

SEDUM VALENS (CRASSULACEAE), A NEW SPECIES FROM THE SALMON RIVER CANYON OF IDAHO

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ABSTRACT

Sedum valens (Crassulaceae) is described from the Salmon River Canyon of central Idaho. Though it shares numerous morphological traits with *Sedum borschii* and *S. leibergii*, the species differs strikingly in having myriad leaves packed into rosettes as wide as 1 dm. The leaves are ciliate, a characteristic otherwise unknown in temperate North American *Sedum*, except in *Sedum radiatum*, a highly dissimilar species. Further distinguishing characteristics are found in leaf shape, phenology, fruit characteristics and in habitat.

Key Words: Crassulaceae, Idaho, Salmon River Canyon, *Sedum*.

In the northwestern United States, the genus *Sedum* L. (Crassulaceae) includes 20 native taxa as circumscribed by Clausen (1975), including 5 taxa endemic to the region: *S. borschii* (R. T. Clausen) R. T. Clausen, *S. lanceolatum* Torr. var. *nestoticum* (Jones) Hitchc., *S. leibergii* Britt., *S. moranii* R. T. Clausen, and *S. rupicolum* Jones. Clausen (1975) identified a distinct evolutionary lineage involving *S. borschii* and *S. leibergii*, along with the California and Oregon endemic *S. radiatum* S. Wats. and the more widespread *S. stenopetalum* Pursh. This group is characterized by open, obpyramidal, cymose inflorescences of yellow flowers, widely divergent fruit follicles and observed patterns of interspecies hybrid fertility. A group of populations in the Salmon River Canyon system (hereby referred to as *Sedum valens*) appears to belong to this lineage, sharing its morphological distinctions while at the same time bearing consistent differences from all other species. Within this group, *S. valens* appears to be closest to *S. borschii* and *S. leibergii*, sharing their papillate leaves, variable numbers of flower parts, and glandular-punctate follicles.

TAXONOMY

Sedum valens Björk, sp. nov. (Fig. 1).—Type: UNITED STATES, Idaho, Idaho Co., Salmon River Canyon, 16.5 air km E of Riggins, 900 m W of the junction of Elkhorn Creek and the Salmon River, elev. 609 m, on granite and granitic sand on steep canyon walls, growing with *Pinus ponderosa* Dougl., *Pseudotsuga menziesii* (Mirbel) Franco, *Holodiscus discolor* (Pursh) Maxim., *Philadelphus lewisii* Pursh, *Selaginella douglasii* (Hook. & Grey) Spring, *Micranthes occidentalis* (S. Wats.) Small, *Glossopetalon spinescens* A. Gray, *Heuchera grossulariifolia* Rydb., and *Cystopteris fragilis* (L.)

Bernh. 45°24'N, 116°6'W, 3 December 2003, *C. R. Björk 8008* (holotype: ID, isotype: WS).

Paratypes: USA. IDAHO. Idaho Co.: Salmon River Canyon, 200 m E of the mouth of French Creek, 45°25'N 116°1'W, elev. 616 m, *C. R. Björk 8007* (ID); Salmon River Canyon, 2.5 km NNW of the Salmon River on west slopes above the Wind River, 45°28'N 115°56'W, elev. 840 m, *C. R. Björk 8006* (ID); Salmon River Canyon, 45°26'N 115°57'W, elev. 614 m, *C. R. Björk 8005* (ID); Salmon River Canyon, 45°25'N 115°59'W, elev. 624 m, *C. R. Björk 8004* (ID).

Herba biennis, folliis plurimus et ciliaris, prolificae vegetativa praecox maturescens, floribus multus aureus, inflorescentia ramosa, foliiculo glandulosi divergens.

