The Cruciferae of Montana
by Gerald Clark

A THESIS Submitted to the Graduate Committee in partial fulfillment of the requirements for the
degree of Master of Science in Botany at Montana State College
Montana State University
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Abstract:
A survey was made of the Crucifers of Montana; the survey included species known to be within the
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the state. This survey was made by systematically keying out the herbarium specimens included, in the
Montana State College Herbarium, Bozeman, Montana, and by reviewing all literature pertaining to
distribution.

A key was compiled and presented based upon Herbarium specimens, field notes, and monographs of
the genera of the family. The terminology used in this key is as simplified as possible; all specialized
terminology is avoided.

The existing and potential economic importance of the various members of the family are given.
ACKNOWLEDGEMENT

The author wishes to acknowledge the encouragement and assistance of Dr. W. E. Booth in formulating the key and in helping surmount the obstacles encountered during work on this problem.
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GERALD CLARY

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Bozeman, Montana
June 1949
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ABSTRACT

A survey was made of the Crucifers of Montana; the survey included species known to be within the state as well as those which were thought to be within the state, or that have a chance of migrating into the state. This survey was made by systematically keying out the herbarium specimens included in the Montana State College Herbarium, Bozeman, Montana, and by reviewing all literature pertaining to distribution.

A key was compiled and presented based upon Herbarium specimens, field notes, and monographs of the genera of the family. The terminology used in this key is as simplified as possible; all specialized terminology is avoided.

The existing and potential economic importance of the various members of the family are given.
INTRODUCTION

The family Cruciferae is well established in Montana, with twenty-eight genera and ninety-eight species represented. The family is a rather difficult one taxonomically, since the characteristics used for classification are sometimes minute. Often it is impossible to key a plant in flower, since the distinguishing characters are found in the fruit. A specialized nomenclature has developed around this family: the terms used to describe some of the characters, such as "pubescent type" are seldom used in reference to any other plant family.

The latest taxonomic work covering the Cruciferae of Montana is the NEW MANUAL OF BOTANY OF THE CENTRAL ROCKY MOUNTAINS, first published in 1885 by Dr. J. M. Coulter and revised by A. Nelson in 1937. Although it covers more of the state than any other manual available on the subject, it does not cover the flora of the northeast or western portions of Montana. Coverage of the western region, although incomplete, has been materially aided by such recent manuals as A MANUAL OF THE HIGHER PLANTS OF OREGON, by Peck (1941), and ILLUSTRATED FLORA OF THE PACIFIC STATES, by Abrams (1944).

For these reasons the author has developed a taxonomic key covering all of the crucifers found in Montana. In this key, specialized terminology has been avoided whenever possible. An attempt was made to provide keys that could be used for plants either in flower or in fruit, but this was found to be impossible in some of the genera.
The Cruciferae is a large family of about 200 genera and 1800 species; it is a cosmopolitan family of wide geographic distribution. This family is also called Brassicaceae after the genus Brassica which is probably the most important genus economically.

The Cruciferae are herbs or, rarely, shrubby plants, with alternate leaves and racemose or corymbose flowers. Leaf form, root type, and longevity are extremely variable. The flowers are regular with four petals, four sepals in a single tetrameros whorl, and six stamens arranged in two whorls, the inner whorl of four and the outer of two. The nature of the pistil is controversial, but morphological evidence substantiates the theory of a single pistil made up of four united carpels (Arber 1931), (Saunders 1932), (Eames and Willson 1928, 1930). Some of the genera do not follow this general form. The Lepidia do not always have four petals; they may have four, two, or none and the stamens may be fewer than six. Stanleya does not have tetradymanous stamens; all six are the same length.

In recent years much work has been done on the various genera of this family. Some of the most able taxonomists of the 20th century have expended a great deal of time and effort in monographic studies. It seems fitting that these works, as well as those not of a monographic nature but contributions of value none the less, should be reviewed here.

The most recent work on Stanleya is a monographic study by Rollins (1939a). In this study he points out the relationship between
Stanleya and Thelypodium as well as the relationship of both to the Capparidaceae. Evidence is given to substantiate the theory that the Cruciferae were derived from the Capparidaceae. Preliminary studies of the chromosome complement of the species of Stanleya were conducted and used to further substantiate the proposed theory of development.

Payson (1922a) published a monograph on Thelypodium and its immediate allies. This work was very carefully done and, while it is not recent, the species distinctions and generic limitations which he imposed on the genus are still valid. Thelypodium as treated in this study includes a small homogenous group of limited geographical distribution and monophyletic origin.

No recent monographic study of Cardaria is available, which is unfortunate since this genus is very similar to Lepidium and Hymenophysa. Rollins (1940) separated Lepidium Draba L. and Hymenophysa pubescens C. A. Mey. from their respective genera and combined them under Cardaria. This separation is not considered valid by some authors; therefore the reasons for it will be summarized here. Cardaria differs from Lepidium in the following respects: 1) the siliques of Lepidium are uninflated, those of Cardaria are; 2) the siliques of Lepidium are margined, those of Cardaria are not; 3) the siliques of Cardaria are indehiscent, those of Lepidium are dehiscent; 4) the nectar glands of Cardaria are well developed and surround the base of the single stamens, the glands of Lepidium are poorly developed and do not surround the base of the single stamens. Cardaria shows no characteristic which would separate it from
Hymenophysa; therefore the two are considered congeneric.

Hitchcock (1936, 1945) reviewed the species of *Lepidium* which occurred in the United States in 1936 and published a review of the species that occurred in Mexico, Central America, and the West Indies in 1945. This creditable work made the compilation of the *Lepidia* of Montana relative simple. Two species were found that had not been previously reported in Montana. These were *L. montanum* Nutt. and *L. latifolium* L. *L. latifolium* is an introduced species while the occurrence of *L. montanum* is probably a range extension.

Payson (1926) monographed the species of *Thlaspi* indigenous to the United States. He divided the genus into six species, two of which, *T. glaucum* A. Nels. and *T. parviflorum* A. Nels., occur in Montana. Recent authors include all of these species under one name, *T. alpestre* L. In this paper, the genus is separated into the species proposed by Payson. The reasons for doing this were twofold: first, field observations indicated that *T. glaucum* and *T. parviflorum* are separated by characters which do not intergrade; second, *T. alpestre* is a European species that would have to be introduced into North America by some carrier and the distribution is much too extensive for such a manner of introduction. There appears to be a need for further work in this genus.

Payson (1922b) published a monograph on the species of *Sisymbrium* indigenous to North America in which he defined the limits of the genus and discussed the similarities of *Sisymbrium* and *Thelypodium*. This work is still valuable in classification of these indigenous species; however, recent introductions have created a need for a more extensive coverage of the genus.
Specimens of *S. Loeselii* L. collected in Gallatin and Phillips counties in 1948 were the first collected in Montana. This species is not included in recent publications, but a description of it can be found in *Flora of the Prairies and Plains of Central North America*, by P. A. Rydberg (1932).

Pearson (1928) and Sun (1946) have presented papers on the taxonomy of *Brassica*. Both workers have included data on the chromosome number of the species as well as taxonomic keys. The so-called "*Brassica alba*" is not included in the genus *Brassica* by these men. Sun has expressed doubt as to the validity of the exclusion and states that the species should be investigated further. Wheeler (1938) has pointed out that "*Brassica alba*" is a nomenclatural error, that the species should be called *Brassica hirta* Moench, if it is included in the genus.

In the same publication it is pointed out that *Brassica arvensis* Rabenh. is an invalid name which should be *Brassica kaber* (DC.) L. C. Wheeler. The generic limits of *Sinapis* and *Brassica* are not well defined. There are no criteria of separation between the two genera that all botanists will accept, and as a result there is much confusion regarding the members of genera. It may be that *B. hirta*, *B. kaber*, and perhaps *B. nigra* (L.) Koch. should be placed in *Sinapis*. I do not believe it feasible to place one and not the other into *Sinapis* and am therefore including all of the species under *Brassica*.

Fernald (1909) published a comprehensive paper on *Barbarea* which, although carefully prepared, failed to withstand the test of time. Numerous changes have been made since this paper was published, particularly in the western species. The treatment of the genus.
in this paper follows that of Abrams.

There has been no recent monographic treatment of *Rorippa*, but there have been innumerable articles in the literature pertaining to the taxonomy and nomenclature of many of the species as well as articles dealing with the correct name of the genus. Fernald (1940) and Butters and Abbe (1940) have published articles dealing with the synonymy and taxonomy of *R. palustris* Moench., *R. hispida* Britt., and *R. islandica* (oeder ex. Murr.) Borbas. Rollins (1941a) published data that indicates *R. columbiana* (Suksdorf) Howell to be a synonym of *R. calycina* (Engelm.) Rydb. Fernald (1929) published proof of the correct name for the genus although Mackenzie (1929) disagreed with the interpretation.

Rollins (1939b) published a monographic work on *Physaria* which covers the distribution, taxonomy, synonymy, cytology, and phylogeny of the genus. Payson (1918) published a preliminary treatment of the genus which was not nearly so complete as the work published by Rollins; for that reason the views of the most recent author were adopted in this paper.

Payson (1921) published a monograph on *Lesquerella*; as is characteristic of Payson's work, it is complete in every detail. There has been no subsequent work on the genus other than a few descriptions of new species, none of which occur in this area. This monograph is probably the most complete and thorough of any of Payson's many fine publications on the genera of the *Cruciferae*. All of the
various methods of investigation at the disposal of a taxonomist are employed in this work except cytology. The section on the phylogeny is excellent; here is shown the supposed area of development, the nearest relatives, and the supposed phylogenetic order of the species. Many of the *Lesquerella* resemble *Physaria*, their nearest relative, the two can be told apart easily by the nature of the septum. *Lesquerella* has a vein extending from the apex to near the center of the septum, *Physaria* does not have this characteristic. There are, of course, other characters but this is the most easily seen.

Payson (1917) published a treatment of western *Drabas* which, though helpful, was incomplete because of the scarcity of material at his disposal at that time. Fernald (1934) monographed the *Drabas* of northeastern America. This work, even though it does not include many of the species indigenous to the west, is of value to the western taxonomist because of the many photographs of species that are found in the west. Hitchcock (1941) revised the *Drabas* of western North America. As is characteristic of Hitchcock's work, no data on the cytology or phylogeny was given. The keys, descriptions, and interspecific relationships were very well prepared.

Horsefly Pass, Crazy Mountains, 8200 feet, July 20, 1902. Hitchcock (1941) states that the type specimen "is merely a dwarf form such as occurs in many alpine regions in exposed situations," referring, of course, to the Black Butte specimen. Unfortunately the three different collections were mounted on the same Herbarium sheet at the Montana State College Herbarium; the collection bearing the label "type" is not the Black Butte collection but the one from Horsefly Pass; it differs from the other two in having leaves that are more densely imbricate and smaller (3-5 mm. long). The specimen can be matched by the following collections: Hitchcock and Muhlick Nos. 8913, 12091, and 10834; Rydberg and Bessey No. 4181; Blankinship, Summit of Mt. Bridger, 1899, Summit of Mt. Bridger, 1900, Mammoth Hot Springs, 1899; R. S. Williams, Helena, April, 1886, Tiger Butte, 1887, Belt River, 1892. Blankinship's collection from the summit of Mt. Bridger in 1900 contains plants of both Draba oligosperma and Draba oligosperma var microcarpa indicating that the two grew side by side on the same location. Hitchcock's statement that the apparent variation is due largely to exposure, soil, and elevation is seemingly incorrect; the variation is hereditary.

