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***Hypogymnia pulverata* (Parmeliaceae) and *Collema leptaleum* (Collemataceae), two macrolichens new to Alaska**

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Abstract: *Hypogymnia pulverata* is a foliose macrolichen distinguished by its solid medulla and laminal soredia. Though widespread in Asia, it is considered rare in North America, where it is currently known from three widely separated locations in Québec, Oregon, and Alaska. We document the first report of this species from Alaska and from several new localities within south-central and southwestern Alaska. *Collema leptaleum* is a non-stratified, foliose cyanolichen distinguished by its multicellular, fusiform ascospores and a distinct exciple cell type. It is globally distributed, known most proximately from Kamchatka, Japan and eastern North America, but considered rare in Europe. It has not heretofore been reported from western North America. We report it from three locations in south-central Alaska.

Key words: North America, Alaska, biogeography, lichens, *Hypogymnia*, *Collema*

Introduction: The Cook Inlet in south-central Alaska is a long, narrow body of water that produces unique biogeographic and climatological features in the surrounding terrestrial ecosystems. For over a distance of 290 km, this area brings together one of the steepest temperature gradients in all of Alaska with the intersection of the high precipitation and oceanic temperature regimes of the Pacific coast and the continental climatic zones of the Alaska interior (see e.g. climate maps in Krog 1968). Biogeographically, the inlet represents the transition between *Picea sitchensis* and *Tsuga mertensiana* in the south, widely considered the northernmost extent of the Pacific coastal rainforest (Schoonmaker et al. 1997) and *Picea glauca* and *P. mariana* of the north. Hultén (1941) recognized this area, and the Kenai Peninsula which helps form the inlet, as a unique phytogeographic district within Alaska based on its phanerogam flora, terming it the ‘Central Pacific Coast district’. This combination of climatic and substrate diversity makes Cook Inlet an area of exceptional interest for epiphytic lichens.

The earliest lichen collections known from Cook Inlet are those of the renowned ichthyologist Tarleton H. Bean, who visited the area in 1880 (specimens in US), and whose collections were documented by Rothrock (1884). Krog (1968) was the first to document an array of oceanic macrolichens such as *Nephroma helveticum* var. *sipeanum*, *Platismatia norvegica*, *Pseudocyphellaria crocata* and *Sticta limbata* from upper Cook Inlet, where, she believed, they reached their northern limits. Krog (1968) also reported two remarkable disjunctions from the region, namely *Anaptychia palmulata* and *Heterodermia galactophylla*, species of tropical and Asian distribution otherwise confined in North America to the eastern half of the continent. However, collections were limited and she did not recognize a wider pattern in her phytogeographical analyses. More recently, intensified lichenological work has turned up several additional disjunct macrolichens, notably *Erioderma pedicellatum*, an IUCN-listed cyanolichen known in North America otherwise only from Atlantic Canada (Nelson et al. 2009). In the present paper, we report on two more noteworthy range extensions for species likewise found primarily in Asia and/or eastern North America, namely *Hypogymnia pulverata* and *Collema leptaleum*.

Materials and Methods: The collections reported here were made between 2007-2010 during botanical surveys in and around Denali National Park and Preserve, Katmai National Park and Preserve, Lake Clark National Park and Preserve, and air quality monitoring field work in south-central and southeastern Alaska. Specimens were studied using standard light microscopy methods. Photographs were taken through an Olympus trinocular compound microscope with a mounted digital camera or with a digital SLR camera. Specimens of *Collema leptaleum*, including the type, were examined on loan from FH and US.

Results: The Species

Hypogymnia pulverata (Nyl. ex Crombie) Elix, *Brunonia* 2(2): 217 (1979). Basionym: *Parmelia mundata* Nyl. var. *pulverata* Nyl. ex Crombie, J. Linn. Soc., Bot. 17: 395 (1879). Type: [AUSTRALIA: Tasmania] Montis Tabularis, 1802-5, R. Brown 550 (BM, n.v.).

