NEW AND NOTEWORTHY REPORTS OF LICHENS AND ALLIED FUNGI TO COLORADO (U.S.A.), INCLUDING DESCRIPTIONS OF TWO SPECIES NEW TO SCIENCE

Erin A. Manzitto-Tripp[1,2*], Jacob L. Watts[2], Seth J. Raynor[1,2]

[1]Museum of Natural History, University of Colorado, UCB350, Boulder, Colorado 80309, U.S.A.
[2]Dept. of Ecology & Evolutionary Biology, University of Colorado, UCB334, Boulder, Colorado 80309, U.S.A.
[*]Author for correspondence: erin.manzittotripp@colorado.edu

ABSTRACT

Colorado's southern Rocky Mountains and adjacent High Plains are home to some of the most vast, intact, and minimally disturbed natural ecosystems remaining in the western United States. Colorado moreover ranks among the top 10 states in the USA for percentage of land that is in the public domain, and hence has a very long history of land conservation, stewardship, and research and interest in natural history. Despite extensive knowledge gained about the biota of Colorado over the prior century, the lichens of Colorado have never been thoroughly nor comprehensively inventoried beyond the geographically and/or temporally limited efforts by a handful of scholars over the years. Three years ago, we launched a large-scale study of the state's lichen biota, targeting all ecosystems, elevations, geographical regions, and substrates. Our field collections and subsequent identification efforts have revealed the magnitude of the task ahead: a first full and comprehensive lichen inventory. Here, we describe two new species of *Caloplaca s.l.* to science, *Tassiloa friogranitica* and *Pyrenodesmia praemonatana*, provide IUCN conservation assessments for both, and discuss their morphological and molecular affinities to close allies. Finally, we report on 32 species of lichens and allied fungi newly documented in Colorado to our knowledge, along with an additional 17 species otherwise known only from one or a few pre-existing collections in the state.

RESUMEN

Las Montañas Rocosas del sur de Colorado y las llanuras altas adyacentes albergan algunos de los ecosistemas naturales más vastos, intactos y menos alterados que quedan en el oeste de los Estados Unidos. Además, Colorado se encuentra entre los 10 estados de EE. UU. con mayor porcentaje de terreno de dominio público, lo que le confiere una larga tradición en materia de conservación, gestión e investigación del territorio, así como un gran interés por la historia natural. A pesar de los amplios conocimientos adquiridos sobre la biota de Colorado durante el siglo pasado, los líquenes de Colorado nunca han sido inventariados de forma exhaustiva y completa, más allá de los esfuerzos limitados geográfica y/o temporalmente realizados por un puñado de estudiosos a lo largo de los años. Hace dos años, iniciamos un estudio a gran escala de la biota de líquenes del estado, centrándonos en todos los ecosistemas, altitudes, regiones geográficas y sustratos. Nuestras recolecciones de campo y los posteriores esfuerzos de identificación han revelado la magnitud de la tarea que tenemos por delante: un primer inventario completo y exhaustivo de los líquenes. Aquí describimos dos nuevas especies de *Caloplaca* s.l. para la ciencia, *Tassiloa friogranitica* y *Pyrenodesmia praemonatana*, proporcionamos evaluaciones de conservación de la UICN para ambas y discutimos sus afinidades morfológicas y moleculares con sus parientes cercanos. Por último, informamos sobre 32 especies de líquenes y hongos afines documentadas por primera vez en Colorado, según nuestro conocimiento, junto con otras 17 especies que solo se conocían por una o varias colecciones preexistentes en el estado.

INTRODUCTION

The southern Rocky Mountains, which includes many of the highest peaks and flanking high plains of the continental United States, is rich in species with narrow ecological affinities to landscapes sensitive to environmental modification (Neely et al. 2001). This region represents a biological mosaic of environments including high elevation tundra, talus, and vast subalpine areas receiving year-round precipitation, shaded riparian woodlands along canyons and waterways, semi-arid piñon-juniper mesas, extensive short-grass prairies, shrub-sagebrush communities, treeless high desert steppe and dunes, and of course, ruderal environments typical of human-perturbed landscapes. In the midst of this brilliant mosaic are the headwaters of many of the highest-flowing rivers of the American West. Unsurprisingly, given this landscape splendor and diversity, there exists a long legacy of botanical exploration of the region, beginning with the important collections made by Edwin James on Long's Expedition of 1820 (see Weber & Wittman 2012 for a history of botanical exploration in Colorado; also see Weber & Wittmann 2007; Ackerfield 2022).

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In contrast to this rich history of plant exploration in the area, the lichens of Colorado, United States of America (hereafter, USA), have received considerably less attention. Lichens are obligate symbiotic organisms that serve as are core constituents of ecosystems comprising the southern Rocky Mountains, where they span numerous habitat types and microniches (Anderson 1962, 1964; Anderson & Carmer 1974; Carmer 1975; Diaz & Manzitto-Tripp 2023; Flock 1978; Manzitto-Tripp et al. 2025; Raynor et al. 2023, 2024, 2025; Raynor & Manzitto-Tripp in revision; Shrestha & St. Clair 2009; Shushan & Anderson 1969; Tripp 2015, 2017; Tripp et al. 2018, 2019; Watts et al. 2024, 2025; Weber & Shushan 1955). Here, like elsewhere, they contribute core ecological functions including nitrogen fixation, primary decomposition and soil formation, provision of habitat for invertebrates and other organisms, and participation in nutrient cycling (Asplund & Wardle 2017). Early research on the Colorado lichen biota includes the work of Weber and Shushan (1955), Anderson (1962) and Anderson (1964), followed by Weber (1965), Shushan and Anderson (1969), and additional works (Anderson & Carmer 1974; Carmer 1975; Flock 1978). Amongst the most impact of collectors were Sam Shushan, Roger Anderson, and William Weber, although thousands of collections made by the first two individuals remain unidentified and stored in boxes at COLO and BRY.

Because of a lack of organismal expertise that plagues many portions of the world including the USA, lichens are among the least recognized macro-organisms from a conservation planning and action standpoint (Allen et al. 2019; Wrobleski et al. 2023). They are also among the most threatened of any class of organisms, as a function of their obligate symbioses between unrelated partners (which contributes to drivers of rarity), their sessile life history strategy, their sensitivity to pollutants, and their reliance on intact habitats with unaltered substrates (rocks, trees) for continued livelihood (Allen 2017).

Nonetheless, large regional lichen inventories have been conducted in several portions of the USA. These areas include but are not limited to the southern Appalachian Mountains (Tripp & Lendemer 2019a, b), Pacific Northwest (McCune 2017), and Greater Sonoran Desert (Nash et al. 2002, 2004, 2007). Despite the unique geographical position and ecological amplitude characteristic of the southern Rocky Mountains and adjacent high plains, this area has never been comprehensively inventoried for its lichens. The (1) ruggedness and remoteness of much of the state coupled with (2) a very short season in which alpine and subalpine habitats are accessible for fieldwork and (3) the paucity of lichen taxonomic expertise have all contributed to this overall history of under-collection and lichen biodiversity inventory.

In more modern times, very few researchers have published on the lichen biota of Colorado. Henson et al. (2013) surveyed granitic rocks in Rocky Mountain National Park, but her research documented only 81 species. Shrestha and St. Clair (2009) made further additions to the lichen flora of the state in southwestern Colorado. Manzitto-Tripp (Tripp 2015, 2017; Tripp et al. 2019) inventoried the lichens of an uncommon outcropping of Fox Hills sandstone leading to the discovery a surprisingly diverse lichen community and several species new to science. However, that work was geographically restricted to small outcrops in Boulder County, reflecting the limited extent of locations in which this sandstone formation is exposed at the surface. Thus, while both earlier and modern studies have increased knowledge of the lichens of Colorado, there have been no prior attempts to comprehensively document lichen biodiversity of the state. This is especially the case with the crustose element of the lichen biota, which is likely to comprise upwards of 65% or more of the state's total (Manzitto-Tripp et al. 2022). Among these are numerous species that represent either new state records or are not yet described as new to science (Manzitto-Tripp, Raynor, & Watts, in progress). Thus, despite their ecological amplitude and functional significance, and although core constituents of the western North American biota as a whole, lichen biodiversity remains woefully understudied in the southern Rocky Mountains and adjacent high plains of Colorado.

We predict that the diversity of landscapes and habitats spanning Colorado has given rise to a both a taxonomically rich and oftentimes ecologically rare lichen biota, with biogeographical affinities to a wide range of regions ranging from the eastern temperate hardwood forests to northeastern Maritime habitats, the Pacific Northwest, the Canadian Rockies, the Sonoran Desert, and the Great Plains. Indeed, our earliest work in Colorado yields evidence in support of this hypothesis (Diaz & Manzitto-Tripp 2023; Manzitto-Tripp et al.

2025; Raynor et al. 2023, 2024, 2025; Raynor & Manzitto-Tripp in revision; Tripp 2015, 2017; Tripp et al. 2018, 2019; Watts et al. 2024, 2025;). The present study reports on (1) two new species of *Caloplaca* s.l. to science: *Tassiloa friogranitica* and *Pyrenodesmia praemontana*; (2) numerous range extensions of lichen species documented in Colorado for the first time; and (3) noteworthy reports of lichen species previously known only from one or a few pre-existing collections in the state. This work contributes to our recently launched comprehensive inventory of lichen biodiversity of the southern Rocky Mountains (Manzitto-Tripp, Raynor, and Watts, in prep.).

METHODS

Field Work.—Fieldwork to comprehensively document the lichens of Colorado began in earnest in the summer of 2022 by the authors, with sporadic collections having been made in prior years by the first author. Our work began with focused inventories of two specific regions, both in the Front Range Mountains that form the skyline west of the Boulder-Denver metropolis: (1) lichens of the Indian Peaks Wilderness in Arapaho-Roosevelt National Forest (Raynor & Manzitto-Tripp, in review) and (2) lichens of Boulder's Open Space and Mountain Parks (OSMP) (Watts & Manzitto-Tripp, in prep.). Intensive lichen fieldwork was conducted in both locations during the summers of 2022 and 2023. Additionally, sporadic lichen collections were made by all three authors in other areas in a fortuitous manner, between 2022 and 2024. The two new species described below were first collected by the first author in prior years (i.e., 2015 and 2016), and a second population of one of the two new species was recently discovered 2024.

Our field sampling was designed to target all major habitat types (e.g., alpine, subalpine, lower montane, grassland transition zones, riparian areas, exposed steep slopes) and all substrates suitable for lichen growth (e.g., rock, bark, lignum, and decaying wood, soil, bryophytes, sap). We placed special emphasis on difficult to reach, off-trail terrain that was unlikely to have been sampled for lichens in earlier times, as well as mesic canyons and corridors that we predicted could harbor unusual diversity. Field photographs were labeled and archived for future use.

Herbarium Study.—Final lichen identifications were made at the University of Colorado, Museum of Natural History, COLO Herbarium (Thiers, ongoing) using an Olympus SZX16 and Olympus BX51 coupled to an Olympus EP50 camera. Samples were hand-sectioned then examined in water mounts along with other media (e.g , in K or stains). Where necessary to isolate spores from asci (e g , in both species herein newly described in Section III), we placed thin sections in a water mount, used a lighter to boil these water mounts for one second, then placed coverslips over water mounts prior to examination following methods in Vondrák et al. (2013). Spot tests using standard reagents (KOH, C, KC, P, I, HNO3) were conducted as needed. Additionally, Thin Layer Chromatography (following Culberson 1972 and utilizing Solvent C) and/or DNA sequencing (nrITS locus, methods as described in Watts et al. 2024) was conducted on a subset of specimens to help confirm their identifications where necessary. In addition to study of our own newly collected materials, we examined material housed at COLO using similar methods to the above, providing annotations where necessary. This includes a large donation of earlier collections made by S. Shushan and R. Anderson that were recently gifted to COLO from BRY but not yet accessioned at the former institution. All collections cited below were verified by the authors and as such, we do not include a "!" following any of the studied specimen citations, unless in reference to a type specimen housed elsewhere.

We referenced our collections against published literature, floras and field guides, existing herbarium material, and the Consortium of Lichen Herbaria. Our taxonomy follows Esslinger (2021) for the most part. Data and specimens reported in this study are deposited at COLO and data are being uploaded to COLO's database, which is hosted on the Consortium of Lichen Herbaria (lichenportal.org). As the vast majority of lichen herbaria in the USA deposit their data at the Consortium, we used this resource as our initial authority for determining whether a given species was a new state record. We then verified these decisions with published literature, where available. We preface this with the caveat that several records on the Consortium remain unverified and misidentified. We addressed this concern as much as possible using published literature, where available.

DNA Extraction and Molecular Analyses.—We extracted genomic DNA from *E. Manzitto-Tripp 11352*, *11356*, and *E. Manzitto-Tripp & W. Manzitto-Tripp 11381* (*Tassiloa friogranitica*) as well as *E. Tripp 5866*, *E. Manzitto-Tripp & J. Watts 10500*, & *J. Watts & E. Henry 1931* (*Pyrenodesmia praemontana*), all housed at COLO, using a modified CTAB method (Doyle & Doyle 1987). We amplified the nrITS region (including 5.8s) from material of all collections using Promega PCR Master Mix as well as ITS4 and ITS5 primers (White et al. 1990). All six accessions yielded PCR products, which were sent to Quintara Biosciences (Cambridge, MA) for cleanup and bidirectional Sanger Sequencing. All wet lab work was conducted in the molecular laboratory of the first and second authors at the University of Colorado.

To place the putative new species in a phylogenetic context, we used Wetmore (1994), Arup et al. (2013), Kondratyuk et al. (2015), and Frolov et al. (2021) to help guide the assembly of two phylogenetic matrices: one for *Tassiloa* and the second for *Pyrenodesmia*. These matrices were assembled by downloading nrITS sequences from a range of taxa representative of major lineages of Teloschistaceae sensu Arup et al. (2013), i.e., Caloplacoideae, Teloschistoideae, and Xanthorioideae. Pending results of early BLAST analyses (data not shown), sampling was further concentrated within the first two lineages. Our final matrices consisted of a total of 28 and 38 terminals, respectively. We used maximum likelihood methods implemented in raxml 2.0 (Edler et al. 2020) and an ML + transfer bootstrap + consensus algorithm with a GTR+I model of sequence evolution and 100 bootstrap replicates. A 50% majority rule consensus tree was visualized in FigTree v1.4.4 (Rambaut 2020) and modified in Adobe Illustrator v28. Relationships recovered with <70% bootstrap values were considered unsupported whereas those with 70–79%, 80–89%, or > 90% were considered weakly, moderately, or strongly supported, respectively. Outgroup selection was guided by rooting in prior literature (e.g., Arup et al. 2013; Frolov et al. 2021).

Conservation Assessments.—We followed the Categories and Criteria of IUCN and the guidelines for their application (IUCN 2024) to conduct species conservation assessments for both new entities. Following Yahr et al. (2024), we defined a single mature individual as 1 square meter of rock inhabited by the species of concern.

RESULTS AND DISCUSSION

We initially predicted that the diversity of landscapes and habitats spanning Colorado was likely to harbor a taxonomically diverse lichen biota with biogeographical affinities to numerous areas of the North American landmass (and beyond). Our early fieldwork (and subsequent identifications) to begin characterizing Colorado's lichens has fully supported this prediction, with discovery of numerous species new to science (two new species described in Section I of this contribution; also see: Manzitto-Tripp & Watts, in review [1, 2]; Raynor et a. 2023, 2024, 2025; Tripp et al. 2019; Watts et al. 2025) that are attributable to lineages representing a wide array of biomes from around North American and across the world (Section II).

