

A STUDY OF THE GENUS ANEMONE

AS FOUND IN MANITOBA.

by

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THE ANEMONES OF MANITOBA.

The genus Anemone, although represented by only six species in this province, well deserves our careful consideration, if only for the reason that one of its most wide-spread members, Anemone patens, commonly known as the prairie crocus, has very fittingly been chosen as the floral emblem of Manitoba. While winter's snow yet lingers in the valleys, and not a green blade of grass can be found, this hardy little flower emerges from its furry coat, disregarding the chilling wind, and clothes every sunny hillside with lilac, encouraging us to believe that it is really Spring.

The white wood anemones, A. canadensis and A. quinquefolia, though more retiring than their predecessor, have, by the size, purity and profusion of their blossoms, been rendered very attractive, and are well worth a detailed study.

The remaining three species, A. cylindrica, A. multifida, and A. virginiana, while their flowers are not so large or conspicuously colored, are noticeable to the most casual observer, and intensely interesting to a botanist, by reason of their curiously woolly fruits, which often remain on the plant over the winter.

The position of the anemones in the systematic order of plants is as follows:

Division II	Spermatophyta.
Subdivision II	Angiospermae.
Class 2	Dicotyledonae.

Sub-class 1.	Archichlamydeae.
Order,	Ranunculales.
Family,	Ranunculaceae.
Tribe,	Anemoneae.
Genus,	Anemone.

(Gray's Manual of Botany, 7th edition, 1908.)

According to the chart devised by Mez and Ziegenspeck (1926) in which plants are classified and related in reference to their serum reactions, all plant life may be represented as branching from one main stem, which has its roots in autotrophic bacteria, and progresses upward through algae, fungi, mosses, ferns, gymnosperms, and angiosperms, till at its apex we find the Compositae. Among the lowest of the dicotyledons is the Ranunculaceae, shown as a short branch with no offshoots, and at the same height as the Rosaceae, which has many families related to it. The Ranunculaceae family, therefore, is primitive, but not so much so as the Menispermaceae, Ceratophyllaceae, Nymphaeaceae and Magnoliaceae, which all appear below it on the chart.

The family Ranunculaceae, to which the anemones belong, is considered by recent authors (e.g. Hutchinson, 1926¹), Clements²), to contain the most primitive of the herbaceous

1. Families of Flowering Plants, (Hutchinson, (1926)
2. Flower Families and Ancestors, Clements, (1928.)

Dicotyledons. This opinion is based on several characteristics, among which are the following:-

- 1.- They are nearly all perennials with alternate leaves.
- 2.- The flowers are predominately hypogynous, actinomorphic and hemicyclic to rarely completely cyclic.
- 3.- All the parts of the flower are free, as a rule, the sepals and petals (if present) are often numerous, while the stamens and pistils are usually so.
- 4.- The seeds contain a copious endosperm surrounding a very small embryo.

The tribe Anemoneae (Gray, 1908), comprises the genera Ranunculus, Myosurus, Adonis, Thalictrum, Anemone, Trantvetteria, Anemonella and Hepatica, of which the first five occur in Manitoba.

The foregoing are similar in that they are all herbs; the sepals, which may number from 3 to 20, are imbricated in the bud; the stamens are numerous; the carpels are one-ovuled; the fruit is an achene; the leaves may be basal or alternate, and are usually divided. Anemone resembles Hepatica in the fact that it has no petals, and possesses an involucre, remote from the flower in the former genus, but close to it and resembling a floral envelope in the latter. Ranunculus and Adonis have petals, but no involucre, while Thalictrum has neither. The ovule in Ranunculus is erect, but in all the other related genera it is suspended. The Anemones are, with the exception of A. patens, without nectaries, while Ranunculus and Myosurus have nectariferous pits at the base of the petals. The above-mentioned and other characteristics of these genera are set forth in the accompanying table.

TRIBE ANEMONEAE.

	Ranunculus	Batrachium	Thalictrum	Adonis
Duration	Annual or perennial	perennial (aquatic)	herbaceous perennial	annual
Roots or Rootstocks	Fleshy fibrous	fibrous	short perennial rootstock	
Leaves	alternate, simple, entire, divided or dissected	alternate, dissected or palmately lobed	ternately decompound, basal and cauline, alternate petioles dilated at base.	alternate, pinnately dissected, segments linear.
Involucre	absent	absent	absent	absent
Inflorescence	solitary or corymbed yellow or white	solitary small white	racemed or panicled, dioecious, purplish or greenish	solitary, red or yellow.
Sepals	usually 5, imbricate in bud, spurless deciduous	usually 5, imbricate in bud, spurless	4 or 5 small imbricate in bud, spurless	5 - 8 imbricate in bud, spurless
Petals	often more than 5, with nectariferous pit	usually 5, with nectariferous pit	absent	5-16, with no nectariferous pit
Stamens	numerous, occasionally few all anther bearing	numerous occasionally few; all anther bearing	numerous exerted, filaments often dilated	numerous; all anther bearing
Pistils	several or many, one-ovuled	many in a globular head	4 - 15 few	numerous in a head
Styles	Subulate long, & filiform		Subulate	persistent
Stigmas			unilateral or sessile & elongate	
Achenes	capitate or spicate, generally flattened, smooth or echinate, ovule ascending or erect	oblique, compressed, not margined; transversely wrinkled, beakless, or short beaked; ovule ascending or erect	one seeded, ribbed or nerved, stipitate or sessile (inflated in some species; ovule suspended	1 seeded, capitate or spicate, rugose reticulated, tipped with the persistent styles ovule suspended

TRIBE ANEMONEAE

	Anemone	Pulsatilla	Hepatica	Myosurus
duration duration roots or tubers or rootstocks rootstocks leaves	herbaceous perennial	herbaceous perennial	perennial	annual
	horizontal rootstocks	tap root	fibrous	fibrous
	basal, lobed divided or dissected	basal, long petioled ternately divided central division stalk- ed, lateral divisions 2-parted	basal, ever- green pur- plish red beneath 3 lobed	basal, linear tufted
involucre involucre	remote, ses- sile or short petioled	remote sessile 3-leaved	close under flower, ses- sile 3-leaved	absent
Flowers Flowers	solitary or cymose, white greenish, red or yellow	solitary purple or white	solitary white or purple	solitary greenish- yellow, small
sepal Sepals	4-20, petiol- ed, imbricate in bud, spur- less	5-7 imbricate in bud spurless	imbricate in bud spurless	5, imbricate in bud, spurred
petal Petals	absent	absent	absent	absent or when present, with nectar- iferous pit
stamen Stamens	numerous, all anther bear- ing	numerous outer ones sterile functioning as nectants	numerous all anther- bearing	5 - 25 all anther- bearing
stigma Pistils	usually numerous	numerous	several in a small head	numerous, borne at ma- turity on elongated receptacle
style styles	short subulate	elongated densely plu- mose, persis- tent	short subulate	minute or elongated
stigma Stigmas	introrse unilateral	introrse unilateral	introrse unilateral	

Achenes

compressed
one-seeded,
pointed or
woolly, ovule
suspended

with long,
persistent
styles, ovule
suspended

short-beaked
pubescent

somewhat 3-sided
apiculate or aris-
tate, in a long
spike, ovule at-
tached near top

Amemone

Pulsatilla

Hepatica

Nysurus

TRIBE ANEMONE
A/E (cont'd).

KEY TO THE ANEMONES OF MANITOBA.

(Compiled partly from Gray and Britton and Brown,
and partly from the author's observations.)

Anemone.

Erect perennial herbs. Radical leaves lobed, divided or dissected, those of the stem 2 or 3 together, opposite or whorled, sessile or petiolate, forming an involucre remote from the flower. Peduncles one-flowered, solitary or umbellate. Sepals 4-20 petaloid. Petals 0. Stamens ∞ , shorter than the sepals. Carpels ∞ . Achenes pointed or with long feathery tails, compressed, one-seeded, ovule anatropous, suspended.

I. Pulsatilla.

Achenes with long persistent plumose styles. Inner stamens anther-bearing, outer ones often small, abortive, and answering to petals.

