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

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.

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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Approved:

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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.

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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 toxonomic 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.

LITERATURE REVIEW

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 tetramerous 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 tetradynamous 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 compreshensive 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 synonomy and taxonomy of R. palustris Moench., R. hispida Britt., and R. islandica (oeder ex. Murr.) Borbas. Rollins (1941a) published data that indicates R. columbiae (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, synonomy, 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.

In the treatment of D. oligosperma Hook. p. 74, D. oligosperma var. microcarpa Blank., Mont. Agr. Coll. Sci. Stud. 1:59 (1905) type location, Black Butte, Tobacco Root Range, is listed as a synonym of D. oligosperma Hook., Fl. Bor. Am. 1:51, 1833. In Blankinship's publication the following specimens are cited: Black Butte, Tobacco Root Range, 10,000 feet, August 11, 1902; Dewey, June 24, 1902;

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 D. oligosperma and D. 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 Artic North America at the present time; therefore the widely separated locatilites 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 reveiwed, 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 seeded 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-veined -Eruca 37

Pods not beaked, but sometimes tipped with a persistant 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 compound 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 lonitudinal 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 - - - - - - - - - - - - - - - - - Gardamine 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 sourthern border of Montana.

3. Stanleya viridiflora Nutt. Torr. & Gray, Fl. N. Amer. 1:98. 1838

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

1. Thelypodium integrifolium (Nutt.) Endl. Walp. Rep. 1:172. 1842

Entire-leaved Thelypodium

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

Thelypodium lilacinum Greene, Pl. 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.

2. Thelypodium sagittatum (Nutt.) Endl. Walp. Rep. 1:172. 1842

Sagittate Thelypodium

Strepthanthus sagittatus Nutt. Journ. Acad. Phila. 7:12. 1834

Thelypodium Nuttallii S. Wats. Bot. King. Expl. 26. 1871

Thelypodium torulosum Heller, Bull. Torrey Club 25:265. 1898

Thelypodiopsis sagittata O.E. Schulz. Bot. Jahrb. 66:99. 1933

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.

Cardaria Desv. Journ. Bot. 3:163. 1813

Whitetop

Perennial, erect herbs; leaves alternate, toothed, the upper clasping; flowers pervect, 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 Hymenophysa 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. Hymenophysa differs from Cardaria only in the degree of pubescence and the inflorescenee type. C. Draba is an introduced species. The oldest collection was made near Yreka, California in 1876. The plant prefers and 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

1. Cardaria Draba (L.) Desv. Journ. Bot. 3:163. 1813

Pepperweed (Whitetop)

Lepidium Draba L. Sp. Pl. 645. 1753

Distribution: Beaverhead, Bighorn, Carbon, Cascade, Deerlodge, Fergus, Flathead, Gallatin, Granite, Jefferson, Judith Basin, Lake, Lincoln, Madison, Park, Phillips, Pondera, Ravalli, Roosevelt, Rosebud, Sanders, Silver Bow, Stillwater, Teton and Valley counties.

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

Hoary 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 - - - - - - - - - - - - - - - - - 1. 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

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.

2. Lepidium densiflorum Schrad. Ind. Sem. Hort. Gottin. 4. 1832

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.

4. Lepidium montanum Nutt. Torr. & Gray, Fl. N. Amer. 1:116. 1838

Mountain Pepperweed

Lepidium corymbosum Hook. & Arn. Bot. Beech. 323. 1840

Lepidium utahiense Regel, Acta. Hort. Petrop. 1:42. 1871

Lepidium scopulorum f. nanum Thell. Monog. Lepid. 211. 1906

Lepidium brachybotryum Rydb. Bull. Torr. Bot. Club 34:427. 1907

Lepidium philonitrum Nels. & Macb. Bot. Gaz. 56:474. 1913

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.

