

As all insects had been carefully excluded from the flowers in the boxes, the few berries produced appear to be the result of self-fertilization. The flowers of *V. pennsylvanicum* are therefore not entirely self-sterile. Self-pollination may have been brought about by the jarring of the flowers by the wind or rain.

The ecology of variety *nigrum*, which was frequently found among the plants of *pennsylvanicum*, does not differ from that of the latter species. It is visited by the same insects.

WALDOBORO, MAINE.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF
HARVARD UNIVERSITY—No. CXVI.

ARABIS IN EASTERN AND CENTRAL NORTH AMERICA

MILTON HOPKINS

(Plates 457 and 458)

INTRODUCTION

IN the large family *Cruciferae*, several genera have long needed critical study. *Arabis* is one of these. Its great complexity, not only in North America but likewise in Europe and Asia, has long perplexed assiduous students and, although many excellent treatments have appeared as parts of various regional floras and synopses, no single adequate study of it in North America has, as yet, been made. It was, therefore, with considerable trepidation that I undertook a critical examination of the genus, for I realized too well the vast scope of the problem. The present paper is offered as a first venture and possesses many limitations with which no one is more familiar than I. It treats the genus in eastern North America primarily from the region east of the one hundredth meridian, but in those cases where a species occurs in western North America as well as in the eastern part, I have discussed it throughout the natural extent of its range.

HISTORY

Although Linnaeus tells us¹ that *Arabis* was named for the country Arabia, it has recently come to my attention that perhaps he did not

¹ Phil. Bot. 169 (1751), in which he says of *Arabis*: "Arabia Regione."

give us all the facts. In tracing the etymology of the name,¹ I find that it occurs in two 15th Century manuscripts of Dioscorides' *Materia Medica* which, in published form, were undoubtedly available to Linnaeus at the University of Upsala. In the standard edition of Dioscorides' work, edited by Max Wellman in 1907,² the section in Book ii (§185) pertaining to *Arabis* is omitted from the main text, although included in a footnote, because practically the same description (with only the most minor variations) is given for "*Drabe*" in an earlier section (157). The description for *Arabis* reads as follows, the brackets being mine:

"Grass [herb] about a cubit high, slender, stem-leaves like a *Lepidium*, but softer and whiter, and the top an umbel having white flowers. The herb is cooked in a gruel in Cappadocia. Fruit when dry is mixed with condiments as a substitute for pepper."

In view of the fact that Linnaeus named a plant *Lepidium Draba*, one is somewhat inclined to the belief that perhaps he was familiar with the above description, and that more than likely he had also seen Dioscorides' similar one for *Arabis* but, realizing that the genus *Arabis* was quite distinct from the genus *Lepidium*, had used the name for our genus, and concluded that, because it (as well as *Lepidium*) was "cooked in a gruel in Cappadocia," it must have been named by Dioscorides from some region nearby. And what region more probably than Arabia? The words "Arabia Regione" in the *Philosophia Botanica* give only part of the story; one concludes from them that Linnaeus himself named the plant after the country Arabia. But what appears to be much more likely is that Dioscorides first applied the name, and that Linnaeus obtained it from him.

Linnaeus, in 1753,³ described seven species of *Arabis* and two of *Turritis*, which genus was first merged with *Arabis*, in 1829 by Gaudin.⁴ Of Linnaeus' list only *A. lyrata* and *A. canadensis* were strictly North American, the others all being European or Eurasian (except for *A. alpina* and *T. glabra*, which have since been found in North America as well as in Europe). Michaux⁵ next discussed the genus in North America, but he included only one species of *Arabis* and none

¹ For invaluable assistance in this search I am deeply indebted to Professor Arthur Stanley Pease of Harvard University. He has also very kindly made the translation for me from Wellman's text.

² Wellman, i. 254 (1907).

³ *Species Plantarum*, ii. 664-666 (1753).

⁴ Gaudin, *Fl. Helvetica*, 299 (1829).

⁵ Michaux, *Fl. Bor.-Am.* ii. 31 (1803).

of *Turritis*, his *A. falcata* being merely another name for Linnaeus' *A. canadensis*. In 1807 Persoon published his *Synopsis Plantarum* which included among the known species of *Arabis* and *Turritis* only three from North America, *A. lyrata*, *A. canadensis* and *T. laevigata*. He described no new species but merely brought together in one work those which had already been published in previous volumes by other authors. After Persoon, Pursh, in 1814, treated seven species of *Arabis* and two of *Turritis*,¹ and Nuttall, in 1818, published nine of the former and one of the latter.² The treatments of Pursh and of Nuttall, although primarily not of a monographic nature, were eminently satisfactory at the time. But not until three years after Nuttall's work was published did a really impressive treatment appear, when DeCandolle finished his *Systema*, in 1821. In this great work all the known species of *Arabis* and *Turritis* were treated with adequate diagnoses and discussions of ambiguous or obscure characters. The *Prodromus*, by the same author and appearing three years later but written on a much more condensed scale, contained one more species of American *Arabis* than the *Systema*. The next important study of *Arabis* (in North America) appeared in 1829 in Hooker's *Flora Boreali-Americana*. With many important specimens from Canada and Greenland in his possession Hooker could, quite naturally, give highly accurate descriptions and could include more species from the New World than any of his predecessors had done. He incorporated into his treatment all the new species which had, earlier in the same year, been described by Graham from plants grown at the Royal Botanic Garden at Edinburgh. Hooker's treatment of *Arabis* is scholarly and, although his statements of ranges are often somewhat vague, this is due largely to the fact that the country was unexplored and lacked political boundaries. Hence such ranges as "shores of the Arctic Sea between 107° and 130°" were considered as ample information regarding the station from which a particular species was collected. Nearly ten years after Hooker, in 1838, the first part of Torrey & Gray's superb *Flora of North America* appeared. *Arabis*³ was given a comprehensive treatment, on the basis of more material than previous American authors had seen. Many of Torrey & Gray's names are still quite valid. The first edition of Gray's *Manual* (1848) "hastily prepared to supply a pressing want"⁴ treated *Arabis* and

¹ Pursh, *Fl. Am. Sept.* ii. 436, 437 (1814).

² Nuttall, *Genera*, ii. 70, 71 (1818).

³ Torrey & Gray, *Fl. N. Am.* i. 78-83 (1838).

⁴ Gray, *Preface to Manual*, ed. 2 (1856).

Turritis as separate genera, but the fifth edition, nineteen years later, carried them both under *Arabis*, and except for an occasional divergence,¹ succeeding American authors have continued to treat *Turritis* as a section of *Arabis*.

The impetus given to botanical exploration by the opening of the West during the middle and latter part of the nineteenth century made itself manifest in the extensive collecting during that time. Many of the species of *Arabis* brought back were quite new to science. The Synoptical Flora of North America, begun by Gray, with certain sections by Watson, and continued under the editorship of Robinson, contains 38 species of *Arabis* (the treatment by Watson). Edward L. Greene, Marcus E. Jones, Aven Nelson and P. A. Rydberg have worked on the genus and proposed many new species (Greene, in fact, published two species with the same name!²); but no investigation, whose chief purpose was to "clean house" and to take stock of assets and liabilities, has occurred. The task is not an easy one, involving the examination of well over one hundred type-specimens located in all the important American herbaria. My attempt to put in order those species in eastern and central North America is here presented.

DIAGNOSTIC CHARACTERS

ROOTS. The roots of *Arabis* are always either biennial or perennial, those of the former type having simple herbaceous tap roots while those of the latter possess well developed caudices which usually become woody. In eastern North America most of the species are biennial, although *A. arenicola*, *A. alpina* and *A. pendulocarpa* (*A. Collinsii*) become perennial with the characteristic much branched woody caudices. The other species are more usually biennial but some of them, notably *A. patens*, *A. lyrata*, *A. Drummondii*, *A. divaricarpa* (*A. brachycarpa*), *A. Holboellii*, *A. retrofracta* and *A. Hookeri* tend to assume a perennial habit in certain parts of their ranges. Thus, in the Allegheny mountains of Virginia and North Carolina, *A. lyrata* is more often a perennial than a biennial and the woody caudex with its numerous branches resembles exactly that of many of the species from the Rocky Mountains, where a perennial habit, at least in *Arabis*, is predominant. These perennial roots extend downward to a depth of as much as two decimeters, resisting even

¹ Such as Rydberg, Fl. Rocky Mts. 337 (1917).

² *A. inamoena* in Fedde, Rep. Sp. Nov. v. 243 (1908) and in Leaflets, ii. 158 (1911).

such coarse implements as a small pick-axe, and being extracted in toto only with the greatest patience and diligence. Although Gray says of *Arabis*: "HERBS, with annual, biennial or perennial roots."¹ I have never yet observed any plant with typically annual roots. Every specimen which has come to my notice has, without exception, possessed a slender or a stout tap root or else a perennial caudex and, although some of the biennial plants may doubtless be short-lived, I should question their being truly annuals.

STEM. The stem of *Arabis* may be either simple or branched. *A. virginica*, *A. alpina*, *A. Holboellii*, *A. Hookeri* and *A. lyrata* tend to branch at the base in great profusion, a simple stem being the exception. Many of the western species, whose high mountain habitats are unfavorable to great stature, are low and are very much branched at the base. But branching at the top is likewise common in the genus and occurs, more or less, in nearly all species. Especially is this true of *A. divaricarpa* (*A. brachycarpa*) whose primary fruiting raceme is nearly always accompanied by numerous secondary branches which bear young flowers. The stem may be either glabrous or pubescent or, if the latter, the pubescence may occur throughout or merely at the base. The types of hairs which are found on the stem, as well as on the leaves, will be discussed under PUBESCENCE.

RADICAL LEAVES. The basal leaves either form dense rosettes or else are merely few to many, not aggregated in thick clusters. When they form rosettes they frequently persist for two years and become brown and black marcescent masses at the base of the stem. Those which are not in rosettes usually do not last more than one season and not infrequently disappear by the time the fruit is ripe. It is a very rare specimen of *A. canadensis* which has its basal leaves attached to the stem after the middle of July, but specimens of *A. laevigata* or of *A. viridis* seldom come into an herbarium without their basal leaves firmly attached to the crown.

The shape of the radical leaves varies from narrowly oblanceolate to broadly obovate-spatulate while the margins may range from entire or subentire to very slightly denticulate or decidedly dentate-serrate but, unlike many members of the *Cruciferae*, they are only rarely lyrate-pinnatifid. *A. virginica* is the only species which has strictly lyrate-pinnatifid basal leaves, while *A. lyrata*, *A. viridis* and *A. glabra* may or may not have them. The two former species most commonly

¹ Gray, *Genera*, i. 141 (1848).

have such margins, but the last one only infrequently possesses them and is more usually found to have them irregularly but rather sharply dentate. The apices may vary from slightly acuminate, as in some specimens of *A. Drummondii*, to rounded or obtuse, as in some plants of *A. laevigata*. And the size varies considerably, due probably to environmental factors as well as to genetic ones. Some species, as *A. pendulocarpa* (*A. Collinsii*) have very small radical leaves, from 1 to 5 cm. long, while others, notably *A. glabra*, have them of enormous size for the genus—as long as 12 cm. All of these leaves are petioled, the petiole being rather narrowly winged, and they may be either glabrous or pubescent.

CAULINE LEAVES. These may vary from linear-spatulate, as in *A. lyrata*, to broadly elliptic, as in *A. canadensis*, and are either sessile or very short-petioled. The lowermost may have short winged petioles, as is usually the case in *A. glabra*, but the middle and uppermost are always sessile, with either a nonclasping or an amplexicaul base. If the latter condition is typical for a species, the base is either sagittate or auriculate or, more rarely, both types may be found on the same stem. Beginning at the lower part of the stem and progressing upwards towards the raceme of flowers, the stem-leaves gradually become diminished in size so that measurements should always be made from those leaves nearest the middle of the stem. This progressive decrease in size is very gradual, but its occurrence makes measurements of extreme uppermost or lowermost leaves very misleading. Associated with this progressively diminished size of the cauline leaves is the fact that they are either remote, *i. e.* arranged so that the tip of one leaf does not touch the base of the next higher one; subremote, in which case the tip of one leaf may slightly overlap the base of the next successive one; or definitely imbricated, the leaves clearly overlapping one another as shingles on a house. To rely solely on this remoteness or non-remoteness of stem-leaves is, however, dangerous, for it frequently happens that a plant whose normal tendency is to develop imbricate leaves, will, if the environment is shady, assume the remote-leaved habit, with a stem of the most delicate texture and cauline leaves so few in number as to be almost negligible. Such cases have been observed in *A. pycnocarpa* (*A. hirsuta* of Am. authors) especially.

