (Fig. 126, d). 45. *Prenanthes*

1. **EUPATORIUM** (Tourn.) L.

Wiegand, K.M. *Eupatorium purpureum* and its allies. Rhodora **22**: 57-70. 1920. Wiegand, K.M. & C.A. Weatherby. The nomenclature of the verticillate *Eupatoria*. Rhodora **39**: 297-306. 1937.

a. Leaves in whorls of 3-6, or the upper opposite, the bases not united; flowers purplish.

b. Leaves abruptly contracted to the petiole, more or less 3-nerved; plant somewhat viscid; inflorescence convex; florets mostly 6-10. 1. *E. dubium*

b. Leaves tapering to the petiole, mostly pinnately-veined; plant not viscid; inflorescence, or its parts, flat-topped; florets mostly 9-15 in each head.

c. Leaves smaller above, not overtopping the inflorescence. 2. *E. maculatum*

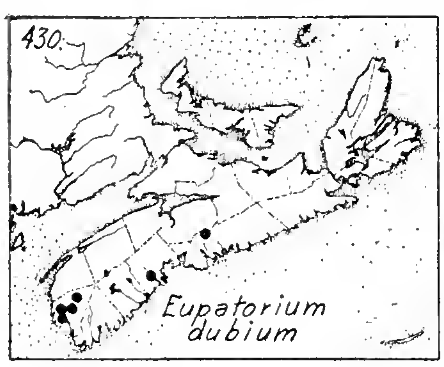
c. Leaves large on the upper part of the stem, the upper much overtopping the inflorescence. *E. maculatum* var. *foliosum*

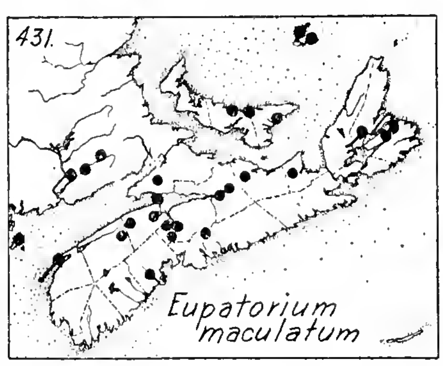
a. Leaves opposite, the bases united around the stem; flowers white or a dingy pinkish-white. 3. *E. perfoliatum*

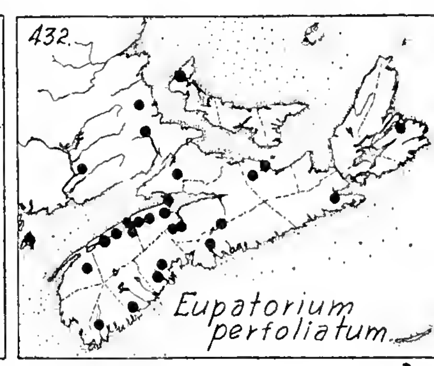
1. **E. dubium** Willd. Map 430.

Local to rare; isolated clumps about the rocky shores of some of the lakes in the Tusket Valley, Yarmouth Co., scattered east to Halifax and Lunenburg Cos. Aug.-Sept. (*E. verticillatum* Lam.).

N. S. & N. H. south to S. C.







2. **E. maculatum** L. JOE-PYE WEED. Fig. 115, a. Map 431.

Common and conspicuous along brooks, edges of meadows and swamps throughout the northern region from Digby Neck to northern C. B.; rare southward. [*E. purpureum* var. *maculatum* (L.) Darl.]. Late July-Sept. Nfld to Minn & B C. south to Conn & N. H.

Var. **foliosum** (Fern.) Wieg., Rhodora **22**: 66. 1920, is found throughout the eastern range of the species, and is not uncommon in northern N. S.

3. **E. perfoliatum** L. BONESET. Fig. 115, b. Map 432.

Scattered throughout; wet shores, meadows, edges of swamps and bogs, along roadside ditches, streams and rivers It is usually scattered and does not become a weedy species. Forma **purpureum** Britt. with the heads of varying shades of pink or reddish, was found abundant along the river at Ste. Croix, Hants Co. Late summer and autumn.

N. S. to Man. south to Fla. and Tex.

2. SOLIDAGO L. GOLDENROD

a. Rays whitish or cream-colored, otherwise similar to No. 4. 3. *S. bicolor*

a. Rays yellow.

b. Leaves fleshy, shiny, entire; heads in a crowded oblong inflorescence; involucre of flower-head 4-6 mm high; plant of brackish shores. 13. *S. sempervirens*

b. Leaves thin, not fleshy, usually toothed; plants mostly inland, at least not restricted to the sea-coast.

c. Heads more or less stalked, in irregular but not in flat-topped corymbs; rays mostly fewer than the disk flowers.

d. Heads large; involucres 6-12 mm high; leaves pinnately-veined.

e. Heads in a terminal small compact inflorescence; leaves obtuse; plant 1-4 dm high. 8. *S. multiradiata*

e. Heads axillary in the axils of the leaves; leaves ovate, acute to acuminate; involucre 8-12 mm high. 9. *S. macrophylla*

d. Heads smaller; involucres 2-5, rarely to 6, mm high.

f. Heads in the axils of the upper leaves; or, more often, the inflorescence long and narrow, erect, with the branches short and crowded (Fig. 115, c, j).

g. Heads in the axils of normal or but little-reduced leaves, the clusters widely scattered.

h. Leaves lanceolate; stems smooth, terete, glaucous. 1. *S. caesia*

h. Leaves ovate, mostly petioled; stem not glaucous, more or less zig-zag, often pubescent near the top. 2. *S. flexicaulis*

g. Heads crowded in the axils of much reduced upper leaves to form an erect crowded inflorescence.

i. Heads large; involucres 5-6 mm high; leaves elliptical to lanceolate, smooth on both sides. 6. *S. Randii*

i. Heads smaller; involucres 3-4.5 mm high; leaves finely puberulent or rough-pubescent on both sides.

j. Bracts of the involucre narrow and acuminate, without scarious margins (Fig. 115, d); upper part of the stem and the leaves finely puberulent only (Fig. 115, e). 5. *S. puberula*

j. Bracts broad and obtuse with scarious margins (Fig. 115,i); upper part of the stem and the leaves finely white-pubescent.

k. Inflorescence erect, the heads not arranged unilaterally on the branches; leaves pinnately-veined; pubescence long and open (Fig. 115, f). 4. *S. hispida*

k. Inflorescence small, usually curved, the heads strongly secund or unilateral on the branches; leaves much reduced towards the top of the stem, with 3 more or less equal veins; pubescence short, whitish (Fig. 115, g). 7. *S. nemoralis*

f. Heads in terminal, usually one-sided racemes, the total forming a large erect or curved compound inflorescence called a thyrse; plants large (Fig. 115, h).

l. Leaves pinnately-veined, not 3-ribbed, although sometimes obscurely so.

m. Basal leaves long-petioled, conspicuously larger than the 5-50 stem-leaves (Fig. 116, a).

n. Branches of the panicle pubescent; panicle narrow and compact, the branches short and often ascending.

o. Plants 4-15 dm high, of wet soils; stems and leaves smooth or nearly so.

p. Inflorescence elliptical or narrower, the branches appressed; heads not along one side only of the branches; involucres 4-5 mm long. 11. *S. humilis*

p. Inflorescence more spreading, the heads arranged unilaterally along the panicle branches; involucres 3-4 mm long, the bracts more rigid and incurved. 10. *S. uniligulata*

o. Plants 3-6 dm high, of dry soils and barrens; stems and leaves grayish-pubescent. 7. *S. nemoralis*

n. Branches of the panicle glabrous; panicle ample, the branches recurved-spreading; of fields and roadsides (Fig. 116, a). 12. *S. juncea*

m. Basal leaves similar to the 30-100 or more uniform and gradually reduced stem leaves, usually absent at flowering time; leaves elliptical to lanceolate.

q. Stem, branches and leaves glabrous or smooth.

r. Branches of the inflorescence strongly ascending; involucre 4.5-6.5 mm high; leaves widely lanceolate to oblong, strongly tapering to each end. 14. *S. Elliottii*

r. Branches of the inflorescence arching and reflexed; involucre 3-4 mm high; leaves narrowly lanceolate, gradually tapering to each end. 15. *S. rugosa* var. *sphagnophila*

q. Stem, branches and leaves pubescent to long villous.

s. Flowers mostly in a large terminal inflorescence; upper leaves short, not exceeding the branches of the inflorescence. 15. *S. rugosa*

s. Flowers scattered on short branches, the panicles exceeded by the surrounding leaves. *S. rugosa* var. *villosa*

l. Leaves more or less plainly 3-ribbed, with two of the side veins becoming prominent and elongated parallel to the midrib; heads in one-sided spreading or recurved panicles, forming an ample thyrse.

t. Flowers small, the involucre 2-3 mm high; rays 10-20, small and short (Fig. 116, b). 16. *S. canadensis*

t. Flowers larger, the involucre 3.5-5 mm high; rays 7-15, larger.

u. Leaves glabrous or somewhat scabrous above, pubescent at least on the midrib beneath. 17. *S. gigantea*

u. Leaves glabrous both above and beneath. *S. gigantea* var. *leiophylla*

c. Heads sessile or nearly so, in flat or round-topped corymbs; rays more numerous than the disk flowers; leaves linear (Fig. 116, c).
v. Leaves 3-5-ribbed; heads 20-30-flowered.
w. Branches of the inflorescence glabrous or nearly so. 18. *S. graminifolia*
w. Branches of the inflorescence hirtellous with minute spreading h4irs. *S. graminifolia* var. *Nuttallii*
v. Leaves 1-ribbed, or obscurely 3-ribbed; heads 12-20-flowered. 19. *S. galetorum*

1. S. caesia L., var **axillaris** (Pursh) Gray

Scattered in thickets and open woods throughout the north-central region; Macoun lists it from Halifax and the North Mt., near Annapolis; and specimens from oak woods near Kentville belong here.

N. S. to Minn. south to Fla., & Tex.

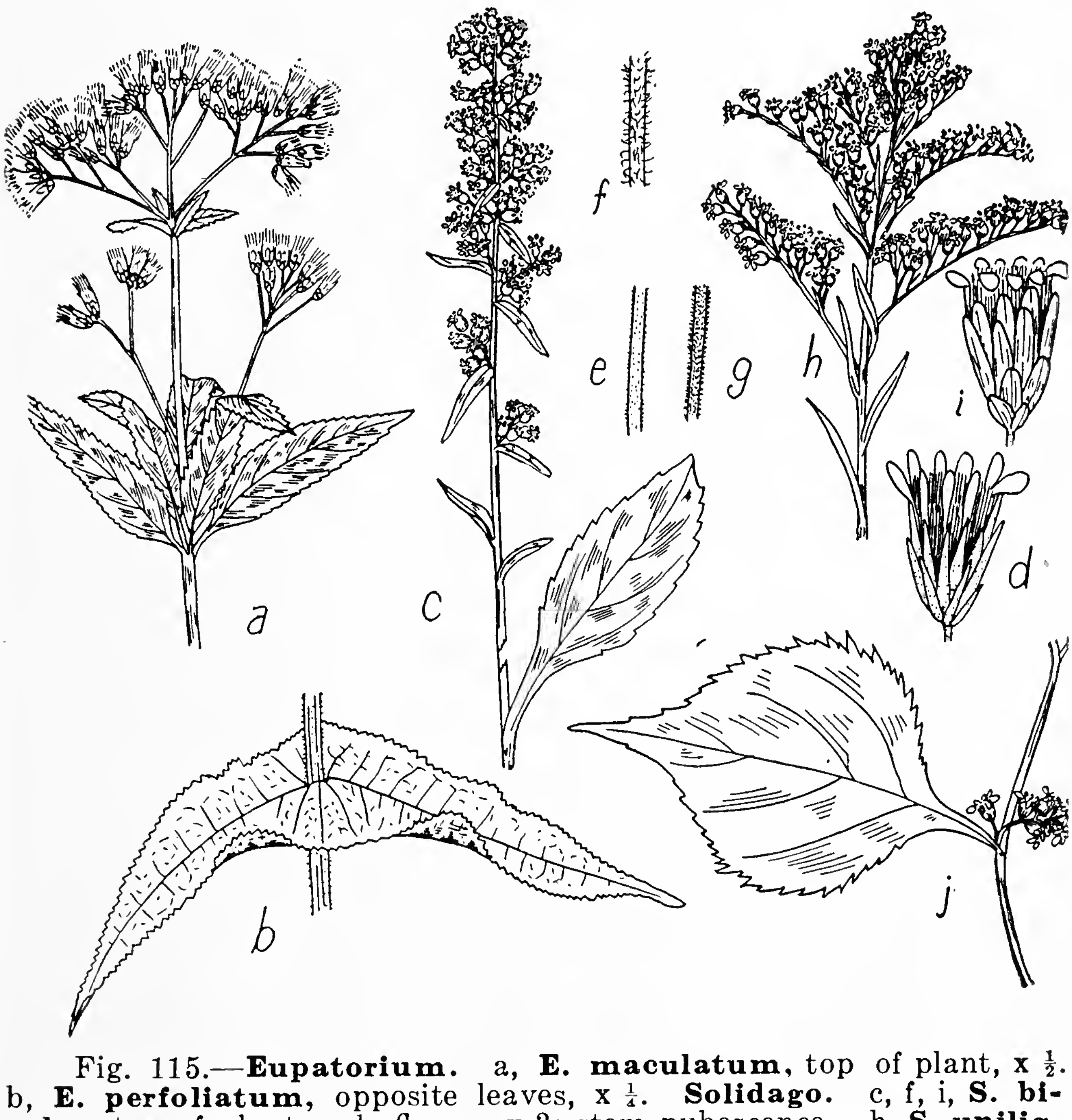
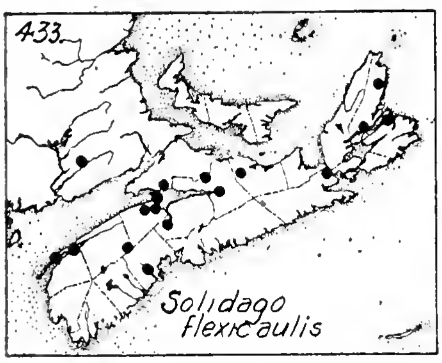
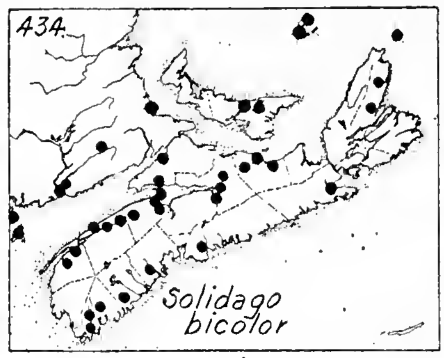
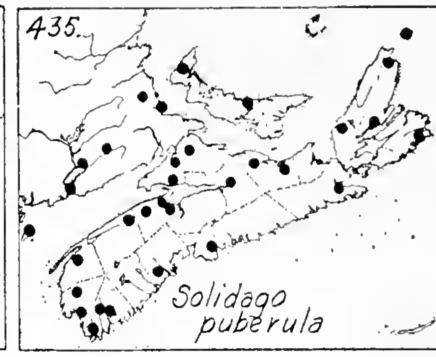


Fig. 115.—**Eupatorium.** a, **E. maculatum**, top of plant, x ½. b, **E. perfoliatum**, opposite leaves, x ¼. **Solidago.** c, f, i, **S. bicolor**, top of plant, x ⅓; flower, x 3; stem pubescence. h, **S. uniligulata**, inflorescence, x ⅓. j, **S. flexicaulis**, leaf and flowers, x ⅓.







2. **S. flexicaulis** L., see Victorin and Rousseau, Contrib. Inst. Bot. Univ. Montreal **36**: 56-58. 1940. WOOD GOLDENROD. Fig. 115, j. Map 433.

Common in rich woods, on calcareous slopes, and alluvial flood plains from Digby Neck and Lunenburg Co. to northern C. B. It is characteristic of climax forests along flood plains in C. B.; rare in the southwestern counties, so that Fernald (1922) considered a collection from Bridgewater worthy of record. Late July-Aug. (*S. latifolia* L.).

Nfld. to N. D. south to Ga. & Kans.

3. **S. bicolor** L. WHITE GOLDENROD. Map 434.

Common in dry soil, old fields and barrens over most of the province; it is a heath pioneer and an early introduction in burnt-over forest in C. B.; rare or absent in Yarmouth and southern Digby Co. Aug.-Sept.

N. S. to Minn. south to Ga. & Mo.

4. **S. hispida** Muhl

Similar to the last except in the color of the flowers; it is rare and only an occasional specimen is seen.

Nfld. to Man. south to Ga. & Ark.

5. **S. puberula** Nutt. ROUGH GOLDENROD. Map 435.

Very common throughout; dry soil, old fields, barrens, exposed headlands and open woods; rarer in the southwestern counties. Aug.-Sept.

Nfld. to Que. south to Penn. and Fla.

6. **S. Randii** (Porter) Britt.

Known only from Guysborough Co., where Rousseau reports it from a gravelly beach at Guysborough (1938).

Granite rocks or dry granitic soil; Me. and Mass. west to Mich.

7. **S. nemoralis** Ait. OLD-FIELD GOLDENROD. Map 436.

Local and of limited distribution; Fernald (1921) states that it was not seen in Queens and Shelburne Cos. and in Yarmouth Co. only at Carleton. In the Annapolis

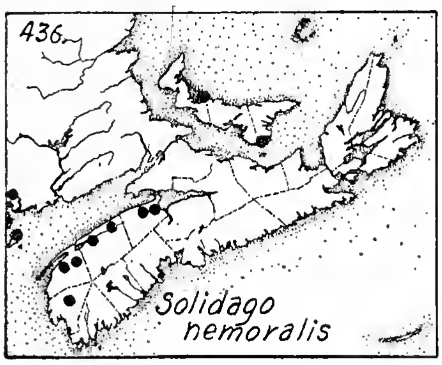
Valley it is one of the commonest goldenrods of late summer, occupying old fields, sandy roadsides and replacing *S. puberula* on lighter soils. Aug.-Sept.

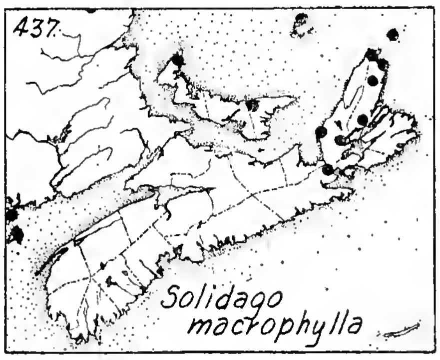
Nfld. to Sask. south to Ariz. and Fla.

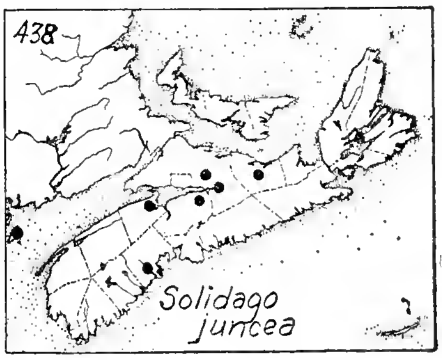
8. **S. multiradiata** Ait.

Collected but once; barren on St. Paul Is., northern C. B. by Perry and Roscoe.

Alaska to Man.; Nfld., Gaspe and N. S.







9. **S. macrophylla** Pursh Map 437.

Scattered in northern C. B. in the coniferous forest, and an early introduction in burned-over land; reported from Pirates Cove, Guysborough Co. by Macoun for the only record from the mainland.

Nfld. south to N. Y. west to Lake Superior.

10. **S. uniligulata** (DC.) Porter

This is one of the commonest goldenrods throughout the more acid and boggy parts of the province, and it is characteristic of bogs, dryish peaty barrens and even denuded granitic hills; Yarmouth along the Atlantic Coast to northern C. B., rarer inland and more typically only in bogs. Several varieties are described but whether these are valid or merely ecological forms is not yet clear.

Nfld. to Minn. south to N. C. & Ill.

11. **S. humilis** Pursh, see Rhodora **17**: 6. 1915.

This puzzling species is often much like the preceeding one, but is in places in northern N. S. quite distinctive and different from the above plant of bogs and acid barrens. About Oxford and in neighboring areas it is common in poorly-drained fields, growing vigorously with a dense elliptical inflorescence of pale appearance and erect appressed branches. The inflorescence has a brushed upwards appearance quite different from *S. uniligulata*. Macoun's records of *S. uliginosa* and *S. racemosa* belong to the preceeding species; and Nichol's records of this species from various habitats of northern C. B. probably also apply to *S. uniligulata.*

Nfld. to Ont. & Minn. south to N. C.

12. **S. juncea** Ait. EARLY GOLDENROD. Fig. 116, a. Map 438.

Common from Cumberland Co. east to C. B. scattered west to Kings and Lunenburg Cos.; not seen by the Gray Herbarium Expedition in Yarmouth, Shelburne or Queens Cos. It is one of the earliest goldenrods of the season and very common about Truro. Found on dryish soils, roadsides and fields. Early Aug.-Sept.

N. S. to Sask. south to S. C. & Mo.

13. **S. sempervirens** L. SEASIDE GOLDENROD.

Found around the whole coast of the province and on Sable Is ; salt marshes and sea-shores just above the range of the high tides. It is abundant on the running dykes, and is found on the slopes next to the tidal rivers. Forma **ochroleuca** Weatherby, Rhodora **44**: 235. 1942, with the ray flowers very pale yellow almost white, was found scattered in a salt marsh by Mr. Weatherby at Parrsboro, Cumberland Co., Aug. 12, 1942.

Gulf of St. Lawrence south along the seashore to Fla. & Mex.

14. **S. Elliottii** T, & G., var. **ascendens** Fern., Rhodora **38**: 215. 1938 Map 439.

Abundant and often dominant in boggy clearings, swales, damp thickets, spruce and maple swamps, and lake shores from Yarmouth Co. east at least to Queens Co. One colony found on a gravelly bank south of Belleville, Yarmouth Co. is apparently a hybrid between this species and *S. rugosa* (Fernald, 1922). Late Aug.-Sept.

Dela. to eastern Mass.; N. S.

15. **S. rugosa** Mill. ROUGH GOLDENROD. See Fernald, M.L. The *Solidago rugosa* complex. Rhodora **38**: 216-224. 1936.

Common throughout; waste places, along fence-rows, open woods and a weed in old or deserted fields. Aug.-Oct. Nfld. to Man. south to Fla.

Var. **villosa** (Pursh) Fern. is frequent throughout, growing in habitats similar to those of the species. This more northern form is common in low ground from Nfld. to Ont. becoming more infrequent south to Va.

Fig. 116.—**Solidago.** a, **S. juncea,** plant, x $\frac{1}{4}$; flower, x 3. b, **S. canadensis,** top of plant, x $\frac{1}{4}$; flower, x 3. c, **S. graminifolia,** x $\frac{1}{4}$.

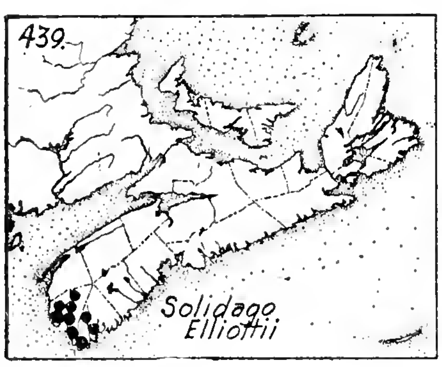
Var. **sphagnophila** Graves was stated to be occasional in spruce swamps and wet savannahs from Yarmouth and Shelburne Cos. (Fernald, 1921); and reported by Miss Perry (1931) from a wet gulch on St. Paul Is., northern C. B. In 1936, however, Fernald restricts the range of this plant to southern Me. to N. C., so that the N. S. plants are apparently not exactly typical of the more southern form.

