

*SEDUM KIERSTEADIAE* (CRASSULACEAE), A NEWLY DESCRIBED SPECIES  
FROM THE KLAMATH REGION OF CALIFORNIA, U.S.A.

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ABSTRACT

*Sedum kiersteadiae* is a locally common succulent of rocky, often ultramafic substrates at mid to high elevations, narrowly endemic to the western Klamath region of northern California. It is recognized by its widely spreading yellow petals and its relatively loose rosettes with visible internodes.

RESUMEN

*Sedum kiersteadiae* es una suculenta localmente común de sustratos rocosos, a menudo ultramáficos en elevaciones de medianas a altas, endémica del oeste de la región Klamath del norte de California. Se reconoce por sus pétalos amarillos ampliamente extendidos y sus rosetas relativamente flojas con internudos visibles.

INTRODUCTION

In the Klamath Region of northern California and southwest Oregon, *Sedum* section *Gormanina* has diversified into six morphologically similar species. Two of the species, *S. obtusatum* A. Gray and *S. laxum* (Britton) Berger (Boyd & Denton 2012) have been treated as having four subspecies each (Denton 1982). The section was studied by Clausen (1942, 1975), and its classification was further refined by Denton (1982), who had access to additional specimens. This research was made readily accessible by *Sedum* treatments in the Jepson Manual (Denton 1993; Boyd & Denton 2012). However, as field botanists worked with populations unknown to previous researchers, they found problems with those treatments: similar plants from the same area were often identified as belonging to two or more species, certain supposedly rare plants were encountered frequently, and many plants had combinations of traits that did not fully match any of the published descriptions.

In 2011–2013, we studied variation and classification in this group. Full results of the study, including an identification key, will be published elsewhere. Here we raise to the rank of species one of the more distinctive elements in *Sedum* section *Gormanina*. Although the type specimen of *S. obtusatum* subsp. *boreale* R.T. Clausen is an example of this taxon, we find that Clausen's descriptions do not fully match the plant as we understand it, so a full description is provided here. The plant cannot be treated as a species under its original epithet because that is preempted by *Sedum boreale* Hort. ex Guenthart (Guenthart 1902).

***Sedum kiersteadiae*** B.L. Wilson & R.E. Brainerd, sp. nov. (Figs. 1–2). TYPE: U.S.A. CALIFORNIA. Shasta Co.: NE of Slate Mountain, W of USFS Road 37N08Y; T36N R6W S2, SW ¼ of NW ¼, 41.01159°, -122.53148°, 4500 ft, 15 Jun 2012, Lindstrand III & Van Susteren NSR-17 (HOLOTYPE: OSC; ISOTYPES: CAS, CHSC, DAV, HSC, MO, NY, RSA, UC, WTU).

*Sedum obtusatum* A. Gray subsp. *boreale* R.T. Clausen, Bull. Torrey Bot. Club 69:32. 1942. *Sedum obtusatum* A. Gray var. *boreale* (R.T. Clausen) H. Ohba, J. Bot. Res. Inst. Texas 1:889. 2007. TYPE: U.S.A. CALIFORNIA. Siskiyou Co.: Mt. Shasta, E side Mud Creek Canyon, 5600 ft, 26 Jul 1940, R.T. Clausen, W.B. Cooke & H. Trapido 4952 (HOLOTYPE: BHI; ISOTYPE: NY!). Not *Sedum boreale* Hort. ex Guenthart (1902).

Sterile rosettes usually loose, with visible internodes; leaves obovate and usually notched; sepals less than half as long as the petals; petals yellow with midribs usually pink to red, whole petals senescing red, the upper half spreading about 90° from the flower axis.

*Description.*—Plants succulent, herbaceous, perennial. Rhizomes and stolons to 15 cm long, 3–6 mm diameter; sterile rosettes often numerous. Rosette leaves often loosely arranged with visible internodes, glaucous,