Biennial, light green or yellowish green herb. Basal rosettes 3–10 cm wide, with leaves numerous (87–188). Rosette offshoots maturing and detaching by the time of anthesis of the flowering rosettes. Leaves narrowly oblanceolate, (8–) 16–38 × 2–4.4 mm (measurements of largest rosette leaves on dried, pressed specimens of flowering rosettes), strongly flattened dorsiventrally, the blade weakly differentiated, strongly papillate with marginal papillae on the proximal 2/3 of the leaf conspicuously lengthened, forming unicellular cilia up to 1.3 mm long. Inflorescences erect, much-branched, the peduncle 70–115 mm tall. Flowers numerous per inflorescence (36–139). Petals yellow, 3.8–6.3 × 1.2–2.2 mm (measurements from dried, pressed petals). Follicles widely divergent, 4.0–7.7 mm long, 1.5–2.8 mm tall, glandular-punctate. Flowering in April to May.

No other temperate North American *Sedum* taxon is known to produce cilia except *S. radiatum*, a highly dissimilar non-rosetteform species, and the papillate condition is found in only a few species (Clausen 1975). While rosette width varies greatly in *S. valens*, the only other

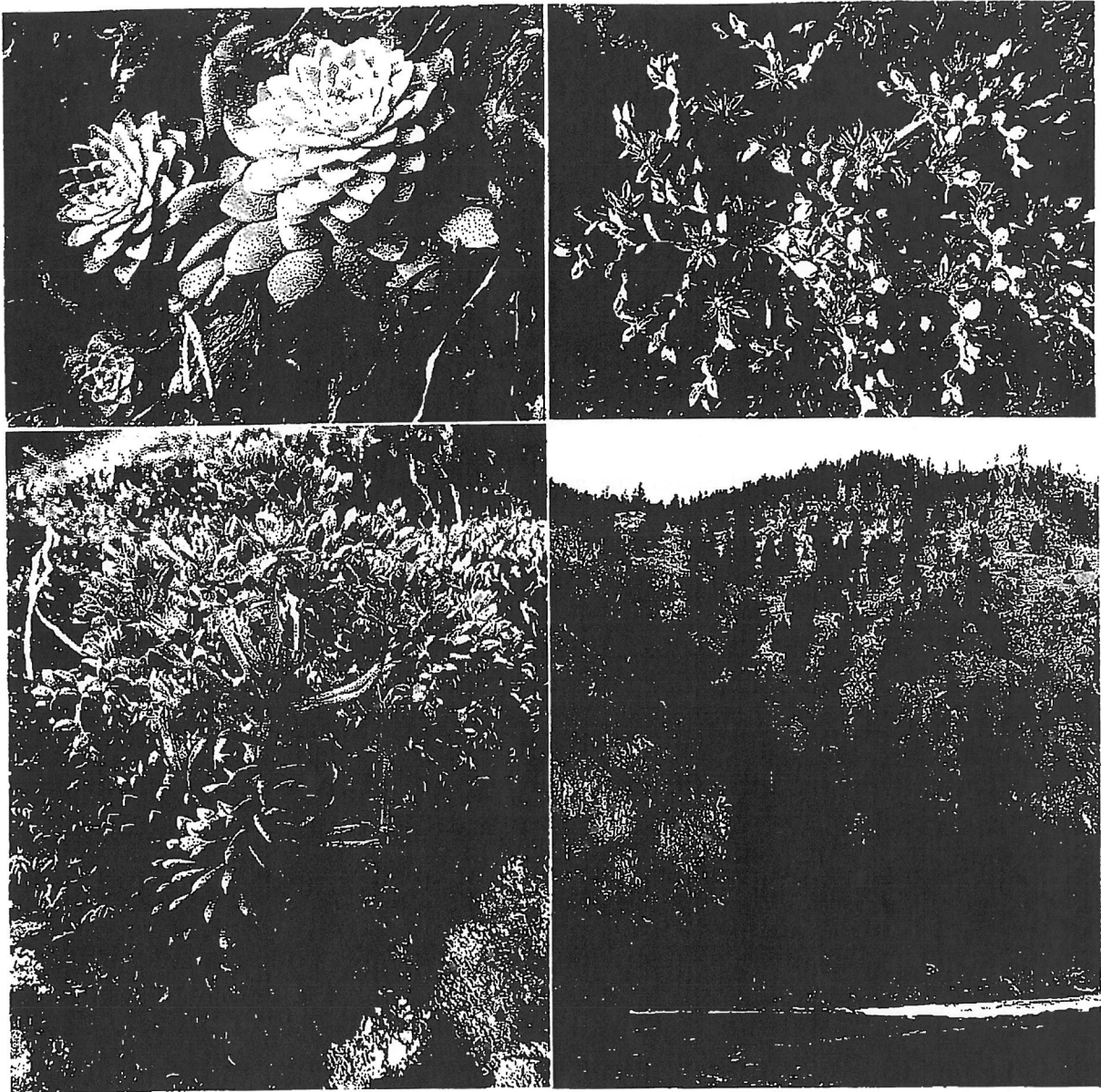


FIG. 1. *Sedum valens*. Upper left: young rosettes in June; upper right: inflorescence seen from above; lower left: habit in flower, the rosette is approximately 1 dm wide; lower right: habitat in the Snake River Canyon, showing the cliffy and woodland habitats of *S. valens*.

western North American *Sedum* capable of producing rosettes as large as its maximum width are *S. albomarginatum* R. T. Clausen, which is endemic to the Feather River Canyon of California (Denton 1993), and *S. oregonense* (S. Watson) Peck of western Oregon and northwestern California. Both of these species differ greatly from *S. valens* in reproductive and vegetative morphology. Additionally, no other North American *Sedum* produces rosettes bearing a number of leaves approaching that found in *S. valens*.