FLOWERS. Perhaps the most unsatisfactory organ on which to base a determination, not only of *Arabis* but of any member of the *Cru-*

ciferae, is the flower. Generic lines based solely on this, instantly disappear, and to identify a cruciferous plant in full flower is a task which only a person with great confidence would undertake. The saying "By their fruits ye shall know them" should be a law in so far as the crucifers are concerned. The flowers in *Arabis* vary in size, some being large and showy for the genus (the usual size being from 5 to 7 mm. long), as in *A. Holboellii*, where they attain a length of 9 mm., and others being so minute as to be inconspicuous, as typified by *A. dentata* which has them only slightly over 2 mm. long. They may occur in very close and compact racemes, as illustrated by *A. viridis*, or they may be in long, loose racemes with an average of sometimes as much as 1 cm. between the flowers. They are always actinomorphic, composed of two bimerous whorls and have four minute nectaries located on the receptacle at the base of the stamens, thus suggesting that the flowers are entomophilous.¹

The petals vary only slightly in shape and are usually either spatulate-oblong or spatulate-oblongate. The obtuse to subtruncate apex is the broadest part and this shows considerable variation in breadth, that of the petals of *A. Holboellii* being often as much as 2.25 mm., while that of the petals of *A. pycnocarpa* (*A. hirsuta* of Am. authors), which are long and narrow, never exceeds 1 mm. The venation is fine and delicate except in one form of *A. alpina*² where it is distinctly coarse. The color of the petals varies from white through delicate shades of pink to purple, except in *A. glabra* and in *A. dentata*, in which it is deep cream-color to yellowish. In fact, these two species may often be determined in the field in a flowering condition (if one has successfully placed them in the genus!) because they are the only species which have petals bordering on yellow.

The sepals show somewhat more variation than do the petals, being either oblong or oblongate in shape and varying from obtuse to subacuminate at the apex. They are either membranaceous or

¹ Although insect pollination may occur in *Arabis*, the genus does not depend solely on this method. Self pollination occurs frequently, the anthers of the four long stamens touching the stigma with their lower ends or those of the two short stamens touching it with their tips. The flowers are homogamous in all species, and although various insects appear to visit various species, self pollination apparently occurs regardless of insect visitors. Because the nectaries secrete only a small amount of nectar (only those two at the base of the short stamens appear to be functional) the genus is not a paradise for honey-seeking insects. Certain species of bees, flies and butterflies are the chief visitors. For a complete discussion of this interesting topic see J. R. A. Davis's translation of "Knuth's Handbook of Flower Pollination," iii. 83-86 (1908).

² *f. phyllopetala*. See Fernald in RHODORA, xxv. 270 (1933).

herbaceous in texture, and are green or yellow or purple, with varying hues of these colors. Often they possess a hyaline or a whitish margin. They vary in size from one-half to two-thirds the length of the petals to nearly their entire length, as in *A. viridis*. And they may be either glabrous or pubescent; the types of this pubescence will be discussed under PUBESCENCE. They are always in two decussate whorls, one median and one transverse, the latter, contrary to the orthodox idea that the median pair is the outermost, being, according to Mrs. Arber, the outer pair.¹

The flowering pedicels, at anthesis, are either ascending, divaricately spreading or descending. They are so similar to the fruiting pedicels in every respect that they will be discussed under that heading.

FRUIT. The most important diagnostic character in *Arabis*, as in most cruciferous genera, is the fruit, not solely in distinguishing species, but also in determining phylogenetic trends which enable one to place groups of species in sections and subsections. Sereno Watson² grouped the genus into the three sections which are now usually recognized, although only one of them (section *Sisymbirina*) is of his authorship. In this paper, however, I have omitted any mention of sections because I do not feel qualified to group the entire genus into new sections of my own manufacture. The species which occur in eastern North America are treated in the order designated in the key. This follows in some respects the ideas of Watson and others; in many respects, however, it differs.

The siliques are either erect and ascending, divaricately spreading or reflexed and, although some species often may have them in two of the above categories, most of them are either of one type or the other. They are glabrous or pubescent, the trichomes, when present, minute and stellate. The nervation of the valves varies in different species. In *A. virginica* the nerve is apparent only at the extreme base or in rare cases is so faint that the silique appears nerveless, while in *A. canadensis* it is prominent to the tip of the fruit. The length of this nerve is so distinctive that it serves as a most valuable character upon which to differentiate species.

The fruiting pedicels, like their earlier stage at the flowering period, are either ascending, divaricate or reflexed. Although their ultimate position may often be guessed during anthesis, frequently they

¹ Agnes Arber in *New Phytol.*, xxx. 27-29 (1931).

² In Gray, *Synop. Fl. N. Am.* i. 159-167 (1895).

become more divergent or more reflexed in fruit and, as one might expect, they are of greater length in the fruiting state than in the flowering one. It often happens that during the flowering period they are quite pubescent but as maturity approaches this pubescence is diminished in amount or entirely disappears.

The seeds show wide variation and range in shape from broadly quadrate to narrowly elliptic or oblong. They may be quite wingless or definitely winged; in *A. canadensis*, the seeds of which are more broadly winged than in almost any other species, the wing ranges from 0.75 mm. to 1 mm. in width. The seeds appear in either one or two rows in the silique, but in many species where, when young, they are in two rows, maturity usually finds them crowded into one irregular row. Such is the case in *A. divaricarpa* (*A. brachycarpa*) and, although included by Watson in his section *Turritis* (which has seeds "somewhat in two rows"¹), it might equally well be placed in his section *Euarabis*. Likewise, *A. glabra*, although placed by Watson in section *Sisymbрина*, has seeds in one row or two rows and both winged and wingless.

PUBESCENCE. This, a most important diagnostic character, occurs on all parts of the plant except on the petals and seeds and, although it varies in quantity, the type of pubescence appears constant for each species. Most commonly found are the ordinary simple hairs which appear to be the most primitive ones. Seen under the microscope they are observed as slender bristles tapering gradually at the apex to a fine point. Next frequent is the bifurcate hair, which consists of a simple one, two-branched at base. This may be several times compounded until the stellate hair, the most complex of all, is reached. This occurs in many forms and degrees. It may be coarse and large, as in some specimens of *A. divaricarpa* (*A. brachycarpa*), in which case the trichomes are most often spaced far apart, or it may be minute and delicate as in *A. pendulocarpa* (*A. Collinsii*) in which the trichomes are so close together that they appear pannose. Another type of hair which is present, although rather rare, is the malpighiaceae (bifurcate) one, the prongs of which are so flexed at right angles as to be parallel to the surface of the stem or leaf and to give it a strigose appearance. This type of hair is found in *A. Drummondii* var. *oxyphylla*. The hairs are all filiform and slenderly subulate and are unicellular, even when much branched. They are always non-glandular.²

¹ In Gray, Synop. Fl. N. Am. i. 163 (1895).

² Although glandular hairs are very scarce in the *Cruciferae*, they occur occasionally, as in *Descurainia glandulifera* Rydb.

OTHER CHARACTERS. In the above paragraphs I have discussed only those characters which play an important part in the identification of species. Others, while not of the greatest significance and not possessing any especial variations, may be mentioned. The stamens seem to be of no diagnostic value, nor are the oblong or rarely sagittate anthers, although I have repeatedly endeavored to find adequate differences in species based on relative length and shape of these organs. The ovary is oblong to linear, superior, and possesses ovules with curved embryos without endosperm. The cotyledons vary from accumbent to incumbent or they may be quite oblique. Some species have them accumbent, some have them incumbent, and a few have them both accumbent and incumbent on the same plant. In view of this variation I have not used the position of the cotyledons as a diagnostic character in this paper.

GEOGRAPHIC DISTRIBUTION

In North America *Arabis* extends from Greenland to Alaska, south to northern Florida and Mexico. Unlike its relative in the *Cruciferae*, *Draba*, it is not of great complexity in Greenland, Labrador and Quebec, although in the Cordilleran area it becomes highly so, and has a large number of species. It prefers chiefly calcareous regions, but some species are also found growing in granitic or silicious environments. Because the region of central and northern Canada has been only locally botanized, the known distribution of the genus in that area is seemingly erratic and often incongruous, but in the future, when the present gaps are filled, it is hoped that in many cases a more normal range will be worked out. I cannot at the present explain why, for example, typical *A. lyrata*, a plant of Alleghenian distribution and extending as far north as southern Ontario, should apparently be isolated in the Lake Athabasca region of southern Mackenzie and northern Alberta.

Arabis presents, in the range covered in this paper, a few very striking examples of endemism and isolation which will be discussed under the species concerned, since at the present writing it appears wiser to postpone a more prolonged account of this subject until the genus in the western part of its range has been more thoroughly studied.

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In citing specimens from the above herbaria, the following symbols have been employed: The United States National Herbarium (US); The New York Botanical Garden (NY); The Brooklyn Botanic Garden (Bklyn); The Academy of Natural Sciences of Philadelphia (Phil); The Missouri Botanical Garden (Mo); The University of Wisconsin Herbarium (Wisc); The University of Minnesota Herbarium (Minn); The Deam Herbarium (Deam); The Pomona College Herbarium (Pom); The University of Wyoming Herbarium (Wyo); The Herbarium of the National Museum of Canada (Can); The Amherst College Herbarium (Amh). The specimens in the Gray Herbarium and in that of the New England Botanical Club have received no special designation. In view of the large amount of material studied it has seemed unnecessary to cite more than a few characteristic specimens from each state or province.

SYNOPTIC TREATMENT OF ARABIS IN EASTERN AND CENTRAL
NORTH AMERICA

- a. Mature fruiting pedicels erect, ascending or divaricately spreading but not definitely descending or strictly deflexed; flowering pedicels at anthesis erect, ascending or divaricately spreading. . . . b.
- b. Mature siliques erect or ascending, often appressed or subappressed to the main stem, not divaricately spreading, straight or curved inward; fruiting pedicels erect or ascending. . . . c.
- c. Mature siliques one-nerved only at the base, often only faintly so, or more rarely (in *A. arenicola*) as far as the middle; flowers in close racemes. . . . d.
- d. Plants glabrous throughout; seeds definitely in two rows, narrowly oblong to elliptical, wingless. . . . 1. *A. arenicola*.
- d. Plants with pubescent stem and basal and cauline leaves; seeds in only one row, orbicular to subquadrate, winged all around. . . . e.
- e. Basal leaves lyrate-pinnatifid, petals small, 1.5–3 mm. long; siliques 2–2.5 cm. long; biennial plants of south and southwestern United States. . . . 2. *A. virginica*.
- e. Basal leaves merely dentate to subdentate, never lyrate-pinnatifid; petals large for genus, 7–9 mm. long; siliques 4–7 cm. long; perennial plants of Greenland south to Quebec. . . . 3. *A. alpina*.
- c. Mature siliques one-nerved at least to the middle or well beyond the middle; flowers in loose racemes (except sometimes in *A. glabra*). . . . f.
- f. Seeds distinctly in only one row. . . . g.
- g. Cauline leaves spatulate to linear, not clasping; plant much branched from the base. . . . 4. *A. lyrata*.
- g. Cauline leaves lanceolate to ovate, amplexicaul to subamplexicaul; plant simple or with only one or two branches at the base. . . . h.
- h. Fruiting pedicels appressed or subappressed to rachis. . . . i.
- i. Mature siliques 5–9.5 (rarely 4) cm. long, terete, never appearing moniliform; sepals and flowering pedicels always glabrous. . . . j.
- j. Stem hirsute at base with spreading hairs. . . . 5. *A. glabra* var. *typica*.
- j. Stem appressed-pubescent at base. . . . 5a. *A. glabra* var. *furcatipilis*.
- i. Mature siliques 3–5 cm. long, flat, often appearing moniliform; sepals and flowering pedicels glabrous or hirtellous. . . . 6. *A. pycnocarpa*.
- h. Fruiting pedicels not appressed or subappressed, merely ascending. . . . k.
- k. Mature siliques 5–7 cm. long; cauline leaves glabrous on upper surface, pubescent on lower surface. . . . 7. *A. georgiana*.
- k. Mature siliques 2.5–4 cm. long; cauline leaves pubescent on both surfaces. . . . 8. *A. patens*.
- f. Seeds distinctly in two rows. . . . l.
- l. Stem profusely branched at base; seeds entirely wingless; plants of Greenland and the Yukon Territory. . . . 9. *A. Hookeri*.