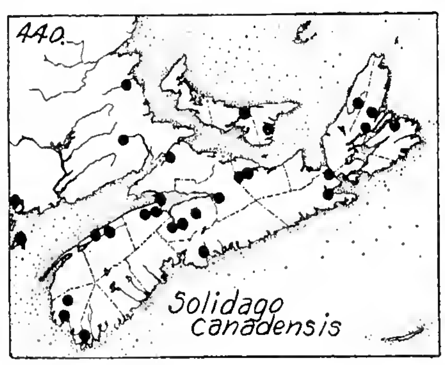
X **S. asperula** Desf. is a hybrid between this species and the seaside *S. sempervirens,* and is more or less intermediate between these two species. This has been reported from various locations along the Atlantic Coast of N. S. and is to be expected wherever the habitats allow the two species to grow together.

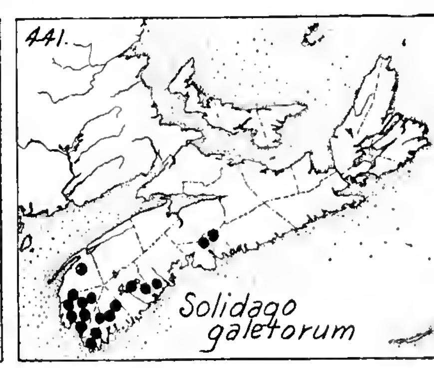
16. **S. canadensis** L. CANADA GOLDENROD. Fig. 116, b. Map 440.

This is one of the commonest species throughout the northern regions of the province; fields, roadsides and edges of woods from Annapolis Co. to northern C. B., very rare in the south western counties. Fernald (1921) states that "during the whole summer we did not see this characteristic Canadian species in southern Yarmouth Co. nor in Shelburne and Queens Cos." Late July-Aug. Fernald (1922) reports one clump from Five-River Lake, Shelburne Co., that is apparently a hybrid between this species and *S. uniligulata.*

Nfld. to N. D. south to Va. & Ky.







17. **S. gigantea** Ait., see Rhodora **41**: 457. 1939.

Scattered in thickets, rich soil, along intervales and at the edge of woods from Yarmouth east to C. B. Aug. Nfld. to Que. south to S. C. Tex. & Wisc.

Var. **leiophylla** Fern., Rhodora **41**: 457. 1939, is less common than the species. It is unknown in the south western counties; Fernald (1921) reports it from moist thickets from near the mouth of Bevis Brook, Port Bevis, C. B.; and Rousseau (1938) found it in swamps at Gabarus, C. B. (*S. serotina* Ait.).

Nfld. to B. C. south to Ga., Tex. & Ore.

18. **S. graminifolia** (L.) Salisb. NARROW-LEAVED GOLDENROD. Fig. 116, c.

Common on sandy and gravelly lake shores, in damp thickets, and swamps in the southwestern counties; becoming rarer east to C. B. and grading into the following variety.

Var. **Nuttallii** (Greene) Fern. is common throughout, and a common weed in damp fields, along roadsides and in damp thickets. July-Aug.

Nfld. to Minn. south to N. J. & Tenn.

19. **S. galetorum** Greene, Leaflets 2: 152. 1911. Map 441.

Scattered on sandy and gravelly beaches of lakes and in damp thickets from Digby Co. around the coast to Grand Lake, Halifax Co. This species is rather variable, but it may be best to consider the variations as one species and as distinct from the more southern *S. tenuifolia* Pursh. (*S. tenuifolia* var. *pycnocephala* Fern., Rhodora **23**: 293-294. 1921). Aug.-Sept. N. S.

3. BELLIS (Tourn.) L.

1. **B. perennis** L. ENGLISH DAISY.

This plant has not been observed in recent years, but it may be found occasionally cultivated. It was reported by Macoun from meadows and pastures, North Sydney, where it had escaped from ballast.

Introduced from Eu. and widely distributed.

4. ASTER (Tourn.) L.

Shinners, L. H. The genus *Aster* in Nova Scotia. Rhodora **45**: 343-350. 1943. The key and order of this genus largely follows this treatment.

a. Middle and lower stem-leaves petioled, the blades abruptly narrowed, or truncate or cordate at the base.
 b. Outer involucral bracts 1.0-2.5 mm wide, less than 2½ times as long as wide; peduncles usually more or less glandular; basal leaves very large and rough (Fig. 117, a). 1. *A. macrophyllus*
 b. Outer involucral bracts 0.2-0.8 mm wide, more than 2½ times as long as wide.
  c. Involucral bracts glabrous on the back.
   d. Stem-leaves tapering or truncate at the base; involucres 5.2-8.2 mm high; disk 4.5-7.5 mm across; inflorescence corymbose-paniculate, the peduncles very uneven in size. 3. *A. ciliolatus*
   d. Stem-leaves cordate at the base; involucre 3.6-5.2 mm high; disk 3-5 mm across; inflorescence racemose-paniculate, the peduncles equal or grading uniformly in size. 4. *A. cordifolius*
  c. Involucral bracts pubescent on the back; leaves firm, usually truncate at the base (Fig. 117, e). 5. *A. undulatus*
a. Middle and lower stem-leaves sessile, or tapering gradually to slender petiole-like bases.
 e. Middle involucral bracts with midveins expanded upward into prominent colored (usually green) tips.

f. Involucral bracts glabrous on the back.
g. Plants mostly low or much branched; involucres 3.3-6.0 mm high outer bracts 0.3-3.3 mm long, not more than $\frac{2}{3}$ as long as the inner.
h. Rays 3.5-6 mm long; leafy bracts of the peduncles and ultimate branches of the inflorescence oblong-lanceolate or narrowly oblong, acute or obtuse.
i. Leaves pubescent on the midvein beneath, at least towards the base; common throughout. (Fig 117, c). 6. *A. lateriflorus*
i. Leaves glabrous beneath.
j. Involucres 4.8-6.0 mm high; stems glabrous or more commonly pubescent; Cape Breton. 7. *A. acadiensis*
j. Involucres 3.3-5.0 mm high;stems glabrous; southwestern N.S. 8. *A Tradescanti*
h. Rays 5.5-10 mm long; leafy bracts of the peduncles and ultimate branches of the inflorescence linear-lanceolate, acuminate. 9. *A. paniculatus*
g. Plants stout, often branched only near the top; involucres 5-12 mm high; outer bracts 3-12 mm or more long, more than $\frac{2}{3}$ as long as the inner.
k. Stems glabrous or pubescent above in lines.
l. Internodes just below the inflorescence 4-16 mm long; plants 8-50 cm tall; involucres 5-8 mm high. 10. *A. novi-belgii*
l. Internodes just below the inflorescence 16-45 mm long; plants 30-110 cm tall; involucres 6-9 mm high. 11. *A. foliaceus*
k. Stems hispid-pubescent over the surface. 12. *A. puniceus*
f. Involucral bracts glandular or pubescent or both on the back.
m. Involucres less than 6 mm high; leaves tapering to the base. 5. *A. undulatus*
m. Involucres more than 6 mm high; leaves clasping; heads showy. 13. *A. novae-angliae*
e. Middle involucral bracts without colored tips, or with colored tips not formed by the expansion of the midveins.
n. Involucres more than 6 mm high; plants relatively short, mostly much less than 1 m high.
o. Outer bracts 1.0-2.5 mm wide (Fig. 117, b). 2. *A. radula*
o. Outer bracts 0.2-0.8 mm wide.
p. Largest stem-leaves 3-12 mm wide; plants with 41-75 leaves below the inflorescence (Fig. 118, b). 14. *A. nemoralis*
p. Largest stem-leaves 9-50 mm wide; plants with 10-40 leaves below the inflorescence.
q. Largest stem-leaves 9-24 mm wide; plants with 25-40 leaves below the inflorescence. 15. *X.A. Blakei*
q. Largest stem-leaves 20-50 mm wide; plants with 10-20 leaves below the inflorescence (Fig. 117, f). 16. *A. acuminatus*
n. Involucres less than 6 mm high; plants 1-2 m high; inflorescence flat-topped; rays white (Fig. 118, d). 17. *A. umbellatus*

Fig. 117.—**Aster.** a, **A. macrophyllus,** inflorescence and leaf, x $\frac{1}{2}$. b, **A. Radula,** x $\frac{1}{3}$. c, **A. lateriflorus,** x $\frac{1}{2}$. d, **A. cordifolius,** x $\frac{1}{3}$. e, **A. ciliolatus,** leaf, x $\frac{1}{3}$. f, **A. acuminatus,** x $\frac{1}{3}$.

1. **A. macrophyllus** L. LARGE-LEAVED ASTER. Fig. 117, a. Map 442.

Scattered from Yarmouth east to Pictou Co.; dry woods, thickets, and open barrens in the southwest. Var. **velutinus** Burgess has the leaves and stems more villous-pubescent, but is probably of little significance. July 15-Aug.

N. S. to Minn. south to N. C.

2. **A. radula** Ait. [Including var *strictus* (Pursh) Gray]. Fig. 117, b. Map 443.

Common to scattered throughout; boggy barrens, peaty swales, bogs and damp thickets. It is one of the characteristic plants of the Atlantic Region. July-Sept.

Nfld. south to W. Va.

3. **A. ciliolatus** Lindl. Fig. 117, e.

Scattered along roadsides and open thickets from Hants Co. northwards; common between Halifax and Truro. (*A. Lindleyanus* T. & G.).

Lab. to the Mackenzie south to northern N. Y.

4. **A. cordifolius** L. BLUE WOOD ASTER Fig. 117, d. Map 444.

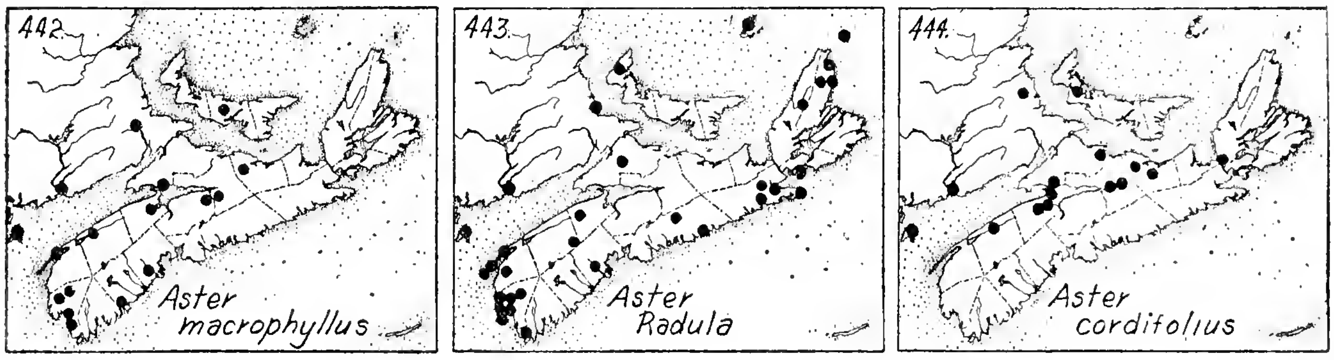
Common from Annapolis Co. to C. B.; thickets, roadsides, fields and about dwellings. July-Aug. Considerable variation exists in the size of the flowers and inflorescence and in the flower-color.

N. S. to Ont. & Minn. south to Ga. & Mo.

5. **A. undulatus** L.

Scattered in dry open woods and thickets in southern Lunenburg Co., and often invading old fields; Greenfield, in adjacent Queens Co. (Weatherby, 1942).

N. S. to Ont. and Minn. south to Fla. and La.



6. **A. lateriflorus** (L.) Britt. SMALL WHITE ASTER. Fig. 117, c. Map 445.

Common throughout; run-out fields, barrens, roadsides and pastures. *A. multiflorus,* stated by Nichols (1918) to be characteristic of blueberry barrens in northern C. B. is apparently this plant. July-late Sept.

N. S. to Que. south to Conn. and the mts. of N. C.

7. **A. acadiensis** Shinners, Rhodora **46**: 31. 1944.

Swamps and damp woods in Cape Breton: Baddeck and Ingonish. This slender plant with more diffuse inflorescence and fewer longer-peduncled heads than *A. lateriflorus* is not well known. So far it has been found in N. S., P.E.I. and N. B. (*A. lateriflorus* var. *tenuipes* Wieg., Rhodora **30**: 174. 1928).

8. **A. Tradescanti** L., see Fernald, Rhodora **35**: 312-314. 1935.

Scattered in boggy savannahs, around gravelly and sandy beaches of numerous lakes in southern Yarmouth Co.; Sandy Cove, Digby Neck; Ponhook L., Queens Co.; and east to Bridgewater. [*A. saxatilis* (Fern.)Blanchard].

Nfld. and southern N. S.; Que. south to southern Me. & Conn.

9. **A. paniculatus** Lam., see Wiegand in Rhodora **35**: 28-29. 1933.

Damp thickets and marsh ground; common around Truro and to northern C. B.; probably generally distributed in north and eastern N. S. but the distribution not well known.

N. S. to Ont. & Wisc. south to Conn., Penn. & Ill.

10. **A. novi-belgii** L.

Common on sandy or gravelly beaches, and in swamps and damp places near the coast; abundant on Sable Island, often also on the mainland. Shinner, in Rhodora **45**: 346. 1943, has separated the northeastern shorter plants as *A. Rolandii* Shinners, and this name may apply to the plants of the Maritime Provinces.

Near the coast from Que. to N. S. and Me., southwards.

11. **A. foliaceus** Lindl. LARGE BLUE ASTER. Fig. 118, a.

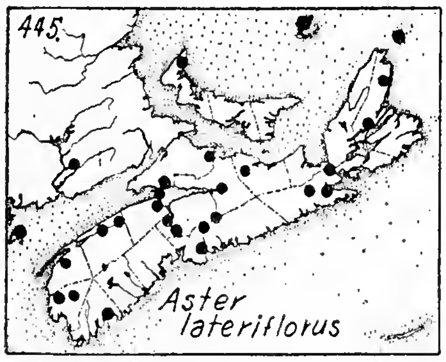
Common throughout; swamps, marshes and roadsides. (Including *A. junceus* and *A. longifolius* of Nova Scotian records). The plants included under this species are very variable and complex. Hybrids may also be common.

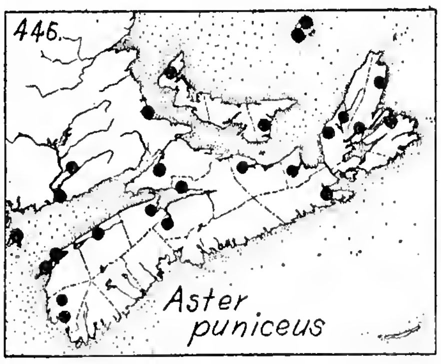
Lab. & Nfld. south to Que., Me. & N. H.; westward.

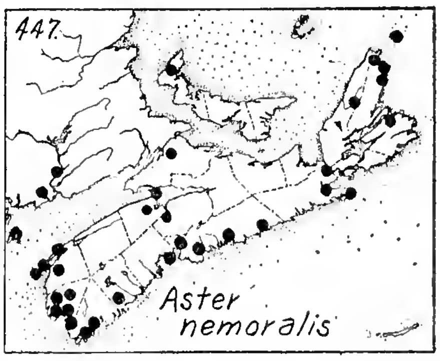
12. **A. puniceus** L. ROUGH ASTER. Fig. 118, c. Map 446.

Common, probably throughout; swamps and wet open places.

Nfld. to Man. south to Ga. & Tenn.







13. **A. novae-angliae** L. NEW ENGLAND ASTER.

Vicinity of Annapolis, Annapolis Co., and Woodburn

Pictou Co.; frequently cultivated, and an occasional escape. Aug.-Sept.

N. S.; Me. to Sask. south to S. C. & Kans.

14. **A. nemoralis** Ait. Fig. 118, b. Map 447.

Common throughout; bogs and marshes, lake margins, and dominant on peaty barrens. Aug.-Sept.

Nfld. to Hudson Bay south to N. J.

Fig. 118.—**Aster.** all x $\frac{1}{3}$. a, **A. foliaceus.** b, **A. nemoralis.** c, **A. puniceus.** d, **A. umbellatus.**

15. **X. A. Blakei** (Porter) House, N. Y. State Museum Bull. 219-220: 241. 1919. Map 448.

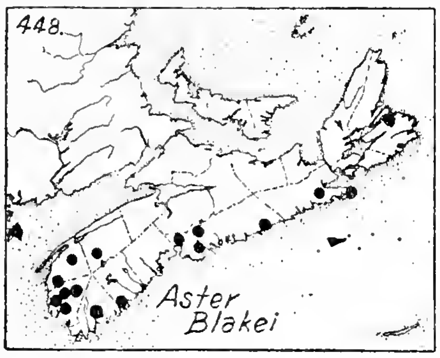
Borders of woods and thickets, in damp or sometimes rather dry ground; common in the southern and eastern parts of the province. In view of the intermediate characters this plant is considered to be a hybrid of *A. nemoralis* and *A. acuminatus*, and in places seems to be more common than either of its parents. (*A. nemoralis* var. *Blakei* Porter).

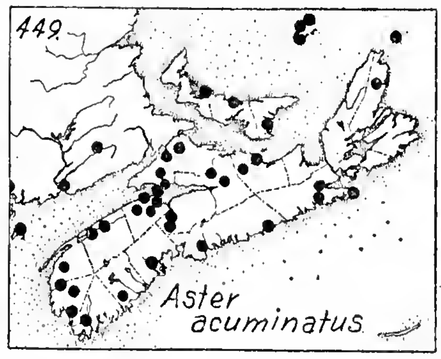
N. S. to N. Y. & N. J.

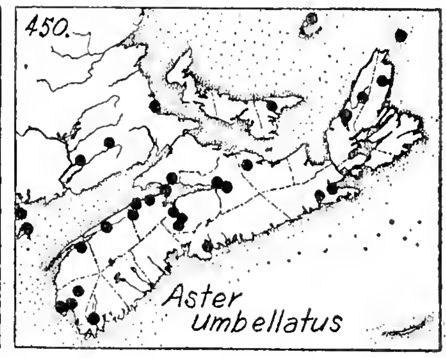
16. **A. acuminatus** Michx. WOOD ASTER. Fig. 117, f. Map 449.

Deciduous woodlands and thickets, preferring drier soils; common in the northern counties, scattered elsewhere. Aug.-Sept.

Lab. to Ont. south to Ga.







17. **A. umbellatus** Mill. TALL WHITE ASTER. Fig. 118, d. Map. 450.

Swamps, damp thickets, marshes and roadside ditches; very common throughout and conspicuous along all wet roadsides in late summer, often growing with *Solidago graminifolia*.

Nfld to Sask. south to Ga. & Iowa.

5. **ERIGERON** L. FLEABANE

a. Rays scarcely exceeding the disk; heads about 5 mm wide, very numerous in an elongate inflorescence (Fig. 119, c). 1. *E. canadensis*

a. Rays much exceeding the disk; heads 15-33 mm wide, solitary or several to numerous in a flattish corymb.

b. Leaves sessile and clasping; heads conspicuous, with bluish or pinkish rays.

c. Stems unbranched; heads 1-7, 2.5-3.5 cm wide; rays about 50, bluish, about 1 mm wide. 2. *E. puchellus*

c. Stems branched above; heads numerous, 1.5-2 cm wide; rays pinkish, about 0.5 mm wide. 3. *E. philadelphicus*

b. Leaves sessile, not clasping; heads 1-2 cm wide.

d. Heads solitary on long peduncles; rays 20-30, whitish to pale pink; plants slender, 2-3 dm high (Fig. 119, b). 4. *E. hyssopifolius*

d. Heads numerous; rays 60-90; plants stout, often branched above, 2-15 dm high.

e. Median stem-leaves entire or nearly so, linear to narrowly lanceolate; lower ones toothed at apex (Fig. 119, d).

f. Stem and leaves pubescent with numerous short appressed hairs. 5. *E. ramosus*

f. Stem and leaves smooth or with scattered stiff spreading hairs. *E. ramosus* var. *septentrionalis*

e. Median stem-leaves coarsely toothed, ovate to narrowly lanceolate (Fig. 119, a); stems and leaves sparsely pubescent with stiff spreading hairs. 6. *E. annuus*

1. **E. canadensis** L. HORSE-WEED. Fig. 119, c.

This is a weed of waste places and of light soil, becoming common in parts of the province and especially in the

Annapolis Valley; often very common in strawberry fields. July-Sept.

Found throughout the world.

2. **E. puchellus** Michx. ROBIN'S PLANTAIN.

Rare; reported in Macoun's Catalog from Halifax and Pictou; not recently collected and apparently not established in the province. July.

Thickets and moist banks; Me. to Minn. south to Fla.

3. **E. philadelphicus** L. PHILADELPHIA FLEABANE.

Rare; reported by Fernald (1921) from Hectanooga, Digby Co.; seen by J. Adams at Hillsborough, C. B. July-Aug.

Pastures and meadows; Lab. to B. C. south to Fla.

Fig. 119.—**Erigeron.** a, **E. annuus.** x $\frac{1}{3}$. b, **E. hyssopifolius**, x $\frac{1}{3}$. c, **E. canadensis**, top of small inflorescence, x $\frac{1}{3}$. d, **E. strigosus**, leaf, x $\frac{1}{3}$. **Antennaria.** e, **A. canadensis**, leaf showing appendage, x 1. f, **A. neodioica**, x $\frac{1}{2}$.

4. **E. hyssopifolius** Michx. Fig. 119, b. Map 451.

Confined almost entirely to gypsum outcrops; common in such locations around Windsor and elsewhere in Hants Co.; around Antigonish Co.; Port Bevis and Cape North in C. B. Nichols (1918) records it from the stream bank association between flood levels in northern C. B. Early July.

Calcareous rocks; Nfld. to Mackenzie south to N. S., Me. & Mich.

5. **E. ramosus** (Walt.) BSP. DAISY FLEABANE. Fig. 119, d.

Scattered to common in run-out fields, waste places, and roadsides throughout; often the commonest weed on deserted farms in the central part of the province; probably introduced from further south and west. Early July-Sept. Nfld. to B. C. south to Fla., Tex. & Calif.

Var. **septentrionalis** Fern. and Wieg., Rhodora **15**: 59-61. 1913, is a northeastern variety with the pubescence of the stem resembling that of *E. annuus* but with the leaves narrower and but little toothed. This is found along river banks in native habitats; reported from Pictou by Fern. & Wieg.; found along the rocky banks of the Salmon R., Bay St. Lawrence, Victoria Co.

6. **E. annus** (L.) Pers. Fig. 119, a. DAISY FLEABANE.

Common throughout; roadsides, waste places and run-out fields. July-Sept.

N. S. to Man. south to Ga., Ky. & Mo.

6. ANTENNARIA Gaertn. EVERLASTING

Fernald, M. L. Key to the Antennaria of the "Manual Range." Rhodora **47**: 221-235; 239-247. 1945.

a. Rosette leaves comparatively small, 0.3-2.0 cm wide, with only the mid-rib prominent to the tip.

b. Middle and upper stem-leaves terminated by a flat or involute papery appendage; rosette leaves tapering and acute at the tip, very rarely rounded.

c. New rosette leaves bright green and glabrous or soon becoming so on the upper surface. 1. *A. canadensis*

c. New rosette leaves grayish- or silky-woolly on the upper surface. 2. *A. neglecta*

b. Middle and upper stem-leaves acute or terminated by a sharp awn-like tip, but not by an appendage; rosette leaves mostly rounded at the end, with a very small pointed tip.

d. Involucre 7-11 mm high; heads in a loose inflorescence, with the lower pedicel often much longer than the upper; upper part of the stem bare or nearly bare of leaves, the upper stem-leaves terminating in a long point; stolons long and only tardily developing rosettes of leaves. 3. *A. petaloidea*

d. Involucre of pistillate plants 6-9 mm high, of the staminate plants 5-7 mm high; heads in a compact inflorescence; leaves equally spaced on the stem, and all ending merely in an acute tip; stolons short, quickly developing rosettes.

e. Leaves more or less whitish-woolly and dull above.

f. Tips of the involucral bracts linear-oblong, mostly blunt and shining white.

