

***LOMATIUM RONEORUM* (APIACEAE),
A NEW SPECIES FROM THE EAST SLOPES OF THE CASCADE MOUNTAINS,
WASHINGTON STATE**

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ABSTRACT

Lomatium roneorum Darrach, **sp. nov.**, is a narrowly endemic species of probable conservation concern found growing on friable arkosic sandstone substrates of the lower-middle Eocene Chumstick Formation and Mesozoic acidic metamorphic substrates in Chelan County along the east slope of the Cascade Mountains in central Washington state. The species is morphologically distinct in the genus. *Lomatium roneorum* is distinguished from the apparently closely related *L. cuspidatum* Mathias & Constance, which is mostly restricted to ultramafic rock. The new species produces more crowded and numerous glaucous leaflets, shorter blunt-tipped leaflets lacking the elongate apiculus of *L. cuspidatum*, larger fruits with shorter pedicels, and yellowish flowers, typically with a distinctive irregular abaxial russet wash rather than the reddish-purple-brown flowers diagnostic of *L. cuspidatum*. Additionally, plants of *L. roneorum* often produce an involucre composed of a few typically broad bracts. The species is known from four locations near the towns of Leavenworth and Plain, Washington.

Lomatium is by far the largest genus in Apiaceae in North America. A parade of newly-described species and infraspecific taxa over the last decade demonstrates that there remains undocumented biodiversity in the genus. Newly described taxa within the last decade include *L. tamanitchii* Darrach and Thie (2010), *L. ochocense* Helliwell (2010), *L. bentonitum* Carlson & Mansfield (Carlson et al. 2011), *L. pastorale* Darrach & D.H. Wagner (2012), *L. brunsfeldianum* McNeill (2012), *L. swingerae* McNeill (2014), *L. tarantuloides* Darrach & Hinchliff (2014), and *L. knokei* Darrach (2014). In particular, recent molecular genetic sampling and cladistic analysis in the genus and related genera in subfamily Apiodeae has provided significant new understanding (George et al 2014; Smith et al 2018).

Lomatium roneorum was first collected 1 May 1987 by G. Patrick east of Plain, Washington, in Chelan county. Initially identified as *Lomatium cuspidatum*, the collection was later annotated by Dr. Mark Schlessman as being unusual and perhaps worthy of consideration of recognition at varietal rank. Later collections further to the north near Basalt Peak were made by E. Burnett in 1989, and a collection in 1999 by local botanist Thayne Tuason immediately north of the town of Leavenworth, Washington, was also recognized as unusual for *L. cuspidatum*. This 1999 collection was sent to the late Dr. Ronald Hartman at RM, University of Wyoming. His determination of *L. cuspidatum* for these plants perhaps, in part, reflects a dearth of material representing that species at RM. The existence of these plants came to the author's attention in 2009, stemming from a series of photographs taken of the Leavenworth population in 2006. A subsequent field and collecting visit to the Leavenworth area population in June of 2011 was undertaken by the author. Review of this 2011 material with collections at WTU revealed a suite of consistent character differences when compared with other taxa in the genus, and, in particular, *Lomatium cuspidatum* Mathias & Constance.

Lomatium roneorum M.E. Darrach **sp. nov.** Figures 1–8. **TYPE: USA. Washington.** Chelan Co.: infrequent on open steep friable arkosic tuffaceous sandstone slope, 2.60 km N of Leavenworth, 47.62149 N -126.66228 W, 80% slope, aspect 230°, elev. 636 m (2084 ft), 11 Jun 2016, M.E. Darrach 1132 (holotype: WTU; isotypes: CIC, OSC, SRP).

Lomatium roneorum combines character states distinct from its immediately associated and regionally contiguous congeners and all other recognized members of the genus. The following characters and ecological parameters are particularly diagnostic in discriminating *L. roneorum* from *L. cuspidatum*: plants with numerous strongly overlapping/crowded blunt-tipped leaflets, all corollas yellow, and most with an irregular russet wash on abaxial surfaces, leaves less planar than *L. cuspidatum*, plants on average larger, fruit pedicels shorter and with fruit dimensions that are significantly larger than *L. cuspidatum*, involucre bracts few, but usually present, while *L. cuspidatum* rarely displays any involucre development. *L. cuspidatum* is restricted to ultramafic substrates, while *L. roneorum* is not known to occur on ultramafic lithologies.