Draba fladnizensis Wulfen was collected in Carbon county in 1908 by P. H. Hawkins and the identification verified by Hitchcock in 1949. This plant has not been previously reported in Montana and is listed by Hitchcock as rare on the highest peaks of Colorado and southern Utah; it is also found in British Columbia. It is known to occur in Norway and Sweden and is conspecific with those found in the Rocky Mountains.
D. fladnizensis is apparently not found in Arctic North America at the present time; therefore the widely separated localities where the plants now occur must be relict stands of the species. Hitchcock (1941) postulates "that not only did D. fladnizensis occur in Arctic America at one time, but that it migrated from there down through the Rocky Mountains to its present range in Colorado." The presence of this plant on one of the high peaks (11,000 feet) in Carbon county supports this postulation.

A careful revision of the genus Descurainia that occurs in North America was published by Detling (1939). In this work such taxonomic criteria as growth habit, pubescence, glandulosity, leaf form arrangement of seeds and shape of siliques, orientation of pedicels and siliques, size of flowers, and flower color were investigated and incorporated into the keys where possible. Distribution and point of origin of the endemic species is covered very thoroughly. There is no data on cytology or any discussion pertaining to the probable position of Descurainia in relation to the genera of the family. Baldwin and Campbell (1940) investigated the cytology of this genus and found the basic chromosome number to be seven; diploid, tetraploid, and hexaploid plants were found. Polyploidy was found to be intraspecific.

Rollins (1941b) published a monographic study of Arabis. In this work he gives the supposed phylogenetic relationship of the species and includes a discussion on the relationship of the genus to other genera within the family. The nearest related genus to Arabis is
Sibara, a genus that is not indigenous to Montana. The genus *Arabis* is large and taxonomically very difficult; Rollins has done an exceptionally fine monographic work and far be it from the author to criticize it; however, it seems from the keys and descriptions that some of the species could very well be included under one entity. Unfortunately, there is not sufficient material at hand to prove conclusively that this is the case. As Rollins has said, this monograph is a step in the right direction, but much work yet remains to be completed. Hopkins (1937) has also worked with the genus *Arabis*. He has revised those species that occur in Eastern and Central North America.

Manton (1932) published a general cytological survey of the *Cruciferae* in which the chromosome numbers of certain species of 80 genera have been determined. An attempt was made to determine the evolutionary trends and to correlate the chromosomes with taxonomy. It was found that an aneuploid relationship is frequent between the fundamental numbers of genera and that polyploidy between species is frequent. Fundamental numbers of 5, 6, 7, 8, 11, 13, and 15 have been recorded for the family.
MATERIALS AND METHODS

In the preparation of this thesis dealing with the crucifers of Montana, recent monographs of the genera were used. They were checked for distribution, generic and specific characters, and the keys were modified or completely changed to fit Montana species. Any material pertaining to the genus more recent than the monographs was reviewed, evaluated, and either adopted or discarded depending upon the value and validity of the material. In instances when the genus had not received recent monographic treatment, all articles pertaining to its taxonomy were reviewed, and if of value, included in the treatment of the genus.

In addition to the literature incorporated, the materials available in the Montana State College Herbarium, which consisted of 900 sheets of specimens, was carefully checked.

Field notes obtained during the summer and fall of 1948 and spring of 1949 were used to supplement data obtained from herbarium specimens.

Distribution was determined on the basis of specimens in the Montana State College Herbarium as well as on monographs and published distribution notes. Those species that occurred in bordering states in regions adjacent to Montana were included unless a natural barrier seemed to restrict their distribution or migration into Montana.

The sequence of genera is in accord with the arrangement given by Engler and Prantl (1895). The author is aware that other systems of classification have been offered, but these are not unanimously.
accepted. The "Engler and Prantl" system of classification is still in current use in the newer American manuals.

In writing the key, the indented form was used. In this type of key, the character description is indented a fixed distance from the left margin of the page, similar characters being indented a similar distance.

It will be noted on examination of the key given on page 17 that two alternatives are given for each character or group of characters. The plant must conform to one of the two first alternatives; if it does not, either the wrong genera or family has been selected. Progressing down the key, the same procedure is followed in selecting the proper character, utilizing all the alternatives until the group which is followed by the generic name is reached. If the key used is a species key, the name reached is the species rather than the genus.
Artificial Key to the Genera

Pods more than 4 times as long as broad

Partition of the pod not a thin transparent membrane

Pods splitting transversely into numerous one seed-ed joints; seeds nearly square ------------ Chorispora 87
Pods not splitting transversely; seeds nearly round - - Raphanus 40

Partition of the pod a thin transparent membrane

Pods stipitate; anthers exserted beyond the petals;
anthers rolled back similar to a ram's horn

Stipe of pod more than 1 cm. long; partition of
pod without a longitudinal mid-band; petals
yellow --------------------- Stanleya 22
Stipe of pod less than 1 cm. long; partition of
pod with a longitudinal mid-band; petals violet;
rose or white --------------- Thelypodium 24

Pod not stipitate; anthers not exserted or rolled back
in the above manner

Pods beaked

Flowers yellow, not purple-veined

Petals 6 mm. or more long; beak 3 mm. or
more long; cotyledons folded back on
themselves ------------------- Brassica 38
Petals less than 6 mm. long; beak less
than 3 mm. long; cotyledons folded back.
on the hypocotyle and radicle — — — — — — Barbarea 41

Flowers variously colored, purple-

weened — — — — — — — — — — — — — — — — — — Eruca 37

Pods not beaked, but sometimes tipped with a

persistent stigma

Plants pubescent with branched hairs

Pods, stems, and leaves pubescent with 2-

branched hairs — — — — — — — — — — — — — — — — — — Erysimum 83

Pods, stems and leaves pubescent with

hairs of more than 2 branches

Leaves compound or lobed nearly to midrib

Alpine plants; stems arising from a

branched woody base — — — — — — — — — — — — Smelowskia 68

Plants of lower altitudes; stems

arising from a simple tap-root — — — — Descurainia 69

Leaves entire or toothed, never com-
pound or deeply lobed

Pods less than 2 cm. long

Seeds in 2 rows in each chamber of

the pod — — — — — — — — — — — — — — — — — — Draba 55

Seeds in 1 row in each chamber of

the pod — — — — — — — — — — — — — — — — — — Stenophragma 72

Pods more than 2 cm. long

Stigma in flower or in fruit deeply

2-lobed (1 mm. or more) — — — — — — Hesperis 87
Stigma in flower or in fruit not deeply 2-lobed (less than 0.5 mm.) ---- Arabis 73

Plants glabrous or pubescent with simple hairs

Mature pod 2 cm. or more long

Pod compressed or cylindrical

Partition with a longitudinal mid-band due to elongation of the cells in that region;

petals never yellow or white ---- Thelypodium 24

Partition without a longitudinal mid-band; petals yellow or white

Stigma not distinctly lobed; pod

flattened ---------------- Gardamime 46

Stigma lobed; pod scarcely if at all flattened ----------- Sisymbrium 34

Pod 4-angled

Leaves entire, clasping ------------ Conringia 88

Leaves compound, petioled ---------- Barbarea 41

Mature pods less than 2 cm. long

Pods compressed; stem and basal leaves

entire or dentate

Pods compressed parallel to the partition ---------------- Draba 55

Pods compressed contrary to the partition ---------------- Thlaspi 32
Pods not compressed; stem leaves, basal leaves or both compound

Pods and pedicels erect, strongly appressed to the rachis; diameter of the pedicels equal to the diameter of the pod ———— Sisymbrium 34

Pods and pedicels not strongly appressed to the rachis; diameter of the pedicels not equal to the diameter of the pod ———— Rorippa 43

Pods not more than 4 times as long as broad

Pods not compressed

One seed in each chamber of the pod ——— Cardaria 26

More than one seed in each chamber of the pod

Pubescence of branched hairs

Pods twin-like ——— Physaria 48

Pods not twin-like

Stem leaves clasping; pods obovoid, glabrous and margined ——— Camelina 54

Stem leaves not clasping; pods globose, pubescent with branched hairs, not margined ——— Lesquerella 50

Pubescence of simple hairs or glabrous

Leaves all basal, awl-shaped ——— Subularia 26

Leaves not all basal, not awl-shaped ——— Rorippa 43
Stem leaves deeply lobed or compound -- -- -- - Rorippa 43
Stem leaves not deeply lobed -- -- -- -- - Camelina 54

Pod compressed

Pod compressed parallel to the partition

One or two seeds in each chamber of the pod -- -- -- - Alyssum 85
More than two seeds in each chamber of the pod

Stem leaves compound and deeply lobed -- -- - Smelowskia 68
Stem leaves not compound or deeply lobed

Plants mostly less than 2 dm. high; seeds not winged -- -- -- -- -- Draba 55
Plants generally more than 2 dm. high;
seeds winged -- -- -- -- -- -- -- Berteroa 86

Pod compressed contrary to the partition

One seed in each chamber of the pod -- -- -- -- -- - Lepidium 28
More than one seed in each chamber of the pod

Plants pubescent with forked hairs -- -- -- -- - Capsella 53
Plants glabrous -- -- -- -- -- -- -- - Thlaspi 32
**Stanleya Nutt. Gen. 2:71. 1818**

**Prince's Plume**

Annual or perennial, usually herbaceous plants; stems and leaves glabrous or pubescent with simple hairs; stems simple or branched, basal leaves absent or present in the form of a rosette; stem leaves petiolate or sessile and clasping, dissected to entire; inflorescence racemose; buds club-shaped; sepals linear, reflexed or spreading at anthesis; petals yellow to white; filaments of stamens nearly equal, glandular tissue usually surrounding base of single stamens, rudimentary or on under side of paired stamens only; siliques borne on a long (1-3 cm.) stipe, linear, flattened parallel to septum or nearly terete; stigma sessile or the style only slightly developed; seeds oblong, marginless. Stanleya is an indicator of selenium bearing soils. It is found in heavy clay soils and is not adapted to mountainous conditions. The nearest relative of Stanleya is Thelypodium. The morphology of the flower, fruit, and leaves of these two are so similar that they could be considered congeneric. Stanleya is distinguished from Thelypodium by greater stipe length, club-shaped buds, and sepals that are spreading at anthesis rather than being erect.

**Key to Species**

Middle and upper stem leaves petioled

Inner surface of petal-claw densely pubescent,

petals bright yellow; lower stem leaves compound or if entire less than 2 cm. wide --- ------- - - - - 1. S. pinnata
Inner surface of petal-claw glabrous, petals pale yellow or white; lower stem leaves 3-10 cm. wide, usually entire -- -- -- -- -- -- -- - 2. S. tomentosa 

Middle and upper stem leaves sessile -- -- -- -- -- -- -- - 3. S. viridiflora

1. Stanleya pinnata (pursh) Britt. Trans. N.Y. Acad. 8:62. 1889
   Golden Prince's Plume (Desert Plume)

   Cleome pinnata Pursh Fl. Amer. Sept. 2:739. 1816
   Stanleya pinnatifida Nutt. Gen. 2:71. 1818
   Stanleya heterophylla Nutt. Torr. & Gray, Fl. N. Amer. 1:97. 1838

   Distribution: Fergus and Powder River counties.

2. Stanleya tomentosa Parry, Am. Naturalist 8:212. 1874
   Hairy Prince's Plume

   Distribution: northern Wyoming but may occur along the southern border of Montana.