Anemone patens.

II. Anemone proper.

Styles short, not plumose. Staminodia none. Sepals 5 - 8.

A. Achenia densely woolly, compressed. Involucre far below the flower. Stem commonly branching above. Tall, generally 2 - several flowered.

(1) leaves of involucre short-petioled. Sepals usually red. Head of fruit globose or oval.

A. multifida.

(2) Taller. Involucral leaves long-petioled. Sepals white or green, silky downy beneath. Head cylindrical, oval or oblong. Style subulate.

(2) Stems slender, one flowered. Plant 4' - 9' high. Involucral leaf divisions lobed or incised. One radical leaf occurring later than the flower, white or tinged with purple outside. Achenes rather few, ovate, oblong.

A. quinquefolia.

(1) Stout, 1' - 2' high, branching and bearing several flowers. The lateral peduncles involucreless. Leaves of involucre sessile. Sepals 5, obovate, white. Head of fruit globose. Carpels nearly orbicular, naked, wing-margined.

A. canadensis.

B. Achenes pubescent or nearly glabrous.

(b) Head of fruit cylindrical. Divisions of the leaves wedge-shaped, narrow. Secondary involucre usually wanting.

A. cylindrica.

(a) Head of fruit oblong or oval. Divisions of the leaves ovate broad. Secondary involucre present on lateral peduncles.

A. virginiana.

I. (ANEMONE, L. SP. PL., 538, (1753).)

The genus Anemone derives its name from the Greek, meaning "to be shaken by the wind", because growing in windy places, or blossoming at the windy season. Its members, commonly called windflowers, are widely distributed in temperate, sub-arctic or alpine regions, and comprise, according to the Index Kewensis, 1929, about 140 species, six of which occur in Manitoba, viz:- A. patens, A. canadensis, A. cylindrica, A. multifida, and A. quinquefolia. The various authors disagree as to the limits of the genus; in fact, the same writer at different times contradicts himself, e.g. "Linneaus in the earlier edition of his Genera Plantarium has Hepatica, Pulsatilla and Anemone, but united them in the first edition of his Species Plantarium"¹. Also Gray, in the first four editions of his manual, recognized Anemone and Pulsatilla as distinct, but united them in the fifth and subsequent editions. As there seems to be considerable difference of opinion amongst authors, it is difficult to know which one to follow, but as Gray is the most generally accepted authority in this province, it has been deemed advisable in this paper, to unite Pulsatilla and Anemone, as has been done in the most recent editions of his manual.

1. Britton, Ann., N.Y. Acad. Sci. VI, 215, 1891.

ANEMONE PATENS, L. VAR. WOLFGANGIANA (BESS) KOCH.

- Pulsatilla patens, Mill. Gard. Dist. Ed. 8, No. 4 (1768).
Clematis hirsutissima, Pursh Fl. Am. Sept. 385 (1814).
A. Nuttalliana, D.C. Syst. 1: 193, (1818).
Pulsatilla Nuttalliana, Spreng. Syst., 11, 663 (1825).
Pulsatilla patens, A. Gray, Gen. III, 1, 18 t. 3 (1848).
A. patens, var. Nuttalliana, A. Gray, Man. Ed. 5, 36, (1867).
A. patens, var. hirsutissima, Hitch. Trans. St. Louis, Ae., V,
482, (1891).
P. hirsutissima Britton, Ann. N.Y. Acad. Sc. 6, 217 (1891).
A. patens, Hook, Fl. Bor. Am. 1, 4, (1830). (*should be no. 5.*)

Life History.

Anemone patens, the prairie crocus, or pasque flower, is a perennial commonly found throughout Manitoba, though there are a few districts where it has not yet obtained a foothold. A gravelly hillside facing south is an ideal location for these flowers, which may be found there early in April, and have occasionally been known to bloom in March. The flower buds break through the soil usually in clumps of five or more, each bud being covered with a grayish-green furry involucre, which protects it from the cold, and also renders it very difficult to discern, being almost the same colour as the surrounding grass. The first flowers open when their petioles are quite short and at first resemble crocuses,

having a bell-shaped, half-open calyx, surrounded by the bracts forming the involucre. See Fig. 1. (c & d.).

Later the petiole lengthens rapidly, both above and below the involucre, and the sepals, now paler in colour, spread out widely, (see Fig. 1. 3), while the first leaves appear folded and doubled back, superficially resembling those of a fern, and covered with grayish down. After the flower has been fertilised (usually by insects) the sepals wither and fall, the petiole continues its growth to a height of six inches or more, while the feathery styles elongate to nearly an inch and a half in length, (see Fig. 1. e.), and finally the fruits are carried away by the wind.

The leaves are, by this time, fully developed, and are four or five inches across, ternately divided, dark green and covered, like the rest of the plant, with silky hairs. They wither early in the fall, but remain attached to the rootstock, and can readily be found the next year.

Importance to Man.

The prairie Anemone possesses an acrid poisonous sap, which irritates the skin. This acidity is due (according to Pammel) to the presence of a crystalline substance called anemonine, the vapours from which inflame the eyes to a very great degree, even closing them temporarily. Sheep have been known to die from the effects of eating anemones, not, however, from poison, but by having their digestion

impaired by the presence in their stomachs of felt-like balls of epidermal hairs. A.patens was used by the Omaha Indians as a medicine in cases of rheumatism and neuralgia, when the fresh leaves were crushed and applied to the surface over the affected part. The juice from the bruised leaves acted as a counter-irritant, causing a blister if left on long enough.

DESCRIPTION IN DETAIL.

Root.

The root is a shallow taproot often branching into two, and bearing numerous tough brown rootlets. In structure it is a triarch root, with three bundles of strongly lignified vessels in the central cylinder, (see Fig. 4). The cortex is composed of large hexagonal cells with a starchy content, the latter being more in evidence as fall approaches. The outer layer of the epidermis is of a brown colour and suberised, especially in the older roots.

Stem:

The stem, or caudex, is so short as to be barely discernible as such, and is not distinguishable from the root proper except by the fact that the old leaf bases are to be

1. Gilmore, Eth. Ann. 33, 82, (1919).

found there, also the buds of the next year's flowering shoots, each in the axil of a leaf. The stem is really a sympodial rhizome, and the superposed branches can quite readily be seen, giving the stem a furrowed appearance, (see Fig. 2). The three bundles of the root have divided radially, forming six in the stem, as shown in transverse section.

Leaves.

The leaves are few in number (usually three surrounding a flower stalk), with long, slender, hairy petioles, the average length being four to five inches. They are grayish-green in colour, owing to the long unicellular hairs with which the laminae, as well as the petioles, are covered, and are slightly lighter on the lower side. The compound leaf is composed of three leaflets, the centre one having a petiole which may be three quarters of an inch long, while the lateral leaflets are often without petioles, or with very short ones, rarely exceeding one quarter of an inch in length. Each leaflet is ternately divided in a somewhat irregular fashion, the segments being linear in shape, with a blunt point at the tip. (See Fig. 7).

The venation is multicostate reticulate, there being an indistinct midrib in each division of the leaf, and two or more veins parallel to it connected laterally, giving a cellular appearance resembling that of a butterfly's wing. (See Fig. 7)

A cross section of the leaf shows that it has on the upper surface a very thick cuticle, an epidermis one cell in depth

and a few stomata. Beneath this is one layer of palisade cells, then several spongy parenchymatous cells. The lower epidermis is similar to the upper except in the larger number of stomata. A peculiarity of the latter is the very small size of the guard cells compared to that of the other epidermal cells. The epidermal hairs are very long, unicellular, and have very thick walls, the lumen occupying about one third of the width of the hair. There are small raised epidermal cells surrounding the base of each hair, which is not appreciably swollen.

Inflorescence.