Herbs: Perennial, long-lived, moderately-pleasant aromatic, glabrous and strongly glaucous throughout, caulescent, caudex simple to, rarely, branched. Plants 19–58 cm in height with typical plants approximately 40 cm tall when in mature fruit. Plant stature increasing from anthesis through to fruit maturity. **Root:** taproot, lacking swellings (Figure 1) 20.0–60.0+ cm long by 8–13 mm in breadth at maximum width. Root surmounted by a root crown exposed at/near the surface and lacking any pseudoscape. Roots typically wedged into rock crevices making excavation difficult. Root crown annual scars typically poorly resolved, but approximate ages up to at least 45-years are noted. **Leaves:** old sheathing leaf bases often lacking, but more typically are present just below or at the soil surface obscuring the root crown, leaves 1–11, most typically about 5, venation obscure, glabrous and strongly glaucous, compound, ternate-bipinnate to biternate-bipinnate or biternate-bipinnate and partially tripinnatifid. Basal leaf dimensions 4.0–44.5 cm in length including petiole x 0.8–29.8 cm in width, triangular to quadrate in outline shape. Cauline leaf dimensions 2.7–19.0 cm including petiole x 2.5–8.5 cm, quadrate in outline. Basal leaf petioles 1.7–18.5 cm long, cauline leaf petioles 2.7–9.0 cm. Both with variably-developed winged basal portions, winged bases entire, herbaceous with variably green to discontinuously weak to occasionally moderately-developed light purple anthocyanic coloration at the base. Leaf bases becoming stramineous and chartaceous with age, prominent nerves on winged petioles 10–20. Leaves non-planar, distributed in a distinct, but subdued, 3-dimensional geometry. Leaflets crowded and often upturned, cuneate, elliptical to broadly oblanceolate, shortly mucronate or not. Leaflets 1.0–5.2 mm x 0.4–2.1 mm with typical material 1.7–3.5 mm x 0.8–1.4 mm usually with very fine serrations only visible above 20x magnification. **Inflorescences:** compound, 1–21 with 1–5 being typical; peduncles terete, strongly ascending, straight to curved or weakly sigmoidal, 12.5–62.5 mm at maturity, elongating with age as fruit develops; involucre bracts herbaceous 0–6, typically 1–3, 1.7–14.0 mm x 0.3–3.5 mm. Peduncles equaling to greatly exceeding the leaves as the inflorescence matures. Rays 6–24, unequal in length at maturity and in flower. Rays that are entirely ♂ 0–19, rays of mixed sex 0–21, rays that are entirely ♀, rare. The longer rays bear umbellets that are a mixture of male, female and, to a lesser extent, perfect flowers. Minimum ray length per inflorescence in flower 6.0–35.0 mm, maximum ray length per inflorescence in flower 24.0–58.0 mm. Minimum fruit-bearing ray length per mature infructescence 18.0–41.0 mm, maximum fruit-bearing ray length per mature infructescence 32.0–54.5 mm. Shortest rays usually bearing umbellets with entirely male flowers that do not lengthen with plant maturity. These short, staminate umbellets are typically clustered at the umbel center, they are irregularly deciduous by maturity and tend to bear fewer flowers. Umbellets 1–26 with typical range of 13–21 on most specimens. **Involucre:** bracts green to green-anthocyanic, herbaceous, narrow to linear, bract number 3–10 with typically values of 5–9, distribution radial to irregularly dimidiate. Involucre bracts 0.7–7.4 mm in length, 0.3–2.8 mm in width, glabrous, free to base, often with a well-developed mid-vein, occasionally weakly pinnatifid divided. **Flowers:** primarily andromonoecious on most plants, but some plants or individual inflorescences are polygamo-monoecious. Male flower

