

Lepraria adhaerens: A new species from North America

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ABSTRACT. – *Lepraria adhaerens* K. Knudsen, Elix & Lendemer is described as a new species of lichenized fungi growing usually over mosses and lichens on rock and soil, in southern California, Missouri and Pennsylvania. It is characterized by the presence of pannarin and zeorin.

Keywords: *Lepraria*, lichenized Ascomycetes, North America, California, Santa Monica Mountains, Ozarks, Pennsylvania, Stereocaulaceae.

Lepraria is a world-wide genus, widely distributed in North America on soil, bryophytes, bark, and rock with 21 taxa reported (Esslinger 2006) but that was reduced to 20 taxa as we agree that *L. frigida* J.R. Laundon is a synonym of *L. eburnea* J.R. Laundon (Tønsberg 2004). However, the recent description of *Lepraria santamonicae* K. Knudsen & Elix (2007) again increased the number of taxa to 21.

In a continuation of our studies of the genus *Lepraria* in North America (Knudsen et al. 2006; Knudsen & Elix 2007) we describe *Lepraria adhaerens*, a species widely distributed across the continent with a distinctive blue-gray thallus and unique chemistry of pannarin and zeorin.

***Lepraria adhaerens* K. Knudsen, Elix & Lendemer, sp. nov.**

Thallus leprosus, diffusus, granulosis, caesius, granula plerumque sine hyphysis hyalinis projectis, substrato adhaerens. Substantiae diagnosticae pannarinum et zeorinum continente.

TYPE: USA. CALIFORNIA. SAN DIEGO CO.: Torrey Pines State Park, 32° 54' 58"N, 117° 19' 56"W, 107 m, thin-soiled opening in maritime chaparral on sandstone bluffs, growing over *Rinodina intermedia*, *Lepraria xerophila*, bryophytes and soil, 13.April.2005, K. Knudsen et al. 2700 (UCR!, holotype; ASU!, CANB!, PH!, SD!, UGDA!, isotypes).

DESCRIPTION. - Thallus saxicolous, or muscicolous and lichenicolous over soil or rock, but not usually growing directly on soil, diffuse, distinctly blue-gray, but sometimes with a dull brownish hue in part, dispersed to contiguous, either patchy and thin (less than 0.5 mm thick), and spreading up to ca. 2 cm, adhering to mosses, lichens or mineral grains of the substrate or on substrates where it is well-established and dominant, forming a thick (less than 1 mm) areolate crust of fused granules with a loose upper layer, divided by deep fissures between the areoles and covering areas up to several meters; always without lobes or distinct rim; granules lumpy, adhering to one another, 40-100 µm diam., with a colorless outer layer comprised of uneven and indistinct gelatinized hyphae or of irregular, paraplectenchymatous hyphae, ca. 2-4(5) µm diam., one to two layers thick, surrounding an algal core; without projecting hyphae, but frequently producing thin colorless ±thick-walled hyphae, 2-3 µm diam., acting as anchors or rhizines; the

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Figure 1. Type locality, Torrey Pines State Park, San Diego County. Blue flag marks location of *Texosporium sancti-jacobi*. *Lepraria adhaerens* is scattered throughout open area on small patches of lichens and bryophytes on a thin sandy soil over sandstone. Image by Rolf Muerter.



Figure 2. *Lepraria adhaerens* forming a dull areolate crust growing on sandstone of vertical road cut in Weir Canyon, Orange County, California. Image by Rolf Muertter.

chlorococcoid green algal, 10-14 μm in diam., often aggregating within the enlarged granules which ultimately fragment into sticky agglomerations; without a medulla or lower surface, but older thalli forming a lower necral layer of gelatinized granules which incorporates the remains of lichen or moss hosts mixed with grains of the substrate; in several thalli non-lichenized algae were observed between the granules and more rarely independent fungi or bacteria. Ascomata and conidiomata absent.

The morphology of *L. adhaerens* is most similar to that of *L. santamonicae* (Knudsen & Elix 2007), but is not radically different from other unstratified *Lepraria* species with indeterminate thalli which lack lobes. The most characteristic feature of *L. adhaerens* is the small attaching hyphae and the tendency of granules to readily adhere to one another and the substrate.

CHEMISTRY. – Lichen substances by HPLC/TLC: pannarin (major), zeorin (major or minor)(undetected in only one specimen), \pm atranorin (minor), and often with accessory norpannarin (minor), dechloropannarin (minor) and hypopannarin (minor). TLC in solvent C: pannarin and zeorin are evident. Spot tests: K- KC- C- P+ orange, UV-.

DISCUSSION. – This is the first reported co-occurrence of pannarin and zeorin in the genus *Lepraria*. Zeorin is the most common triterpene in lichens and occurs in a number of species of *Lepraria* including *L. lobificans* Nyl. and *L. pallida* Sipman. Pannarin is not known in other *Lepraria* species but is common in the cyanolichen genus *Pannaria* as well as in the phylogenetically distant genera *Lecanora* and *Rinodina*. Pannarin is a β -orcinol depsidone as are the accessories dechloropannarin, norpannarin and hypopannarin present in *L. adhaerens*. Moreover, the biosequentially related chlorodepsidones argopsin and norargopsin have been reported from two *Lepraria* species, namely *L. santamonicae* (Knudsen & Elix 2007) and *L.*

coriensis (Hue) Sipman (Elix 2006). Like *L. adhaerens*, *L. coriensis* contains zeorin as a major component, but contains usnic acid rather than pannarin, whereas *L. santamonicae* lacks zeorin or other substances.