The inflorescence is solitary, borne on a long hairy scapiform stem, which is hollow except where the grayish-green involucre is attached, the latter being sessile, whorled and multifid, apparently formed by the union of three finely-dissected leaves. (See Fig. 6.). The flower-stalk is very short at first, elongating considerably during anthesis, and up to the time when the seeds are ripe, mature specimens varying from six inches to a foot in height. This elongation takes place both above and below the involucre, which by this means becomes gradually separated from the flower. There is but one floral envelope, purple outside and paler within, covered with long silky hairs, which give it a grayish tinge. The flower does not open fully at first which accounts for the name "crocus" having been applied to it, although Anemone is not even distantly related to the family to which the genus

Crocus belongs.

Receptacle.

The receptacle is hollow, convex and covered with shallow pits into which the bases of the seeds are inserted, (see Fig. 6.). As the achenes mature, the receptacle becomes even more convex, thus spreading out the plumose styles to catch the wind, and also loosening the fruits in their tiny depressions.

Perianth.

There is only one floral envelope, which is therefore called a calyx. The sepals are separate, hypogynous, usually six in number, and arranged in two whorls, similarly to the perianth of a lily. They are ovate to oblong in shape, 25-35 mm. long, and usually 10 mm. wide, truncate at the base and pointed at the tip. They are lilac in colour, shading to purple at the base, and gradually fade as the flower matures, finally withering to a light brown, and dropping off. The outer side of the sepals is the darker, and is covered with whitish unicellular hairs about five millimeters in length, while the inner surface is without hairs and almost white in colour. The sepals are prominently marked with purple vascular bundles, which run from base to apex in parallel lines about a millimeter apart and are connected by numerous cross bundles or veins.

Androselinum.

The stamens are numerous, separate and hypogynous,

and are attached to the receptacle above the sepals, (see

FIG. 6). They gradually decrease in size from the centre

outwards, the outermost circle being composed of stamens

with very short filaments and ovate or spatulate heads. The

filaments are pale yellow in colour, long and slender, tapering

from the base upwards, with a vascular bundle in the centre.

The anthers are two-celled, basifixed, and extrorse, opening

along the sides to discharge the pollen, which is creamy white,

spherical, dry, and has the extine marked with a network of

ridges.

Gynaeceum.

The pistils are numerous, separate, and protogynous,

massed together on the apex of the receptacle, (see FIG. 6).

The ovary is superior and one-celled, containing one anatropous

ovule. The style is pale green in colour,

long, slender and hairy. Its epidermal cells are oblong in

shape, and are interspersed with raised stomata. There is

one vascular bundle in the centre, in which the spiral vessels

can be easily seen. The style elongates considerably after

fertilisation, attaining a length of one and a half inches.

The stigma is slightly curved and cannot be easily differentiated

from the style, except by the presence of the stigmatic papillae

on the convex surface.

See FIG. 8

Nectaries.

The nectaries are represented by the staminodes, previously mentioned, which form the outer whorl of the androecium, (see Fig. 698). They have very short, wide tapering stalks with an aborted anther attached at the apex of each, but not differentiated in structure, seeming to be merely a continuation of the filaments. The staminodes are uniformly yellow in colour, but vary in shape and size, being oval as a general rule.

SPECIAL MECHANISM FOR POLLINATION.

The gynaecium ripens first, and as the pistils are taller than any of the stamens, the flowers are more than likely to be cross-pollinated by insects which alight on the stigmas after crawling over the androecium of another flower.

The stamens are at first entirely erect, but as they ripen they turn outwards and downwards away from the pistils. The outer short stamens dehisce first, and the stigmas are receptive until the last innermost circle of anthers are mature. These stamens are also the tallest and their pollen can easily be transferred to the stigmas, if these have not already been fertilized. The massing of the pistils and stamens in the centre of the flower makes a convenient landing-stage for insects of which several species, mainly small beetles and bees, have

been noticed crawling over the flowers, thus distributing the pollen. As the flower matures, the peduncle lengthens, and the wind bends it over, thus facilitating self-pollination.

FRUIT AND SEED.

The fruit is an achene with a plumose style which is usually over an inch in length and extremely hairy, especially at the lower end, thus enabling the seed to anchor itself when it reaches the ground, (see Fig. 5). The seeds require a period of rest, as has been shown by planting fresh seeds, which do not germinate. The pericarp is thin, brown and hard, is hairy on the outside, and has a sharp point at the basal end, while the apex tapers off into the long style.

The seeds are pale brown oval bodies, slightly flattened and with a distinct longitudinal ridge along one side. (see Fig. 9). They are usually two and a half millimetres long and one millimetre wide at the broadest part which is nearer to the upper end of the seed. There is a short beak terminating this wider end, while at the lower narrower end is a rough semi-circular patch. The embryo is less than a millimetre in length, and is to be found in the upper end of the seed, the remainder of which is composed of endosperm containing both starch and oil.

VARIATIONS.

The principal variations are in the number of sepals, flowers with seven, eight and occasionally five having been

found. Out of five hundred specimens counted, one had five sepals, five had seven, and two had eight, the remainder having six. There may also be an occasional variation in colour, in which case the flowers instead of being lilac, are creamy white, but these are rather rare.

CONCLUSION.

This brings to an end the part of this paper dealing with Anemone patens, which has been shown to be a simple type, well adapted to serve as an introduction to the study of Angiosperms in general, and the family Ranunculaceae in particular. The inclusion of A. patens in the above family is due to its primitive construction, which it has been the writer's aim to elucidate.

ANEMONE PATENS.

- Fig. 1. a, b, c, d, e. Series of photographs of A. patens showing progressive development at daily intervals.
- Fig. 2. Plants of A. patens showing the sympodial rhizome.
- Fig. 3. Flowers at different stages of development.
- Fig. 4. Microphotograph of a hand-cut section of root.
- Fig. 5. Pistil just after pollination, and a mature achene drawn to the same scale.
- Fig. 6. Sectional elevation of a flower of A. patens, note;
 - (a) The hypogyny of the flower.
 - (b) The hollow peduncle.
 - (c) The solid partition in the peduncle at the point of the attachment of the involucre.
 - (d) The convexity of the receptacle.
 - (e) The varying sizes of the stamens.
 - (f) The staminodes.
- Fig. 7. Leaf of A. patens to show the general morphology.
- Fig. 8. Series of stamens and staminodes from the same flower drawn to scale.
- Fig. 9. Seeds of A. patens showing the groove.



a.



b.



c.



(d)



(e) (10 days later)



Fig 2.

Fig. 5 (x4)

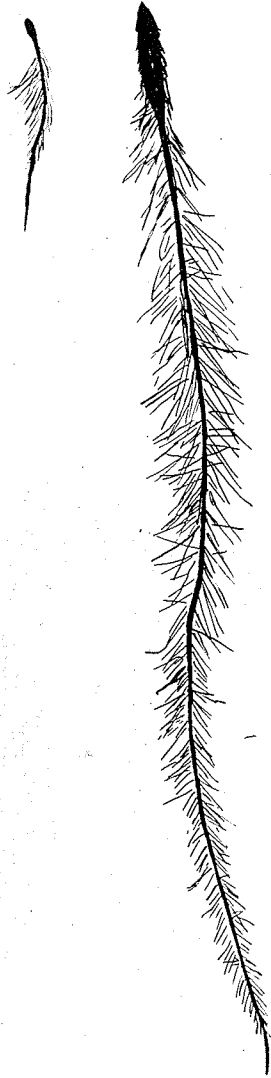


Fig. 4 (x75)