We here describe two species (*Tassiloa friogranitica* and *Pyrenodesmia praemontana*) new to science and discuss their phylogenetic and morphological relatedness to other taxa (Section I). We then report on 49 lichen species as either new records for the state of Colorado (*n* = 32, including the two new species; Section II) or noteworthy discoveries of lichen species known only from one or a few pre-existing records within Colorado's borders (*n* = 17; Section III). Instances of rediscovery are new collections of species known primarily from a much historical time period (e.g., pre-1970s). Notes and discussion follow each taxon entry, along with conservation assessments.

SECTION I: TAXONOMIC SECTION

Pyrenodesmia praemontana E. Tripp, J. Watts, & Raynor, **sp. nov.** (**Figs. 1 & 2**). Type: U.S.A. Colorado. Mesa Co.: Uncompahgre National Forest, Carson Hole Trail to La Fair Creek, rock outcrops of Wingate Sandstone and montane forest with *Alnus incana*, *Ceanothus fendleri*, *Purshia tridentata*, *Muhlenbergia montana*, and *Equisetum laevigatum*, steep, S-facing canyon wall, coordinates, 38.7338°, -108.6218°, 7705 ft (2349 m) elevation, saxicolous on exposed sandstone, 14 May 2024, *E. Manzitto-Tripp & J. Watts 10500* (holotype: COLO!).

MycoBank #: MB859643; Genbank PV899927

Similar to *Pyrenodesmia atroalba* but differing by its paraphyses that are segmented throughout and irregularly bullate to budding (vs. with one or two slightly swollen cells with few to no branches) and its reddish-brown to brownish-black (vs. light brown to brown) discs; similar to *Pyrenodesmia variabilis* but differing by its paraphyses that are segmented throughout and irregularly bullate to budding (vs. with one to two cells slightly swollen, unbranched or slightly branched) and its lack of pruina on the thalli and apothecia margins (vs. presence of pruina).

Thallus dispersed areolate to scant (e.g., when obscured by apothecia); **Upper surface** dark gray, dull, variably smooth to textured with very short, isidia-like protrusions; **Prothallus** absent; **Cortex** medium to dark brown, ca. 6–12 µm thick; **Medulla** hyaline, ca. 42–91 µm thick; **Isidia**-like protrusions, where present, small, ca. 0.1 mm in diameter, subcylindrical to globose, absent to scattered over surface of thallus; **Apothecia** sessile, abundant, crowded (up to four per areole); **Discs** flat to wavy, dark reddish-brown to brownish-black, shiny, never pruinose, 0.2–0.75(–1) mm in diameter; **Margins** entire to verrucose to discontinuous, lecanorine, thin, becoming increasingly excluded with age; **Thalline margin** (70–)100–168 µm thick measured at thickest portion, variably K- or K+ purple or brownish-purple (K+ reaction variable within a single apothecium), C-; **Epihymenium** light to dark golden to orangish-brown or light reddish-brown 4.2–14.2(–20) µm thick, variably K- to K+ pink to violet, C-; **Hymenium** hyaline to light brown, weakly to moderately inspersed, (36–)50–76 µm; **Hypothecium** hyaline to light brown, (25–)51–125 µm thick; **Paraphyses** segmented throughout, the segments irregularly submoniliform (bullate to budding/branching), inflated apically; **Asci** weakly clavate, 25–56 × 9.3–18.7 µm; **Ascospores** 8/ascus, hyaline, polarilocular, 13–16(–18) × 5–8.5 µm, isthmus (1–)2–3(–4) µm wide; **Algal cells** spherical to subspherical, 6–15.3 µm diameter, trebouxioid; **Pycnidia** not seen.

Etymology.—*Pyrenodesmia praemontana* is so named for the tendency of the species to grow on myriad sandstone formations deposited as consequences of the Ancestral Rocky Mountains. The Maroon and Lykins formations are arkosic (high feldspar content due to the erosion of granite) sandstones deposited by the ancient streams (fluvial) which eventually contributed to the erosion of the Ancestral Rocky Mountains. And though not contemporaneous with the uplift of the Ancestral Rocky Mountains, the Wingate and Foxhills formations were also formed directly by the ancient sediments that were uplifted during this orogeny. The Wingate formation was deposited by strong wings (eolian) of vast dune fields of an ancient desert that existed at the western foothills of the then eroding Ancestral Rocky Mountains. And though much younger in origin, the Foxhills formation is a marine shoreface deposit of the Western Interior Seaway, the location of which was influenced by the structural inheritance of the then completely eroded Ancestral Rocky Mountains. These formations, among many more, are now exposed as large cliff complexes and foothill canyon networks where *Pyrenodesmia praemontana* sp. nov. now thrives due to the uplifting of the modern Rocky Mountains which began not long after the deposition of the Foxhills formation.

Chemistry.—Apothecial discs C- and variably K- or K+ brownish purple. No substances detected via TLC despite numerous attempts (see Santesson 1970 and Wetmore 1994), which is not atypical of the group and likely related to low concentrations of anthraquinones.

Substrate & Habitat.—So far as known, *Pyrenodesmia praemontana* is restricted to sandstone outcrops in Colorado: the type locality on Fox Hills Sandstone, a second, recently discovered population growing on Wingate Sandstone of the Uncompahgre Plateau in western Colorado, a third, recently discovered population growing on Maroon Sandstone in central Colorado, and a fourth recently discovered population growing on soft, subcalcareous red sandstone of the Lykins formation not far from the type locality at Joder Ranch, OSMP. All four populations of *Pyrenodesmia praemontana* were found on sun-exposed surfaces of these relatively nutrient depauperate sandstone formations. Given this range, from central to western Colorado, we expect that our continued inventory of lichens throughout the southern Rocky Mountains and adjacent High Plains will yield additional discoveries of *Pyrenodesmia praemontana* along with a more nuanced understanding of its niche. This in fact was the case for two other species previously considered endemic to Fox Hills Sandstone: *Candelariella clarkiae* E. Tripp & Lendemer and *Lecidea hoganii* E. Tripp & Lendemer. Subsequent to their initial description from Fox Hills Sandstone (Tripp & Lendemer 2015), both species were found elsewhere on other sandstone types: the former in Utah (*S. Leavitt 23127*, Wingate Sandstone) and the latter in Boulder County (*E. Manzitto-Tripp & J. Watts 10221*, Red Lykins Sandstone). The discovery of *Pyrenodesmia praemontana* occurring on Fox Hills, Wingate, Maroon, and Lykins Sandstones marks another such instance of

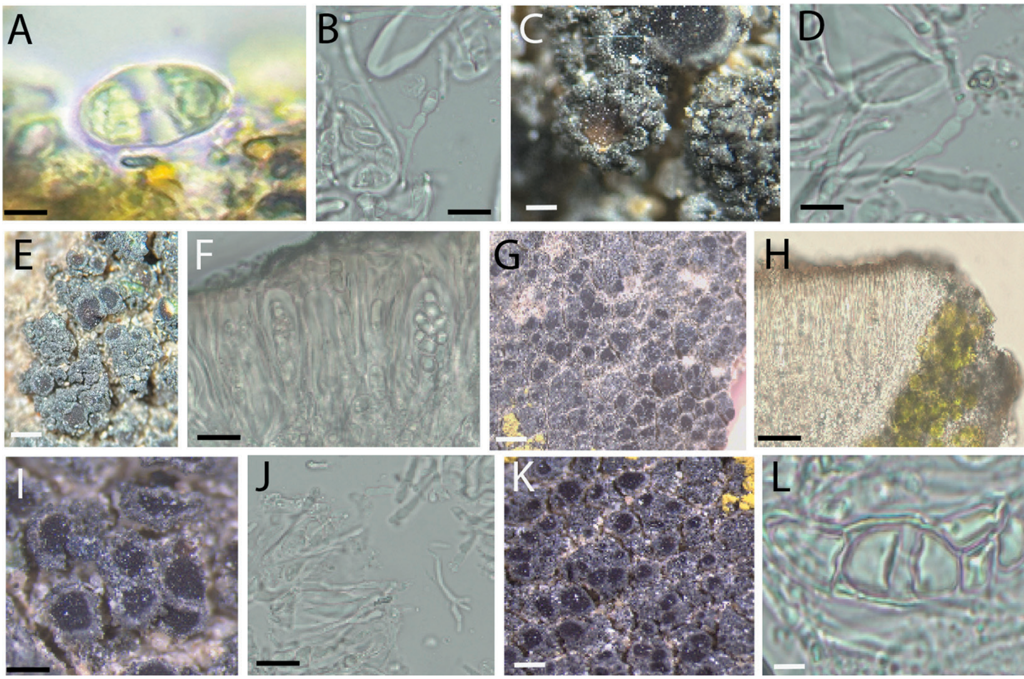

Fig. 1. Macro- and micromorphology of *Pyrenodesmia praemontana*. A. Mature polarilocular spore outside of ascus showing prominent isthmus. **B.** Segmented/branched paraphysis that is budding and inflated apically. **C.** Thallus with subcylindrical to globose isidia-like protrusions and reddish-brown apothecia discs. **D.** Segmented/branched paraphysis that is budding. **E.** Thallus with subcylindrical to globose isidia-like protrusions. **F.** Immature and mature asci that are weakly clavate and bear 8 spores each. **G.** Dark gray, dull, areolate thallus with dark reddish-brown to brownish-black discs. **H.** Cross section through apothecium showing thalline margin, dark golden epihymenium, hyaline to light brown hymenium, and hyaline hypothecium. **I.** Dark reddish-brown to brownish-black discs. **J.** Irregularly branched and bullate paraphyses. **K.** Weakly verrucose apothecia margins and dark reddish-brown to brownish-black discs. **L.** Mature polarilocular spore inside of ascus showing prominent isthmus. Scale Bars: A. 10 µm. B. 20 µm. C. 0.5 mm. D. 20 µm. E. 0.5 mm. F. 40 µm. G. 0.5 mm. H. 8 µm. I. 0.5 mm. J. 20 µm. K. 0.5 mm. L. 10 µm. Images from *E. Tripp 5805b* and *E. Manzitto-Tripp & J. Watts 10500.*

lichens occupying both Fox Hills and Wingate Sandstone, following *C. clarkiae* (and here, additional formations as well).

Distribution.—*Pyrenodesmia praemontana* is so far known from four collections (three sites) on three sandstone outcrops in Colorado at low to middle elevations: two from the Front Range foothills in Boulder, Colorado (5281 ft), one from the Uncompahgre Plateau (7705 ft) bordering the northwestern portions of the San Juan Mountains in western Colorado, and the third from the mountains of central Colorado (8381 ft; Fig. 2).

Notes.—As recently revised (Frolov et al. 2021) the genus *Pyrenodesmia* (*Pyrenodesmia* s.s., following Massalongo 1852; Arup et al. 2013; Frolov et al. 2021) consists of a minimum of 21 species, now 22 with the present addition. Species in this lineage oftentimes bear blastidia, soredia, or pustules, have (only) sedifolia-gray pigments in their thalli and apothecia, typically occur amongst sunlit outcrops (especially acidic ones), and are primarily holarctic in distribution (Frolov et al. 2016; 2021). Molecular data in combination with these morphological attributes, in particular, their complete lack of anthraquinones, led Frolov et al. (2021) to differentiate species they considered to belong to *Pyrenodesmia* s.s. from close relatives, which those authors treated in *Kuettlingeria* and *Sanguineodiscus* (i.e , Clade vs. Clades K and S, Fig. 1 in Frolov et al. 2021). In that study (Frolov et al. 2021), species of *Kuettlingeria* and *Sanguineodiscus* were differentiated from those in *Pyrenodesmia* s.s., but their production of anthraquinones in the apothecia, with very few exceptions, along with additional features (see Table 3 in Frolov et al. 2021). Based on this three-genera solution proposed in Frolov et al. (2021): (1) *Pyrenodesmia* s.s. has a Holarctic distribution with three centers of diversity: the

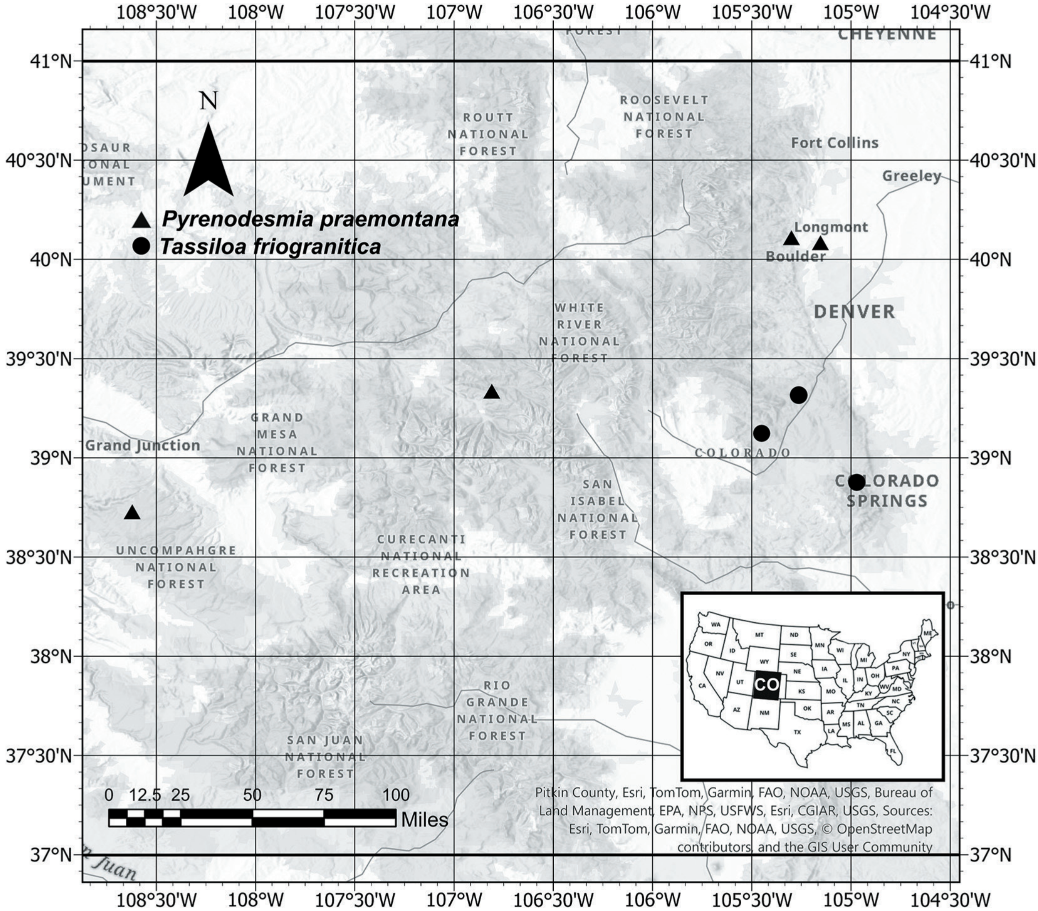

Fig. 2. Map of all known populations of *Pyrenodesmia praemontana* (triangles) and *Tassiloa friogranitica* (circles).

Mediterranean basin, central Asia, and arid western North America where at least six species including the new species occur (*P. albovariegata* B. de Lesd., *P. atroalba* (Tuck.) I.V. Prolov & Vondrák, *P. peliophylla* (Tuck.) S.Y. Kondr., *P. pratensis* (Wetmore) I.V. Frolov & Vondrák, *P. praemontana* and *P. variabilis* (Pers.) A. Massal.; (2) *Kuettlingeria* has a Holarctic distribution with a center of diversity in the Mediterranean basin; and (3) *Sanguineodiscus* occurs in the Mediterranean basin, adjacent northern Europe and central Asia, and is absent from North America. Frolov et al. (2021) discussed the option of recognizing the above taxa within a single genus, *Pyrenodesmia* s.l., but ultimately advocated for recognition of species in these three different genera given morphological and chemical differences.