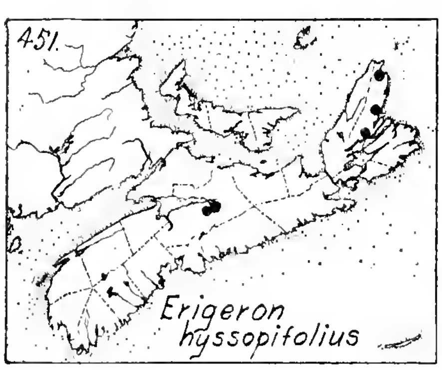
g. Plants slender to 4 dm high; stem-leaves to 4 mm wide, becoming well separated; basal leaves 5-18 mm wide; corollas 3.2-5 mm long. 4. *A. neodioica*

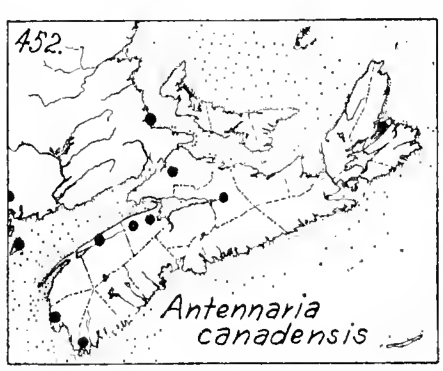
g. Plants stout, to 5 dm high; stem-leaves 3-8 mm wide, often over-lapping; basal leaves larger and greener; corollas 4.8-6 mm long. *A. neodioica* var. *grandis*

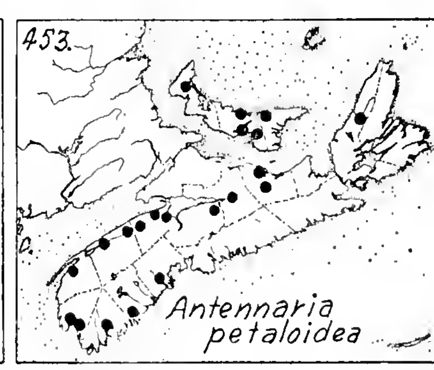
f. Tips of the involucral bracts tapering with a sharp or acute tip, thinner and much duller. *A. neodioica* var. *attenuata*

e. Leaves of the rosette glabrous, green and shining above. *A. neodioica* var. *chlorophylla*

a. Rosette leaves large, 1-7 cm wide, with 3-7 somewhat prominent long ribs beneath. 5. *A. Parlinii*







1. **A. canadensis** Greene. Fig. 119, e. Map 452. PUSSY-TOES, EVERLASTING.

Common throughout; hills, dry and sterile soil, old pastures and deserted fields. May 15-June.

N. S. to Man. south to N. Y.

2. **A. neglecta** Greene

Scattered around Truro; the distribution of this form in the province is poorly known, but it may prove to be widespread in the northern part of the region.

N. S. to Ont. south to Va., & Kans.

3. **A. petaloidea** Fern., var **subcorymbosa** Fern., Rhodora **16**: 133. 1914. Map 453.

Scattered, probably throughout the province; railroad embankments, sandy thickets, gravelly banks and fields, usually growing in slightly better soils and more shady locations than the other species. June.

Nfld. to P.E.I. south to central Me. & Cape Cod.

4. **A. neodioica** Greene. Fig. 119, f. EVERLASTING.

Scattered throughout. Nfld. to Wisc. south to Va. Var. **attenuata** Fern. is common throughout in gravelly thickets, stony pastures, fields, roadsides and on sterile soil. Nfld. to Wisc. south to Va. Var. **grandis** Fern. is not uncommon, especially in the Annapolis Valley. N. S. to Mich. south to Mass. Var. **chlorophylla** Fern. Rhodora **23**: 296. 1921, is rather similar in appearance to *A. canadensis*. It is reported (Fernald, 1921) from pasture fields at Yarmouth, and from mixed woods and moist thickets, Meteghan, Digby Co. Nfld. to Wisc. south to N. S., N. Eng. and N. Y. June.

5. **A. Parlinii** Fern.

Reported (Fernald, 1922) as "abundant at the border of dry pine and oak woods on steep slopes along the Lahave River, Bridgewater." Occasional broad-leaves forms have been observed at different places in the Annapolis Valley, and various forms may be introduced. The most probable one is *A. plantaginifolia* Richards, which has the leaves minutely hairy above. This was reported by Lindsay from Halifax and Pictou. No recent collections have been seen.

N. S. to Ont. south to Ga. & Ia.

7. ANAPHALIS DC.

Fernald, M.L. *Anaphalis margaritacea* again. Rhodora **40**: 218-219. 1938. Hara, Hiroshi. *Anaphalis margaritacea*. Rhodora **41**: 390-391. 1939.

a. Plants 2-9 dm high; leaves linear-lanceolate; heads numerous, in an open corymb.
  b. Leaves rather broadly linear-lanceolate, not reduced in length just below the inflorescence, glabrous or nearly so, and green on the upper sides. 1. *A. margaritacea*
  b. Leaves linear to narrowly linear-lanceolate, much reduced upwards towards the inflorescence.
    c. Leaves cobwebby on both sides. var. *intercedans*

c. Leaves bright green and glabrous above. var. *angustior*

a. Plants dwarf, leaves comparatively wide; heads showy, few, in a crowded cluster. var. *subalpina*

1. **A. margaritasea** (L.) B. & H. PEARLY EVERLASTING. Fig. 120, a.

This northern plant is scattered in northern C. B. where the clumps of green, leafy plants are conspicuous. Plants from P.E.I. and Pictou Co. are not so typical. Common in eastern Asia and northwestern N. A.: Nfld. to N. Eng. (*A. margaritacea* var. *occidentalis* Greene).

Var **intercedans** Hara is the common form of the plant in N. S.; common on dry hillsides, newly cleared areas, along stone walls and borders of woods. Aug.-Sept. (*A. margaritacea* var. *revoluta* forma *arachnoidea* Fern.). Nfld. to Alaska south to Va. & Ore.; northern Japan.

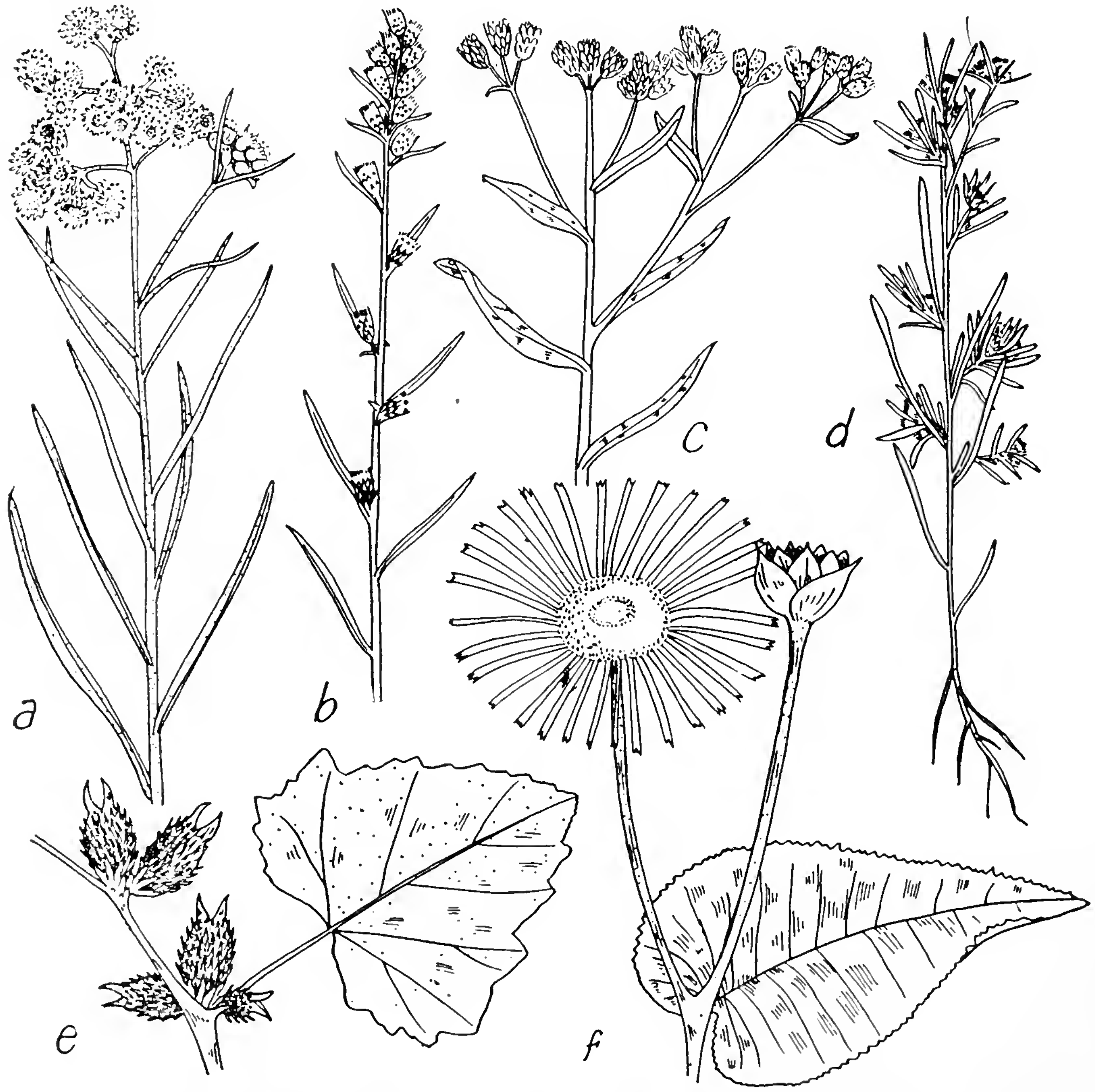


Fig. 120.—**Anaphalis.** a, **A. margaritacea,** x ¼. **Gnaphalium.** b, **G. sylvaticum,** x ⅓. c, **G. obtusifolium,** x ⅓. d, **G. uliginosum,** x ⅓. **Xanthium.** e, **X. echinatum,** fruits and leaf, x ⅓. **Inula.** f, **I. Helenium,** top of branch, x ⅓.

Var. **angustior** (Miquel) Nakai is occasional throughout N. S. (*A. margaritacea* forma *anochlora* Fern.). Throughout the range of the species.

Var. **subalpina** Gray, Fl. N.A. p 233. 1886, is a western form in the Rocky Mts., occurring eastward on the mts. of Que. and Nfld. and other cool areas. St. John (1921) states that it is very common on the dry dunes and barrens of Sable Is., where other varieties of the species are apparently absent.

8. GNAPHALIUM L. CUDWEED

a. Plants low, much-branched; heads in a flat-topped corymb, or else in a very irregular diffusely-branched inflorescence; bristles of the pappus separate.
  b. Plants stout, erect; heads ovoid, clustered at the ends of the branches; achenes smooth.
    c. Leaves tapering to the base, not decurrent on the stem; bracts of the receptacle white, rather obtuse (Fig. 120, c). 1. *G. obtusifolium*
    c. Leaves wide at the base, and prominently decurrent on the stem; bracts yellow-white, acutish. 2. *G. decurrens*
  b. Plants low, diffuse, and becoming prostrate; heads small, exceeded by the leaves; achenes scabrous; involucral bracts light-brown (Fig. 120, d). 3. *G. uliginosum*
a. Plants erect, unbranched, the heads in small clusters on short branches of the inflorescence in the leaf-axils, forming a spike-like raceme; bristles of the pappus united at the base into a ring (Fig. 120, b). 4. *G. sylvaticum*

1. **G. obtusifolium** L. OLD-FIELD BALSAM. Fig. 120, c. Map 454.

Scattered on dry sandy or rocky places in the western part of the province; Sable Is. Aug.-Sept. (*G. polycephalum* Michx.).

N. S. to Man. south to Fla. & Tex.

2. **G. decurrens** Ives

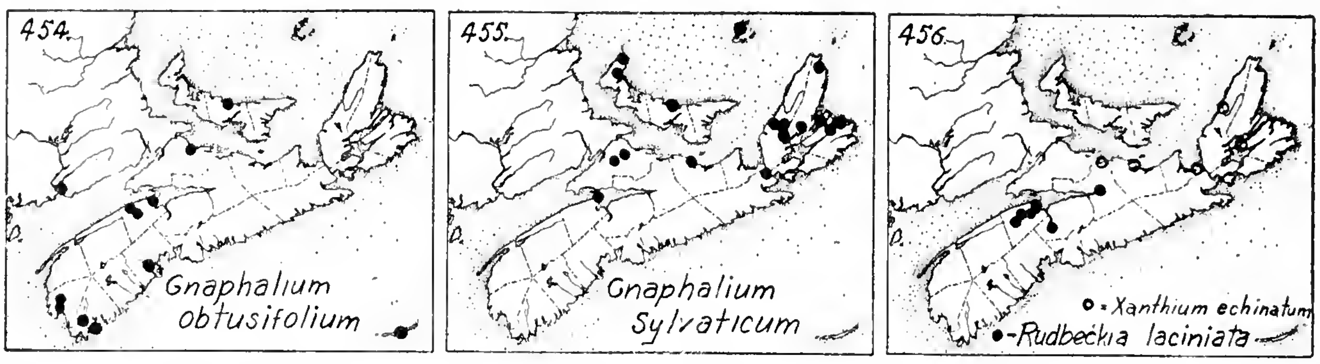
A specimen collected by Howe at Windsor belongs here; no other collection is known for the province.

Introduced; Que. to B. C. south to Penn. & Ariz.

3. **G. uliginosum** L. LOW CUDWEED. Fig. 120, d.

Common and weedy throughout; abundant in poorly-drained cultivated land, and especially so in wet years in grain fields. June-Oct.

Nfld. to B. C. south to Va., Ind. & Colo.



4. **G. sylvaticum** L. Fig. 120, b. Map 455.

Scattered in clearings and along roadsides, common in C. B. and becoming rarer west to Cumberland and Kings Cos., often appearing as if native; not found in the acidic areas of the province.

N. S. to Que. south to Me.; introduced from Eu.

9. INULA L.

1. **I. Helenium** L. ELECAMPANE. Fig. 120, f.

Introduced from Europe by the early French settlers; scattered from Yarmouth to the Strait of Canso, often found along damp roadsides in the Annapolis Valley where the sunflower-like appearance and large woolly leaves make it a conspicuous plant. Aug.

Introduced from Eu.; N. S. to Minn. south to N. C. & Mo.

10. IVA L.

1. **I. frutescens** L., var. **oraria** (Bartlett) Fern., Rhodora **37**: 184. 1935. MARSH ELDER.

Undoubtedly introduced; rapidly spreading along the salt marsh by the covered bridge at Avonport, Kings Co; found in Yarmouth Co. on the bar below Yarmouth.

Salt marshes; Mass. to Md.

11. AMBROSIA (Tourn.)L. RAGWEED

a. Plant 2-10 dm high; leaves finely lobed or divided.
  b. Plant annual, without running rootstocks; fruit ovoid, with about 6 acute teeth around the upper margin. 1. *A. artemisiaefolia*
  b. Plant perennial with slender running rootstocks; fruit with the teeth or tubercles very small or absent. 2. *A. coronopifolia*
a. Plants 1-4 m high; leaves deeply 3-lobed. 3. *A. trifida*

Fig. 121.—**Ambrosia.** a, **A. artemisiifolia,** x $\frac{1}{4}$. **Rudbeckia.** b, **R. hirta,** x $\frac{1}{2}$. c. **R. laciniata,** flower and leaf, x 1/5. **Bidens.** d, **B. cernua,** flowers, x $\frac{1}{2}$; achene. e, **B. frondosa,** top of plant, x $\frac{1}{2}$; achene.

1. **A. artemisiaefolia** L. RAGWEED. Fig. 121, a. See Fernald and Griscom. *Ambrosia artemisaefolia* and its variations in temperate North America. Rhodora **37**: 184-185. 1935.

Ragweed occurs upon light soil; it is common in the Annapolis Valley, scattered along roadsides in newly disturbed soils to Yarmouth; and found around the sea-coast in the sand and gravel of the upper beaches; rare from Halifax east and in C. B. The different varieties have little significance in the province; although the typical one with coarse leaves and wide staminate involucres is supposed to be native.

Mostly introduced from western N. A.

2. **A. coronopifolia** Torr. and Gray. PERENNIAL RAGWEED.

This western species is becoming sparingly naturalized in the east. It was collected by H. Groh in an orchard at South Berwick, Kings Co. (*A. psilostachya of* Gray's Manual).

3. **A. trifida** L. GREAT RAGWEED.

Sparingly introduced around towns and ports, occasionally seen in rich soil along roadsides: Dartmouth, Kentville, Parrsboro, North Sydney, scattered in Pictou Co., etc.

Introduced from west and south; widely distributed.

12. XANTHIUM (Tourn.) L.

1. **X. echinatum** Murr. COCKLEBUR. Fig. 120, e. Map 456.

Sandy and gravelly beaches along the Northumberland Strait and to western C. B., occasionally found around the Bras d'Or Lakes. This plant is usually found just above the high tide level but it sometimes extends up from the beaches into low areas in cultivated fields. It is rarely common or of economic importance.

N. S. to N. C. and westward around the Great Lakes.

13. RUDBECKIA L.

a. Disk of the flower dark brown; leaves narrow, unlobed; stem to 10 dm high (Fig. 121, b). 1. *R. hirta*

a. Disk of the flower greenish-yellow; leaves mostly lobed; stem 10-25 dm high (Fig. 121, c). 2. *R. laciniata*

1. **R. hirta** L. BLACK-EYED SUSAN. Fig. 121, b.

The typical form, with the hairs on the lower leaf-surface variously spreading and with open smooth spaces between their bulbous bases, is rare in the province. The most typical collection seen was from Boylston, Guysborough Co.

Var. **sericea** (T. V. Moore) Fern., see Rhodora **39** 457-459. 1939, with the hairs on the lower leaf-surfaces mostly appressed, crowded and with minute bulbous bases, is common throughout the Annapolis Valley and scattered east to C. B., rare in the southwestern counties. Large colonies of it grow along the railroad between Halifax and Mount Uniacke. July 15-Aug.

N. S. to Man. south to Fla. and Tex.

2. **R. laciniata** L., var **gaspereauensis** Fern. Rhodora **24**: 205. 1922. CONEFLOWER. Fig. 121, c. Map 456.

The type of this variety was collected by Prof. H. G.

Perry in an alluvial soil close to the shore of the Black River, tributary to the Gaspereau in Kings Co. It has since been found in swales, roadside swamps, and in gulleys at various places in Kings, Hants and Colchester Counties, usually rare but occasionally growing in large colonies or spreading out into considerable areas. The value of this variety is doubtful, since many collections from Illinois to Pennsylvania show as much pubescence on the undersides of the leaves as do the Nova Scotian plants. Aug.

N. S. to Man. south to Fla. and Ariz.

14. HELIANTHUS L.

a. Plants annual; tubers and spreading rootstocks not present; disk of the flower-head over 2.5 cm wide. 1. H. *annuus*

a. Plants perennial; tubers and running rootstocks usually present; disks of the flower-heads 1-2 cm wide. 2. H. *tuberosus*

1. **H. annuus** L. SUNFLOWER.

Occasionally seen as an escape in waste places; not common nor persisting. Common in gardens.

Minn. to Tex. and westward; introduced eastward.

2. **H. tuberosus** L. JERUSALEM ARTICHOKE.

Occasional in waste places; rather common in orchards on various types of soil in the Annapolis Valley.

Throughout eastern and central N.A.; introduced into N. S.

15. COREOPSIS L.

1. **C. rosea** Nutt. COREOPSIS

Scattered to often common on wet shores and cobbly or sandy beaches and margins of lakes and streams in the Tusket Valley, Yarmouth Co.; unknown elsewhere in the province. Aug.

N. S.; Mass. to N. J. and southward.

16. BIDENS L. BEGGAR-TICKS

Sherff, E. E. The Genus Bidens. Field Mus. Nat. Hist. Publ. Bot. Series. Vol. 16: 1-709. 1937.

a. Leaves compound with the terminal leaflet plainly stalked; rays absent, or small and inconspicuous (Fig. 121, e).

b. Outer involucral bracts 3-5, mostly 4, not plainly fringed; body of the achene 3-6.2 mm long, the awns barbed upwardly.
1. *B. discoidea*

b. Outer involucral bracts 5-16, evenly and copiously fringed with white hairs.

c. Outer involucral bracts 10-16; inner bracts shorter than the disk; achenes brown or olivaceous, the body 6-12 mm long, and the awns downwardly barbed. 2. *B. vulgata*

c. Outer involucral bracts 5-8; inner bracts equal to the disk; achenes blackish, 6-10 mm long.

d. Awns downwardly barbed. 3. *B. frondosa*

d. Awns upwardly barbed. *B. frondosa* var. *anomala*

a. Leaves simple and toothed, or the lower divided and lobed with the terminal leaflet on a widely-winged stalk; heads discoid or radiate.

e. Flowers small, 1-2 cm wide, discoid or with narrow rays; heads usually erect in fruit.

f. Margin of the achene upwardly barbed, at least near the base.

g. Petiole broadly winged; blade usually 3-parted. 4. *B. connata*

g. Petiole not, or very narrowly winged; blade not divided, except in very vigorous plants. B. *connata* var. *petiolata*

f. Margin of the achenes downwardly barbed for the entire length; leaves lanceolate, entire or nearly so. 5. *B. hyperborea*

e. Flowers much larger, 1-5 cm wide, with wide rays; margins of the achenes downwardly barbed for the entire length (Fig. 121, d).

h. Stem 1-9 dm high, branched; heads many, nodding in fruit.
6. *B. cernua*

h. Stem 2-20 cm high, simple or nearly so; heads solitary, or few, erect or nearly so in fruit. B. *cernua* forma *minima*

1. **B. discoidea** (T. & G.) Britt.

Scattered in swamps and gravelly or sandy shores near Pictou, probably local in the north central region of the province. Sherff lists it only from beaches at Pictou. July-Aug.

N. S. to southern Que. & Minn. south to Ala., Ohio & Tex.

2. **B. vulgata** Greene. BEGGAR-TICKS.

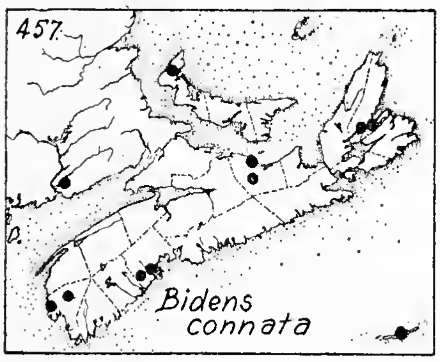
Common in ditches and around the dykelands at Truro; rare or absent elsewhere; perhaps introduced.

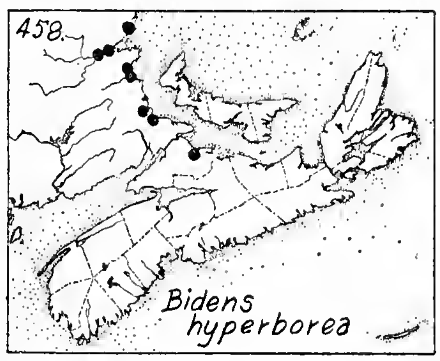
N. S. & Que. to B. C. south to N. C. & Calif.

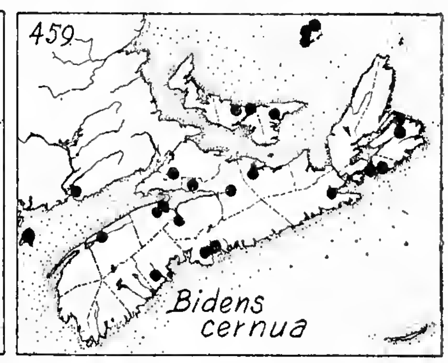
3. **B. frondosa** L. COMMON BEGGAR-TICKS. Fig. 121, e. Map 460.

Common throughout, often growing in shade around dwellings and as a solid mat in damp waste places. In rich soil it is high and much-branched, while in exsiccated soil it may be but a few inches high with a simple stem and few heads. Nfld. to Ont. and Wash. south to Fla. & Calif.

Var. **anomala** Porter is rather common from Yarmouth Co. along the Bay of Fundy to Amherst. Usually it grows along the edges of brackish areas, but occasionally it is found along fresh-water streams a short distance from the coast. C. B. south near the coast to D. C.; locally inland.







Var. **pallida** Wieg., Rhodora **26**: 5. 1924, is a poorly-understood plant with pale-green leaves, the side branches longer than the main stem, and the terminal leaflet tending to be stalked. Sherff reports this as collected by Brother Peter at Halifax in 1896. Rare and apparently widely scattered.