6. Lepidium ramosissimum Nels. Bull. Torr. Bot. Club. 26:124. 1899

Congested Pepperweed

Lepidium divergins Osterhout Bull. Torr. Bot. Club 30:237. 1903

Lepidium Fletcheri Rydb. Bull. Torr. Bot. Club 34:428. 1907

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 intermedium var. pubescens Greene, Bot. Gaz. 5:157. 1881

Lepidium medium var. pubescens (Greene) Robinson, Gray. Syn. Fl. N. Amer. 1: 127. 1895

Lepidium occidentale Howell, Erythea 3:32. 1895

Lepidium bernardinum Abrams, Bull. Torr. Bot. Club 37:149. 1910

Lepidium hirsutum Rydb., Bull. Torr. Bot. Club 39:322. 1922

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

Annual, pod flat and round, broadly winged and deeply notched - 1. T. arvense

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.

2. Thlaspi glaucum A. Nels. Bull. Torr. Club 25:275. 1898

Blue Penny Cress

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

Thlaspi Nuttallii Rydb. Bull. Torr. Club 20:235. 1902

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

3. Thlaspi parviflorum A. Nels. Bull. Torr. Club. 27:265. 1900

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 primitve 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 representitives 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

1. Sisymbrium altissimum (L.) Britt. Sp. Pl. 659. 1753

Tumble Mustard

Norta altissima Britt. in Britt. & Brown, Ill. Fl. ed. 2. 2:174. 1913

Distribution: Cascade, Daniels, Flathead, Gallatin, Lake, Musselshell, Ravalli, Roosevelt, Sherdan, 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-poded Tumbleweed

Distribution: Gallatin and Phillips counties.

4. Sisymbrium officinale (L.) Scop. Sp. Pl. 660. 1753

Hedge Mustard

Erysimum officinale L. Sp. Pl. 660. 1753

Sisymbrium officinale Scop. Fl. Carn. ed. 2. 2:26. 1772

Sisymbrium leoicarpum 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.

1. Eruca sativa Mill. Gard. Dict. ed. 8. no. 1. 1768

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 campestris 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.

3. Brassica Juncea (L.) Cosson Bull. Soc. Bot. Fr. 6:609. 1859

India Mustard (Brown Mustard)

Sinapis juncea L. Sp. Pl. 668. 1753

Distribution: cultivated and sometimes found as an escape.

4. Brassica kaber (DC.) L.C. Wheeler Rhodora 40:306. 1938

Charlock (Field Charlock)

Sinapis arvensis L. Sp. Pl. 668. 1753

Brassica arvensis Rabenhorst Fl. Lusatica 1:184. 1839

Brassica sinapistrum Boiss. Voy. Espag. 2:39. 1839-45

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 longtudinally grooved, strongly constricted between the 4-10 seeds when dry - - - - - - - - - - - - - - - - 1. R. 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: occassional adventive

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

Wintercress

Biennial or perennial herbs; stems erect, angular, generally purple 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 irragation 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

1. Barbarea americana Rydb., Mem. N.Y. Bot Gard. 1:174. 1900

American Wintercress

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

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

2. Barbarea stricta Andrz. in Bess. Enum. Pl. Volh. 72. 1822

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; stima 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, equal-

ing 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

1. Rorippa Armoracia (L.) A.S. Hitchc. Sp. Fl. Manhattan 18. 1894

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. Obs. 1:114. 1905

Distribution: Chauteau, Custer, and Gallatin counties.

3. Rorippa curvisiliqua (Hook) Bessey Mem. Torrey Club 5:169. 1894

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.

4. Rorippa islandica (Oeder ex. Murr.) Borbas, Bal. Tav. es Partmell., 392. 1900

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

Brachylobus hispidus Desv. Journ. Bot. 3:183. 1814

Nasturtium palustre DC. Syst. 2:191. 1821

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

Rorippa hispida (Desv.) Britt. Mem. Torrey Club 5:169. 1894

Radicula hispia Britt. Torreya 6:30. 1906

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

Distribution: Cascade, Flathead and Madison counties.