   Green Prince's Plume

   Stanleya collina M.E. Jones, Zoe. 3:284. 1893

   Distribution: Shinberger's Canyon, Montana; local inquiries concerning the exact location of this site have not been successful.
Thelypodium Endl. Gen. 876. 1839

Thelypody

Biennial or perennial herbs with simple or branched stems; hairs absent or unbranched; stem leaves frequently clasping at the base; flowers purple, lilac, rose or white; sepals scarcely if at all swollen at the base; petals linear, oblong or oblanceolate, entire; anthers frequently tapered to a point; inflorescence usually racemose, rarely corymbose; pods round or slightly flattened parallel to the partition, distinctly stipitate or sessile, 1.5-10 cm. long, 1-2 mm. wide, horizontal to erect; style short, stigma small, entire or very slightly 2-lobed; cells of the septum elongated parallel to the framework of the pod, usually more or less contorted, cells shorter, and walls usually less closely compacted near the margin; the central region of the septum composed of elongated cells frequently appearing under a hand lens as a broad midvein; seeds not winged. Members of Thelypodium prefer a saline soil. They are usually found on bottom lands where the soil is very wet in the spring. They are found only in the western portion of the United States and none of the species are adapted to alpine conditions. The pods of Thelypodium do not show characters which lend themselves to species separation but they are important in generic separation. The septum of the pod has a characteristic cellular pattern consisting of a broad region composed of cells elongated parallel to the marginal framework and extending through the middle of the septum. Species are not admitted to Thelypodium unless they have this type of septum.
Key to Species

Stem leaves not clasping the stem at the base — — — — — 1. T. integrifolium

Stem leaves clasping the stem at the base — — — — — — 2. T. Sagittatum


Entire-leaved Thelypodium

Pachypodium integrifolium Nutt.: Torr. & Gray, Fl. N. Amer. 1:96. 1838

Thelypodium lilacinum Greene, Fl. Baker. 3:9. 1901

Thelypodium rhomboideum Greene, Pittonia 4:314. 1901

Thelypodium affine Greene, Pittonia 4:314. 1901

Distribution: Gallatin, Lewis and Clark, Madison, Park, and Silver Bow counties.


Sagittate Thelypodium


Distribution: Madison county and Yellowstone National Park.
Subularia L. Sp. Pl. 642. 1753

Awlwort

Small, submerged, aquatic, annual herbs with basal awl-shaped leaves and small white flowers borne on a leafless scape; stamens 6; style none; pod short-stipitate, ovoid to spherical; valves convex, ribbed dorsally; the partition broad; seeds few in each cell, marginless. This plant is found growing in shallow water along the shores of mountain lakes from British Columbia to the Sierra Nevada, California, east to Newfoundland, Maine, and Wyoming. Specimens of this genus have not been examined by the author, but collections have been made in Missoula county.

1. Subularia aquatica L. Sp. Pl. 642. 1753

Water Awlwort

Distribution: rare aquatic crucifer found only in cold mountain lakes in Montana, Idaho, and Wyoming; reported in Montana's mountainous region.


Whitetop

Perennial, erect herbs; leaves alternate, toothed, the upper clasping; flowers perfect, in terminal panicles; petals white; stamens 6; ovary sessile; styles slender, short; pod ovate, heart-shaped at the base, acute at the apex, neither winged nor matched at apex; valves strongly convex; seeds solitary in
each cavity. The members of this genus have given taxonomists trouble for over a century. Cardaria Draba has been placed in five genera other than Cardaria: Nasturtium, Lepidium, Draba, Cardiolepis and Physolepidion. Abrams, Hitchcock, and Peck still refer to this species as Lepidium Draba. The other species present in Montana, Cardaria pubescens, is still called Hymenophyse pubescens by several authors. Cardaria differs from Lepidium in that it has inflated, indehiscent pods and nectar glands that completely surround the single stamens and subtend the paired stamens. Hymenophyse differs from Cardaria only in the degree of pubescence and the inflorescence type. C. Draba is an introduced species. The oldest collection was made near Yreka, California in 1876. The plant prefers alkaline soil but it is not restricted to this type of habitat. C. pubescens is also an introduced species. The seeds were believed to have been introduced as impurities in alfalfa seed. Its distribution is still incomplete but will probably parallel that of C. Draba. Both of these plants are serious weeds in grain fields, hay meadows, and pastures. Both are very resistant to 2,4-D.

Key to Species

Pods glabrous ------ 1. C. Draba
Pods pubescent ------ 2. C. pubescens

Pepperweed (Whitetop)

Lepidium Draba L. Sp. Pl. 645. 1753


2. Cardaria pubescens (Meyer) Rollins, Rhodora 42:305. 1940

Hairy Cress (Hairy Whitetop)

Hymenophysa pubescens C.A. Mayer, Ledeb. Fl. Alt. 3:181. 1831

Distribution: Gallatin and Park counties; Yellowstone National Park.

Lepidium (Tourn.) L. Sp. Pl. 643. 1753

Pepperweed (Pepperwort)

Annual biennial, or perennial herbs; leaves compound or entire; pubescence, if any, of simple hairs; petals small, white or greenish, rarely wanting; stamens often less than 6; stigmas sessile or nearly so; pods oblong or nearly round, flattened contrary to the partition, winged at the apex; valves keeled, dehiscent; seeds 1 in each cell, flattened. This genus is adapted to a wide variety of habitats. One species, Lepidium latifolium, thrives best on a wet saline soil while others inhabit soils of normal pH and become pests in gardens and cultivated fields. Some, such as L. campestre,
are found in range land and pastures. None of the members of this genus afford much feed for either livestock or wild game and most of them are considered serious weed pests.

Key to Species

Woody based perennials, or if annuals the upper stem leaves W-shaped at the base or the basal lobes of the leaves encircling the stem

Stem leaves either W-shaped at base or the basal lobes encircling the stem

Stem leaves W-shaped at base, fruit conspicuously winged at tip --------------- l. L. campestre

Stem leaves with basal lobes encircling the stem, fruit not conspicuously winged at tip ------- 5. L. perfoliatum

Stem leaves neither W-shaped at base nor the basal lobes encircling the stem

Leaves entire or dentate, 4-8 cm. broad, style obsolete -------------- 3. L. latifolium

Leaves entire or pinnate, if entire not as broad as above, style 0.3 mm. or more long --------- 4. L. montanum

Annuals or perennials, but never woody-based; upper stem leaves neither W-shaped at the base nor the basal lobes of the leaves encircling the stem

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Petals 2 mm. or more long; fruits 5-7 mm. long - - - - - - 7. L. sativum
Petals less than 2 mm. long, or if over 2 mm. long, fruits less than 5 mm. long
Racemes numerous; axillary and terminal, congested, 2-4 cm. long - - - - - - - - - - - - - - - - 6. L. ramosissimum
Racemes mostly terminal, not congested, over 4 cm. long
Pods ovate, upper half averaging more in width than the lower half; apical notch of pod as deep or deeper than broad - - - - - - - - - - - - - - - - - - - - - - - - - - - - 2. L. densiflorum
Pod nearly round, upper half averaging less in width than the lower half; apical notch of pod not as deep as broad - - - - - - - - - - - - - - - - - - - - - - - - - - - - 8. L. virginicum

1. Lepidium campestre (L.) R. Br. Ait. f. Hort, Kew. 4:88. 1812
   Field Pepperweed

Distribution: Cascade, Gallatin and Madison counties.

   Prairie Pepperweed (Common Pepperweed)

Lepidium pubicarpum Nels. Bot. Gaz. 30:189. 1900
Lepidium Bourgeauanum Thell. Monog. Lepid. 237. 1906

Distribution: well established in Montana.

3. Lepidium latifolium L. Sp. Pl. 644. 1753
   Bog Pepperweed

Distribution: Gallatin county.

   Mountain Pepperweed

   Lepidium utahense Regel, Acta. Hort. Petrop. 1:42. 1871
   Lepidium scopulorum f. nanum Thell. Monog. Lepid. 211. 1906

Distribution: Beaverhead county.

5. Lepidium perfoliatum L. Sp. Pl. 643. 1753
   Clasping Pepperweed (Round-leaved Pepperweed)

Distribution: Carter, Cascade, Gallatin, Ravalli, and Silver Bow counties.

   Congested Pepperweed

Distribution: Well established throughout the state.

7. **Lepidium sativum** L. *Sp. Pl.* 644. 1753
   
   *Garden Pepperweed* (*Garden Cress Pepperweed*)
   
   Distribution: Gallatin and Lewis and Clark counties.

8. **Lepidium virginicum** L. *Sp. Pl.* 645. 1753
   
   *Virginia Pepperweed* (*Wild Pepperweed*)
   
   **Lepidium Menziesii** DC. *Syst.* 2:539. 1821
   
   
   
   **Lepidium occidentale** Howell, *Erythea* 3:32. 1895
   
   
   
   Distribution: Gallatin county.

   **Thlaspi** (Tourn.) *L. Sp. Pl.* 645. 1753
   
   *Penny Cress*
   
   Erect, glabrous, annual or perennial herbs; basal leaves forming a rosette, entire or toothed; stem leaves W-shaped at base and clasping; flowers racemose, white or purple; pods triangular or nearly round, generally emarginate, flattened contrary to the partition, winged; valves dehiscent; seeds
2 or more in each cell; reticulate. Many botanists today have combined the indigenous species of *Thlaspi* into one species, *T. alpestre*, which is a European species. It is probable that *Thlaspi* entered America by way of Siberia and the Aleutian Islands and would seem to be related to the species of Asia rather than to those of Europe. Payson (1926) states that specimens of *T. cochleariforme*, a Siberian species, are very similar to *T. glaucum*, one of the common plants found in Montana. If *T. cochleariforme* and *T. alpestre* are separate entities, then it would be preferable to call this plant by the former name. The author has not seen either of the species in question, and it is more logical to choose the entities used by Payson. They seem to be separated on valid taxonomic characters which as a rule are not variable. These entities are *T. parviflorum* and *T. glaucum* and their separation is based on style and petal length. *T. arvense* is a European species introduced into North America. Its classification presents no problem to the taxonomist for it is very easily distinguished from the other members of this genus that occur in Montana. *T. glaucum* and *T. parviflorum* are usually found in wooded sub-alpine situations. *T. arvense* is a common weed in cultivated fields and gardens.

Key to Species


Biennial or perennial, pod wedge-shaped, ob-
scuredly winged and shallowly or not at all notched

Style 1 mm. or more long; petals usually over
4 mm. long -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -2. T. glaucum

Style less than 0.5 mm. long; petals less than
4 mm. long -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -3. T. parviflorum

1. Thlaspi arvense L. Sp. Pl. 646. 1753
   Field Penny Cress (Fanweed, Stinkweed)

   Distribution: entire state.

   Blue Penny Cress

Thlaspi alpestre var. glaucum A. Nels. Wyo. Exp. Station Bull. 28:84. 1902

   Distribution: Cascade, Gallatin, Madison, Meagher, and Missoula counties.

   Thorowort Penny Cress

   Distribution: Beaverhead county.

Sisymbrium L. Sp. Pl. 657. 1753
   Tumbleweed
Annual, biennial or perennial herbs with branching, erect or decumbent stems; hairs absent or if present, unbranched; stem leaves frequently clasping entire or compound; flowers various; sepals scarcely swollen at the base; petals entire, white or yellow; nectar glands usually enlarged around the solitary stamens, reduced below the double stamens; inflorescence usually short and corymbose, elongating and lax in fruit; pods round, stipitate or sessile; style short or lacking; stigma subentire or distinctly 2-lobed, the lobes extended over the septum; septum thin and cell pattern usually undifferentiated into a central region of elongated cells; seeds not winged. The species of *Sisymbrium* seem to have originated in Arizona since it is here that the genus is best represented. The most primitive species of the group is *S. ambiguum* and is closely related to *Thelypodium*. It differs only by the less differentiated cell pattern of the septum and by the slightly 2-lobed stigma with the lobes extended over the septum. From a morphological point of view, it can be seen that *Sisymbrium* and *Thelypodium* are very closely related. *S. salsugineum* and *S. linifolium* are the only representative of the genus that are indigenous to Montana. *S. linifolium* is a very common weed while *S. linifolium* has been collected only once in Montana and four times in all of North America. *S. officinale*, *S. altissimum*, and *S. Loeselii* are European introductions. *S. Loeselii* was first collected in Montana, June 10, 1948, and is abundant along roadsides in Gallatin county. *S. altissimum* is a common weed in grain fields in Montana.