Hypogymnia pulverata is the only widespread Northern Hemisphere member of the morphologically circumscribed subgenus *Solidae* (Bitt.) Krog, the species of which are readily distinguished on account of their mostly solid medulla. *H. pulverata* is unique in this group on account of its laminal, granular soredia that arise through disintegration of the upper cortex (Figure 1). All other high latitude Northern Hemisphere *Hypogymnia* species with laminal soredia have hollow lobes. *Hypogymnia imshaugii* may occasionally produce solid lobes (Goward unpublished) but that species is esorediate and possesses a much different thallus architecture of lobes standing out at an angle from its substrate, and is not known to occur in Alaska. *Hypogymnia pulverata*, by contrast, possesses a characteristic trailing habit (Figure 1).

Hypogymnia pulverata was first reported in North America by Brodo (1989) from a collection on *Picea mariana* near the Inuit village of Umiujaq, Québec, along the eastern coast of Hudson Bay. Nearly a decade later and over 3,000 km away, a single site was reported from litterfall in a mature *Picea sitchensis* coastal dune forest in Tillamook County, Oregon (McCune et al. 1997). Most recently, in 2004, the species was collected from a U.S. Forest Service Forest Inventory Analysis plot (FIA plot 44542) in a mature *Tsuga mertensiana* forest southwest of

Hope, Alaska on the Kenai Peninsula (Sarah Jovan, pers. comm. 2009), the basis for the inclusion of Alaska in the range of the species by McCune and Geiser (2009). *Hypogymnia pulverata* is considered common across Australasia (Elix 1979, Elix 1992) and is also known from Japan, China, and the Russian Far East (Rassadina 1971, Elix 1992). Its apparent rarity in North America, though, has so far led to a critically imperiled (S1) listing in the state of Oregon (NatureServe 2011).

In the upper Cook Inlet basin, *Hypogymnia pulverata* was primarily observed on the dead twigs and branches of *Picea glauca* and *P. mariana*, often in stands immediately adjacent to open peatlands (Figure 1) or small ponds. Thalli were occasionally observed on the bark of *Betula neoalaskana* within these same forests. Both P+ red (protocetraric acid) and P- chemotypes are known for *Hypogymnia pulverata*, yet so far only P+ red material has been documented in Alaska. *Hypogymnia pulverata* rarely produces apothecia, which are typically subpedicellate with a sorediate, funnel-shaped receptacle and concave to flat discs 3-12 mm wide. We note that only one of our reported collections (Walton 13583) contained apothecia. At sites southwest of Cook Inlet, *Hypogymnia pulverata* appeared to be widespread but uncommon within large tracts of *Picea glauca* forest. *Hypogymnia pulverata* was most often seen on mature *Picea glauca* trees skirted with a moderate to high abundance of dead twigs and branches occurring up to 2 m or more in height (Figure 1). Often one to a few thalli would be observed on a single tree, with no additional thalli observed on surrounding trees with similar structure. Several thalli were also observed on *Betula neoalaskana* boles both in mixed mature *P. glauca* – *B. neoalaskana* forest and occasionally in pure stands of *B. neoalaskana*. East of Cook Inlet on the Kenai Peninsula, *Hypogymnia pulverata* was found in a mixed mature *Tsuga heterophylla* – *Picea* forest. Associated epiphytic macrolichens from *Hypogymnia pulverata* collection sites include *Alectoria sarmentosa*, *Bryoria* spp., *Tuckermannopsis chlorophylla*, *T. sepincola*, *Hypogymnia apinnata*, *H. bitteri*, *H. occidentalis*, *H. physodes*, *Leptogium saturninum*, *Lobaria hallii*, *L. pulmonaria*, *L. scrobiculata*, *Melanohalea olivacea*, *Nephroma bellum*, *N. parile*, *Parmelia sulcata*, *Platismatia glauca*, *Pseudocyphellaria anomala*, *P. crocata*, *Ramalina dilacerata*, *R. roesleri*, *R. farinacea*, and *Usnea* spp. All known Alaskan localities of *Hypogymnia pulverata* are shown in Figure 2.

Specimens examined: U.S.A. ALASKA.