5. Rorippa nasturtium-aquaticum (L.) Schinz. & Thell. Fl. Schweiz. ed. 3:240. 1909

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.

6. Rorippa obtusa (Nutt.) Britt. Mem. Torrey Club 5:169. 1894

Blunt-leaved Yellowcress

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

Radicula obtusa Greene Leaflets. Bot. Obs. 1:113. 1905

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

7. Rorippa sinuata (Nutt.) A.S. Hitchc. Sp. Fl. Manhattan 18. 1894

Spreading Yellowcress

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

Radicula sinuata Greene Leaflets Bot Obs. 1:113. 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 - 1. 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

1. Cardamine Breweri S. Wats. Proc, Amer. Acad. 10:339. 1875

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.

3. Cardamine pennsylvanica Muhl. ex Welld. Sp. Pl. 3:486. 1800

Pennsylvania Bittercress

Cardamine hirsuta var. acuminata Nutt. in Torr. & Gray. Fl. H. Amer. 1:85 1838

Cardamine acuminata Rydb. Bull. Torrey Club 29:237. 1902

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 as 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 nonexistant. 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 sourthern and southwestern border.

2. Physaria brassicoides Rydb. Bull. Torr. Bot. Club 29:237. 1902

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

Physaria macrantha Blank., Mont. Agric, Soil Sci. Stud. 1, pt. 2:60. 1905

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

4. Physaria Geyeri (Hook.) Gray. Gen. Ill. 1:162. 1848

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 calcarious 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 - 11. L. alpina

1. Lesquerella alpina (Nutt.) Wats. Proc. Amer. Acad. 23:251. 1888

Alpine Bladder-pod

Vesicaria alpina Nutt. Torr. & Gray, Fl. N. Amer. 1:102. 1838

Alyssum alpinum Kuntze Rev. Gen. Pl. 2:931. 1891

Lesquerella spathulata Rydb. Contr. U. S. Nat. Herb. 3:486. 1896

Lesquerella parvula Greene Pittonia 4:308. 1901

Lesquerella nodosa Greene Pittonia 4:309. 1901

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

2. Lesquerella arenosa (Richards) Rydb. Bull. Torr. Bot. Club 29:236. 1902

Rydberg's Bladder-pod

Vesicaria arenosa Richards, Flanklins Journ. to Shores of Polar Sea. 743. 1823

Lesquerella argentea arenosa Rydb., Contr. U. S. Nat. Herb. 3:485. 1896

Lesquerella versicolor Greene, Pittonia 4:310. 1901

Lesquerella Macounii Greene, Pittonia 4:310. 1901

Lesquerella rosea Greene, Pittonia 4:311. 1901

Lesquerella ludoviciana (Nutt.) Wats. var arenosa Wats. Rydb. Bull. Torr. Bot. Club. 29:236. 1902

Lesquerella Lunellii Nelson Bot. Gaz. 42:49. 1906

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

3. Lesquerella argentea (Pursh) MacMillan Metasp. Miss. Valley,,263. 1892

Silver Bladder-pod

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

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

Vesicaria ludoviciana DC. Syst. 2:297. 1821

Lesquerella ludoviciana (Nutt.) Wats. Proc. Am. Acad. 23:252. 1888

Alyssum glubosum Kuntze. Rev. Gen. Pl. 2:931. 1891

Distribution: Gascade county.

4. Lesquerella condensata A. Nels Bull. Torr. Bot. Club 26:238. 1899

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

5. Lesquerella curvipes A. Nels. Bull. Torr. Bot Club 25:205. 1898

Distribution: Carbon county.

Capsella Medic. Pfl. 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, C. Bursa-pastoris, which is an introduced plant from Europe that is a common weed in fields and gardens throughout the state.

1. Capsella Bursa-pastoris (L.) Medic. Pflanzeng. 1:85. 1792

Shepherd Purse

Bursa Bursa-pastoris Britt. Mem. Torr. Club 5:172. 1894

Bursa pastoris Weber, in Wigg. Prim. Fl. Hoist. 47. 1780

Thlaspi Bursa-pastoris L. Sp. Pl. 647. 1753

Distribution: throughout the state.