- l. Stem simple or only slightly branched at base; seeds winged narrowly all around except sometimes in *A. glabra*; plants of boreal North America....m.
 - m. Fruiting pedicels merely ascending or divaricately spreading, finely stellate-pubescent to glabrous, stem finely appressed-pubescent at base with forked trichomes.....10. *A. divaricarpa*.
 - m. Fruiting pedicels strictly appressed or subappressed, always glabrous; stem hirsute or glabrous (except in *A. glabra* var. *furcatipilis* which is appressed-pubescent at the base)....n.
 - n. Stem densely hirsute below with spreading hairs; flowers creamy-white to deep cream-color or more rarely very light yellow; siliques terete.....5. *A. glabra*.
 - n. Stem quite glabrous or rarely very scantily hirsutulous at extreme base; flowers whitish to pink or more rarely purplish; siliques flat.....11. *A. Drummondii*.
- b. Mature siliques divaricately spreading, never appressed or subappressed, curved outward or downward (except in *A. dentata* where they are straight), often arcuate to subarcuate; fruiting pedicels ascending or divaricately spreading....o.
- o. Plants with stem and radical and cauline leaves glabrous (except in *A. viridis* var. *Deamii*)....p.
- p. Siliques one-nerved at least to the middle and often beyond; flowers in very close, compact racemes; sepals nearly as long as petals; lower cauline leaves sharply dentate to lacinate.....12. *A. viridis*.
- p. Siliques one-nerved only at the base or rarely to the middle; flowers in very long, loose racemes; sepals only one-half the length of petals; lower cauline leaves serrate-dentate to subentire.....13. *A. laevigata*.
- o. Plants with stem and radical and cauline leaves pubescent....q.
- q. Basal leaves finely stellate-pubescent on both surfaces; flowers whitish to pink or purplish.....10. *A. divaricarpa*.
- q. Basal leaves hirsute on both surfaces with simple hairs or, if stellate-pubescent, only so on the lower surface, strigose to strigillose above; flowers white to cream-color or yellowish....r.
- r. Siliques finely and evenly stellate-pubescent.....14. *A. dentata* var. *typica*.
- r. Siliques quite glabrous....s.
- s. Seeds entirely wingless.....14a. *A. dentata* var. *phalacrocarpa*
- s. Seeds definitely winged....t.
- t. Siliques 6–9 cm. long; flowers in very close compact racemes.....12. *A. viridis* var. *Deamii*.
- t. Siliques 2.5–4 cm. long; flowers in loose racemes...8. *A. patens*.
- a. Mature fruiting pedicels pendulous or reflexed; flowering pedicels at anthesis reflexed or at least somewhat descending....u.
- u. Siliques one-nerved only at the base or slightly beyond; petals 1.75–2.25 mm. broad at apex.....15. *A. Holboellii*.
- u. Siliques one-nerved at least to the middle and usually beyond; petals not exceeding 1.5 mm. broad at apex....v.
- v. Seeds broadly winged all around; cauline leaves oblong to elliptical, not clasping at base; flowers white to creamy; siliques distinctly falcate.....16. *A. canadensis*.

- v. Seeds narrowly winged all around; cauline leaves linear to lanceolate or narrowly oblong with a subamplexicaul base; flowers white to pinkish; siliques straight or only slightly curved. . . . w.
- w. Pubescence of stem and pedicels finely and minutely hoary-stellate; petals 6–9 mm. long, 1–1.5 mm. broad at apex. 17. *A. retrofracta*.
- w. Pubescence of stem and pedicels coarser, loosely hispid to loosely hirsute; petals 4–6 mm. long, 0.5–0.75 mm. broad at apex. 18. *A. pendulocarpa*.

1. *A. ARENICOLA* (Richards.) Gelert. Perennial from a branching caudex: stem decumbent or erect, branching from the base or simple, low, 12–16 cm. high, glabrous, often purplish at base passing to green above; radical leaves firm, tough or subcoriaceous, numerous, spatulate to oblanceolate, 2–5 cm. long, 3–6 mm. broad, glabrous or more rarely subciliate, obtuse, subentire to dentate with 2–6 shallow teeth, tapering to a long winged petiole; petioles glabrous or more rarely slightly hirsutulous; cauline leaves few, firm, spatulate to narrowly oblanceolate, 8–15 mm. long, 2–4 mm. broad, glabrous throughout, entire, obtuse to subacute, the lowermost sometimes short-petioled, the middle and uppermost sessile: flowers in rather close racemes; flowering pedicels erect or ascending, glabrous, 3–5 mm. long at anthesis; sepals membranaceous, 1.75–2.5 mm. long, averaging 1 mm. broad, one half as long as petals, oblong, obtuse or very rarely subacute, glabrous, yellowish-brown to reddish-purple; petals milk-white, 3.5–5 mm. long, 2–3 mm. broad at apex, oblong-spatulate to oblanceolate: siliques 1–3 cm. long, 1.5–2.25 mm. broad, straight or slightly curved, glabrous, erect or ascending, at maturity faintly one-nerved at base or somewhat beyond, more rarely nearly to top, acute, glabrous; fruiting pedicels erect or ascending or more rarely divaricately spreading, slender, glabrous, 5–9 mm. long at maturity; style 0.25–0.75(–1) mm. long, abruptly tipping the silique; seeds small, in two rows, narrowly oblong to narrowly elliptical, wingless, 1.5–2 mm. long, 0.35–0.5 mm. broad.—Bot. Tidsk. xxi. 287–291 (1898); Britton, Man. Fl. N. States & Can. 464 (1901); Simmons, Vasc. Pl. Ellsmld. 80 (1906); Britton & Brown, Ill. Fl. ed. 2: ii. 179 (1913); Simmons, Phytogeo. Arct. Arch. 95 (1913); Vooge, Vasc. Pl. Erick Rand's Land, 26 (1932). *Eutrema arenicola* Richardson in Hooker, Fl. Bor.-Am. i. 67. t. 24 (1833); T. & G., Fl. No. Am. i. 112 (1838); Watson in Gray, Synop. Fl. N. Am. i. 136 (1895). *Sisymbrium humifusum* J. Vahl, Fl. Dan. t. 2297 (1840); J. Lange, Medd. Groenld. iii Hefte, 51 (1880). *Parrya arenicola* Hooker, Outl. Arct. Pl. 315 (1860). *Arabis humifusa* Wats. in Proc. Am. Acad. xxv. 124 (1889); Macoun, Cat. Can. Pl. v. 303 (1890); Wats. in Gray, Synop. Fl. N. Am. i. 159 (1895).—Sandy or rocky shores in arctic and subarctic regions, East and West Greenland south of lat. 72°, Baffin Island, the Ungava region of Quebec, and Labrador. The following are characteristic. GREENLAND: Disco, Quannersoit, Fries, 22 July 1871; Svartenhuk Halvø,

Tartusaq Hus, $71^{\circ} 22' N.$, *Porsild & Porsild*, 20 July 1929; Umiarfik Fjord, Vestside, udenfor anden Indsnoeing, lat. $72^{\circ} 8' N.$, *M. P. Porsild*, 8 Aug. 1934. CANADIAN ARCTIC ARCHIPELAGO: Baffin Island, Lake Harbor, lat. $62^{\circ} 49'$, *Malte*, no. 118,878; Southampton Island, lat. $64^{\circ} 10'$, *Malte*, no. 120,652. UNGAVA: Wolstenholm, Hudson Strait, lat. $62^{\circ} 40'$, *Malte*, no. 120,929; Port Harrison, east coast of Hudson Bay, lat. $58^{\circ} 17'$, *Malte*, nos. 120,786 & 120,826. LABRADOR: spur on southwest side, Mt. Tetragona, Torn-gat Region, *Abbe*, no. 390; easterly slope of Bishop's Mitre, Kaumejet Mts., *Abbe*, no. 391. *Fl.* June–July; *fr.* July–Aug. MAP 1.



MAP 1. Range of *ARABIS ARENICOLA*.

Var. *PUBESCENS* (S. Wats.) Gelert. Base of stem and radical leaves pubescent with simple and bifurcate hairs.—*Bot. Tidssk.* xxi. 290 (1898). *A. humifusa* (J. Vahl) S. Wats. var. *pubescens* S. Wats. in Gray, *Synop. Fl. N. Am.* i. 160 (1895).—West coast of Hudson Bay from lat. 52° to $57^{\circ} N.$, also



MAP 2. Range of *ARABIS ARENICOLA*, var. *PUBESCENS*.

at Lake Athabasca, Saskatchewan, and, according to Simmons, in Ellesmereland. ONTARIO: South Twin Island, James Bay, *J. M. Macoun*, no. 2,311 [Can]; Charlton Island, James Bay, *Potter*, no. 540; Cape Henrietta Maria, James Bay, *Spreadborough*, no. 62,308 (as *A. petraea*) [Can]; gravelly shores, west coast Hudson Bay, lat. 56° , *J. M. Macoun*, no. 1,693.

MANITOBA: rocks along stream, York Factory, Hudson Bay, *Bell*, no. 100,737 [Can]. SASKATCHEWAN: north shore of Lake Athabasca, *J. W. Tyrell*, no. 34,262 [Can]. MAP 2.

In making the new combination *Arabis arenicola*, Gelert¹ has thoroughly discussed the synonymy of this plant and has clearly brought out the fact that, although previously they had been thought to be quite different, *Eutrema arenicola* Richards. and *Sisymbrium humifusum* J. Vahl are actually the same plant. It seems confined to the region east of Hudson Bay between latitudes 72° and 54° , although

¹ Gelert in *Bot. Tidssk.* xxi. 287–291 (1898).

it extends as far west as Southampton Island. In Greenland it is reported at numerous stations on both the east and the west coasts, although I have seen no specimens from the east coast, and in southern Baffin Island it has been collected by *Malte* at Lake Harbor. Hooker says of *Eutrema arenicola* (which is merely a synonym for our plant): "HAB. deep sand upon the shores of Arctic America between long. 107° and 150°. *Dr. Richardson. Capt. Sir John Franklin and Capt. Back.*"¹ and Sereno Watson extends Hooker's range to "Glovonin Bay, Alaska, *Muir*; Grinnell Land ? *Greely*".² The *Muir* and the *Greely* specimens are both in the Gray Herbarium and are very immature plants, both in the early flowering stage. The stems are entirely scapose (the stems of *A. arenicola* are never scapose, but always possess from two to four cauline leaves at least one of which is placed usually just below the inflorescence so that it appears almost as a bract), and the radical leaves are decidedly oval, abruptly passing into a winged petiole (the radical leaves of our plant are spatulate to oblanceolate tapering gradually into a winged petiole), and are of a much finer texture than are those of typical *A. arenicola* from northeastern North America with which I am familiar. There seems to be little doubt that the *Greely* and the *Muir* specimens belong to some other genus in the Cruciferae, most probably to *Parrya*. But as to the Richardson specimen which is figured in Hooker's *Flora Boreali-Americana*, it seems only logical to conclude that presumably it was actually collected at a much more easterly station than "between long. 107° and 150°."³ Gelert has compared it with typical Greenland material of our plant and says: "it was immediately evident to me that this plant [*Eutrema arenicola*—the Richardson one] is identical with *Arabis humifusa* [the Greenland plant.]"⁴ And if one wishes further evidence, he need only glance at an herbarium sheet of *A. arenicola* and compare it with Hooker's plate; that the two are identical no one will doubt.

¹ Hooker, *Fl. Bor.-Am.* i. 67. t. 24 (1830).

² Watson in Gray, *Synop. Fl. N. Am.* i. 137 (1895).

³ The bases for Hooker's records of numerous other plants often need careful scrutiny, inasmuch as several instances similar to the present one are quite familiar to students of the region. He reports *Geum* (*Sieversia*) *triflorum* as occurring in Labrador, Newfoundland and the White Mountains of New Hampshire, although Professor Fernald, in an unpublished manuscript, remarks: "It is a noteworthy fact that only upon these statements of Hooker's has *Geum triflorum* been listed from either Labrador, Newfoundland or New England. In fact the plant is very rare as far east as Ontario and northern New York. It seems highly probable that Hooker's information was in some way confused."

⁴ Gelert, l. c. 289.

As is quite natural, most writers have followed Hooker and Watson in citing the range for this plant. Thus Gelert writes, "The geographic distribution is in Arctic America from Alaska to Grinnell Land and Labrador, in west Greenland from 61°–70° N. lat."¹ And Simmons says: "Occurrence. Grinnell Land: Discovery Harbor (GREELY); I think there need be no doubt about the determination, as the plants of the expedition were examined by *Watson* among others; indeed there is a note of interrogation put after the name (GREELY . . .)."² Other students have written similarly, but I cannot at the present time and from the scanty evidence at hand, become convinced that the plant is to be found west of southern Baffin Island. It seems unwise to map ranges without data from herbarium specimens, and, having discarded the *Muir* and the *Greely* plants as misidentifications, I have, consequently, made the above assumption with reference to the plant collected by Dr. Richardson.