MATANUSKA-SUSITNA BOROUGH: Denali National Park and Preserve, near Kahiltna River, mature *Picea* – *Betula* forest; 62.480°N 151.172°W; 243 m elev., on *Picea glauca* branch, *LaSelle 07-225* (herb. Denali NPP); Denali National Park and Preserve, near toe of Ruth Glacier, *Picea* – *Betula* peatland forest; 62.703°N 150.326°W; 205 m elev., on *Picea mariana* branches, *Nelson 08-389 & 08-390* (herb. Denali NPP), on *Picea mariana* branch, *Walton 11352* (herb. Denali NPP), bark of *Betula neoalaskana*, *Spribille 27977 & 27993* (ALA), bark of *Picea* branches and twigs, *Spribille 27995 & 28003* (ALA); Parks Highway, near Milepost 127, *Picea mariana* peatland forest; 62.490°N 150.277°W; 209 m elev., bark of dead *Picea mariana* twig, *Walton 11669* (herb. Walton), bark of *Betula neoalaskana* branch, *Walton 11670* (herb. Walton); Petersville Road, east of Trail Ridge Road, *Picea* peatland forest; 62.321°N 150.466°W; 166 m. elev., on bark of *Picea* sp., *Spribille 27704* (herb. Spribille); Knik, Mackenzie Point Road; 61.317°N 150.022°W; 39 m elev., dead *Picea glauca* branch, *Root 1888* (herb. Root). KENAI PENINSULA BOROUGH: U.S. Forest Service Forest Inventory and Analysis Plot 44542, 60.829°N 149.951°W; 335 m elev., 100 yr old hemlock stand, (no substrate given), *T. Boucher plot 44522*, coll. #6 (herb. USFS FIA program); Hope, Resurrection Creek Road; 60.895°N 149.603°W; 214 m elev., dead *Picea glauca* branch, *Root 1890* (herb. Root); LAKE AND PENINSULA BOROUGH: Lake Clark National Park and Preserve, unnamed lake, *Picea mariana* peatland forest; 60.109°N 154.894°W; 166 m elev., bark of *Picea mariana* branch, *Walton 13583* (herb. Lake Clark NPP); Katmai National Park and Preserve, Milone Lake, *Picea glauca* forest; 58.407°N 156.122°W; 80 m elev., bark of dead *Picea glauca* twig, *Walton 13007* (herb. Katmai NPP); Katmai National Park and Preserve, Nonvianuk River, *Picea glauca* forest; 59.022°N 155.650°W; 199 m elev., bark of dead *Picea glauca* twig, *Walton 13023* (herb. Katmai NPP); Katmai National Park and Preserve, Naknek Lake, bark beetle killed *Picea glauca* forest; 58.68°N 155.50°W; 130 m elev., bark of dead *Picea glauca* twig, *Walton 13039 & 13040* (herb. Katmai NPP), bark of *Betula neoalaskana* bole, *Walton 13041* (herb. Katmai NPP); Katmai National Park and Preserve, Colville Lake, bark beetle killed *Picea glauca* forest; 58.713°N 155.515°W; 78 m elev., bark of dead *P. glauca* twigs, *Walton 13472 & 13479* (herb. Katmai NPP), bark of *Betula neoalaskana* bole, *Walton 13381* (herb. Katmai NPP); Katmai National Park

and Preserve, Brooks Camp, bark beetle killed *Picea glauca* forest; 58.548°N 155.783°W; 22 m elev., dead *Picea glauca* twigs, *Walton 13411*, 13507, 13508 (herb. Katmai NPP); Katmai National Park and Preserve, Bay of Islands, bark beetle killed *Picea glauca* forest; 58.636°N 155.443°W; 41 m elev., dead *Picea glauca* twig, *Walton 13406* (herb. Katmai NPP).

Collema leptaleum Tuck., Proc. Amer. Acad. Arts Sci. **6**: 263 (1864). Type: [U.S.A.: New Hampshire] “in Montib. Albis”, 1852, *Tuckerman s.n.* (FH-TUCK-1508!).

Collema leptaleum is an epiphytic foliose cyanolichen distinguished by apothecia with a euparaplectenchymatous proper exciple (large, open cells that are the same size in all dimensions), and by its slightly curved, multicellular, acicular to fusiform ascospores 26–50 µm in length (Figure 3). *C. leptaleum* has two intergrading morphological varieties, the most common of which (var. *leptaleum*) ranges from pulvinate tufts of distinguishable small lobes to a stretched, almost crustose thallus with small, marginal and laminal pustules and abundant apothecia (Figure 3). The other variety (var. *bilosum* (Mont.) Degel.) has isidia, infrequent apothecia and is not discussed here because it is generally considered a tropical taxon. Similar epiphytic species in Alaska include *Collema curtisporum*, which has longer ascospores and a euthyparaplectenchymatous exciple (Degelius 1954, 1974).