**Key to Species**
Pods awl-shaped, appressed to the rachis - - - - - - - - - 4. S. officinale
Pods not awl-shaped, not appressed to the rachis

Plants with rhizomes - - - - - - - - - - - - - - - - - - - - - - - - - - - - 2. S. linifolium
Plants without rhizomes;

Pods 4-8 cm. long; pedicels as thick as the pods - - - - - - - - - 1. S. altissimum
Pods 2-4 cm. long; pedicels less than half as thick as the pods

Leaves entire, plants glabrous, petal white - - - - 5. S. salsugineum
Leaves toothed, plants hirsute, petals yellow - - - - - - - - - - - - - - - - - - - - - - - 3. S. Loeselii

   **Tumble Mustard**

_Norta altissima_ Britt. in Britt. & Brown, Ill. Fl. ed. 2. 2:174. 1913

Distribution: Cascade, Daniels, Flathead, Gallatin, Lake, Musselshell, Ravalli, Roosevelt, Sheridan, Stillwater, Wibaux, and Yellowstone counties; Yellowstone National Park:

2. Sisymbrium linifolium Nutt. Torr. & Gray, N. Amer. Fl. 1:91. 1838
   **Flax-leaf Plains-mustard**

_Nasturtium linifolium_ Nutt. Journ. Acad. Phila. 7:12. 1834
_Schoenocrambe linifolia_ (Nutt.) Greene, Pittonia 3:127. 1896
Schoenocrambe pinnata Greene, Pittonia 3:127. 1896

Distribution: Beaverhead, Gallatin, Lewis and Clark, and Silver Bow counties.

3. Sisymbrium Loeselii L. Cent. Pl. i. 18
   Small-podded Tumbleweed

Distribution: Gallatin and Phillips counties.

   Hedge Mustard

Erysimum officinale L. Sp. Pl. 660. 1753
Sisymbrium officinale Scop. Fl. Carn. ed. 2. 2:26. 1772
Sisymbrium leocarpum Jordan Diag. 1:139. 1864

Distribution: Gallatin, Lincoln, and Missoula counties.

5. Sisymbrium salsugineum Pallas, Reise 2 app. 114, t 5. 1773

Sisymbrium glaucum Nutt. in T & G. Fl. N. Amer. 1:93. 1838

Distribution: Beaverhead county.

Eruca (Tourn.) Mill. Gard. Dict. Abr. ed. 4. 1754

The genus is represented in Montana by a single species, Eruca-sativa. It was collected in Flathead county in 1889 and listed as an escape from cultivation. This is the only record of this species in Montana.

_Rocket Salad (Garden Rocket)_

*Brassica Eruca* L. Sp. Pl. 667. 1753

*Eruca Eruca* Britt. in Britt. & Brown, Ill. Fl. ed. 2. 2:192. 1913

Distribution: Flathead county.

*Brassica* (Tourn.) L. Sp. Pl. 666. 1753

_Mustard_

Annual, biennial, or perennial herbs; stem erect; basal leaves compound; stem leaves entire or toothed; petals yellow; inflorescence racemose; pods elongated, round or four-sided, sessile, tipped with a persistant flat, angular, or round beak; valves 1-3 nerved; stigma round or 2-lobed; seeds in one row in each cell. This genus is native of Europe, Asia and northern Africa, all of our species have been introduced. *B. campestris* and *B. kaber* are very common weeds in cultivated fields. *B. nigra* is less common but a potential weed hazard. *B. hirta* and *B. juncea* are the cultivated mustards of agriculture. This crop is valued at almost $1,500,000 yearly in Montana.

**Key to Species**

Upper leaves clasping by a W-shaped base --- 1. *B. campestris*

Upper leaves not clasping by a W-shaped base
Valves strongly 3-nerved; beak not cone-shaped

Pods hirsute; beak flattened ——— ——— ——— ——— ——— ——— 2. B. hirta

Pods glabrous, beak angular ——— ——— ——— ——— ——— ——— 4. B. kaber

Valves strongly 1-nerved; beak cone-shaped

Pods closely appressed to the rachis; less than 2 cm. long ——— ——— ——— ——— ——— ——— 5. B. nigra

Pods not closely appressed to the rachis,
more than 2 cm. long ——— ——— ——— ——— ——— ——— 3. B. juncea

1. Brassica campes'tris L. Sp. 666. 1753
Bird Rape (Common Mustard, Birdseed Rape)

Distribution: Daniels and Gallatin counties.

2. Brassica hirta Moench Suppl. Meth. 84. 1802
White Mustard (Yellow Mustard)

Sinapis alba L. Sp. Pl. 668. 1753

Brassica alba Rabenhorst Fl. Lusatica 1:184. 1839

Distribution: cultivated and sometimes found as an escape.

India Mustard (Brown Mustard)

Sinapis juncea L. Sp. Pl. 668. 1753
Distribution: cultivated and sometimes found as an escape.


**Charlock (Field Charlock)**

*Sinapis arvensis* L. Sp. Pl. 668. 1753

*Brassica arvensis* Rabenhorst *Fl. Lusatia* 1:184. 1839


Distribution: Daniels, Gallatin, Lewis and Clark, Madison, Powder River, and Wibaux counties.

5. *Brassica nigra* (L.) Koch in *Roehl, Deutsch. Fl.* ed. 3. 4:713. 1833

**Black Mustard**

*Sinapis nigra* L. Sp. Pl. 668. 1753

Distribution: Bighorn, Cascade, Flathead, and Jefferson counties.

**Raphanus (Tourn.) L. Sp. Pl. 669. 1753**

**Radish**

Annuals or biennials; stems erect or widely branching from the base; leaves deeply toothed or compound; petals white, pale yellow, or purple; pod elongate, linear, fleshy or corky, constricted or continuous and spongy between the seeds, indehiscent, tapering above into the persistent slender style; seeds round. Introduced from Europe and temperate Asia. *R. sativus*
is the common cultivated garden radish. One form exists as an adventive weed.

Key to Species

Pods longitudinally grooved, strongly constricted between the 4-10 seeds when dry ---- 1. Raphanistrum

Pods not longitudinally grooved, slightly constricted between the 2 to several seeds -------- 2. R. sativus

1. Raphanus Raphanistrum L. Sp. Pl. 669. 1753

Wild Radish (Jointed Charlock)

Raphanistrum inocuum Moench, Meth. 217; Medic. in Usteri, Ann. Bot. 8. 1794

Distribution: Stillwater county.

2. Raphanus sativus L. Sp. Pl. 669. 1753

Garden Radish

Distribution: occasional adventive

Barbarea R. Br. in Ait. Hort. Kew ed. 2. 4:109. 1812

Wintercress

Biennial or perennial herbs; stems erect, angular, generally purplè near
the base; leaves compound; petals yellow; inflorescence racemose; pods elongated, linear, 4-angled; valves keeled or ribbed; style less than 3 mm. long; stigma round or 2-lobed; seeds in 1 row in each cell, flat, oblong, and slightly reticulate. This genus is generally found in wet places near swamps and along irrigation ditches. Because of this growth habit, it probably will never become a serious weed. The genus is often confused with Brassica and is often identified as B. campestris. Petal and beak length as well as seed type make the two genera easily distinguishable.

Key to Species

Pods ascending, not appressed to the rachis - - - - - - - - - - 1. B. americana

Pods ascending, strongly appressed to the rachis - - - - - - - - - - - - 2. B. stricta

   American Wintercress

Barbarea orthoceras var. dolichocarpa Fern. Rhodora 11:140. 1909

Distribution: Cascade, Gallatin, Jefferson, Missoula, and Stillwater counties.

   Erect-pod Wintercress

Barbarea orthoceras Ledeb. Rhodora 11:140. 1909
Distribution: Carbon, Gallatin, and Yellowstone counties.

Rorippa Scop. Fl. Carn. 520. 1760

Marsh Cress (Water Cress)

Annual, biennial, or perennial; aquatic or semi-aquatic herbs; leaves simple, lobed or compound; petals yellow or white; style short and slender; stigma 2-lobed or entire; pods short and round, slightly if at all, compressed parallel to the partition; valves nerve-less or one-nerved; seeds very small, in 2 rows in each cell. This genus has been called Sisymbrium, Radicula, Roripa, and Rorippa. It has been subdivided into Armoracia, Rorippa, and Nasturtium by some authors.

Key to Species

Flowers white

Upper leaves pinnately divided; pods linear --- 5. R. Nasturtium-aquaticum
Upper leaves simple; pods ovoid ---- 1. R. Armoracia

Flowers yellow

Plants with rootstocks; petals much exceeding the sepals

Pods glabrous or nearly so --- 7. R. sinuata
Pods pubescent ---- 2. R. calycina

Plants without rootstocks; petals scarcely
equaling the sepals

Pods spherical, or if oblong-ellipsoid,
the pod shorter than the pedicels -- - - - - - - 4. R. islandica

Pods oblong to linear cylindrical, equaling or longer than the short pedicels

Style about 1 mm. long - - - - - - - - - - - - 6. R. obtusa

Style minute; 0.5 mm. long or less - - - - - - - - 3. R. curvisiliqua

   Horseradish

Cochlearia Armoracia L. Sp. Pl. 648: 1753

Nasturtium Armoracia Fries ex A. Gray Man-ed. 2:31 1856

Radicula Armoracia Robinson Rhodora 10:32. 1908

Armoracia Armoracia Britt. in Britt. & Brown, Ill. Fl. ed. 2 2:163. 1913

Distribution: escape from cultivation.

2. Rorippa calycina (Engelm.) Rydb. in Mem. N.Y. Bot Gard. 1:175. 1890
   Columbia Yellowcress

Rorippa columbiae (Suksdorf) Howell Fl. N.W. Amer. 1:40

Nasturtium columbiae Suksdorf Deutsch. Bot. Monatss. 16:211. 1898

Radicula columbiae Greene Leaflets Bot. Ols. 1:114. 1905

Distribution: Chauteau, Custer, and Gallatin counties.

*Western Yellowcress*

*Sisymbrium curvisiliqua* Hook. Fl. Bor. Amer. 1:61. 1830

*Nasturtium curvisiliqua* Nutt. in Torr. & Gray. Fl. N. Amer. 1:73. 1838

*Nasturtium lyratum* Nutt. in Torr. & Gray, Fl. N. Amer. 1:73. 1838

*Radicula curvisiliqua* Greene Leaflets Bot. Obs. 1:113. 1905

Distribution: Cascade, Gallatin, Madison, and Silver Bow counties and Yellowstone National Park.


*Obtuse Fieldcress*

*Sisymbrium amphibium* var. *palustre* L. Sp. Pl. 657. 1753

*Radicula palustris* Moench. Meth. 263. 1794

*Nasturtium terestre* R. Br. in Ait. Hort. Kew. ed. 2. 4:110. 1812


*Nasturtium palustre* DC. Syst. 2:191. 1821

*Rorippa palustris* (L.) Bess, Enum. Pl. Vol h. 27. 1821


*Radicula hispida* Britt. Torreya 6:30. 1906

*Radicula palustris* var. *hispida* Robinson Rhodora 10:32. 1908

Distribution: Cascade, Flathead and Madison counties.

**Watercress**

*Sisymbrium Nasturtium-aquaticum* L. Sp. Pl. 657. 1753

*Nasturtium officinale* R. Br. in Ait. Hort. Kew. ed. 2. 4:110. 1812

*Radicula Nasturtium-aquaticum* Britt. & Rendle List Brit. Seed Plants 3. 1907

Distribution: entire state.