The plate of *Sisymbrium humifusum* (*A. arenicola*) in *Flora Danica*³ illustrates a plant which is slightly different from that figured by Hooker⁴ but, as the species in nature shows considerable diversity in the form of its radical leaves, one can safely discount such small variations. Regarding this point Gelert says: ". . . when we compare the two figures, that of Hooker . . . and that of the *Flora Danica* we find some difference, the first showing a plant with entire leaves (in the description: integerrima vel parce dentata) and rather short pods (in the description: pedicello vix duplo longiores), the latter showing a plant with deeply dentate leaves (in the description: grosse dentata) and long pods (in the description: pedicello triplo longiores). However these proportions are variable. The common form has entire or slightly dentate leaves, and the pods are generally three or four times as long as the pedicels. Richardson has found the plant on sandy shores. In Greenland also the plant is found on sandy ground."⁵

Var. *pubescens* was first described by Watson,⁶ who differentiated it from the typical form of the species on the basis of pubescence. The stem in the variety is usually hirsute and the radical leaves are likewise hirsute, whereas the typical form has them both always

¹ Gelert, l. c. 290.

² Simmons, *Vascular Plants of Ellesmereland*, 80 (1906)

³ J. Vahl in *Fl. Dan.* t. 2297 (1840).

⁴ Hooker, l. c. pl. 24.

⁵ Gelert, l. c. 289.

⁶ Watson, l. c. 160.

glabrous. It is found on the west coast of Hudson Bay between latitudes 52° and 57° N., and also as far west as Lake Athabasca in Saskatchewan. I have examined the Saskatchewan specimen (*Tyrell*, no. 34,262), and have carefully checked its determination. It is quite possible that the plant extends farther northward; Simmons reports it from Ellesmereland and says: "The Ellesmereland specimens, of which I have only a couple, are very small with somewhat more dentate leaves than in the figures quoted, for the rest, they are well in accord with them as also with specimens from Greenland in the Copenhagen Herbarium. As they are rather hairy in the lower part of the stem and in the leaves, they may be referred to var. *pubescens*, (WATS.) GEL."¹ However, the specimens at my disposal from the region around the west coast of Hudson Bay do not reveal such decidedly dentate leaves as those of which Simmons speaks. One sheet (*Tyrell*, no. 100,703, 19th July 1893) from the Northwest Territory, lat. $60^{\circ} 20'$, long. $104^{\circ} 30'$, in the Herbarium of the National Museum of Canada is labelled *A. arenicola* var. *pubescens*, and has very dentate radical leaves. It is, however, unquestionably *A. lyrata* var. *kamchatica*. The question arises, therefore, whether Simmons really had var. *pubescens* from Ellesmereland, or whether it was something quite different.

2. *A. VIRGINICA* (L.) Poir. Biennial from a long tap-root: stem spreading from the base, decumbent or ascending, 1-2.5 dm. high, usually hirsute at the base with short and simple or bifurcate hairs, passing to glabrous above or hirsute throughout; basal leaves narrowly oblong, 3-8 cm. long, 7-12 mm. broad, lyrate-pinnatifid with nearly even oblong to linear segments, the segments nearly all one-toothed or entire, petioled, hirsute or glabrous, the hairs when present all simple or more rarely somewhat bifurcate; cauline leaves similar to basal ones but smaller, or the uppermost lanceolate and subentire, 3-7 cm. long, 7-10 mm. broad, either short-petioled or sessile, nearly always glabrous, rarely sparingly hirsute with simple hairs: flowers small, inconspicuous, in close racemes; flowering pedicels short, 2-3 mm. long at anthesis, glabrous; sepals membranaceous, 1-2 mm. long, one-half to two-thirds the length of the petals, glabrous or rarely with a few scattered simple hairs, often tinged purplish or pinkish; petals 1.5-3 mm. long, white to faintly pinkish, oblanceolate to narrowly oblong and rarely almost linear: siliques 2-2.5 cm. long, (1-) 1.25-1.75 (-2) mm. broad, nearly straight or very rarely slightly curved, erect or ascending or more rarely somewhat spreading, glabrous, faintly one-nerved at the extreme base or more rarely entirely nerve-

¹ Simmons, l. c. 80.

less; fruiting pedicel stoutish, erect or ascending, glabrous, 3–7 mm. long at maturity; style short, 0.25–0.5 mm. long, supporting the minute bivalvate stigma; seeds orbicular to suborbicular or more rarely subelliptic, distinctly in one row, narrowly and evenly winged all around, averaging 1.5 mm. long and 1.25 mm. broad.—Encycl. Supp. i. 413 (1810), excl. description and syn. *Cardamine virginica* Michx.; Trelease in Branner & Coville, Rep. Geol. Surv. Arkansas for 1888; 165 (1891); Britton & Brown, Ill. Fl. ii. 147 (1897); Small, Fl. Se. U. S. 483 (1903); Robinson & Fernald in Gray, Man. ed. 7: 437 (1908); Rydberg, Fl. Pr. & Pl. 38 (1932). *Cardamine virginica* L. Sp. Pl. ii. 656 (1753), nec Linn. Herb., nec Michaux, Pursh, DeCandolle, Am. auctores. *Cardamine Ludoviciana* Hooker in Jour. Bot. i. 191 (1834); T. & G. Fl. N. Am. i. 85 (1838); Eaton & Wright, N. Am. Bot. ed. 8: 169 (1840); Walpers, Rep. i. 136 (1842); Dietrich, Syn. iii. 698 (1843); Chapman, Fl. S. U. S. 26 (1860). *Sisymbrium Ludovicianum* Nutt. ex. Hooker in synonym. Jour. Bot. i. 191 (1834). *Arabis Ludoviciana* Meyer in Index Sem. Hort. Petrop. ix. 60 (1843); Gray, Man. ed. 2: 33 (1857); Wood, Classbk. rev. ed. 231 (1861); Coulter in Contr. U. S. Nat. Herb. ii. 19 (1891); Watson in Gray, Syn. Fl. N. Am. i. 161 (1895); Chapman, Fl. S. U. S. ed. 3: 27 (1897). *Planodes virginica* Greene, Leaflets Bot. ii. 221 (1912).—Florida to Texas, north to Virginia, Ohio, Indiana, Illinois, Missouri and Kansas; also California and northern Lower California. The following are characteristic. VIRGINIA: weed in cornfield, Williamsburg, *Grimes*, no. 3,296. NORTH CAROLINA: Weldon, *Bartram*, 19 April 1908 [Phil]. SOUTH CAROLINA: waste ground, Calhoun, Pickens Co., *House*, no. 3,137 [NY]; Clemson College, Oconee Co., *House*, No. 1,703 [NY]; Oconee Co., *A. P. Anderson*, no. 1,137 (as *Cardamine arenicola*) [NY]. GEORGIA: Chattahoochee, *Canby*, no. 10; Georgia, *T. & G. Fl. N. Am.*, without date or number; flat rocks, Athens, *Harper*, March 1897 [Bklyn]. FLORIDA: Quincy, *Herb. Chapman*, without date or number [NY]; Chattahoochee, in cultivated ground, *Curtiss*, 4 May 1898 [Bklyn]; Monticello, Jefferson Co., *Lighthipe*, 20 March 1891 [Bklyn]. OHIO: Fernbank, ad ripas fluminis Ohio, prope "North Bend," *Short*, without date or number [US]; near Cincinnati, *T. G. Lea*, 8 June 1838 [Phil]. INDIANA: sandy soil of flood plain of White R., 2 mi. s. of Bedford, Lawrence Co., *Kriebel*, no. 1,617; in open woods in Goose Pond, about 2½ mi. north of Griffin, *Deam*, no. 50,053 [Deam]; frequent in fallow cornfield, 2 mi. west of Decker, *Deam*, no. 42,858 [Deam]. KENTUCKY: Campbell Co., *T. G. Lea*, 24 April 1838 [Phil]; Ohio R., opposite Hanover, *A. H. Young*, May 1880 [Phil]. TENNESSEE: waste places around Nashville, *Gattinger*, no. 150; cultivated ground, Knoxville, *Ruth*, no. 356; waste ground, summit of Lookout Mt., *Churchill*, 25 April 1906. MISSISSIPPI: Houston, *C. L. Sherwood*, March 1892 [NY]; moist soil, Columbus, *Biltmore Herb.*, no. 1,047b [US]; Starkville, *E. C. Times*, 11 April 1921 [Wisc.]. ALABAMA: Mobile, *Mohr*, without date or number; Auburn, Lee Co., *Earle &*

Underwood, March 1896 [NY]; waste places, Tuscaloosa, *Mohr*, 9 June 1898 [US]; Auburn, Lee Co., *Earle & Earle*, no. 16 [NY]. ILLINOIS: roadsides, Grand Tower, *Gleason*, 3 May 1902; waste places, Saline, *M. S. Bebb*, April 1866 [Bklyn]; N. Evanston, *Earle*, 1878 [US]; E. St. Louis, *Eggert*, 15 April 1878 [US]. MISSOURI: moist prairies and field, St. Louis, *Geyer*, April 1842; woods, Campbell, *Bush*, no. 6,602; Davis Creek bottom, near Emma, *Demetrio*, no. 91; low ground, Independence, Jackson Co., *Bush*, no. 36. ARKANSAS: on rocky slope, Hot Springs, Garland Co., *Moldenke & Moldenke*, no. 1,411 [NY]; common in fields, Noark, Clay Co., *Bush*, no. 39 [NY]; Fort Towson, *Leavenworth*, March & April [Phil]. LOUISIANA: dry ground along railroad, Gretna, opposite New Orleans, *Ball*, no. 309; waste and cultivated ground, Natchitoches, *E. J. Palmer*, no. 7,031 [US]; Opelousia, *Canby*, *Sargent & Trelease*, no. 16 [US]; St. Martinsville, *Langlois*, 13 March 1892 [Minn]. KANSAS: open ground, Cherokee Co., *A. S. Hitchcock*, no. 610. OKLAHOMA: Moffett, *Benke*, no. 4,561; Muskogee, *E. Brainerd*, 7 April 1908; edge of creek near Crusher Spur, Murray Co., *Stevens*, no. 38; in edge of creek near Paul's Valley, Garvin Co., *Stevens*, no. 1,061. TEXAS: Houston, *E. Hall*, no. 15; San Antonio, *V. Havard*, no. 220; sandy bottoms, Columbia, Brazoria Co., *E. J. Palmer*, no. 5,036 [US]; Waco, McLennan Co., *Heller*, no. 1,372 (as *Roripa tanacetifolia*); Corpus Christi, Nueces Co., *Heller*, no. 1,407. CALIFORNIA: about borders of pools, San Diego, *Brandeggee*, no. 1,644; Point Loma, San Diego, *Brandeggee*, May 1905 [Bklyn]; San Diego, *Brandeggee*, April 1903. LOWER CALIFORNIA: Tia Juana Mesa, *C. R. Orcutt*, no. 1,459 [US]. *Fl.* March-May; *fr.* April-August.

In 1803 Michaux identified a cruciferous plant from "Canada, Nova Anglia et Pennsylvania"¹ as *Cardamine virginica* L. and gave a diagnosis. This was not, however, the Linnean *C. virginica*, a plant not found, at least to the best of my knowledge, either in Canada, New England or Pennsylvania, but which grows south and west of those regions very commonly. Michaux' identification of his plant was merely an error, but unfortunately subsequent authors did not realize this fact and copied his description almost word for word. Consequently, the *C. virginica* as described by Pursh,² by De Candolle,³ by Elliott,⁴ and by Darby,⁵ is not what we now know as *Arabis virginica* (which is based on the true *C. virginica* of Linnaeus), but a wholly different plant, identified today with *C. parviflora* as var. *arenicola* (Brit.) O. E. Schulz.

¹ Michaux, *Fl. Bor.-Am.* ii. 29 (1803).

² Pursh, *Fl. Am. Sept.* ii. 439 (1814).

³ De Candolle, *Systema*, ii. 258 (1821).

⁴ Elliott, *Bot. S. Car. & Ga.* ii. 144 (1824).

⁵ Darby, *Bot. Southern States*, pt. ii, 21 (1841).

The first correct nomenclatorial combination for our plant was that of Poiret, but he likewise, was quite ignorant of the Michauxian misinterpretation. His description of *A. virginica*¹ so parallels that of Michaux for *C. virginica*, that it seems unquestionable that he based the description on Michaux's own type of *C. virginica*. Linnaeus' herbarium was still, at that time, at Upsala, and the possibility that Poiret had access to it is extremely unlikely. It is much more plausible to believe that he assumed that the Michaux plant and the Linnean one were identical and that his combination was made on that basis. Hence, it is quite valid as to name, but not as to the plant described. Furthermore, the fact that the Michaux herbarium was at the Jardin des Plantes, of which Poiret was the Director, lends further proof to this theory.