pedicels smooth, glabrous, 2.8–5.1 x 0.15–0.4 mm in width, female and perfect flower pedicels smooth, glabrous, 1.6–5.9 x 0.3–0.8 mm. Both male and female flowers have very short but well-developed triangular calyx teeth that senesce as the fruit matures. Flowers glabrous 8–34 per umbellet with values of 12–28 typically encountered, petals pale to bright yellow with an irregularly distributed russet wash abaxially, 0.6–2.6 mm long, 0.5–1.2 mm wide, ovate with an adaxially strongly incurved short apiculus; stamens 5 and alternating with the 5 petals, anthers bright yellow to pale yellow, pollen yellow to whitish-yellow, filaments 0.5–2.1 mm. Stylopodia yellowish green to greenish yellow prior to pollination, becoming reddish purple post-pollination. Styles laterally flattened, strongly curved, divergent; ovaries green and glabrous. **Fruit:** hemispherically arranged with 0–17 fruit per umbellet; 4–12 being the most common range, the longer rays usually considerably more fecund, pedicels spreading-ascending to semi-erect, 3.8–9.3 mm with typical values of 5.3–8.3 mm encountered on most specimens. Fruits glabrous, 11.2–17.0 mm long with typical material 13.7–16.3 mm, 4.5–5.9 mm wide. Fruit wing width 0.5–0.8 mm, not obviously thickened, body width 3.4–4.7 mm. Fruit strongly dorsi-ventrally compressed with obtuse base and distal acute margin. Fruit aspect ratio 2.2–3.2. Fruit shape distinctly oblong to occasionally narrowly elliptical, with intervals and nerves both tannish brown and wings a contrasting paler tan. Dorsal fruit surfaces with 3–5 weakly-developed nerves flush with the fruit surface; vittae obscure, 2–8 in the intervals, 6–16 along the commissure, 1–2 on the wings. **Carpophore:** cleft to the base, persistent. A composite illustration is provided in Figures 1 and specimen photographs are in Figures 2 through 8.

Additional collections examined. Washington. Chelan Co.: Above FS road 6101, ca. 0.5 mi SE of Maverick Saddle, ca. 5 mi E of Wenatchee Lake, N 47.831801, W -120.602626, 1,193 m, 27 May 2013, *Legler 12661* (WTU); along Estes Butte trail #1527, ca 1.5 mi from trailhead on slope N of Rock Creek, Chiwawa River drainage, N 47.982077, W 120.78468, 1109 m, 26 May 2013, *Legler 12658* (WTU); ridgetop 1.06 km NNE of Basalt Peak, N 47.98564, W -120.74440, 1698 m, 27 May 2017, *Darrach 1149* with Mary Kline (WTU).

Etymology. The epithet “roneorum” commemorates the surname Rone. It was chosen by the successful bidder for the plant naming auction held for this species in the fall of 2017.

Habitat. *Lomatium roneorum* is known from four populations near the towns of Leavenworth and Plain, Washington. All four sites are characterized by rocky substrates with acidic lithologies ranging from friable tuffaceous arkosic sandstones of the lower-middle Eocene Chumstick Formation to older Cretaceous multiply-deformed metamorphic rocks. Occupied habitats are invariably challenging settings in which successful establishment of plants would appear to be difficult. Ecological settings range from xeric open south-aspect steep slopes to gentle slopes of variable aspect under partial conifer canopy, where susceptibility to being shaded out may play a role in population persistence, particularly in the absence of fire.

Geographic range. *Lomatium roneorum* is presently known from within an area of approximately 250 square kilometers. It is clear, however, that only a very small proportion of this total extent includes occupiable habitat. Comprehensive surveys for the species have not been conducted and it can be reasonably assumed that there are populations remaining to be discovered. The species is sufficiently distinctive and robust in size that reconnaissance surveying using high-quality binoculars is likely to be an effective initial approach in at least some settings.