Although based only on a single locus and with a study design not intended to assess generic delimitation, our phylogenetic results nonetheless failed to recover three well-supported clades corresponding to *Pyrenodesmia* s.s , *Kuettlingeria*, and *Sanguineodiscus* as in Frolov et al. (2021). Instead, our analyses (Fig. 3) revealed that none of these three genera are reciprocally monophyletic and instead resolved two different lineages of *Sanguineodiscus*, two of *Kuettlingeria*, and several of *Pyrenodesmia*, most of these supported by bootstrap values. Our results therefore support recognition of all taxa within a single expanded concept, *Pyrenodesmia* s.l. If recognized accordingly, *Pyrenodesmia* would consist of an additional minimum of 18 species (sensu Frolov et al. 2021), bringing the total taxonomic diversity of *Pyrenodesmia* s.l. to 40 species.

However, we caution that generic delimitation in this group is complex and should be further addressed by future studies with expanded taxon sampling and greater locus representation.

Despite topological differences between our phylogeny and that presented in Frolov et al. (2021), our analyses recovered strong support (96% bootstrap) for a clade containing the three accessions of *Pyrenodesmia praemontana* (GenBank numbers: *E. Tripp 5866*: PV360705; *J. Watts & E. Henry 1931*: PV899924; *E. Manzitto-Tripp & J. Watts 10,500*: PV899927). This new species was resolved as sister to an accession of *P. helygeoides* (Vain.) Arnold from Europe with weak support (79%), and together, this clade was resolved as sister to a clade of Eurasian *K. diphyodes* with weak support (76%). This clade (*Pyrenodesmia praemontana* + *P. helygeoides* + *K. diphyodes*) was, in turn, resolved as sister to a clade containing the North American species *P. pratensis*, *P. variabilis*, and *P. atroalba* with moderate support (80%). As such, our results support recognition of a more broadly circumscribed *Pyrenodesmia* s.l. rather than a narrower definition proposed by Frolov et al. (2021). As herein documented, we detected anthraquinone presence/absence variably in the apothecia of the new species, within an individual as well as within an apothecium. This result is not particularly surprising given that intraspecific variation in anthraquinone production has been documented in other species in the group already (Frolov et al. 2021; see also Wetmore 1994).

Pyrenodesmia praemontana is distinguished from all other species in this group most readily by its paraphyses that are segmented throughout, with segments that are irregularly bullate to budding or branching. Other species in this group produce segmented paraphyses (Frolov et al. 2016), but these lack the irregular buds or branches typical of the new species. Additionally, specimens producing the small, isidia-like protrusions further set this new species apart from others, however this feature is variable across specimens (e.g., present in *E. Tripp 5866*, *5805b*, poorly developed in *J. Watts & E. Henry 1931*, and not developed in *E. Manzitto-Tripp & J. Watts 10500*). We suspect that variation in protrusion presence/absence is likely to be a function of extent of thallus surface that is or is not decorated with fruiting bodies. For example, when material is profusely fertile, as in *E. Manzitto-Tripp & J. Watts 10500*, scant thallus is visible and hence protrusions are absent. In contrast, *E. Tripp 5866* and *E. Tripp 5805b* are characterized by thallus material lacking abundant apothecia and as a result, the thallus has more prominent protrusions. Material of *J. Watts & E. Henry 1931* bears a moderate extent of thallus material lacking fruiting bodies and, in these areas, the isidia-like protrusions become apparent. Additional macro- and micromorphological features discussed below help to further distinguish *Pyrenodesmia praemontana* from all other known species. In Frolov et al. (2016), specimens of *Pyrenodesmia praemontana* that bear isidia-like protrusions would fail to key. Specimens lacking this feature would most likely key to *Caloplaca transcaspica* (Nyl.) Zahlbr., which is a morphologically distinctive species from central Eurasia with a white to very light gray thallus.

Pyrenodesmia praemontana can readily be differentiated from its close relatives *P. helygeoides* and *P. diphyodes* by chemistry and habitat as well as distribution. Both of the latter species lack anthraquinones altogether, in contrast to the new species. Additionally, *Pyrenodesmia helygeoides* is an artic-alpine species that often grows on siliceous rocks in or near water. So far as understood, material ascribed to both of these two names lacks the irregularly budding/branching paraphyses. Material of the new species that bears isidia-like protrusions might be confused for another primarily European species and one not sampled here, *Caloplaca isidiigera* Vĕzda (*Caloplaca cerina* group), but the latter bears true isidia, an orange epihymenium, has apothecia with a consistent K+ purple-red reaction, and spores with wider septa (Šoun et al. 2011).

In the USA, *Pyrenodesmia praemontana* is most likely to be confused with *P. atroalba* or *P. variabilis* owing to its thick, gray, areolate thallus, sessile apothecia with clearly lecanorine margins (the algae becoming excluded with age), exciples that are variably K+ purplish-brown, relatively large spores with a developed isthmus, and occurrence on rock (see Wetmore 1994; note the non-monophyly of North American material of *P. variabilis* with European material; Fig. 3). However, *P. atroabla* differs from *Pyrenodesmia praemontana* by the anatomy of the paraphyses (typically consisting of only one or two cells that are primarily non-branching), and disc color (light brown to brown vs. dark reddish-brown to black). *Pyrenodesmia variabilis* can be differentiated from *Pyrenodesmia praemontana* by its thallus color, frequently pruinose thalli and apothecia

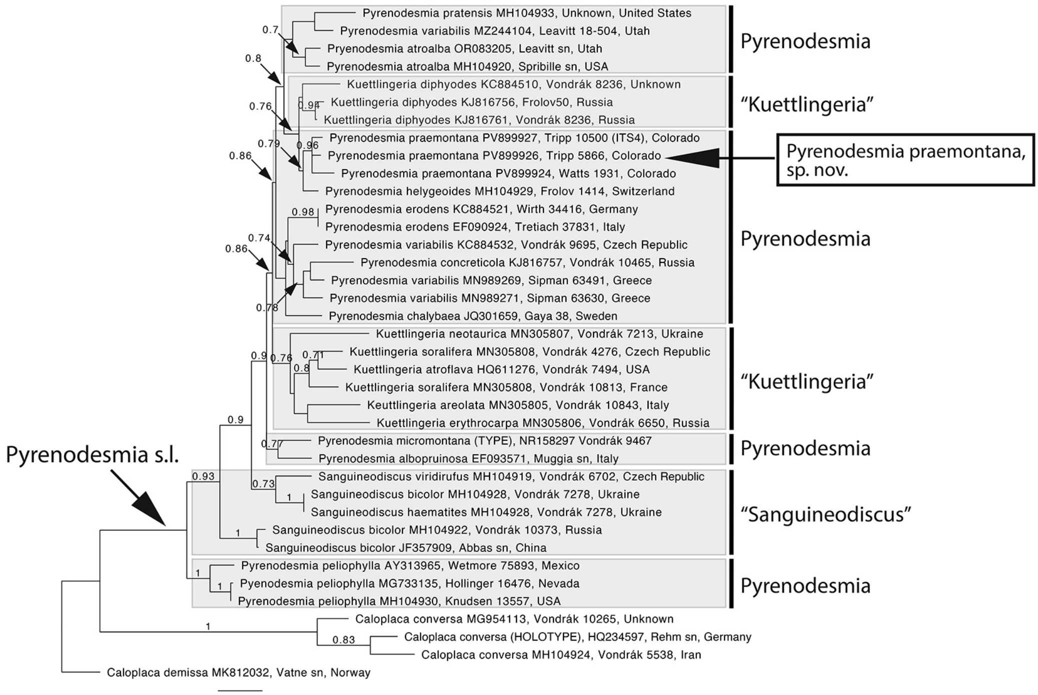

Fig. 3. Majority rule (50%) maximum likelihood phylogeny of *Pyrenodesmia praemontana* and other members of *Pyrenodesmia* s.l., based on nrITS. Taxon sampling informed by Wetmore (1994), Arup et al. (2013), and Frolov et al. (2016, 2021). Numbers above (or next to) branches indicate bootstrap support following 100 replicates (relationships recovered with <70% bootstrap values were considered unsupported and numerous are not shown here). The new species is highlighted with a black box. Tree rooted with *Caloplaca demissa*.

margins, as well as anatomy of the paraphyses. Finally, it is unlikely that *Pyrenodesmia praemontana* could be confused for *P. pratensis*, which is related to *P. atroalba* and *P. variabilis* (Fig. 3), because the latter species is sorediate. *Pyrenodesmia praemontana* additionally bears some resemblance to *P. albovariegata* B. de Lesd., but the latter can be differentiated by its typically bluish-gray thallus that becomes mottled, stipitate areoles, and C+ violet apothecial margins. Finally, specimens of the new species that bear isidia-like protrusions can be differentiated from *P. neotropica* Wetmore, which has a verruculose thallus with isidia, by the latter's pseudocyphellae, dark golden-brown epihymenium, K+ brown epihymenium, and occurrence on bark.

We here confirm the variation in anthraquinone presence/absence in apothecia of *Pyrenodesmia praemontana*, both within an individual as well as within a single apothecium, through thin-sectioning and spot testing numerous fruiting bodies under compound microscopy on all original material. Most commonly, material is K+ purplish brown, but K- sections constituted approximately 25% of all tested sections, suggesting variable distribution of anthraquinones within and among fruiting bodies. More research will continue to yield refined species concepts following Frolov et al.'s excellent revision (2021), and likely also reveal additional, as yet named lichen biodiversity.

Conservation Assessment.—Based on our current knowledge and field exploration throughout the southern Rocky Mountains, *Pyrenodesmia praemontana* is currently assessed as Critically Endangered (CR) under criterion D of the IUCN Red List (IUCN 2024), which was invoked as a result of only four known populations consisting of a total of five mature individuals of the new species observed at the four sites. So far as understood, this appears to be a range-restricted species, although additional fieldwork throughout the region may yield newly discovered populations.

Additional Specimens Examined: **U.S.A. COLORADO. Boulder Co.:** Niwot, small outcropping of Fox Hills Formation sandstone 0.25 km N of Mineral Road and 0.3 km W of Somerset Drive, 40.089411°, –105.154294°, 5281 ft (1610 m) elevation, saxicolous on exposed sandstone, 24 Jun 2016, *E. Tripp 5805b* (COLO); Niwot, small outcropping of Fox Hills Formation sandstone 0.25 km N of Mineral Road and 0.3 km W of Somerset Drive, 40.089411°, –105.154294°, 5281 ft (1610 m) elevation, saxicolous on exposed sandstone, 4 Mar 2017, *E. Tripp 5866* (COLO); Joder Ranch, Boulder Open Space & Mountain Parks, saxicolous on red Lykins Sandstone amongst *Pinus ponderosa* forest, 24 Jun 2023, *J. Watts 3128* (COLO). **Pitkin Co.:** White River National Forest, Rocky Fork Creek, trailside outcropping of red sandstone of the Maroon Formation, 39.341006°, –106.810138°, 8381 ft (2555 m) elevation, saxicolous in lush, steep, riparian canyon, 22 Jun 2024, *J. Watts & E. Henry 1931* (COLO).

Tassiloa friogranitica E. Tripp, Raynor, & J. Watts, **sp. nov.** (**Figs. 2, 4**). Type: U.S.A. Colorado. Park Co.: Pike-San Isabel National Forest, Tarryall Creek, vicinity of Box Canyon, rock outcrops of Pikes Peak Granit and montane forest with *Ceanothus fenderli*, *Cercocarpus montanus*, *Jamesia americana*, *Juniperus communis*, *Pinus ponderosa*, *Pseudotsuga menziesii*, and *Rubus deliciosus*, 39.1230°, –105.4497°, 8,468 ft (2,580 m) elevation, saxicolous on rocks above creek, 11 Apr 2025, *E. Manzitto-Tripp & W. Manzitto-Tripp 11381* (holotype: COLO!).

MycoBank #: MB859644; Genbank PV899929

Similar to *Tassiloa wetmorei* but differing by its non-parasitic habit (vs. parasitic), its non-lobulate areoles (vs. small, marginal lobules), and its slightly shorter spores that bear a septum; similar to *Pachypeltis cladodes* but differing by its dispersed (vs. continuous) areoles, thin, coralloid (vs. stout, globose) isidia, occurrence on rocks (vs. primarily on mosses), and occupancy of lower montane (vs. alpine) environments; similar to *Polycauliona thamnodes* but differing by its estipitate (vs. stipulate) areoles, lack of (vs. presence of pseudocyphellae), and larger spores often exceeding 19 µm (vs. smaller spores typically <13 µm).

Thallus areolate to subsquamulose, highly dispersed and not contiguous, the subsquamules 0.3–0.6 mm, often obscured by abundant isidia, when visible entire to moderately incised; **Upper surface** yellow-orange to orange, typically more yellow in color in shaded portions of rock crevices; **Cortex** golden-brown to orange-brown, ca. 9–15 µm thick; **Medulla** hyaline to slightly pale yellowish, very thin, bordering thallus attachment to substrate only (most of thallus thickness composed of algal cells), ca. 5–10 µm thick; **Isidia** thin, 45–65 µm thick at widest part, primarily coralloid, rather thin, fragile and delicate, oftentimes branching and forming masses; **Apothecia** occasional, solitary, 0.3–0.7 mm broad and constricted at the base, sometimes becoming substipitate; **Discs** orange, darkening to dirty brownish-orange, 0.2–0.6 mm broad, plane, sunken beneath margin when immature, becoming even with margin at maturity; **Margins** lecanorine, persistent and pillowy, entire when developing but sometimes breaking down into stunted, globose isidia when developed, resembling the thallus; **Thalline margin** 120–150 µm thick measured at thickest portion; **Epihymenium** golden orange to brownish-orange, 18–30 µm thick, K + pink to violet, C; **Hymenium** hyaline but oftentimes streaked light pink, 61–78 µm thick, K+ pinkish-purple; **Hypothecium** hyaline to light brown, 47–70 µm thick; **Asci** narrowly clavate 56–63 × 11–12 µm (width at widest point); **Ascospores** hyaline, hyaline sometimes with orange to orangish-brown locules, polarilocular, 10–13 × 4–7 µm, isthmus 0.5–1 µm when mature, inconspicuous to poorly developed when immature; **Paraphyses** ca. 1–2 µm in diameter, hyaline (with pigment in between the paraphyses), cylindrical, non-septate for most of length, occasionally once-septate towards apex, without an expanded apex; **Algal cells** spherical to ellipsoidal, 6–9 µm in diameter, trebouxioid; **Pycnidia** not seen.

Etymology.—*Tassiloa friogranitica* is so named for its (so far as is known) restricted occurrence on Pikes Peak Granite, which is an intrusive granite characterized by coarse-grained crystals of quartz, feldspar, and biotite, making it very friable. The coarse-grained, friable nature of Pikes Peak Granite makes it prone to grusification—a process where individual grains crumble away from the rock—ultimately leading to a landscape of gravelly soil, abundant rounded domes, and rock spires that so characterizes the region to which *Tassiloa friogranitica* is native. The bases of its dainty, branching isidia are often nestled between two easily-separated large grains of granite, the parent hyphae of which likely originate from an endolithic hyphal network that may contribute to the grusification process via biomechanical and chemical weathering. This hypothesized method of thallus fragmentation via grusification may significantly contribute to the reproductive success of this new species.

Chemistry.—Apothecial discs K+ violet. C–. Chemosyndrome Group A: thallus and apothecia with parietin, fallacinal, parietinic acid, teloschistin, and trace of an unknown substance that may be emodin.