Leaf and rosette characters of *S. valens* are the most striking morphological distinctions from *S. leibergii*, *S. borschii* and all other *Sedum*.

Individual plants of *S. valens* are remarkable for their large rosettes (to 10 cm across), formed by a maximum of nearly 200 narrowly oblanceolate leaves. Rosettes of *S. leibergii* are smaller, rarely reaching 5 cm wide, and are formed by no more than 40 leaves. Leaf shape of these two species is unusual among North American *Sedum* in being both several times longer than wide, and widest near the apex. Leaves of *S. valens* are strongly flattened dorsiventrally and lack a distinct blade, while those of *S. leibergii* are broadly elliptical to terete in blade cross-section, and are spatulate with a well defined blade. Leaves of *S. valens* are more strongly papillate, and the marginal papillae on the proximal 2/3 of the leaf are lengthened

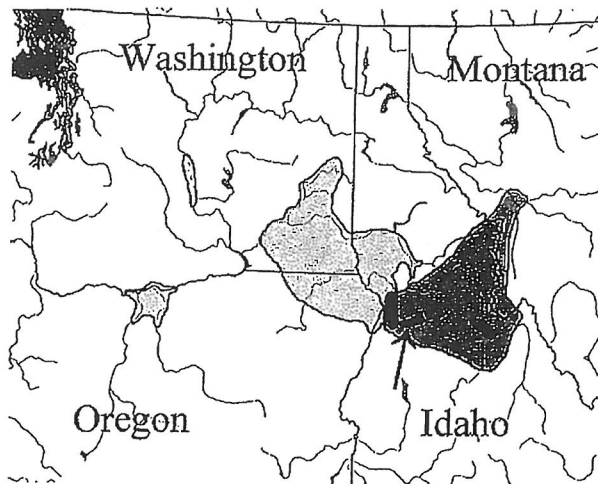


FIG. 2. Map of the ranges of *Sedum leibergii* (light gray with outlines, western), *Sedum borschii* (medium gray with outlines, eastern), and *Sedum valens* (black). The arrow points to the type locality of *S. valens*. The dark gray areas with outlines in the range of *S. leibergii* and *S. borschii*.

conspicuously, forming unicellular cilia as long as 1.3 mm. Leaves of *S. leibergii* lack cilia. Otherwise among North American *Sedum*, only *S. radiatum* has distinctly ciliate leaves (Ohba 2009), but that species differs from *S. valens* in lacking basal rosettes and non-papillate fruit follicles. *Sedum borschii* produces rosettes up to only 2 cm wide, formed of no more than 15 leaves, and its leaves are ovate, elliptical or lanceolate. The papillae of *S. borschii* occur mostly on the leaf margins and apex, but they are inconspicuous and never lengthen into cilia.