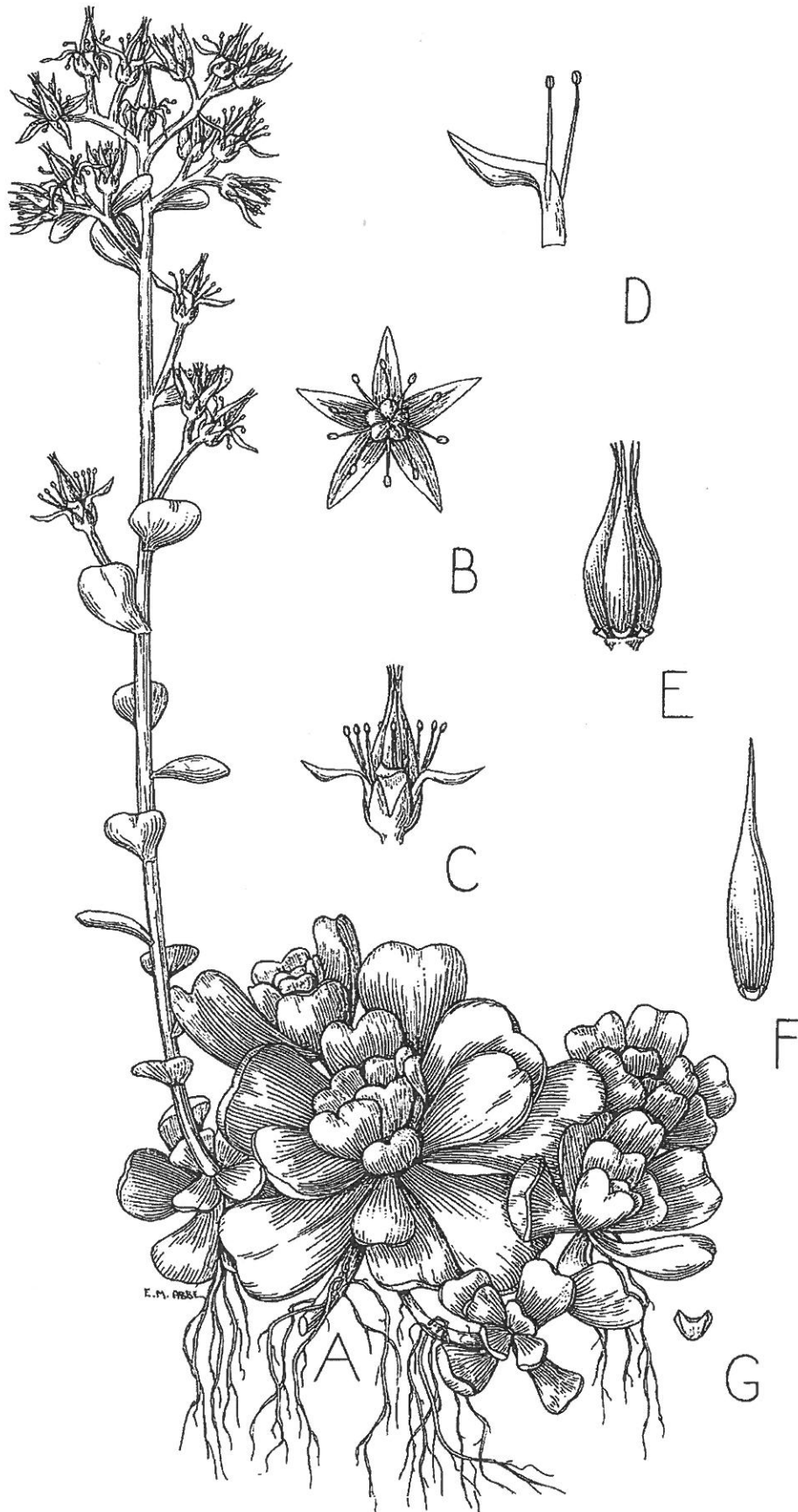


FIG. 1. Type plant of *Sedum obtusatum* subsp. *boreale* from Mud Creek Canyon, Mt. Shasta, Siskiyou Co., California, cultivated in greenhouse, Ithaca New York, May 1943. A. Habit. B. Flower from above ( $\times 1.7$ ). C. Flower from side ( $\times 1.7$ ). D. Petal and two stamens ( $\times 2.6$ ). E. Carpels ( $\times 2.6$ ). F. Single carpel and nectary ( $\times 3.4$ ). G. Nectary ( $\times 4.3$ ). Drawing by Elfriede Abbe, from Clausen (1975) p. 374. Used with permission from Cornell University Press.