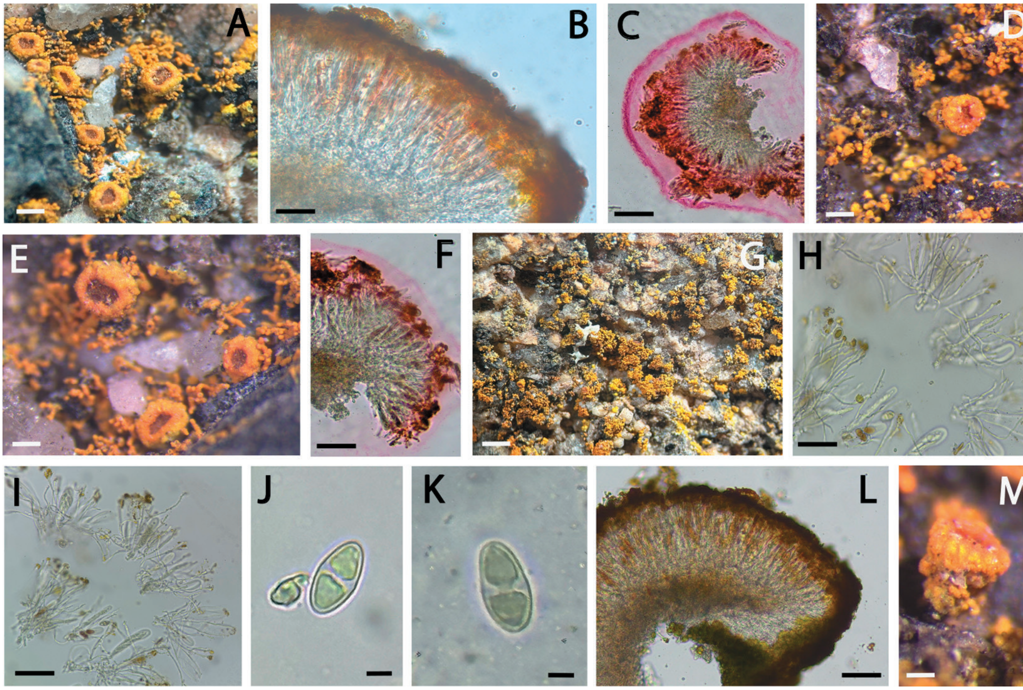

Fig. 4. Macro- and micromorphology of *Tassiloa friogranitica*. **A.** Dispersed thallus obscured by coralloid isidia and apothecia with pillowy margins. **B.** Cross section through apothecium showing hyaline hymenium that is often streaked light pink, and golden orange to brownish orange epihymenium. **C.** K+ pink to violet epihymenium. **D.** Apothecium constricted at base and with dark orange discs surrounded by coralloid isidioid thallus. **E.** Coralloid isidia and solitary apothecia with dark orange discs and pillowy margins. **F.** K+ pink to violet epihymenium. **G.** Highly dispersed thallus, yellowish orange in color, and isidia forming masses. **H.** Paraphyses and immature asci/spores. **I.** Paraphyses and immature asci/spores. **J.** Mature ascospore. **K.** Mature ascospores. **L.** Cross section through apothecium showing hyaline hymenium that is weakly streaked light pink. **M.** Substipitate apothecium. Scale Bars: A. 0.6 mm. B. 20 µm. C. 55 µm. D. 0.6 mm. E. 0.5 mm. F. 40 µm. G. 1 cm. H. 30 µm. I. 35 µm. J. 5 µm. K. 5 µm. L. 60 µm. M. 0.5 mm. Images from *E. Tripp et al. 5614*

Substrate & Habitat.—*Tassiloa friogranitica* is so far known only from rich, intact, and protected forests dominated by *Pseudotsuga menziesii* and *Populus tremuloides* where it has been found occurring specifically on a sheltered, north-facing rock outcrops of Pikes Peak Granite origin. In two of three locations (Box Canyon and Hurricane Canyon), populations were found immediately above shaded, fast-flowing creeks (Tarryall River and French Creek), and in the third location above an ephemeral stream (Little Scraggy Peak) suggests a nuanced and perhaps narrow habitat preference of this unique new species. Pikes Peak Granite is a feldspar-rich, highly friable and therefore crumbling rock type that is known to harbor other rare and/or narrowly distributed species with an affinity to this substrate (Fayette 1999).

Distribution.—*Tassiloa friogranitica* is known only from six collections made from three locations in lower foothills (~8,500–9100 ft) in the vicinity of Pikes Peak (Fig. 2).

Notes.—So far known only from a three locations, *Tassiloa friogranitica* (Fig. 4) is a highly distinctive species that is unlikely to be confused with any previously described species owing to its autonomous habit and thin, fragile and delicate coralloid isidia that occur sporadically on dispersed areoles (to subsquamules) against rock crevices, specifically those of Pikes Peak Granite. Because of its delicate, coralloid isidia, *Tassiloa friogranitica* is most likely to be confused for two of its two closest relatives and two of the three described species of *Tassiloa*: *T. wetmorei* (Nimis, Poelt, & Tretiach) S.Y. Kondr. et al. and *T. digitaurea* (Søgaard, Søchting & Sancho) S.Y. Kondr. et al., both of which similarly bear fragile isidia (note: for simplicity, we here refer to the asexual reproductive propagules of all three species as “isidia” owing to their presumably functional similarity even though these structures may or may not be homologous to true isidia from a developmental standpoint [and therefore have been called “isidia-like” structures by prior authors; see Kärnefelt (1990) and Nimis et al. (1994]). The new species is different from *T. wetmorei* because the latter is parasitic (primarily on *Pertusaria*, *Aspicilia*, and *Buellia*), often resulting in blackened, necrotic tissue of the host near infection, produces small, marginal lobules, and has slightly longer spores (12–17 µm) that mostly lack a septum at maturity. So far as known, *T. wetmorei* occurs predominantly from Mexico to the southwestern USA. The new species is different from *T. digitaurea* because the latter is fruticulose, composed primarily of vertical, terete to sometimes flattened and moderately branched isidia, has branching paraphyses, and slightly longer spores (13–16 µm). So far as known, *T. digitaurea* occurs predominantly in southern Patagonia (southern South America).

Elsewhere in North America, the new species could be confused for *Pachypeltis cladodes* (Tuck.) Søchting, *Polycauliona thamnodes* (Poelt) Arup, Fröden, & Søchting, or *Polycauliona coralloides* (Tuck.) Hue. *Pachypeltis cladodes* is different from *Tassiloa friogranitica* by its continuous thallus of dense, stout, globose isidia, deep orange color, and occurrence on the tops of mosses in alpine environments (vs. a dispersed thallus, fragile, coralloid isidia, color that is lighter orange, and occurrence on rocks in lower montane forest in *Tassiloa friogranitica*; we note however that thallus color may sometimes vary as a function of anthraquinone concentration and/or thallus exposure). *Polycauliona thamnodes* is different from *Tassiloa friogranitica* by its somewhat stipitate areoles, pseudocyphellae, and much larger spores that are often >19 µm. (vs. non-stipitate areoles, lack of pseudocyphellae, and smaller spores in *Tassiloa friogranitica*). *Polycauliona coralloides*, although with isidia somewhat reminiscent of the new species, is different from *Tassiloa friogranitica* by its minutely fruticose, loose, cushion-like thalli that are somewhat roughened and lumpy, and occurrence primarily on seashore rocks in spray zones so far known from Oregon to California and Baja California (vs. non-fruticose, smooth thalli and inland occurrence not near spray zones in *Tassiloa friogranitica*).

Phylogenetic analyses confirm the new species strongly supported belonging to *Tassiloa* in the Teloschistoideae (Fig. 5). The two accessions from Colorado formed a weakly supported clade (73% BS) that is sister to *T. wetmorei* with strong support (90% BS). Together, *Tassiloa* was resolved as sister to a lineage that contains *Villophora*, *Josefpoeltia*, and *Teloschistes* (85% BS), as in prior study (Kondratyuk et al. 2015).

Conservation Assessment.—Based on our current knowledge and field exploration throughout the southern Rocky Mountains, *Tassiloa friogranitica* is currently assessed as Critically Endangered (CR) under criterion D of the IUCN Red List (IUCN 2024), which was invoked as a result of only three known populations consisting of a total of six mature individuals of the new species observed. So far as understood, this appears to be a highly range-restricted species, perhaps as a function of geology and microclimate.

Additional Specimens Examined: **U.S.A. COLORADO. El Paso Co.:** Pike-San Isabel National Forest, Hurricane Canyon Natural Area, ~0.8–2.0 mi ESE of Manitou Reservoir along banks of North Fork French Creek, W of confluence with South Fork French Creek, rocky outcrops of Pikes Peak Granite and rich riparian forest dominated by *Pseudotsuga menziesii* and *Populus tremuloides*, mesic slopes above river, 38.876°, –104.974°, 8,589 ft (2,616 m) elevation, saxicolous on rocky overhang above creek, 28 Mar 2025, *E. Manzitto-Tripp 11348*, *11352*, *11356* (COLO!); Pike-San Isabel National Forest, Hurricane Canyon Natural Area, ~0–0.5 mi S of confluence of North Fork French Creek and South Fork French Creek, rocky outcrops of Pikes Peak Granite and rich riparian forest dominated by *Pseudotsuga menziesii* and *Populus tremuloides*, mesic slopes above river, 38.876°, –104.971°, 9,042 ft (2,754 m) elevation, saxicolous on rocks on steep hillside, 28 Mar 2025, *E. Manzitto-Tripp 11365* (COLO!); Pike National Forest, Hurricane Canyon Research Natural Area, ESE of Manitou Reservoir, near confluence of North and South Fork of French Creek, rocky slopes above creek, 38.87751°, –104.97689°, 8,625 ft (2629 m) elevation, saxicolous on Pikes Peak granite, 8 Jul 2025, *S. Raynor et al. 6410* (COLO!). **Jefferson Co.:** Pike-San Isabel National Forest, unnamed drainage on west face of Little Scraggy Peak, ephemeral stream over Pikes Peak granite with large boulders scattered throughout understory, mixed conifer forest of *Pseudotsuga menziesii* and the occasional *Pinus flexilis* with *Juniperus communis* and *Jamesia americana* in understory, 39.318°, –105.279°, 8454 ft (2577 m) elevation, saxicolous on moist overhanging rock above ephemeral stream, Jun 2025, *J. Watts & E. Manzitto-Tripp 3815* (COLO!).

SECTION II. NEW REPORTS FOR COLORADO

Acarospora nevadensis H. Magn.—This is a rare species throughout its known distribution, which consists of the arid intermountain southwest, primarily in Nevada and Arizona, with additional populations from the Baja Peninsula to California and North Dakota (Knudsen & Werth 2008). *Acarospora nevadensis* is one of the

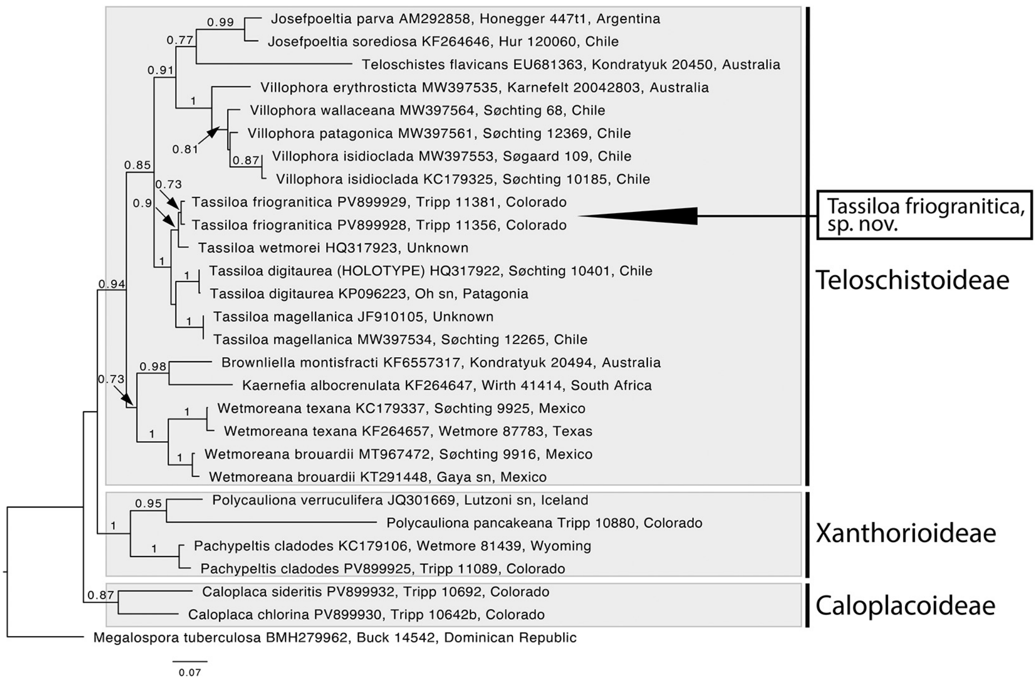

Fig. 5. Majority rule (50%) maximum likelihood phylogeny of *Tassiloa friogranitica* and other members of Teloschistoideae, as well as select individuals belonging to Xanthorioideae and Caloplacoideae based on nrITS. Taxon sampling informed by Kondratyuk et al. (2015) among numerous other references. Numbers above (or next to) branches indicate bootstrap support following 100 replicates (relationships recovered with <70% bootstrap values were considered unsupported and numerous are not shown here). The new species is highlighted with a black box. Tree rooted with *Megalospora tuberculosa*.

10 or so species of North American *Acarospora* with gyrophoric acid (Knudsen & Morse 2009), thus yielding a C+ red and KC+ pink reaction in the thallus. It can additionally be differentiated from congeners by its interrupted algal layer, pruinose thallus, and discs with a more reddish hue (and irregular texture) compared especially to *A. strigata* (Nyl.) Jatta, which in our area most frequently has black to at-most dark brownish-red discs and is always C-.

Voucher specimens: **COLORADO. Boulder Co.:** Joder Ranch, OSMP, Ponderosa savanna, 6100 ft (~1860 m), 6 Jun 2023, *J. Watts 878* (COLO); Joder Ranch, OSMP, Ponderosa savanna with Lykins outcrop, 6300 ft (~1920 m), 12 Sep 2023, *J. Watts & E. Manzitto-Tripp 1020* (COLO).

Agonimia opuntiella (Buschardt & Poelt) A. Vězda—Until the present report, this species was known primarily from the eastern USA and Great Plains. Although miniscule, this remarkable lichen is highly recognizable by its minute, greenish brown squamules that are frequently blastidiate and its hyaline, prickly hyphal hairs that arise from the thallus (Tripp & Lendemer 2019). These features make *Agonimia opuntiella* difficult to confuse with any other lichen. The species occupies a wide variety of substrates ranging from growing over mosses or detritus, particularly in calcareous areas. We here report it as new for Colorado and in fact, western NA as a whole, where it was found on low-lying lignum and woody rhizomes in the grasslands of northern Colorado.

Voucher specimen: **U.S.A. COLORADO. Larimer Co.:** Soapstone Prairie Natural Area, isolated patch of old *Pinus ponderosa*, 6280 ft. (~1900 m), 17 Oct 2024, *J. Watts, S. Raynor & Crystal Strouse 2799* (COLO). **Weld Co.:** Pawnee National Grasslands, easternmost tract, 4590 ft (~1400 m), 8 May 2024, *E. Manzitto-Tripp & S. Raynor 10375* (COLO).