4. **B. connata** Muhl. Map 457. SWAMP BEGGAR-TICKS.

Wet thickets and swales back of brackish shore of Lahave River, Bridgewater: first station east of southern Maine. Earlier records belong to var. *petiolata* (Nutt.) Farw. (Fernald, 1922). Var. **inundata** Fern., Rhodora **23**: 298. 1921, is a possible endemic variety described from a sphagnous bog at Sand Beach, Yarmouth Co., and reported from various places in the province. Sherff considers these plants merely as variations of *B. connata* which are closely matched by specimens from widely separated localities.

Var. **petiolata** (Nutt.) Farw., see Sherff, p. 257, has been collected in boggy swales, borders of ponds and ditches in various parts of the province; frequent at the borders of fresh-water ponds on Sable Is. Range of the species and more common.

N. S. and Me. to Que. south to N. J., Mich and Mo.

5. **B. hyperborea** Greene. See Fassett, Norman C. *Bidens hyperborea* and its varieties. Rhodora **27**: 166-171. 1925. Map 458.

Tidal mud-flats of the River Philip, Oxford. Var. *colpophila* Fern. & St. John, Rhodora **20**: 149. 1918, with which this collection was identified, is a variation of the species with the stem somewhat branching and the leaves serrate. Lower St. Lawrence, around Gaspe, N. B. and south along the coast to N. Y.

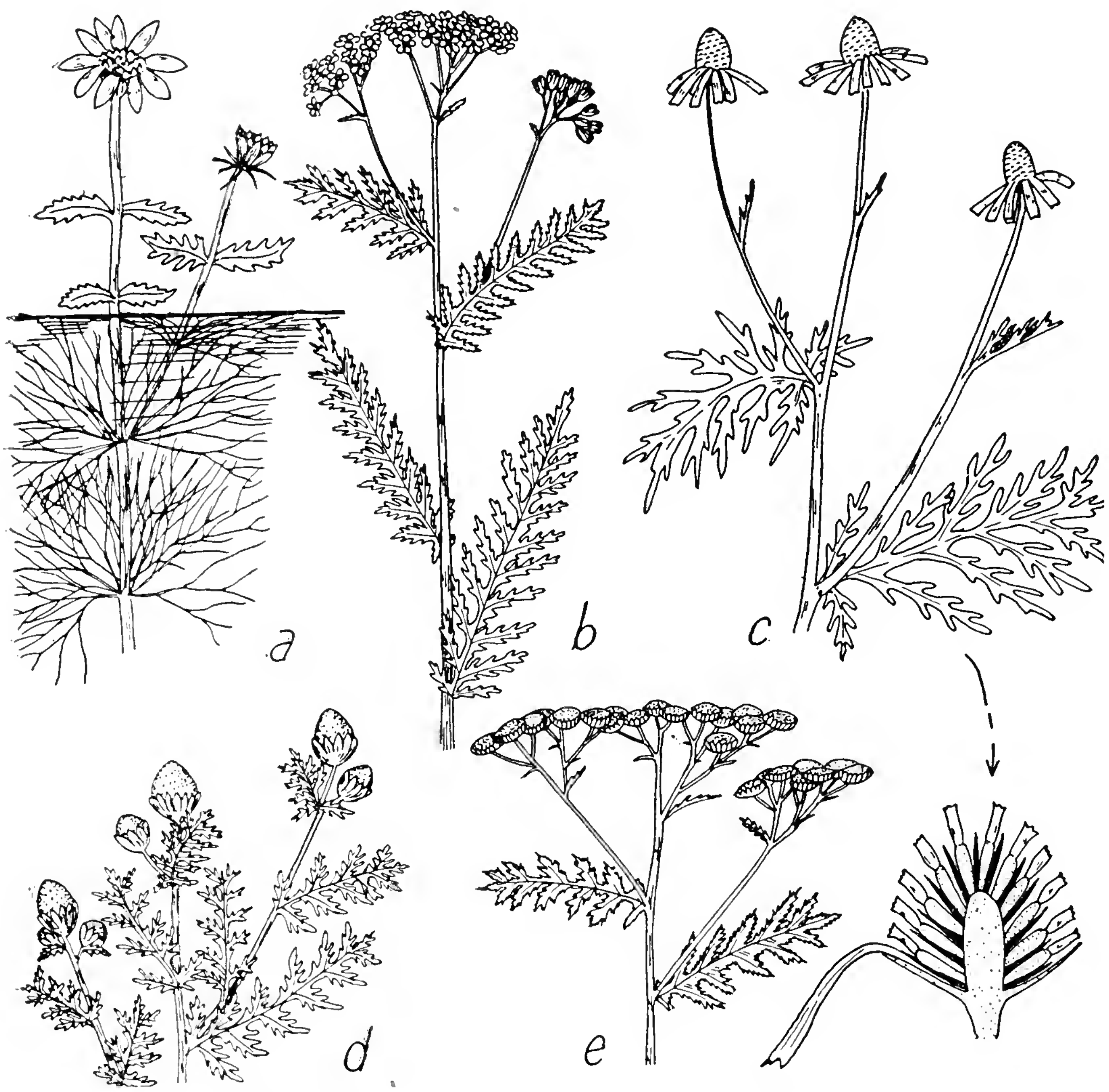


Fig. 122.—**Megalodonta.** a, **M. Beckii,** x $\frac{1}{3}$. **Achillea.** b, **A. Millefolium,** x $\frac{1}{3}$. **Anthemis.** c, **A. Cotula,** x $\frac{1}{3}$. **Matricaria.** d, **M. matricarioides,** x $\frac{1}{3}$. **Tanacetum.** e, **T. vulgare,** inflorescence, x $\frac{1}{4}$.

6. **B. cernua** L. NODDING BUR MARIGOLD Fig. 121, d. Map 459.

Conspicuous and common in springy land, swamps and wet thickets from Annapolis and Lunenburg Cos., to northern C. B. July-Sept. Fernald in Rhodora **24**: 206. 1922, has described several forms based upon leaf shape.

The plant is very variable and the following is the best marked.

Forma **minima** (Huds.) Larss. is the smallest extreme; boggy margin of Hebb's L., Bridgewater (Fernald, 1922); bog at the margin of the sea at Gabarus, C. B. (Rousseau, 1938).

N. S. to B. C. southward; Eu. & Asia.

17. MEGALODONTA Greene

1. **M. Beckii** (Torr.) Greene Fig. 122, a. WATER MARIGOLD

Deadwater of Rocky Brook north of Hassett, Digby Co., for the first record east of Penobscot, Maine (Fernald, 1922); abundant below the bridge at the outlet from Lake Ainslie of the Southwest Margaree R. (Roland 1938). Aug. (*Bidens Beckii* Torr.).

N. S. and Que. to Man. south to N.J. Mo.

18. GALINSOGA R. & P

1. **G. ciliata** (Raf.) Blake, in Rhodora **24**: 35. 1922. QUICKWEED.

Common along the streets of Halifax; unknown elsewhere. June-Oct. (*G. pariflora* Cav. var. *hispida DC.*).

Introduced from tropical America; widespread.

19. ACHILLAEA (Vaill.) L. YARROW

a. Leaves lanceolate, simple, finely toothed; corymb very loose and leafy, with heads few on long pedicels. 1. *A. Ptarmica*

a. Leaves finely divided; corymb more compact, the heads numerous, on short pedicels.

b. Leaves conspicuously dotted, their ultimate segments strongly callus-thickened towards the apex; rays purplish. 2. *A. asplenifolia*

b. Leaves not conspicuously dotted, their ultimate segments not callus-thickened towards the apex; rays white to pinkish. 3. *A. Millefolium*

1. **A. Ptarmica** L. SNEEZEWEED.

Local; common around Pleasant Bay in C. B.; collected at Truro and Woodville, rarely elsewhere. July-Sept.

Introduced from Eu; from N. S. to Alberta.

2. **A. asplenifolia** Vent., see Rydberg, N.A. Flora **34:** pt. 3: 225. 1916.

Plants collected in the western half of the province have been placed here. The distinctness of this species is unknown, and is rather doubtful. In all probability it will hybridise with the following species and produce flowers of various color shades. It is retained here until further study is carried out.

Perennial garden plant; widely escaped in N.A.

3. **A. Millefolium** L. Fig. 122, b. YARROW.

Common throughout; roadsides, lawns, fields, and waste places, sometimes a weed in hay fields and often troublesome in dykelands in Cumberland Co. Forma **rosea** Rand & Redfield has pinkish rays or disk flowers. Rousseau (1938) has an interesting discussion of the inheritance of this pink color. *A. ligustica* All. is considered to be merely a variation of this species. *A. lanulosa* Nutt. is a plant typical of the Rocky Mountains and the northwestern part of N. A. St. John considers that all the yarrow on Sable Is. belongs to this species, but much of the material of *A. Millefolium* from N. S. is more or less woolly and the lines between the two species in the east are not at all distinct. June 15-Sept.

Eurasia; throughout most of N. A.

20. ANTHEMIS (Michx.) L.

1. **A. Cotula** L. CHAMOMILE Fig. 122, c.

Very common about farmyards, scattered along roadsides and in waste places throughout; usually growing where the soil is more or less compacted. July-Oct. A closely related species, *A. arvensis* L., var. *agrestis* (Wallr.) DC., has been found in P.E.I. (Charlottetown) but is not known definitely from N. S. This plant differs in not being strong-scented, the leaves are not so finely divided, the lower branches are often rooting at the nodes, and the seeds are not tubercled on the sides.

Introduced from Eu.; generally distributed in N. A.

21. MATRICARIA (Tourn.) L.

a. Flower-heads 3-4 cm wide, with long white rays; plant not strong-scented. 1. *M. inodora*

a. Flower-heads small, rayless, very conical; plant with a strong odor suggesting pineapple. 2. *M. matricarioides*

1. **M. inodora** L. MAYWEED.

Growing in much the same situations as *Anthemis* and rather similar to it in appearance. It is, however, more confined to seashore regions; common as a weed along the French Shore of Digby and Yarmouth Co., and along Northumberland Strait; scattered elsewhere in towns, waste places and along roadsides; rather rare inland. July-Aug.

Nfld. to Conn. & Mich.; introduced from Eu.

2. **M. matricarioides** (Less.) Porter. Fig. 122, d. PINEAPPLE WEED.

Very common along roadsides, about dwellings and in waste places throughout. July-Nov. [*M. suaveolens* (Pursh) Buch.].

Introduced from the West Coast into eastern America: Eu.

22. CHRYSANTHEMUM (Tourn.) L.

a. Basal leaves crenate-dentate; middle and upper stem-leaves oblong or oblanceolate, coarsely and regularly crenate or dentate above, with larger spreading teeth at the base. 1. *C. Leucanthemum*

a. Basal leaves pinnatifid, subpinnatifid or coarsely and irregularly toothed; middle and upper stem-leaves narrowly oblong or oblanceolate, conspicuously subpinnatifid at base. var. *pinnatifidum*

1. **C. Leucanthemum** L. OX-EYE DAISY.

Reported by Fernald (1922) to be common at Annapolis Royal and Granville; apparently more or less common in Annapolis Co. Fields and roadsides: Nfld. and Que. becoming rarer southward. Introduced from Eu.

Var. **pinnatifidum** Lecoq. & Lamotte is the common daisy of pastures, cultivated land and waste places throughout. June-July.

Nfld. to N. J. and becoming rarer westward; introduced from Eu.

23. TANACETUM L.

1. **T. vulgare** L. Fig. 122, e. TANSY.

Scattered throughout; in small patches near old houses or along roadsides, becoming a weed in fields and orchards on the deeper soils around the Minas Basin and locally in good soils elsewhere. Aug.-Sept. Forma **crispum** (L.) Fern., Rhodora **38**: 235. 1936, with the leaves finely divided and closely toothed with the teeth partly inturned, is scattered in various parts of the province.

Introduced from Eu.; N. S. to Minn. & Ore. south to Ga.

24. ARTEMISIA L.

a. Leaves smooth on both sides, thin and crowded, once-divided with triangular sharp teeth; heads small. 1. *A. biennis*

a. Leaves whitish-hairy on one or both sides; heads larger, 2-7 mm long.

b. Leaves densely whitish-woolly on both sides, the lobes rounded and about 5 mm wide; heads 6-7 mm long. 2. *A. Stelleriana*

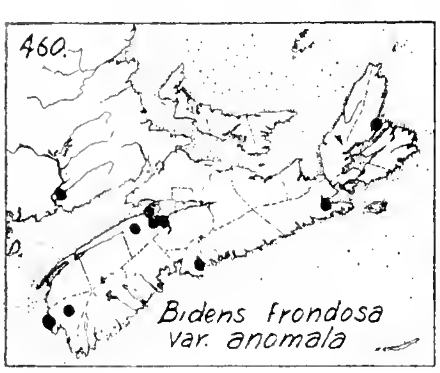
b. Leaves smooth on one side, or very finely pubescent on both sides; heads 2-4 mm long.

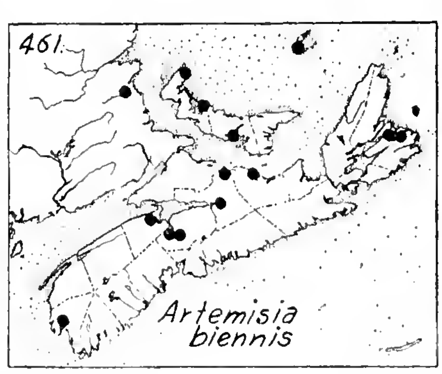
c. Leaves smooth above, white-woolly beneath, partly twice-divided, with lobes 2-4 mm wide and tapering to a sharp tip. 3. *A. vulgaris*

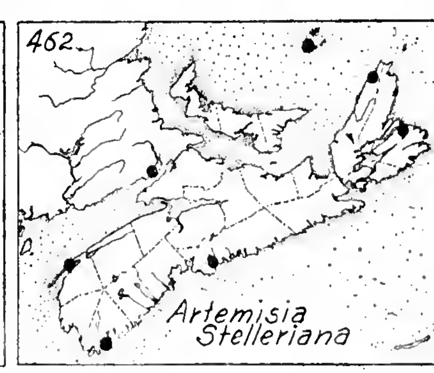
c. Leaves finely pubescent on both sides, 2-3 times divided into narrow lobes.

d. Receptacle of the head with numerous long hairs between the florets; middle leaves 3-6 cm long, the lobes 1-several mm wide; lower leaves long-petioled; plants stout. 4. *A. Absinthium*

d. Receptacle without long hairs; middle stem-leaves less than 3 cm long, finely divided into lobes less than 1 mm wide; plant slender with the lower leaves short-petioled. 5. *A. Pontica*







1. **A. biennis** Willd. Map 461. BIENNIAL WORMWOOD.

Reported by Lindsay from Windsor and Pictou; collected at Pictou, rather common along the North Shore in the heavy soils; scattered west to Kings Co. Aug.-Sept.

Introduced from western America; widely scattered.

2. **A. Stelleriana** Besser. Map 462. BEACH WORMWOOD.

Scattered around the coast on rocky or sandy beaches; commonest in northern C. B., scattered down the Atlantic coast to Yarmouth and Digby Cos. Early Aug.

Introduced from Asia; along the coast from Que. to N. J.

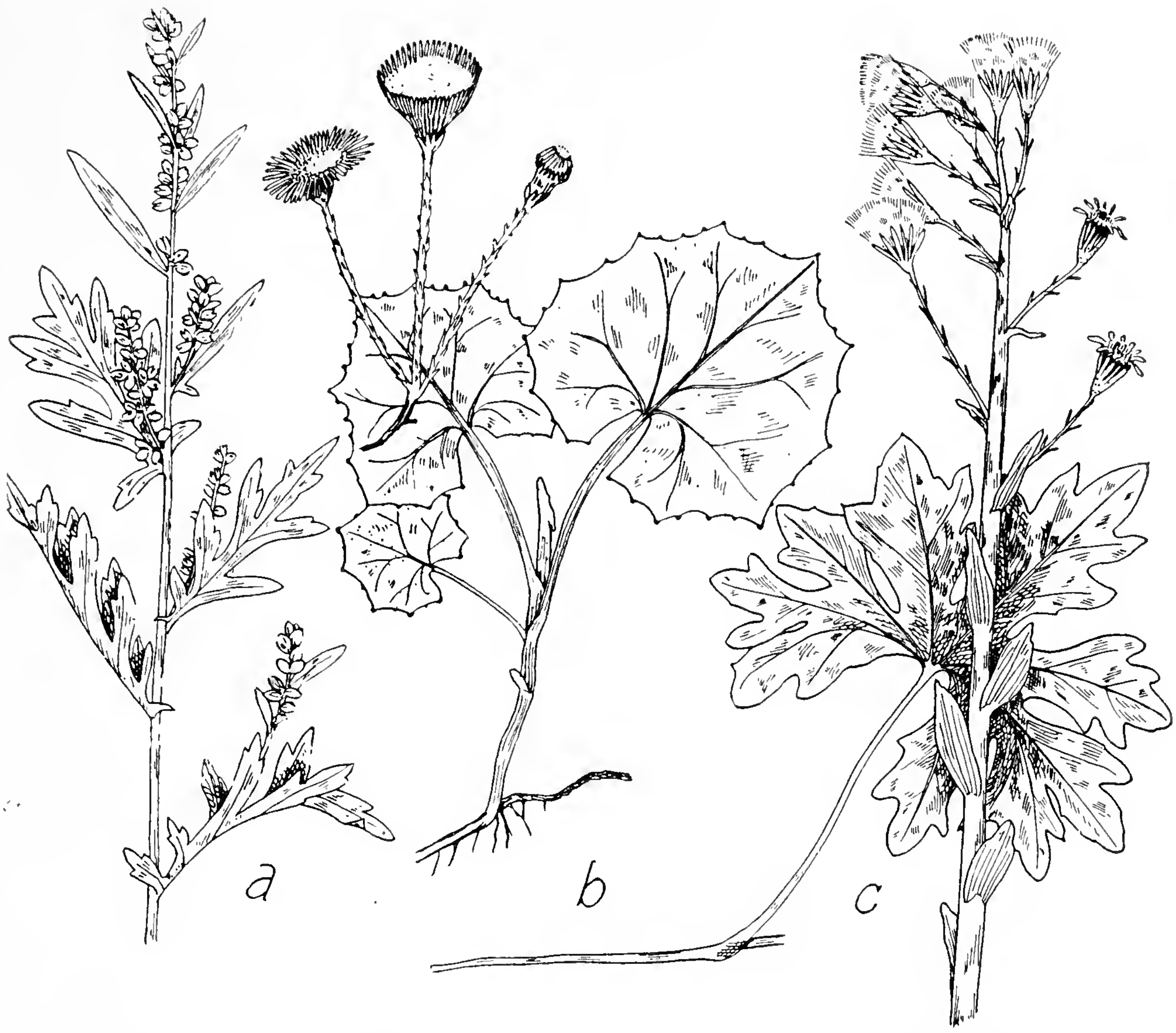


Fig. 123.—**Artemisia.** a, **A. vulgaris,** x $\frac{1}{3}$. **Tussilago.** b, **T. Farfara,** flowering plant, x $\frac{1}{2}$; summer leaves, x $\frac{1}{3}$. **Petasites.** c, **P. palmatus,** flowering plant, x $\frac{1}{3}$; leaf, x $\frac{1}{3}$.

3. **A. vulgaris** L. Fig. 123, a. COMMON WORMWOOD.

Orchards, roadsides and waste places about towns; common from Annapolis to Halifax and Pictou Cos; probably throughout.

Native to western America; introduced from N. S. to Ga.

4. **A. Absinthium** L. WORMWOOD.

Rare; found around old dwellings where it was formerly planted as a garden herb. Lindsay lists it from Pictou and Five-Islands; collected at Sheet Harbour, Halifax Co. Aug.

Introduced from Eu.; Nfld. to Mont. south to S.C.

5. **A. Pontica** L. ROMAN WORMWOOD.

Known only from a collection from waste ground, Dartmouth (Fernald, 1922). Aug.

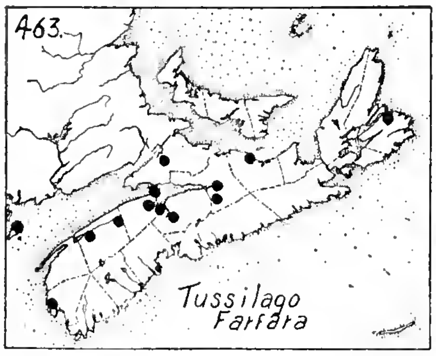
Introduced from Eu.; N. S., sparingly found west and south.

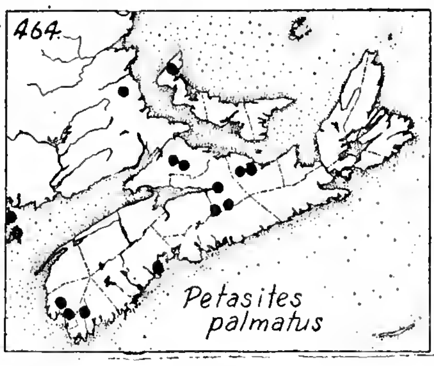
25. TUSSILAGO (Tourn) L.

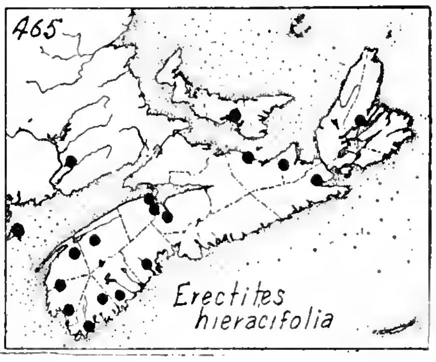
1. **T. Farfara** L. Fig. 123, b. Map 463. COLTSFOOT.

Scattered and becoming a common weed in many parts of the province, especially about ports. It spreads actively by running rootstocks, and forms large patches on damp hillsides, river banks, roadside cuts and in heavy soil. Early May.

Introduced from Eu.; N. S. to Minn. south to Penn.







26. PETASITES (Tourn.) Hill

1. **P. palmatus** (Ait.) Gray Fig. 123, c. Map 464. SWEET COLTSFOOT.

Scattered in woods, swamps, recent clearings and roadside thickets from Belleville, Yarmouth Co. to Cumberland and east to C. B.; rather common in the north-central part of the province, carpeting the ground over considerable areas back of Stewiacke; rare elsewhere. The leafless flowering-stems arise in May or early June, while the green leaves appear later from the same rootstocks. (*P. frigidus* (L.) Fries var. *palmatus* (Ait.) Cronquist, in Rhodora **48**: 123-125. 1946).

Lab. & Nfld. to Alberta south to Mass., Minn. & Calif.

27. ERECTITES Raf.

1. **E. hieracifolia** (L.) Raf. Fig. 124, a. Map 465. FIREWEED.

Common throughout; moist woods, recently burnt areas, and open thickets. Fernald, in Rhodora **19**: 24-27. 1917, has named three varieties upon the size and shape of the leaves. These characters appear to be very variable. Var. *intermedia* Fern., according to this treatment, would be our commonest form. This has the leaves broad with somewhat clasping bases, rapidly reduced in size upwards to the inflorescence. Other collections show large leaves up to the apex of the stem. July-Sept.