The type of Michaux's plant was examined by Professor M. L. Fernald in 1903, and has since been identified by him as *C. parviflora* var. *arenicola*.² The type of *C. virginica* in the Linnean Herbarium, although examined by Britton over 40 years ago, has again been verified for me through the kindness of Mr. C. A. Weatherby, whose very complete notes leave no doubt in one's mind that it is the plant under discussion. Britton says of it:

The specimen preserved under the name *Cardamine virginica* in the Linnean Herbarium is *Sisymbrium asperum* L. of Southern Europe, which bears a wonderful resemblance to the plant of the Southern United States, readily distinguishable, however, by its glandular-roughened siliques, those of our plant being perfectly glabrous. The foliage of the two species is practically identical. It is perfectly evident, however, from his description that Linnaeus had only the American plant in mind, and this is proved by the types preserved at the British Museum of Natural History. I found no specimen of his *Sisymbrium asperum* except the one labelled *Cardamine virginica*, in the Linnean

¹ The following excerpt from Poiret's Encycl. Suppl. i. 413 (1810), shows how closely his own description follows that of Michaux. Michaux's in Latin, is given first; Poiret's follows immediately after in French:

"*Cardamine (virginica)*, glabra, erecta, foliis omnibus pinnatis; pinnulis minutis, ovalibus linearibusve, subauriculatis; siliquis tenuibus, longis, stricte erectis."

"Autant & plus rapprochée des arabettes que les cressons, cette plant, d'après M. de Lamarck, doit trouver sa place ici. Ses tiges sont droites, glabres, presque simples; toutes les feuilles ailées, médiocrement pétiolées, glabres à leurs deux faces; les folioles petites, ovales ou linéaires, entières, légèrement ondulées à leurs bords, auriculées ou munies d'une dent à leur base; la terminale ordinairement à trois lobes obtus; les feuilles radicales plus grandes, étalées en rosette; celles des tiges alternes, peu nombreuses, distantes. Les fleurs sont petites, pédicellées, réunies en une grappe lâche, terminale; il leur succède des siliques grêles, alongées, roides, droites, comprimées. Cette plante croît dans la Virginie."

² For discussion see Fernald in RHODORA, xxix. 191 (1927).

Herbarium, and it is clear that this one has been accidentally fastened down to the wrong sheet.¹

The habit of *A. virginica* so resembles that of a *Cardamine* or of *Capsella Bursa-Pastoris*, especially in the flowering stage, that a natural confusion as to its identity in the field is pardonable. In the fruiting condition there is little chance for error in determination because its siliques often possess a faint nerve at the base (a most important character in *Arabis*, but entirely lacking in *Cardamine*), but if this nerve is absent, as it sometimes is, the seeds are always evenly winged throughout, a character which instantly places a dubious *Cardamine* in *Arabis*.

In its distribution, this plant ranges throughout the southeastern United States, often in waste ground as a weed, or in fields and prairies, but also commonly in wet woods or about wet rocky places. North of Virginia it is unknown and is comparatively rare in Ohio, Indiana and Illinois. In California it is very uncommon and, although I have seen specimens only from San Diego (and one from Lower California), Munz says of its occurrence in the state: "Rare, about drying pools, San Diego, Ingelwood, Gardenia; to central Calif., Lower Calif."²

3. *A. ALPINA* L. Perennial from a branching caudex: stems erect or decumbent, 1–3.5 dm. high, branching at the base, loosely to densely hirsute below with spreading, simple and 2- or 3-forked hairs, above hirtellous or more rarely glabrous: radical leaves in rosettes, 0.5–11 cm. long, 0.5–2.5 cm. broad, oblanceolate to obovate-spatulate, coarsely and unevenly dentate to subentire, subacute, stellate-pubescent on both surfaces with 2–3-forked, more rarely simple hairs, petiolate; petioles broadly wing-margined, sparingly to densely stellate-pubescent; cauline leaves remote to subimbricate, rarely imbricate, oblong to ovate-lanceolate, subamplexicaul with an auriculate base, 1–10 cm. long, 0.5–2.5 cm. broad, unevenly dentate to subentire, subacute, stellate-pubescent on both surfaces with 2–3 forked hairs, more rarely the uppermost merely hirtellous: flowers large, showy, in close racemes; flowering pedicels erect, subappressed, sparingly hirsute to glabrous, 6–8 mm. long at anthesis; sepals oblong-lanceolate, greenish-yellow, one-half the length of petals, herbaceous, 3–5 mm. long, loosely hirsute or hirtellous to glabrous; petals white to deep cream color, oblanceolate-spatulate, 7–9 mm. long, 2–4 mm. broad at top, delicately and finely veined: siliques 4–7 cm. long, 1.5–2 mm. broad at maturity, straight or slightly curved inwards, glabrous,

¹ Britton in Bull. Torr. Bot. Club xix. 221 (1891). For further discussion, proving Britton's point, see Baker in Journ. Bot. xliii. 255 (1905).

² Munz, Man. So. Calif. Bot. 203 (1935).

erect or ascending, nerveless or nearly so or if one-nerved then only at the extreme base and very faintly so; fruiting pedicels ascending, glabrous, 7–15 mm. long at maturity; stigma small, flat-topped to subcupulate, on a short stocky style 0.25–0.75 mm. long; seeds in one row, orbicular to subquadrate, averaging 1.25 mm. in diameter, narrowly winged all around, the wing averaging 0.25 mm. broad.—Sp. Pl. ii. 664 (1753); Oeder in Fl. Dan. t. 62 (1766); Scopoli, Fl. Carn. ed. ii. 29 (1772); Lam. Encyl. i. 218 (1783); Curtis in Bot. Mag. vii. t. 226 (1793); Persoon, Synop. Pl. ii. 204 (1807); Poir. Suppl. Encyl. i. 410 (1810); Pursh, Fl. Am. Sept. ii. 438 (1814); Hartman, Handbk. Scand. Fl. 225 (1820); DC. Syst. ii. 216 (1821) and Prod. i. 142 (1824); Hooker, Fl. Bor.-Am. i. 41 (1829); E. Meyer, Pl. Labr. 84 (1830); Schlecht., Fl. Labr. in Linnaea x. 102 (1836); T. & G. Fl. N. Am. i. 80 (1838); Ledebour, Fl. Ross. i. 117 (1842); Walpers, Rep. i. 130 (1842); Dietrich, Synop. iii. 689 (1843); Bennett, Fl. Alps i. 18 (1846); Godet, Fl. Jura 36 (1853); Bouvier, Fl. Suisse 40 (1878) and Fl. Alps 10 (1882); Gaudin, Synop. Fl. Helv. 550 (1886); Wats. in Gray, Synop. Fl. N. Am. i. 163 (1895); Britton & Brown, Ill. Fl. ii. 147 (1897); Britton Man. Fl. ed. 2: 464 (1905); Porsild, Fl. Disko, Greenland 83 (1926). *Turritis verna* Lam. Fl. Fr. ii. 490 (1778). *Arabis incana* Moench, Meth.



MAP 3. American Range of *ARABIS ALPINA*.

257 (1794). *A. alpina* var. β *minor* Lange, Medd. Groenld. iii. Hefte, 251 (1887). *A. alpina* var. γ *ruderalis* Wormskj. in Lange, Medd. Groenld. iii. Hefte, 251 (1887). *A. alpina* var. *typica* Paoletti in Fiore & Paoletti, Fl. Anal. d'Ital. i. 427 (1908).—Cliffs, ledges and gravel of basic or circumneutral rock or wet springy hillsides and alpine meadows, e. and w. Greenland, s. of lat. 73° , Baffin Island, Ungava, Labrador, Newfoundland and the Gaspé Peninsula of Quebec. The following are characteristic. GREENLAND: on cliffs, northwest side of Disco Island, *Ohlin*, no. 77; Qeqertarssuaq, Nûgâtsiaq $71^{\circ} 33'$, 16 Juli 1929, *Porsild & Porsild*; Godhavn, Disco Island, *Ralph Robinson*, nos. 61 & 62; Ilua, lat. bor. $59^{\circ} 55'$, *Lundholm* 1889. BAFFIN ISLAND: Cannon Inlet, *R. Robinson*, no. 66; wet ground, among rocks at waterfall, Lake Harbour, *Malte*, no. 126,873; Frobisher Bay, *C. S. Sewall*, no. 314. UNGAVA: Cape Chidley, Hudson

Strait, sandy shores, *R. Bell*, no. 166; Port Harrison, east coast of Hudson Bay, wet sand, *Malte*, no. 120,721; Wakeham Bay, Hudson Strait, *Malte*, no. 120,247; Port Burwell, Hudson Strait, *Malte*, nos. 120,178, 120,149, 118,876 & 118,877. LABRADOR: on granitic rock, old sea beaches, Northwest Bay at Head of Ryan's Bay, *Woodworth*, nos. 242 & 243; 20 mi. n. of Nachvak, *H. S. Forbes*, 28 Aug. 1908; Rama, *Sornborger*, no. 168; mossy bed of a brook, Forteau, Straits of Belle Isle, *Fernald & Wiegand*, no. 3,490; stream bank, west of Blanc Sablon, *Abbe*, no. 1,209. NEWFOUNDLAND: conglomerate limestone



MAP 4.
Range of
ARABIS
ALPINA, var.
GLABRATA
(Greenl.) and
of A. ALPINA,
forma PHYL-
LOPETALA
(Nfld.)

and calcareous sandstone cliffs and ledges, Cow Head, *Fernald & Wiegand*, no. 3,488; east slope of Fishing Head, St. Anthony, *Abbe*, no. 392; wet quartzite rocks and seepy banks along upper Deer Pond Brook, *Fernald & Long*, no. 28,418; limestone cliffs and ledges on western slope under summit, Bard Harbor Hill, *Wiegand, Gilbert & Hotchkiss*, no. 28,416. QUEBEC: grassy brookside, Pointe a Peau, Brest, Saguenay Co., *St. John*, no. 90,497; calcareous alpine meadow, alt. 1000-1125 meters, Table-Topped Mt., Gaspé Co., *Fernald & Collins*, no. 575; gravel-bar below Middle Camp, Grand Cascadepia River, Bonaventure Co., *Williams, Collins & Fernald*, July 12-15, 1905; gravel and alluvium along Rivière Ste. Anne des Monts, Gaspé Co., *Fernald, Griscom, Mackenzie & Smith*, no. 25,804; along brooks alt. 350-900 meters, north slope of Mt. Albert, Gaspé Co., *Collins & Fernald*, no. 95. *Fl.* July-Aug. fr. July-Sept. MAP 3.

Var. GLABRATA Blytt. Stem glabrous throughout; leaves usually glabrous, rarely with a few scattered simple hairs.—Norges Flora iii. 974 (1876); Hartman, Scand. Fl. ed. 11: 191 (1897); Lange, Medd. Groenld. iii. 48 (1880). GREENLAND: Disco Island, Tigpiarsuk ved Nugssag 70° 16' N., 31 Aug. 1928, *Porsild*; Disco Island, Quannerssit, 22 June 1871, *Fries*. MAP 4.

Forma PHYLLOPETALA Fernald. Petals firm, greenish white and coarsely veined, otherwise as in the typical form of the species.—RHODORA, xxv. 270 (1933).—NEWFOUNDLAND: shaded shelves of limestone cliff, Crow's Head, St. John Bay, *Fernald, Long & Fogg*, no. 1,753 (TYPE in Gray Herb.); thickets on quartzite gravel along brook, Deep Gulch, Doctor Hill, *Fernald, Long & Fogg*, no. 1,754. MAP 4.

In discussing *A. alpina* in the Synoptical Flora of North America, Watson says: "The *A. stricta* of Pursh's Flora collected in Labrador by *Colmaster*, is probably this species."¹ Without a doubt he is correct as to the specimen concerned. Pursh² copied the description

¹ Watson in Gray, Synop. Fl. N. Am. i. 163 (1895).

² Pursh, Fl. Am. Sept. ii. 437 (1814).

of Willdenow¹ word for word and, although Willdenow did not copy that of Hudson,² who is the original author of the name, he deviated only slightly. Hudson's plant is strictly a British one, and is not found in the New World as far as I can ascertain. The ascription of *A. stricta* Huds. to North America in Index Kewensis is no doubt erroneous.