Arthonia subfuscicola (Linds.) Triebel.—We here report, to the best of our knowledge, the third known population of this parasitic species from North America, previously represented on the continent by only two specimens: the first from the Santa Catalina Mountains at 8990 ft (~2740 m) near the summit of Mt. Lemmon in southern Arizona, growing on *Lecanora carpinea* (L.) Vain. (*T. Nash 4043*; Triebel et al. 1991) and the second from the town of Bellingham, Washington, also growing on *L. carpinea* (Haldeman 2018). *Arthonia subfuscicola* is otherwise known from Europe, where it is relatively uncommon to rare. This is a four-celled species that, so far as known, is restricted to *Lecanora albella* (Pers.) Ach. and *L. carpinea*. Our material has spores that are ~13–15 × 5 µm. *Arthonia subfuscicola* is perhaps most likely to be confused with *A. varians* (Davies) Nyl. but differs by clearly occupying both the thalli and apothecia of its host (Hafellner & Grube 2023). We consider it to be very rare in North America, which reflects a similar rarity in Europe. In Colorado, it was collected growing on the thalli and apothecia of *Lecanora carpinea*.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, upper montane forest between Red Deer Lake and Buchanan Pass, 9347 ft (2870 m), 22 Aug 2023, *E. Manzitto-Tripp & S. Raynor 10167* (COLO).

Arthopyrenia cinereopruinosa (Schaer.) A. Massal.—This species is known in North America from a handful of records around the Great Lakes, central Appalachian Mountains, coastal California, and Pacific Northwest. Its brown, 2-celled spores (18–22 × 7–8 in Harris [1975] vs. 15–16 × 5.5–6 µm in our material) with equally sized cells or the upper cell sometimes slightly larger (these slightly constricted in the middle), spores with rounded ends and unornamented walls, and occupancy of smooth portions of the bark of trees help to identify this species. We note, however, that the type and material that has been ascribed to this name are problematic (Thiyagaraja et al. 2021) such that further work is ultimately needed.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, alpine slopes of North Blue Lake, 11417 ft (~3480 m), 5 Sep 2023, *E. Manzitto-Tripp & S. Raynor 10187* (COLO).

Aspicilia knudsenii Owe-Larss. & A. Nordin.—This species is known primarily from the arid intermountain West, with additional populations extending into more mesic environments including coastal Oregon. *Aspicilia knudsenii* is characterized by its olive-brown thalli with relatively large, oftentimes sunken apothecia, olive-green epihymenium, discs that are approximate 0.4–0.7 mm in diameter, 8-spored asci with relatively large spores that are ~21–22 × 12–14 µm in our area (elsewhere, up to 27 µm long and 17 µm wide), submoniliform paraphyses with 1–3 septations apically, and presence of stictic acid as a major compound. The present report represents a significant range extension. In Colorado, it was collected from alpine tundra at Niwot Ridge, an LTER station in the Front Range Mountains.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest Niwot Ridge, ca. 1 mi N of Niwot Mountain, ca. 6 mi W of Ward, 11400 ft, (~3475 m), 14 Aug 1973, *J. Flock FL-461* (COLO).

Biatora chrysantha (Zahlbr.) Printzen.—This species ("Moss Tops") is one of several sterile, sorediate crusts in North America that occurs on bryophytes, humus (sometimes over rocks), and lignum. *Biatora chrysantha* is characterized by a thick, well-developed thallus with large, conspicuous soralia. Our specimen was additionally found with apothecia and spores (these 2-celled, hyaline, ~12–13 × 4–5 µm), helping to confirm its identity along with sequencing of its nrITS region + *5.8s* (Genbank PV899923). In our area, it is easily differentiated from *B. vernalis* (L.) Fr. by the presence of soralia that are C+ pink owing to gyrophoric acid as here confirmed by TLC (*B. vernalis* is never sorediate and is C–). *Biatora chrysantha* is otherwise known from the southern to northern Appalachians and Great Lakes region where it is common, the Pacific Northwest, and a handful of records from Arizona and New Mexico. To our knowledge, this is the first report of the species in Colorado where it was collected on lignum, bark, and overgrowing moss.

Voucher specimens: **Colorado. Boulder Co.:** Roosevelt National Forest, subalpine mesic slopes of Willow Creek, 9000–9300 ft (~2740–2840 m), 6 Jun 2023, *E. Manzitto-Tripp & S. Raynor 9731* (COLO); Roosevelt National Forest, Indian Peaks Wilderness, mixed forest on bank of Willow Creek, corticolous on bark of Aibes lasiocarpa, 8495 ft (2590 m), 6 Jun 2023, *S. Raynor & E. Manzitto-Tripp 2576* (COLO); OSMP, Bear Canyon, mesic montane forest, muscicolous, 7000 ft. (~2130 m), 26 Oct 2024, *J. Watts 854* (COLO).

Biatoropsis usnearum Räsänen.—This species is member to a diverse complex of basidiomycete lichen parasites whose taxonomy and phylogeny were clarified in Diederich et al. (2022). The genus *Biatoropsis* can be distinguished from similar gall-producing basidiomycete parasites on species of *Usnea* Dill. ex Adanson by their transversely septate (vs. longitudinally septate) basidia. *Tremella santessonii* Diederich also produces transversely septate basidia but basidia are much shorter in this species (16–21 µm) than in *Biatoropsis* (20–70 µm; Diederich et al. 2022). *Biatoropsis usnearum* produces relatively large galls (up to 2.5 mm diam. in our material) that have a brown to pinkish-brown center and dark brown to blackish-lobed edges when galls are fully mature. Elsewhere in its range, *B. usnearum* has been shown to infect a variety of host species of *Usnea* (Diederich et al. 2022), however we have found this species parasitic only on *U. cavernosa* Tuck. in Colorado. The related species *Biatoropsis minuta* Millanes can be differentiated by its smaller (0.1–0.8 mm diam. in our material), completely black, non-lobed galls that grow on *U*, *perplexans* Stirt. Another related species, *B. hirtae* Diederich & Millanes, can be differentiated by its flattened, tan galls that infect *U. hirta*. Both *B. minuta* and *B. hirtae* were recently reported from Colorado (Raynor et al. 2023). The distribution and abundance of *B. usnearum* seems to be constrained by the distribution and abundance of its host species, at least in Colorado material, much as is the case for *B. minuta* and *B. hirtae*. However, the degree of specificity of *B. usnearum* to *U. cavernosa* remains to be further explored by additional collections within Colorado as well as adjacent portions of the southern Rocky Mountains. Elsewhere in the USA, *B. usnearum* is reported from other species of *Usnea* (e.g., its common occurrence on *U. subgracilis* in the southern Appalachian Mountains; Tripp & Lendemer 2019), but a comprehensive study is needed to more fully understand host identity and specificity throughout this range.

Voucher specimens: **COLORADO. Archuleta Co.:** San Juan National Forest, streamside upper montane forest, East Fork of San Juan River, 7843 ft (2390 m), 24 Nov 2023, *J. Watts & E. Henry 900* (COLO). **Gilpin Co.:** Roosevelt National Forest, James Peak Wilderness, streamside subalpine mixed conifer forest, right off S. Boulder Creek, lichenicolous on *Usnea cavernosa*, 9382 ft (~2860 m), 13 Aug 2023, *S. Raynor & J. Hayes 3896* (COLO). **Huerfano/Las Animas Co.:** San Isabel National Forest, Apishapa Pass, south of La Veta, 9015 ft (2747.9 m), 6 Oct 1960, *S. Shushan 24889* (COLO). **La Plata Co.:** San Juan National Forest, 10–12 mi N of Hesperus, 9000 ft (2743 m), 6 Sep 1958, *Shushan 14936* (COLO). **Routt Co.:** Routt National Forest, vicinity of Gold Lake, ca. 2.5 mi E of Slavonia, Hahns Peak Quad., 9000 ft (~ 2743 m), 29 Jul 1956, *S. Shushan 8300* (COLO). **San Juan Co.:** San Juan National Forest, South Mineral Campground, 7 mi W of Silverton, 10000 ft (~3048 m), 21 Aug 1951, *S. Shushan 262* (COLO).

Buellia abstracta (Nyl.) H. Olivier.—This species, whose identity was clarified in Giralt et al. (2011), is characterized by is saxicolous habit, typically endolithic and indistinct thallus, presence of norstictic acid (but see Knudsen & Kocourkova 2012), black discs, dark brown epihymenium, hyaline hymenium, orangish-brown hypothecium, N- and I- exciple, and medium-sized, straight spores. Although uncommon to rare, where found, it typically occupies pebbles or decaying rock in the USA and elsewhere (Scheidegger 1991; Bertrand & Valance 2023). In our region, it is most likely to be confused with a *Lecidea* Ach. or *Sarcogyne* Flowtow owing to its black discs and lack of thallus, but its brown, 2-celled spores (12–13 × 4–5 µm, slightly larger in our region compared to elsewhere, see Giralt et al. 2011) readily differentiate it from those genera. Additionally, our material produces stictic acid (and is K+ yellow), being similarly deficient in norstictic acid as has been noted and rather common in southern California (Knudsen & Kocourkova 2012). The name *Buellia sequax* (Nyl.) Zahlbr. has been misapplied to this taxon (Giralt et al. 2011). In Colorado, we found *B. abstracta* on two occasions. The first collection was made at ~13200 ft (~4020 m) in the high alpine on a very steep, knife edge ridge between North and South Arapaho Peaks in the Indian Peaks Wilderness that lines the Boulder-Denver Skyline. The second was made at ~6000 ft (~1830 m) at the base of Flagstaff Mountain in Boulder's Open Space and Mountain Parks growing amongst Red Fountain Formation sandstone. This niche breadth is reflected elsewhere throughout its range (e g , Knudsen & Kocourkova 2012).

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, northeastern base of Flagstaff Mountain, 5966 ft (1818 m), 31 Jul 2023, *J. Watts 1132* (COLO). **Grand Co.:** Arapaho National Forest, steep knife edge between North and South Arapaho Peaks, 13233 ft (~4020 m), 8 Aug 2023, *E. Manzitto-Tripp et al. 10061* (COLO).

Caloplaca demissa (Körb.) Arup & Grube.—This species is characterized by its gray to brownish-gray or greenish-brown crustose thallus with conspicuously lobate margins (these frequently pruinose), its lack of secondary metabolites, and its discrete, laminal soralia. *Kuettlingeria teicholyta* (Ach.) Trevis. is similar in appearance but grows on calcareous rock and has confluent soredia. *Hyperphyscia adglutinata* (Flörke) H. Mayrhofer & Poelt is a similarly gray, lobate crust with laminal soralia and lacks secondary chemistry but differs by the presence of a lower cortex and a corticolous growth habit. *Caloplaca demissa* is common on the west coast of the USA, with scattered additional populations in southern Arizona and New Mexico and sporadic occurrences in eastern North America. It is otherwise common in Europe. In addition to morphology, sequence data from the nrITS region + *5.8S* help to further confirm the identification of one of our collections (Genbank PV899931).

Voucher specimen(s): **COLORADO. Boulder Co.:** OSMP, protected base of large granitic cliff in mixed lower montane forest, 7633 ft (~2326 m), 21 Oct 2023, *J. Watts 809* (COLO). OSMP, protected base of "Jaws" outcropping of Fountain formation, 7176 ft (~2187 m), 17 Nov 2024, *J. Watts 2902* (COLO).

Catillaria erysiboides (Nyl.) Th. Fr.—This species is most readily characterized by its minute granular thallus, beige apothecia, hyaline to pale yellowish-brown hypothecium, *Porpidia*-type asci, hyaline 2-celled spores that are constricted in the middle and asymmetrical (i.e., with one cell slightly wider than the other), spores that are 9–10 × 5–6 µm in our area (elsewhere, 8–11 × 4–5 µm; McCune 2017), and occurrence primarily on lignum (but see Spribille et al. 2010). *Catillaria erysiboides* is rare in North America (Printzen & Tønsberg 1999), previously known only from the Pacific Northwest, and is otherwise more common in Europe. It is most likely to be confused with other members of the genus such as *C. nigroclavata* (Nyl.) Schuler, which differs most prominently by its brown hypothecium, dark brown to black apothecia, slightly narrower spores that are not asymmetrical, and occurrence primarily on bark. These are the first reports of *C. erysiboides* from Colorado where it was found growing on the bark of *Abies* as well as on lignum.

Voucher specimens: **COLORADO. Grand Co.:** Arapaho National Forest, Crater Lake towards junction with Pawnee Pass Trail, 10316 ft (~3140 m), 4 Aug 2023, *E. Manzitto-Tripp et al. 9982* (COLO). **Hinsdale Co.:** BLM Land, subalpine forest near CR35 W of Cataract Gulch, 9389 ft (~3000 m), 25 Jul 2024, *E. Manzitto-Tripp 11049* (COLO).

Catillaria nigroclavata (Nyl.) Schuler.—This species is similar to *C. erysiboides* but differs in features as laid out in the above, most notably its brown hypothecium and slightly longer spores (10–12 × 3–5 µm in our material) with similarly sized lumina. *Catillaria nigroclavata* is a common species of eastern temperate North America and has also been found in scattered locations throughout west North America including New Mexico, Arizona, California, and Wyoming. Its discovery in Colorado, where it was found growing on bark in a subalpine forest at ~10700 ft (~3260 m) on *Abies*, is therefore not particularly surprising.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, Indian Peaks Wilderness, wet subalpine conifer forest, between Lake Isabelle and Long Lake, corticolous on *Abies lasiocarpa* bark, 10660 ft (~3250 m), 30 Jun 2022, *S. Raynor & E. Manzitto-Tripp 829* (COLO).

Chaenothecopsis debilis (Sm.) Tibell.—This species is readily differentiated from congeners and other calicioids by its relatively long (to ~1.0 mm), reddish-colored stalks that become intensified after addition of HNO_3, brown epihymenium and hymenium, dark brown hypothecium, ellipsoidal, smooth-walled spores that are frequently a mixture of simple and 1-septate (and measuring 6–7 × 2–3 in our material), and spores with septa that are similar in color to the spore walls. The ascomata of this species are additionally K–. The majority of calicioids have spores that are either simple or septate but not a mixture of the two, representing a characteristic feature of this species (along with a few others). See Selva & Tibell (1999) for additional information on *C. debilis*, which is common throughout North America but surprisingly has not yet been identified from Colorado. We found the species growing at low elevations in a rich, riparian corridor on the eastern slope of the Indian Peaks Wilderness.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, subalpine mesic slopes of Willow Creek, 9000–9300 ft (~2740–2840 m), 6 Jun 2023, *E. Manzitto-Tripp & S. Raynor 9747* (COLO).

Chaenothecopsis savonica (Räsänën) Tibell.—This remarkable non-lichenized species is characterized by its black stipes that are HNO3+ green, non-pruinose capitula that are K+ dirty pale red (elsewhere reported yellowish-brown), dark brown epihymenium, pale reddish-brown hymenium (in our material), and relatively small, smooth-walled, ellipsoid, and always simple spores (5.5–6.5 × 3–3.5 µm in our material; 4–5 × 3–3.5 *fide* protologue). It can be differentiated from *C. debilis* (Turner & Borrer ex Sm.) Tibell by aforementioned features. The type of *C. savonica* is from the historic province of Savonia in northern Finland (*Huuskonen s.n.*-H, photo!; *Huuskonen s.n.*-M, photo!). In Colorado, the species was collected growing on lignum in rich, subalpine forest.

Voucher specimen: **COLORADO. Grand Co.:** Arapaho National Forest, Crater Lake towards junction with Pawnee Pass Trail, 10316 ft (~3140 m), 4 Aug 2023, *E. Manzitto-Tripp et al. 9999* (COLO).