Similarities and relationships

Lomatium roneorum displays recognized morphological similarities with the apparent ultramafic substrate obligate *Lomatium cuspidatum* Mathias & Constance. The two taxa geographically most closely approach each other at the type locality, with a spatial separation of approximately 3 km and 670 m in elevation difference. Table 1 presents the full suite of character states and parameters that consistently separate the two species. Limited molecular genetic

investigations of both *L. roneorum* and *L. cuspidatum* by Dr. James Smith at Boise State University (unpublished data) have not as yet returned conclusive evidence of significant genetic separation between the two taxa. However, distinct and consistent morphological differences and a complete lack of any specimens exhibiting any intermediate character states support recognition of *L. roneorum* at the specific rank.

KEY TO POSSIBLE CLOSE RELATIVES OF *LOMATIUM RONEORUM*

1. Small (<12 cm tall) acaulescent (caulescent) plants with or lacking an obvious shallowly-seated simple tuberous root; rarely, if ever, moniliform.
 2. Plants tap-rooted, lacking any tuberous swellings; montane plants with irregularly-toothed partially fused leaflets **L. martindalei** (Coul. & Rose) Coul. & Rose
 2. Plants with an obvious shallowly-seated simple tuber.
 3. Plants usually with a single greatly-reduced photosynthetic cauline bract; mature fruit glabrous; plants typically of mid-montane elevations, usually on rocky mesic substrates **L. piperi** Coul. & Rose
 3. Plants lacking a cauline bract; mature fruit finely scabrous or glabrous; plants of rocky or deeper loess-derived soils.
 4. Maturing fruits glabrous, usually with a distinct anthocyanic rim; fruit pedicels (2–)4.6–11.7(–17) mm; open rocky soil habitats **L. canbyi** (Coul. & Rose) Coul. & Rose
 4. Maturing fruits finely scabrous, lacking an anthocyanic rim; fruiting pedicels (0.6–)0.8–2.3(–3) mm typically of loess-derived deeper soils **L. gormanii** (Howell) Coul. & Rose
1. Larger caulescent or acaulescent plants lacking obvious shallowly-seated simple thickened tuber; deeper-seated moniliform or irregular tubers sometimes present.
 5. Caulescent plants with umbellets completely lacking involucler bracts; flowers yellow; mature fruit with aspect ratio (2–)3–5(–8) **L. ambiguum** (Nutt.) Coul. & Rose
 5. Plants with umbellets usually having an involucler; caulescent or acaulescent; fruit aspect ratio usually <3; flowers yellow, white or purple-brownish-purple.
 6. Plants with an obvious swelling at the peduncle terminus; ultimate leaflet segments broad, typically with distal coarse teeth; plants usually acaulescent, but may be distinctly caulescent in Chelan and Kittitas counties, WA **L. nudicaule** (Pursh) Coul. & Rose
 6. Plants lacking a swelling at peduncle terminus; ultimate leaflet segments various.
 7. Plants smaller, never taller than 40 cm; not bushy in stature
 8. Plants glabrous; ultimate leaflet segments (1.6–)6.3–48.1(–98) × (0.9–)1.2–2.9(–4.3) mm; roots typically tuberous moniliform **L. geyeri** (S. Wats.) Coul. & Rose
 8. Plants hairy; ultimate leaflet segments (0.9–)1.3–5.1(–8.6) × (0.3–)0.4–1.2(–2.3) mm; root typically a tap root, occasionally with an irregular deep-seated tuber **L. macrocarpum** (Nutt. ex Torr. & Gray) Coul. & Rose
 7. Plants robust–larger species occasionally as tall as 1m or more, often bushy in stature.
 9. Plants short hairy throughout.
 10. Mature fruit (13–)17–24(–32) × (3.5–)5–8.5(–10) mm; distinctly bushy plants as tall as 1m; restricted to Chelan and Kittitas cos., WA **L. thompsonii** (Mathias) Cronq.

