

PURPLE-FLOWERED ARABIS OF THE PACIFIC COAST OF NORTH AMERICA

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The genus *Arabis* (Cruciferae) is well-represented in the flora of western North America. Some species are abundant and widespread while others are very restricted in distribution, often being confined to specialized habitats and/or soil types. In my treatment of the genus in North America west of the hundredth meridian (Rollins, 1941), I recognized 53 species together with a number of infraspecific taxa. Since then, names for several additional taxa that occur in the same area have been published (Boivin, 1951; Rollins, 1946, 1971). Our present concern is with one of the evolutionary "bursts" within *Arabis* which has resulted in a group of related species found in the hills, mountains and coastal areas of northern California and southern Oregon. The most spectacular feature shared by these species is a comparatively large and conspicuous lavender to purplish flower. This feature, coupled with that of a rosette (usually flattened) of obovate to broadly oblanceolate leaves from which the fertile stems arise marks these species as being distinctive among the American members of the genus. The known species involved are *A. aculeolata*, *A. blepharophylla*, *A. mcdonaldiana*, *A. modesta*, and *A. oregana*. None of these are widespread in occurrence. Presumably the most restricted, *A. mcdonaldiana*, is known from but a single locality. In 1942, Lincoln Constance and I hiked to this site at the summit of "Big" Red Mountain southeast of Bell Springs in northern Mendocino County, California. There we found *A. mcdonaldiana* growing abundantly on red serpentized soil in open areas between such shrubs as *Arctostaphylos*, *Ceanothus prostratus*, and *Quercus vaccinifolia*. A few days before, we had collected *A. aculeolata* at four different locations in Josephine County, Oregon and in at least two instances the site was a serpentine barren. More recent collections of these purple-flowered species show that serpentine soils figure prominently in the habitat of at least three of the species. Adaptation to serpentized soils or at least the reduced competition provided by such sites as in the genus *Streptanthus* (Kruckeberg, 1951, 1969) appears to be a significant factor involved in the speciation of the group. The need for a careful and detailed study of the situation in this respect is clearly indicated. Additional field research in the area would be rewarding.

Some further evidence suggesting a highly local occurrence of this type of *Arabis* which is at the same time associated with outcrops of serpentine rocks comes from added new material. In 1971, Chester A. Ground sent to me for determination specimens collected on a serpentine ridge of the south slope of Preston Peak in northern Siskiyou County, California. Although obviously related to *A. aculeolata*, these specimens appeared to

be a sample of an undescribed taxon but they were without mature fruit. During the field season of 1972, Mr. Ground and Gilbert J. Muth were able to collect a number of specimens of the same taxon in various stages of maturity. From these, it is evident that an undescribed species is indeed represented. In order to provide a quick guide for those wishing to distinguish among the species of this purple-flowered group, the following key is presented.

- A. Seeds wingless; plants glabrous throughout 1. *A. serpentinicola*.
- A. Seeds winged at least distally; plants pubescent or hirsute (*A. mcdonaldiana* with only a few simple trichomes on teeth of basal leaves).
- B. Seeds oblong; winged primarily at the distal end; siliques 4–6 cm. long, 1.5–2 mm. wide, acute at apex; Napa and Yolo Counties, California northward to southern Oregon.
- C. Plants low, less than 1.5 dm. high, glabrous except for a few marginal trichomes on basal leaves; petals 2.5–3 mm. wide; usually truncate 3. *A. mcdonaldiana*.
- C. Plants taller, 2–5 dm. high, hirsute or pubescent at least below; petals 4–8 mm. wide, rounded at apex.
- D. Trichomes simple, forked or three-pronged at apex of long stalk, large with bulbous base; leaves ciliate; stems coarsely hirsute with spreading trichomes, rarely glabrous.
- E. Leaf trichomes simple; basal leaves dentate, narrowly obovate, densely rosulate, 1–2.5 cm. long, 0.5–1 cm. wide; stems several from a closely branching caudex 2. *A. aculeolata*.
- E. Leaf trichomes forked or rarely three-pronged at apex; basal leaves usually entire, broadly obovate, loosely rosulate to erect, 2–5 cm. long, 1–2.5 cm. wide; stems one or few from a simple or loosely branched caudex 4. *A. oregana*.
- D. Trichomes dendritically branched with a short stalk, comparatively small without a bulbous base; leaves uniformly pubescent without a ciliate margin; stems with appressed several-rayed trichomes 5. *A. modesta*.
- B. Seeds orbicular, winged all around; siliques 2–3 cm. long, 2–3 mm. wide, obtuse at apex; primarily coastal or in the outer coast ranges from Sonoma County to Santa Cruz County, California 6. *A. blepharophylla*.

1. *Arabis serpentinicola* Rollins, sp. nov.