Cladonia acuminata (Ach.) Norrlin.—This species is characterized by its persistent primary thallus with narrowly lobed squamules, these weakly sorediate along the margins, and its secondary thallus of mostly simple to sparingly branched podetia at the apex, these variously decorticate or decorated with squamules or soredia. *Cladonia acuminata* typically produces atranorin, norstictic acid, and connorstictic acid, here confirmed via TLC. The species occurs throughout the USA, preferring higher elevations, and it is somewhat surprising that we newly report it to Colorado here. It was found growing on decaying lignum on soil at ~10700 ft (~3260 m) in subalpine forest, and on soil at 12170 ft (3710 m) in an alpine meadow.

Voucher specimens: **COLORADO. Boulder Co.:** Roosevelt National Forest, Indian Peaks Wilderness, wet subalpine conifer forest, between Lake Isabelle and Long Lake, lignicolous on fallen decaying wood, 10660 ft (~3250 m), 30 Jun 2022, *S. Raynor & E. Manzitto-Tripp 823* (COLO). **Huerfano Co.:** San Isabel National Forest, Sangre de Cristo Mountains, Culebra Range, east-facing alpine meadows below Trinchera Peak, terricolous on soil among mosses, 12170 ft (3710 m), 8 Jul 2024, *S. Raynor & J. Watts 5550* (COLO).

Cladonia bellidiflora (Ach.) Schaerer.—This remarkable, red-apotheciate species is characterized by its yellowish to grayish-green persistent primary thallus with squamules that are esorediate and deeply incised, its oftentimes clustered podetia that are commonly unbranched and hollow, either mostly decorticate or corticate and strongly interrupted, but always with dense, small to large squamules, and podetia that often become yellow or brown towards their base. Its K+ orange and P+ orange thallus is also UV+ bright blue-white owing to the presence of squamatic acid, as confirmed in our specimens via TLC, along with the presence of usnic acid. The lichenicolous hyphomycete *Taeniolella beschiana* Diederich occurs on podetia and/or squamules of *C. bellidiflora* (Zhurbenko & Pino-Bodas 2017) but has not yet been discovered on Colorado material. Both in the USA and elsewhere worldwide, *Cladonia bellidiflora* is a species with affinity to cool, moist, boreal forests where it occurs on soil, humus, and rotting wood (Brodo & Ahti 1996). In the USA it occurs primarily along the Pacific Coast, inland through montane habitats of the Pacific Northwest, and at higher latitudes in Canada in Alaska. In Colorado, it was collected on soil in moist, subalpine forests.

Voucher specimens: **COLORADO. Boulder Co.:** Roosevelt National Forest, Roosevelt National Forest, subalpine mesic slopes of Willow Creek, 900–9300 ft (~2740–3110 m), 6 Jun 2023, *E. Manzitto-Tripp & S. Raynor 9730* (COLO). **Boulder Co.:** Roosevelt National Forest, steep N-facing slopes of unnamed ridge, Jasper Creek drainage, 10230 ft (~3120 m), 29 Jun 2023, E. *Manzitto-Tripp & S. Raynor 9773* (COLO).

Digitothyrea divergens (Henss.) P.P. Moreno & Egea.—A globally rare or overlooked foliose cyanolichen, *Digitothyrea divergens* is here reported as new to Colorado, extending its North American range inland to the northeast by a few hundred miles. It is characterized by its chroococcoid cyanobacterial photobiont, rugose upper surface, furrowed lower surface, and apothecia that rarely develop mature spores. *Digitothyrea polyglossa* (Nyl.) P.P. Moreno & Egea shares these characters, but its lobes are wider (0.5–1.5 mm), more sparingly branched, and remain flat while those of *D. divergens* are narrower (0.5–1 mm), frequently branched, and ascending. Our material differs from the Greater Sonoran Desert treatment in being variably gray pruinose to black in color rather than strictly black, a character common in the Lichinaceae. It is differentiated from *Thyrea confusa* Henssen and related species by its stipitate to sessile apothecia, these remain immersed to semi-immersed in *T. confusa*.

Voucher specimen: **COLORADO. Boulder Co.:** BLM land, Mitre Peak, just N of Shelf Road climbing area, semi-mesic Dolomite overhang of a NW aspect, 7196 ft (~2193 m), 4 May 2024, *J. Watts & S. Raynor 1355* (COLO).

Endococcus verrucosus Hafellner.—This species was described by Hafellner (1994) as occurring parasitically on the thalli (and less commonly on apothecia) of different species of *Aspicilia* (see also Diederich et al. 2018). Hafellner (1994) furthermore distinguished *Endococcus verrucosus* by its I+ blue hymenium and brown, 2-celled spores that are rounded to fusiform at both ends, these mostly 14–17 × 7–9 µm but slight smaller in our material (13–14 × 6–7 µm; others, e.g., Zhurbenko & Notov 2015, have reported spores as 10–15 × 6–8). Although much research remains to be conducted on the genus both within the USA and elsewhere (Kocourkova & Knudsen 2011), it nonetheless seems to readily differentiable from related species by the above features. In the western USA, related species such as *E. thelommatis* Kocourk. & K. Knudsen are known but the latter occurs on *Thelomma santessonii* Tibell and is so far reported only from southern California. In Colorado, *E. verrucosus* was found growing in middle montane forest at on submerged *Aspicilia aquatica* Körber (sterile).

Voucher specimens: **COLORADO. Boulder Co.:** Roosevelt National Forest, vicinity of Buchanan Pass Trail, 9347 ft (~2870 m), 22 Aug 2023, *E. Manzitto-Tripp & S. Raynor 10175* (COLO). OSMP, White Rocks, lichenicolous on sterile *Aspicilia cinerea*, 5174 ft (~1577 m), 9 Sep 2024, *J. Watts et al. 2653 & 2665* (COLO).

Fuscopannaria cyanolepra (Tuck.) P.M. Jørg.—This species, which belongs to the *Fuscopannaria praetermissa* (Nyl.) P.M. Jørg. complex, is characterized by its tiny brown squamules, the margins of which are almost entirely dissolved into abundant bluish-gray, farinose soredia, its typical lack of pruina, and characteristic occurrence on soil (Jørgensen 2000a). The only other species with which *F. cyanolepra* could be confused are two others with distinctly brown thalli and bluish soredia: *F. mediterranea* (Tav.) P.M. Jørg. and *F. sorediata* P.M. Jørg. Both of the latter are corticolous and have a western maritime and eastern montane distribution, respectively. Additionally, the soredia of *F. mediterranea* are grayer in color and do not dissolve the entire margin. The soredia of *F. sorediata* are not continuous all the way to the thallus margin. The marginal squamules of *F. sorediata* are also larger and more elongate compared to those of *F. cyanolepra*, which never exceed a few millimeters in length and are rarely raised from the substrate. These features along with the riparian, terricolous habit of our collections solidify our material as *F. cyanolepra*. This species is a rare disjunct in Colorado from its primary distribution in the western coastal states where it was previously considered to be endemic (Root et al. 2011), where it typically occupies lower elevations (Jørgensen 2000b).

Voucher specimen(s): **COLORADO. Boulder Co.:** OSMP, Bear Canyon, soil over rock next to Bear Creek, 6903 ft (~2104 m), 26 Oct 2023, *J. Watts 872* (COLO). Boulder Co.: Cave Creek, Middle St. Vrain, 7900 ft (~2407 m), 2 Oct 1938, *W. Kiener 8679* (COLO).

Lacrima sonorae (Wetmore) Søchting, Arup & Bungartz.—This species is member to the *Caloplaca sideritis* (Tuck.) Zahlbr. group and is characterized by its thin, gray, mostly areolate to minutely squamulose thallus, an inner apothecial margin that is concolorous with orange to dark orange discs (these K+ red), and its outer apothecial margin that is gray. This combination of thallus and apothecial characters distinguish this species from all others in the *C. sideritis* group as set forth in Wetmore (1996) and others. *Caloplaca sideritis* s.s. (Gen) has gray inner and outer margins and *C. atroflava* (Turner) Mong. exhibits only a gray outer margin in older apothecia (Wetmore 1996). *Lacrima sonorae* has been found in a variety of habitats ranging from sea-level on the west coast of the USA to over 14000 ft (4270 m) in the Sierra Nevada Mountains to inland habitats including central Texas (Wetmore 1996). We here report the first two collections from Colorado, these ranging from ~6700–9700 ft (~2040–2960 m) elevation in the Front Range Mountains. Both collections were discovered on shaded rocks in stream-side forested habitats; the lower elevation collection was associated with *Populus angustifolia* E. James and *Acer glabrum* Torr. habitat in Gregory Canyon (Boulder Open Space and Mountain Parks) and the higher elevation specimen was collected in mixed conifer forest in the upper-montane to subalpine ecotone dominated by *Picea engelmannii* Engelm. and *Abies lasiocarpa* (Hook.) Nutt.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Gregory Canyon, montane riparian forest, 6697 ft (~2041 m), 21 Oct 2023, *J. Watts 794* (COLO). **Grand Co.:** Arapaho National Forest, Indian Peaks Wilderness, conifer forest near Roaring Fork Arapaho Creek, saxicolous on granitic rock, 9722 ft (~2963 m), 16 Sep 2022, *S. Raynor 1579c* (COLO).

Lecanora subrugosa Nyl.—This species, also a member of the *Lecanora subfusca* group, has pale gray continuous to areolate thalli that are K+ yellow, reddish-brown discs, reddish to yellowish-brown epihymenia that lack POL+ granules, ampithecia with large POL+ crystals that do not dissolve in K, hyaline hymenia that are variably inspersed with oil droplets in our material (elsewhere commonly non-inspersed), and thick-walled spores that are ~9–10 × 6.5–7 µm in our material. Chemically, *Lecanora subrugosa* can be identified additionally by the presence of roccellic acid, as here confirmed by TLC (in addition to chloroatranorin and atranorin). In the USA this species is known from the Great Lakes area, the Pacific Northwest, and from the southwestern states. It is most likely to be confused with *L. argentata* (Ach.) Malme, which can be differentiated by its production of gangaleoidin rather than roccellic acid (Brodo 1984). This is the first report of *Lecanora subrugosa* from Colorado where it was found growing on the bark of *Abies lasiocarpa*.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, lower montane riparian forest bordering South Fork Middle Boulder Creek, 9799 ft (~2990 m), 29 Jun 2023, *E. Manzitto-Tripp & S. Raynor 9783* (COLO).

Lecidea perlatolica Hertel & Leuckert.—The *Lecidea atrobrunnea* complex is one of the cryptically diverse, still incompletely known saxicolous groups in the southern Rocky Mountain lichen biota, consisting of entities with variable chemistry and minute, sometimes imperceptible, morphological differences. As delimited in Noell and Hollinger (2019), the group consists of six species that differ only in chemistry, although it is probable that additional entities belong to this group. Among these, *Lecidea perlatolica* is characterized by its morphologically variable, brown areolate thallus that contains perlatolic acid (Anantaprayoon et al. 2023) yielding a conspicuous UV+ blue-white reaction in the medulla. In our material, the areolate thallus is often a duller shade of brown compared to more typical *L. atrobrunnea* (Ramond ex Lam. & DC.) Schaerer. *Lecidea perlatolica* is likely a common species in the southern Rocky Mountain that has been overlooked for many years. In Colorado, we have found this species growing on rocks in lush, subalpine meadows to highly exposed alpine ridges in the Front Range and Medicine Bow Mountains.

Voucher specimens: **COLORADO. Boulder Co.:** Roosevelt National Forest, alpine slopes immediately S of South Arapaho Peak, 13267 ft (~4040 ft), 8 Aug 2023, *E. Manzitto-Tripp et al. 10072* (COLO); Roosevelt National Forest, Indian Peaks Wilderness, open subalpine forest with interspersed meadows, 21 Aug 2023, *S. Raynor 4051* (COLO). Grand Co.: Arapaho National Forest, Indian Peaks Wilderness, grassy alpine ridge, 17 Jul 2022, *S. Raynor & E. Manzitto-Tripp 961* (COLO); Arapaho National Forest, Indian Peaks Wilderness, rocky alpine ridge, 17 Jul 2022, *S. Raynor & E. Manzitto-Tripp 992* (COLO). **Larimer Co.:** Roosevelt National Forest, meadows surrounding Corral Creek below Iron Mountain, 10438 ft (~3180 m), 1 Jul 2016, *E. Manzitto-Tripp & E. Williams 5845* (COLO).

Leptogium laceroides (B. de Lesd.) P.M. Jørg.—*Leptogium laceroides* is a rather distinctive species that is morphologically related to members of the *L. saturninum* (Dickson) Nyl. complex. It is easily distinguished from all other isidiate *Leptogium* (Ach.) Gray spp. that bear white tomentose rhizines by its dense, sub-marginal to marginal secondary lobules. It is the isidiate counterpart to the fertile *L. burgessii* (L.) Mont., which also produces secondary lobules (Jørgensen & Nash 2004). *Leptogium joergensenii* and morphologically related species with marginal lobules are differentiated by their lack tomentose rhizines. It is otherwise known primarily from Central and South America with outlying populations in the southwestern USA, Appalachian Mountains, and Maine and Canadian providences surrounding the Gulf of Maine. *J. Watts 1134 (COLO)*.

Voucher specimen: **COLORADO. Boulder Co.:** OSMP, Gregory Canyon, steep, mossy canyon walls under *Pseudotsuga menziesii*, muscicolous over rock, 6200 ft (~1890 m), 15 Jul 2023, *J. Watts 1134* (COLO).

Marchandiomyces corallinus (Roberge) Diederich & D. Hawksw.—This is a pink lichenicolous basidiomycete fungus found on a number of (mainly foliose) lichen species. It is widespread throughout the eastern USA and Europe, but rarely reported from western North America. It is characterized by pink, subspherical bulbils to 250 µm in width, these covered in a hyaline amorphous layer easily observed under light microscope (Diederich et al. 2022). It is most easily confused with *Erythricium aurantiacum* (Lasch) D. Hawksw. & A. Henrici, especially when occurring on *Physcia* spp., but this species is a red to orange rather than bright pink, has smaller bulbils (to 150 µm), and characteristically erodes the entire thallus of its hosts, a character never observed in *M. corallinus*. Additionally, the bulbils of this species lack the hyaline amorphous outer layer characteristic of *M. corallinus*. *Corticium silviae* Diederich is also a lichenicolous basidiomycete fungus composed of pink bulbils, but this species is restricted to *Thamnolia* Ach. ex Schaerer.

Voucher specimen: **COLORADO. Teller Co.:** Pike National Forest, Raspberry Mountain, 10093 ft (~3076 m), 5 May 2024, *J. Watts & S. Raynor 1387* (COLO).

Ochrolechia subisidiata Brodo.—This species is remarkable for its granular to isidiate, cream-colored thallus, chemistry, and southwestern biogeographical affinity. Herbarium records document it from xeric sites in the southwest USA and northern Mexico, characteristically growing on Juniper wood in Pinyon Pine-Juniper forests. It is the only granular to isidiate *Ochrolechia* species from the Western USA and is not easily confused with any other member of the genus. *Ochrolechia pseudopallescens* Brodo is verruculose and found on wood and bark, but this species is never truly isidiate and contains protolichesterinic and lichesterinic acids while *O. subisidiata* contains lecanoric, gyrophoric, and variolaric acids. We report it new to Colorado, growing in a similar habitat to its core range on long-exposed wood of an old *Juniperus scopulorum* Sarg. on a steep, east-facing slope. This represents the second-most northern collection of *O. subisidiata*, with a disjunct collection reported from the foothills of western Montana.

Voucher specimen: **COLORADO. Fremont Co.:** BLM land, Seep Springs area, 7038 ft (~2145 m), 4 May 2023, *J. Watts & S. Raynor 1362* (COLO).