N. S. to Ont. south to Fla. & Tex.

28. SENECIO (Tourn.) L.

a. Plants leafy to the top, the leaves gradually becoming smaller upwards.
  b. Plants slender, 1-7 dm high, annual; leaves pinnately-lobed; flower-heads inconspicuous, without rays or with the rays small and narrow.
    c. Rays absent; outer bracteoles around the involucre black-tipped. 1. *S. vulgaris*
    c. Rays present, often rolled outwards; outer bracteoles not black-tipped.
      d. Plant lightly pubescent but not glandular; bracteoles very small. 2. *S. sylvaticus*
      d. Plant densely glandular-pubescent and viscid; bracteoles one-third to one-half the length of the involucre. 3. *S. viscosus*
  b. Plants stout, 3-12 dm high; biennials or perennials; leaves simple, or if otherwise, finely twice to thrice divided; heads showy with conspicuous flat rays.
    e. Leaves widely lanceolate and obscurely toothed, whitish-woolly beneath; flower-heads 2.5-5 cm wide. 4. *S. Pseudo-Arnica*
    e. Leaves finely divided, smooth; flower-heads 1-1.5 cm wide; flower-heads numerous, showy. 5. *S. Jacobaea*
a. Plants usually with many larger basal leaves which are merely toothed or shallowly lobed, and few and much smaller stem-leaves.
  f. Basal leaves large, round or ovate, the principal ones cordate at the base (Fig. 124, d).
    g. Basal leaves dentate with rounded or blunt teeth. 6. *S. aureus* var. *intercursus*
    g. Basal leaves sharply serrate or dentate to acutely lacerate, membranous. *S. aureus* var. *aquilonius*
  f. Basal and lower leaves ovate to oblong-lanceolate, squarish at the base (Fig. 124, e), or tapering.
    h. Basal leaves squarish or very slightly cordate at the base; leaves, stem, and branches of the inflorescence smooth or nearly so. 7. *S. Robbinsii*
    h. Basal leaves long-tapering at the base; stem, especially at the nodes, and leaves, and branches of the inflorescence more or less whitish-woolly. 8. *S. pauperculus*

1. **S. vulgaris** L. Fig. 124, b. COMMON GROUNDSEL.

This common weed is well established in waste places, around roadsides, in towns and gardens, usually in rich soil; common in towns and gradually spreading out into the country; common along the Bay of Fundy around the fishing villages. May-Oct.

Introduced from Eu.; widespread in N. A.

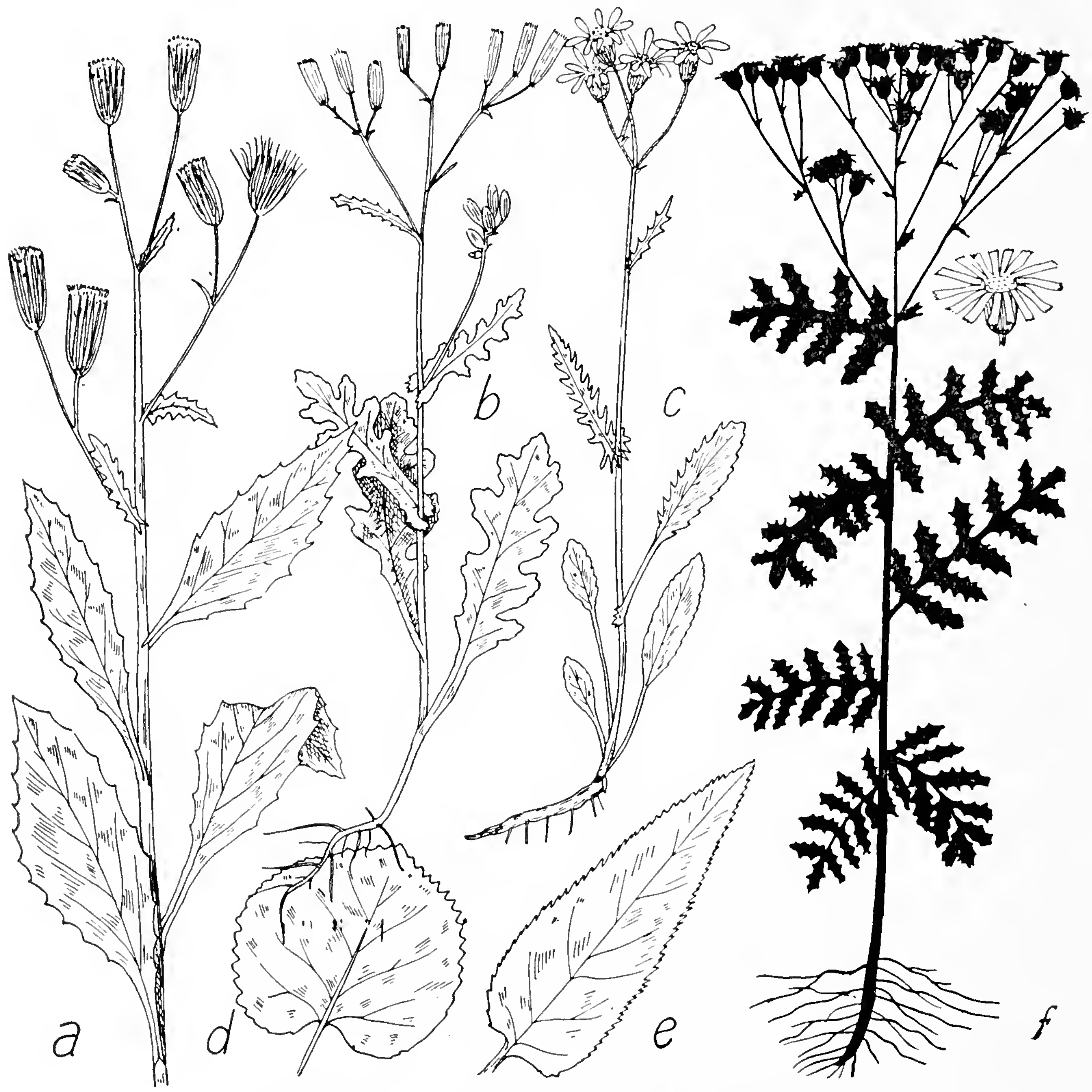


Fig. 124.—**Erectites.** a, **E. hieracifolia**, x $\frac{1}{3}$. **Senecio.** b, **S. vulgaris**, x $\frac{1}{3}$. c, **S. pauperculus**, x $\frac{1}{3}$. d, **S. aureus**, leaf, x $\frac{1}{3}$. e, **S. Robbinsii**, leaf, x $\frac{1}{3}$. f, **S. Jacobaea** plant, x 1/10; flower, x 1.

2. **S. sylvaticus** L. Map 466.

Clearings, waste places and sea-coasts along the Bay of Fundy and east to C. B., usually growing near the coast. The plant is very variable according to ecological conditions, varying from tiny unbranched plants to much-branched ones with over a hundred heads. June-Sept.

Introduced from Eu.; Nfld. to Que. south to Me.

3. **S. viscosus** L CLAMMY GROUNDSEL.

Common around towns and about railroads, becoming weedy. July-Sept.

Introduced from Eu.; N. S. to N. Eng. & N. C.

4. **S. Pseudo-Arnica** Less. BEACH SENECIO.

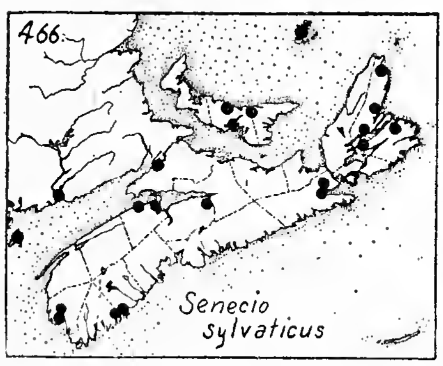
Rare; St. John reports it as infrequent in gulches near the sea and on the top of the beaches on Sable Is.; Rousseau (1938) found it at Canso on a gravelly beach with *Cornus suecica* and *Pinus Banksiana*; and it is abundant on the cobbly barrier beach below Yarmouth. Early Aug.

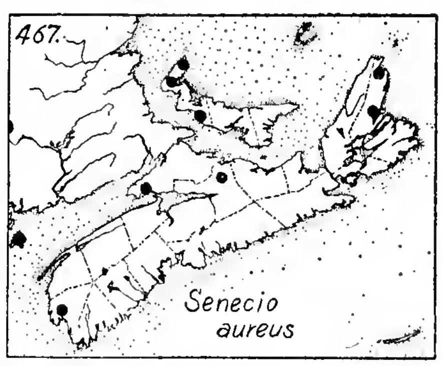
Lab. south to Me.; Alaska.

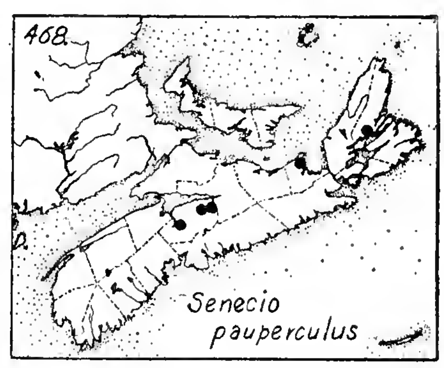
5. **S. Jacobaea** L. Fig. 124, f. RAGWORT, STINKING WILLIE.

Very common from Pictou east to northern C. B. in pastures, along roadsides, waste places and burnt-over woods. It is becoming frequent in parts of Colchester Co.; and has been introduced into small areas in Yarmouth, Halifax and Kings Cos. Late July-Aug.

Introduced from the British Isles; N. S. to Que. and N. Eng.







6. **S. aureus** L., var. **intercursus** Fern., Rhodora **45**: 499. 1943. Map 467. GOLDEN RAGWORT.

Rare; seen in the western counties by the Gray Herbarium Expedition only at Belleville, Yarmouth Co.; occasional in Cumberland, Colchester and Victoria Cos.; found in a pure stand in a wet meadow west of Parrsboro, where it covered acres of ground. Late June-July. N. S. to Mich. south to Penn. Ala. & Mo.

Var. **aquilonius** Fern. Rhodora **45**: 500, 1943, is rare; Barrasois R., C. B. Nichols, no 852. (Fernald, 1. c.). (*S. pseudaureus* Rydb.).

Nfld. to Algoma south to C. B., P.E.I., Ohio & Wisc.

7. **S. Robbinsii** Oakes. Fig. 124, e. SWAMP RAGWORT

Common in swamps, wet meadows, low fields and wet thickets throughout, especially abundant from Hants Co. to northern C. B. Late June-July.

N. S. & N. B. to northern N. Y.

8. **S. pauperculus** Michx., var **neoscoticus** Fern,. Rhodora **45**: 502. 1943. Fig. 124, c.

This plant is confined to gypsum outcrops where it is often an abundant and conspicuous element of the flora on the dryish cliffs and talus slopes. Common about Windsor, Five-Mile R., Antigonish Harbour and Cape North. Robinson (1908) states that rough places along the intervale streams of eastern N. S. are almost sure to contain *S. obovatus* Muhl. and *S. Balsamitae.* These records probably refer to the previous two species. Early June. N. S. & Gaspe.

29. ARCTIUM L. BURDOCK

Fernald, M.L. and Wiegand, K.M. A Synopsis of the Species of *Arctium* in North America. Rhodora **12**: 43-47. 1910.

a. Involucre large and conspicuously woolly; leaf-blades roundish ovate and obtuse; petioles very angular. 1. *A. tomentosum*

a. Involucre smooth or slightly cob-webby; leaf-blades usually more acute; petioles slightly angular.

b. Head short-peduncled, racemose or sub-spikelike. 2. *A. minus*

b. Heads longer-peduncled, more or less in a corymb. *A. minus* var. *corymbosum*

1. **A. tomentosum** Mill. WOOLLY BURDOCK.

This large burdock is common around Pugwash, Cumberland, Co.; not seen elsewhere.

Sparingly introduced from Eu. into eastern Can. and the U. S.

2. **A. minus** (Hill.) Benth. COMMON BURDOCK.

Common in waste places, roadsides, orchards and around buldiings throughout. Plants with larger heads, more spreading involucre and darker ground color to the achenes were formerly segregated as *A. nemorosum* Lejeune. Fernald (1921) reports this from Weymouth, Digby Co., but this is perhaps best considered a variation of *A. minus.*

Var. **corymbosum** Wieg., Rhodora **26**: 5. 1924, is intermediate in some respects between *A. minus* and *A. Lappa.* A collection from Pictou by H. Groh, Aug. 1926, is placed here. *A. Lappa* has not been seen in the province.

Introduced and widely distributed in N. A.

30. CARDUUS (Tourn.) L.

a. Heads nodding, large, solitary on long peduncles; involucre 3-4 cm wide. *1. C. nutans*

a. Heads clustered at the ends of winged branches; involucre 1.5-3 cm wide.

b. Leaves widely lanceolate, shallowly incised with the spiny lobes pointing forward, whitish-woolly beneath; involucre about 1.5 cm wide or less. 2. *C. crispus*

b. Leaves narrowly lanceolate, deeply incised with long spiny lobes which project backwards, smooth beneath; involucre about 1.3-2.5 cm wide. 3. *C. acanthoides*

1. **C. nutans** L. PLUMELESS THISTLE.

Sparingly introduced fro n Eu., from Penn. northwards to N. B. about seaports and towns; rare. No specimens have been seen from N. S. June-Oct.

2. **C. crispus** L. WELTED THISTLE.

The only collection seen is one from South Sydney and reported by Macoun. Aug. -Sept.

Sparingly introduced from Eu. and occasionally found about seaports.

3. **C. acanthoides** L.

Sparingly introduced in waste ground and on ballast; Yarmouth, Sydney, Pictou and Pugwash. Aug.-Sept.

Sparingly introduced from Eu. about seaports.

31. CIRSIUM (Tourn.) L. THISTLE

a. Heads large, 3-9 cm wide; plants not spreading by underground rootstocks, usually solitary.

b. Outer and inner involucral bracts spine-tipped; leaves whitish-hairy beneath, decurrent on the stem, very spiny. 1. *C. vulgare*

b. Outer bracts spine-tipped, the inner soft and spineless; leave whitish beneath, not decurrent on the stem, less deeply cut, with softer and smaller spines. 2. *C. muticums*

a. Heads small, 2-5 cm wide or less, numerous; outer bracts of the involucre appressed and barely prickly-pointed.

c. None of the leaves strongly decurrent; vigorously spreading in patches by strong running rootstocks. 3. *C. arvense*

c. Lower leaves, at least, strongly decurrent; plants solitary, not spreading by underground rootstocks. 4. *C. palustre*

1. **C. vulgare** (Savi) Airy-Shaw, in Fedde Rept. Spec. Nov. **43**: 302-315. 1938. Fig. 125, g. BULL or SCOTCH THISTLE.

Scattered throughout; open pastures, along roadsides, and in waste ground, often in grazed areas but not found in cultivated ground. July 15-Sept. [*C. lanceolatum* (L.) Hill].

Introduced from Eu.; Nfld. to Ore. south to Fla. & Calif.

2. **C. muticum** (Muhl.) Spreng. Map 469. SWAMP THISTLE.

Low ground, wooded swamps, meadows and moist places; probably throughout, often rather common. Late July-Aug.

Introduced from Eu.; Nfld. to Sask. south to Fla. and Tex.

3. **C. arvense** (L.) Scop. CANADA THISTLE.

This is the commonest of the thistles and one of the worst weeds of the province; found throughout. Forma **albiflorum** (Rand & Redf.) R. Hoffm., with white flowers, is common around Truro and occasionally seen elsewhere.

Introduced from Eu.; Nfld. to B. C. south to Va. & Utah.

4. **C. palustre** (L.) Scop.

Scattered in the vicinity of Halifax where it was found in various localities by W. G. Dore and Eville Gorham in the summer of 1944. It closely resembles *C. arvense* in general appearance.

Introduced from Eu.; Nfld. to N. H.

32. ONOPORDUM (Vaill.) L.

1. **O. Acanthium** L. COTTON THISTLE.

This plant is rather similar in appearance to the Scotch Thistle. Specimens from the province have not been seen, but it is reported in Gray's Manual from N. S. & N. B. south to N. J. It is naturalized from Eu. and may occasionally appear.

33. SILYBUM (Vaill.) Adans.

1. **S. marianum** (L.) Gaertn. LADY'S THISTLE.

An occasional garden escape, or weed of ballast or waste ground; collected at Halifax by H. Groh. Introduced from southern Eu.; rare in N. A.

34. CENTAUREA L.

a. Plants annual; leaves linear, entire; marginal flowers large and ray-like. *1. C. Cyanus*

a. Plants perennial; lower leaves wider, more or less toothed or lobed.

b. Heads small, 5-10 mm wide, the involucral bracts fringed only at the tip; lobes of the leaf very long and narrow. *2. C. maculosa*

b. Heads large, 12-20 mm wide the involucral bracts fringed to the base; leaves widely and shallowly lobed or nearly entire. 3. *C. nigra*

1. **C. Cyanus** L. BACHELOR'S BUTTON, CORN FLOWER.

This garden flower is occasionally found in waste places, around garden or on dumps, not persisting for any length of time. Aug.-Sept.

Introduced from Eu.; widely grown in N. A.

2. **C. maculata** Lam.

Sandy soil and waste places, rare; Woodside, Kings Co., collected by H. Groh, 1936. July-Aug.

N. S. to Minn. south to N. J. & Penn; introduced from Eu.

3. **C. nigra** L. Fig. 125, a. KNAPWEED.

Common along roadsides throughout, often forming a continuous band along newly disturbed embankments. It is only occasionally a weed in hayfields, although around Annapolis and other parts in southwestern N. S. it is common in both fields and pastures. The color of the involucre is variable, from black to yellowish, but this does not seem to be correlated with any other character. The pappus hairs are likewise very variable in size and number and may occasionally be absent. This last type has been named *C. nigrescens* Willd., but all gradations can be found in the province. A white-flowered plant was collected at Scott's Bay, Kings Co., by J. F. Hockey, July 1939. July-Aug.

Introduced from Eu.; Nfld. to N. J. and scattered westward.

35. CNICUS L

1. **C. benedictus** L. BLESSED THISTLE.

Rare; not collected in recent years; occasionally introduced into N. A. on ballast, in waste places or about towns. Introduced from Eu.

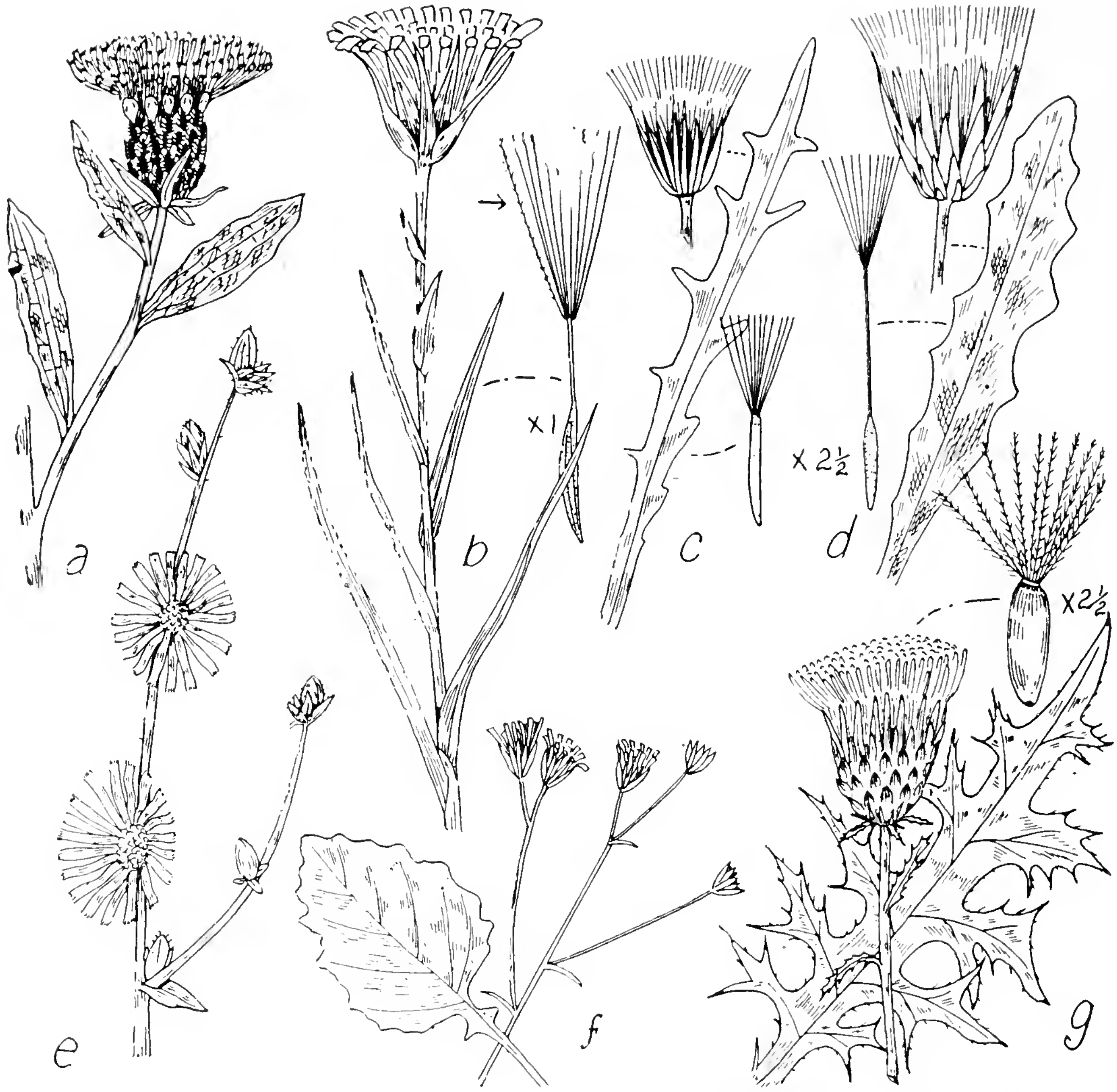


Fig. 125.—**Centaurea.** a, **C. nigra,** flower, x ½. **Tragopogon.** b, **T. pratense,** top of plant, x ½; achene. **Leontodon.** c, **L. autumnalis,** leaf, x ½; fruiting head, x 1. **Hypochaeris.** d, **H. radicata,** leaf, x ½; fruiting head, x 1; achene. **Cichorium.** e, **C. Intybus,** flowers, x ⅓. **Lapsana.** f, **L. communis,** x ½. **Cirsium.** g, **C. vulgare,** flower and leaf, x ½; achene.

36. LAPSANA L.

1. **L. communis** L. Fig. 125, f. NIPPLEWORT.

Scattered in towns or about greenhouses; Mahone Bay to Guysborough and Pictou Cos.

Introduced from Eu.; N. S. to Mich. south to Penn.

37. ARNOSERIS Gaertn.

1. **A. minima** (L.) Dumort. LAMB SUCCORY.

Fernald, 1922, reports this tiny annual plant from gravelly railroad bed and near the station at Belleville, Yarmouth Co. The plant may be easily over-looked, but with the present-day spraying of the railroad right-of-way it is doubtful if this plant still exists at that place.

Sparingly introduced from Eu. into eastern N. A.; known from no other place in Canada.

38. **CICHORIUM** (Tourn.) L.

1. **C. Intybus** L. CHICORY. Fig. 125, e.

Becoming common, especially along the roadsides of the Annapolis Valley, where the plant has often spread along the roadsides for a mile or more; occasionally seen about towns, ports, and waste places elsewhere throughout the province. It is rapidly spreading and is destined to be a common weed. July-Sept.

Introduced from Eu.; Nfld. to Wash. south to Fla. & Calif.

39. **HYPOCHAERIS** L.

1. **H. radicata** L. Fig. 125, d. CAT'S EAR.

This plant is now a bad weed in lawns, along roadsides and in fields about Yarmouth and at least to Arcadia. It is apparently of recent introduction and is known from no other place in N. S.; undoubtedly a bad weed.

Introduced from Eu.; Nfld. to Ohio & Penn.; Colorado and on the West Coast.

40. **LEONTODON** L.

1. **L. autumnalis** L. Fig. 125, c. FALL DANDELION, AUGUST FLOWER.

Common throughout, especially characteristic of roadsides and lawns after the grass has been mown. Var. **pratensis** (Link) Koch is a slightly larger plant with the involucre and the tips of the peduncles densely soft-pubescent with blackish hairs. This is about as abundant as the species in N. S. Late June-Oct. (*Apargia* Scop.).

Nfld. to Mich. south to Penn. & Ohio; introduced from Eu.

41. **TRAGOPOGON** (Tourn.) L.

a. Flowers yellow; peduncle little thickened below the flower-head. 1. *T. pratensis*

a. Flowers purplish; peduncle thickened and hollow just below the flower-head. 2. *T. porrifolius*

1. **T. pratensis** L. Fig. 125, b. GOAT'S-BEARD.