Varying considerably in size and in the degree of pubescence, this plant reaches its northernmost limit at lat. 73° 16', Kap Franklin, Greenland.³ It occurs on both the east and the west coasts of that island, south of lat. 73°; and is on Baffin Island, in the eastern Ungava region of Quebec, in Labrador and Newfoundland, thence westward to the Gaspé Peninsula. The variations in stature are considerable, plants often being as low as 7 cm. (Labrador: *Forbes*, 28 Aug. 1908), and as high as 40 cm. (Greenland: Disco Island, *R. Robinson*, no. 61). Some specimens are extremely hirsute on the lowermost part of the stem, while others are very sparingly so, and the basal leaves may likewise vary greatly in pubescence. However, these and similar variations are to be expected in a plant which is so universally distributed throughout the subarctic regions of northeastern North America and, although I have seen no specimens of the following varieties cited by Lange:

- β, *minor* Lange, c. 2'' longa, foliis minutis (c. 1 cm. longis)
- γ, *ruideralis* Wormskj., major, fere pedalis, polyphylla, caule saepe ramossissimø,⁴

I can only interpret them as transient variations due to various edaphic or environmental conditions.

The species is extremely popular as a commercial rock-garden plant, and as such it is sold by many seed houses. An occasional escape, therefore, seems entirely to be expected, and it is as such that I have viewed a sheet "by the roadside, Rockport, Maine" in the Herbarium of the New England Botanical Club. Mr. A. H. Norton also reports it as having gotten a foothold at Cape Elizabeth, Maine.

The earliest published record for var. *glabrata* appears in Blytt's *Norges Flora*, where one finds the description, "I alle Dele aldeles glat"⁵ (all parts glabrous throughout). In North America the variety seems restricted to Greenland, and more especially to the region

¹ Willdenow, *Sp. Pl.* iii. 539 (1801).

² Hudson, *Fl. Angl.* i. 292 (1778).

³ Devold & Scholander, *Fl. Pl. of se. Greenland* 49 (1933).

⁴ Lange, *Medd. Groenld. Hefte* iii. 251 (1887).

⁵ Blytt, *Norges Flora*, iii. 974 (1871).

around Disco. The total absence of pubescence on the plant appears to be a constant and permanent character and as such warrants varietal recognition.

Forma *phyllopetala*, in which the petals are firm, greenish-white and coarsely veined in contrast to those of the typical form of the species which are milk-white, delicate and obscurely veined, already has been adequately discussed by Fernald. I have seen no specimens from regions other than in Newfoundland where it was originally collected.

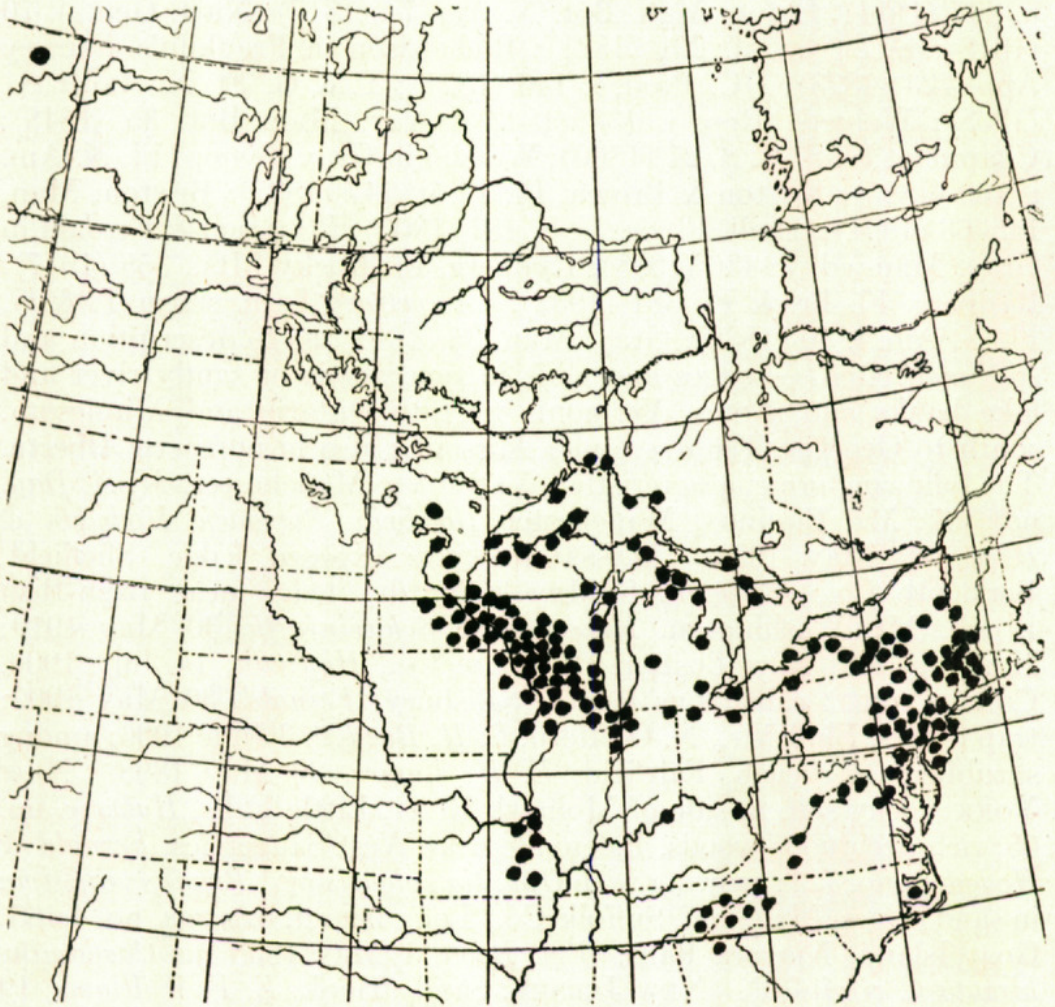
4. A. LYRATA L. Biennial northward, passing to perennial southward: stem ascending, 7–36 cm. high, more or less slender, branching from the base and somewhat above the base, hirsute at base with simple and bifurcate hairs, soon becoming glabrous above or more rarely glabrous throughout: radical leaves 2–4 cm. long, 0.5–1 cm. broad, spatulate to oblanceolate, most frequently lyrate-pinnatifid but often merely dentate or very rarely subentire, densely to sparsely hirsute on both surfaces or rarely only on the lower, with simple and bi- or trifurcate hairs, obtuse to subciliate; petioles hirsute with simple and forked hairs; cauline leaves 1–3 cm. long, 1.5–5 mm. broad, spatulate to linear, tapering to a sessile base or more rarely to a short petiole, the lowermost often lyrate-pinnatifid, more usually dentate to subentire, the uppermost entire, glabrous or more rarely sparingly hirsute with simple and forked hairs; flowers in loose racemes; flowering pedicels erect or spreading, glabrous, 3–4 mm. long at anthesis; sepals 1.5–2.5 (–3) mm. long, one-half to one-third the length of the petals, herbaceous, glabrous, ovate to oblong, acute, greenish to purplish, usually with a narrow hyaline margin; petals white to pinkish or rarely light purple, 6 (5–) –8 mm. long, 2–2.5 (–3) mm. broad at apex, subtruncate or more rarely obtuse, spatulate to oblanceolate; siliques 2–4 (–4.5) cm. long, 0.5–1 (–1.25) mm. broad, slender, straight or slightly curved inward, more or less flat, glabrous, loosely ascending or widespreading, one-nerved at least beyond the middle and often nearly to the tip; fruiting pedicels loosely ascending or spreading, slender, glabrous, 5–15 mm. long at maturity; style slender, up to 1.5 mm. long, or obsolete; seeds elliptical to oblong, averaging 1 mm. long, 0.75 mm. broad, definitely in one row, quite wingless.—Represented in North America by the following varieties and forms.

- a. Stem and (or) radical leaves somewhat pubescent with simple, bifurcate or trifurcate hairs. b.
- b. Flowers 6 (5–) –8 mm. long; style 0.65–1.25 mm. long, stigma never sessile. var. *typica*.
- b. Flowers smaller, 3.5–5 (–6) mm. long; style rarely exceeding 0.5 mm. long or obsolete, the stigma then sessile. c.
- c. Siliques short, not exceeding 2 cm. long; range of var. *typica* var. *typica* f. *parvisiliqua*.
- c. Siliques longer, 2–4 cm. long; plants of Alaska and adjacent regions. var. *kamchatica*.

- a. Stem and radical leaves quite glabrous or rarely the petioles sparingly hirsute with a few scattered simple hairs; stigma sessile or on a short style usually not exceeding 0.75 (1) mm. long; flowers 4–7 mm. long. var. *glabra*.

Var. **typica**. *A. lyrata* L. Sp. Pl. ii. 665 (1753); Gronov. Fl. Virg. ed. 2: 99 (1762); Hill, Veg. Syst. xii. t. 9 (1767); Mill. Gard. Dict. (8) Sp. no. 5 (1768); Persoon, Synop. ii. 204 (1807); Pursh, Fl. Am. Sept. ii. 437 (1814); Eaton, Man. Bot. N. Am. 74 (1817); Nutt. Gen. ii. 70 (1818); DC. Syst. ii. 231 (1821); Richardson in Franklin's Journey App. 723 (1823); DC. Prod. i. 146 (1824); T. & G. Fl. N. Am. i. 81 (1838); Walpers, Rep. i. 133 (1842); Gray, Man. Bot. 35 (1848); Chapman, Fl. S. U. S. 27 (1860); Watson in Gray, Synop. Fl. N. Am. i. 159 (1895); Britton & Brown, Ill. Fl. ii. 147 (1897); Britton, Man. Fl. 463 (1901); Small, Fl. Se. U. S. 484 (1903); Robinson & Fernald in Gray, Man. ed. 7: 436 (1908); Rydberg, Fl. Rocky Mts., 358 (1917); Rydberg, Fl. Pr. & Pl. 381 (1932). *A. petraea* Lam. sensu T. & G. Fl. N. Am. i. 80 (1838); Gray, Man. 35 (1848), as to description and specimen cited.—Ledges and cliffs in rich woods or sandy river and lake banks and shores, Vermont, west to Ontario and Minnesota, south to Georgia, Tennessee and Missouri; also in northern Alberta. The following are characteristic. VERMONT: Manchester, *M. A. Day*, no. 397; Mt. Equinox, Manchester, *Goodwin, Rossbach, Hodgdon & Drew*, 19 May 1934. MASSACHUSETTS: exposed ledge, Sheffield, Berkshire Co., *Hoffman*, 8 May 1929; dry ledge near Bash-Bish Brook, Mt. Washington, *Knowlton & Schweinfurth*, 30 May 1919; Hanging Mt., New Boston, Berkshire Co., *Hoffman*, 14 July 1906. CONNECTICUT: calcareous ledges, Salisbury, *Fernald*, 30 May 1902; trap ledges, Bluff Mt., N. Guilford, *G. H. Bartlett*, 3 June 1906; among shrubbery on beach, Fairfield, *E. H. Eames*, 29 May 1898. NEW YORK: rocky soil, n. side of Mohawk River, Little Falls, *Haberer*, no. 65; rich deciduous woods, Palenville near West Saugerties, *Fernald & Hodgdon*, no. 721; growing with *Opuntia vulgaris* and *Prunus maritima* in sand dunes, Mt. Sinai, Suffolk Co., Long Island, *Svenson*, no. 4,465; Goat Island, Niagara Falls, *Wm. Boott*, 1 May 1858 (as *Cardamine hirsuta* v. *virginica*). NEW JERSEY: Sandy Hook, *E. F. Williams*, 19 June 1900; red shale outcrops, $\frac{1}{4}$ mi. n. of Somerset, *F. J. Hermann*, no. 3,986; Budd's Lake, Morris Co., growing on the open flat sandy shores, *T. C. Porter*, 25 June 1869. PENNSYLVANIA: Safe Harbor, Lancaster Co., *Heller*, 18 April 1889; Blue Hill ledges, Snyder Co., *Wiegand & Manning*, no. 1,260; dunes, Presque Isle, *Pease*, no. 12,987. MARYLAND: dry open hillside along the Susquehanna R., Bald Friar, *Fogg*, no. 1,900; shaly beach of creek, serpentine barrens, Baltimore, *Churchill*, 3 May 1910; shady bank above Oakington Bar, *G. H. Shull*, no. 434. DISTRICT OF COLUMBIA: near Washington, Larkspur Island in the Potomac, *Coville*, 9 May 1890; vicinity of Washington, *T. H. Kearney*, 11 April 1897 [NY]. VIRGINIA: abundant in open rocky woods, Great Falls, *W. Deane*, 17 April 1915; rich hill, rocks

over creek, Wytheville, *H. Shriver*, April 1876; Eggleston's, *Brown, Hogg et al*, 4 June 1890 [NY]; Laurel Creek, north fork of Holston River Valley, Smyth County, *Britton, Britton & Vail*, 22 June 1892. WEST VIRGINIA: White Sulphur Springs, *Gray, Canby & Redfield*, Aug. 1876. NORTH CAROLINA: Grandfather Mt., Mitchell Co., *Heller*, no. 1,238; rocky summit of Cedar Cliff Mt., *Biltmore Herbarium*, no. 41b;



MAP 5. Range of ARABIS LYRATA, var. TYPICA.