FIG. 2. *Sedum kiersteadiae*. Note widely spreading yellow petals often marked with red on the dorsal surface, and the open spacing of leaves on the sterile shoot. Photo credits: Whole plant and top flower, Julie Kierstead Nelson. Center and lower flower, and sterile shoot, Peter F. Zika.

flattened, broadly obovate to oblanceolate, cuneate at base, 12–32 × 5–18 mm, 1.2–5.3 times as long as wide, apex usually notched, sometimes obtuse or truncate. Flowering shoots often reddish, 7.5–28.5 cm, nodding in bud, erect in flower and fruit. Leaves on flowering shoots usually pink to green, (4–)11–19 × (2–)5–9 mm, 1–3.7 times as long as wide, narrowly obovate, truncate at base, apex usually obtuse. Inflorescences panicle-like cymes 4–13.6 × 2–3(–4) cm, usually cylindrical, proximal branches solitary at nodes, ascending. Flowers 10–30. Calyx greenish, (8–)15–45% as long as the petals, free calyx lobes (0.5–)2–4(–6) mm long, acute. Petals 6–8(–12) mm long, light yellow with midribs usually pink or red dorsally, sometimes white ventrally (sometimes also dorsally) when young, lower half sometimes red, entire petal eventually senescing red, becoming whitish or pale tan when dead. Upper half of petal blade narrow, spreading (70–)80–90(130)° from the flower axis at anthesis, apex acute, usually with subterminal mucro. Stamens 10, shorter than or equaling petals; filaments white or yellow-green, aging red; anthers usually red, rusty, or dark orange aging purple or black, sometimes yellow aging light brown, becoming tan when dead and dried. Follicles erect, green aging red, fused 0.5–1 mm at base.

*Chromosome number.*— $2n = 30$  (Clausen 1942, based on count for Clausen *et al.* 4952).

*Habitat and Range.*—Rock outcrops and rocky open forests, usually on serpentine substrates, NE Trinity County and adjacent NW Shasta and S Siskiyou counties, CA, in the Klamath Range, also disjunct on the southeast side of Mt. Shasta (Fig. 3), 1000–2500 m elevation, more common at higher elevations.

*Etymology.*—The name *S. kiersteadiae* honors California botanist Julie Kierstead Nelson, who was inspired to study the natural world by her father, Robert William Kierstead. Conveniently, the Dutch “kier stead” refers to a place or homestead with cracks; this plant generally grows in cracks in its rocky home.

*Classification.*—This species belongs in *Sedum* subgenus *Gormanina* section *Gormanina* (Clausen 1975).