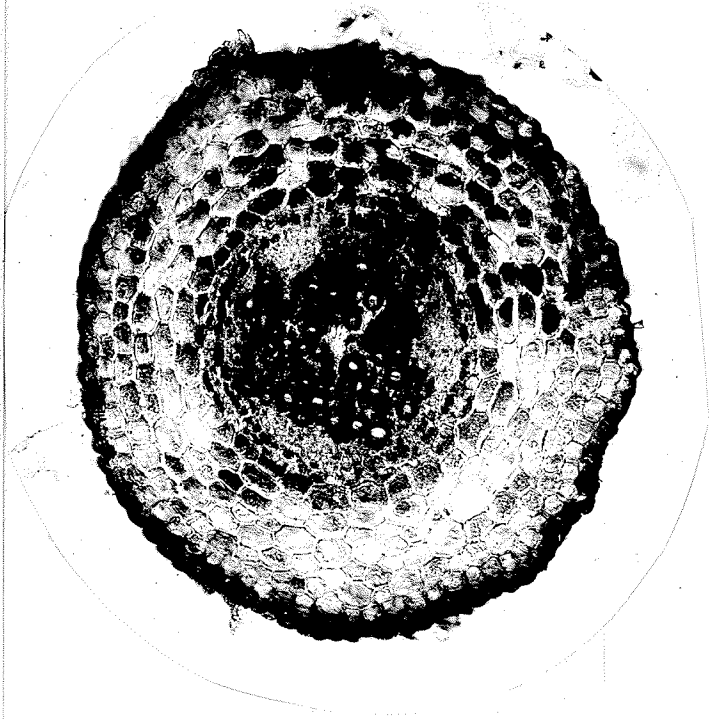


Fig. 3



Fig. 7. (natural size)

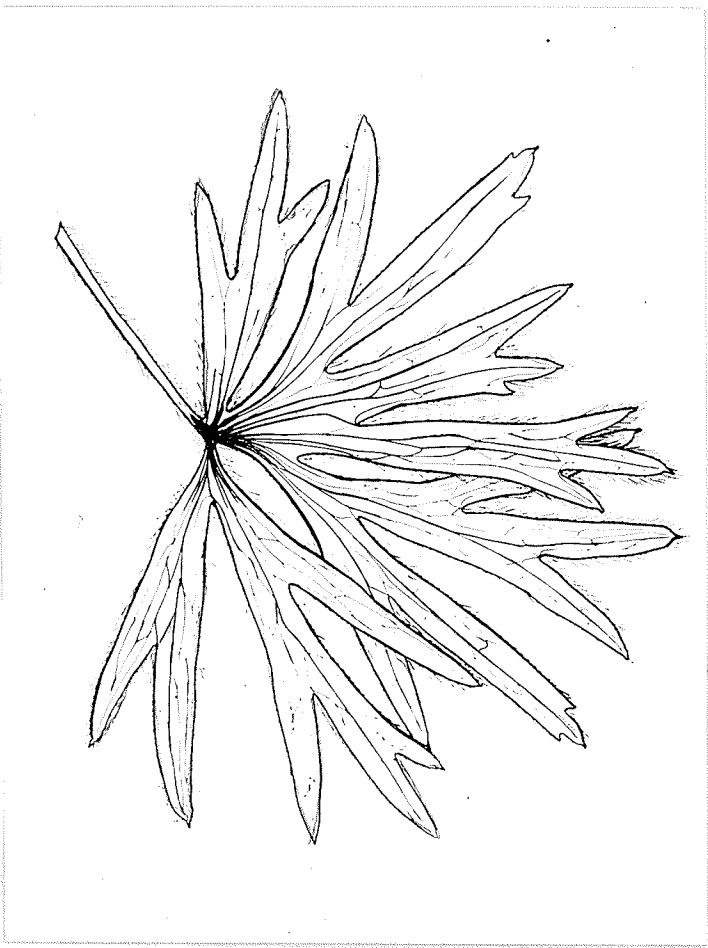
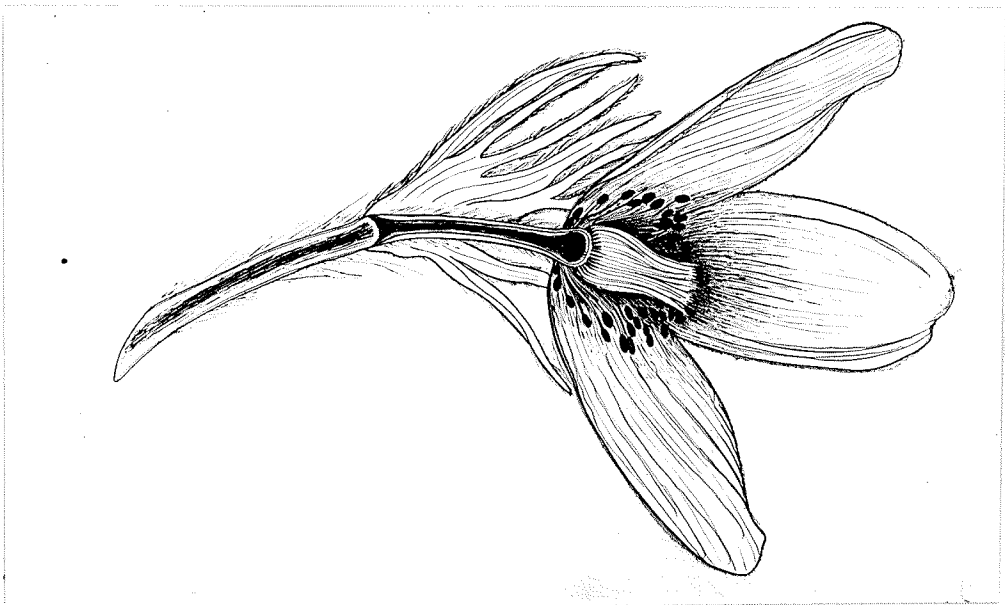


Fig. 6. (x 2 1/2)



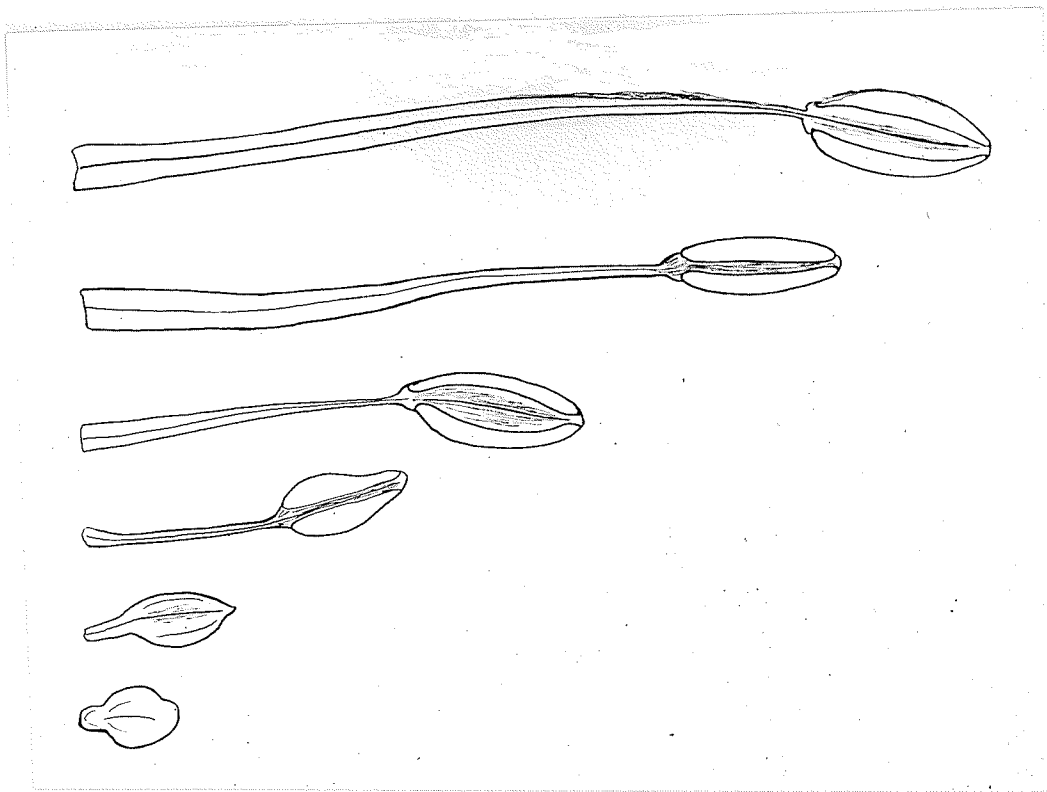


Fig. 8. (X15)

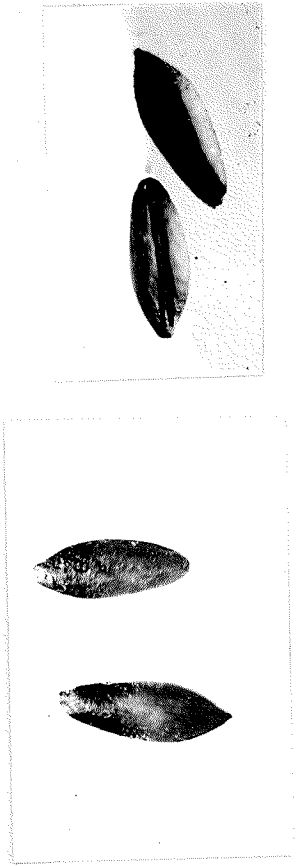


Fig. 9.