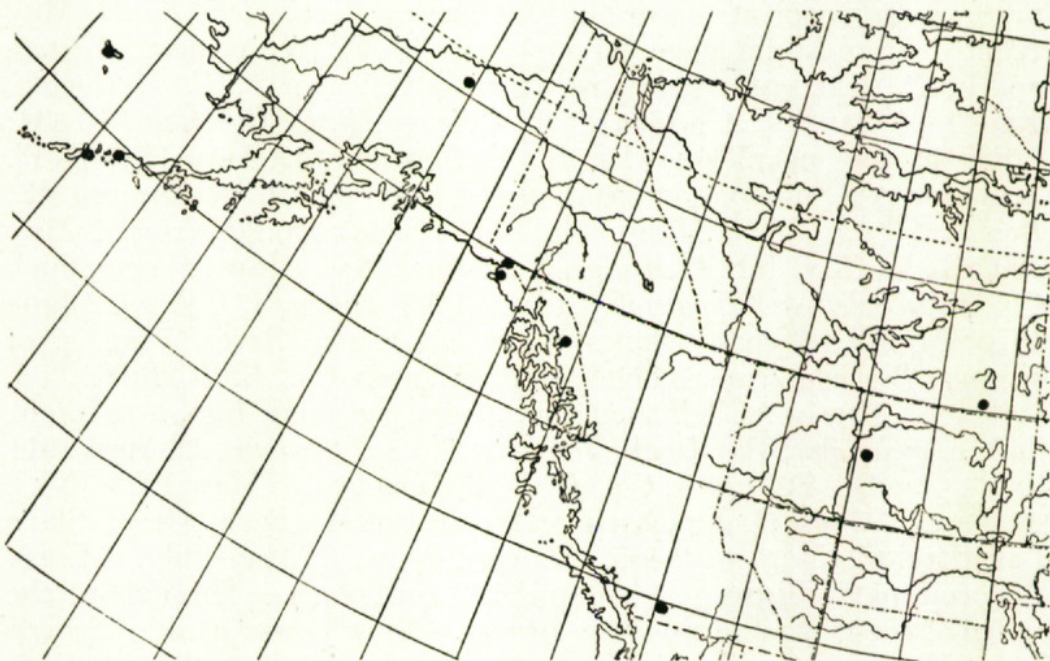
on compacted shell, 10 miles s. of Newbern, Craven Co., *Weatherby*, no. 6,092. GEORGIA: northern Georgia, *Vasey*, 1878 [Phil.] ONTARIO: Niagara, *Macoun*, no. 33,785; railroad embankment, Jack Fish, Thunder Bay Distr. *Pease & Bean*, no. 23,535; Hay Bay, Tobermory, Bruce Co., *Krotkov*, no. 7,466; beach, Providence Bay, Manitoulin Island, *Pease & Ogden*, no. 25,002. MICHIGAN: sandy woods, Seul Croix School, Schoolcraft Co., *Pease & Ogden*, no. 25,067; dry sandy beach of Lake Superior, Bête Grise, Keweenaw Co., *Fernald & Pease*, no. 3,339; Isle Royale, *W. S. Cooper*, 8 July 1909. OHIO: Cedar Point, Erie Co., *Moseley*, 19 May 1892; Sandusky, *Kellerman*, 31 May

(without year); Fulton Co., *Moseley*, 23 May 1925 [US]. INDIANA: on sandy banks of Clear Creek, Steuben Co., *Deam*, 12 June 1904; sand hill, Miller, *A. Chase*, no. 789; sandy open woods, Lake Chicago Basin, Pine, *O. E. Lansing, Jr.*, no. 2,705. KENTUCKY: Knobs, Greenup Co., *Short*, June (without year) [Phil]; edge of woods and fields (near Louisville), *O. E. Mueller*, April (without year) [Minn]. TENNESSEE: in apricis rupestribus ad fluv. Holston, *Rugel*, April 1842; ad rupes prope Painted Rock infra Warm Springs, *Rugel*, April 1842 [NY]; on rocks along Tennessee R., Knoxville, *Ruth*, nos. 235 & 1,941 [NY]. WISCONSIN: wooded hills and on limestone rocks $\frac{1}{4}$ mi. e. of Richland Center, Richland Co., *O. E. Lansing Jr.*, no. 3,404 (in part); open woods at top of bluffs at Dewey Park, *F. H. Smith*, May 1935; dry sandstone ledge, Trempealeau bluff, Trempealeau, *Fassett*, no. 4,242. ILLINOIS: sandy woods near Chicago, *F. E. McDonald*, June 1891; sand in Sheridan Park, Chicago, *F. C. Gates*, no. 16,334; sandy barrens near Oquawka, *H. N. Patterson*, 19 May 1873 [NY]. MINNESOTA: common on sand dunes near mouth of Zumbro R., *Rosendahl*, no. 5,528 [Minn]; bluffs in Winona Co., *Holzinger*, May 1909; Lake City, *W. H. Manning*, 25 June 1883. IOWA: Winneshiek Co., *Fitzpatrick & Fitzpatrick*, 16 June 1899; Decorah, *Holway*, 2 June 1876 [Minn]; on rocky slopes, Valley of Canoe River, 7 mi. s. of Hesper, *Rosendahl*, no. 3,858 [Minn]; Clinton Co., *G. D. Butler*, no. 19 [Mo]. MISSOURI: Jefferson Co. in sandy ground, *Eggert*, (without date or number); Bat Rock, Jefferson Co., *Letterman*, 22 April 1911 [NY]; Pacific, St. Louis Co., *H. W. Edmonds*, 15 May 1927 [NY]. ALBERTA: Moose Lake District, Wood Buffalo Park, Great Slave Lake Region, *Raup*, no. 2,485. *Fl.* April–May; *fr.* May–July. MAP 5.

Forma **parvisiliqua** n. f., siliquis 1–2 cm. longis.—Throughout the range of the typical form of the species. NEW YORK: bank of Seneca Lake, Watkins, *Coville*, 14 June 1884; Aquebogue, Long Island, *E. S. Miller*, 10 June 1875 [Wisc]. NEW JERSEY: Starr's woods, Camden, *C. A. Boice*, 28 April 1869 [Phil]; 3 miles e. of Mickleton, Gloucester Co., *B. Heritage*, 11 May 1892 [Phil]. PENNSYLVANIA: Penn Valley, *Fannie Mulford*, 30 May 1899 [Bklyn]; serpentine barrens, Nottingham, Chester Co., *U. Taylor*, 4 May 1913 [Bklyn]; stony soil, Friedensville, Lehigh Co., *Mary H. Williams*, 13 July 1924 (TYPE in Gray Herb.); Bushkill, Pike Co., *E. B. Bartram*. DELAWARE: serpentine e. of Mt. Cuba, Christiana, *Pennell*, no. 1,507 [Phil]; dry serpentine rocks near Centerville, *A. Commons*, 2 June 1874 [Phil]. MARYLAND: Cromley's Mount, Oakwood, Cecil Co., *Pennell*, no. 1,585 [Phil]; near Annapolis, *K. A. Taylor*, 9 May 1891 [Minn]. DISTRICT OF COLUMBIA: rocky bank, *E. L. Morris*, no. 2,393 [Bklyn]. VIRGINIA: summit of Stony Man Mt., alt. 4,031 ft., near Luray, *Steele & Steele*, no. 31 [US]; New River, White Sulphur Springs, *Canby*, August 1876 [US]. NORTH CAROLINA: Roan Mt., *J. D. Smith*, 15 July 1880 [US]; Grandfather Mt., Mitchell Co., *Heller*, 25 August 1893 [Phil]. ONTARIO: Experimental Farm, Ottawa, probably introduced near hot bed, *Macoun*,

no. 66,463 [Can.]. MICHIGAN: Rock Harbor, Isle Royale, *Cooper*, no. 66 [Minn]. WISCONSIN: wooded hills and on limestone rocks, $\frac{1}{4}$ mi. e. of Richland Center, *O. E. Lansing, Jr.*, no. 3,404; dry limestone cliffs along Fairplay Creek, Fairplay, *Fassett*, no. 10,321 [Wisc]; dry sand plain near Kilbourn, Delton, *Fassett*, no. 3,524 [Wisc]; Danbury, *Davis & Baird*, 26 August 1916 [Wisc]; south side Lake Watosah, near Keshena, *E. E. Honey*, 14 June 1934 [Wisc]. MINNESOTA: Itasca Co., *J. H. Sandberg*, no. 749 [Minn]. MISSOURI: sandy banks of Meramec R., Crawford Co., *Eggert*, April 1882 [Mo].

Var. *KAMCHATICA* Fischer. Biennial; stem hirsute at base with spreading, simple and bifurcate hairs; radical leaves glabrous or spar-



MAP 6. Range (American) of *ARABIS LYRATA*, var. *KAMCHATICA*.

ingly hirsute; flowers 3.5–5 (–6) mm. long; stigma sessile or on a short style not exceeding 0.5 (0.75) mm. long.—Fischer ex. DC. Syst. ii. 231 (1821); Hultén, Fl. Kamtchatka, ii. 165 (1928) in part; *Arabis ambigua* var. *intermedia* DC. Syst. ii. 231 (1821) and Prod. i. 146 (1824); Cham. & Schlecht. in Linnaea, i. 16 (1826). *A. Kamtchatica* Ledebour, Fl. Ross. i. 121 (1842); Busch in Not. Syst. Herb. Hort. Petrop. iii. 11 (1922); Busch in Fl. Sib. Orient. Extrem. iv. 467 (1926). *A. petraea* & *Kamtchatica* Regel in Bull. Mosc. (Pl. Raddeanae) xxxiv. 167 (1861).—Alaska to Mackenzie, south to British Columbia and northern Saskatchewan. The following are characteristic. ALASKA: Yakutat, wet meadows, *Mr. & Mrs. E. P. Walker*, no. 1,055 (as *Cardamine* ?); banks, Captains Bay, *Harrington*, 8 June 1872; Unalaska Island, *L. M. Turner*, no. 1,282 in part (as *A. petraea* var. *ambigua*); Glacier Bay, *C. P. Anderson*, no. 1,232 [NY]; Mt. McKinley, *R. L. Shainwald*, 20 July 1903 [NY]; Juneau, *C. P. Anderson*, no. 466 [NY]; Disen-

chantment Bay, *F. Funston*, no. 84 [NY]; St. Paul Island, Behring Sea, *J. M. Macoun*, no. 89,539 [Can]; Minn Glacier, *Addison Brown*, 14 Aug. 1893 [Amh]. BRITISH COLUMBIA: Yale, wet gravel near springs, *Macoun*, no. 1,736 [Can.]. SASKATCHEWAN: Clearwater R., sandy banks, lat. 57° , *J. M. Macoun*, no. 1,725 [Can.] MACKENZIE: lat. $60^{\circ} 20'$, long. $104^{\circ} 30'$, *J. W. Tyrell*, 18 July 1893, no. 100,738 [Can]. MAP 6.

Var. **glabra** (DC.) comb nov. Biennial or rarely perennial; stem and radical leaves quite glabrous or very rarely the petioles sparingly hirsute with a few scattered and simple hairs; style not exceeding 0.75 (–1) mm. long.—*A. ambigua* var. *glabra* DC. Syst. ii. 231 (1821); DC.



MAP 7. Range of *ARABIS LYRATA*, var. *GLABRA*.