Specimens examined: (KNF = herbarium of the Klamath National Forest; other herbarium acronyms follow Thiers (continuously updated)). **CALIFORNIA: Shasta Co.:** Ridge top N of Sanford Pass; T36N R6W S15, 4600 ft, 15 Jun 2012, Lindstrand & Van Susteren NSR-15 (CHSC, DAV, HSC, KNF, STNF, UBC); The Incline, Upper Slate Creek watershed; N of USFS Road 36N44; T36N R6W S12, 4200 ft, 15 Jun 2012, Lindstrand & Van Susteren NSR-18 (CAS, MICH, MO, NY OSC, RSA, WTU, UC). **Siskiyou Co.:** Mount Shasta, Mud Creek, 5716 ft, 7 Aug 2011, Colberg MEC-1 (MO, OSC, RSA, UC, WTU); on the banks of Mud Creek Canyon, 6500 ft, 22 Aug 2013, Wm. Bridge Cooke 15459 (OSC); Mount Bradley, in rocks 10–50 m W of lookout, also E of lookout in rocky openings, 5556 ft, 12 Jul 2011, Lindstrand & Van Susteren NSR-09 (BH, F, GH, NY, US); Gray Rocks Lake, downslope of trail to lake near trailhead, T39N R5W S21, 5830 ft, 20 Jul 2011, Lindstrand & Van Susteren NSR-11 (CAS, CHSC, DAV, HSC, MO, NY, RSA, UBC, UC); Rattlesnake Hill, on ridge N of USFS road 38N21, T37N R5W S20, 5580 ft, 20 Jul 2011, Lindstrand & Van Susteren NSR-12 (BH, GH, KANU); along Mount Eddy Trail, ca. 1.75 mi from trailhead, 7000 ft, 29 Jul 2011, Van Susteren JVS 1 (CAS, OSC, UC); off trail between Heart Lake & Castle Lake below Little Castle, 5950 ft, 30 Jul 2011, Van Susteren JVS 2 (CHSC, DAV, HSC, UBC); Rail Creek road (road 41N08, to Kanagaroo Lake), 4913 ft, 9 Aug 2011, Wilson *et al.* CWG-18 (F, RENO, UC, US); ridge line W of Kangaroo Lake, near loop at end of road, 6604 ft, 9 Aug 2011, Wilson *et al.* CWG-19 (CAS, MO, NY, OSC, WTU); 0.9 mi by road E of summit on Highway 3 at Scott Mountain, 5076 ft, 31 Jul 2011, Zika & Wilson 25677 (CAS, CHSC, OSC, WTU); Shasta-Trinity National Forest; 10.1 mi NW of Highway 3 on road 42N17, 5777 ft, 31 Jul 2011, Zika & Wilson 25680 (F, RENO, UBC, US, WTU); near Pacific Crest Trail, ca. 0.5 km NW of Parks Creek Pass and junction with FS road 42N17C and Route 17, 2.5 air mi NW of the NW Deadfall Lake, 6890 ft, 31 Jul 2011, Zika & Wilson 25683 (CAS, OSC, UC, US, WTU); South Fork Willow Creek; N end road 42N19, along South Fork, 3691 ft, 21 Jun 2012, Zika *et al.* 25901 (DAV, MO, NY, RSA, WTU). **Siskiyou/Trinity Co. border:** Mount Eddy, N side of ridgeline; T40N R5W Section 20, 6600 ft, 7 Aug 2011, Colberg MEC-2 (CHSC, STNF, WS); Pacific Crest Trail W of Toad Lake, to ridge between Toad and Porcupine lakes, T40N R6W Section 36, ft, 31 Jul 2011, Nelson JKN-1 (GH, KANU). **Trinity Co.:** ca. 6 mi N on trail to Canyon Creek Lakes, ca. 10 mi N of Dedrick, 4400 ft, 24 Jun 1976, Denton 3967 (OSC); Little Boulder Lake Trail #8N11, ca. 0.1 to 0.25 mi up from lake, or 0.1–0.25 mi down from intersection with main Boulder Lake Trail, 6200 ft, 28 Aug 2011, Erwin SE-1 (KNF, MO, NY, RSA, STNF); Parks Creek Summit, Pacific Crest Trail, ca. 1/8 to 1/4 mi W of trailhead on Forest Road 17, Shasta Trinity National Forest, 6897 ft, 28 Jun 2013, Nelson JKN-2013-1 (GH, WS); 3.7 mi up Canyon Creek Trail, 100 ft E of trail on rock outcrop, accessed by Canyon Creek Road off Hwy 299, 4699 ft, 23 Jun 2011, Stubbs *et al.* RS-27 (MO, NY); between Cedar and Bear Creeks, Forest Service Road 40N45, 2.7 road mi S of junction with FS Road 17, 1.7 air mi WSW of SE Deadfall Lakes, 6496 ft, 31 Jul 2011, Zika & Wilson 25687 (US, WTU); Forest Service Road 40N45, 9.1 road mi S of junction with FS Road 17, 2.7 air mi NNW of Picayune Lake, 31 Jul 2012, Zika 25689 (OSC, UC, WTU); Forest Service road 25 at Horse Heaven Meadows, 3 air km NNW of Grey Rocks Peak, 28 Jun 2013, Zika 26294 (MO, OSC, RSA, UC, WTU).

#### DISCUSSION

Most populations of *Sedum kiersteadiae* occur in the western Klamath Region, including Mount Eddy, Scott Mountain, and the Trinity Mountains (Fig. 3). Clausen (1975) referred these plants to *S. obtusatum* subsp. *re-*