The history of the specific name of this Anemone is a rather confusing one, and apparently its real name is still a debatable point. It was first named as above in 1810, then in 1823 as *A. hudsoniana*. Macoun (1883) and Gray (1908) both inclined to the former name, giving *A. hudsoniana* as a synonym, while Britton and Brown (1913) definitely state that *multifida* and *hudsoniana* are two distinct species, though frequently confused, our Mantodea one being the latter. Here, as elsewhere in this paper, Gray's nomenclature has been followed.

- A. multifida*, Poit., Suppl. Lem. Encycl., 1, 364 (1810).
- A. hudsoniana*, Richards, Frank. Journ., Ed. 2, App. 22 (1823).
- A. commersoniana*, D.C. ex Desess., Ic. 1, 4, t. 17. (1820).
- A. globosa*, Nutt. ex Pritz., Linnaea, xv, 673 (1841).
- A. lanigera*, Gay, Fl. Chil., 1, 22 (1845).
- A. sanguinea*, Pursh. ex Pritz., Linnaea, 1841, 672.
- A. narcisiflora*, H. & A. Bot. Beechey, 121, not. l.
- A. multifida*, Cat. Can. Plants, 1, Macoun, (1883).
- A. multifida*, Am. N.Y. Acad. Sc. 222, (1891).
- A. multifida*, Poit., Gray Mem. Ed. 7, (1908).
- A. hudsoniana*, Richards, B. & B., 1913.

ANEMONE MULTIFIDA, POIT.

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ANEMONE MULTIFIDA, Poir.

Anemone multifida, or the red windflower, grows locally in many districts in southern Manitoba, coming out into bloom late in June or early in July, and often associated with A. cylindrica on grassy hillside or prairie. It is generally from 12 to 18 inches in height, and somewhat bushy in habit, having a number of long-petioled radical leaves, from amongst which rise involucrate flowering stems, each bearing three solitary dull purplish-red blossoms $\frac{1}{2}$ to 1 inch in diameter. The two lateral pedicels usually have a secondary two-parted involucre, while the centre one is naked.

The fruiting head is globose, and the achenia are copiously covered by silky white hairs, which facilitate transportation by the wind.

DESCRIPTION IN DETAIL.

Root.

The root has three or four main branches, which go straight downwards, and each bear a few tough, coarse rootlets. In structure it is very similar to the one already described, and, therefore, does not merit a separate discussion.

Stem.

The plant grows from a multicipital caudex, and there are in consequence several flowering shoots from the same root, similarly to the condition found in A. patens. These stems

the flowers are fully opened.
 essence, while in A. patens, there are no leaves visible until
 in Amorpha multifida the leaves appear before the inflo-
 (see Fig. /)
 being so numerous as those of the previously mentioned species,
 and clothed with unilobular hairs, the latter, however, not
 ternately divided into linear or lanceolate lobes, multicostrate
 bear a strong resemblance to those of A. patens, being 2-3
 base, where they are broad, flat and clasping. The laminae
 are narrow and ribbed throughout their length, except toward the
 ing stem, and have petioles from 4 to 8 inches long, and which
 The root leaves are usually three or four to each flower-
Leaves.

actually hollow, as is that of A. patens.
 The stem is of a very loose texture in the centre, but is not
 is reached, where they are very large and irregular in shape.
 become successively larger and thinner walled till the centre
 -walled cells. The cells inside the ring of vascular tissue
 the cortex which is a cylinder of five or six rows of thick-
 die and appearing to be a continuation of the bundle towards
 woody sclerenchyma cells corresponding to each vascular bun-
 of a ring near the outside of the stem. There is a group of
 woody, and having a number of vascular bundles in the form
 differ greatly from those of the latter plant, being very

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-4-

Inflorescence.

The flowering stem bears a whorled involucre, composed of three leaves similar to those found at the root and previously described, their petioles varying in length from $\frac{1}{2}$ inch to 2 inches, though the former length is the more usual one. From this involucre commonly spring three peduncles, one of which is naked, while the other two each bear a two-leaved secondary involucre. The flower is purplish-red to pink in colour, occasionally whitish, and is similar in structure to that of A. patens, but considerably smaller, being only from $\frac{1}{2}$ inch to 1 inch wide when fully opened.

Receptacle.

The receptacle is ovoid in shape, and taller than that of A. patens. It is hairy, and has a honeycombed appearance due to the close-set hexagonal depressions with which it is covered.

Perianth.

The calyx consists of six or more reddish, oblong sepals $\frac{1}{4}$ to $\frac{1}{8}$ inch long and similar to those of A. patens in structure and arrangement.

Androecium and Gynaecium.

The androecium is similar to that of the previously men-

-5-

tioned species, except that the stamens are smaller and there are no staminodes. The gynaeceum, however, differs markedly from that of *A. patens*, for the style is not plumose, but spiny, turning dark brown with age. The pistils average 1.7 mm. in length, the stigmatic papillae occupying .2 mm., and the style .8 mm. The ovary is closely covered with appressed silky white hairs. There are no nectaries in this species, nor in any of those subsequently mentioned.

Fruit and Seed.

The fruiting head is globose when young (see Fig. 2) and consists of a large number of achenes, differing from those of *A. patens* in that each has, instead of a long feathery persistent style, a short subulate one. The ripened receptacle and the achenia themselves are all closely covered with silky hairs which expand as the fruits ripen, pushing the seeds apart and giving to them a woolly appearance. The former is lanceolate in shape, usually a centimeter in length and 4 mm. in greatest width. ^{See Fig 5. *A. cylindrica*} The achenia are flattened and tipped with the subulate styles.

(30)⁶

ANEMONE MULTIFIDA.

Fig. 1. Leaf showing general shape and venation.

Fig. 2. Immature fruiting head to show shape.

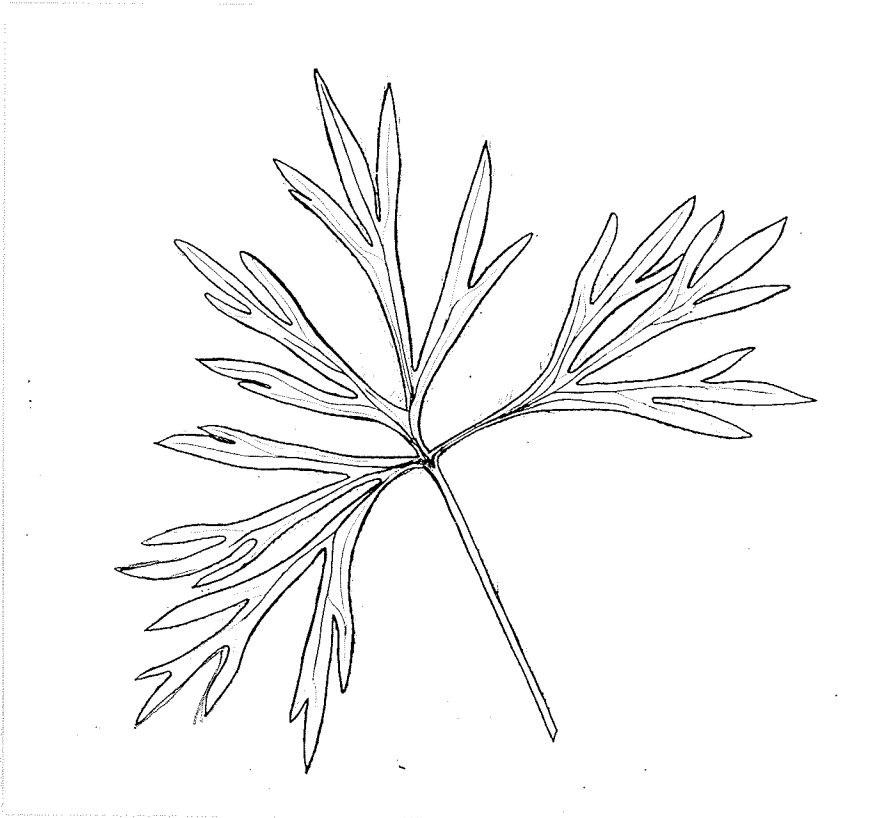


Fig 1. (slightly enlarged)