Sedum valens inflorescences are larger than those of either *S. leibergii* or *S. borschii*. They are taller, though this is due only to branch length, not to stem length, which is roughly the same as those of *S. borschii* and *S. leibergii* (Table 1). Flower number and degrees of division in the cymes are greater than in *S. leibergii* or *S. borschii*. The size and number of flower parts do not differ significantly. Follicle dimensions of *S. valens* are

greater than those of *S. leibergii*, and they are longer but equally wide to those of *S. borschii*.

Phenological differences also distinguish *S. valens* from *S. leibergii* and *S. borschii*. *Sedum valens* produces offshoot rosettes that detach around the time of flowering, producing independent clones with fully formed, surficial rosettes that do not contract in the summer. *Sedum leibergii* also produces offshoots prior to flowering, but they remain attached to the parent rosette well after flowering, and often through winter. These offshoot buds do not form mature, leafy rosettes until late winter or early spring of the following year. Prior to that time, they remain pale, turion-like and subsurficial in moss mats. In winter, the old, senesced rosettes and flowering stems of the previous summer almost always bear at least one offshoot, while old stems of *S. valens* never bear attached offshoots. *Sedum borschii* produces mature offshoot rosettes by the time of flowering, but the rosettes remain permanently attached. This gives *S. borschii* a suffruticose growth form.

The known population of *S. valens* occurs on siliceous rock of the Idaho Batholith, but at the western end of its distributional range, it extends onto the batholith margins, on contact-metamorphics with calcareous modification. Most *S. borschii* populations are also on granite, while *S. leibergii* is thus far known only on basalt and calcareous rocks. The range of *S. borschii* reaches to within 10 km of *S. valens*, but its populations occur at least 500 m higher in elevation. *Sedum borschii* grows in montane to subalpine woods and rock outcrops, while *S. valens* occupies drier, warmer *Pinus ponderosa*/*Pseudotsuga menziesii* woodlands and canyon scrub communities. *Sedum leibergii* occurs mostly northwest of the range of *S. valens*, but it also occurs disjunctly eastward in Lemhi Co., Idaho (Fig. 2). Specimens of *S. leibergii* from Montana (MONTU, WTU) are misidentified *S. borschii*. *Sedum leibergii* grows at similar elevations, to within about 10 km of *S. valens*, but no overlap in ranges has been observed. *Sedum leibergii* grows in hotter, drier, usually non-forested habitats and

TABLE 1. MEANS AND RANGES OF QUANTITATIVE CHARACTERS IN *SEDUM VALENS*, *S. LEIBERGII* AND *S. BORSCHII*. Measurements obtained from the type, paratype specimens and specimens of the other species as cited under "other specimens examined".

Character	<i>S. valens</i>	<i>S. leibergii</i>	<i>S. borschii</i>
Rosette leaf length (mm)	27.7 (14-62)	17.0 (13-24)	4.9 (2.3-7.5)
Rosette leaf number	122.4 (87-188)	10.6 (12-36)	9.0 (6-14)
Stem length (mm)	88.3 (70-115)	83.0 (50-143)	75.3 (43-105)
Number of cyme divisions	3.2 ([1] 2-5)	1.9 (1-3)	1.1 (1 [2])
Inflorescence width	72.6 (38-118)	44.9 (18-74)	21.3 (9-44)
Flower number	78.7 (36-139)	19.8 (4-44)	6.5 (2-15)
Follicle length	5.5 (4-7.7)	2.8 (2.2-3.4)	3.9 (2.2-5.1)
Follicle width	2.1 (1.5-2.8)	1.0 (0.7-1.2)	2.3 (1.2-3)
Follicle length/width ratio	2.7 (2.2-3.7)	2.9 (2.3-3.7)	1.7 (1.4-2.2)

almost always in moss mats on ledges and in crevices, never in forest understory. *Sedum valens* also often grows in moss mats, but unlike *S. leibergii*, it frequently occupies soils and humus amid woodland understory vegetation.