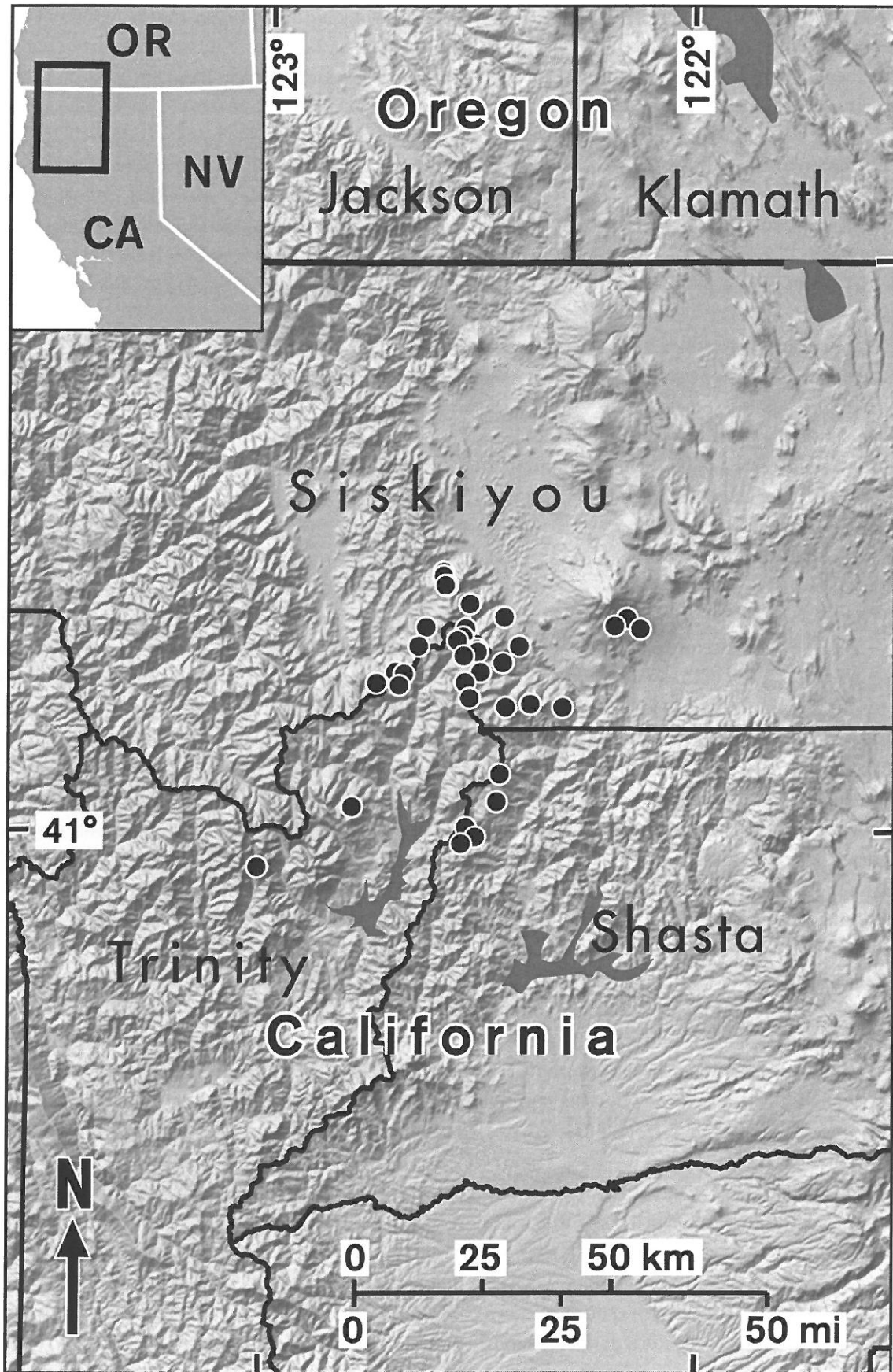


FIG. 3. Distribution of *Sedum kiersteadiae* in northern California.

*tusum* (Rose) Clausen. Denton recognized that they did not belong with that taxon and treated them as a disjunct population of yellow-flowered *S. obtusatum* subsp. *obtusatum*. We find that they differ from both these taxa in their narrower, more spreading petals and more open rosettes. We feel this combination of traits is convincing taxonomic evidence and unique among *Sedum* section *Gormaniana*, to treat *S. kiersteadiae* at the species level.

The taxon most similar to *S. kiersteadiae* is the recently described *S. citrinum* Zika, endemic to a small area of Del Norte County, California (Zika 2014). Both species have narrow, widely spreading, yellow petals and open rosettes. *Sedum kiersteadiae* differs from *S. citrinum* in having a panicle-like cyme with elongated lower branches (Fig. 2), rather than a flat-topped cyme, flowering shoots that never branch from the base, and anthers that are usually rusty brown aging black, rather than yellow aging brown. The two do not overlap in range.