10. Mature fruit (7–)11.5–16(–17) mm × (2.5–)3–5(–5.5) mm; slender usually single-stemmed plants throughout east slope of the WA Cascades; ultimate leaflets variably broad (higher elevations) to narrow (lower elevations); plants 2–8 dm.
 **L. brevifolium** (Coul. & Rose) Coul. & Rose
9. Plants glabrous or with numerous narrowly triangular to peg-like papillae.
11. Plants with papillae clearly visible under 10x lens.
12. Plants bushy with strong odour when herbage is crushed; papillae widely distributed on plants **L. grayi** (Coul. & Rose) Coul. & Rose
12. Plants not usually bushy; herbage moderately smelling when crushed; papillae usually restricted to leaf veins and rachises.
13. Mature fruit with well-developed pedicels (3.5–)5.4–10.4(–13.8) mm
 **L. multifidum** (Nutt.) McNeill & Darrach
13. Mature fruit with very short (lacking) pedicels (0.6–)0.8–1.8(–2.5) mm
 **L. dissectum** (Nutt.) Mathias & Constance
11. Plants lacking papillae.
14. Plants with mature fruit deflexed; ultimate leaflet segments (7.3–)12–32(–45) × (0.8–)1.9–5.3(–9.2) mm **L. brandegeei** (Coul. & Rose) Macbr.
14. Plants with mature fruit ascending to strict on angled pedicels ultimate leaflet segments distinctly smaller.
15. Ultimate leaflets cuspidate; flowers brownish purple; ultramafic substrates
 **L. cuspidatum** Mathias & Constance
15. Ultimate leaflets shortly apiculate to blunt, not cuspidate; flowers yellow with irregular russet wash; plants of acidic lithologic substrates **L. roneorum** Darrach

Discriminating Character	<i>L. roneorum</i>	<i>L. cuspidatum</i>
Elevation	635 – 1698 m / averaging lower elevation	914 – 2134 m / averaging higher elevation
Substrate	acidic lithologies	ultramafic lithologies
Plant Height	range 19.0 – 58.0 cm / \bar{x} = 38.5 cm 1-stdev = 24.9 – 52.1 cm	range 16.0 – 39.0 cm / \bar{x} = 27.9 cm 1-stdev = 19.5 – 36.3 cm
Leaflet Shape & Distribution	cuneate, elliptical to broadly oblanceolate / numerous, crowded	narrowly elliptical, strongly apiculate cuspidate / fewer, less crowded
Involucre	usually present with at least 1 bract	Absent
Flower Color	always yellow with an abaxial russet wash	always deep reddish to brownish purple
Mature Fruit Pedicel Length	range 3.8 – 9.3 mm / \bar{x} = 6.8 mm 1-stdev = 5.3 – 8.3 mm	range 5.0 – 21.8 mm / \bar{x} = 11.1 mm 1-stdev = 7.3 – 14.9 mm
Mature Fruit Length	range 11.2 – 17.0 mm / \bar{x} = 15.0 mm 1-stdev = 13.7 – 16.3 mm	range 7.3 – 14.5 mm / \bar{x} = 11.2 mm 1-stdev = 9.4 – 13.0 mm
Mature Fruit Aspect Ratio	2.2 – 3.2	1.7 – 3.3

Table 1. Comparison of *Lomatium roneorum* character states and ecologic parameters with *Lomatium cuspidatum* character states and ecological parameters.

Phenology, ecology, and conservation

Emergence of *Lomatium roneorum* occurs each year, depending upon elevation and depth of snowpack, from mid-April to mid-May. Plants are at anthesis from late April through late May and are in full fruit by late May to late June at higher elevations. The plants rapidly senesce thereafter, seed is generally fully dispersed by mid-July, and the plants become largely unrecognizable as they reach full dormancy.

Lomatium roneorum appears to be a long-lived perennial species. However, analysis of root crown scars, a proxy for age utilized in other species in the genus (Darrach & Hinchliff 2014; Darrach 2014), has been inconclusive.

The species is presently known to occur at four, well-separated localities. The population at the type locality comprises approximately 125 individuals; the Maverick Saddle population is very small with only 5 plants documented; the Estes Butte trail population, while not visited by the author, is suspected to comprise a few hundred plants. The largest population is on the Basalt Peak ridgeline, with an estimated 800 plants present. The small population sizes indicate that significant conservation concerns for the species are warranted and that further inventory and assessment efforts should be a high priority. Numerous small seedlings scattered near established plants at all three populations investigated by the author appears to indicate that seed viability and germination are not likely to be significant limiting factors in the persistence of the species. However, the rocky and often friable nature of the substrates clearly present a challenging setting for long-term establishment of reproductive individuals. Recruitment levels are apparently very low.

