

## CAREX ATROSPICATA (CYPERACEAE), SP. NOV., FROM THE ROCKY MOUNTAINS

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### ABSTRACT

**Carex atrospicata** Rink & Licher, **sp. nov.** (sect. *Luzulinae*), is described from Idaho, Montana, and Wyoming. It includes the taxon Dorn (1988) described as *Carex luzulina* var. *atropurpurea* from Wyoming. *Carex atrospicata* differs significantly from *C. luzulina* Olney and includes greater morphological breadth than Dorn described. Molecular evidence shows wide separation between *C. atrospicata* and the other species in sect. *Luzulinae*. *Carex atrospicata* and *C. luzulina* co-occur with no apparent intermediates. Collections of *C. atrospicata* have been misdetermined as *C. fissuricola* Mack., *C. fuliginosa* Schkuhr, or *C. luzulina* without varietal status. We identify additional taxonomic problems within sect. *Luzulinae*.

*Carex* sect. *Aulocystis* (Ball & Mastroguiuseppe 2002), was demonstrated as polyphyletic by Jiménez-Mejías et al. (2016) and Roalson et al. (2021). Based on this work, Jiménez-Mejías et al. (2022) named sect. *Luzulinae* and recognized it as including four species, all from the western USA and Canada: *C. fissuricola* Mackenzie, *C. lemmonii* W. Boott, *C. luzulifolia* W. Boott, and *C. luzulina* Olney (incl. *C. albida*). Zika and Wilson (2012) placed *C. albida* in synonymy of *C. lemmonii*, based on a morphometric analysis. The remaining North American species in the old sect. *Aulocystis* belong to different clades, which have yet to be given new sectional names.

We were unable to identify *Carex* collections from the Wind River Range of Wyoming (*Rink 16753*) and the Sawtooth Mountains of Idaho (*Rink 16968*) using keys at our disposal (Ball & Reznicek 2002; Cronquist et al. 1977; Dorn 1992; Hermann 1970), though it seemed clear that they belonged within sect. *Aulocystis*. These plants are distinctive with long-sheathing bracts, gynecandrous terminal spikes, dark scales, and dark, glabrous perigynia (Figs. 1 and 2), easily distinguished at a distance from sympatric sedges.

Walter Fertig (pers. comm.) advised us that we might be looking at *Carex luzulina* var. *atropurpurea*, as described by Dorn in his 1988 Wyoming Flora, a taxon overlooked in the Flora of North America treatment (Ball & Mastroguiuseppe 2002). A cursory comparison with specimens determined as *C. luzulina* var. *atropurpurea* showed a strong likeness to our unknown specimens. However, the Rink collections had both glabrous perigynia and gynecandrous terminal spikes, neither of which are characters described for *C. luzulina*. Despite these problems, we agreed that our plants were akin to Dorn's taxon but also that there was likely more to be understood about its taxonomy.

**Methods.** We examined collections of *Carex luzulina* var. *atropurpurea* from ASC, BRY, F, ID, MICH, MONTU, OBI, RM, and WS, as well as the other two varieties of *C. luzulina*, var. *ablata* and var. *luzulina*, as well as the other taxa in sect. *Luzulinae* (*C. fissuricola*, *C. lemmonii* W. Boott, and *C. luzulifolia* W. Boott, all formerly within sect. *Aulocystis*) and *C. fuliginosa* (previously in sect. *Aulocystis*, but now in a separate clade yet to be named at sectional rank (Jiménez-Mejías et al. 2016)). We measured morphological characters from most mature and complete specimens. We reviewed the *C. fissuricola* specimen used in the molecular work that resulted in the naming of sect. *Luzulinae*

(Jiménez-Mejías et al. 2022). We conducted additional field work to observe living plants and collect additional material.



Figure 1. (a) *Carex atrospicata*, and (b) *Carex luzulina* — both at Branham Lakes, Tobacco Root Mountains, Montana. Note the gynecandrous, mixed, and androgynous terminal spikes in *Carex atrospicata*.



Figure 2a. *Carex atrospicata* perigynia (Rink 17674), and Figure 2b – *Carex luzulina* perigynia (Tiehm 17596).

We reviewed the literature relating to *Carex luzulina* and its close relatives in an effort to understand its synonymy and interpretations of relationships within the group. We reviewed original publications/descriptions of the taxa and examined the type specimens of *C. luzulina* var. *atropurpurea* Dorn (Johnson 3), *C. fissuricola* Mackenzie (Heller 9429), *C. owyheensis* Nelson (= *C. luzulina*) (J.F. Macbride 442), and *C. pseudojaponica* C. B. Clarke (= *C. luzulifolia*, A.A. Heller 7187).

**Results and Taxonomy.** Jiménez-Mejías et al. (2016), in their broad molecular analysis of *Carex* phylogenetics, attempted to sample all taxa in sect. *Luzulinae* (except for *Carex luzulina* var. *atropurpurea*, of which they were unaware). Their work demonstrated the coherence of the group and its placement in relation to other groups in *Carex* (Figure 3). However, we were puzzled that *C. fissuricola* appeared to be more distinctly separated from the other taxa in the section, especially given our difficulty in separating many specimens of *C. fissuricola* from those of *C. luzulina*. For *C. fissuricola*, Jiménez-Mejías used *Mancuso 310* from Lemhi Co. Idaho, in the heart of the range of *C. atropurpurea* and of questionable range for *C. fissuricola* (in our opinion at the time). Ball & Mastrogiuseppe (2002), in their brief discussion of *C. fissuricola*, stated that “A population in Lemhi County, Idaho, has the terminal spike gynecandrous and the perigynium glabrous or subglabrous. It is tentatively included in *C. fissuricola*.” These are both characters that we associate with *C. atrospicata*, the taxon we propose here.

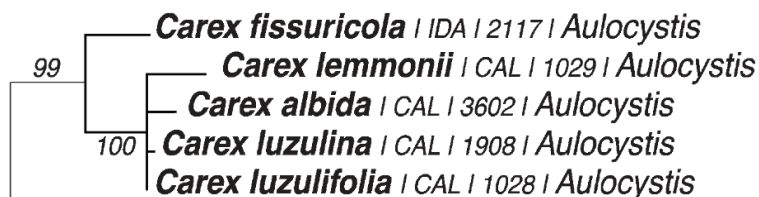


Figure 3. Sect. *Luzulinae* clade from Jiménez-Mejías et al. (2016).