Camelina Crantz, Stirp. Aust. 1:18. 1762

False-flax

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 revel 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 Andrz. Syst. 2:517. 1821

Little-pod False-flax

Distribution: throughout the state.

2. Camelina sativa (L.) Grantz. Stirp. Aust. 1:18. 1762

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 dispite 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; styles of varying length

Styles less than 0.5 mm. long - - - - - - - -Series VII

Styles 0.5 mm. long or longer --- - - - - - -Series VIII

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 - 4. D. crassifolia

Flowering stems bearing one or more leaves

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

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 lemmon 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. fladnizensis

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 mearly 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, sparce; 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 of 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

1. Draba aurea M. Vahl. in Hornum. Fors. Dansk. Oecon. Plantel. ed. 2:599. 1806

Golden Draba

Draba luteola Greene, Pittonia 4:19. 1899

Draba surculifera Nels., Bull. Torr. Bot. Club 26:237. 1899

Draba Bakeri Greene, Pl. Baker. 3:6. 1901

Draba aureiformis Rydb., Bull. Torr. Bot. Club 28:278. 1901

Draba McCallae Rydb., Bull. Torr. Bot. Club 29:241. 1902

Draba uber Nelson, Bot. Gaz. 34:366. 1902

Draba decumbens Rydb., Bull. Torr. Bot. Club 29:240. 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 grandifora Engler ex Schulz(Engler, Pfl. 4:105,339. 1927

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

Distribution: Lewis & Clark county.

3. Draba crassa Rydb., Mem. N.Y. Bot Gard. 1:182. 1900

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

Distribution: Park county.

4. Draba crassifolia R. Grah., Edinb. N. Phil. Journ. 182. 1829

Rocky Mountain Draba

Draba Parryi Rydb., Bull. Torr. Bot Club 29:241, 1902

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 pectinata (Wats.) Rydb., Bull. Torr. Bot Club 39:327. 1912

Draba Mulfordae Payson, Amer. Journ. Bot. 4:264. 1917

Draba Nelsonii Macbride and Payson, Am. Journ. Bot. 4:258. 1917

Draba globosa Payson, Am. Journ. Bot. 4:259. 1917

Draba sphaerula Macbride and Payson, Am. Journ. Bot. 4:258. 1917

Draba caeruleomontana Payson and St. John, Proc. Biol. Soc. Wash. 43:119. 1930

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

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

6. Draba fladnizensis Wulfen, in Jacq., Miscell. Austr. 1:147. 1778

Artic Draba

Draba Pattersonii Engler, Pflanzen reich 4^{105}:260. 1927

Distribution: Carbon county.

7. Draba incerta Payson, Amer. Journ. Bot. 4:261. 1917

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 laevicapsula Payson, Amer. Journ. Bot. 4:262. 1917

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

Distribution: Carbon, Meagher, and Teton counties.

8. Draba lanceolata Royle, Illustr. Bot. Himal. Mts. 1:72. 1939

Lanceolate Draba

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

Draba cana Rydb., Bull. Torr. Bot. Club, 29:241. 1902

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

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

9. Draba nemorosa L. Sp. Pl. 643. 1753

Woods Draba

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

10. Draba nivalis Liljebl., Vet. Acad. Handl. Stockl. 208. 1793

Snow Draba

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

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

11. Draba oligosperma Hook., Fl. Bot. Amer. 1:51. 1833

Glacier Draba

Draba andina (Nutt. ex T. & G.) Nelson, Bull. Torr. Bot. Club 26:352. 1899

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

Draba saximontana Nelson, Bull. Torr. Bot. Club 27:264. 1900

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

12. Draba oreibata Macbride & Payson, Amer. Journ. Bot. 4:257. 1917

Distribution: Glacier National Park.