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(32)

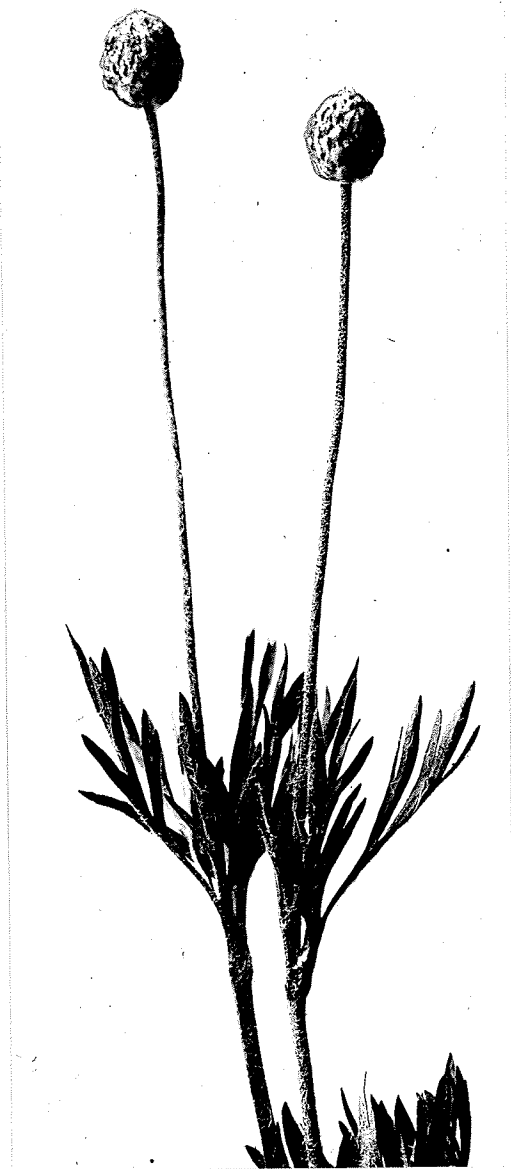


Fig 2.

ANEMONE VIRGINIANA L.

A. virginiana L, Sp. Pl., 540 (1753).

A. hirsuta, Moench., Meth. Suppl., 105 (1802).

This plant has often been confused with *A. riparia* Fernald, in fact Britten and Brown give the latter name as a synonym. According to Gray, however, they are two very distinct species, *A. riparia* having large white or reddish petals, while those of *A. virginiana* are small and greenish.

A. virginiana is a tall plant found in the shady woods of southern Manitoba, but it is rather rare, and in consequence of the inconspicuousness of its flowers may easily be overlooked. It is somewhat leafy in habit, and the leaves are larger, thinner, and of a darker green than those belonging to the species mentioned heretofore. The plant grows to a height of almost 3 feet, and is topped by the small greenish flowers, which occur in June, July and August, and later develop into woolly fruits very similar in appearance to those already described.

DESCRIPTION IN DETAIL.Root.

The root is a fibrous-branching tap root, the main portion being short and stout, and having a large number of approximately equal branches coming off from it at right angles, and spreading out in all directions parallel to the surface of the soil. Occasionally ^{on} some of the older plants, one of the lateral branches is larger than the others, and bears adven-

The upper surface of the leaf is dark green, sparsely more numerous.
to 1 mm. long on the veins and petiole, where they are also
They are only .5 to .5 mm. long on the lamina itself, and .5
going species, and the hairs are shorter and less in number.
The laminae are somewhat thinner than those of the fore-

acute-pointed at the apex, with serrate margins. (See Fig 4)
into ovate-lanceolate leaf-divisions, cuneate at the base and
wide and a little less in length. They are ternately cleft
The laminae are broader than long, being 5-7 inches

plates.
rows of cortical cells, the outer ones being rich in chloro-
chyma cells outside the phloem of each. There are several
alternating with smaller ones, and having a group of scleren-
have a ring of vascular tissue, consisting of 6 large bundles
one side, similarly to a corn stem. They are hollow and
quite circular in cross-section, being slightly concave on
slightly hairy, especially towards the apex, and are not
varying in length from 6 to 15 inches. The latter are
rounded by two or four radical leaves, which have petioles
with two or three flowering stems arising from it, each sur-

There is a multipital gland as in *A. multilida*.

Stem and Leaves.

of the root is of the triarch type, typical of the genus.
showing that the plant is a surface feeder. The structure
tious buds, but all the roots are comparatively shallow,

(See Fig. 1.)

(34)

dotted with short hairs, while the lower side is lighter in colour and has a large number of longer hairs on all the veins. The venation differs from that of the two preceding species, being digitately reticulate and having as a rule five main diverging veins.

The flowering stems each bear an involucre composed of three leaves similar to those at the base, but with shorter petioles (2 - 3 inches in length), from the centre of which rises a naked pedicel from 6 to 10 inches long, accompanied by one or two proliferous ones, each bearing an involucre, or secondary involucre, consisting of two short petioled leaves like those of the primary involucre mentioned above.

The flower and its parts.

The flower is greenish in colour, usually not being over three quarters of an inch in diameter.

The receptacle is almost identical with that of A. cylindrica, being the same shape, but a little shorter and wider, covered with short hairs, and honeycombed with depressions for the achenes.

The sepals, usually five in number, are acute, light green on the inside, but whitish outside owing to their being thickly covered with hairs, and they turn back and fall off as the receptacle enlarges. (see Fig. 3). In some localities a variety of A. virginiana occurs having large white sepals⁽¹⁾ and apparently this variation is found in

(1) Gray. Man. Ed. VII, 402, (1908).

Manitoba since Hales lists A. riparia in his "Selected Western Flora", doubtless confusing it with A. virginiana, since he does not mention the latter at all.

The androecium and gynaeceum do not differ materially from those of A. multifida, except that the styles are longer and more divergent.

Fruit and Seed.

The fruit is very similar in structure and general appearance to that of A. multifida, but is slightly different in form owing to a corresponding difference in the shape of the receptacle, that of A. virginiana being almost cylindrical and rounded at both ends. (see Fig. 5). The styles are more in evidence than they are in A. multifida, but the hairs are just as numerous and expansible making it almost impossible to distinguish between the two species except by an examination of the receptacle. See Fig. 5, *A. cylindrica*.

ANEMONE VIRGINIANA.

- Fig. 1. Root system showing adventitious buds.
- Fig. 2. Plant of A. virginiana showing first flower bud with naked pedicel, also a later involucellate one.
- Fig. 3. Flower of A. virginiana.
- Fig. 4. Leaf showing general morphology.
- Fig. 5. Plant with immature fruiting heads.