**Blunt-leaved Yellowcress**

*Nasturtium obtusum* Nutt. in Torr. & Gray. Fl. N. Amer. 1:74. 1838


Distribution: Cascade, Fergus, Flathead, Gallatin, Madison and Missoula counties.


**Spreading Yellowcress**

*Nasturtium sinuatum* Nutt. in Torr. & Gray, Fl. N. Amer. 1:73. 1838

*Radicula sinuata* Greene Leaflets Bot Obs. l:113. 1905

Distribution: Cascade, Gallatin, Phillips and Wibaux counties.

*Cardamine* (Tourn.) L. Sp. Pl. 654. 1753

**Bittercress**
Annual or perennial herbs; leaves entire or compound; petals white or purple; inflorescence racemose or corymbose; pods elongated, compressed parallel with the partition; valves nerveless; seeds in 1 row in each cell. This is a very common semi-aquatic plant found along the banks of mountain streams. Some of the species are alpine.

Key to Species

Basal leaves simple, stem leaves 3-7 foliolate;
plants with rhizomes ------------------l. C. Breweri

Basal leaves pinnate, stem leaves 5-15 foliolate;
plants without rhizomes
Pod 8-20 seeded; leaflets mostly rounded ------2. C. oligosperma
Pod 20-30 seeded; leaflets oblong or linear ----3. C. pennsylvanica

   Brewer's Bittercress

Cardamine orbicularia Greene Pittonia 4:202. 1901

Distribution: Carbon, Cascade, Gallatin, Glacier, Madison, Missoula, Park, Stillwater, and Yellowstone counties.

2. Cardamine oligosperma Nutt. in Torr. & Gray, Fl. N. Amer. 1:85. 1838
   Few-seeded Bittercress
Distribution: Gallatin and Park counties.


*Pennsylvania Bittercress*


1838


Distribution: Cascade, Gallatin, Flathead, Missoula, and Stillwater counties; Yellowstone National Park.

*Physaria* A. Gray, gen. *Ill.* 1:162. 1848

*Twin-pod* (Double Bladder Pod)

Perennial; tufted; silvery stellate; stems simple, arising from an elongated base; basal leaves usually numerous, often forming rosettes, petiolate, oblanceolate to nearly round, entire or dentate; inflorescence congested to somewhat elongated; petals yellow or rarely purplish; sepals linear-oblong, pubescent; pedicels rigid; pods twin-like, constricted, pubescent, often much inflated; ovules 2-6 in each cell. The genus *Physaria* is confined to western North America. It occurs chiefly on high plateaus and lower mountain elevations in dry barren situations where sunlight is intense and competition from other plants almost nonexistent. *Physaria* has the same floral pattern, habit of growth, and pubescent type as *Lesquerella*. The pods are also similar but differ in the following respects: *Physaria* has twin-
like pods that are constricted at the partition and usually highly inflated. The pods of Lesquerella are never twin-like, and are never constricted at the partition. They are usually highly inflated.

Key to Species

Apical notch of pod less than 1 mm. — — — — — — — — — — 4. P. Geyeri

Apical notch of pod more than 2 mm.

Partition obovate; ovules 4 in each cell of the pod — — — — — — — — — — — — — — — — — — — — — 3. P. didymocarpa

Partition narrowly oblong to linear-oblong;

ovules 2 in each cell of the pod

Notches of pod equal above and below;

valves nearly round — — — — — — — — — — — — — — — — — 1. P. austmalis

Notches of pod unequal (upper very deep, lower shallow or absent); valves heart-shaped — — — — — — — — — — — — — — — — — 2. P. brassicoides

1. Physaria australis (Payson) Rollins Rhodora 41 p. 408. 1939

Australian Twin-pod

Physaria didymocarpa (Hook.) Gray var. australis Payson in Ann. Mo. Bot. Gard. 5:144. 1918
Distribution: not reported in Montana but may occur along the southern and southwestern border.


Distribution: not reported in Montana but may occur along eastern border of the state.

3. Physaria didymocarpa (Hook.) Gray, Gen. Illustr. 1:162. 1848

Common Twin-pod (Double Bladder-pod)

Vesicaria didymocarpa Hook. Fl. Bor. Amer. 1:49. 1830

Coulterina didymocarpa O. Kuntze, Revis. Gen. 2:931. 1891


Distribution: Cascade, Choteau, Custer, Fergus, Gallatin, Glacier, Granite, Madison, Meagher, Missoula, Park, Stillwater, and Yellowstone counties.


Geyer's Twin-pod (Geyer's Double Bladder-pod)

Vesicaria Geyeri Hook. Lond. Journ. Bot. 6:70. pl. 5. 1847

Coulterina Geyeri O. Kuntze Revis. Gen. 2:931. 1891

Distribution: Deer Lodge, Jefferson, Madison, and Missoula counties.

Lesquerella Watson, Proc. Amer. Acad. 23:249. 1888

Bladder-pod
Annuals or perennials, frequently forming rosettes; stems generally unbranched; basal leaves compound or entire; stem leaves usually entire; pods glabrous or stellate, inflated flattened parallel to the partition, sessile or stipitate; ovules usually few; seeds sometimes winged. The genus is most abundant in the arid regions of western North America with the geographical center of distribution in northern New Mexico. The region of greatest specific concentration is located in central Texas. The plants seem to prefer a calcareous soil but are not limited by soil type. They are found growing in sandy loam, heavy clay, and decomposed granite.

Key to Species

Pedicels uniformly curved downward, not curved like the letter "S"

Stems stout; fruiting racemes not borne along one side of the axis 3. L. argentea

Stems slender; fruiting racemes usually borne along one side of the axis 2. L. arenosa

Pedicels curved like the letter "S", straight or uniformly curved upward

Basal leaves linear or narrowly lance-shaped

Fruiting inflorescence raised conspicuously above the leaves 1. L. alpina

Fruiting inflorescence scarcely raised above
the basal leaves — — — — — — — — — — — — — — — — — — — — — — — 4. L. condensata

Basal leaves spatulate to nearly round

Pods, when mature, twice as long as

wide, or longer — — — — — — — — — — — — — — — — — — — — — — — — — — — — 5. L. curvipes

Pods, when mature, never twice as long

as wide — — — — — — — — — — — — — — — — — — — — — — — — — — — — 31. L. alpina


Alpine Bladder-pod

Vesicaria alpina Nutt. Torr. & Gray, Fl. N. Amer. 1:102. 1838
Alyssum alpinum Kuntze Rev. Gen. Pl. 2:931. 1891
Lesquerella paetzula Greene Pittonia 4:308. 1901
Lesquerella nodosa Greene Pittonia 4:309. 1901

Distribution: Gallatin, Lewis and Clark, Park, and Sweetgrass counties.


Rydberg's Bladder-pod

Vesicaria arenosa Richards, Flanklins Journ. to Shores of Polar Sea. 743. 1823
Lesquerella versicolor Greene, Pittonià 4:310. 1901
Lesquerella Macounii Greene, Pittonia 4:310. 1901
Lesquerella rosea Greene, Pittonia 4:311. 1901


Distribution: not reported but may occur along the southern border of Montana.

   Silver Bladder-pod

Myagrum argenteum Pursh. Fl. Am. Sept. 2:434. 1816

Alyssum Ludovicianum Nutt. Gen. N. Am. Fl. 2:63. 1818

Vesicaria ludoviciana DC. Syst. 2:297. 1821


Distribution: Cascade county.


Distribution: Beaverhead, Madison, Meagher, and Wheatland counties.


Distribution: Carbon county.

Capsella Medic. Fl. Gatt. 1:85. 1792

Shepherd Purse
Annual; basal leaves in a rosette, compound, stem leaves dentate to entire, W-shaped at the base; pubescent with branched hairs, some unbranched hairs present also; petals white; inflorescence racemose; style short; stigma not lobed; pod strongly flattened contrary to the narrow partition, flat, wedge-shaped, notched at the apex; seeds numerous in each cell. This genus is represented by a single species, \textit{C. Bursa-pastoris}, which is an introduced plant from Europe that is a common weed in fields and gardens throughout the state.

\begin{itemize}
\item 1. \textit{Capsella Bursa-pastoris} (L.) Medic. Pflanzeng. 1:85. 1792 \textbf{Shepherd Purse}
\item \textit{Bursa pastoris} Weber, in Wigg. Prim. Fl. Hoist. 47. 1780
\item \textit{Thlaspi Bursa-pastoris} L. Sp. Fl. 647. 1753
\end{itemize}

\textbf{Distribution:} throughout the state.

\begin{itemize}
\item \textit{Camelina Crantz}, Stirp. Aust. 1:18. 1762 \textbf{False-flax}
\end{itemize}

Annual herbs; stems erect; leaves entire or dentate; the stem leaves W-shaped and clasping the base; pubescent with branching hairs; petals yellow or greenish; inflorescence racemose; pods short, inflated, nearly round,
or obovoid; valves 1-nerved; style slender; stigma round; seeds in 2 rows, usually few. This genus is represented by 2 species, both of which are introduced from Europe. They are common weeds in fields and gardens throughout the state. The species are separated on characters which intergrade to some extent and further investigation may reveal them to be conspecific.

**Key to Species**

Basal leaves sessile; pod 4-5 mm. long --------- 1. *C. microcarpa*

Basal leaves petioled; pod 6-8 mm. long --------- 2. *C. sativa*

1. *Camelina microcarpa* Andr. Syt. 2:517. 1821
   
   **Little-pod False-flax**
   
   Distribution: throughout the state.

   
   **Big-seed False-flax**
   
   *Myagrum sativum* L. Sp. Pl. 641. 1753
   
   Distribution: throughout the state.

   *Draba* (Dill.) L. Sp. Pl. 642. 1753
Whitlow Wort (Whitlow Grass)

Annual, biennial, or perennial; stems leafy or leafless, pubescent with simple or forked hairs or glabrous; leaf blades entire or dentate; inflorescence racemose or corymbose; petals white or yellow, often notched at apex sometimes deeply so; pods dehiscent, strongly compressed parallel to the partition and flat, often elongate and twisted; seeds marginless, numerous, in 2 rows in each cell. These plants are of diverse habit and have variable morphological characters (even within species), but all are rather closely related despite their variable appearance. Some are found only in alpine situations, while others occur only at lower elevations. The distribution is world wide. Of the characters used for identification, pubescence type seems to be the most reliable.