Reported in Macoun's Catalog as luxuriant at Prince's Church, Pictou; Robinson (1906) says that it had not yet spread beyond the limits of the town. It is now a common and troublesome weed in grass lands and meadows along the intervales of Pictou County. Elsewhere in the province it is frequent along railroads, roadsides, on grassy banks and occasionally in meadows from Annapolis to C. B. It is a rapidly spreading and persistent weed. *T. dubius* Scop., with involucral bracts exceeding the flowers and with the peduncles thickened at the top, is becoming common across the continent and may be present. *T. pratensis,* however, seems to be the form around Truro. July.

Introduced from Eu.; N. S. to Man. south to N. J. & Colo.

2. **T. porrifolius** L. SALSIFY, OYSTERPLANT.

This garden plant occasionally escapes or persists; rare, collected near an old estate on the ridge above Grand Pre, Kings Co.

Introduced from Eu.; N. S. to B. C. south to Ga. & Calif.

42. TARAXACUM (Haller) Ludwig DANDELION

a. Achenes brownish-green; few or none of the outer bracts of the involucre with a callosity near the summit; leaves coarsely and usually shallowly lobed.

b. Outer bracts of the involucre elongated, conspicuously reflexed even in bud. 1. *T. officinale*

b. Outer bracts rather short, lanceolate to deltoid-ovate, ascending to spreading. *T. officinale* var. *palustre*

a. Achenes reddish; most of the outer bracts with a callosity near the summit on the back; leaves deeply lobed nearly to the midrib with narrow lobes, usually reddish at the base. 2. *T. laevigatum*

1. **T. officinale** Weber. DANDELION.

Common throughout and an aggressive weed along roadsides, in lawns, pastures, and cultivated soils. May-June. (*T. palustre* (Lyons) Lam. & DC., var. *vulgare* (Sm.) Blytt. according to Fernald in Rhodora **35**: 380. 1933). Early introduced from Eu.; Nfld. to Alaska southwards.

Var. **palustre** (Sm.) Blytt. is common in low pastures, on wet slopes, and roadsides, usually small and less common than the species. Care must be taken not to confuse this plant with the next species, which it closely resembles. Introduced from Eu.; Nfld. & Que. to southern N. Eng. & Penn.

2. **T. laevigatum** (Wild.) DC. RED SEEDED DANDELION. Fig. 126, b. Scattered throughout much of the province, and common in the Annapolis Valley. It prefers drier soils than the preceeding species, and is often found on dry hillsides, new clearings in woods, and in old pastures. This species, being smaller and less aggressive, usually chooses thinner, more open turfed areas. (*T. erythrospermum* Andrz.).

Introduced from Eu.; N. S. to Alta. south to N. C. & Wyo.

43. SONCHUS (Tourn.) L. SOW THISTLE

a. Perennial with creeping rootstocks; plant to 2 m high; flower-heads about 4 cm wide; achenes 2-3 mm long.
  b. Involucre and peduncles glandular hairy. 1. *S. arvensis*
  b. Involucre and peduncles glabrous or nearly so. *S. arvensis* var. *glabrescens*
a. Annual, with fibrous roots only; flower heads 1.2-2.5 cm wide; achenes 1-1.5 mm long.
  c. Stem-leaves spiny-toothed, scarcely divided, the auricles at the base rounded; achenes not transversely wrinkled, with 3 longitudinal nerves on each side. 2. *S. asper*
  c. Stem-leaves slightly or not at all spiny-toothed; often deeply lobed, the auricles at the base pointed; achenes transversely wrinkled, with more than 3 longitudinal nerves on each side. 3. *S. oleraceus*

1. **S. arvensis** L. 126, a. PERENNIAL SOW THISTLE.

Becoming a common weed, especially along roadsides, about towns, along dykes and around ports. In places, as in Cumberland Co., it has become a troublesome weed in cultivated fields and grain fields. It is rapidly spreading in the Annapolis Valley and elsewhere in the province. Naturalized from Eu.; Nfld. to Minn. & B. C. south to N. J. & Colo.

Var. **glabrescens** Guenther, Grab. & Wimm., see Rhodora **30**: 19, 1938, is rarer than the species. It has apparently been introduced from the Prairie Region in grains and feeds, and is becoming established in orchards, around farmyards and occasionally along roadsides. This

Fig. 126.—**Sonchus.** a, **S. arvensis,** x $\frac{1}{4}$. **Taraxacum.** b, **T. laevigatum,** plant, x $\frac{1}{3}$; achene, x 5. **Lactuca.** c, **L. canadensis,** leaf and flowers, x $\frac{1}{3}$; achene, x 5. **Prenanthes.** d, **P. altissima,** x $\frac{1}{3}$.

plant, once established, appears to be the more aggressive form.

Native of Eu.; widely introduced.

2. **S. asper** (L.) Hill. SPINY SOW THISTLE.

Scattered in cultivated fields and gardens throughout; it is usually not an aggressive weed but is found in small numbers in rich soil or about buildings and orchards. Several forms of this and the next species exist and may grow together, so that at times it is rather difficult to know just which species is concerned.

Introduced from Eu.; throughout the world.

3. **S. oleraceus** L. ANNUAL SOW THISTLE.

Scattered to common in cultivated fields, waste places, along roadsides and in orchards, found in similar habitats and very similar to the preceeding species.

Native of Eu.; now spread throughout the world.

44. LACTUCA (Tourn.) L. WILD LETTUCE

Wiegand, K.M. Variations of *Lactuca canadensis* L. Rhodora **22**: 9-11. 1920. Fernald, M.L. *Lactuca.* Rhodora **40**: 477-481. 1938.

a. Achenes beakless or nearly so; flowers bluish; pappus hairs tawny. 1. *L. biennis*

a. Achenes with a long slender beak; flowers cream-colored; pappus whitish.

  b. Involucre 10-14 mm long; achenes 3-3.5 mm long; pappus hairs 5-7 mm long.

    c. Leaves all unlobed, with a clasping base. 2. *L. canadensis*

    c. Leaves all, or at least the lower, lobed.

      d. Leaves with the lobes narrow and curved, the upper unlobed leaves linear, pointed or arrow-shaped at the base. *L. canadensis* var. *longifolia*

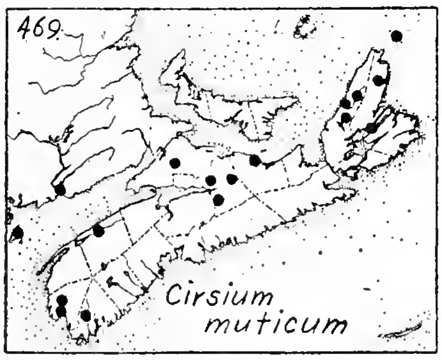
      d. Leaves with the lobes much broader, often toothed, obliquely truncate at the tip; upper leaves wider, winged and clasping at the base. *L. canadensis* var. *latifolia*

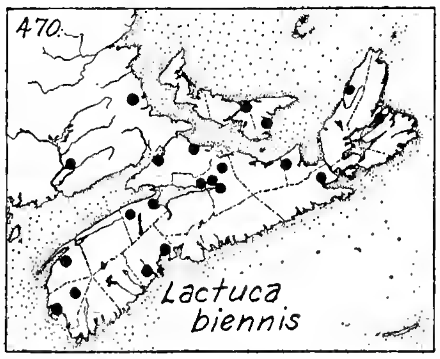
  b. Involucre 16-22 mm long; achenes 7-9 mm long; pappus hairs 9-12 mm long. 3. *L. hirsuta*

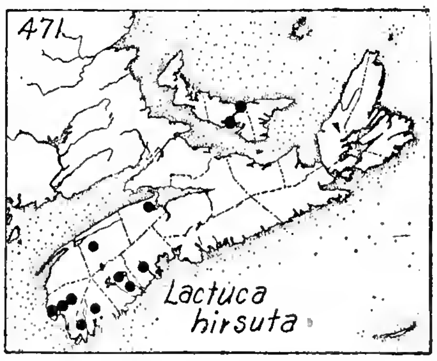
1. **L. biennis** (Moench.) Fern., Rhodora 42: 300. 1940. Map 470. FALL WILD LETTUCE.

Scattered throughout, and common from Annapolis Co. to northern C. B.; along roadsides, in clearings, waste places and pastures. It is very conspicuous along roadsides in the northern part of the province in late summer. July-Sept. [*L. spicata* (Lam.) Hitch.].

Nfld. to Man. south to Tenn. & Colo.







2. **L. canadensis** L. Fig. 126, c. WILD LETTUCE.

Scattered throughout; a weed of waste places, roadsides, edges of thickets and open woodlands (*L. integrifolia* Bigel.). July-Aug. N. S. to Wisc. south to Ga. & Okla.

Var. **longifolia** (Michx.) Farw. is a common weed; waste places, roadsides and burnt-over land. N. S. to B. C. south to La.

Var. **latifolia** O. Ktze is rare; found occasionally in open woods and along roadsides; perhaps an ecological form. N. S. to Wisc. south to Fla.

3. **L. hirsuta** Muhl., var. **sanguinea** (Bigel.) Fern., Rhodora **40**: 481. 1938. Map 471.

Scattered in Yarmouth, Shelburne and Queens Cos.; east to Kings Co.; P.E.I., where it is rare. Aug.

P.E.I. to N.Y. and south to Va., La. & Tex.

45. PRENANTHES (Vaill.) L.

a. Heads slender, nearly erect, mostly 12-16-flowered; involucre pubescent; leaves sessile. 1. *P. racemosa*

a. Heads stouter, commonly pendulous, 5-12-flowered (Fig. 126, d); involucre glabrous; leaves mostly petioled.

b. Heads 8-12-flowered; principal involucral bracts 8.

c. Plant 1.5-15 dm high; inflorescence paniculate; outer involucral bracts lance-deltoid, the longest 1.5-2.5 mm long. 2. *P. trifoliolata*

c. Plant 0.5-7.5 dm high; stem unbranched and the inflorescence a panicle, rarely more branched; outer involucral bracts ovate to ovate-lanceolate, very unequal, the longest 3-6 mm long. *T. trifoliolata* var. *nana*

b. Heads 5-6-flowered; principal involucral bracts 5. 3. *P. altissima*

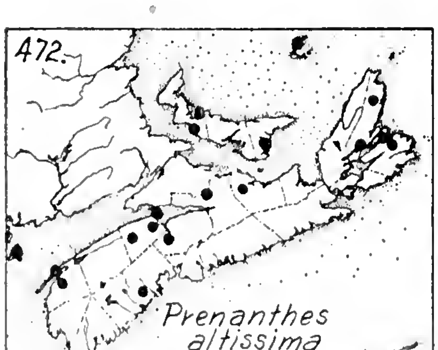
1. **P. racemosa** Michx. RATTLESNAKE ROOT.

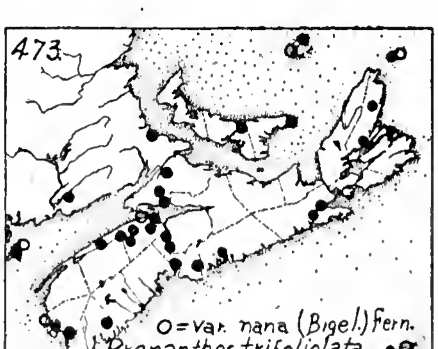
Reported in Macoun's Catalog as common at Sydney Mines; the only specimen seen from the Maritimes was from Saint John, N. B.

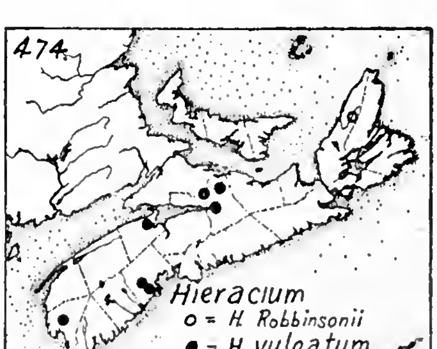
N. S. to Alberta south to N. Y.

2. **P. trifoliolata** (Cass.) Fern. Map 473. LION'S-PAW.

Found in rich woods, or also in light open woods, in gravelly, sandy or more acid soils, along the edge of thickets and on wooded roadsides; common throughout; Nfld. to N. S. and Mo. south to N. C. & Tenn.







Var. **nana** (Bigel.) Fern. is found on mossy places, barrens, turfy crests, and around the cooler coasts of the province; scattered around the coast of C. B., rare elsewhere. Lab. & Nfld. to the coast of N. S. and the higher mountains of New England and northern N. Y.

3. **P. altissima** L. Map 472.

Rich woods from Digby Neck to northern Cape Breton; rare or absent in the southwestern counties. July-Aug. Forma **hispidula** Fern., Rhodora **23**: 300. 1921, has the stem hairy and the leaves pubescent at least on the veins on the underside. Rich woods; Sandy Cove (Fernald, 1921).

Nfld. to Man. south to Tenn. & Ga.

46. HIERACIUM (Tourn.) L. HAWKWEED

a. Leaves all basal, not toothed nor lobed; stolons present or absent.
 b. Flowers solitary, or with an additional one or two smaller ones.
  c. Flowers solitary; leaves green above, strongly whitened beneath with stellate hairs; plants with strong spreading stolons. 1. *H. Pilosella*
  c. Flowers usually in 2's or 3's; leaves green on both sides; flowers smaller; stolons weakly spreading. 2. *H. Auricula*
 b. Flowers numerous in a crowded corymb-like inflorescence, 2 cm or less in width.
  d. Leaves setose to hirsute on both surfaces; stolons present, often rather weakly developed; plants not glaucous.
   e. Flowers orange-red; leaves long-hirsute. 3. *H. aurantiacum*
   e. Flowers yellow; leaves setose only. 4. *H. pratense*
  d. Leaves glabrous to slightly hairy, but not densely setose, more or less glaucous; flowers yellow.
   f. Rootstock slender and elongated; stolons numerous. 5. *H. floribundum*
   f. Rootstock short, stout and abuptly terminated; stolons absent or very weak. 6. *H. florentinum*
a. Leaves numerous and scattered along the stem, lanceolate to ovate, if mainly basal then deeply toothed or lobed; stolons absent; heads various, to 4.5 cm wide.
 g. Leaves mainly basal, with one to several smaller ones often found along the stem, elliptical to ovate, toothed, the lower long petioled; flower-heads 2-4.5 cm wide.
  h. Stem naked or with one or two leaves borne near the base; lowest leaves with rounded or cordate bases. 7. *H. murorum*
  h. Stem with several leaves which are rapidly reduced in size upwards; lowest leaves attenuate to the petioles.
   i. Involucre and pedicels stipitate-glandular, with no or but few glandless hairs overtopping the glands. 8. *H. vulgatum*

i. Involucre and pedicels glandless or only very minutely glandular, copiously long-pilose or villous. 9. *H. Robinsonii*

g. Leaves numerous, scattered along the stem, the lower ones not conspicuously larger than the stem-leaves.

j. Plant very rough-hairy, stout; axils and branches of the inflorescence white-tomentose with numerous dark glands; leaves without a bloom, more or less hairy, nearly entire.

k. Lower internodes, petioles and mid-ribs of the leaves with long slender hairs; leaves with scattered hairs on the upper surface. 10. *H. scabrum*

k. Lower internodes often with a white tomentum, but only with short stiff hairs; leaves glabrous except for minute gland-tipped hairs. *H. scabrum* var. *leucocaule*

j. Plant nearly glabrous or smooth; axis and branches of the inflorescence without glands; leaves conspicuously toothed.

l. Flower-heads 10-22 mm wide, on widely spreading, slender, glabrous flexuous branches. 11. *H. paniculatum*

l. Flower-heads 25-45 mm wide, on stiff, erect pubescent branches.

m. Involucre 8-13 mm high; upper internodes of the stem and branches without or with only a few scattered stiff hairs.

n. Involucre dark; leaves mostly 8-20, remote; heads 1 to several in an open panicle. 12. *H. canadense*

n. Involucre olive; leaves 25-50 or more, often crowded; heads many, crowded. *H. canadense* var. *fasciculatum*

m. Involucre 5-10 mm high; upper internodes of the stem and branches copiously villous-hirsute. *H. canadense* var. *hirtirameum*

1. **H. Pilosella** L. Fig. 127. MOUSE-EAR HAWKWEED.

Abundant and one of the worst pasture weeds of the province. It was introduced about 40 years ago near Pictou, and has by now spread throughout the province. It is especially common in the eastern part of the province, and the abundance of the plant is correlated with open soils, bare slopes and over-grazed pastures. Var. *viride* Ser. is a coarser plant with the leaves green on both surfaces. This has been listed for the province, but has not been noticed in recent years. Late June-early Aug.

Introduced from Eu.; eastern America.

2. **H. Auricula** Lam.

This small species is local, but often covers considerable areas; leached pastures and bare slopes on the south side of the Annapolis Valley south of Kentville and at Waterville.

Introduced from Eu.; unknown elsewhere in America.

3. **H. aurantiacum** L ORANGE HAWKWEED, DEVI'LS PAINT BRUSH

Local, but becoming more common. This species, like the following, has become established in back regions on leached, well-drained soils of old pastures and fields. At Advocate it extends for miles; in the Annapolis Valley it is slowly becoming established in many locations; and it is scattered elsewhere. Once established it is very persistent. June 20-July.

Introduced from Eu.; N. S. to Ont. & Penn.

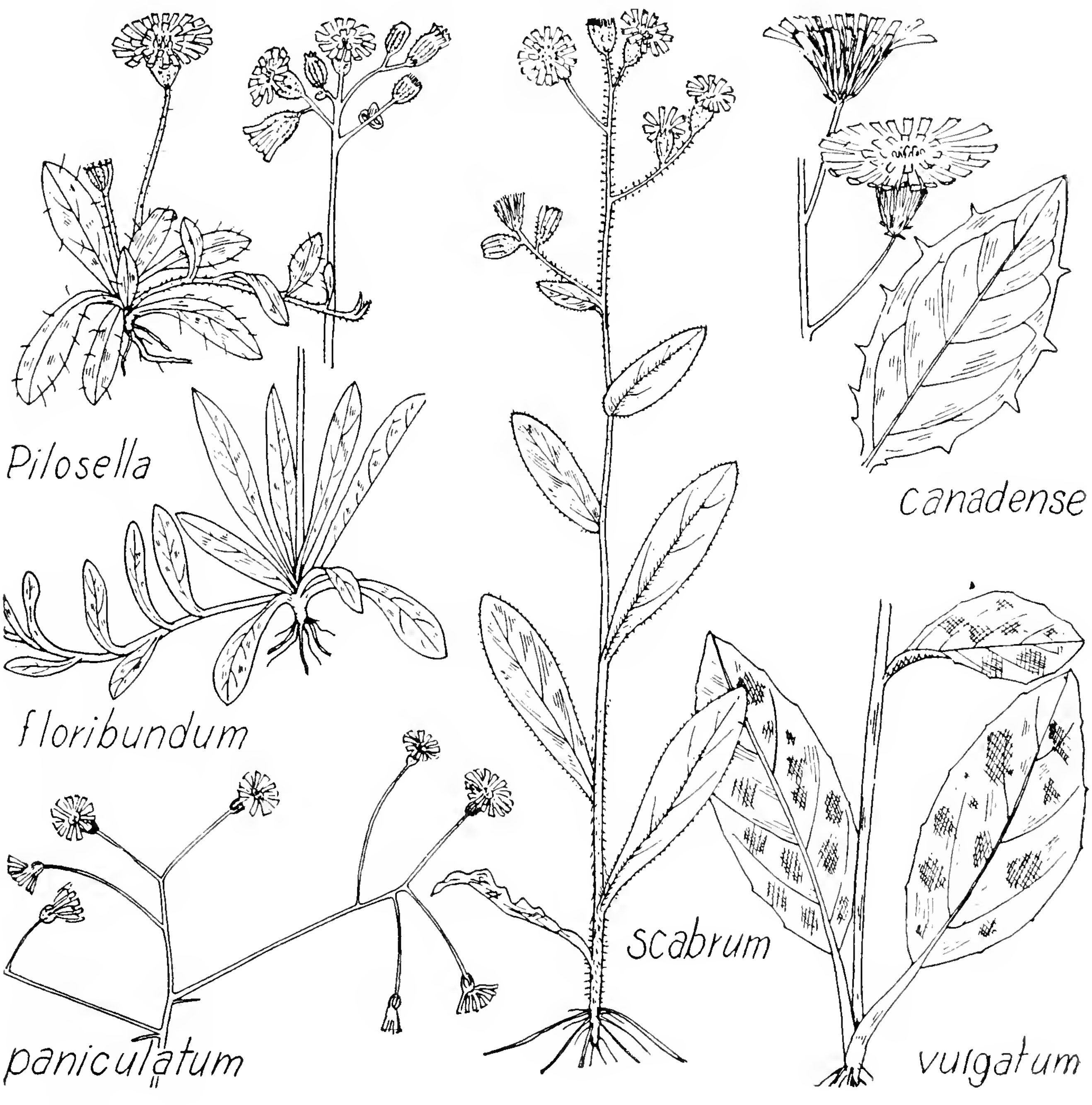


Fig. 127.—**Hieracium.**

4. **H. pratense** Tausch. HAWKWEED.

Scattered or local from Digby Co. to northern C. B. Along the Cobequids and in other hilly areas with leached and open soils it becomes abundant and often dominant along roadsides, in fields and open areas, rarely found in cultivated fields. The two following species are often considered as varieties of this one, but since they are distinct so far as Nova Scotia is concerned they are here kept separate. July-Aug.

Introduced from Eu.; N. S. to N. Y. & Penn.

5. **H. floribundum** Wimm. & Grab. KING DEVIL. Fig. 127.

This rapidly spreading plant is common in the northern part of the province, and scattered elsewhere; old fields, pastures, roadsides, etc.

Introduced from Eu. into eastern U.S. and Can.

6. **H. florentinum** All. KING DEVIL.

Rather rare northwards and confined to old fields, sandy roadsides and banks. This plant is tall in this part of the province, often over 5 dm high, and rather local. In the Annapolis Valley another and lower form is very common. In general the introduced hawkweeds are quite uniform in the province, since they have originated from or e or a few scattered introductions.

Introduced from Eu.; N. S. to Ont. and N. Y.

7. **H. murorum** L. GOLDEN LUNGWORT.

Sparingly introduced; Sydney and Bridgewater.

Introduced from Eu.; N. S. to Que.

8. **H. vulgatum** Fries. Fig. 127. Map 474.

Local in Cumberland and Colchester Counties; often common along roadsides in the mountains, and scattered southward along the railroad to Halifax: rare elsewhere. July.

Introduced from Eu.; local from Nfld. and Que. to N. Y.

9. **H. Robinsonii** (Zahn) Fern., Rhodora **45**: 317. 1943.

Gravel in river bottoms, Big Intervale, C. B., Macoun's collection no. 16,699. See Fernald in Rhodora 45: 319. 1943, for a key to this and the preceeding two species.

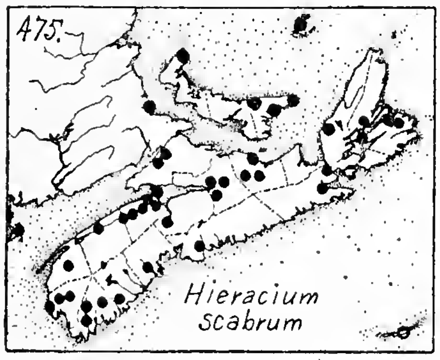
Nfld. to N. S., Me., N. H. & Que.

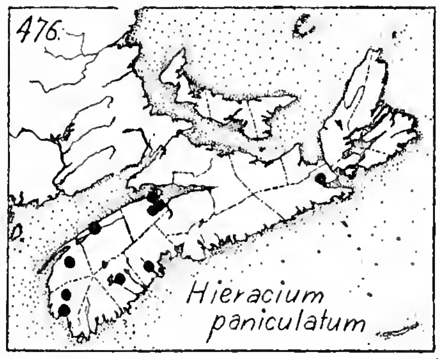
10. **H. scabrum** Michx. Fig. 127. Map 475. ROUGH HAWKWEED.