Collema leptaleum is purported to be one of the most widely distributed species in the genus (Degelius 1974). Outside of North America, it has been reported from Asia (Liu and Wei 2009, Degelius 1974), Australia (Elix 1994, Degelius 1974), South America and Africa (Degelius 1974). In Europe, it is known from one location (Tønsberg 1993) in Norway, where it is red listed (Jørgensen et al. 2007). Within North America, *Collema leptaleum* var. *leptaleum* has been known to occur in eastern United States for over 150 years. *Collema leptaleum* var. *bilosum* is reported mainly from tropical and subtropical regions but can co-occur with var. *leptaleum* in lower latitudes (Degelius 1974).

Alaskan specimens of *Collema leptaleum* all belonged to var. *leptaleum*, and both pulvinate and stretched crustose thallus morphologies (Degelius 1974, Tønsberg 1993) were observed. Most specimens were collected in moist, boreal

forests on *Picea glauca* twigs. *Collema leptaleum* was one of the most common non-stratified cyanolichens at a site near Cascade Creek in Denali National Park and Preserve, along a thin strip of forest on the floor of a steep-walled mountain valley at approximately 300 m in elevation. The only other collection location in Denali was less than 20 kilometers away, in a mixed *P. glauca* – hardwood alluvial floodplain forest at an elevation of 146 m. The single specimen collected outside Denali was found just west of the city of Anchorage, on *Salix* sp. in a *Picea mariana* peatland near sea level. Associated macrolichens from the above localities largely overlap in distribution with those already listed under *Hypogymnia pulverata*. The known occurrences of *Collema leptaleum* in Alaska are shown in Figure 2

Specimens examined: U.S.A. **ALASKA.** MATANUSKA-SUSITNA BOROUGH: Denali National Park and Preserve, Cascade Creek, mature *Picea glauca* forest in steep walled mountain valley; 62.432 °N 152.039 °W; 340 m elev., on *Picea glauca* twigs, *Nelson 10-294*, 10-309, 10-325, 10-353, 10-367 (herb. Denali NPP), on *Populus balsamifera* twig, *Nelson 10-337* (herb. Denali NPP); Denali National Park and Preserve, Midway Lakes, mixed *Picea* – hardwood riparian and upland forest; 62.3836 °N 151.8551 °W; 150 m elev. on *Alnus* sp. twig, *Nelson-07-2078* (herb. Denali NPP); KENAI PENINSULA BOROUGH: Beluga, one mile west of town site, along ATV trail near lake, *Picea* – *Betula* forest near edge of *Sphagnum* bog; 61.13813° N 151.11278 °W; 34 m elev., on *Salix* sp. twig, *Root 2981* (herb. Root). **MAINE:** PENOBSBOT CO.: Alton, near Dead Stream, on trunk of *Acer rubrum* in semi-open woodland, *E.C. Ogden 5331* (US); (no locality given), *W. Blake 39* (FH-TUCK-1508). **MARYLAND:** (no locality given), *Tuckerman s.n.* (FH-TUCK-1508). **MASSACHUSETTS:** New Bedford, *H. Willey s.n.* (FH). **NEW JERSEY:** Pines, on *Quercus obtusiloba*, 1864 and 1865, *Austin 91* and 144 (same packet) (FH-TUCK-1508).

Conclusions: The Cook Inlet region has not been well collected for lichens, so the full extent of the *Hypogymnia pulverata* or *Collema leptaleum* populations in these areas are not known. Extensive work in southeast Alaska has not yielded any locations for either of these species. In recent years, fieldwork in the upper Cook Inlet has brought to light many remarkable epiphytic macrolichens, including *Erioderma pedicellatum* (Hue) P. M. Jørg. (Nelson et al.

2009. We have observed a unique lichen community within these humid boreal forests, one rich in cyanolichens and sensitive air quality species. This suggests a combination of environmental and biotic factors conducive to epiphytic lichen community development. For these reasons, future research should focus on quantitatively documenting the lichen community and structure within the Cook Inlet region.