ECOLOGY

Sedum valens appears to be limited to lower elevations in the Salmon River Canyon and tributary canyons. About half of the observed individuals of *S. valens* occupy duff over granitic sand in woodland understory with *Pinus ponderosa* Dougl., *Pseudotsuga menziesii* (Mirbel) Franco, *Holodiscus discolor* (Pursh) Maxim., *Philadelphus lewisii* Pursh, *Synthyris missourica* (Raf.) Pennell, *Carex geyeri* Boott, *Poa wheeleri* Vasey in Rothr., and *Cystopteris fragilis* (L.) Bernh. The remainder grow on mossy ledges, crevices and cliff faces with *Glossopetalon spinescens* A. Gray, *Heuchera grossulariifolia* Rydb., *Micranthes idahoensis* (Piper) Brouillet & Gornall, *Sedum stenopetalum* Pursh, *Selaginella douglasii* (Hook. & Grev) Spring., and *Woodsia scopulina* D.C. Eaton. In either case, it grows mostly on

north- and east-facing slopes. Few individuals occur on south- or west-facing slopes, suggesting that *S. valens* is best adapted to relatively cool, shaded conditions.

The total range of *S. valens* could not be elucidated due to the extremely rugged terrain and nearly impassible slopes upstream from the easternmost populations encountered. The continuance of suitable habitat eastward into these impassible areas suggests that *S. valens* extends beyond the area searched. No individuals were found in apparently suitable habitat in some tributary canyons however, including French, Elkhorn, or Partridge Creeks. *Sedum valens* has been found no higher than 1300 m elev. So far, fewer than 10,000 individual plants have been encountered in the study area. Despite the wilderness status of the potential habitat upstream, *S. valens* may be a priority for conservation given its limited known range, small populations, and its proximity to a well-traveled recreation road. Since the first discovery of *S. valens*, large portions of the population along the road have been destroyed during a road-widening project (Karen Gray personal communication).

KEY TO *SEDUM* OF IDAHO (EXCLUDING *RHODIOLA*)

- 1a. Plants rhizomatous, forming dense to loose mats often >20 cm wide; leaves alternate, bright yellow-green, 3-5 x 3-3.5 mm; growing in disturbed sites, introduced. *Sedum acre*
- 1b. Plants not or only weakly rhizomatous, not forming mats, though often clustered; leaves alternate or opposite, color various, but not bright yellow-green, if as small as *S. acre*, then opposite; native species, mostly in undisturbed habitats 2
- 2a. Leaves opposite *Sedum debile*
- 2b. Leaves alternate 3
- 3a. Mature follicles erect; inflorescences domed; leaves broadest at the base, lacking buds on the flowering stems. 4
- 4a. Leaves of the flowering stems 4-9 (rarely to 20) mm long, ovoid to elliptical, slightly flattened, curving toward the stem; rare, canyons of central Idaho *Sedum rupicolum*
- 4b. Leaves of the flowering stems 7-20 mm long, linear or narrowly lanceolate, terete, not or scarcely curving toward the stem; common throughout the state *Sedum lanceolatum* var. *lanceolatum*
- 3b. Mature follicles widely spreading; inflorescences obpyramidal; leaves variously shaped, but if broadest near the base, then buds numerous in leaf axils of the flowering stems 5
- 5a. Flowering stems with sterile buds in the leaf axils; leaves keeled, the midrib persistent after the leaf withers *Sedum stenopetalum* var. *stenopetalum*
- 5b. Flowering stems lacking sterile buds in the leaf axils; leaves not keeled, the midribs withering with the leaves 6
- 6a. Plants suffrutescent; rosette leaves 2.3-7.5 mm long; follicle length/width ratio 1.4-2.2; growing at elevations >1200 m. *Sedum borschii*
- 6b. Plants not suffrutescent; rosette leaves 13 mm long or >; follicle length/width ratio at least 2.2; mostly growing at elevations <1000 m 7
- 7a. Rosettes with 12-36 leaves, contracted and turion-like through the summer drought; leaves subterete, with a distinct blade, never ciliate; not known from granite, never in forest understory, widespread *Sedum leibergii*
- 7b. Rosettes with 87-188 leaves, growing surficially as mature, leafy rosettes through the summer drought; leaves distinctly flattened, without a distinct blade, ciliate; mostly on granite, often in forest understory, Salmon River Canyon *Sedum valens*