Walt Fertig (WS) provided us with an online image of *Mancuso 310* (Figure 9), and we determined that this specimen is actually *C. atrospicata*. Its separation from the branch to *C. luzulina* and the other *Luzulinae* taxa in the Jiménez-Mejías tree shows *Carex atrospicata* to be distinct from the other sect. *Luzulinae* taxa, supporting the separation of *C. atrospicata* as a species.

In addition to the Jiménez-Mejías molecular evidence, morphological differences exist between *Carex atrospicata* and the other taxa in sect. *Luzulinae*, including those that Dorn used to separate *C. luzulina* var. *atropurpurea* from *C. luzulina* var. *ablata*. Dorn’s (1988) brief Latin diagnosis for *C. luzulina* var. *atropurpurea* follows:

“*Carex luzulina* Olney var. *atropurpurea* Dorn, var. nov.

Differt a var. *ablata* squamis pistillatis atropurpureis vel castaneopurpureis, acutis, costa plurumque apice attingente; foliis vulgo 2-4mm latis. Holotypus: Wyoming, Fremont Co., Wind River Range near head of N. Fork of Popo Agie Creek, Wind River Peak, 24-30 July 1959, Johnson 3 (RM).”

[“Differs from var. *ablata* with pistillate scales blackish-purple or brown-purple, acute, the midrib mostly reaching the tip; leaves commonly 2-4mm wide.”] (Dorn email to Rink, Nov. 11, 2024)

Dorn separated *Carex luzulina* var. *atropurpurea* from *C. luzulina* var. *ablata* using pistillate scale color and shape and leaf width, characters which we find valid. However, our review of a far greater number of specimens than Dorn had available to him indicates that additional characters (perigynia shape, color, and vestiture, varying gender arrangement of the terminal spikes) better describe the differences between var. *atropurpurea* and var. *ablata*, as well as the other taxa in sect. *Luzulinae*, and its placement at the varietal rank under *C. luzulina* is untenable. We circumscribe *C.*

*atrospicata* more broadly than Dorn described *C. luzulina* var. *atropurpurea*. *Carex atrospicata* is contrasted with *C. luzulina* below:

1. Pistillate scales black or dark brown, midvein often obscure or narrow (typically 0.1 mm wide); perigynia tapered, usually lacking a definite shoulder, glabrous (rarely with a few distal marginal cilia), evenly dark except lighter at the base and occasionally on the marginal ribs; terminal spikes gynecandrous, staminate, mixed, pistillate or androgynous; lateral spikes pistillate; distal lateral spikes often on pedicels such that they are clumped at nearly the same height as the terminal spike, occasionally surpassing it; maximum leaf blade width 2.5-4(-6.5) mm ..... **Carex atrospicata**

1. Pistillate scales brown, midvein obvious, usually typically 0.2 mm wide; perigynia acuminate, with a definite shoulder, the margins ciliate, sometimes with hairs on the faces, usually irregularly mottled; terminal spikes mostly androgynous or staminate (rarely pistillate or mixed), lateral spikes pistillate or androgynous; distal lateral spikes usually well-graduated below the terminal spike; maximum leaf blade width (3-)3.4-7.4(-8.5) mm ..... **Carex luzulina**

*Carex atrospicata* is readily identifiable at a glance, and we have seen no evidence of intermediates between it and the other taxa in sect. *Luzulinae*. Molecular study shows it as separate from other taxa in the group, thus we describe *Carex atrospicata* as a distinct species, the epithet referring to the dark spikes, with the vernacular name Darkspike sedge.

**CAREX ATROSPICATA** G. Rink & M. Licher, **sp. nov.** **TYPE: Montana.** Madison Co.: E side of Upper Branham Lake, Tobacco Root Mountains, subalpine meadow, 45.51691 N -111.99032 W, 2690 m elev, 4 Aug 2023, *G. Rink 17674 & M. Licher* (holotype: ASC; isotypes: BRY, IDF, MICH, MONT, MONTU, MSUNH, MSUB, NY, RM, USU-UTC, UT, UW, WS, WTU, others to be distributed). Figure 10.

*Carex luzulina* var. *atropurpurea* Dorn, Vasc. Pl. Wyoming 296. 1988. **TYPE: Wyoming.** Fremont Co.: Wind River Range near head of North Fork of Popo Agie Creek, Wind River Peak, 24-30 July 1959, *W.M. Johnson 3* (holotype: RM). Specimens examined: Appendix A.

Similar to other taxa in sect. *Luzulinae* with its long inflorescence bract sheaths, leafy lower culms, erect inflorescence (lower spikes sometimes spreading), clustered upper spikes, bidentate perigynia, and 3 stigmas. Differing from the other *Luzulinae* taxa in its generally smaller stature, with culms at most 30-45 cm tall (rarely to 60 cm), while the other species can reach heights of 80-100 cm. Differing also in the diversity of terminal spike gender arrangement (no other species frequently have gynecandrous terminal spikes), and in its dark floral scales. Differing from *Carex luzulina* by its smooth-margined and consistently dark-colored perigynia, long-tapering to a poorly defined beak.

**Plants** perennial, loosely caespitose in small clumps from short rhizomes; rhizomes 2-3 mm thick, the maximum internode length to 0.5 cm long. **Stems** 16-45(-68) cm tall, 0.8-1.5 mm thick, rounded to sharply angled, smooth below, sometimes slightly scabrid above, exceeding the leaves. **Leaves** 4-9 per culm, clustered towards the base, 1-several blades from the lower third of the culm, blades flat to V-shaped, lax, green, 2-4(-6.1) mm wide (wider blades), up to 20 mm long. **Inflorescence** 5-40 cm long, consisting of 10-90% of plant height, composed of 1-3 clustered sessile to sub-sessile terminal spikes and 2-3(-4) peduncled lower spikes, the terminal spike gynecandrous, staminate, mixed, androgynous, or pistillate, 8-13 mm long, 3-9 mm wide, the lower lateral spikes pistillate, 7-19 mm long, 4-10 mm wide, mostly erect, lowest spike often on a peduncle 3.5-23 cm long, the lateral spikes infrequently subtended by smaller sessile spikes originating from the peduncle, all spikes dark due to dark scales and perigynia; proximal inflorescence bract shorter than the inflorescence, the sheath 7-50 mm long, sheath tip width at mouth 1-2(-2.5) mm, mostly hyaline, but some with brownish, mottled or slightly purplish tint. **Pistillate Scales** 3-5 mm long, just over half as long (to nearly as long) as the perigynia, uniformly dark brown to black and shiny, the midrib absent or to 0.1 mm wide, usually lighter colored, sometimes slightly excurrent, usually extending to the top of the scale, the scale tip

acute to rounded. **Perigynia** narrowly elliptic to lanceolate, tapered at both ends with an indistinct beak, not inflated, dark brown to black and shiny when mature, sometimes pale near the base, usually solid-colored rather than mottled, glabrous (rarely with a few small prickles on the upper margins), 4-6(-7) mm long, 1-2 mm wide, ascending, unveined to rarely with up to five veins on each face, the marginal ribs light colored; orifice not hyaline, bidentate, the teeth 0.2-0.3(-0.5) mm long. **Anthers** (1.7-)2-3 mm long. **Stigmas** 3. **Achenes** trigonous, 1.6-2.5 mm long, 0.6-0.8 mm wide, the stipe and apiculus obvious.