Key to Species

Plants annual ------------------- Series I
Plants biennial or perennial

Leaves glabrous or with simple hairs
Stems with one or more leaves above the basal leaves ------------------- Series II
Stems leafless above the basal leaves
Flowers yellow ------------------- Series III
Flowers white = ------------------ 12. D. oreibata

Leaves pubescent, some of the hairs forked or
stellate

Stems leafy, the flowering stems with at least 1 leaf

Leaves ash-grayish pubescent with very fine closely interwoven many-branched hairs
having 5 or more rays ———— Series IV
Leaves not ash-grayish, often stellate-pubescent but the hairs stiff and little interwoven, rays of hairs 4 or less

Styles 1 mm. long or longer ———— 1. D. aurea
Styles less than 1 mm. long ———— Series V

Stems leafless

Lower side of leaves with hairs which are branched in comb-like fashion,

Leaves 0.75-1.75 mm. broad; hairs closely appressed ———— 11. D. oligosperma
Leaves 1.5-3.5 mm. broad; hairs not closely appressed ———— 7. D. inserta

Lower side of leaves glabrous or pubescent;
hairs unlike those above

Leaves ash-grayish with fine matted appressed hairs; styles less than 3 mm. long ———— Series VI
Leaves not ash-grayish, hairs coarse;
styless of varying length
Series I

Pods 3-5 mm. long, usually not over 1 mm. broad; leaves and stems pubescent with cross-like unstalked hairs. - - - - - - - - - - - - - - - - - - - - 2. D. brachycarpa

Pods larger than above; pubescence simple or if branched, the hairs stalked

Flowering stems without leaves, all leaves in basal rosettes

Petals deeply 2-lobed; most of the pods at least 2 mm. broad - - - - - - - - - - - - - - - - - - - - 17. D. verna

Petals sometimes notched at the apex but not 2 lobed; pods mostly less than 2 mm. broad - - - - - - - - - - - - - - - - - - - - 14. D. crassifolia

Flowering stems bearing one or more leaves

Inflorescence, including pedicels, pubescent - - - 14. D. praeflata

Inflorescence and pedicels glabrous

Pedicels usually at least 1.5 times as long as the pods - - - - - - - - - - - - - - - - - - - - 9. D. nemorosa

Pedicels little longer than pods, sometimes shorter
Plants biennial or winter annuals; flowers white; pedicels 8-20 mm. long -------------- 16. D. stenoloba
Plants annual, flowers lemon yellow; pedicels 1-6 mm. long -------------- 15. D. reptans

Series II

- Styles less than 0.5 mm. long; plants slender, the roots small and fiberous
  Flowers white; perennials; leaves less than 3 mm. broad; plants found only above timber line --- 6. D. fladhizensis
  Flowers yellow; biennials or short-lined perennials; leaves over 3 mm. broad; plants usually below timber line --- 16. D. stenoloba

- Styles at least 0.5 mm. long, or if shorter the plants with fleshy main root
  Basal leaves 3-10 mm. broad, 7-8 cm. long;
  petals yellow ------------------------ 3. D. crassa
  Basal leaves seldom as much as 3 mm. broad,
  not over 4 cm. long; petals white ------------------ 10. D. nivalis

Series III

- Styles less than 0.2 mm. long; petals 2-3 mm. long;
midnerve of leaf not prominent below ------------ 4. D. crassifolia

Styles more than 0.2 mm. long; petals over 3 mm. long;
midnerve of leaves prominent below ------------ 5. D. densifolia

Series IV

Pods oval or egg shaped, never contorted, 4-8 (10) mm. long ------------ 7. D. incerta

Pods oblong or nearly so, often contorted or over 10 mm. long:
Pods glabrous or sparsely ciliate ------------ 10. D. nivalis
Pods covered with branched hairs ------------ 8. D. lanceolata

Series V

Pods over 1/3 as broad as long, or if broader, not contorted
Pods pubescent with stellate or forked hairs ------------ 7. D. incerta
Pods glabrous
Petals white ------------ 6. D. fladnizensis
Petals yellow
Basal leaves 5-10 mm. broad ------------ 3. D. crassa
Basal leaves 1-3.5 mm. broad ------------ 7. D. incerta
Pods less than 1/3 as broad as long, or if broader,
then usually contorted

Pubescence all branched, felt-like in appearance,
  rays mostly over 5 and nearly all the same length -- 8. D. lanceolata
Pubescence not all branched, not felt-like in appearance, rays with 4 or 5 rays
  Pods less than 7 mm. long; petals less than 2 mm. long
      Flowers white ----------------- 6. D. fladnizensis
      Flowers yellow ----------------- 16. D. stenoloba
  Pods more than 7 mm. long; petals more than 2 mm. long
      Pubescence of many-branched hairs and a few simple hairs -- 8. D. lanceolata
      Pubescence of branched and simple hairs in nearly equal proportions
          Pods glabrous ----------------- 10. D. nivalis
          Pods pubescent
              Petals over 4 mm. long -- 1. D. aurea
              Petals less than 4 mm. long
                  Inflorescence and fruits glabrous -- 16. D. stenoloba
                  Inflorescence and fruits pubescent -- 14. D. praealta

Series VI
Styles less than 0.5 mm. long - - - - - - - - - - - - 10. D. nivalis
Styles 0.5 mm. long or longer - - - - - - - - - - - - - - 13. D. Paysonii

Series VII

Petals white in anthesis

Hairs simple to four rayed, sparse; leaves greenish - - - - - - - - - - - - - - - - - - - - - - - 8. D. fladnizensis
Hairs many-rayed and matted; leaves often grayish - - - - - - - - - - - - - - - - - - - - - - - 10. D. nivalis

Petals yellow in anthesis

Petals 3 mm. long; styles less than 0.2 mm. long - - 4. D. crassifolia
Petals over 3 mm. long; styles over 0.2 mm. long - - 7. D. incerta

Series VIII

Pubescence of leaves mostly simple or forked - - - - - - 5. D. densifolia
Pubescence of leaves both simple and many-branched

Leaves less than 1.5 mm. wide; hairs tangled - - - - 13. D. Paysonii
Leaves more than 1.5 mm. wide or if wider the hairs not tangled
Leaves with stiff straight cilia, rayed

hairs few or absent - - - - - - - - - - - - - - - - - - 5. D. densifolia
Leaves sometimes ciliate but the cilia curved, branched and soft; rayed hairs abundant

7. D. incerta


Golden Draba

Draba luteola Greene, Pittonia 4:19. 1899
Draba uber Nelson, Bot. Gaz. 34:366. 1902

Distribution: Cascade, Fergus, Lincoln, Park, Rosebud counties and Glacier National Park.

2. Draba brachycarpa Nutt. ex T. & G., Fl. N. Amer. 1:108. 1838

Short-fruited Whitlow Grass

Discovium gracile Raf., Journ, de Phys. Lxxxix. 96. 1819
Discovium Ohiotense DC. Syst. ii. 700. 1821
Alyssum bidentatum Nutt. ex Torr. & Gray, l. c. 1838
Draba brachycarpa (Nutt.) Greene, Pittonia 4:207. 1900
Draba brachycarpa var. apetala and grandiflora Engler ex Schulz (Engler, Pl. 4:105, 339. 1927

Draba bidentata Nutt. ex Schulz, l. c. 339. 1927

Distribution: Lewis & Clark county.


Draba chrysantha Wats., Proc. Amer. Acad. 17:364. 1882

Distribution: Park county.


Rocky Mountain Draba


Draba albertina Greene, Pittonia 4:312. 1901

Distribution: Madison and Park counties, and Glacier National Park.

5. Draba densifolia Nutt. ex T. & G., Fl. N. Amer. 1:104. 1838

Rockcress Draba

Draba glacialis Adams. var. pectinata Wats., Proc. Amer. Acad. 23:260. 1880


Draba globosa var. sphaerula (Macbride & Payson) Schultz op cit., 103. 1927

Distribution: Custer, Park, Silver Bow counties, and Yellowstone National Park.


Artic Draba

Draba Pattersonii Engler, Pflanzenreich 4:105:260. 1927

Distribution: Carbon county.


Yellowstone Draba

Draba glacialis Adams. var. A and B, Hook., Fl. Bor. Amer. 1:51. 1833

Draba oligosperma var. pilosa (Regel) Schulz (Engler, Pflanzenreich 4:105
1927


Draba longipes Raup, Contr. Arn. Arb. 6:165. 1934

Distribution: Carbon, Meagher, and Teton counties.


Lanceolate Draba

Draba stylaris Gray as treated by Fern. & Knowlt., Rhodora 7:64. 1905

Draba valida Goodding, Bot. Gaz. 27:55. 1904

Distribution: Cascade, Fergus, Meagher, Lake, and Teton counties.

   Woods Draba

Distribution: Cascade, Gallatin, Lewis & Clark, Madison, Missoula, Ravalli, and Rosebud counties.

    Snow Draba

Draba lonchocarpa Rydb., Mem. N.Y. Bot. Gard. 1:181. 1900

Distribution: Cascade, Carbon, Gallatin, Lake, Madison, Park and Teton counties.

    Glacier Draba


Draba glacialis Adams. Gray Syn. Fl. N. Amer. 1:112. 1895


Distribution: Beaverhead, Carbon, Cascade, Deerlodge, Gallatin, Lewis & Clark, Meagher, Park, Silver Bow, Sweet Grass counties and Yellowstone Park.

Distribution: Glacier National Park.


**Payson Draba**


*Draba globosa* Payson var. *sphaerula* (Macbride & Payson) Schulz, op cit. 103

*Draba barbata* Pohle, as treated by Schulz, op. cit., 101


Distribution: Gallatin, Madison, Meagher, and Teton counties.


**Undine Draba**

Distribution: Yellowstone National Park.

15. *Draba reptans* (Lam.) Fernád. Rhodora 36:368. 1934

**Carolina Draba**

*Draba caroliniana* var. *micrantha* (Nutt.) Gray, Man. ed. 5:72. 1867

*Draba micrantha* Nutt. ex T. & G., Fl. N. Amer. 1:109. 1838


*Draba cuneifolia* var. *californica* Jepson, Man. Fl. Fl. Calif. 533. 1925

Distribution: Cascade, Custer, Gallatin, Lewis & Clark counties and Yellowstone National Park.

**Shiny Draba**

*Draba nitida* Greene var. *nanna* Schulz, (Engler, Pflanzenreich 4:105; 320) 1927  
*Draba deflexa* Greene, Pittonia 4:20. 1899


17. *Draba verna* L., Sp. Pl. 642. 1753  
**Spring Draba**

Distribution: Sanders county.

*Smelowskia* C.A. Mey. in Ledeb. Fl. Alt. 3:165. 1831  
**Smelowskia**

Low, tufted, perennial with a much branched woody base; leaves compound, ashy gray with stellate hairs; flowers racemose, small, white, yellow or tinged with purple; sepals unequal; pods flattened contrary to the narrow septum, oblong to ovate, tapered at both ends; stigma sessile; seeds few to numerous.  
*S. calycine* is the only representative of this genus that is present in Montana. This plant prefers an alpine or sub-alpine habitat and is never found in the lower mountain valleys or foothills.
1. *Smelowskia calycina* (Desv.) C.A. Mey. in Ledeb., Fl. Alt. 3:170. 1831

**Alpine Smelowskia**


*Smelowskia lineariloba* Rydb., Bull. Torrey Club 31:555. 1904

Distribution: Beaverhead, Carbon, Custer, Gallatin, Glacier, Madison, and Park counties; Yellowstone National Park.

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*Descurainia* Webb and Berth., Phyt. Can. 1:72. 1836

**Tansymustard**

Annual or biennial plants; stems usually erect and widely branching; leaves compound, earlier ones in a basal rosette which withers as the plant matures, reduced in size upward; inflorescence racemose; petals yellow or whitish; sepals green or yellow; pubescence of branched and simple hairs, often simple hairs are absent; stalked glands often found; pod linear or clavate round or nearly so; valves 1-nerved; style short or obsolete; stigma entire; seeds in 1 or 2 rows in the cell. The endemic species of *Descurainia* probably originated in Arizona and New Mexico. The migration apparently took place in all directions from this area. *D. Sophia* is an Old World species which has been introduced and become well established throughout the United States, Canada and Alaska. *D. Richardsonii* and *D. pinnata* are native species that have become widely distributed throughout the United States and Canada. The genus is most often found in cultivated
fields, and disturbed areas and becomes a weed in these habitats.