Parmeliella triptophylla (Ach.) Müll. Arg.—This micro-squamulose cyanolichen is characterized by its bluish brown to grayish brown squamules that rest against a prominent black hypothallus, yielding an overall dark color to individuals of this species, its biatorine apothecia with pale reddish-brown discs, its small hyaline spores, and occurrence on bark and rocks (the latter to a lesser extent), typically at elevation. It can be differentiated from *Fuscopannaria praetermissa* (Nyl.) P.M. Jørg., with which it might be confused, by its dense black prothallus. *Parmeliella triptophylla* (Ach.) Müll. Arg. can be found throughout the USA in mesic montane habitats ranging from throughout the Appalachian Mountains and Great Lakes to the Pacific Northwest and southwestern USA. Its occurrence in Colorado is therefore not particularly surprising.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Bear Peak, saxicolous on well-lit, N-facing rock, 7925 ft (~2415 m), 19 Oct 2023, *J. Watts763a* (COLO). OSMP, lower Gregory Canyon, saxicolous just above soil at base of moss-dominated cliff, 6215 ft (~1894 m), *J. Watts 1122* (COLO). Roosevelt National Forest, Como Creek just west of Peak-to-Peak Hwy., 8883 ft (2707 m), 14 Sep 2024, *J. Watts & A. Tan 2712* (COLO). **Douglas Co.:** Pike National Forest, Missouri Gulch, riparian outcroppings of Fountain Formation, 7597 ft (2315 m), 24 May 2024, *J. Watts 1700* (COLO). **Mineral Co.:** San Juan National Forest, vicinity of Big Meadows Reservoir, steep, rocky, N-facing slopes in montane forest, 9,163 ft (2,791 m), 2 Jun 2024, *E. Manzitto-Tripp 10676* (COLO).

Peccania subnigra (B. de Lesd.) Wetmore.—Known mostly from the Great Basin and western Colorado Plateau with outlying collections in North Dakota, *Peccania subnigra* is a minute, fruticose cyanolichen with abundant apothecia. Its branches are erect, cylindrical, and tightly packed to form cushions, much like in the polysporous *Lichinella stipatula* Nyl. *Peccania subnigra* can, however, be differentiated from the latter by its abundant apothecia bearing 8-spored asci and larger, ellipsoidal spores (~10 × 5.5 uM). *Peccania tiruncula* has rounder spores, irregular branches, and rarely forms cushions. *Pecannia subnigra* is further differentiated from the latter by occurring on soil rather than rock.

Voucher specimen: **COLORADO. Boulder Co.:** Hall Ranch Open Space, Indian Lookout Mountain, terricolous in crevice on red soils of the Fountain Formation, 5968 ft (~1819 m), 7 Mar 2023, *J. Watts 1174* (COLO).

Peltigera cinnamomea Goward.—*Peltigera cinnamomea* is a large-lobed cyanolichen that is likely rare in our region and distinguished by its slender, discrete rhizines and veins that are cinnamon or rust colored towards the center. It is perhaps most similar to *P. canina* (L.) Willd. and *P. praetextata* (Flörke ex Sommerf.) Zopf, which share characteristic large lobes that are often frosted in appearance from the presence of tomentum on the lobes, as well as lower surface veins that lack erect hairs. *Peltigera canina* differs from *P. cinnamomea* primarily by the presence of tufted flocculent rhizines. *Peltigera praetextata* differs from *P. cinnamomea* primarily by the presence of lobules along the lobe margins or stress cracks. Neither of these species, however, bear the diagnostic rusty cinnamon veins characteristic of *P. cinnamomoea*. This species has its center of distribution in the Pacific Northwest with multiple populations being found inland throughout the northern Rockies. All of our specimens were collected on soil along a small creeks (a small tributary of Arapaho Creek and Craig Creek) between ~8400 and ~9000 ft in near-pristine wilderness habitats. These deeply sheltered and relatively wet drainages provide habitats similar to the previously known localities for this species in the northern Rocky Mountains.

Voucher specimens: **COLORADO. Grand Co.:** Arapaho National Forest, Indian Peaks Wilderness, banks of Arapaho Creek, 8412 ft (~2564 m), 3 Jul 2023, *S. Raynor & E. Manzitto-Tripp 2999 & 3000* (COLO). **Park Co.:** Pike National Forest, Lost Creek Wilderness, near-pristine, remote section of Craig Creek, riparian mixed conifer forest, terricolous, 9063 ft. (~2762 m), 7 Jun 2025, *J. Watts 3835* (COLO).

Tassiloa friogranitica. See Section I.

Porpidia contraponenda (Arnold) Knoph & Hertel.—This remarkable crustose species is characterized by its thick, white, well-developed thallus that is continuous to areolate, large black apothecia, blue green epihymenium, I- medulla, halonate spores (these mostly 15–22 × 5–9 µm), occurrence on non-calcareous rock, and presence of methyl 2′-*O*-methylmicrophyllinate, as here confirmed using TLC. *Porpidia contraponenda* is elsewhere known relatively commonly from throughout the Appalachian Mountains and Great Lakes region and the Pacific Northwest, where it is less frequently encountered. In addition to morphology and chemistry, its identification was further confirmed via the sequencing of nrITS+5.8*s* data (GenBank PV899922). In our area, this species is perhaps most likely to be confused with *P. crustatula* (Ach.) Hertel & Knoph, which differs by its smaller spores and production of stictic acid, amongst other features. In Colorado, *Porpidia contraponenda* is known from a single collection, from subalpine forest growing on rock in a remote watershed of the west slope of the Indian Peaks Wilderness, Front Range Mountains.

Voucher specimen: **COLORADO. Grand Co.:** Arapaho National Forest, Roosevelt National Forest, subalpine mesic slopes of Willow Creek, 9755 ft (~2970 m), 25 Sep 2023, *E. Manzitto-Tripp & S. Raynor 10249* (COLO).

Pyrenodesmia praemontana. See Section I.

Squamulea squamosa (B. de Lesd.) Arup, Søchting & Frödén.—This widespread, rock-dwelling species has thick, areolate to squamulose thallus with convex lobes and dark apothecia. There is a long history of confusion surrounding the name *S. squamosa* compared to *S. subsoluta* (Nyl.) Arup, Søchting & Fröden. Bungartz et al. (2020) chose to retain *S. squamosa* and *S. subsoluta* as separate species in their phylogenetic study but recognized that distinction between the two can be difficult (see Wetmore 2003). We follow this lead, noting that although *S. subsoluta* is already documented from Colorado, these collections are marked by thalli that are rarely squamulose (and typically with flat lobes). Our material collected recently in Colorado has a distinctly squamulose thallus (also with convex lobes) and best fits circumscriptions of *S. squamosa*. Despite its occurrences in most of the states immediately proximal to Colorado, *C. squamosa* has not yet been documented from the state.

Voucher specimen: **COLORADO. Boulder Co.:** OSMP, Joder Ranch, base of a large cliff of Lyons sandstone, 6168 ft (~1880 m), 14 Sep 2023, *J. Watts 396* (COLO).

SECTION III. RARE SPECIES AND/OR REDISCOVERED SPECIES IN COLORADO

Abrothallus parmeliarum (Sommerf.) Arnold.—This foliose to subfoliose species is parasitic on species of *Parmelia* Ach. (Diederich 2003). In Colorado, it has been reported growing on *Parmelia sulcata* Taylor and *P. saxatilis* (L.) Ach. Prior to this report, *Abrothallus parmeliarum* was known only from five collections made in Colorado and not reported from the state in over six decades (i.e , since 1963). *Abrothallus parmeliarum* is characterized by its strongly convex apothecial discs that are black and often covered in a green pruina. It can be differentiated from all other lichenicolous species by its relatively large stature and its host preference. It is so far known in Colorado only from the mesic foothills of the Front Range Mountains.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Green Mountain, mesic montane forest with numerous boulders, 7705 ft (~2348 m), 24 Oct 2023, *J. Watts 835* (COLO). Caribou Ranch Open Space, Delonde Creek, 8736 ft (~2662 ft), 11 Jul 2024, *J. Watts 2158* (COLO). Roosevelt National Forest, Como Creek just west of Peak-to-Peak Hwy., 8883 ft (2707 m), 14 Sep 2024, *J. Watts & A. Tan 2683* (COLO) **Larimer Co.:** Arapaho-Roosevelt National Forest, mesic N-facing slopes just above the Cache la Poudre River, 6900 ft (~2103 m), 11 May 2024, *J. Watts 1466* (COLO).

Arthonia varians (Davies) Nyl.—This non-lichenized species parasitizes the apothecia of *Lecanora rupicola* (L.) Zahlbr. (Grube 2004; Van den Boom & Etayo 2014), so far as understood. *Arthonia varians* is further characterized by its olive to light brown epihymenium, I+ red hymenium, 8-spored asci, and hyaline, 4-celled spores. In Colorado, *A. varians* was previously known from *W. Weber S-2247* from Larimer County in the Front Range Mountains. We collected it just south of this location in rich, riparian forests of the Indian Peaks Wilderness.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, Roosevelt National Forest, subalpine mesic slopes of Willow Creek, 9000–9300 ft (~2740–2840m), 6 Jun 2023, *E. Manzitto-Tripp & S. Raynor 9757* (COLO).

Aspicilia fumosa Owe-Larss. & A. Nordin.—This species is a classic example of a rare disjunction from the high deserts of the Great Basin and Colorado Plateau from the Front Range foothills; *Acarospora nevadensis*, reported here as new to Colorado, is another. *Aspicilia fumosa* is characterized by its light gray, areolate thallus and lack of secondary metabolites, green to blue green epihymenium and relatively large spores (22–24 × 17–17 µm in our material) and long, filiform conidia (16–20 µm in our material). It is superficially similar to a number of gray *Aspicilia* spp., including *A. americana* B. de Lesd., *A. caesiocinerea* (Nyl. ex Malbr.) Arnold, *A. cinerea* (L.) Körber, and *A. cyanescens* (Owe-Larsson & A. Nordin. *Aspicilia americana* has smaller spores, *A. caesiocinerea* has shorter conidia, *A. cinerea* contains norstictic acid (resulting in a K+ yellow to red spot test), and *A. cyanescens* is generally darker in color with radiate, fissured margins and longer conidia. Our collections are from boulders just above the soil on various types of sandstone in lower montane habitats and represent the second time the species has been encountered in the state, not having been collected in Colorado since 1989 in a similar environment at Roxborough State Park. We expect this relatively recently described species to end up being widespread and common in suitable habitats.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Mount Sanitas, ground-level arkosic sandstone of the Fountain formation, 6326 ft (~1928 m), 8 Jun 2023, *J. Watts & S. Raynor 1268* (COLO); 12 Jul 2023, *J. Watts & R. Wilkens 2853* (COLO).

Bellemerea sanguinea (Krempelh.) Hafellner & Cl. Roux.—This remarkable species is clearly differentiated from species of *Aspicilia* A. Massal. by its reddish-brown discs. In our area, it could be confused for either *B. cinereorufescens* (Ach.) Clauzade & Cl. Roux or *B. alpina* (Sommerf.) Clauzade & Cl. Roux. From the former, it is differentiated by its larger spores (commonly reported as 14–22 × 6–14 [our material specifically 18–20 × 9–12] vs. 7–16 × 4–9 µm in *B. cinereorufescens*) and discs that are lighter reddish-brown when dry, turning red when wet. From the latter it can be differentiated by its K- thallus and lack of substances as confirmed via TLC (*B. alpina* is K+ red and produces norstictic acid). Prior to our work, *B. sanguinea* was known from only one other collection in Colorado made over three decades ago in Routt National Forest, north-central Colorado. We have documented this species from various portions of the Front Range Mountains ranging where it almost always occurs in mesic, stream-side forest on acidic rock.

Voucher specimens: **COLORADO. Boulder Co.:** Roosevelt National Forest, alpine slopes N of Blue Lake, 11417 ft (~3480 m), 5 Sep 2023, *E. Manzitto-Tripp & S. Raynor 10184* (COLO). **Grand Co.:** Arapaho National Forest, Indian Peaks Wilderness, near Buchanan Creek, 10810 ft (3295 m), 4 Sep 2022, *S. Raynor 1498* (COLO); Arapaho National Forest, Indian Peaks Wilderness, S of Watanga lake, 10329 ft (3148 m), 16 Sep 2022, *S. Raynor 1588* (COLO); Arapaho National Forest, Indian Peaks Wilderness, Wheeler Creek Basin, 9755 ft (2973 m), 25 Sep 2023, *S. Raynor & E. Manzitto-Tripp 4563* (COLO).

Bilimbia sabuletorum (Schreber) Arnold.—This crustose lichen is characterized by it continuous, oftentimes verrucose green to grayish-green thallus with pale to reddish-brown to sometimes black, convex apothecia, hyaline hymenium, brown hypothecium, and hyaline, fusiform, warted spores that are typically 6-celled and ~29–32 × 5 µm (in our material). *Bilimbia sabuletorum* occurs throughout the USA but commonly so in the eastern USA and less commonly so throughout the western USA. It grows characteristically in montane, conifer forests on soils and on bryophytes covering rocks. In Colorado, it was known from only a few records dating to the first decade of the 20th Century except for a single collection in western Colorado (Pitkin County) made in 2011. We here reconfirm its occurrence in the state from three records: two made on the west slope of the Indian Peaks Wilderness, Front Range Mountains, and one made in the foothills of the West Elk Mountains in western Colorado. All three were found in mesic, coniferous forests at lower to middle montane elevations.

Voucher specimens: **COLORADO. Grand Co.:** Arapaho National Forest, Indian Peaks Wilderness, near Roaring Fork Arapaho Creek, 9170 ft (2795 m), 16 Sep 2022, *S. Raynor 1543* (COLO); Arapaho National Forest, Indian Peaks Wilderness, Arapaho Creek, 9755 ft (2973 m), 25 Sep 2023, *S. Raynor & E. Manzitto-Tripp 4581* (COLO). **Gunnison Co.:** Gunnison National Forest, West Elk Mountains, riparian forest along FR709, Coal Creek, 6580 ft (~2010 m), 13 May 2024, *E. Manzitto-Tripp & J. Watts 10447* (COLO).

Fulgidea oligospora (Timdal) Bendiksby & Timdal.—Often found growing on burnt bark or wood, *Fulgidea oligospora* is characterized by its pastel green to yellow-green irregular squamules and abundant, lecideine apothecia that remain immature and typically are devoid of spores. Only a single specimen has ever been observed with mature apothecia (Timdal 2001). It is known from only three localities in Colorado, the last of which was collected four decades ago. *Fulgidea oligospora* is differentiated from *Xylospora friesii* (Ach.) Bendiksby & Timdal by its asci that remain immature and lack a gyrose upper surface and by containing alectorialic and/or thamnolic acids, which are lacking in *X. friesii*. *Hypocenomyce scalaris* (Ach. ex Lilj.) M. Choisy is much more common in Colorado and superficially similar, but the squamules of the latter are more regularly ladder-like (as the name suggests) and are densely sorediate on the lower surface. *Fulgidea oligospora* was collected between 6200–8200 ft (~1890–2500 m) elevation in a variety of montane habitats, all from burnt stumps.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Gregory Canyon just off Ranger Trail, 6895 ft (~2101 m), 21 Oct 2023, *J. Watts & E. Clark 783* (COLO); OSMP, Anemone Loop Trail, 6283 ft (~1915 m), 8 Jun 2024, *J. Watts 1910* (COLO); OSMP, W slope of South Boulder Peak, 6680 ft (~2036 m), 29 Jun 2024, *J. Watts & E. Henry 1948* (COLO). **Fremont Co.:** BLM land, Shelf Road climbing area, Cactus Cliff crag, 6856 ft (~2089 m), 26 Nov 2024, *J. Watts et al. 2956* (COLO). **Gilpin Co.:** Chaenotheca Gulch, SE of the junction of Ellsworth Creek and South Boulder Creek 8289 ft (~2526 m), 11 Jul 2024, *J. Watts & E. Manzitto-Tripp 2140* (COLO); Chaenotheca Gulch, SE of the junction of Ellsworth Creek and South Boulder Creek 8289 ft (~2526 m), 11 Jul 2024, *E. Manzitto-Tripp & J. Watts 10899* (COLO). **Teller Co.:** Pike National Forest, ridge just north of Raspberry Mountain Trailhead 10154 ft (3095 m), 5 May 2024, *S. Raynor & J. Watts 5020* (COLO).