**Phenology, habitat, and distribution.** Flowering and fruiting Jul-Sep. Subalpine to alpine habitats, wet meadows, boggy wetlands, open grassy meadows, soil pockets in tundra, streambanks, and rocky talus slopes, 2050–3350 m. Central Idaho, southwestern Montana, and western Wyoming. (Figures 4a, b, habitat at the type location; Figure 5, Range map).



Figures 4a, b. *Carex atrospicata* habitat at Branham Lakes, Tobacco Root Mtns., Montana.

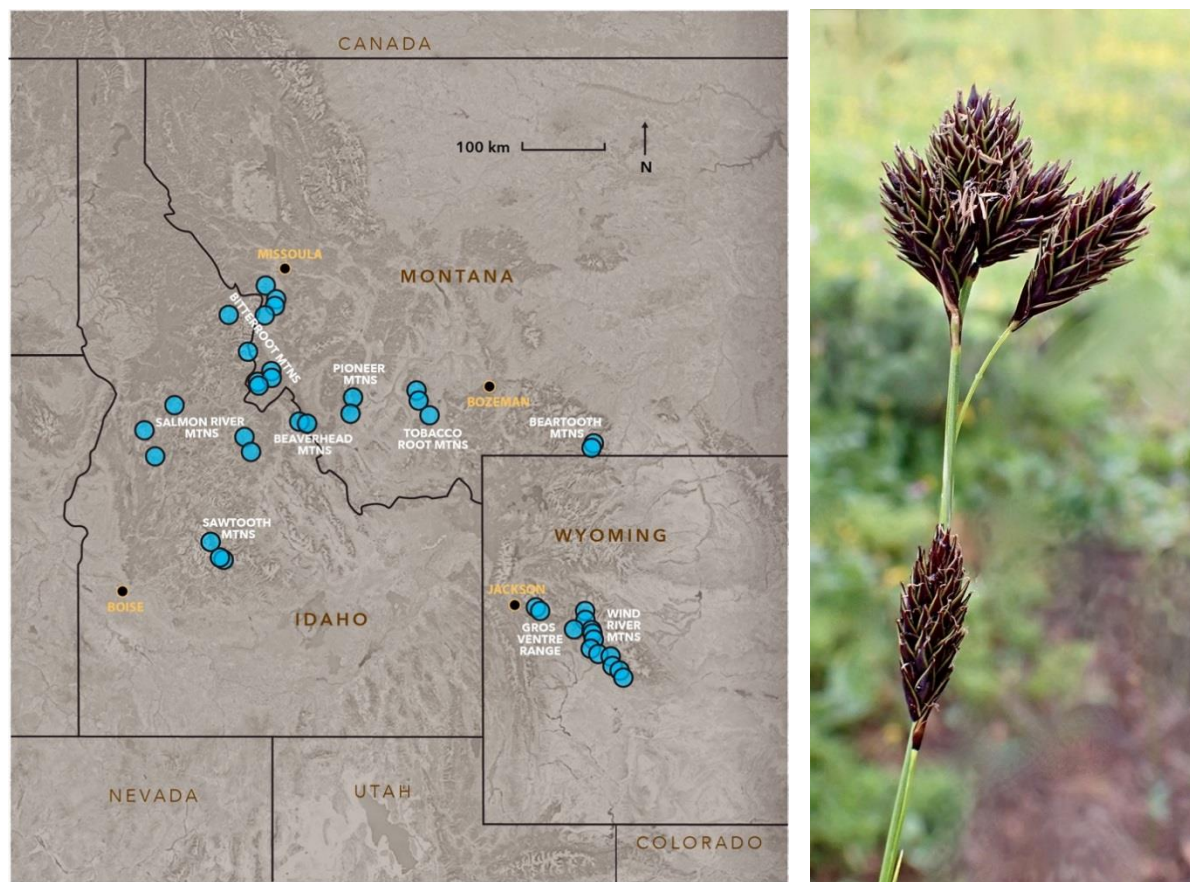


Figure 5. *Carex atropicata* Range Map. Figure 6. *Carex atropicata* “Darkspike sedge” inflorescence.

**Discussion.** *Carex atropicata* perigynia are glabrous (rarely with a few marginal hairs toward the tip), shiny, smooth margined, tapered to the tip, and mostly evenly dark colored (Figure 2a), while the perigynia of *C. luzulina* are usually ciliate on the upper margins and infrequently with hairs on the faces, dull, with distinct beaks, and blotchy coloration (Figure 2b). *Carex atropicata* scales are evenly and consistently dark, often with only a fine midrib of a lighter shade, acute tipped, and with the midrib more often excurrent compared to *C. luzulina* scales which are a lighter brown color, with rounded tips, and midribs less often excurrent. Due to the dark scales and dark perigynia, specimens are often identifiable from herbarium images online. *Carex atropicata* leaves reach their maximum width of 4 mm (up to 6.5 mm in just one specimen, *Handley 6571*), while those of *C. luzulina* often reach to 7 (8.4) mm. *Carex atropicata* inflorescence architecture is also distinct, with all lateral spikes solely pistillate (rarely androgynous), and usually fewer small sub-terminal sessile to sub-sessile spikes than are found in *Carex luzulina*. Often, the distalmost peduncled lateral spike arises remotely but reaches to the level of the terminal cluster or slightly exceeds it (Figure 6), which never occurs in *C. luzulina*.

Dorn’s type for *Carex luzulina* var. *atropurpurea* (*Johnson 3*, Fig. 11) has a staminate terminal spike (as is often the case in *C. luzulina*). Now that we have examined all 75 vouchers from ASC, BRY, ID, MONTU, and RM, we see that 47 have at least one culm with a gynecandrous terminal spike (121 out of 317 total culms have gynecandrous spikes), and the rest of the terminal spikes are a combination of either staminate, pistillate, androgynous, or mixed (Figure 7).