Key to Species

Pod 15-30 mm. long, septum of pod with 2-3 longitudinal nerves

Pod mostly less than 15 mm. long, septum of pod with 1 longitudinal nerve

Pod linear, apex of valves acute, seeds in 1 row, pedicels and often the leaves beset with glandular hairs, basal leaves 1-2 pinnate

Pod club-shaped or nearly so, apex of valves rounded, seeds in 2 rows or if crowded into 1 row, pedicels and leaves not beset with glandular hairs or basal leaves not simple

1. Descurainia pinnata (Walt.) Britt. Mem. Torrey Club. 5;173. 1894

Sisymbrium brachycarpum Richards, in Franklin 151. Journ., ed. 1. App. 744. 1823


Sophia gracilis Eydb., Mem. N.Y. Bot. Gard. 1:475. 1900
Sophia intermedia Rydb., Mem. N.Y. Bot. Gard. 1:184. 1900
Sophia brachycarpa Rydb., in Britt. Man. 462. 1901
Sophia magna Rydb., Bull. Torrey Club 34:436. 1907
Descurainia brachycarpa (Richards) O.E. Schulz, Pflanzenreich 4, Fam. 105:325. 1924
Sophia glandifera Osterhout Bull. Torrey Club 53:35. 1926
Sisymbrium intermedium Garrett, Spring. Fl. Wasatch Reg., ed. 3:65. 1927

Distribution: entire state.

2. Descurainia Richardsonii (Sweet) O.E. Schulz Pflanzenreich 4, Fam. 105:318. 1928

Richardson Tansymustard

Sisymbrium Richardsonii Sweet, Hort. Brit. ed. 2:30. 1830
Sisymbrium canescens var. major Hook., Fl. Bor. Am. 1:62. 1840
Sisymbrium californicum S. Wats., Bot. King. Exped. 23. 1871
Sophia brevipes Rydb., Bull. Torrey Club. 29:238. 1902
Sophia californica Rydb., Bull. Torrey Club. 29:238. 1902
Sophia leptophylla Rydb., Bull. Torrey Club. 29:239. 1902
Sophia purpurascens Rudb., Bull. Torrey Club. 31:556. 1904
Sisymbrium viscosum Blank., Mont. Ag. Coll. Studies, Bot. 1:60. 1905

Sophia Richardsoniana Rydb. Brittonia 1:89. 1931


Flixweed Tansymustard

Sisymbrium Sophia L. Sp. Pl. 6:59. 1753

Sisymbrium parviflorum Lam. Fl. France. 2:519. 1778


Sophia Sophia Britt. in Britt. & Brown. Ill. Fl. 2:144. 1897


Distribution: Gallatin, Powder River, and Wibaux counties.

Stenophragma Celak. Flora 55:438. 1872

Annual; erect herbs; leaves entire or toothed; pubescent with forked hairs; petals white or pink; flowers in terminal racemes; style very short; stigma two lobed; pod very narrow; seeds in one row. This genus is represented by a single specie. It was naturlized from Europe and Northern Asia and is common but not abundant on range land in the vicinity of Bozeman, Montana.
1. **Stenophragma Thaliana** Celak. OEster. Bot. Zeitsch. 27:177

**Turkey Pod**

**Arabis Thaliana** L. Sp. Pl. 665. 1753

**Sisymbrium Thalianum** Gray. Ann. Sci. Nat. 7:399. 1826

**Distribution:** Gallatin county.

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**Arabis L. Sp. Pl. 2:664. 1753**

**Rockcress**

Biennial or perennial herbs, often with a woody base, glabrous to pubescent with simple or branched hairs; stems round, leafy, simple or branched; basal leaves petiolate, entire or dentate; stem leaves sessile, often W-shaped at base, entire to dentate; inflorescence racemose; petals white to purple, spatulate to oblong; sepals erect, bounded on the margins by a narrow colored band; anthers oblong, not pointed at apex; pods linear, straight or curved, erect to reflexed, flattened parallel to the partition; (nearly round in *A. glabra*) valves one-nerved to completely nerveless; seeds flattened or plump, generally winged. *Arabis* is a cosmopolitan genus adapted to many diverse habitats and soil types; no single area in western America is predominate because of the number of endemic species of *Arabis* present. Plants of the genus are found from Alaska to California. *Thelypodium* and *Arabis* in flower resemble each other somewhat, but they are easily separated by stamen characters. *Thelypodium* has slender tapering anthers while the
anthers of Arabis are oblong and blunt. The stamens of the Arabis are tetra-
dynamous while those of Thelypodium are not. A. glabra is the only member
of the genus that is sufficiently abundant to be considered a weed. As a
rule, it inhabits roadsides and similar disturbed areas rather than cultivated
fields or gardens.

Key to Species

Basal leaves blunt and rounded at tip, often forming
a flat rosette at the base of the stems, blade nearly
as broad as long, glabrous or hirsute with simple
or forked hairs; pods erect or ascending; glandular
tissue subtending single stamens only; outer sepals
swollen at the base, except in A. glabra

Pods definitely flattened

Stem leaves W-shaped at base, seeds winged, at least
at the distal end, petals white to pink - - - - - - - - - - 6. A. hirsuta
Stem leaves not W-shaped at base, seeds wingless,
petals white - - - - - - - - - - - - - - - - - - - - - - - - 12. A. Nuttallii
Pods nearly round - - - - - - - - - - - - - - - - - - - - - 5. A. glabra

Basal leaves pointed or rarely blunt at tip, not
forming a flat rosette at the base of the stems,
blades linear to linear-ob lanceolate (if broader,
then minutely pubescent or the pods reflexed or both)
pods erect to reflexed; glandular tissue continuous beneath all stamens; outer sepals not swollen at the base, or only slightly so

Leaves, stems and pedicels grayish due to the very minute pubescence  

13. A. puberula

Leaves, stems and pedicels green, basal leaves sometimes appearing grayish

Mature fruiting pedicels erect to ascending, never forming right angles with the rachis or descending; pods erect or ascending

Basal leaves narrowly linear, densely hirsute with large simple or forked hairs; lower stem leaves hirsute  

1. A. Cusickii

Basal leaves rarely linear, never hirsute with hairs of the above type; lower stem leaves never hirsute

Basal leaves and lower stem leaves appearing grayish and felt-like (due to dendritic pubescence)

Petals less than 7 mm. long; pods erect or nearly so  

11. A. microphylla

Petals more than 7 mm. long; pods spreading or reflexed  

14. A. sparsiflora

Basal leaves and lower stem leaves not grayish or felt-like in appearance
Pubescence when present of 2 forked hairs

Seeds mostly in 1 row, tufted, from a much branched woody base, pod 1-nerved only to the middle or below, seeds winged all around — — — — — — — 10. A. Lyallii

Seeds generally in 2 rows, plants not tufted, base not much branched or woody, pod 1-nerved to above the middle, seeds winged on one side and the distal end — — — — — — — — — — — 3. A. Drummondi

Pubescence of 3 to many forked hairs

Stems numerous from a much branched base, pod nerved only at the base, stem leaves ovate — — — — — — — — — 4. A. fructicosa

Stems generally few from an unbranched base, pod nerved to the middle or above, stem leaves oblanceolate — — — — — — — 2. A. divaricarpa

Mature fruiting pedicels diverging at right angles to strictly reflexed; pods diverging at right angles to the rachis to strictly reflexed

Pedicels 2-4 (—6) mm. long; pods spreading at right angles to the rachis; stem leaves ovate, oblanceolate, glabrous to pubescent — — — — — — — 8. A. Lemmoni
Pedicels 6-20 mm. long; pods spreading to reflexed; stem leaves oblong to lanceolate, generally-pubescent

Mature fruiting pedicels spreading at right angles to rachis, straight or arched downward, not strongly descending or strictly reflexed; siliques straight and spreading at right angles or bow-shaped

Plants 1-2 (-3) dm. high, tufted;
   stems numerous, slender; stem leaves few, small and far apart -- -- -- -- -- -- -- -- 11. A. microphylla

Plants 3-9 dm. high, stems one to several, stout; stem leaves numerous, overlapping near base
   Basal leaves entire; stems densely appressed-pubescent below - - - - - - - - - 9. A. lignifera
   Basal leaves dentate; stems hirsute with spreading hairs below - - - - - - - - 14. A. sparsiflora

Mature fruiting pedicels definitely descending to strictly reflexed, straight, not widely spreading; pods mostly straight, pendulous to strictly appressed against the rachis

Pedicels strictly reflexed, appressed to the rachis - - - - - - - - - - - - - - 7. A. Holboellii
Pedicels nearly reflexed, not appressed to the rachis

Stems hirsute with spreading hairs below; pods straight

7. A. Holboellii

Stems appressed pubescent below;

pods often curved

9. A. lignifera

1. **Arabis Cusickii** Watson in Proc. Amer. Acad. 17:363. 1882

*Cusick's Rockcress*

Distribution: may occur in southwestern Montana.

2. **Arabis divaricarpa** A. Nels. in Bot. Gaz. 30:193. 1900

**Turritis brachycarpa** T. & G., Fl. N. Amer. 1:79. 1838

ed 6. 67. 1889

**Arabis confinis** Watson, in Proc. Amer. Acad. 22:466. 1887


**Arabis nemophila** Greene, Leaflets 2:78. 1910

**Arabis dactylica** Greene, ibid. p. 80


**Arabis Stokesiae** Rydb., Fl. Rky. Mts. 361. 1918

Distribution: Beaverhead, Broadwater, Carbon, Cascade, Gallatin, Glacier,
Granite, Lewis & Clark, Madison, Missoula, Park and Stillwater counties; Yellowstone National Park.

   
   **Drummond Rockcress**

   *Turritis stricta* Graham, in Edinb. New Phil. Journ. 350. 1829
   *Streptanthus angustifolius* Nutt. in T. & G., Fl. N. Am. 1:76. 1838
   *Arabis con finsi* Wats., in Proc. Am. Acad. 22:466. 1887
   *Arabis Connexa* Greene, in Pitt. 4:197. 1900
   *Turritis Drummondi* (Gray) Loanell, in Amer. Midl. Natur. 5:236. 1918

   Distribution: Beaverhead, Gallatin, Granite, Park, Rosebud, Stillwater, and Teton counties; Glacier and Yellowstone National Parks.

4. *Arabis fructicosa* A. Nels., Bot. Gaz. 30:190. 1900
   
   **Fruitbearing Rockcress**

   Distribution: Yellowstone National Park

   
   **Towermustard**

   *Turritis glabra* L., Sp. Pl. 666. 1753
   *Arabis perfoliata* Lem., Dict. 1:219. 1793

   Distribution: Carbon, Cascade, Gallatin; Madison, Park, Rosebud, and
Stillwater counties, and Yellowstone National Park.


   Hairy Rockcress

Turritis hirsuta L., Sp. Pl. 666. 1753

Arabis ovata Poir., in Lam. Encycl. Suppl. 5:557. 1817

Arabis rupestris Nutt., in Torr. & Gray, Fl. N. Amer. 1:81. 1838

Arabis pycnocarpa Hopkins, in Rhodora 39:112. 1937

Distribution: Beaverhead, Cascade, Gallatin, Lewis & Clark, and Roosevelt counties.

7. Arabis Holboellii Hornem., Fl. Dan. 11:5. t. 1879 (1827)

   Holboell's Rockcress

Arabis retrofracta Graham, in Edinb. New Phil. Journ. 344. 1829

Streptanthus virgatus Nutt., in T. & G., Fl. N. Amer., 1:76. 1838

Arabis secunda Howell, in Erythea 3:33. 1895

Arabis arcuata Gray, var. secunda (Howell) Robinson, in Gray, Syn. Fl. N. Amer. 1:164. 1895

Arabis rhodantha Greene, Pitt. 3:155. 1897

Arabis lignipes A. Nelson, in Bot. Gaz. 30:191. 1900


Arabis Collinsii Fern., in Rhodora 7:32. 1905


Distribution: Beaverhead, Broadwater, Carbon, Cascade, Custer; Gallatin, Jefferson, Madison, Meagher, Missoula, Rosebud, Sanders, and Wibaux counties; Yellowstone National Park.