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Literature cited:

Brodo, I. M. 1989. *Hypogymnia pulverata*, new to North America. *Lichenologist* 21: 184–186.
<http://dx.doi.org/10.1017/S0024282989000344>

Degelius, G. 1954. The lichen genus *Collema* in Europe. *Symbolae Botanicae Upsaliensis* 13: 1–499.

Degelius, G. 1974. The lichen genus *Collema* with special reference to the extra-European species. *Symbolae Botanicae Upsaliensis* 20: 1–215.

Elix, J. A. 1979. A taxonomic revision of the lichen genus *Hypogymnia* in Australasia. *Brunonia* 2: 175–245.
<http://dx.doi.org/10.1071%2FBRU9790175>
<http://dx.doi.org/10.1071/BRU9790175>

Elix, J. A. 1992. *Hypogymnia*. Pp. 201–213 in: *Flora of Australia* Vol. 54, Lichens-Introductions Lecanorales 1. Australian Government Publishing Service, Canberra.

Hultén, E. 1941. *Flora of Alaska and the Yukon*. I. *Lunds Universitets Årsskrift N.F. Avd. 2*, 37: 1–127.

Jørgensen, P. M., Tønsberg, T. and O. Vitikainen. 2007. *Nordic Lichen Flora*. Volume 3. Cyanolichens. Museum of Evolution, Uppsala University and Nordic Lichen Society, Uddevalla. 219 pages.

Krog, H. 1968. The macrolichens of Alaska. *Norsk Polarinstitutt Skrifter* 144: 1–180.

Liu, H. and J. Wei 2009. A brief overview of and key to species of *Collema* from China. *Mycotaxon* 108: 9–29.

<http://dx.doi.org/10.5248%2F108.9>
<http://dx.doi.org/10.5248/108.9>

McCune, B. and L. Geiser. 2009. *Macrolichens of the Pacific Northwest*. 2nd Edition. Oregon State University Press, Corvallis, Oregon.

McCune, B., Rosentreter, R. and A. DeBolt. 1997. Biogeography of rare lichens from the coast of Oregon. Pp. 234–241 in: T. N. Kaye et al. eds. *Conservation and management of Native Plants and Fungi*. Native Plant Society of Oregon, Corvallis, Oregon.

NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life. Version 7.1. NatureServe, Arlington, Virginia. Retrieved April 20, 2011 from website: NatureServe.
<http://www.natureserve.org/explorer>.

Nelson, P. R., J. Walton and C. Roland. 2009. *Erioderma pedicellatum* (Hue) P. M. Jørg., new to the United States and western North America, discovered in Denali National Park and Preserve and Denali State Park, Alaska. *Evansia* 26: 19–23. <http://dx.doi.org/10.1639/0747-9859-26.1.19>

Rassadina, K. A. 1971. *Parmeliaceae*. *Handbook of Lichens of the U.S.S.R.* 1: 282–386. [In Russian]

Rothrock, J. T. 1884. List of, and notes upon, the lichens collected by Dr. T.H. Bean in Alaska and the adjacent region in 1880. *Proceedings of the United States National Museum* 7: 1–9.
<http://dx.doi.org/10.5479%2Fsi.00963801.397>
<http://dx.doi.org/10.5479/si.00963801.397>

Schoonmaker, P. K., von Hagen, B. and E. C. Wolf. 1997. *The rain forests of home*. Profile of a North American Bioregion. Island Press, Washington, DC.

Tønsberg, T. 1993. *Collema leptaleum* new to Europe. *Graphis Scripta* 5: 22–23.

Figure 1. (A) *Hypogymnia pulverata* habit from Katmai National Park and Preserve, Alaska, (B) *H. pulverata* habitat *Picea mariana* forest adjacent to snow covered peatlands, near Denali National Park and Preserve, and (C) twigs and branches of *Picea glauca*, Katmai National Park and Preserve, where *H. pulverata* is often observed.

Figure 2. Map of current known distribution of *Hypogymnia pulverata* and *Collema leptaleum* in Alaska. Triangles represent *C. leptaleum* locations and circles *H. pulverata* locations. Darker tone corresponds to increasing elevation.

Figure 3. (A) *Collema leptaleum* habit (PRN-07-353), (B) a cross section of an apothecium in water, (C) apothecial cross section showing exciple cells and (D) ascospores.