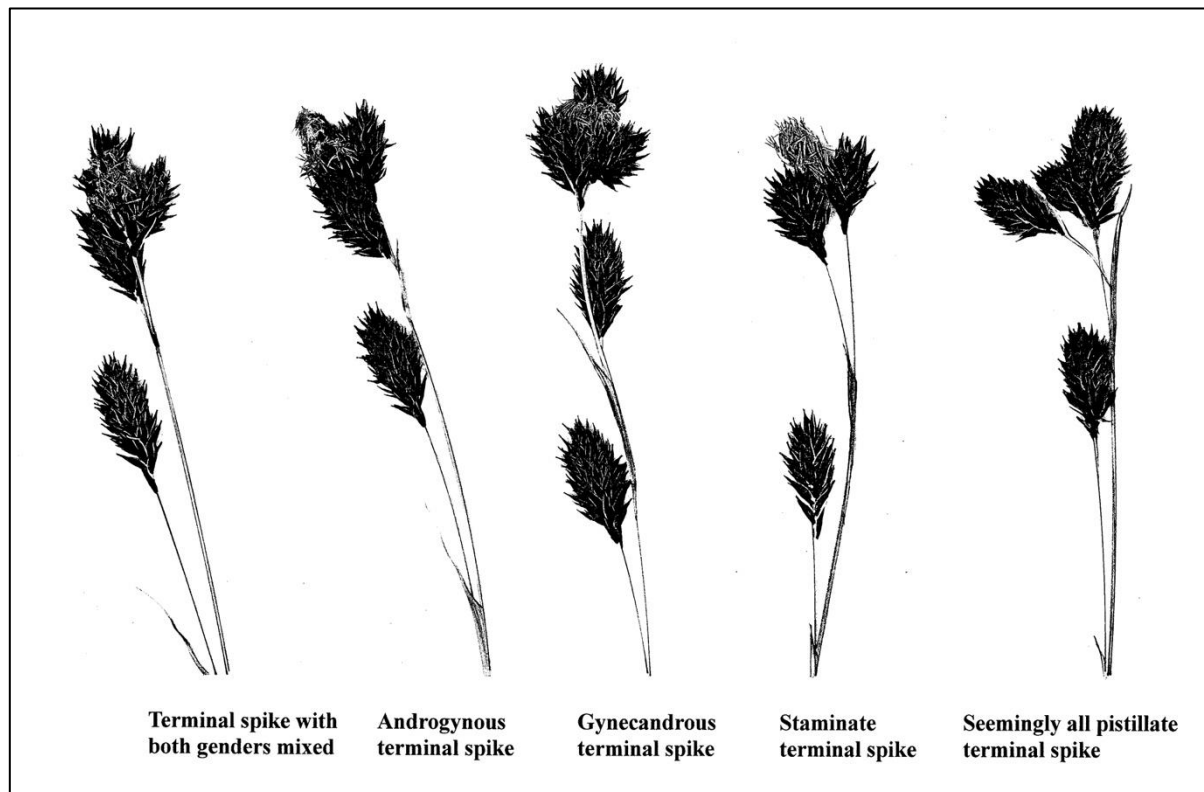


Figure 7. *Carex atrospicata* showing varying terminal spike gender arrangements.

*Carex atrospicata* shares the narrow leaf blades of *Carex lemmonii* but differs from *C. lemmonii* with its shorter culms, darker scales and perigynia, smooth-margined perigynia, and its terminal spikes of all sexual combinations.

*Carex atrospicata* shares the glabrous (rarely, a few hairs on the upper margin of few perigynia in a spike) perigynia of *Carex luzulifolia*. The perigynia of *Carex atrospicata* are narrower and taper to the beak rather than abruptly contracting to a parallel-sided elongate beak from a much wider body as in *C. luzulifolia*. The terminal spike(s) of *C. luzulifolia* are almost always staminate, with rounded, lighter scales, and look significantly different from the lateral spikes, while the terminal spikes of *C. atrospicata* are varied in their sexual arrangement, with acute, dark scales, and often appear similar to the lateral spikes. *Carex luzulifolia* has significantly broader maximum leaf widths than *C. atrospicata*.

*Carex atrospicata* differs from *C. fissuricola* in the same characters as it differs from *C. luzulina*. *Carex fissuricola* can have dark brown perigynia and scales, but the scales are typically less dark than the perigynia, whereas in *C. atrospicata* the scales and the perigynia are the same shade of dark. Also, both the scales and perigynia of *C. fissuricola* are scabrous, whereas those of *C. atrospicata* are glabrous.

At Upper Branham Lake in the Tobacco Root Mountains, where we collected the type (Rink 17674), we observed *Carex atrospicata* and *C. luzulina* in the same meadow, apparently distinct, without intermediates. The proportion of gynecandrous to staminate or androgynous terminal spikes on *C. atrospicata* culms varied from population to population in three subalpine meadows to the east of Upper Branham Lake.

Some *Carex atrospicata* specimens have inflorescences that we call paniculate (or branched), a character that has not been previously described for taxa in this section. The terminal spike

occasionally has one or more small sessile spikes attached at their bases. Similar small sessile spikes occasionally occur at the base of the lateral peduncled pistillate spikes. Robust specimens of *Carex luzulina* can exhibit this trait as well (Licher 6954, 6972; Rink 16162, 16165, 16188, 16209).

**Taxonomic history of *Carex luzulina* and its varieties.** Much of the early literature related to *Carex luzulina* and its varieties is brief, leading to a profusion of early descriptions of taxa that have been synonymized over time. Many of the characters that were originally used in descriptions and keys are no longer those that best describe the taxa as currently understood.

Ball & Mastrogiuseppe (2002) recognized two varieties of *Carex luzulina* Olney: var. *luzulina* and var. *ablata* (L.H. Bailey) Hermann, neither of which included Dorn's var. *atropurpurea*, presumably because Ball and Mastrogiuseppe had not become aware of Dorn's variety. What follows is a brief review of the historic classification of the five combinations given for *C. luzulina* varieties, taxonomic entities which we now consider to be two species with no varieties.