8. Arabis Lemmonii Wats. in Proc. Amer. Acad. 22:467. 1887

Lemmonis Rockcress

Arabis canescens Nutt., var. latifolia Watson, in King. Geol. Expl. Forthieth Parallel 5:17. 1871


Arabis bracteolata Greene, Leaflets 2:73. 1910

Arabis Kennedyi Greene, ibid. p. 71

Arabis oreocallis Greene, ibid. p. 73

Arabis polyclada Greene, ibid. p. 75

Arabis semisepulta Greene, ibid. p. 74

Arabis Egglestonii Rydb., Fl. Rky. Mts. 361. 1918

Arabis drepaniloba Greene, in Pitt. 3:306. 1898

Distribution: Gallatin, Glacier, Madison, Missoula, and Park counties.


Woody Rockcress

Distribution: may occur along the southwestern border of Montana.
10. *Arabis Lyallii* Watson in Proc, Amer. Acad. 11:122. 1875

Lyall Rockcress

*Arabis Drummondii* Gray, var. *alpina* Watson in King, Geol. Exp. Fortieth Parallel 5:18. 1871
*Arabis multiceps* Greene, Leaflets 2:75
*Arabis armerifolia* Greene, *ibid.*
*Arabis densa* Greene, *ibid.*

Distribution: Flathead, Gallatin, and Lake counties; Glacier and Yellowstone National Park.


Littleleaved Rockcress

*Arabis Macounii* Watson in Proc. Amer. Acad. 26:124. 1891
*Arabis densicaulis* A. Nels., in Bot. Gaz. 30:190. 1900

Distribution: Gallatin and Lewis & Clark counties; Yellowstone Park.


Nuttall's Rockcress

*Arabis bridgeri* M.E. Jones, Contrib. West. Bot. 14:38. 1912


Silver Rockcress (Blue Mountain Rockcress)

*Arabis canescens* Nutt., in Torr. & Gray. Fl. N. Amer. 1:83. 1838

*Arabis tenuis* Greene, Pittonia 4:189. 1901

Distribution: may occur in southwestern Montana.


Small-leaved Rockcress

*Arabis campyloloba* Greene, Pittonia 4:192. 1900

*Arabis elegans* Nelson, in Bot. Gaz. 30:192. 1900


*Arabis columbiana* Macoun. Cat. Canad. Fl. 2:304. 1890

Distribution: Park county and Yellowstone National Park.

*Erysimum* L. Sp. Pl. 660. 1753

*Erysimum* (Yellow Phlox)

Annual, biennial, or perennial herbs: stems erect, simple or branched; petals yellow; sepals erect, the outer two swollen at the base; pubescence
of appressed 2-branched hairs, sometimes intermixed with simple hairs; pods linear, more or less 4-angles; style short; stigma 2-lobed; seeds in one row in each cell. This genus is very common and widely distributed in the prairies and foothills of Montana. It is less common in the higher mountain regions.

Key to Species

Petals 4-8 mm. long

Fruiting pedicels less than half the thickness of the pod, pod 1.5-2.5 cm. long — — — — — — — 1. E. cheiranthoides

Fruiting pedicels half as thick as the pod or thicker, pods 3-5 cm. long — — — — — — — — 2. E. inconspicuum

Petals 10-15 mm. long — — — — — — — — — — 3. E. asperum

1. Erysimum cheiranthoides L., Sp. Pl. 661. 1753
   Treacle Erysimum (Wormseed Mustard)


Cheiranthus cheiranthoides Heller, Cat. N. Amer. Pl. 4. 1898

Distribution: Cascade, Custer, Flathead, Gallatin, Lewis & Clark, Madison, Missoula, Stillwater, and Teton counties.

2. Erysimum inconspicuum (S. Wats.) MacM., Met. Minn. 268. 1892
Smallflowered Prairierocket

Erysimum parviflorum Nutt., in Torr. & Gray, Fl. N. Amer. 1:95. 1838

Erysimum asperum var. inconspicuum S. Wats., Bot. King. Expl. 24. 1871

Distribution: Beaverhead, Cascade, Custer, Fergus, Gallatin, Madison, Phillips, Richland, Teton, and Wibaux counties.

3. Erysimum asperum (Nutt.) DC., Syst. 2:505. 1821

Douglas Wallflower

Cheiranthus capitatus Dougl., in Hook. Fl. Bor. Amer. 1:38. 1829

Erysimum elatum Nutt., in Torr. & Gray, Fl. N. Amer. 1:95. 1838

Erysimum capitatum Greene, Fl. Fran. 269. 1891

Cheiranthus elatus Greene, Pitt. 3:135. 1896


Distribution: Cascade, Custer, Gallatin, Granite, Jefferson, Madison, Missoula, Park, Rosebud, Sheridan, Stillwater, and Wibaux counties; Yellowstone National Park.

Alyssum (Tourn.) L. Sp. Pl. 650. 1753

Alyssum

Annual; densely stellate; sepals ovate, spreading; petals at first yellow and then turning white; style short, slender; stigma entire; pods round in outline, compressed parallel to the partition, strongly-margined;
seeds usually margined, 1 to 2 in each cell. Common in range lands and in disturbed areas. Our species is an introduced plant of European origin.


*Pale Alyssum* (Yellow Alyssum)


Distribution: Fergus, Gallatin, and Missoula counties.

*Berteroa DC. in Mem. Mus. Par.* 7:232. 1821

*False Alyssum*

Perennial, stems erect, branched from base or near base; pubescence of stellate hairs; sepal ascending in anthesis, equal; petals white, deeply notched; stigma entire or nearly so; style long, slender; pod oblong, about 3 times as long as broad; seeds winged, wings very narrow. *B. incana*, the single American representative of the genus, is a European introduction. The plant grows in coarse gravelly soil and is seldom found in any other soil type; because of this growth habit it probably will never become a weed pest.

1. *Berteroa incana* DC. *Syst.* 2:291. 1821
Hoary Falsealyssum

_Alyssum incanum_ L. *Sp. Pl.* 650. 1753

_Berteroa viridis_ Tausch, in *Syll. Ratisb.* 2:245. 1828

Distribution: Gallatin and Jefferson counties.

_Hesperis (Tourn.) L.* *Sp. Pl.* 663. 1753

_Rocket_

Perennial; stems erect; pubescent with forked hairs, leaves entire; petals purple or almost white; stigmas with 2 erect lobes; pods elongate, nearly round, 1-nerved; seeds in one row in each cell; globose, wingless.

The species found in Montana is an escaped ornamental. It seems to inhabit ditch banks and burrow pit or similar disturbed areas. From a distance it resembles fireweed.


_Dame's Rocket_

Distribution: Gallatin county.

_Chorispora_ R. Br, *ex DC. Syst.* 2:435. 1821
Annual, erect; basal leaves toothed or compound, stem leaves entire or lobed, petiolate; petals purple; inflorescence a lax raceme; pod elongate, indehiscent, beak generally half as long as the pod or longer, breaking transversely into two seeded segments. The genus is represented in Montana by a single species, *C. tenella*, which was introduced from Europe. This plant has been collected once in Montana. It was found growing near a Railroad elevator in Gallatin county.

1. *Chorispora tenella* DC. *Syst.* 2:435. 1821

*Distribution: Gallatin county.*

*Conringia* (Heist.) Adans. *Fam. Pl.* 2:418. 1763

**Haresear Mustard**

Annual; erect glabrous herbs; leaves oval or elliptic, clasping; petals whitish yellow; style 2-lobed or entire; pods elongate, 4-angled; seeds in one row in each cell, oblong, wingless. This genus is a native of Europe and Asia. One species is adventive in the United States. The plant is a common weed in gardens and cultivated fields.

1. *Conringia orientalis* Dumort. *Fl. Belg.* 123. 1827
Treacle Haresear Mustard

Brassica orientalis L., Sp. Pl. 666. 1753

Erysimum perfoliatum Grantz, Stirp. Aust. 1:27. 1762

Erysimum orientale R. Br., Hort. Kew. ed 2. 4:117. 1812


Distribution: Gallatin, Meagher, Stillwater, Wibaux and Yellowstone counties.
DISCUSSION

In any taxonomic work, the expression of phylogenetic relationships is as much a part of the whole as the classification and naming of the plants comprising the group being worked upon. The phylogenetic concept is often shunned in modern literature, but it is this important contribution that separates a taxonomic paper from one dealing purely with nomenclature and classification.

The Cruciferae have fewer intergeneric variations in major characters than most families, yet their morphology and organography are more complex than a superficial examination would indicate. The Cruciferae have been placed in the Papaverales by Gray (1895) and in the Rhoedales by Engler and Prantl (1894). The Papaverales include the families Papaveraceae, Fumariaceae, Cruciferae, Capparidaceae, and Resedaceae. The Rhoedales include the families Papaveraceae, Capparidaceae, Cruciferae, and Resedaceae. The sequence in which they occur is that listed above. Fumarioideae is given as a sub-family under Papaverae by Engler and Prantl; in this way the entire group remains essentially the same; only the name is changed. Most European authors follow Engler and Prantl by placing the family Capparidaceae in a more primitive position in respect to the Cruciferae. American authors, however, follow Gray in considering the Cruciferae the more primitive of the two. It can be seen then that there is no agreement even in the phylogenetic position of the family in respect to other related families.
Within the family, the position of the genera is determined by such characters as presence or absence of a stipe, type of trichomes, manner in which the pod is compressed, size of the pod, the type of lobing of the pistil, and type and position of the nectar glands. The phylogenetic arrangement presented by Engler and Prantl has not been changed to any degree and any changes that were made are not accepted unanimously by botanists.

It is probable that the Engler and Prantl sequence of the genera need revision, but as yet there is not sufficient evidence to support any large change in the phylogenetic arrangement. When this evidence becomes available it will be possible to construct a generic key based on true relationships rather than on characters that may be only superficial. When such a key is completed the family will no longer present the difficult classification problem that it does today.

In the preparation of the generic key in this paper, characters were used that seem to be the most obvious and intergrade the least. Length of pod in relation to width, which is the first major division, can be seen on immature pods as well as mature ones. The nature of the false portion of the pod, whether it is a transparent membrane, or a corky or pithy layer, is also evident early in the development of the fruit. The length of the stipe of the pod varies a great deal, but unless it is over 1 cm. long, and hence very evident, it is not used in a separation. Flower color, an admittedly weak character, is used only once, and then only to separate three genera, all of which may have flowers
and pods on the plant at the same time. Brassica and Barbarea are included in this separation. These two genera are more often confused than any other genera of crucifers. One of the characters used to separate them is the nature of the cotyledons, a good taxonomic character, but one that is not easily seen, and hence has been used only once in the key. In this instance, however, it is the surest way of differentiating between the two genera when the plants are mature. With immature specimens the length of the beak and petals may be used but with some difficulty. The trichome type is used extensively; it is one of the best characters available for the separation of the family into groups; the amount of pubescence may vary under different ecological conditions but the type of hairs is constant. The manner of pod compression is an excellent character, but in herbarium specimens it is often difficult to tell whether a pod is compressed parallel to the partition or contrary to it; hence the character is not used as a major separation.

Further study of the phylogenetic relationship of the genera and species may bring out a new concept in regard to major and minor characters within the family. It seems very likely that characters now being used in major separations may prove to be only minor in that more clear cut differences are yet to be found. More critical studies in the morphology and cytology of the species will do much to clarify some of the present concepts, but it seems likely that a more expedient method might be found in serological analysis.
SUMMARY

1. A key to the Cruciferae of Montana has been compiled and presented.
2. Distribution of all the species has been prepared from the specimens at the Montana State College Herbarium and recent literature pertaining to distribution.
3. The economic importance of the Cruciferae has been evaluated and recorded.
4. All new distributions have been recorded and discussed.
5. The phylogeny of the Cruciferae has been discussed.
6. The keys, their construction, and characters used, are discussed.
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