Associated vascular plant taxa documented to co-occur with *Lomatium roneorum* include the following: *Abies lasiocarpa*, *Achillea millefolium*, *Agoseris heterophylla*, *Agoseris retrorsa*, *Allium acuminatum*, *Amelanchier alnifolia*, *Antennaria rosea*, *Arctostaphylos nevadense*, *Balsamorhiza sagittata*, *Boechera* sp., *Boechera retrofracta*, *Bromus tectorum*, *Bromus carinatus*, *Carex rossii*, *Castilleja* sp., *Clarkia pulchella*, *Clarkia rhomboidea*, *Claytonia lanceolata*, *Collinsia parviflora*, *Collomia grandiflora*, *Collomia tinctoria*, *Comandra umbellata*, *Cystopteris fragilis*, *Dicentra uniflora*, *Douglasia nivalis*, *Draba verna*, *Drymocallis glandulosa*, *Epilobium brachycarpum*, *Eriogonum compositum*, *Eriogonum elatum*, *Eriogonum* sp., *Eriogonum strictum*, *Eriophyllum lanatum*, *Erythronium grandiflorum*, *Galium aparine*, *Galium multiflorum*, *Heuchera cylindrica*, *Holodiscus discolor*, *Hydrophyllum capitatum*, *Ipomopsis aggregata*, *Lewisiopsis tweedyi*, *Lewisia columbiana*, *Linaria dalmatica*, *Lithophragma glabrum*, *Lomatium brandegeei*, *Lomatium brevifolium*, *Lomatium geyeri*, *Lomatium nudicaule*, *Lupinus* sp., *Madia exigua*, *Mentzelia albicaulis*, *Mentzelia laevicaulis*, *Micranthes* sp., *Paeonia brownii*, *Paxistima myrsinites*, *Penstemon* sp., *Penstemon pruinosus*, *Phacelia leptosepala*, *Phacelia linearis*, *Pinus contorta*, *Pinus ponderosa*, *Plagiobothrys tenellus*, *Poa bulbosa*, *Poa secunda*, *Pseudoroegneria spicata*, *Pseudotsuga menziesii*, *Ranunculus* sp., *Rosa* sp., *Sedum lanceolatum*, *Selaginella densa*, *Senecio integerrimus* var. *exaltatus*, *Sorbus sitchensis*, *Spiraea betulifolia*, *Tragopogon dubius*, and *Viola purpurea*.

Field observations field suggest that *Lomatium roneorum* is probably not exposed to any significant immediate threats at the present time. The type locality is infested with non-native weedy species, including significant amounts of cheatgrass (*Bromus tectorum*), and the capability of this site to carry fire is of concern. However, most of the plants are in sparsely vegetated locations along the slope. The most salient long-term threats to the species are likely to be ongoing climate modification and genetic isolation between the small populations with concomitant inefficient seed dispersal (Marisco & Hellmann 2009).