Olney (1867) described *Carex luzulina* Olney with *Bolander 4740* (Figure 12) from Mendocino Co., California as the type. *Bolander 4740* exhibits one end of an extreme range of spike morphology for this widespread and variable taxon. It has pistillate spikes that are dense, with widely spreading perigynia, so that the width to length ratio is greater than in those that have typically been called var. *ablata* (less dense spikes with strongly ascending perigynia). Bailey (1888) described *Carex ablata* L.H. Bailey with *J. Macoun 13401* (Figure 13) from Vancouver Island as the type, and *Carex herbariorum* L.H. Bailey (1892) from a batch of specimens found at the Olney Herbarium at Brown University (BRU) collected by Wheeler's expedition west of the 100<sup>th</sup> meridian, without collector, date, or location; indicated by Bailey to be closely allied with *Carex ablata* and *Carex luzulifolia*. Ball and Mastrogiuseppe (2002) cited *Carex herbariorum* as a synonym of *Carex luzulina* var. *ablata*.

Kükenthal (1909) proposed that *Carex ablata* be demoted to varietal level as *Carex luzulifolia* W. Boott var. *ablata* (L.H. Bailey) Kuk. Hermann (1968) later placed it as *Carex luzulina* Olney var. *ablata* (Bailey) Hermann, where it remained through publication in Ball and Mastrogiuseppe (2002). According to Hermann, "The great frequency of transitional forms between this and typical *Carex luzulina* make it impractical to attempt to maintain it in specific rank as was done by Mackenzie."

In the interim period, Nelson (1912) described *Carex owyheensis* with *Macbride 442* (Figure 14) from Owyhee County, Idaho, as the type. Nelson claimed that this taxon was probably closest to *Carex raynoldsii* Dewey (sect. *Racemosae* G. Don), however our examination of the type places it within a broadly defined *Carex luzulina*, which agrees with the interpretation of Ball and Mastrogiuseppe (2002), who placed it in synonymy under var. *ablata*.

The following couplet was used by Ball & Mastrogiuseppe (2002) to separate var. *luzulina* from var. *ablata*.

- a. Spikes dense; perigynia ± spreading, green or gold with red-brown or purple blotches; pale midvein of pistillate scales more than 0.2 mm wide and extending to tip ..... var. **luzulina**
- a. Spikes lax; perigynia ascending, purple at least distally; pale midvein of pistillate scales usually less than 0.2 mm wide and not extending to tip ..... var. **ablata**

Subsequently, Northwestern caricologists (Wilson et al. 2014; Zika, Hipp & Mastrogiuseppe 2012; Zika 2018), in their regional treatments, took Hermann's (1968) argument even further, eliminating these varieties. We examined over eighty specimens and found little correlation between the characters used in the Ball & Mastrogiuseppe varietal key. While the extremes of spike shape and perigynia orientation per Ball & Mastrogiuseppe look very different, specimens exhibit a cline between the two. The width of the pistillate scale midvein varied considerably even within the same inflorescence, as did how close the midvein came to the tip of the scale. Both plants with wider, denser



spikes of spreading perigynia and those with “lax” spikes of ascending perigynia present a similar variation in midvein widths. We have not found it possible to sort these plants into the Ball & Mastrogiuseppe varieties reliably, thus we find ourselves in tentative agreement with the more recent NW treatments, eliminating these varieties. Thus, with *Carex luzulina* var. *atropurpurea* subsumed into *C. atropicata*, *C. luzulina* is left as a variable species, without formal varieties, with the most widespread range of any species in the section, including all states (except Colorado) west of the Rockies, and British Columbia, Canada. The description of *C. atropicata* increases the number of species within sect. Luzulinae from 4 to 5.

#### KEY TO THE SPECIES IN SECT. LUZULINAE

Note: All species' perigynia will have some green color when young; this portion will usually fade to a lighter straw or golden brown (in *C. luzulifolia*) color when mature.

1. Perigynia generally glabrous throughout, infrequently with a few hairs on the upper margins.
  2. Maximum leaf blade width 5-11(-12) mm; perigynia 1.4-2.5 mm wide, green maturing to pale to chestnut brown; terminal spike staminate (rarely androgynous); proximal inflorescence bract sheath expanded distally, often with a purplish band at the mouth; plants of the Sierra Nevada and northern CA ..... **Carex luzulifolia**
  2. Maximum leaf blade width 1.9-4.5(-6.5) mm; perigynia 0.7-2 mm wide, pale green to dark brownish-black, and/or mottled; terminal spike staminate, androgynous, gynecandrous, pistillate, or mixed; proximal inflorescence bract sheath not expanded distally, without a purplish or brownish band (except rarely in *C. atropicata*); ranges various.
    3. Perigynia (3.4-)4-6.5(-7) mm long, 1-2 mm wide, tapered, without a definite shoulder; mature perigynia and pistillate scales uniformly dark, with only a narrow scale midvein and the marginal ribs or base of the perigynia sometimes of a lighter color; terminal spike staminate, androgynous, gynecandrous, pistillate, or mixed; ID, MO, WY ..... **Carex atropicata**
    3. Perigynia (2.5-)2.7-3.6(-4.3) mm long, 0.7-1.6 mm wide, acuminate, with a definite shoulder; pistillate scales and perigynia not uniformly dark, the scales usually with a contrasting wide light or green midvein and brown or hyaline sides, the perigynia either mottled or of uniformly light color; terminal spike staminate or androgynous; AZ, CA, NM.
      4. Inflorescence pale green to pale brown; perigynia mostly pale green (rarely dark brown), spreading to ascending; CA ..... **Carex lemmonii**
      4. Inflorescence forest green to brown in color; perigynia green with brown mottling, ascending; AZ, CA, NM ..... **Carex aff. luzulina**
1. Perigynia ciliate on the distal margins, distal faces hairy (in *C. fissuricola* and sometimes *C. luzulina*).
  5. Maximum leaf blade width 2.1-4.7 mm; perigynia (2.5-)3-3.5(-4.3) mm long, venation usually obvious, achene often filling more than one half of the perigynia, distance from achene apex to perigynium beak mostly less than 1.5 mm (up to 1.7 mm); pistillate scales hyaline, pale green, or light brown (spikes pale colored); CA ..... **Carex lemmonii**
  5. Maximum leaf blade width (3.1-)4-8.1(-10) mm; perigynia 3.2-5(-5.8) mm long, venation obvious or not, achene often filling less than one half of the perigynia, distance from achene apex to perigynium beak mostly 2 mm or more (rarely as little as 1.2 mm); pistillate scales reddish-brown to dark brown (almost black) (spikes dark colored); widely distributed in the Mountain West.
    6. Perigynia margins and faces hairy, especially distally, sometimes uniformly dark colored; CA, NV ..... **Carex fissuricola**
    6. Perigynia margins hairy, faces hairy or glabrous, not uniformly dark colored; widely distributed in the Mountain West ..... **Carex luzulina**