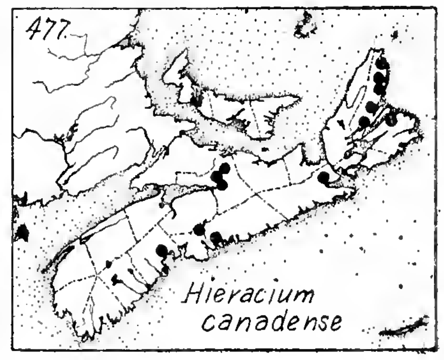
Common throughout; old fields, pastures, rough land and sandy soil. July-Aug. Fernald (1922) reports "a large colony exactly combining the characters of *H. paniculatum* and *H. scabrum* and more abundant than either of them, in dry pine and oak woods on steep slopes along the

Lahave River, Bridgewater." N. S. to Minn. south to Ga. & Kans.

Var. **leucocaule** Fern. & Saint John, Rhodora **16**: 182. 1914, is known only from Sable Is.; scattered over the barrens.







11. **H. paniculatum** L. Fig. 127. Map 476.

Mixed or dry deciduous woods; occasional from Yarmouth east to Kings and Lunenburg Counties, rather common in oak and mixed woods near Kentville; found at Boylston, Guysborough Co.

N. S. to central Me. to Mich. south to Ga. & Ala.

12. **H. canadense** Michx. Fig. 127. Map 477. CANADA HAWKWEED.

Scattered in C. B. along streams, ravines, and on cliffs; grading into the next variety southward. Lab. to B. C. south to Me., Mich. and Ore.

Var. **fasciculatum** (Pursh) Fern., Rhodora **45**: 320. 1943, is scattered, probably throughout the province, becoming common along the roadsides in the Cobequids; occasionally observed in large patches elsewhere. July-Sept.

Var. **hirtirameum** Fern., Rhodora **17**: 19. 1915, is local, and not well known. Collections resembling it have been seen from Guysborough Co. and from Cape Breton.

Nfld. to Wisc. south to N. Eng. & Penn.

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GLOSSARY

Achene. Dry one-celled one-seeded fruit.
Acuminate. Gradually tapering to a point or end.
Acute. Quickly tapering to a sharp point.
Anther. Pollen-bearing part of the stamen.
Apetalous. Without petals.
Apiculate. With a minute point.
Appressed. Lying close or flat against.
Approximate. Closely situated without running together.
Areolate. Reticulated, marked out into small areas.
Aristate. Tipped by a bristle.
Articulate. Jointed.
Ascending. Rising obliquely and curving upward.
Attenuate. Slenderly tapering.
Awn. A bristle-shaped appendage.
Axil. Angle formed by leaf or branch with the stem.
Axillary. Situated in an axil.
Biennial. Lasting two years.
Bisexual. With both stamens and pistils.
Blade. Expanded portion of a leaf.
Bract. Modified or scale-like leaf.
Bracteate. Having bracts.
Bracteole. Small bract.
Campanulate. Bell-shaped.
Canaliculate. Longitudinally channelled.
Canescent. Gray-pubescent.
Capillary. Hair-like.

Capsule. Dry fruit of more than one carpel, opening when ripe.
Carpel. A single pistil, or the equivalent of one in a compound pistil.
Caruncle. Growth or appendage near the hilum of the seed.
Castaneous. Dark-brown.
Cespitose. Growing in tufts.
Chaff. Thin scales or bracts, particularly on the receptacle of the Compositae.
Ciliate. Fringed with hairs.
Ciliolate. Minutely ciliate.
Cinerous. Ash-colored.
Clasping. Of the base of a leaf, partly surrounding the stem.
Clavate. Club-shaped.
Cleistogamous. Fertilized without the opening of the flower.
Conduplicate. Folded together.
Convolute. Rolled up longitudinally.
Cordate. Heart-shaped with point upwards.
Corm. Enlarged base of stem, bulb-like but solid.
Coriaceous. Leathery.
Corymb. Flat-topped or convex flower-cluster with the outer flowers opening first.
Costate. Ribbed.
Cotyledon. Seed-leaf, often the first to appear above ground.
Crenate. Toothed with rounded, shallow teeth.
Crenulate. Finely crenate.
Culm. Stem of grasses and sedges.
Cuneate. Wedge-shaped.
Cuspidate. Sharp-pointed with a rigid or hard point.
Cyme. Flat-topped flower-cluster with the central flowers opening first.
Deciduous. Quickly falling; not persistent.
Decompound. More than once divided.
Decumbent. Reclining with the ends ascending.
Dehiscent. Opening or splitting.
Dentate. Toothed with outwardly directed teeth.
Denticulate. Minutely dentate.
Depressed. Flattened from above.
Dichotomous. Forking.
Diffuse. Loosely or widely spreading.

Dioecious. Staminate and pistillate flowers on different plants.
Distichous. In two vertical ranks.
Divaricate. Widely spreading.
Dorsal. Relating to the back or the outer surface.
Drupe. A fleshy indehiscent fruit with a stone as in cherries.
Drupelet. A small drupe, as in Raspberry.
Entire. Without teeth or divisions.
Epiphytic. Growing on other plants.
Excurrent. With a projecting tip.
Exocarp. Outer layer of the fruit coat.
Exserted. Prolonged beyond the surrounding parts.
Fastigiate. With stems or branches erect and near each other.
Fertile. Capable of bearing fruit; or pollen in connection with anthers.
Fibrillose. With or broken up into fine fibers.
Filament. Stalk of the stamen.
Filiform. Thread-like.
Fimbriate. Fringed.
Floret. A small flower, usually one of a dense cluster.
Foliaceous. Leaf-like.
Foliolate. Having leaflets.
Follicle. Fruit of one carpel, opening by a ventral suture.
Frond. Leaf of a fern.
Fuscous. Grayish-brown.
Gibbous. Swollen on one side.
Glabrate. Nearly glabrous or becoming so with age.
Glabrous. Not hairy.
Glaucous. Covered with a bluish-white or grayish bloom.
Glomerule. A small compact cluster.
Halophyte. Plant growing on brackish or salty locations.
Hastate or *halberd-shaped.* Like an arrow head, with the basal lobes pointing outward nearly at right-angles.
Herbaceous. Not woody; leaf-like in color and texture.
Hilum. Scar or point of attachment of the seed.
Hirsute. With coarse or stiff hairs.
Hirtellous. Minutely hirsute.
Hispid. With rigid or bristly hairs.
Hispidulous. Minutely hispid.
Hyaline. Transparent or translucent.
Imbricate. Overlapping.

Incised. Cut sharply and irregularly.
Included. Not protruding.
Indefinite. Very many, or inconstant in number.
Indehiscent. Not opening nor splitting.
Indigenous. Native and original to the area.
Indurated. Hardened.
Indusium. Covering of the fruiting dot or sorus in the ferns.
Inferior ovary. One joined to the calyx.
Inflorescence. Flowering part of the plant.
Involucel. Small or secondary whorl of bracts.
Involucre. A sheath or collection of bracts about a flower or inflorescence.
Involute. Rolled inward.
Irregular. Having the members of a whorl of flower-parts unequal in shape, size or union.
Lacerate. Irregularly cleft.
Laciniate. Cut into narrow pointed lobes.
Lanceolate. Several times longer than wide, widest be'ow the middle and tapering to the apex.
Leaflet. A single division of a compound leaf.
Lenticular. Lens-shaped.
Linear. Long and narrow with parallel sides.
Megaspore. The larger size of spore in *Selaginella* or *Isoetes*.
Moniliform. Like a string of beads.
Monoecious. With stamens and pistils on separate flowers on the same plant.
Mucronate. With a short, small abrupt point.
Nerve. Unbranched vein or simple slender rib.
Obcordate. Inverted heart-shaped; with the point downwards.
Oblanceolate. Lanceolate with the widest part above the middle.
Oblong. Longer than broad with nearly parallel sides.
Obovate. Inverted ovate, the broadest part above the middle.
Obovoid. Egg-shaped, the widest part uppermost.
Obsolescent. Becoming rudimentary or obsolete.
Obtuse. Blunt or rounded at the end.
Ocrea. A tubular stipule: Smaller ones being ocreolae.
Ovary. Part of the pistil containing the ovules; the enlarged base.

Ovate. With an outline like that of an egg, the broader end downward.

Ovoid. Solid with an oval outline.

Ovule. The part of the ovary which after fertilization becomes the seed.

Palmately. With the lobes or divisions coming from one point, or area.

Panicle. A loose irregular flower-cluster with stalked flowers.

Pappus. The modified calyx in the *Compositae* florets.

Parthenogenetic. Developing without fertilization.

Pectinate. Comb-like with narrow closely-set segments.

Pedicel. Stalk of an individual flower.

Peduncle. Stalk of an inflorescence or a solitary flower.

Perfect. With both stamens and pistils.

Perfoliate. Having the stem apparently pass through the leaf.

Perianth. Calyx and corolla together.

Pericarp. Wall of the fruit.

Perigynium. Inflated sac which encloses the ovary in *Carex.*

Persistent. Long-continuous or lasting.

Petaloid. Colored and resembling a petal.

Petiole. Stalk of a leaf.

Pilose. With soft hairs.

Pinna. One of the main divisions of a frond or leaf.

Pinnate. Compound with the leaflets arranged along each side of a common stalk or axis.

Pinnule. A division of a pinna.

Placenta. Any part of the inside of the ovary which bears ovules.

Plicate. Folded into plaits, usually lengthwise.

Plumose. With fine hairs on each side.

Pome. A fleshy fruit, like that of the apple.

Puberulent. Minutely pubescent.

Pubescent. Covered with hairs, especially short, soft ones.

Pulverulent. Powdered as if by grains of dust.

Punctate. Dotted with depressions, colored dots, or glands.

Pyriform. Pear-shaped.

Raceme. Inflorescence with stalked flowers upon an elongated axis.

Radiate. Spreading from a common center; with ray flowers.

Receptacle. Tip of the stem which bears the flower-parts.

Regular. Uniform in shape and function.

Reniform. Kidney-shaped.

Reticulate. In the form of a network.

Rhachis. Axis of a spike or of a compound leaf.

Rhaphe. Ridge along side of a seed formed by the fused stalk and seed-coat.

Rhizome. Prostrate or underground stem; rootstock.

Rufous. Reddish-brown.

Sagittate. Arrow-head shaped, the lobes directed downwards.

Samara. Indehiscent winged fruit.

Scabrous. Rough to the touch.

Scape. Peduncle rising from the ground, without leaves or nearly so.

Scarious. Thin, dry and papery, not green.

Sepal. Division of the calyx.

Serrate. With sharp teeth pointing forward.

Serrulate. Finely serrate.

Sessile. Without a stalk or petiole.

Setaceous. Bristle-like.

Setose. Beset with bristles.

Setulose. Having minute bristles.

Simple. Of one piece; not compound.

Sorus. Fruit-dot of a fern.

Spadix. Spike with a fleshy axis.

Spathe. Large bract or pair of bracts enclosing or lying behind an inflorescence.

Spatulate. Gradually narrowed downward from a rounded summit.

Spicate. Resembling a spike.

Spike. Inflorescence with the flowers sessile or nearly so upon an elongated common axis.

Spore. Reproductive organs of ferns and their allies, corresponding to the seed of higher plants but much simpler.

Stellate. Star-shaped.

Sterile. Flower without a pistil or stamen without an anther.

Stigma. Tip of the pistil, for reception of the pollen.

Stipe. Stalk of a pistil; stalk of frond of a fern.
Stipule. Appendages, often leaf-like, at the base of the petiole or on each side.
Stoloniferous. Producing runners or stolons.
Striate. Marked with fine longitudial lines.
Strigose. With appressed sharp stiff hairs.
Style. Upper part of the pistil connecting the ovary and stigma.
Subulate. Awl-shaped.
Sulcate. Grooved or furrowed.
Superior. (Ovary) Free from the calyx.
Suture. Line of union or splitting.
Terete. Having a circular cross-section.
Ternate. In threes.
Testa. Outer seed-coat.
Tomentose. Densely pubescent with matted wool.
Trifoliolate. With three leaflets.
Trigonous. Three-angled, as a buckwheat seed.
Truncate. Ending abruptly as if cut off transversely.
Umbel. Inflorescence with the pedicels or peduncles arise from the same point.
Valve. One of the pieces into which a capsule splits; sepal in *Rumex.*
Verticillate. Arranged in a whorl.
Ventral. Belonging to the front or inner surface of a part or organ.
Villous. Bearing long and soft hairs.
Viscid. Glutinous; sticky.

PRESIDENTIAL ADDRESS

Ernest Hess

(Read October 11, 1944)

It is with great regret that I have to report to you the loss through death, of two of our members, during the past session. Both men had belonged to us for twenty five years and more, and both had devoted a life time to the teaching of science.

Donald John Matheson passed away on June 19th, after a short illness. A native of Cape Breton, a graduate of Pictou Academy and Dalhousie University, he began his teaching career at Port Hawkesbury and moved to Halifax in 1905. Teaching first at Morris Street School, he later became Science teacher at the Halifax Academy and at the time of his retirement, five years ago, he was Principal of that Institution. The late Mr. Matheson became a member of the Nova Scotiann Institute of Science in November 1915. He will always be remembered as our most efficient treasurer during a period of twenty years. During his tenure of this office the financial affairs of the Institute have prospered continuously. In recognition of his untiring and faithful services the Council elected him an honorary member of the Institute two years ago.

On February 22nd E. Walter Todd died suddenly at the age of 68, after several years of ill health. Though born in New York, he grew up in Northern Ireland, where he attended the Methodist and Queen's Colleges in Belfast. Shortly after coming to Halifax in 1919, he graduated from Dalhousie University and joined the staff of the Department of Chemistry of the University, where he served faithfully and successfully until his retirement in 1940. He had become a member of the Nova Scotian Institute of Science in November 1919 and was always one of the most regular attendants at our meetings. For four sessions, prior to his retirement, he was a member of the Council. The Institute has lost a loyal supporter in his passing.

The past session, the eighty-second one in the history of the Institute, has not been quite as busy as the previous one. In five ordinary meetings thirteen papers were presented and four demonstrations given. Biochemical papers held the forefront, with Physiology, Biology, Chemistry and Bacteriology following. As in previous war years a scarcity of papers in Physics and Chemistry accounted largely for the below-average number of papers submitted. Other factors contributing to this are the smaller number of graduate students presenting their research work and a decrease in the amount of research work carried on by the Fisheries Research Board members, due to more urgent war time work.

A departure was made this year with the introduction of an extraordinary meeting which took the form of a Symposium. Three speakers, two members of the Institute and a guest, shared in the presentation of the subject; the chemistry, sources, production and the physiology of

Vitamins A and D. Judging by the opinions expressed by the audience the experiment of holding such a meeting must be considered quite successful.

Our membership shows a slight net increase; three ordinary, two associate and four student members have been elected during the session. Seven of our members are in active service and several are doing full or part time war work. The attendance at the meetings was good, with an average of 25 and a maxium of 31 members and guests being present.

The war effort has undoubtedly stimulated scientific research in many fields to a degree hitherto unknown and has put almost unlimited financial and material resources at its disposal. If we may be permitted to look forward to the post war era, let us hope that scientific research will find an equally prominent place and equally ready support by the powers that be, to enable it to contribute its share in the development of a more peaceful world.

Concluding my term of office, I wish to thank all members of the Institute for their forebearance with my short-comings. It was an honour and a pleasure to preside over your meetings. To the Council, which in eight meetings has guided the course of the Institute for another session, special thanks are due. The offices of the treasurer and the two secretaries (not to mention the poor editor) often entail considerable work which is perhaps not always fully appreciated by the membership at large.

Last, but not least, for the future of the Nova Scotian Institute of Science, may I be permitted to use an old academic wish:

"Vivat, Crescat, Floreat!"

PROCEEDINGS OF MEETINGS

Session of 1944-45

(All meetings were held in the Medical Sciences Building, Dalhousie University, Halifax.)

83rd *Annual Business Meeting,* October 11, 1944.

The Presidential address was given by Dr. Ernest Hess, and it is printed in full in the Proceedings.

The Treasurer's Report is summarized as follows:

Receipts	$ 813.27
Expenditures	1062.86
Assets, current account	1033.60
Assets, permanent fund	5500.00

The Corresponding Secretary reported that 16 numbers of back files and bound volumes of the Proceedings had been sent out. The Librarian reported the receipt of 641 publications through the exchange list, the U.S.S.R. being the only continental European country sending material to the Institute. Publications of about 30 societies have been bound up to date. A total of 1096 books and pamphlets had been borrowed from the Library.

The Editor reported that the current number of the Proceedings was now in process of publication.

Officers elected for the year 1944-45 were:

President	Dr. F. R. Hayes
1st Vice President	Dr. C. C. Coffin
2nd Vice President	Dr. C. B. Weld
Treasurer	Prof. W. P. Copp
Corresponding Secretary	Dr. M. K. McPhail
Recording Secretary	Dr. H. B. Collier
Council	Dr. S. A. Beatty, Dr. A. E. Cameron, Dr. W. J. Chute, E. K. Crowdis, Esq., Dr. E. Hess.
Editor	Dr. E. Hess
Librarian	E. K. Crowdis, Esq.
Auditors	Prof. R.J. Bean Dr. H.L. Bronson
Nominations to the Provincial Science Library Commission	Dr. F.R. Hayes, Dr. E.G. Young

First Ordinary Meeting, November 13, 1944.

The following new members were announced (elected by Council October 23); Ordinary, Dr. E. C. Black, C. H. Castell; Student. E. Gorham, Miss H. J. Macdonald, J. B. Neilands.

Papers: "Fractionation of Fish Proteins," by W.J. Dyer; "The Inhibition of Triamineoxidease. I. Products of Protein Cleavage," by J. B. Neilands; "Isolation of Fructuronic Acid from Irish Moss," by F. A. H. Rice.

Second Ordinary Meeting, December 18, 1944.

The following new members were announced (elected by Council November 27): Ordinary, Dr. M.R. Foran, Dr. A.G. Nutlay; Student, E.J. Caule, B.L. Funt, S. Schrage, G.R. Vavasour.

Papers: "The Effect of Temperature on the Growth and Efficiency of Yolk Conversion in a Salmon Embryo." by F.R. Hayes and D. Pelluet; "The Flora of Nova Scotia," by A.E. Roland.

Third Ordinary Meeting January 15, 1945.

Papers: "Xenoliths and Contacts near Halifax, N.S., " by G.V. Douglas and E. Wellington; "Settlement of Marine Wood-borers on floating and fixed submerged wooden Test Blocks," by E.C. Black and C.R. Elsey; "The Stablizing Power of Irish Moss towards insoluble inorganic Salts," by F.A.H. Rice.

Fourth Ordinary Meeting February 12, 1945.

The following new members were announced (elected by Council January 22, 1945): Student, D. Ferguson, R.G.S. Bidwell, J.M.Snow.

Papers: "Gas Exchange in the Swimbladders of Fish," by V.S. Black; "Spoilage of gutted Cod stored in crushed Ice," by J.M. Snow. W.J. Dyer and F.E. Dyer; "The Settlement of Marine Wood-borers in the coastal Waters of British Columbia," by E.C. Black and C.R. Elsey.

Extraordinary Meeting March 12, 1945.

The following new student member was announced (elected by Council March 12, 1945): Thurston Dickinson.

R. A. Hornstein, Meteorologist in Charge, Halifax District Forecast office, gave a paper on "The Development of Modern Meteorology." The paper was followed by an animated discussion.

Fifth Ordinary Meeting, April 9, 1945.

Papers: "Further Observations on the Asphyxiation of fresh-water Fish at various Tensions of Carbon Dioxide," by E.C. Black, V.S. Black, and F.E.J. Fry; "The Use of Plant Tissues for culturing Thermophilic Anaerobic Bacteria found in Foods," by C. H. Castell; "A Milkweed Survey in Ontario and adjacent Quebec," by H. Groh and W.G. Dore.

Extraordinary Meeting, May 1, 1946.

A joint meeting of the Nova Scotian Institute of Science and the Maritime Section, Chemical Institute of Canada. Dr. A. Stanley Cook, Director of Research for Ayerst, McKenna, and Harrison, Ltd., Montreal delivered an illustrated address entitled, "The history and manufacture of antibiotics."

Dr. E.G. Young, Chairman of the Maritime Section of the C.I.C., was in the chair, and Dr. F.R. Hayes, President of the Nova Scotian Institute of Science, moved a vote of thanks to the speaker.

ABSTRACTS

(Papers read before the Institute but not published in the Proceedings)

FRACTIONATION OF FISH PROTEINS. W. J. Dyer, Atlantic Fisheries Experimental Station, Halifax, N.S. (Read November 13, 1944). Preliminary work on the separation and characterization of the various fish proteins has been completed, with a view to the study of the denaturation of these proteins.

THE INHIBITION OF TRIAMINEOXIDEASE. I. PRODUCTS OF PROTEIN CLEAVAGE. J.B. Neilands, Atlantic Fisheries Experimental Station, Halifax, N.S. (Read November 13, 1944). Using washed cells, the effect of glycogen, ammonia, indole, skatole, and hydrogen sulfide on the enzyme triamine-oxidease of five unidentified bacterial species has been investigated. Inhibitors such as cysteine, sodium thioglycollate, potassium cyanide, sodium azide, and carbon monoxide, have been used to substantiate our claim that the catalyst contains heavy metal. With sterile muscle press-juice as hydrogen donator the reduction by mixed cultures has been studied. A search has been made in the genus *Clostridium* for trimethylamineoxidease.

ISOLATION OF FRUCTURONIC ACID FROM IRISH MOSS. F.A.H. Rice, Dept, of Biochemistry, Dalhousie University, Halifax. N.S. (Read November 13, 1944). 2-keto-glucuronic acid has been identified in the hydrolytic products of Irish Moss extract. It has been shown that hydroylsis of di-isopropylidine-2-keto-glucuronic acid by oxalic acid in the presence of an excess of potassium does not cause a complete breakdown of the molecule, but a certain amount is retained, probably as the K salt. It is suggested that 2-keto-glucuronic acid is probably a constituent sugar of the gelose molecule.

THE EFFECT OF TEMPERATURE ON THE GROWTH AND EFFICIENCY OF YOLK CONVERSION IN A SALMON EMBRYO: F.R. Hayes and D. Pelluet, Dept. of Biology. Dalhousie University, Halifax, N.S. (Read December 18, 1944). Salmon larvae were placed in a series of 12 temperature chambers, ranging from 0.2° to 16.0° C., at approximately the time of hatching. The changes in weight of the embryo and yolk sac were followed for some time and finally brought to a common value representing the embryo gain (or yolk loss) in weight in 10 days. From the results were calculated the temperature coefficient, Q_{10} for embryo growth, which showed a drop in the colder chambers from about 8 to a value of a little over 2 at 8° the latter value being maintained at higher temperatures. When the Q_{10} for activity (yolk loss minus embryo gain) was worked out it proved to follow the same plan as the growth values mentioned above.

The effect of temperature on efficiency was also worked out. Efficiency is defined as $\frac{\text{dry embryo gain x 100}}{\text{dry yolk loss}}$. Efficiency in the cold chambers was found to be low and constant at about 42%. At 5° it began to rise, to reach a maximum of nearly 60% in the warmest chamber.

SETTLEMENT OF MARINE WOOD-BORERS ON FLOATING AND FIXED SUBMERGED WOODEN TEST BLOCKS E.C. Black and C.R. Elsey, Dept. of Zoology, University of British Columbia; Pacific Biological Station, Departure Bay, B.C.; Dept. of Physiology, Dalhousie University, Halifax, N.S. (Read January 15, 1945). From July, 1933 to January, 1936 the settlement of marine wood-borers on submerged test boards was investigated in certain harbours on the coast of British Columbia from the south end of Vancouver Island to the Queen Charlotte Islands. The levels investigated at the main station at Departure Bay, Vancouver Island, were: surface (float); zero tide level (8 feet off the bottom); 1 foot off the bottom. Data were obtained at two levels, namely, surface (float) and bottom at 4 stations (Bentinck Island, William Head, Crescent, and Shannon Bay). The wood-borers recorded were those which cause the chief economic damage in the western maritime province, namely, a mollusc, *Bankia setacea* Tryon (northwest shipworm), and an isopod, *Limnoria lignorum* Rathke (gribble). It was found that usually the heaviest settlement of these borers occurs toward the bottom. Occasionally, settlement takes place only on the surface (floating) test board, especially during a light attack. The importance of simultaneous investigation of at least two levels (surface and bottom) in future surveys is emphasized.