6
(38)

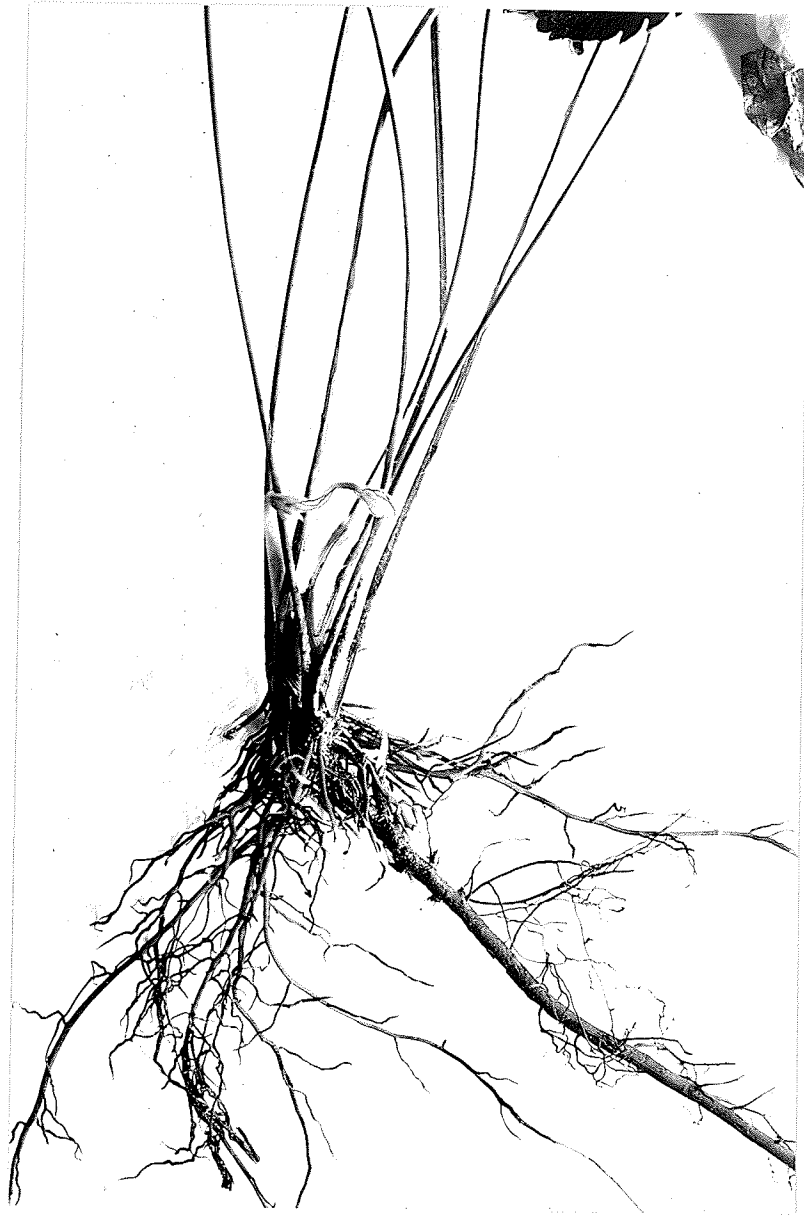


Fig. 1.

7
(39)



Fig 2.

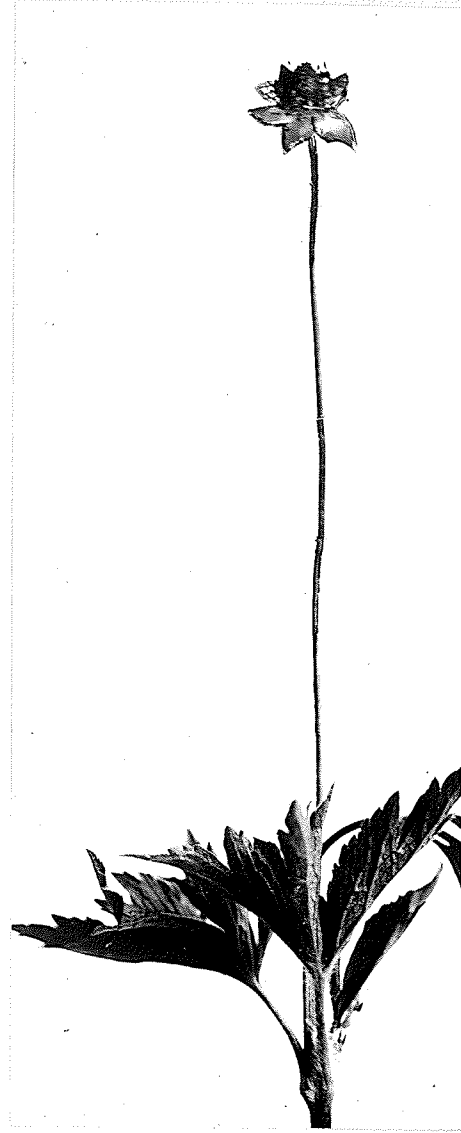


Fig 3.

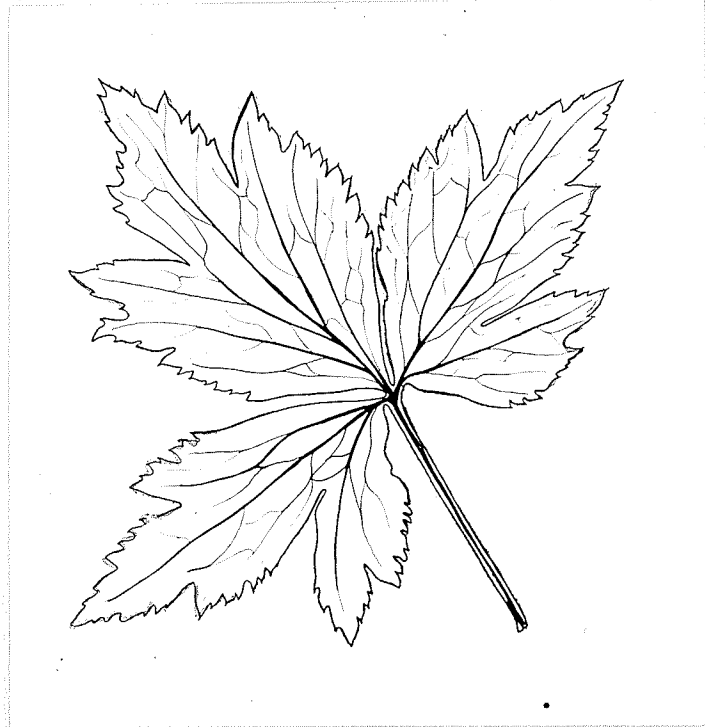


Fig 4 (natural size)

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(40)

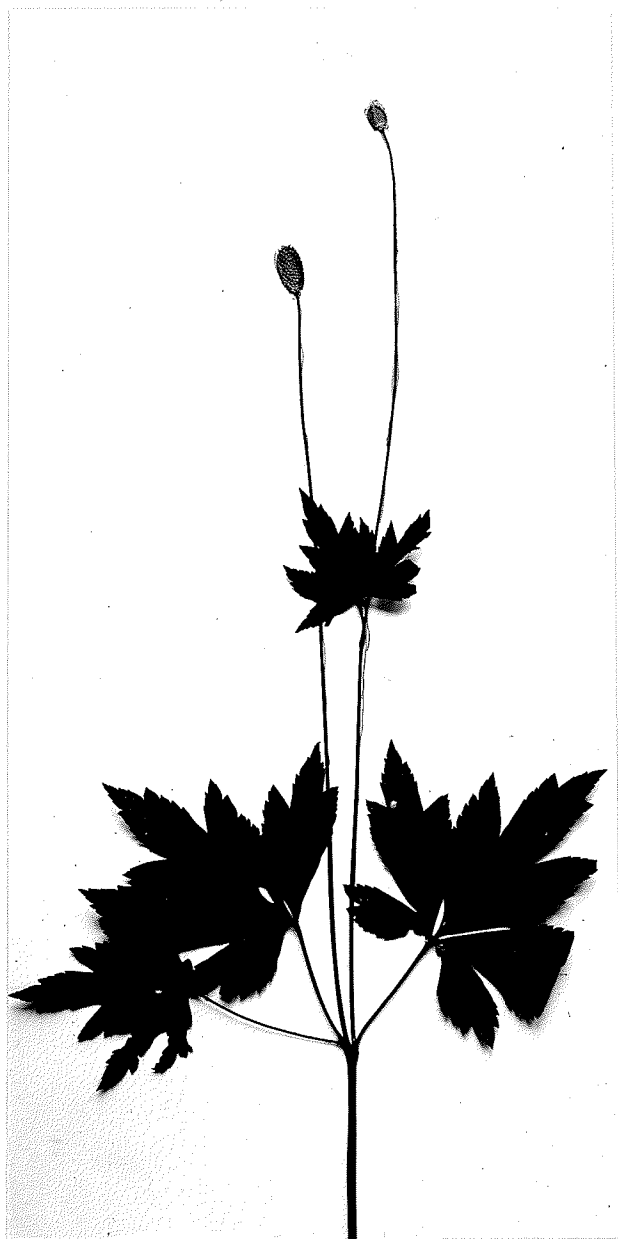


Fig 5.