Herba perennis, glabris, caulibus simplicibus erectis 1.5–3 dm. altis, foliis basilaribus glabris obovatis crassis rosulatis 1.5–2.5 cm. longis, 1–1.5 cm. latis, foliis caulinis sparsis sessilibus non auriculatis 3–6 mm. longis, sepalis purpureis oblongis 4.5–5.5 mm. longis, petalis spathulatis purpureis 12–15 mm. longis, pedicellis divaricatis 4–8 mm. longis, siliquis divaricatis 2–3.5 cm. longis, 1.5–2 mm. latis, seminibus oblongis immarginatis 2–2.5 mm. longis, ca. 1.5 mm. latis, cotyledonibus accumbentibus.

Holotype in the Gray Herbarium, collected in an open seepage area below timberline on a steep and rocky, west-facing, serpentine slope, upper end of Rattlesnake Meadows, Preston Peak, 41°49.8' N. latitude, 123°38' W. longitude, Siskiyou County, California, June 26, 1972, *Chester A. Ground and Gilbert J. Muth* 1790.

Perennial, glabrous throughout; stems simple, one from each single rosette or a few from several rosettes on a branching caudex, erect, 1.5–3 dm. high; basal leaves in a dense flat rosette, short petiolate, broadly obovate, rounded distally, entire to remotely and shallowly dentate, thickish, 1.5–2.5 cm. long, 1–1.5 cm. wide; cauline leaves 2–5, sessile, not auriculate, remote, 3–6 mm. long, 2–3 mm. wide; inflorescences racemose, elongating in fruit; sepals dark purple, erect, oblong, 4.5–5.5 mm. long, outer pair saccate, inner pair plain; petals spatulate, not differentiated into blade and claw, light purple to lavender, 12–15 mm. long, 3–5 mm. wide; stamens erect, strongly tetradynamous; filaments purplish above; anthers ca. 1 mm. long; fruiting pedicels divaricate, 4–8 mm. long, decreasing in length from base to apex of infructescence;

siliques divaricate to divaricately ascending, strongly single-nerved from base to apex, 2–3.5 cm. long, 1.5–2 mm. wide, sessile or with a very short gynophore; styles 0.5 mm. to obsolete; seeds in a single row, wingless, oblong, brown, 2–2.5 mm. long, ca. 1.5 mm. wide; cotyledons accumbent.

Additional specimens studied, all from the same general locality as the holotype. Dry serpentine ridge, 5,800 ft., July 31, 1971, *Ground* 888 (CH); same population as holotype, Aug. 2, 1972, *Ground & Muth* 1794 (CH); 6,000 ft. Aug. 2, 1972, *Ground & Muth* 1795 (CH).

The significant differences between *Arabis serpentinicola* and *A. aculeolata* involve the seeds, the presence or absence of trichomes and the length or absence of a style on the fruit. *Arabis serpentinicola* is wholly glabrous while *A. aculeolata* is always hirsute. The portion of the seeds occupied by the embryo is somewhat similar in the two species but there is a pronounced distal wing and minor wing-margins on the sides of the seeds of *A. aculeolata* whereas the seeds of *A. serpentinicola* are wingless. In some siliques of the latter species, there is a very short rather stout style about 0.5 mm. or less long but in others the stigma is virtually sessile. On the other hand, the siliques of *A. aculeolata* have a slender style 1.5–2 mm. long. Another difference that appears to have some value for distinguishing these species is the shape of the silique apex, being acuminate in *A. aculeolata* and blunt in *A. serpentinicola*.

There is no doubt about the close relationship of these two species which are similar in habit, the nature of the basal and cauline leaves and the flowers. On the whole, *Arabis aculeolata* has longer siliques and pedicels than those of *A. serpentinicola*, and the siliques tend to be more erect. The flowering and fruiting period does not coincide in the two species. *Arabis aculeolata* begins flowering in March in some years but is usually at its flowering peak in April or May. In June and July, *A. serpentinicola* reaches its flowering maximum. Part of this difference may be associated with the differences in altitude where the two species grow. *Arabis aculeolata* is found mostly below 2,000 ft. while *A. serpentinicola* occurs above 5,000 ft.

2. *Arabis aculeolata* Greene

Although we have seen in excess of twenty different collections of this species, it is not certainly known outside of Josephine County, Oregon. There is a single collection at the California Academy of Sciences made by Alice Eastwood in extreme northern Del Norte County, California, and referred by her to *A. mcdonaldiana*, which I have tentatively placed in *A. aculeolata*. The material is in flower only and is hard to deal with on that account. However, it clearly is not *A. mcdonaldiana*. The specimens are small for *A. aculeolata* and the trichomes are less ascicular than in typical specimens but otherwise they seem to fall within the range of variation of that species.

Most of the specimens available for study are in flower because the plants are most conspicuous at that stage and collectors are attracted to

them. Of the six collections with reasonably mature siliques, all but two have sessile siliques. In one collection, *Constance and Rollins* 2967 (DS,GH), some plants have shortly stipitate siliques while in others the siliques are sessile. In one collection, *Eastwood and Howell* 1424 (CAS), the siliques are uniformly stipitate and the stipe is ca. 2 mm. long. Such a character, although sometimes variable within a species, usually does not range as widely as in this case. Flower size is variable as indicated by the specimens examined, also considerable variation in the height of the plants is evident. Looking at the species as a whole, there is an uncommon amount of variation present even though the total geographic range is relatively limited. This may be explained by the probability that the serpentine areas where *A. aculeolata* grows are somewhat separated and the individual populations have evolved in slightly different directions. From such evidence as we can see and measure from the specimens alone, this species would appear to be a good subject for the detailed study of population variation and population disparity within a single species.