THE STABILIZING POWER OF IRISH MOSS TOWARDS INSOLUBLE INORGANIC SALTS. F.A.H. Rice, Dept. of Biochemistry, Dalhousie University, Halifax, N.S. (Read January 15, 1945). Calcium oxalate was held in suspension by gelose, the quantity held in suspension per gram of gelose bearing a logarithmic relationship to the concentration of gelose. On centrifugation, the quantity held in suspension per gram varied logarithmically with the time. The results could be reproduced within 1%. Temperature below 60° C. and pH values between 5.5 and 8.5 had little effect. The quantity and manner of addition of the reagents could affect the sedimentation. Addition of chlorides of sodium, potassium, or calcium lessened the stabilizing power. An equation was developed to express mathematically the relationship between quantity of calcium oxalate held in suspension, concentration of gelose, and time of centrifuging.

GAS EXCHANGE IN THE SWIMBLADDERS OF FISH. Virginia S. Black, Ontario Fisheries Research Laboratory and Department of Zoology, University of Toronto. (Read February 12,1945). In physostomous fish the swimbladder is connected with the foregut by an open duct, thus permitting the intake of air and outgo of gas; in physoclistous fish this duct is closed in the adult, so that all gas exchange to and from the swimbladder is by way of the blood. Fish with both types of swimbladder were asphyxiated individually in tightly covered bottles containing water of various carbon dioxide tensions. After asphyxiation the water in the bottle and the gas in the swimbladder were analysed for carbon dioxide and oxygen. In the physostomes (dace, sucker, chub, bullhead, trout) carbon dioxide only slightly penetrates into the swimbladder; in the physoclists (bass, perch, stickleback, pumpkinseed, sea robin, tautog, cunner, killifish, toadfish) the carbon dioxide pressure in the swimbladder after asphyxiation approximates that of the water. Likewise, oxygen in these physostome swimbladders is not drawn upon during asphyxiation, whereas a marked decrease in swimbladder oxygen occurs in physoclist swimbladders during asphyxiation. In a physostome (mudminnow) with a highly vascular swimbladder well adapted for respiration, gas exchange takes place even more readily than in the physoclists. These results support the view that the difference in response of the two groups of fish probably lies in the extent of vascular surface exposed to the swimbladder lumen.

SPOILAGE OF GUTTED COD STORED IN CRUSHED ICE. J. M. Snow, W. J. Dyer, and F. E. Dyer, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read February 12, 1945). Determinations of trimethylamine, trimethylamine oxide, and bacterial counts on the skin, under-skin, interior, and peritoneum samples from gutted cod stored in melting ice showed that bacterial growth and trimethylamine formation occurred only on the surfaces, principally in the belly cavity.

THE SETTLEMENT OF MARINE WOOD-BORERS IN THE COASTAL WATERS OF BRITISH COLUMBIA. E. C. Black and C. R. Elsey, Dept. of Zoology, University of British Columbia; Pacific Biological Station, Departure Bay, B. C.; and Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read February 12, 1945). The settlement of marine wood-borers in the coastal waters of British Columbia was studied at 10 stations for periods of 8 months to 4½ years betwee n 1931 and 1936. These wood-borers are the northwest shipworm, *Bankia setacea* Tryon, and the gribble, *Limnoria lignorum* Rathke. Great variations were found in the intensity of settlement from area to area and from year to year in any one area. No area was ever entirely free from some degree of attack by one or other or both of the borers. Settlement of shipworms was greatest at the two stations in Masset Inlet (Queen Charlotte Islands), and also in Departure Bay (Vancouver Island.) Infrequent and light attacks by shipworms occurred at Prince Rupert, Vancouver, Crescent, Victoria, Esquimalt, William Head, and Bentinck Island. Attack by gribbles was both severe and continuous at Departure Bay, Esquimalt, and Crescent. A considerable settlement of gribbles occurred at Bentinck Island, William Head, Prince Rupert, Shannon Bay (Masset Inlet,) and Victoria. A less severe attack by gribbles was noted at Vancouver and Buckley Bay (Masset Inlet). The economic significance of these results is discussed.

FURTHER OBSERVATIONS ON THE ASPHYXIATION OF FRESHWATER FISH AT VARIOUS TENSIONS OF CARBON DIOXIDE. E. C. Black, V. S. Black, and F. E. J. Fry, The Ontario Fisheries Research Laboratory, University of Toronto, and Dept. of Physiology, Dalhousie University, Halifax. (Read April 9, 1945). During 1938 certain freshwater fish from Algonquin Park, Ontario, were investigated in the following manner. Live fish were placed in sealers of water containing dissolved oxygen and carbon dioxide. When respiration had ceased the water in the bottle was analysed for free carbon dioxide and dissolved oxygen. When the final oxygen tension in the water was plotted against the carbon dioxide tension for a series of 20-30 individuals, a curve resulted which was characteristic for each species of fish. The specific sensivity seemed to be related to the ecological position of the fish with respect to the thermocline. Fish most sensitive to carbon dioxide (lake trout and ling) were those which are found below the thermocline in the coolest waters. Fish like the speckled bullhead which showed only slight sensitivity to carbon dioxide are found in warm shallow water. During 1939 and 1940 these experiments were repeated and it was found that the relative order of the sensitivity of the fish was the same from year to year. For a given temperature the absolute position of the sensitivity curve seemed to be the same within experimental error. The possible implications of these results are discussed.

THE USE OF PLANT TISSUES FOR CULTURING THERMOPHILIC ANAEROBIC BACTERIA FOUND IN FOODS. C. H. Castell, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read April 9, 1945). Attempts were made to develop a culture medium which would support the growth of thermophilic anaerobic bacteria found in a wide variety of food products. The resultant medium was compared with the standard corn liver medium in the analyses of several hundred samples of food and water.

A MILKWEED SURVEY IN ONTARIO AND ADJACENT QUEBEC. H. Groh, Dominion Dept. of Agriculture, Ottawa, and W. G. Dore, Dept. of Biology, Dalhousie University, Halifax, N.S. (Read April 9, 1945). Density of wild stands of *Asclepias syriaca* was estimated from cross-country transacts. When summarized and plotted on maps, the data showed five areas of high density (over 5000 stalks per survey mile) within the general region. Occurrence of milkweed showed some relationship with land culture and soil type. The potential yield of pods was indicated for certain counties.

PROCEEDINGS

OF THE

Nova Scotian Institute of Science

SESSION OF 1945-46
(Vol. XXI, Part 4)

PRESIDENTIAL ADDRESS

F. Ronald Hayes

(Read October 10, 1945)

This occasion marks the close of the 83rd annual session and the beginning of the 84th. It is my privilege to present a brief review of the Institute's year.

One of the duties devolving on the President at this time is happily light. None of our members has died during the year.

In the period under review, four ordinary members and eleven student members have been elected to the Institute. The total membership now stands at 124.

In addition to the Annual Business Meeting there have been five Ordinary Meetings at which the average attendance was 27. On March 12th a well attended Extraordinary Meeting was held at which an address "The Development of Modern Meteorology" was delivered by Mr. R. A. Hornstein, M. A., Meteorologist-in-Charge, Halifax District Forecast Office. The address, which was given with charm and skill was followed by a lively question period.

At the ordinary meetings fourteen papers were presented, embodying work by seventeen investigators. It is a matter of regret that there were no papers on mathematics, physics or chemistry, for these subjects are considered by some to be the basis of science. It is also unfortunate that no demonstrations were provided and we must all see to it that demonstrations are made available during the coming session. Of the papers presented five were in zoology (including experimental zoology) four were in bacteriological chemistry (fisheries), two each in botany and biochemistry, and one in geology.

We have got behindhand with the publication of the "Proceedings" owing to shortage of labour in the printing office. The Editor is doing everything possible to speed matters up and hopes to have something published during the coming winter.

With the end of the War it is likely that requests will come in from European libraries for sets of the "Proceedings." Since our early volumes are out of print, the Council has looked into the question of reproducing them by some photo-print method. Such methods, which are represented as attractively low-cost in advertising literature, turned out on investigation to be prohibitively expensive, in fact, probably more costly than straightforward printing. For the present the Council has decided against action in the matter.

In 1931 the President in his Annual Address observed with regret that systematic papers on the flora and fauna of the Province had disappeared entirely from our publication. Since that time the Council has sought with success to restore the "Proceedings" to its former authoritative position in systematics. Already in 1933 the President noted in his Address that our first systematic paper in some years—on the dragon flies of the Maritimes—had been published. In the last decade there have appeared, in addition to faunistic notes, comprehensive papers on aquatic plankton, fishes, birds, mosses, ferns and grasses. The "Proceedings" now in the press contains an extensive, illustrated account of the flora of Nova Scotia.

It is a pleasure to acknowledge the generous cooperation of the Officers and Council in administering the Society's affairs. I have to announce with regret that our Corresponding Secretary, Dr. M. K. McPhail is not offering for re-election. In addition to the ordinary duties of office Dr. McPhail has, at considerable cost of time, rescued the back files of the "Proceedings" from threatened oblivion, catalogued them and adequately arranged them. He has also contributed a large measure of sane good humor to Council meetings.

Our good friend Professor W. P. Copp is relinquishing his office as Treasurer, a post in which he has exhibited to the highest degree the required combination of tact and persistence. Under his guidance the Institute's financial position has been steadily strengthened. His soundness and tolerance will be greatly missed at Council meetings.

In conclusion I wish to thank the members of the Institute for honouring me with the highly prized office of President.

PROCEEDINGS OF MEETINGS

Session of 1945-46

(All meetings were held in the Medical Sciences Building, Dalhousie University, Halifax.)

84*th Annual Business Meeting*, October 10, 1945.

The President, Dr. F. R. HAYES, was in the chair. His annual address is printed in full in the Proceedings. Reports of officers were presented and are summarized as follows:

Treasurer's Report:

Receipts	$ 838.50
Expenditures	992.56
Total assets, current account	879.54
Total assets, permanent fund	6000.00

The Corresponding Secretary reported that 165 numbers of back files had been sent out, and three new exchanges had been set up.

The Editor reported that parts 1 and 2 of Volume XXI of the Proceedings were now in the press, but that part 3 would not be published until 1946.

The Librarian reported that 501 publications had been received through the exchange list, and that 1,120 books and pamphlets had been borrowed from the library.

Officers elected for the year 1945-46 were:

President.................Dr. F. R. Hayes
1st Vice President.................Dr. C. C. Coffin
2nd Vice President.................Dr. C. B. Weld
Treasurer.................Prof. W. G. Dore
Corresponding Secretary.................Dr. M. K. McPhail
Recording Secretary.................Dr. H. B. Collier
Council.................Dr. A. E. Cameron, D. K. Crowdis Esq., Dr. W.J. Dyer, Dr. E. Hess, Dr. D. Mainland.
Editor.................Dr. E. Hess
Librarian.................D. K. Crowdis, Esq.
Auditors.................Dr. H. L. Bronson and Professor R. J. Bean.

Nominations to Provincial Science Library Commission:

Dr. F. R. Hayes and Dr. E. G. Young

1*st Ordinary Meeting*, November 12, 1945.

The following new members were announced (elected by Council, October 10): J. G. Aldous, Ph. D., Jean Pratt Milner, M. S. A., as ordinary members; G. R. Smith, Ph. D. and R. E. Wicklund, M. Sc., as associate members; D. G. Ellis, B. Sc., and J. Pawlowski as student members.

Papers: "The Human Requirements of Thiamine," by E. G. Young; "Changes in the inorganic Constituents of developing Salmon Eggs," by F. R. Hayes; "Lipemia, Blood Lipids, and Heparin," by C. B. Weld.

Demonstration: "Measurement of Rate of Flow of Fluids," by C. C. Coffin and S. Schrage.

2nd Ordinary Meeting, December 10, 1945.

The following new members were announced (elected by Council, November 12): Virginia S. Black, B. A., W. J. Brownlee, B. S. A., Mrs. C. Oldfield, M. A., M. G. Whillans, M. D., ordinary members; L. P. Chaisson, Ph. D., and W. R. Martin, M. A., associate members; Ada V. MacLeod, B. Sc., Isabella Wilmot, J. S. Davidge, B. Sc., C. E. Hubley, B. Sc., R. M. McDonald, B. Sc., and Miss T. A. Reid, B. Sc., student members.

Papers: "The Influence of Trimethylamine Oxide upon the Growth of Bacteria," by C. H. Castell; "The Kinetics of Lysolecithin Hemolysis," by H. B. Collier.

Demonstration: "Action Currents in Muscle," by C. B. Weld.

3rd Ordinary Meeting, January 28, 1946.

The following new members were announced (elected by Council January 28): Gerald McKay, Mack Miller, P. M. Laughton, Miss M. E. J. MacMillan, A. G. Bailey, A. F. Dunn, R. D. Hatcher, R. M. Lelacheur Alex MacDonald, H. J. MacLellan, as student members.

Papers: " Absorption of Trypan Blue from the Human Knee Joint," by R. L. Saunders and E. G. Young; "The Influence of Temperature on the respiratory Tolerance of Young Goldfish (*Carassius auratus L*)," by V. S. Black, F. E. J. Fry, and E. C. Black; "Protein and Fat as Energy Sources for the developing Salmon Egg," by A. Hollett.

4th Ordinary Meeting, March 18, 1946.

It was announced that D. J. MacNeil, Ph. D., has been elected to associate membership by Council on February 18.

Paper: "An Apparatus for Dynamic Sorption Studies," by M. R. Foran, J. A. Pearce, C. A. Winkler, S. G. Davies, and J. D. B. Ogilvie.

Discussion: "A proposed Provincial Organization for Research in Nova Scotia," led by Dr. A. E. Cameron, Chairman of the Economic Survey Committee.

5th Ordinary Meeting, May 6, 1946.

Papers: "Corrosion in Canned Fish in Plain Cans," by A. Hollett; "The Distribution of Thiaminase in the Tissues of some Aquatic Animals of Nova Scotia," by J. B. Neilands; "Sterilization of Sea-water with electrically produced Silver Ions," by C. H. Castell, D. Ellis and G. Anderson.

(Papers read before the Institute but not published in the Proceedings.)

THE HUMAN REQUIREMENTS OF THIAMINE. E. Gordon Young, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read November 12, 1945). An analysis of the data of a dietary survey carried out by the individual method amongst individuals receiving incomes of $450-$1500 per annum per family in Halifax, N. S. has been done relative to the intake of thiamine expressed per 1000 Calories. This survey included 385 individuals in 82 families. The average consumption was 0.20 mgm. for men, with a range of 0.13 to 0.43; 0.19 mgm for women, with a range of 0.12 to 0.43; and 0.22 mgm. for children, with a range of 0.09 to 0.45. Expressed on the basis of-non-fat calories the averages were 0.37, 0.35, and 0.37 mgm. respectively. In no case was clinical thiamine deficiency evident.

CHANGES IN THE INORGANIC CONSTITUENTS OF DEVELOPING SALMON EGGS. F. R. Hayes, Dept. of Biology Dalhousie University, Halifax, N. S. (Read November 12, 1945). Sodium, potassium, calcium, magnesium, chloride, and phosphorus have been estimated in the coelomic fluid bathing ripe eggs, in the eggs before and after water hardening, and in the embryo and yolk during development. There appears to be insufficient sodium and calcium to supply needs, for these ions alone are taken up from the surrounding water. In the embryo, calcium and organic phosphate increase in molar concentration during development; other ions show no marked changes. In the yolk, potassium decreases in molar concentration during development, which means that the embryo is specifically selecting this ion; other ions are little changed.

LIPEMIA, BLOOD LIPIDS, AND HEPARIN. C. B. Weld, Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read November 12, 1945). The ability of heparin injected intravenously to reduce the visual opacity of a plasma showing alimentary lipemia has been extended to olive oil and oleic acid as well as cod liver oil. If lipemic plasma from one animal is injected at a constant rate into another animal, a lipemia is readily induced and this is cleared by heparin despite the continuation of the injection of lipemic blood.

If a continuous injection of an artificial oil emulsion (cod liver oil, 5 to 20 % in 5 to 7% isinglass, emulsified in a Waring Blendor) is performed intravenously there is no lipemia unless excessive amounts are given, when the lipemia becomes evident first in arterial blood and only later in venous blood. The oil globules are demonstrable histologically in lung and cause oil embolism of the coronary vessels with heart failure.

Fractionation of the blood lipids into total lipid (alcohol-ether soluble), free lipid (ether soluble), and combined lipid (ether insoluble, alcohol-ether insoluble), and lipid phosphorus has been done. All fractions rise with the development of lipemia by some 20 to 30 % while the optical density of the plasma is increased some 8 to 10 fold. After heparin administration the lipid fractions remain unchanged though the optical densities return nearly to normal.

Microscopic study of the plasma and estimation of the chylomicron counts show that proportionately the chylomicron changes are much greater than the optical density changes. Further studies are being undertaken to ascertain whether or not agglutination of the chylomicrons may occur.

THE INFLUENCE OF TRIMETHYLAMINE OXIDE UPON THE GROWTH OF BACTERIA. C. H. Castell, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read December 10, 1945). Trimethylamine oxide, which is present in relatively large amounts in many sea fish, has a selective action on certain types of bacteria. One per cent added to agar media reduced the bacterial count of fresh fillets approximately 50% and brought about varying reductions in the counts from many other materials. By using pure cultures it has been shown that the inhibiting action of the oxide is confined to certain gram-positive organisms. These findings are in agreement with the generic succession that is known to occur in the microflora of fish as it spoils. The original flora, consisting predominantly of gram-positive micrococci is succeeded by a group of gram-negative rods.

THE KINETICS OF LYSOLECITHIN HEMOLYSIS. H. B. Collier, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read December 10, 1945). The effect of various factors upon the hemolysis of rabbit erythrocytes by lysolecithin (prepared with rattlesnake venom) has been investigated by a photoelectric method. It has been found that the action of lysolecithin is dependent upon cell concentration, has a negative temperature coefficient, and is optimal at pH 6. The action is accelerated in hypotonic solution, but the lysin decreases hypotonic fragility. Cholesterol inhibits, as does serum or plasma.

ABSORPTION OF TRYPAN BLUE FROM THE HUMAN KNEE JOINT. R. L. Saunders and E. G. Young, Depts. of Anatomy and Biochemistry, Dalhousie University, Halifax, N. S. (Read January 28, 1946).

Trypan blue in saline solution has been injected into a living normal knee joint one hour prior to amputation. During this time 99% was absorbed and microscopic examination revealed that the dye had stained only lightly the synovial and subsynovial tissues. In general the synovial cells were devoid of dye granules but these were visible in the macrophages, the fibroblasts, and the monocytes.

The same amount of trypan blue was injected into the ankle joint after amputation. After five hours 88% had been absorbed but much of this remained fixed in the synovialis and both cells and matrix showed intense staining to a depth of 2 mm. It is concluded that trypan blue is absorbed rapidly from the normal knee joint mainly by diffusion into the blood and to a much less degree via the lymph and by phagocytosis. Circulation to the joint is shown to be an important factor.

PROTEIN AND FAT AS ENERGY SOURCES FOR THE DEVELOPING SALMON EGG. Andrew Hollett, Dept. of Biology, Dalhousie University, Halifax, N. S. (Read January 28, 1946). Estimations of protein and fat before hatching fail to show a loss of either despite recorded respiratory measurements which suggest a loss of some 0.6 mg. of fat. An egg weighing 130 mgm. starts off with 25 mgm. of protein, of which 45% is consumed during development; for fat the corresponding figures are 9.4 mgm. and 77%. The dried embryo, when the yolk is gone, weighs 17.3 mgm. The ratio of calorific output as embryo to input as yolk is 43%. Carbohydrate plays no appreciable part as an energy source. Non-protein nitrogen increases steadily throughout development, being stored in the embryo. The carbohydrate, protein, fat sequence of energy sources, said to be of general application, could not be demonstrated; a more likely one is fat, protein, fat, protein.

THE INFLUENCE OF TEMPERATURE ON THE RESPIRATORY TOLERANCE OF YOUNG GOLDFISH (*Carassius auratus L.*) Virginia S. Black, F. E. J. Fry, and Edgar C. Black, Department of Physiology, Dalhousie University and Ontario Fisheries Research Laboratory, University of Toronto. (Read January 28, 1946). The ability of goldfish to use oxygen in the presence of dissolved carbon dioxide was determined at 1°, 7°, 15°, 20°, 25° and 32° C. A group of fish was acclimated to one of the above temperatures. Each fish was then placed in a half-pint sealer of water containing a known amount of carbon dioxide and oxygen. The sealer was completely filled, tightly sealed, and kept at the temperature at which the fish had been acclimated. When the fish had used all the oxygen possible and showed no signs of life, the bottle was opened and the water analyzed for carbon dioxide and oxygen When the tension of carbon dioxide in mm Hg (abscissa) is plotted against the oxygen tension (ordinate) for each fish, a curve can be constructed showing that above a certain carbon dioxide tension the fish is unable to use all the oxygen in the water. It was found that the position of the rise in the curve changed with change in temperature of acclimation. At 1°C the curve rose at 60 mm carbon dioxide; at 7°, 110 mm; at 15°, 120 mm; at 20°, 140mm; at 25°, 160mm and at 32°, 190mm. As the temperature to which the fish was acclimated was increased, the ability of the fish to withstand dissolved carbon dioxide also increased. This change in tolerance with temperature may indicate a means of physiological adjustment whereby the fish can more readily unload oxygen from the blood to the tissues at low temperatures where the affinity of the blood for oxygen is greater than at high temperatures.

AN APPARATUS FOR DYNAMIC SORPTION STUDIES. M. R. Foran, J. A. Pearce, C. A. Winkler, S. G. Davies, and J. D. B. Ogilvie, Dept. of Chemistry, McGill University, Montreal, P. Q., and Dalhousie University, Halifax, N. S. (Read March 18, 1946). An apparatus for determining continuously the weight of vapor from an air stream by a porous sorbent, and the amount escaping, is described. Typical data and the manner of analysing them to show the influence of such factors as the concentration of the vapor, the bed depth, temperature, linear velocity of the air-gas stream, and the previously sorbed material is shown. The general features of sorption and dynamic sorption are shown in relation to the accepted theories of the mechanism of sorption and layer filtration. This manner of determining the equilibrium and history of a sorption process is of particular important to those interested in hydration or dehydration studies at atmospheric pressure.

CORROSION IN CANNED FISH IN PLAIN CANS. Andrew Hollett, Fish Inspection Laboratory, Halifax, N. S. (Read May 6, 1946) Metallic odour and flavour of canned herring and mackerel in plain cans was found to be proportional to the concentration of extractable iron. There was also a rise in pH with increase in corrosion. No relation was found between the tin content and corrosion, metallic odour and flavour being due largely, if not entirely, to the iron dissolved from the steel base plate.

THE DISTRIBUTION OF THIAMINASE IN THE TISSUES OF SOME AQUATIC ANIMALS OF NOVA SCOTIA. J. B. Neilands, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read May 6, 1946.) The visera and muscle of a number of aquatic animals have been tested for thiaminase activity. Chemical and yeast methods have been used for residual thiamine assays. The enzyme was found in a greater proportion of the fresh water and invertebrate species.

STERILIZATION OF SEA-WATER WITH ELECTRICALLY PRODUCED SILVER IONS. C. H. Castell, D. Ellis and G. Anderson, Atlantic Fisheries Experimental Station, Halifax, N. S. (Read May 6, 1946). It has long been known that minute traces of certain heavy metals in contact with a liquid have a germicidal action on bacteria suspended in the liquid. This reaction may be accelerated by passing a current of electricity through the liquid, using the heavy metal as the anode. Machines based on this principle have been manufactured in Nova Scotia and are being sold among others, to commercial fish plants, for purifying their water supplies. In the interest of the fishermen, tests have been made to determine the value and efficiency of these machines when used on sea-water. The results obtained indicate that because of the formation of insoluble silver salts this process is of no value with sea-water.

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Volume XXI

ABSTRACTS

EDITOR'S NOTES

Bound copies of *A Catalogue of Scientific Periodicals in Libraries of the Maritime Provinces*, pp. 1-82, 1936, may still be obtained through the Editor. Price 50 cents.

Paperbound reprints of Vladikov and MacKenzie's *The Marine Fishes of Nova Scotia*, 96 pages, with keys and 131 text figures (Proceedings, Vol. XIX, Part 1, 1935), are also available through the Editor.