OTHER SPECIMENS EXAMINED

Sedum borschii: USA. IDAHO. Idaho Co.: Meadow Creek, above Selway Falls, 31 May

1936, Rollins 1661 (WS); Seven Devils Mountains, 27 June 1961, Clausen 61.178.8 (ID); Patrick Butte, 22 August, 1980, Wellner 2215 (ID). Custer Co.: Camas Creek drainage, Salmon

River Mts., 23 July 1982, *Henderson 5312* (ID). **Lemhi Co.:** ca. 32 air mi NW of Challis, 9 June 1982, *J. Civile 286* (ID); Bighorn Crags, 1 August 1990, *Moseley 1931* (ID); Warm Spring Creek, 25 July 1980, *S. P. Brunsfeld 1618* (ID). **Valley Co.:** Salmon River area ca. 9 air mi W of Loon Creek Point, 17 June 1982, *Civille 299* (ID). MONTANA. **Ravalli Co.:** Bitterroot Mts., W above N Kootenai Lake, 26 July 1972, *Lackschewitz 3892* (WTU); Bitterroot Mts., above Bass Creek Falls, 21 August 1976, *Lackschewitz 6879* (WTU). **Missoula Co.:** Rattlesnake Valley, 6 km NE of Missoula, October 1942, *F. Rose C42-31* (WTU). *Sedum leibergii*: USA. IDAHO. **Idaho Co.:** Snake River 0.5 mi N of Willow Creek, 19 May 1976, *Henderson 2947* (ID); Hells Canyon above Wild Sheep Rapids, 23 May 1976, *Henderson 3034* (ID); 3/4 mi S along SR Trail from S end of Pittsburg Landing, 13 May 1990, *Loraine 2048* (ID); cliffs above Salmon River, near Lucille, 16 May 1937, *Christ 7280* (ID); rocky cliff, 2 mi up Race Creek, from the mouth, W of Riggins, 29 May 1965, *Baker 16784* (ID); Hells Canyon, mouth of Bernard Creek, 24 May, 1974, *Wellner 131* (ID); Whitebird, *Vaughn 4581* (WS). **Nez Perce Co.:** rocky banks along the Snake River, 4 mi E of Lewiston, 25 May 1957, *Baker 14794* (ID); Lewiston, 26 May 1900, *Hunter 43* (WS); S side Clearwater, 29 May 1937, *Meyer 870* (WS). OREGON. **Crook Co.:** Ochoco NF, Grids Creek Rd., 9 June 2000, *Goff 00-03* (WS). **Wallowa Co.:** Deep Creek, 15 May 1936, *Moore, W.R. 53* (WS). WASHINGTON.

Whitman Co.: at the head of Rock Lake, 1904, *Beattie 2398* (WS); Almota, 3 June, 1976, *Old s.n.* (WS); Wawawai, 20 June 1901, *Piper s.n.* (WS); Wawawai, 2 December 2004, *Björk 8130* (ID). **Garfield Co.:** Iliia Grade, 17 June 1913, *Darlington s.n.* (WS). **Klickitat Co.:** Rockland, 5 May 1898, *Suksdorf s.n.* (WS). **Yakima Co.:** Rattlesnake Mts., 16 July 1902, *Colton 703* (WS). **Asotin Co.:** 3 mi S of Asotin, 27 May 1944, *Hitchcock C.L. 8362* (WS).

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