3. *Arabis mcdonaldiana* Eastwood

There are only three collections of this species known to me, two more than I had to work with in 1940. All three are from the same place, summit of (Big) Red Mountain, northern Mendocino County, California. Both the type series, *Eastwood* in 1902 (CAS,GH), and *Constance and Rollins* 3002 (DS,GH) are mostly in flower with, at most, immature siliques. Fortunately a newer collection, *Gankin, Hildreth, N. and I. Knight* 2722 (CAS), has mature fruits. Thus, for the first time it has been possible to determine that the siliques are acuminate at apex and tipped with a style about 1 mm. long. The seeds are oblong, about 2 mm. long, 1-1.2 mm. wide, with a definite distal wing and narrow or nearly obsolete wing-margins along the sides. A distinctive feature of *A. mcdonaldiana* is the short few-fruited infructescence. Only 2 to 4 siliques mature near the apex of the slender stems.

4. *Arabis oregana* Rollins

Although there are a number of newer collections available since my treatment of this species in 1941, they do not provide much additional information. However, it is clear that *Arabis oregana* is not a serpentine inhabiting species. At two stations about three miles apart where Dr. Constance and I found it growing with *Holodiscus*, *Cercocarpus* and *Ceanothus*, south of Ashland, Oregon, the plants were in a rich deep soil and there was no evidence of serpentine rocks in the vicinity. Most of the known collections are from Jackson County, Oregon, but we found the species near Scott River, 10 miles southwest of Scott Bar, Siskiyou County, California. The specimens of this collection are unusual in being nearly glabrous but are otherwise similar in most respects to the Oregon

material. The California collection, *Constance and Rollins 2915* (DS,GH), has the characteristic trichomes of *A. oregana* on the margins of the basal leaves which along with the general features of the plants point to their identity with that species.

5. *Arabis modesta* Rollins

At the time *Arabis modesta* was described, mature fruiting material was not available. Now with ten new collections for study, we still have only two with mature fruits and seeds. In one of these, *Ripley and Barneby 9622* (CAS), from Rogue River Canyon, 5 miles above Galice, Josephine County, Oregon, both pedicels and siliques are divaricately ascending and the siliques are acuminate at the apex. The style is slender, 1.5–2 mm. long. The seeds are oblong, ca. 2 mm. long, slightly wider than 1 mm., and are very dark, the distal wing being nearly black. The other collections, *Harris 21397* (GH), from near the mouth of Scott River, Siskiyou County, California, is similar in most respects but the styles are less than 0.5 mm. long and the siliques are straighter than in the Oregon specimens.

In some of the new collections, the specimens are up to 6 dm. tall which is about 1.5 dm. more than we had seen previously. However, the most notable collections are those of *Donald V. Hemphill* (CAS,GH) from near Monticello Dam, Napa-Yolo county line, California. These specimens not only represent a considerable southward extension of the species range but they also show minor differences when compared to those of the California Siskiyou region or of southern Oregon.

Arabis modesta overlaps the range of *A. oregana* in northern California and southern Oregon and there is one collection, *Applegate 4598* (DS), from about 10 miles southeast of Ashland, Oregon, that suggests the possibility of hybridization between these species. The specimens are nearest to *A. modesta* but the trichomes are slightly larger than in unadulterated plants of the species, and the lower stems and basal portions of the petioles have simple trichomes present to a limited degree. The trends toward larger trichomes and toward simple trichomes are in the direction of *A. oregana*.

6. *Arabis blepharophylla* Hooker & Arnott

There is considerable variation in the coarseness of the pubescence on different plants of *Arabis blepharophylla* both within populations and between populations. In the most extreme forms in one direction, represented by the collections from Bodega Bay in Sonoma County, California, for example, the pubescence is quite uniform on leaves and stems. The trichomes are small, dendritically branched with mostly four prongs, and the leaves show no suggestion of being ciliate-margined. In another direction, exemplified by the type of the species and other specimens from the Presidio area of San Francisco, the trichomes are much coarser and usually

three or two pronged but often with unbranched ones mixed with them. Furthermore, the leaves are most often ciliate and the lower portions of the stems usually possess spreading trichomes.

Other types of variations include the length of the siliques and whether they are blunt or somewhat tapered at apex, the length and thickness of the styles and the height of the plants. However, in spite of the rather considerable evident variation, this species hangs together quite well and I cannot distinguish any infraspecific taxa. Characters that appear to be distinctive turn out to be uncorrelated with other characters that might otherwise be utilized to set off distinctive taxa.

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