Illosporium roseum Mart.—*Illosporium roseum* is a pink, ecorticate lichenicolous fungus that invades the soralia of *Peltigera didactyla* (With.) J.R. Laundon and less commonly other species of *Peltigera* Willd. *Illosporium roseum* is highly distinctive and not easily confused with most other lichenicolous fungus. *Erythricium aurantiacum* is also a pink, somewhat tomentose parasite but is known only from hosts belonging to the Physciaceae and Teloschistaceae (specifically, Xanthorioideae). *Erythricium aurantiacum* is further phenotypically differentiated by its tendency to completely erode the thallus of its host and form dense mats of pink bulbils that are granular to large and tomentose. In contrast, *Illosporium roseum* is composed of generally smaller, granular (and occasionally pruinose) bulbils that are for the most part restricted to soralia but occasionally are found bursting through the margins of its hosts. Prior to our work, it had been collected only once in Colorado, six decades ago in Boulder County on the banks of Lefthand Creek. So far as understood, this species is known from <20 collections in the USA and <90 collections globally.

Voucher specimens: **COLORADO. Archuleta Co.:** San Juan National Forest, SE bank of the South Fork Rio Grande, 16 May 2024, *S. Raynor et al. 5145* (COLO). **Boulder Co.:** Roosevelt National Forest, steep N-facing slopes of unnamed ridge, Jasper Creek drainage, 10230 ft (~3120 m), 29 Jun 2023, *E. Manzitto-Tripp & S. Raynor 9764* (COLO); OSMP, W slope of South Boulder Peak, lichenicolous on *Peltigera didactyla*, 6765 ft (2061 m), 20 Sep 2023, *J. Watts 428* (COLO).

Lecanora cavicola Creveld.—This crustose to occasionally subsquamulose lichen is characterized by its verrucate upper surface that is pale olive to pale grayish-green, white prothallus, and pale greenish to pale pink or orange soredia in combination with spot tests (thallus and soredia K+ yellow and soredia variably C+ pink depending on alectorialic acid concentration; Galloway 2002) and chemistry (atranorin, alectorialic acid, others). *Lecanora cavicola* occupies non-calcareous rocks and occurs in high alpine regions around the world (Crevald 1981) In Colorado, it was previously known from only two collections, both from Rocky Mountain National Park. The present reports extend the known distribution of the species slightly southward where it was collected from the Front Range Mountains as well as on the northern slopes of Trinchera Peak in the Culebra Range.

Voucher specimens: **COLORADO. Grand Co.:** Arapaho National Forest, steep knife edge between North and South Arapaho Peaks, 13233 ft (~4020 m), 8 Aug 2023, E. *Manzitto-Tripp et al. 10042* (COLO). **Huerfano Co.:** N ridge of Trinchera Peak, Culebra Range, 13202 ft (~4023 m), 8 Jul 2024, *J. Watts & S. Raynor 2089* (COLO).

Lecidea protabacina Nyl.—This is the stictic acid-bearing constituent of the *Lecidea atrobrunnea* complex (see *L. perlatolica* section for discussion on this group). *Lecidea protobacina* is distinguished by its subsquamulose areoles, bluish-black apothecia, and small spores (these 6–9 × 3–4 µm in our material). Before our work, this species was known from Colorado only from a single specimen collected in 1965 by W. Weber on the west slope of Hahn's Peak at ~9000 ft We here document the second known occurrence of this species in Colorado, also from the west slope of the Continental Divide at ~10400 ft (~3170 m) elevation in Hell Canyon of the Indian Peaks Wilderness. Spot tests help to aid in the identification of some of the members of this group: K+ yellow in *L. protabacina*, K+ red forming crystals in *L. syncarpa* Zahlbr. owing to norstictic acid, K- in *L. atrobrunnea* and *L. perlatolica*, although note that according to McCune (2017) *L. protobacina* sometimes additionally produces traces of norstictic acid.

Voucher specimen: **COLORADO. Grand Co.:** Arapaho National Forest, Indian Peaks Wilderness, steep west slope conifer forest, 10373 ft (~3160 m), 2 Jul 2023, *S. Raynor & E. Manzitto-Tripp 2942a* (COLO).

Leptogium joergensenii Marcelli & Kitaura.—This recently described species was segregated from the more broadly applied name *L. denticulatum* Nyl. (Kitarua et al. 2015). *Leptogium joergensenii* is characterized by its smooth upper surface, presence of both marginal and laminal lobules, and lack of white, tomentose rhizines on its undersides. In our area, it might be confused for *L. cyanescens*, but that species has columnar isidia. *Leptogium mastocheilum* (Vain.) Kitaura & Marcelli is also similar but differs in having only marginal lobules, and the more narrowly defined *L. denticulatum* has lobules only on its apothecial margins. *Leptogium joergensenii* is rare and/or overlooked throughout its distribution, which spans southern portions of the USA. It is currently known from fewer than 50 collections (*fide* Consortium) and only two historical localities in Colorado, where populations represent its northern limit of distribution. Of the cyanolichen communities of the mesic canyons of the Front Range foothills, this appears to be one of the more conspicuous species despite these canyons lying at its northern distribution limit.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Flagstaff Western Conservation Area, 5894 ft (~1796 m), 28 Sep 2023, *J. Watts 537* (COLO); OSMP, N face of Bear Peak, 7925 ft (~2415 m), 19 Oct 2023, *J. Watts 761* (COLO); Anne U. White Trail, Boulder County Open Space, 6239 ft (~1901 m), 25 Sep 2024, *J. Watts & E. Henry 2752* (COLO); Roosevelt National Forest, Boulder Bowl in Boulder Canyon Narrows Section, 7657 ft (~2333 m), 20 Oct 2024, *J. Watts et al. 2847* (COLO). **Larimer Co.:** Roosevelt National Forest, E banks of Cow Creek S of confluence with West Creek, 7690 ft (~2350 m), 29 Jul 2023, *E. Manzitto-Tripp & S. Raynor 9966* (COLO); Arapaho-Roosevelt National Forest, mesic N-facing slopes just above the Cache la Poudre River, 6900 ft (~2103 m), 11 May 2024, *J. Watts 1468* (COLO). **Park Co.:** Pike-San Isabel National Forest, Eleven Mile Canyon Recreation Area, steep Douglas Fir Forest with abundant boulders, 8156 ft (~2485 m), 22 Aug 2024, *J. Watts 2531* (COLO).

Lichinella minnesotensis (Fink) Essl.—This species was until the present study known from Colorado through only a single collection made at a low elevation (~5600 ft or ~1710 m) near the town of Lyons in the Front Range Mountains. This record dates to the 1960s. *Lichinella minnesotensis* is recognizable by its squamulose thallus with squamules that are characteristically monophyllous and ascending and typically entire along the margins or only weakly lobulate. Specimens of this species are typically fertile and its roughened discs help to further confirm its identification (Schultz 2005). *Lichinella minnesotensis* is primarily a species of the Great Plains, with additional occurrence records from southwestern Texas through southern Nevada. We here document its rediscovery in the state via one collection from similarly low-elevation habitat in southeastern Colorado.

Voucher specimen: **COLORADO. Otero Co.:** Comanche National Grasslands, vicinity of Timpas Creek N of Delhi, 4791 ft (~1460 m), 5 Jun 2015, *E. Manzitto-Tripp et al. 5620* (COLO).

Micarea incrassata Hedl.—This inconspicuous crustose lichen can be identified by its C-, P- areolate thallus, immersed apothecia with poorly developed exciples (these basically lacking a margin when mature), its reddish-brown K- hypothecium, 1-septate spores, micareoid photobiont, and typical presence of cephalodia (Konoreva et al. 2018). *Micarea incrassata* is known elsewhere from alpine tundra soil communities (Konoreva et al. 2018). Prior to our study, the species had been reported from Colorado via a single collection from ~7100 ft in the Front Range Mountains. This specimen (*J. Thomson 22345*, *WIS*) has not been seen by us and it should be noted that the habitats present at this altitude are atypical for the species. We collected and verified the occurrence of *M. incrassata* in Colorado in the high arctic on an exposed knife ridge in the Front Range Mountains.

Voucher specimen: **COLORADO. Grand Co.:** Arapaho National Forest, steep knife edge between North and South Arapaho Peaks, 13223 ft (~4030 m), 8 Aug 2023, *E. Manzitto-Tripp et al. 10045* (COLO).

Physcia halei J.W. Thomson.—This species was previously documented from the state via a collection from lower montane forest at 7100 ft in the Front Range Mountains. *Physcia halei* is relatively common on non-calcareous rocks throughout various portions of the USA including the central and upper Midwest, southwest, and Appalachians. We here confirm the second known occurrence of *Physcia halei* in Colorado via a collection from lower montane forest in the Front Range Mountains. Our specimen contains atranorin as confirmed via TLC.

Voucher specimen: **COLORADO. Boulder Co.:** Roosevelt National Forest, lower subalpine forest near Horseshoe Creek, 10100 ft (~3080 m), 16 Aug 2023, *E. Manzitto-Tripp & S. Raynor 10121* (COLO).

Physconia grumosa Kashiw. & Poelt.—This species is characterized by the presence of both lobules and granular isidia, which may be weakly corticate or pseudocorticate, and its lack of secondary chemistry. Amongst comparable species known from North America, *Physconia grumosa* may be confused with *P. detersa* (Nyl.) Poelt, which also lacks secondary chemistry and produces soredia that may become deeply pigmented and pseudocorticate as is common in the group. However, the latter species lacks lobules on older parts of the thallus. *Physconia isidiigera* (Zahlbr. in Herre) Essl. may have elongate isidioid soredia in extreme cases, but that species has a paraplectenchymatous upper surface whereas P. grumosa has a scleroplectenchymatous upper surface (Esslinger & Dillman 2010).

Voucher specimen: **COLORADO. Boulder Co.:** OSMP,N face of Bear Peak, saxicolous on mesic, high light cliff above scree, 7925 ft (~2415 m), *J. Watts 769* (COLO).

Physconia isidiomuscigena Essl.—This species of the high basin and desert is characterized by its relatively large, ascending thalli with concave lobes with pruinose tips, its soredia that are both laminal and marginal that become isidioid through time, its white to sometimes pale-yellow medulla, and production of variolaric acid plus occasional production of secalonic acid A. In our area, *Physconia isidiomuscigena* is most likely to be confused with *P. enteroxantha* (Nyl.) Poelt, which similarly and frequently has a pale-yellow medulla and is very common in Colorado. However, the latter differs from *P. isidiomuscigena* by producing soredia that are primarily marginal (vs. both marginal and laminal), lacking the characteristic upturned lobes, and in lacking variolaric acid. *Physconia isidiomuscigena* could additionally be mistaken for *P. isidiigera* (Zahlbr.) Essl., but the latter differs also in producing primarily marginal soredia, never has a pale-yellow medulla, and lacks secondary chemistry. Molecularly, *P. isidiomuscigena* is not strongly differentiated from *P. muscigena* (Ach.) Poelt at least based on data sampled (Starosta & Svoboda 2020), but the latter species is apotheciate and lobulate and does not produce soredia or isidia. In Colorado, *P. isidiomuscigena* was previously known only from three collections ranging from the San Juan Mountains to the Front Range. We here document it from five additional collections made in the high basin habitats near Kremmling where it was found growing under junipers over mosses in exposed habitats, the Uncompahgre Plateau, and the City of Boulder OSMP, at a remarkably consistent elevation of ~7400–7800 ft (~2260–2380 m).

Voucher specimens: **Colorado. Boulder Co.:** OSMP, N face of Green Mountain, 7606 ft (~2318), 29 Jun 2024, *J. Watts & E. Henry 1954* (COLO). **Grand Co.:** BLM land near Wolford Mountain, 7471 ft (~2280 m), *E. Manzitto-Tripp & J. Watts 10293* (COLO). BLM land near Wolford Mountain, 7471 ft (~2280 m), *J. Watts & E. Manzitto-Tripp 1212* (COLO). BLM land near Wolford Mountain, 7684 ft (~2342 m), *J. Watts & E. Manzitto-Tripp 1218* (COLO). **Mesa Co.:** BLM land on the Uncompahgre Plateau, Dominguez Escalante National Conservation Area, 7678 ft (~2340 m), 14 May 2024, *J. Watts & E. Manzitto-Tripp 1543* (COLO).

Rhizocarpon viridiatrum (Wulfen) Körb.—This yellow lichenicolous species with submuriform spores grows on saxicolous, crustose lichens, commonly on *Aspicilia* and relatives (Freebury 2014; Szczepańska 2015). *Rhizocarpon viridiatrum* is most likely to be confused with *R. atrovirellum* (Nyl.) Zahlbr. or *R. intermediellum* Räsänen, which are also yellow lichenicolous species. However, the latter two have collar-like areoles surrounding their apothecia and spores that are only 2 to 6-celled whereas *R. viridiatrum* lacks collar-like areoles and has 6–10-celled spores. *Rhizocarpon viridiatrum* was previously known from Colorado from four collections made in the 1930s, all from Rocky Mountain National Park. As such, the present report represents the first documentation of the species in Colorado in 85 years. It was found growing on *Lecidea protabacina* Nyl. at ~10400 ft (~3170 m) in Hell Canyon, located on the west slope of the Indian Peaks Wilderness, just sound of Rocky Mountain National Park.

Voucher specimen: **COLORADO. Grand Co.:** Arapaho National Forest, Indian Peaks Wilderness, steep W slope conifer forest, 10373 ft (~3160 m), 2 Jul 2023, *S. Raynor & E. Manzitto-Tripp 2942b* (COLO).

Rinodina riparia Sheard.—This species is characterized by its smooth, dull gray areolate thallus that is K– and P–, black apothecia with epruinose discs, rather large, *Dirinaria*-type spores (see Figure 1 in Sheard 1998 for description of development thereof) that are slightly pigmented and with a thickened septum that expands in K, spores that are ~18–23 × 10–11 µm in our material, and occurrence on trees, primarily on *Populus angustifolia* (Sheard 2018). *Rinodina endospora* Sheard also has large, *Dirinaria*-type spores but is restricted to California where it usually occurs on twigs. *Rinodina metaboliza* Vain. is also similar to *R. riparia* in many respects but has smaller spores. *Rinodina albertana* Sheard shares a similar niche and large *Dirinaria*-type spores with *R. riparia* but has scabrid thalli due to the presence of blastidia whereas *R. riparia* has a smooth, gray continuous to areolate thallus. *Rinodina riparia* is globally a rare species that is so far as understood to be restricted to western North America. In Colorado, it was known from only two collections. The present report marks the third known occurrence of this species in the state and the first report in four decades.

Voucher specimens: **COLORADO. Boulder Co.:** OSMP, Ranger Trail, Gregory Canyon, on *Populus angustifolia*, 6697 ft (~2041 m), *J. Watts 785* (COLO); OSMP, lower Bear Canyon, 5917 ft (~1803 m), 26 Oct 2023, *J. Watts 840* (COLO).

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