13. Draba Paysonii Macbride, Contr. Gray Herb. n.s. 56:52. 1918

Payson Draba

Draba vestita Payson, Amer. Journ. Bot. 4:261. 1917

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

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

Draba Gilbertiana Gilg. ex Payson, Amer. Journ. Bot. 4:261. 1917

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

14. Draba praealta Greene, Pittonia 3:306. 1898

Undine Draba

Distribution: Yellowstone National Park.

15. Draba reptans (Lam.) Fernald, 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 coloradensis Rydb., Bull. Torr. Bot. Club 31:555. 1904

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

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

16. Draba stenoloba Dedeb., Fl. Ross. 1:154. 1842

Shiny Draba

Draba nitida Greene var. nanna Schulz, (Engler, Pflanzenreich 4105;320) 1927

Draba nemorosa var. stenoloba (Ledeb.) Jones, Proc. Cal Acad. II, 5:621. 1895

Draba deflexa Greene, Pittonia 4:20. 1899

Distribution: Beaverhead, Gallatin, Madison, Meagher, and Teton counties and Glacier National Park.

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 withstellate 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 representitive 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

Hutchinsia calycina Desv., Journ. Bot. 3:168. 1814

Smelowskia linearriloba Rydb., Bull. Torrey Club 31:555. 1904

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

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 - 3. D. Sophia

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 - - - - - - - - 2. D. Richardsonii

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 pinnate - 1. D. pinnata

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

Pinnate Tansymustard

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

Hesperis brachycarpa O. Ktze. Rev. Gen. Pl. 2:934. 1891

Sophia filipes Heller, Bull. Torr. Club. 24:311. 1897

Sophia gracilis Rydb., 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 canescens Richards., Bot. App. Frankl. Narrat. Journ. 744. 1823

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

Descurainia incisa Britt., Mem. Torr. Club. 5:173. 1894

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. Torr. Club. 31:556. 1904

Sisymbrium incisum var. californicum Blank., Mont. Ag. Coll. Sci. Studies Bot. 1:60. 1905

Sisymbrium viscosum Blank., Mont. Ag. Coll. STudies, Bot. 1:60. 1905

Sophia Richardsoniana Rydb. Brittonia 1:89. 1931

3. Descurainia Sophia (L.) Webb. ex. Prantl in Engler & Prantl, Pflanzenf. Zabt. 2:192. 1892

Flixweed Tansymustard

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

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

Hesperis Sophia O. Ktze. Rev. Gen. Pl. 2:935. 1891

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

Sophia parviflora Standl. Contn. U.S. Nat. Herb. 22:347. 1921

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 vacinity 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.

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 leawes sessile, often W-shaped at base, entire to dentate; inflorescence racemose; petals white to purple, spatulate to oblong; sepal 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 ound 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 tetradynamous 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-oblanceolate (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 appear-
ing 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 spread-
ing or reflexed - - - - - - - - - - - - - - - - - - 14. A. sparsiflora
Basal leaves and lower stem leaves not gray-
ish 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 numberous 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 oblong - - - - - - - - - - 2. A. divaricarpa

Mature fruiting pedicels diverging at right angles to strictly reflexed; pods divergint 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 speading 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

Arabis Drummondi var. brachycarpa (T.& G.) Watson & Coulter, in Gray, Man. ed 6. 67. 1889

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

Arabis brachycarpa (T. & G.) Britton in Mem. Torr. Bot. Club 5:174. 1894

Arabis oblanceolata Rydb. in Bull. Torr. Bot. Club 31:557. 1904

Arabis nemophila Greene, Leaflets 2:78. 1910

Arabis dacotica Greene, ibid. p. 80

Arabis brevisiliqua Rydb., Bull. Torr. Bot. Club 39:326. 1912

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.