**Future work within sect. *Luzulinae*.** 1) During the course of our work with this section, Rink discovered several new, disjunct populations of tentative *Carex luzulina* in Arizona, referred to above as *Carex* aff. *luzulina*. These plants differ from most *C. luzulina* specimens in having shorter, mostly glabrous perigynia and narrower leaves (Figure 8), similar to plants seen at one location each in CA and NM (couplet 3 above separates this entity from *C. atrospicata*). 2) *Carex fissuricola* was not sampled by Jiménez-Mejías et al. (2016) which leaves the question of how closely related *C. luzulina* and *C. fissuricola* may be, given the degree of overlap in the characters currently used to separate the two. 3) Questions remain regarding the synonymy of *C. albida* and *C. lemmonii*. We are working with Jiménez-Mejías to resolve these issues. We hope this collaboration will allow for further clarification of relationships within sect. *Luzulinae*.



Figure 8. *Carex* aff. *luzulina* from Mogollon Rim, Arizona.

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Figure 9. Mancuso 310, used as *Carex fissuricola* in Jiménez-Mejías et al. (2016). This specimen is actually *Carex atrospicata*.



Figure 10. *Carex atrospicata* G. Rink & Licher type specimen (Rink 17674).



Figure 11. *Carex luzulina* var. *atropurpurea* Dorn type specimen (Johnson 3).



Figure 12. *Carex luzulina* Olney type (Bolander 4740).





Figure 13. *Carex ablate* L.H. Bailey type (Macoun 13401).



Figure 14. *Carex owyheensis* A. Nels. type (Macbride 442).

## APPENDIX A

**Additional specimens examined. *Carex atropiscata*. Idaho.** Custer: Sawtooth Mtns, Alpine Lake, 28 Jul 2021, *Rink 16979* (ASC); east ridge of Mt. Cramer above Profile Lake, 3 Aug 2009, *Mansfield 9327B* (ID); Clearwater NF, Wind Lakes near Fridays Pass, 20 Aug 1923, *Kirkwood 165* (RM); Payette NF, Josephine Lakes, 13 Jul 2000, *Handley 6571* (RM); Idaho: Wahoo Pass Selway-Bitterroot National Forest, 26 Jul 2014, *Thomas 4562* (ID); Hump Lake, Buffalo Hump, 19 Aug 1954, *Baker 12716* (ID); Lemhi: Bighorn Crags, Wilson Creek, 3 Aug 1990, *Atwood 14218* (ID); Salmon NF, Beaverhead Mtns, Smout Creek, 1 Aug 2010, *Irwin 3354* (RM); Valley: 1 mile northeast of Pearl Lake, 25 Jul 1989, *Ertter 8735* (ID). **Montana.** Beaverhead Co.: Pioneer Mtns, Waukena Lake, 1 Jul 1945, *Hitchcock 13042* (RM); Beaverhead Mtns, Kelly Creek, 20 Jul 2005, *Evert 41383*, (RM); Pioneer Mtns, Tent Lake, 18 Jul 2005, *Evert 41347* (RM); Tweedy Mtn., 3 Aug 2006, *Lesica 9666* (MONTU); Deer Lodge: Storm Lake, Anaconda-Pintlar Mtns., 4 Sep 1981, *Lesica 1856* (MONTU); Storm Lake, Anaconda-Pintlar Mtns., 13 Aug 1972, *Lackschewitz 3921* (MONTU); Warren Lake, Anaconda-Pintlar Mtns., 24 Aug 2974, *Lackschewitz 5690* (MONTU); Granite: Skalkaho-Rye Road, Cougar Creek, Sapphire Mtns., 20 Aug 1985, *Pierce 1471* (MONTU); Madison: Tobacco Root Mtns, Branham Lakes Campground, 4 Aug 2023, *Rink 17674*; Tobacco Root Mtns, Branham Lakes Campground, 17 Jul 2002, *Evert 39469* (RM); Tobacco Root Mtns, S of Curly Lake, 15 Jul 2003, *Evert 40364* (RM); Tobacco Root Mtns., Branham Lakes Campground, 3 Aug 2023, *Licher 6676* (ASC), Branham Lakes Campground, 4 Aug 2023, *Rink 17682* (ASC); Mineral: Bitterroot Range above Upper Bonanza Lake, 10 Sep 2020, *Lesica 11976* (MONTU); Missoula: Bitterroot NF, Carlton Lakes, 21 Aug 1959, *Macdonald 1740* (RM); Bitterroot NF, Carlton Lake, 8 Sep 1968, *Lackschewitz 1045* (two sheets, MONTU); Ravalli: Trapper Peak, Bitterroot NF, 20 Jul 1968, *Arno 131* (MONTU); Bitterroot Mtns, Boulder Ridge, 7 Aug 1968, *Lackschewitz 591* (RM); Lake Jerusalem, Bitterroot Mtns., 11 Aug 1968, *Lackschewitz 658* (MONTU); Lower Little Duffy Lake, Bitterroot Mtns., 23 Aug 1968, *Lackschewitz 876* (MONTU); Watchtower Trail Pass, Bitterroot-Selway Divide, 27 Jul 1969, *Lackschewitz 1538* (MONTU); Watchtower Trail Pass, Bitterroot-Selway Divide, 28 Jul 1969, *Lackschewitz 1539* (MONTU); Bitterroot Mtns, below Watchtower Peak, 27 Jul 1969, *Lackschewitz 1602* (MONTU, RM); East St. Joseph Peak, Bitterroot Mtns., 31 Jul 1969, *Lackschewitz 1640* (MONTU, two sheets); East St. Joseph Peak, Bitterroot Mtns., 31 Jul 1969, *Lackschewitz 1649* (MONTU); Ranger Peak, Bitterroot Mountains, 23 Aug 1969, *Lackschewitz 1856* (MONTU); Ranger Peak, Bitterroot Mountains, 23 Aug 1969, *Lackschewitz 1857* (MONTU); Ranger Peak, Bitterroot Mountains, 23 Aug 1969, *Lackschewitz 1925* (MONTU, RM); Hart Lake, Chaffin Cr. Lake Basin, Bitterroot Mtns., 31 Aug 1969 *Lackschewitz 2018* (MONTU); Tamarack Lake, Chaffin Cr. Lake Basin, Bitterroot Mtns., 31 Aug 1969, *Lackschewitz 2039* (MONTU); Bitterroot NF, Chaffin Creek, 31 Aug 1969, *Lackschewitz 2056* (MONTU, RM); St. Joseph Peak, Bitterroot Mtns., 24 Jul 1971, *Lackschewitz 2964* (MONTU); St. Joseph Peak, Bitterroot Mtns., 24 Jul 1971, *Lackschewitz 2966* (MONTU); Nelson Lake, Bitterroot Mtns., 2 Aug 1971, *Lackschewitz 3151* (MONTU); Chaffin Lakes Basin, Bitterroot Mtns., 7 Aug 1971, *Lackschewitz 3179* (MONTU); Heavenly Twins, Bitterroot Mtns., 15 Aug 1971, *Lackschewitz 3270* (MONTU); East Lake, Canyon Lakes Basin, Bitterroot Mtns., 23 Aug 1971, *Lackschewitz 3378* (MONTU); Chaffin Peak, Bitterroot Mtns., 30 Aug 1971, *Lackschewitz 3395* (MONTU). **Wyoming.** Fremont Co.: Wind River Range North Fork Popo Agie Creek, 24 Jul 1959, *Johnson 3* (RM); Wind River Range, Klondyke Lake, 20 Aug 2006, *Massatti 8945* (ID, RM); Wind River Range, Golden Lake, 17 Aug 2006, *Massatti 8758* (RM); Wind River Range, North Fork Bull Lake Creek, 27 Jul 2006, *Massatti 8409* (RM); Wind River Range, Brown Cliff Lakes, 26 Jul 2006, *Massatti 8130* (RM); Wind River Range, Golden Lakes, 25 Jul 2006, *Massatti 8031* (RM); Wind River Range, Lonesome Lake, 6 Jul 2006, *Massatti 7086* (RM); Wind River Range, Deep Creek and Echo Lakes, 5 Jul 2005, *Massatti 6961* (RM); Wind River Range, North Fork Popo Agie River, along Lizard head Trail, 15 Aug 2020, *Rink 16735* (ASC); Sublette: Wind River Range, Black Joe Canyon, 19 Jul 1991, *Fertig 9794* (RM); Wind River Range, Summit Lake, 31 Jul 1990, *Fertig 4973* (RM); Wind River Range, ¼ mile west of North Fork Peak, 26 Jul 1991, *Fertig 10342* (RM, WS); Wind River Range, Rainbow Lake, 21 Aug 1991, *Fertig 11982* (RM); Gros Ventre