ANEMONE CYLINDRICA. A. Gray.

A. cylindrica, A. Gray, Am. Lyc. N.Y., iii, 221, (1836).

This species is commonly found on the dry prairies and hillsides of Manitoba, and is in bloom from June till August, but is not generally noticed until the seeds are mature, as the flower itself is inconspicuous. The plant grows to a height of from 10 to 18 inches, and the fruits, borne on long naked pedicels, persist well on into the autumn, and are then plainly to be seen protruding above the dead grass and herbage. At this season of the year it is easily confused with *A. multifida*, which is often found in association with it, and the two species may only be distinguished by a careful examination of the fruiting pedicels. The specific name is an indication of the shape of the immature fruit, which is one of the best means of identification. (See Fig. 2.).

DESCRIPTION IN DETAIL.

Root and Stem.

The root is almost identical with that of *A. virginiana* but the secondary roots, instead of being parallel to the surface of the ground, travel downward, which is to be expected, as *A. cylindrica* grows in dry situations. Each plant has three or four flowering stems arising from the caudex, and surrounded by several long-petioled basal leaves. The flow-

ering stems each bear an involucre composed of short-petioled leaves similar to the radical ones, and numbering about twice as many as the 2-4 naked pedicels arising therefrom. Occasionally as one of the latter may be surrounded by a secondary two-leaved involucre, which is formed just above the primary one, and appearing to be a part of it. The usual absence of this involucre is one of the important points to be noted in the identification of the species. In structure the flowering stem is woody and solid, containing numerous vascular bundles arranged in a ring around the central pith, and surrounded by six rows of thick walled cortical cells. Between the cortex and the phloem of each bundle lies a mass of scherenchymatous fibres, which is almost as large as the vascular tissue.

Leaves.

The radical leaves have petioles averaging three inches in length and rarely exceeding four. These are shield-shaped in cross-section, not hollow, contain six large vascular bundles, and have a number of silky epidermal hairs. The laminae of the basal leaves are usually the same size as those of A. multifida, and are broader than long, being on the average 2½ to 3 inches wide, and 1½ to 2 inches in length. They are also 2 - 3 ternately divided, but the lobes are shorter and wider than those of A. multifida and A. patens, and the divisions are rhombic-cuneate in shape. (See Fig 3.) The leaves are silky hairy throughout, similarly to those of A. patens, but the

hairs are shorter and not so numerous, though longer than those of A. virginiana.

Flower.

The flower is very similar to that of A. virginiana, but is a little larger. There are five greenish-white oblong or obtuse sepals, usually 3/8 inch in length and extremely hairy on the outside. (See Fig. /).

The androecium and gynaecium are the prominent parts of the flower, and are very similar to those of A. virginiana, except that the filaments are not so long, and the androecium therefore does not cover so much of the calyx. The styles are about the same length as those of A. virginiana, but longer than those of A. multifida, and are slightly curved outward and downward at the apex.

Fruit and seed.

The shape of the fruiting head is one of the characteristic features of this species, and must therefore be carefully noted. As its name implies, the fruit is cylindrical in shape, and is from 3/4 to 1 1/4 inches long and 1/4 inch wide before the seeds ripen. (See Fig. 2). At maturity the seeds separate, owing to the expansion of their epidermal hairs, (as has already been mentioned in connection with A. virginiana and A. multifida) forming a fluffy ball around the elongated receptacle, and which may remain there for some time, perhaps over winter. (See Fig. 4). When the fruits

are eventually carried away by the wind, the naked receptacle is left as a straight stalk, approximately equal in diameter to the pedicel. (See Fig. 4). Thus, even after the seeds have matured, the plant may be distinguished from the two species which it most resembles (A. multifida and A. virginiana) by the length and shape of the receptacle, as well as by the absence of a secondary involucre. (See Fig. 5)

ANEMONE CYLINDRICA.

- Fig. 1. Flower and buds.
- Fig. 2. Immature fruiting heads showing characteristic shape.
- Fig. 3. Leaf showing general morphology.
- Fig. 4. Series of mature fruiting heads.
- Fig. 5. Drawing showing comparison of mature receptacles of *A. multifida*, *A. virginiana*, and *A. cylindrica*.

Fig. 3. *argyrea* var. *argyrea*

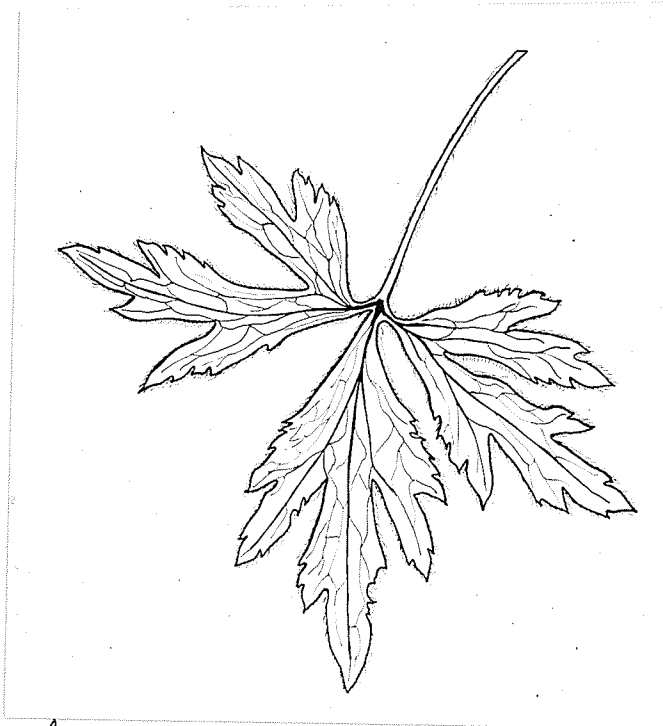


Fig. 2

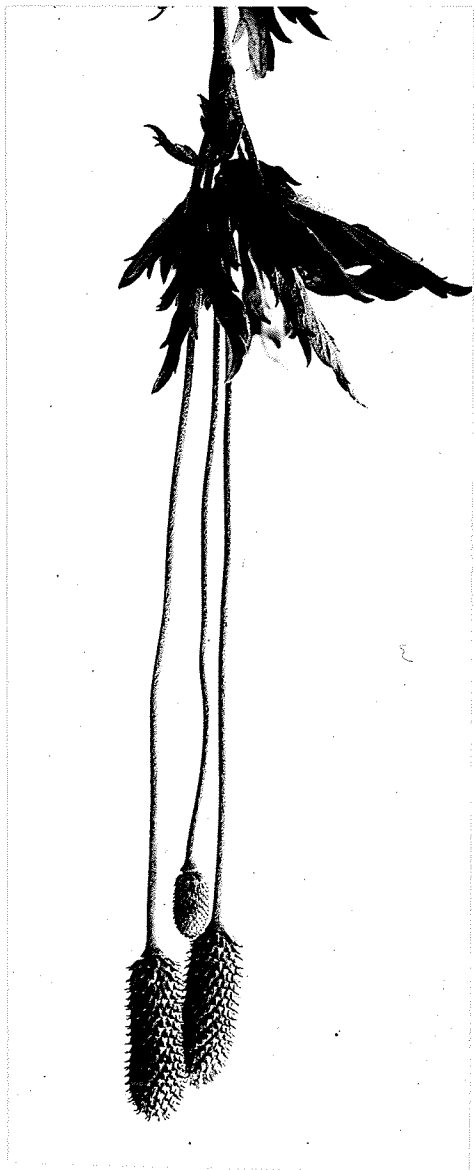


Fig. 1



(47)