3. Arabis Drummondi Gray, Proc. Amer. Acad. 6:187. 1866

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 confinis Wats., in Proc. Am. Acad. 22:466. 1887

Erysimum Drummondi (Gray) O. Ktze., Rev. Gen. Pl. pt. 2:933. 1891

Arabis Connexa Greene, in Pitt. 4:197. 1900

Turritis Drummondi (Gray) Lunell, 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

5. Arabis glabra (L.) Berhnardi, Syst. Verz. Erf. 195. 1800

Towermustard

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

Arabis perfoliata Lam., Dict. 1:219. 1793

Arabis macrocarpa (Nutt.) Torrey, in Bot. Mex. Boundary pt. 1:32. 1858

Distribution: Carbon, Cascade, Gallatin, Madison, Park, Rosebud, and

Stillwater counties, and Yellowstone National Park.

6. Arabis hirsuta (L.) Scop. Fl. Carn. ed. 2:30. 1772

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)

Holboells 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 Kockii Blankinship, In Mont. Agri. Coll. Sci. Stud. 1:57. 1904

Arabis caduca A. Nelson, in Coulter & Nelson, New Man. Bot. Rky. Mts. 229. 1909

Arabis MacDougalii Rydb., in Bull. Torr. Bot. Club 39:326. 1912

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

Arabis pendulocarpa sensu Hopkins, in Rhodora 39:183. 1937 in part.

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

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

Lemmons Rockcress

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

Arabis latifolia (Watson) Peper, in Contrib. U.S. Nat. Herb. 11:295. 1906

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.

9. Arabis lignifera A. Nels., Bull. Torr. Bot. Club 24:123

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 Drummondi Gray, var. alpina Watson in King, Geol. Exp. Fortieth Parallel 5:18. 1871

Arabis oreophila Rydb., in Bull. Torr. Bot. Club 34:437. 1901

Arabis multiceps Greene, Leaflets 2:75

Arabis armerifolia Greene, ibid.

Arabis densa Greene, ibid.

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

11. Arabis microphylla Nutt. ex T. & G., Fl. N. Am. 1:82. 1838

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.

12. Arabis Nuttallii Robinson, in Gray, Syn. Fl. N. Am. 1:160. 1895

Nuttall's Rockcress

Arabis spathulata Nutt., in T. & G., Fl. N. Am. 1:81. 1838

Erysimum Nuttallii O. Ktze., Rev. Gen. Pl. pt. 2:933. 1891

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

Arabis macella Piper in Proc. Biol. Soc. Wash. 33:103. 1920

Distribution: Carbon, Cascade, Gallatin, Glacier, Lake, Lewis & Clark, Madison, Missoula, Park, Roosevelt, Rosebud, Sanders, and Silver Bow counties; Yellowstone National Park.

13. Arabis puberula Nutt., in Torr. & Gray. Fl. N. Amer. 1:82. 1838

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.

14. Arabis sparsiflora Nutt., in Torr. & Gray. Fl. N. Amer. 1:82. 1838

Small-leaved Rockcress

Arabis campyloloba Greene, Pittonia 4:192. 1900

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

Arabis perelegans Nelson, in Coulter & Nelson, New Man. Bot. Rky. Mts. 228. 1909

Arabis columbiana Macoun. Cat. Canad. Pl. 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)

Cheirinia cheiranthoides Link., Enum. Hort. Ber. 2:170. 1820

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

Cheirinia elata Rydb. Bull. Torrey Club 39:323. 1912

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;

seed s 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.

1. Alyssum alyssoides L., Syst. Veg. ed 10, 1130. 1759

Pale Alyssum (Yellow Alyssum)

Clypeola alyssoides L., Sp. Pl. 652. 1753

Alyssum calycinum L., Sp. Pl. ed 2:908. 1763

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 gravely 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 withforked 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.

1. Hesperis matronalis L., Sp. Pl. 663. 1753

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

Chorispora

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 Crantz, Stirp. Aust. 1:27. 1762

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

Conringia perfoliata Link, Enum. Hort. Ber. 2:172. 1822

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 spearations 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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