Prod. i. 146 (1824). *Sisymbrium arabadoides* Hooker, Fl. Bor.-Am. i. 63 (1830). *A. petraea* var. *ambigua* (DC.) Regel in Bull. Mosc. xxxiv (Pl. Raddeanae) 166 (1861) in part. *A. lyrata* var. *occidentalis* Watson in Gray, Synop. Fl. N. Am. i. 159 (1895); Britton & Brown, Ill. Fl. ii. 147 (1897); Piper, Fl. Washington, 292 (1906); Frye & Rigg, Nw. Fl. 190 (1912); Piper & Beattie, Fl. Nw. Coast 170 (1915), all in part. *A. lyrata* var. *kamchatika* Fischer sensu Hultén, Fl. Kamtchatka ii. 165 (1928) in part; Thompson in RHODORA, xxxvii. 418 (1935) in part.—Alaska to Washington, Montana and Saskatchewan; north shore of Lake Superior; western New York. The following are characteristic. NEW YORK: steep rock bank, Green Lake, near Jamesville, *Maxon*, 5 May 1897 [US]. ONTARIO: railroad track, Jack Fish, Thunder Bay District, *Pease & Bean*, no. 23,436; sandy shore of Lake Superior, Agawa Bay, *Pease*, no. 17,978. NORTHWEST TERRITORY: Arctic Canada, waste places, *Dr. Richardson*, ex. Hb. Brit. Mus., no. 2,312 [Can]; Franklin's Journey, Dr. Hooker (as

Sisymbrium arabidoides, probably an isotype of that species) [NY]. SASKATCHEWAN: stony shore, Poplar Point, Lake Athabaska, *Francis Harper*, no. 88 [US]; near east end of Lake Athabaska, *J. W. Tyrell*, no. 100,741 [Can]; Clearwater River, lat. 56°, *J. M. Macoun*, no. 1,724 [Can]; abundant on sand hills north of Prince Albert, *Macoun*, no. 12,398 [Can]. MONTANA: Montana, *Coues*, *Ex. Herb.* *J. W. Chickering*, 1874 [NY]; high rock-slide above Many Glacier Hotel, vicinity of Lake McDermott, *Standley*, no. 16,549 [US]. ALBERTA: Maligne Lake, *S. Brown*, no. 1,169; Mt. Temple, Laggan, *Butters & Holway*, no. a8; Independence Branch, Pabocton Creek, *S. Brown*, no. 1,355; vicinity of Lake Louise, *F. W. Hunnewell*, no. 4,356. WASHINGTON: Nooksack River near Mt. Baker, Whatcom Co., *Suksdorf*, no. 1,999; near Glacier on Heliotrope Ridge, Mt. Baker, *J. W. Thompson*, no. 11,239. BRITISH COLUMBIA: Lower Allokagnik Lake, *McKay*, 1882; west and northwest slopes of Mt. Selwyn, about 56° 1' N., 123° 39' W., *Raup & Abbe*, nos. 3,797, 4,096 & 4,153; creek valleys, Selkirk Range, *Macoun*, 20 Aug. 1885; grassy places by brookside, Yale, *Macoun*, no. 1,732 [Can]. YUKON TERRITORY: Coffee Creek, *Eastwood*, no. 553; Carcross, *Eastwood*, nos. 707 & 708; Klondyke bottom, *Eastwood*, no. 191. ALASKA: Lake Iliama region, *M. W. Gorman*, no. 6; dry sandy beach, Admiralty Island, *Mr. & Mrs. E. P. Walker*, no. 716; near timber line, Kuin Island, *Mr. & Mrs. Walker*, no. 788 (as *Cardamine* ? . . .); vicinity of Karluck, Kadiak Island, *Cloudsley Rutter*, no. 29; Disenchantment Bay, *Funston*, no. 84; St. Paul Island, Behring Sea, *J. M. Macoun*, 3 Aug. 1891. MAP 7.

Typical *A. lyrata* is a plant of Alleghenian distribution in the eastern United States, found in Canada only locally in southern Ontario, except for one very isolated station in northern Alberta, and extending from Vermont, which appears to be its easternmost limit, south through western Massachusetts to North Carolina and Tennessee, west to Missouri, Iowa and Minnesota. From the strictly Eurasian *A. petraea* it is quickly distinguished by its narrowly elliptical to oblong seeds, those of the Old World plant being broadly elliptical to suborbicular, and by its siliques which are one-nerved beyond the middle and acute to subacuminate, whereas those of *A. petraea* are one-nerved only at the base and are blunt and obtuse. In general, the Eurasian plant tends to be more strict, and its fruit is usually shorter and more plump. Busch, according to Hultén, further adds, "In Fl. Sib. Orient. Extrem. iv p. 470 he [Busch] says that this species [*A. petraea*] differs from the American *A. lyrata* in being more robust and in having smaller flowers and thicker and longer pods."¹ Although I cannot agree with Busch that the flowers

¹ Hultén, Fl. Kamtchatka, ii, 167 (1928).

of *A. petraea* are smaller than those of *A. lyrata* (at least the Old World specimens which I have examined do not illustrate this distinction), I quite agree with him regarding the size of the fruit in the two species. Torrey & Gray describe *A. petraea* and cite a specimen as occurring on this continent, but upon examining this sheet, which was collected by Dr. Pitcher on the shore of Lake Superior (in the Herbarium of the New York Botanical Garden), I can identify it only as typical *A. lyrata*. In Torrey & Gray's *Flora* and in the early editions of Gray's *Manual* the name *A. petraea* refers partly to this and partly to *Braya humilis* (C. A. Meyer) Robinson.

Our Alleghenian plant is characterized by its rather large flowers, varying from 6 to 8 mm. long, and by its pubescent basal leaves and pubescent lower stem. Only in very rare cases have I observed a stem which is quite glabrous at the base, and in these few cases the radical leaves have always been hirsute. A style is always developed, being from 0.5 to 1.25 mm. long, and the seeds are small, narrow and un-winged. Lastly, the plant is comparatively low, seldom exceeding 3 dm. in height, and is usually a biennial in the northern part of its range, becoming perennial from Virginia southward; but several specimens from the Great Lakes region exhibit a perennial habit.

In contrast to this typical form of *A. lyrata* there exists in north-western North America, from Ontario through western Canada, very locally in Montana and Washington and north to Alaska, a variety in which the radical leaves and base of stem are always quite glabrous, or which rarely has a few scattered, simple hairs on the petioles, and in which the flowers are sometimes, though by no means always, slightly smaller, varying from 4 to 7 mm. in length. This plant has had a rather turbulent taxonomic history, the correct name for it being var. *glabra*, which is based on DeCandolle's *A. ambigua* var. *glabra*. The original description reads:

α. *glabra*, foliis cauleque glabris. . . .

Hab. α. in Kamchatka et insulis Kurilensibus. . . .

Var. α. est ex omni parte glabra. Folia radicalia oblonga sinuato-lyrata, lobis paucis obtusis; caulina inferiora oblonga dente 1-2 instructa; caetera oblonga ferè linearia integerrima. Caulis simplex, pedalis. Flores albi magnitudine A. Alpinae. Pedicelli erecti, 3 lin. longi. Siliquae lineares, sesquipollicares.¹

Under his *A. ambigua* DeCandolle described two other varieties as follows: "*intermedia*, foliis glabris, caule basi hispido. . . Hab. in

¹ DC. *Systema*, ii. 231 (1821).

Unalaska," and "*scabra*, foliis piloso-scabris, caule glabro. . . Hab. in Sibiria."¹

Var. *intermedia* is merely a synonym of *A. lyrata* var. *kamchatica* Fischer, to be discussed in a following paragraph, and var. *scabra* is a plant with which I am not familiar; in all probability it does not occur in North America. From the above description it is evident that DeCandolle separated three varieties of his plant according to the presence or absence of pubescence on the stem and basal leaves, the most constant character which I have been able to find in this group. One cannot adequately separate the typical form of *A. lyrata* from var. *glabra* merely on the basis of fruit or flower, but with pubescence as a guide the task of segregation becomes relatively simple.

Var. *glabra* is merely an earlier name for one of the two plants which Watson included under var. *occidentalis*, a variety which differed, according to his interpretation, from the typical form only in having a sessile or a subsessile stigma and a nerve on the silique which extended nearly to the tip. His complete description reads: "Pods with sessile stigma or a very short and thick style; the valves rather thin but often faintly nerved to the top."² He included under this variety every North American plant of *A. lyrata* not belonging to the typical form of the species, quite regardless of pubescence or of a glabrous state. Consequently, Hultén, seeing specimens from Alaska in the Gray Herbarium marked "var. *occidentalis* S. Wats.," and being familiar with Watson's description, wrote: "judging from the specimens at my disposal, specimens of the plant which in America is called *A. lyrata* var. *occidentalis* Wats. completely agree with our plant [the Alaskan var. *kamchatica* Fisher] in the size of the flowers and the pods, and I therefore consider them identical."³ All the Alaskan sheets of *A. lyrata* in the Gray Herbarium are labelled "var. *occidentalis* S. Wats." but when they are studied on the basis of presence or absence of pubescence as well as on the size of the flowers, two distinct varieties become clear, var. *glabra* and var. *kamchatica*. But I am unable to separate these varieties one from another or from typical *A. lyrata*, as did Watson, either on the character of a sessile or a non-sessile stigma, or on that of the nervation of the pod. Specimens of each of the two varieties often possess a distinct style, and typical *A. lyrata* may not uncommonly have one, only slightly over one-half

¹ DC., l. c.

² Watson in Gray, Synop. Fl. N. Am. i. 159 (1895).

³ Hultén, l. c. 167.

a millimeter in length. The nervation of the pods is entirely inconstant. In every case, however, the nerve extends beyond the middle.

Rydberg records the occurrence in Montana of *A. ambigua* DC.,¹ which leads one to the assumption that some or all of the varieties are to be found there. But as I interpret DeCandolle's conception of the species, no typical form occurs, only the three varieties as listed in the *Systema*: var. *glabra*, var. *intermedia* and var. *scabra*. Apparently Rydberg did not concur in this interpretation, else he would have correctly taken var. *glabra* as the name for the Montana plant. That he was well aware of the ambiguity of Watson's var. *occidentalis* seems evident, however, from the fact that he discarded it. There is a specimen in the Herbarium of the New York Botanical Garden "legit Coues" from Montana, this being the only specimen of var. *glabra* which I have seen from the general region of the Rocky Mountains in this country. But in Washington it has been collected at least twice, once by Suksdorf and once by J. W. Thompson who says (discussing it as *A. lyrata* var. *kamchatica* Fisher): "While on Mt. Baker last summer [1934], I found this rather rare crucifer in great abundance at about 800 meters, just above perpetual snow. Mr. Suksdorf's collection cited by Piper [*Contr. Nat'l. Herb.* xi. 292 (1906)] must have grown from a chance seed that had been washed down from the higher altitudes where I found it."² Both the Suksdorf and the Thompson specimens should be referred to var. *glabra*.

Var. *kamchatica* has flowers which vary from 3.5 to 5 mm. in length, smaller than those either of the typical form or of var. *glabra*, and develops some degree of pubescence either on the stem or on the radical leaves or on both. This is almost always of a hirsute nature with simple or bifurcate spreading hairs. Its stigma is either sessile or on a short style seldom exceeding 0.5 mm. in length. These characters at once distinguish it from var. *glabra* which has larger flowers, a glabrous stem and radical leaves (except for a few simple hairs on the petioles), and either a sessile stigma or a style up to nearly a millimeter long. DeCandolle's *A. ambigua* var. *intermedia* is merely this plant, but because Fischer's plant was described under *A. lyrata* in the *Systema*,³ it is more fitting to use its name, even though *A. ambigua* var. *intermedia* occurs earlier on the page. It is found throughout Alaska and the islands in the Behring Sea, in British

¹ Rydberg, *Fl. Rocky Mts.* 358 (1917).

² Thompson in *RHODORA* xxxvii. 418 (1935).

³ DC., l. c.

Columbia, Mackenzie and northern Saskatchewan. The paucity of botanical collections from the Yukon region is doubtless the reason why I have seen no specimens from that territory; it should most certainly occur there. The plant from northern Saskatchewan was collected at lat. 57°, on sandy banks of the Clearwater River, while that from Mackenzie was obtained at lat. 60° 20' by *J. W. Tyrell*, both of them being perfectly good specimens of this variety.

(To be continued.)

A SINGULAR VARIATION IN *DESMODIUM*.—While studying the material of *Desmodium acuminatum* a specimen long unrecognized, except for its affinity with the species, was discovered. Its differences are so marked that description seems necessary.

DESMODIUM ACUMINATUM (Michx.) DC. forma **unifoliolatum**, n. f., foliis unifoliolatis, ovatis, acuminatis, dispersis, 5.5–15 cm. longis, 3.2–10.5 cm. latis. TYPE: rocky slopes of Cedar Cliff Mountain, Buncombe County, North Carolina, September 16, 1898, *Biltmore Herbarium*, no. 2125b (in Gray Herb.).

Forma *unifoliolatum* is clearly distinguishable from the other material in the species by its large unifoliolate leaves which are scattered on the stem. In other characters, especially the fruit, the agreement with the species is complete.—BERNICE G. SCHUBERT, Radcliffe College.

THE CORRECT NAMES OF THE SMALL-FLOWERED MALLOWS¹

C. V. MORTON

ONE of the common weeds of California has for many years been known as *Malva borealis* Wallm., under which name it appears in Jepson's Manual of the Flowering Plants of California. In 1933 Professor Jepson sent me material so named and asked for my opinion of the correctness of the identification. I found the specimen to be typical *Malva nicaeensis* All., a species not hitherto reported from the United States. The true *Malva borealis* Wallm. is considered by European botanists a synonym of *M. pusilla* Withering, and such is unquestionably the correct disposition of it.

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Hopkins, Milton. 1937. "CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—No. CXVI. ARABIS IN EASTERN AND CENTRAL NORTH AMERICA." *Rhodora* 39, 63–98.

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