Range, southwest of Red Hills, 2 Aug 1994, *Hartman 49135* (RM); Teton: Gros Ventre Range, northeast flank of Steamboat Peak, 5 Aug 1994, *Hartman 49296* (RM).

**Carex luzulina. British Columbia.** Lake House, Skagit River, 9 Jul 1905, *Macoun 78125* (F). **Arizona:** Coconino Co.: head of E. Clear Creek about 2 kms ne of Potato Lake, 22 Jun 2017, *Rink 14713* (ASC); Turkey Canyon, 2 Jul 2023, *Rink 17539, 17546* (ASC); Turkey Canyon, 3 Jul 2023, *Rink 17551, 17555* (ASC); Beaver Canyon, 3 Jul 2023, *Rink 17560, 17561, 17563* (ASC); Turkey Canyon, 10 Jul 2023, *Licher 6645* (ASC). **California.** Inyo: Onion Valley entrance 23 Jul 1969, *DeDecker 2305* (F); Marin: on the road to Pt. Reyes, 7 Jun 1936, *Howell 12641* (F); Mendocino: near Pt. Arena, 31 Jul 1937, *Stacey 4473* (F); San Luis Obispo: Cypress Mtn., 8 May 1982, *Keil 16031* (OBI); Siskiyou: Wagon Creek, Mt. Eddy, 2 Jul 1922, *Heller 13674* (F); S. Fork of the Salmon River, 23 Jul 1937, *Howell 13332* (F). **Idaho.** Custer: Lola Creek valley, 9 Aug 2010, *Irwin 3826* (RM); southern Salmon River Mtns., 17 Aug 2011, *Irwin 8065* (RM); Salmon River Mtns., 25 Jul 2007, *Evert 42063* (RM); southern Salmon River Mtns., 4 Aug 2012, *Irwin 8909* (RM); Elmore: Sawtooth Mtns., Mattingly Creek, 3 Aug 2021, *Rink 16993* (ASC); Middle Fork of the Boise River at Rock Creek, 26 Jul 2021, *Rink 16968* (ASC); Fremont: Yellowstone Plateau, 30 Jul 2002, *Evert 39623* (RM); Idaho: Salmon River Mtns., Wallis Cabin, 15 Aug 1999, *Handley 3611* (RM); Salmon River Mtns., 14 Jul 2000, *Handley 6670* (RM); Salmon River Mtns., 4 Aug 2000, *Handley 7818* (RM); Lemhi: northern Salmon River Mtns, Long Tom Ridge, 31 Jul 2011, *Irwin 7189* (RM); Salmon River Mtns., China Spring area, 12 Aug 2010, *Irwin 4034* (RM); Salmon River Mtns., Big Boulder Meadow, 30 Jul 2011, *Irwin 7031* (RM); Owyhee: Silver City, 20 Jul 1910, *MacBride 442* (RM); Shoshone: Steven's Peak, 4 Aug 1895, *Leiberg 1454* (F); Valley: Sawtooth Mtns., Gold Fork Lookout, 13 Jul 1937, *Thompson 13833* (F); Frank Church-River of No Return Wilderness, Lick Creek Trail to Lick Lake, 24 Jul 1999, *Handley 2419* (RM); Hartley Meadows, 4 Aug 1999, *Handley 3032* (RM); Salmon River Mtns., Lick Creek Road, 23 Jul 1999, *Handley 2224* (RM); Salmon River Mtns., Logan Creek, 21 Jul 1999, *Handley 2166* (RM); Salmon River Mtns., Secesh Summit, 30 Jul 1999, *Handley 2682* (RM); Salmon River Mtns., Snowslide Lake Trail, 3 Aug 1999, *Handley 2910* (RM). **Montana.** Beaverhead: Beaverhead Mtns., Twin Lakes Campground, 26 Jun 2006, *Evert 41657* (RM); Pioneer Mtns., E of Waukena Lake, 1 Aug 1945, *Hitchcock 13148* (RM); Pioneer Mtns., Tent Lake 18 Jul 2005, *Evert 41350* (RM); Chateau: Bitterroot Nationa Forest, Tolan Creek Road, 13 Sep 1972, *Presby 184* (RM); Madison: Tobacco Root Mtns., Branham Lakes Campground, 17 Jul 2002, *Evert 39490* (RM); Tobacco Root Mtns., Branham Lakes Campground, 3 Aug 2023, *Licher 6677* (ASC); Tobacco Root Mtns., Branham Lakes Campground, 4 Aug 2023, *Rink 17682* (ASC); Ravalli: Bitterroot Mtns., 1 mile e of Chaffin Lakes Basin, 9 Aug 1971, *Lackschewitz 3253* (RM); Silver Bow: Jerry Creek, 11 Jul 1973 *Stickney 2954A* (RM); Yellowstone NP, 10 Aug 1897, *Rydberg 3756* (F). **Nevada.** Carson City: Carson Range, 20 Jul 2016, *Tiehm 17596* (OBI); Elko: Copper Mtns., 30 Jun 2017, *Tiehm 17977* (ASC); Ruby Mtns., Overland Lake, 19 Jul 2021, *Tiehm 18960* (ASC); Ruby Mtns., Lamoille Cyn., 16 Jun 2024, *Rink 18101*; E. Humboldt Range, 20 Jul 1986, *Tiehm 10801* (BRY); Ruby Mtns. Seitz Lake, 16 Sep 1983, *Goodrich 20155* (BRY); Wells, 23 Jun 1882, *Jones sn* (OBI); E. Humboldt Mtns., 8 Aug 1881, *Jones sn* (F); Jarbidge Mtns, 9 Aug 2019, *Rink 16162, 16165* (ASC); Jarbidge Mtns, 11 Aug 2019, *Rink 16188* (ASC); Jarbidge Mtns, 9 Aug 2019, *Rink 16209* (ASC); Washoe: Carson Range, 10 Aug 2017, *Tiehm 18005* (BRY). **Oregon.** Baker: Blue Mtns. Rock Creek Lake, 12 Aug 1915, *Peck 6307* (F); Deschutes: Brokentop Mtn., 14 Jul 1925, *Peck 14395* (F); Hood River, Lost Lake 26 Jun 1921, *Peck 9902* (F); Jackson: Grouse Gap, 22 Jul 2010 *Zika 25208* (MICH); Mt. Ashland, 13 Jul 1013, *Peck 3381* (F); Josephine: Siskiyou Mtns., 29 Jul 1902, *Cusick 2918* (F); Klamath: Crater Lake, 22 Aug 1902, *Cusick 2967* (F); Marian: Silverton Falls, ? Jul 1871, *Hall sn* (F); **Utah:** Salt Lake: Alta, 18 Aug 1879, *Jones sn* (F, two specimens). **Washington.** King/Chelan: Steven's Pass, 9 Aug 1893, *Sandberg 707*, (F); Steven's Pass, ? Aug 1893, *Sandberg sn*, (F); Kittitas: Snoqualmie Pass, 31 Jul 1921, *Wiegand 410* (F); Skamania: Mount Paddo, 7 Sep 1904, *Suksdorf 4323* (F); Mount Paddo, 5 Aug 1905, *Suksdorf 4353* (F); Mount Paddo, 20 Aug 1905, *Suksdorf 4353* (F); Mt. Adams, 9 Aug 1882, *Howell sn* (F); Yakima: Yakima region, ? Aug 1882, *Tweedy 56* (F). **Wyoming,** Park: Yellowstone Plateau, 14 Aug 1984,