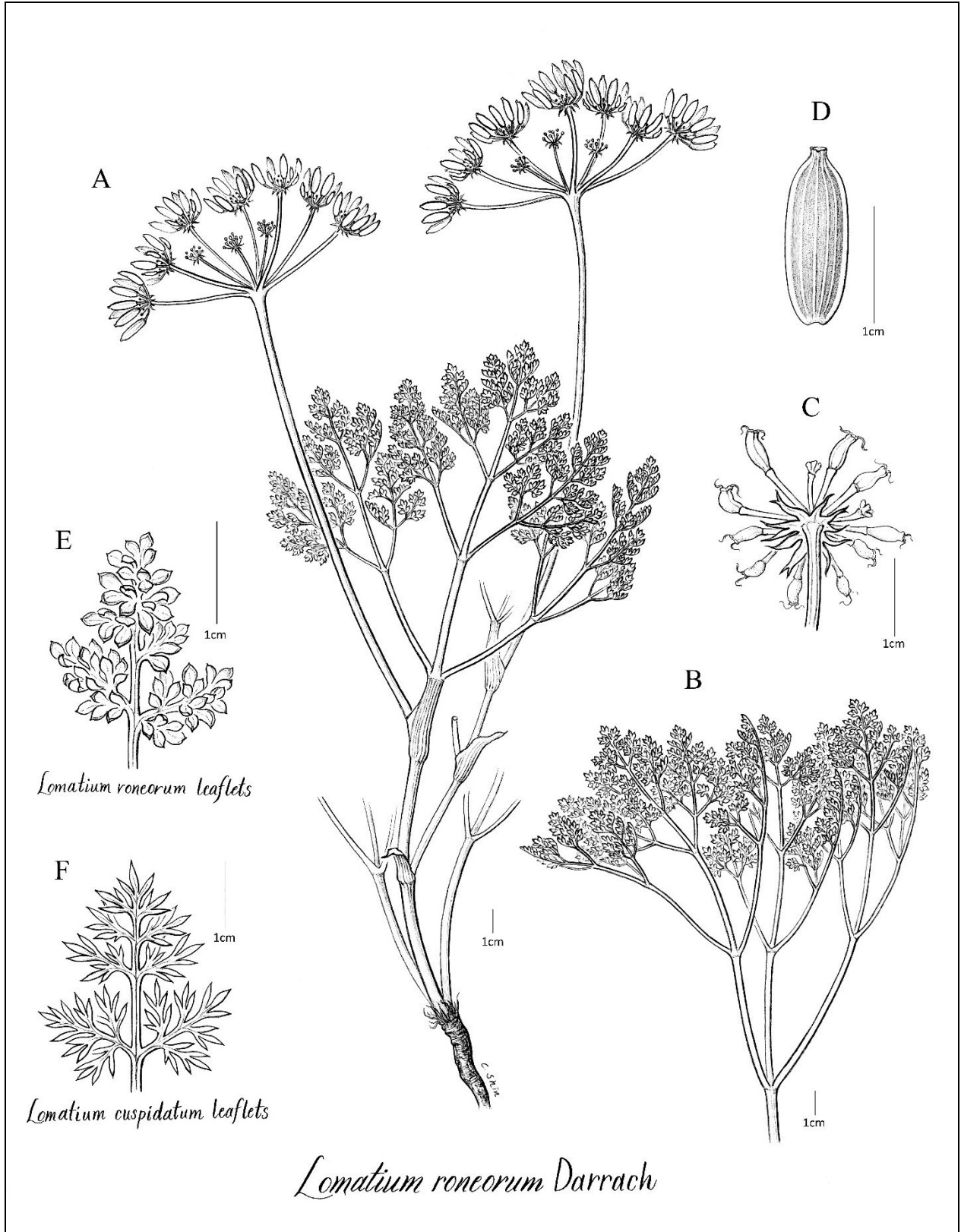


Figure 1. *Lomatium roneorum*. A. Habit of full specimen of plant. B. Primary leaf morphology. C. Involucre morphology on umbel with immature fruit. D. Mature fruit. E. Detail of *L. roneorum* leaflets. F. Detail of *Lomatium cuspidatum* leaflets for comparison purposes.



Figure 2. Typical steep slope habitat of *Lomatium roneorum* at the type locality on Chumstick Formation sandstone.



Figure 3. *Lomatium roneorum* habitat near Estes Butte trail on metamorphic rock substrate.



Figure 4. *Lomatium roneorum* flowers displaying characteristic irregular russet wash color on abaxial petal surfaces.



Figure 5. *Lomatium roneorum* typical flowering specimen growing from a crevice in the rock substrate.



Figure 6. *Lomatium roneorum* typical leaflet morphology.



Figure 7. *Lomatium cuspidatum* typical leaflet morphology. (WTU image collection 2018)



Figure 8. *Lomatium roneorum*, mature fruit.

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