The very open rosettes of *S. kiersteadiae* resemble those of *S. oregonense* (S. Watson) M.E. Peck. *Sedum kiersteadiae* differs from *S. oregonense* in having narrower, widely spreading petals that are yellow, often marked with red. Such petals are unusual in section *Gormaniana* and resemble those of *S. lanceolatum* Torr., in *Sedum* subgenus *Sedum* section *Lanceolata*. The range of *S. lanceolatum* overlaps *S. kiersteadiae* near Mount Eddy, where the two species are occasionally found on the same slope. We speculate that perhaps *S. oregonense* and *S. lanceolatum*, or their ancestors, hybridized to produce *S. kiersteadiae*. The range of *S. kiersteadiae* approaches that of *S. oregonense* in the Canyon Creek watershed, at the west edge of the range of *S. kiersteadiae* and the south edge of the range of *S. oregonense* (Figure 3). In that drainage grow plants that resemble *S. oregonense* in having yellow anthers and relatively wide, obtuse petals that lack red, and resemble *S. kiersteadiae* in having yellow petals. Petals of these plants spread to about 40°, less than *S. kiersteadiae* and more than is typical of *S. oregonense*. The existence of some intermediate plants in small areas where species ranges overlap is not surprising; all tested pairs of taxa in *Sedum* section *Gormaniana* can produce F1 hybrids, many of which are fertile (Denton 1979). The presence of potential hybrids in a limited area does not argue against recognizing the easily distinguished *S. oregonense* and *S. kiersteadiae* as distinct species.

The only other taxon of *Sedum* section *Gormaniana* with a range approaching that of *S. kiersteadiae* is *S. obtusatum* subsp. *paradisum* Denton. It grows in the Canyon Creek watershed at the west edge of the *S. kiersteadiae* range, where both *S. oregonense* and *S. kiersteadiae* also grow. *Sedum paradisum* and *S. kiersteadiae* also grow near each other at the south edge of the range of *S. kiersteadiae*. There, *S. kiersteadiae* can occasionally be found on the north or northwest side of a ridge and *S. paradisum* on the south side; the two were not observed together and morphologically intermediate plants were not observed during this study (Len Lindstrand III, pers. comm.).

The affinities of the plants represented by Clausen *et al.* 4952, the type specimen of *S. obtusatum* subsp. *boreale*, have been interpreted in diverse ways. Originally, *S. obtusatum* subsp. *boreale* was described as having pale to deep yellow, somewhat spreading petals, and the type locality on Mount Shasta, in the southern Cascade Range, was considered the eastern-most population of the taxon (Clausen 1942). We now interpret the type specimen as *S. kiersteadiae* but other specimens cited by Clausen [Siskiyou Co.: Caribou Basin, Salmon-Trinity Alps, 25 July 1937, J. T. Howell 13450 (CAS); Clausen 1942] are better treated as *S. oregonense* with white to pale yellow petals.

Later, Clausen (1975) and Denton (1982) treated the type specimen from Mount Shasta as the northwestern-most, isolated population of a taxon that was more common in the northern Sierra Nevada. This taxon was characterized by relatively large mats of dense rosettes and by wide, apically obtuse, white petals that are pink at the base and senesce pink throughout. We agree that this is an accurate description of the northern Sierra Nevada plants, but not of Clausen *et al.* 4952.

Plants collected for this study at the type locality, Mud Creek on Mount Shasta (Colberg MEC-1, Aug 2011), resemble *S. kiersteadiae* of Mount Eddy and elsewhere in the western Klamath Region in having loose rosettes and yellow, strongly spreading petals that are marked with red. We believe these are representative of the same population as Clausen *et al.* 4952 because the taxon was originally described as having yellow petals (Clausen

1942), and strongly spreading petals can be observed on both the holotype specimen and the drawing of a live clone of the holotype (Clausen 1975, p. 374; Fig. 2). *Colberg MEC-1, Aug 2011* and the holotype (Clausen et al. 4952) both have relatively loose rosettes. A single location is usually home to a single species of *Sedum* section *Gormaniana* (Clausen 1975; pers. obs.), and we have not seen plants with white petals or other evidence that more than one species occurs at Mud Creek.

We suspect that the confusion in interpreting the *S. obtusatum* subsp. *boreale* type specimen was caused in part by the necessary reliance on cultivated plants in previous studies. Variation in plant height, rosette density, leaf thickness, and glaucescence has been observed in cultivated plants depending on substrate and vernalization (Denton 1982). Denton (1982) considered the variations in cultivations too minor to affect taxonomic decisions. We have also observed differences in petal color and degree of spreading (Steven Darington, pers. comm.). We have observed some individual *Sedum* that produce pink or yellow flowers in the wild may produce white flowers in cultivation. Also, each taxon in *Sedum* section *Gormaniana* has a characteristic degree to which petals spread, but petals may spread excessively in cultivated plants, obscuring the differences between taxa. All these variations add a level of confusion to this already difficult group of plants.

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