*Evert 7513* (RM); Teton: Bitch Creek at Trail 008, 21 Jul 2021, *Rink 16958* (ASC); Badger Creek, 21 Jul 2021, *Rink 16957* (ASC); mouth of Waterfalls Canyon, 1 Jul 2006, *Scott 1272* (RM, two specimens); west shore of Jackson Lake, 25 Jun 2006, *Scott 1000* (RM); near Glade Creek, 5 Aug 2006, *Scott 2752* (RM); near Glade Creek, 15 Aug 2007, *Scott 5536* (RM); east slope of Ranger Peak, 17 Jun 2006, *Scott 706* (RM); Bradley Lake, 11 Jul 1991, *Marriott 11383* (RM); Grassy Lake Road w of Flagg Ranch, 9 Jul 1959, *Porter 7881* (RM); Loon Lake, 28 Aug 2018, *Mancuso 4668* (RM); N. fork Teton Canyon, 5 Jul 2021, *Rink 16903* (ASC); Lower Alaska Basin, 23 Aug 1957, *Lewis 760* (RM); Tillery Lake, 13 Aug 2007, *Hartman 86556* (RM); Grand Teton NP, 31 Jul 1956, *Anderson 597* (RM); North Fork of Teton Creek, 26 Jul 1991, *Hartman 30644* (RM); trailhead to Indian Meadows, 28 Jul 1991, *Hartman 30734* (RM); Trapper Lake, 27 Jul 1996, *Evert 32345* (RM); Bearpaw Lake, 27 Jul 1996, *Evert 32314* (RM); W of Glade Creek, 7 Jul 1994, *Evert 27811* (RM); Yellowstone NP, 2 miles n of West Thumb, 20 Aug 1980, *Dorn 3650* (RM, two specimens); East Delacy Creek, 10 Aug 1897, *Rydberg 3756* (RM); Lewis River, 9 Aug 1899, *Nelson 6380* (RM); Lewis River, 23 Jul 1963, *Johnson 408* (RM); Yellowstone NP, Upper Basin, 17 Jul 1906, *Cooper 103y* (RM); West Delacy Creek, 4 Aug 1899, *Nelson 6306* (RM); Loon Lake, 13 Jul 2015, *Heidel 4169* (RM); Arnica Creek, 5 Jul 2001, *Evert 38863* (RM); Mountain Ash Creek, 6 Aug 2003, *Evert 40619* (RM); Spring Creek, 10 Aug 2002, *Evert 39857* (RM); 3 miles south of Old Faithful, 2 Aug 2003, *Evert 40607* (RM); Beula Lake, 7 Aug 2005, *Evert 41453* (RM); Fairy Falls, 26 Jul 2002, *Evert 39589* (RM); 7 miles ese of Old Faithful, 27 Jul 2004, *Evert 41043* (RM); Little Firehole Meadow, 5 Jul 2003, *Evert 40217* (RM); n shore of Shoshone Lake, 14 Jul 1987, *Evert 13304* (RM); Phantom Campsite on the Pitchstone Plateau, 24 Jul 2003, *Evert 40527* (RM); above Fall River, 29 Jul 1987, *Dorn 4729* (RM).