Lepraria adhaerens often has the bluish-gray color of leprose species of Pannariaceae but differs in having a green algal photobiont. *Lepraria santamonicae* is morphologically similar to *L. adhaerens* and may also react P+ orange, but the former species is a greener with just a tint of blue. The chemistry of these *Lepraria* species is best determined by TLC because other indeterminate, non-lobed forms of *Lepraria* which occur in the same region may also exhibit P+ orange reactions (e.g. *L. caesioalba* chemotypes # 1 and #2 and *L. vouauxii*). Although both *L. caesioalba* and *L. vouauxii* usually differ in color being more whitish or yellowish, unfortunately color is not always a reliable character.

At the present time we are taking an inclusive approach to the circumscription of the genus *Lepraria*, including all persistently sterile lichens with a leprose growth form and a green algal photobiont. We recognize that a future revision may lead to new segregations of *Lepraria* but a revision based on molecular studies would be required to differentiate the phylogeny of diverse taxa undergoing convergent evolution.

ETYMOLOGY. – The specific epithet derives from the adhering of the granules to the substrate and one another.

ECOLOGY AND SUBSTRATE. – *Lepraria adhaerens* usually becomes established at a particular site after it has been pioneered by other lichens or bryophytes on granite, slate, sandstone, or carbonate rock. In thin-soiled openings near the coast of southern California it is not found directly on the soil (except for stray granules) but adheres to other lichens and mosses sometimes being anchored by fine hyphae. This species does not appear to be affected by exposure to full sun or rain. At the type locality it occurs growing on *Rinodina intermedia* Bagl. and the lobed *Lepraria xerophila* Tønsberg and bryophytes in thin-soiled openings in maritime chaparral (Fig. 1). In Weir Canyon in Orange County (Fig. 2) it commonly grows on vertical road cuts, and although these typically have a northerly aspect, they are not usually protected from the weather by overarching protective vegetation or rock outcrops. However, in areas where there is snow (like in the eastern North American populations) this species is usually found in protected crevices or under ledges. In southern California it has not been found in the mountains at elevations where snow is common in the winter.

DISTRIBUTION. – At present *L. adhaerens* is known in coastal southern California from the Santa Monica Mountains south to San Diego, and in eastern North America in scattered locations in Pennsylvania and Missouri. The apparent distribution pattern may well reflect the activity of collectors. If it is primarily a temperate species, the southern California and Ozark collections may represent relic populations from an ice age distribution. *L. adhaerens* may not have repopulated Canada and the northern border of the United States or it might be found in refugia like those of British Columbia. It is probably overlooked or not collected because it is often mixed with bryophytes. We expect it to be widespread in North America.

SPECIMENS EXAMINED (ALL PARATYPES). – **USA.** CALIFORNIA. LOS ANGELES CO.: Santa Monica Mountains, Griffith Park, Royce Canyon, 34° 08' 48"N, 118° 18' 43"W, 263 m, in crevices of rock slabs, *K. Knudsen 5809* & *T. Prosewicz* (CANB!, UCR!); Santa Monica Mountains, Latigo Canyon, 34° 04' 50"N, 118° 47' 48"W, 571 m, on slate outcrop and soil on mosses, *Cladonia*, and other lichens, *K. Knudsen 1586* (UCR!, PH!). ORANGE CO.: Santa Ana Mountains, Weir Canyon, 33° 49' 54"N, 117° 43' 12"W, 403 m, over mosses and lichens on north-facing sandstone vertical road cut, *K. Knudsen 6422* & *R. Muertter* (CANB!, UCR!). RIVERSIDE CO.: Santa Ana Mountains, San Mateo Wilderness Area, Tenaja Canyon, 33° 31' 02"N, 117° 23' 38"W, 458 m, on shaded boulder on moss, *J.C. Lendemer 4393* & *K. Knudsen* (PH!); Menifee Hills, 33° 37' 14" N, 117° 13' 57" W, 632 m, among boulders on moss on hilltop, *K. Knudsen 384* (UCR!). SAN DIEGO CO.: Cabrillo National Monument, San Diego, along Bayside Trail, 32° 40' 39"N, 117° 14' 21"W, 12 m., *K. Knudsen 2658* & *A. Compton* (PH!). MISSOURI. CRAWFORD CO.: Woodson K. Woods Recreation Area, along Meramaca Farms Road, 37° 56' 11"N, 91° 30' 40"W, 274 m., on dolomite outcrop beneath under hang growing on filamentous green algae, *J.C. Lendemer et al. 6092* (PH!). LAWRENCE CO.: Fall Hollow Gorge, in ravine along tributary of Goose Creek, 37° 07' 35"N, 93° 38' 20"W, 381 m, on sandstone on lichens and mosses, *J.C. Lendemer et al. 6143* (PH!). PENNSYLVANIA. MONTGOMERY CO.: Fulshaw Craig preserve, on south-facing slope of Ridge Creek Valley, 40° 20' 28"N, 75° 28' 08"W, 300-400 m., in niche of large shaded diabase boulder, *J.C. Lendemer 2183* & *A.F. Rhoads* (PH!). MONROE CO.: Delaware Water Gap National Recreation Area, Mount Minsi, 40° 57' 48"N, 75° 08' 08"W, ca. 300 m, on shaded sandstone and unknown host, *J.C. Lendemer 6796* & *N. Howe* (PH!).

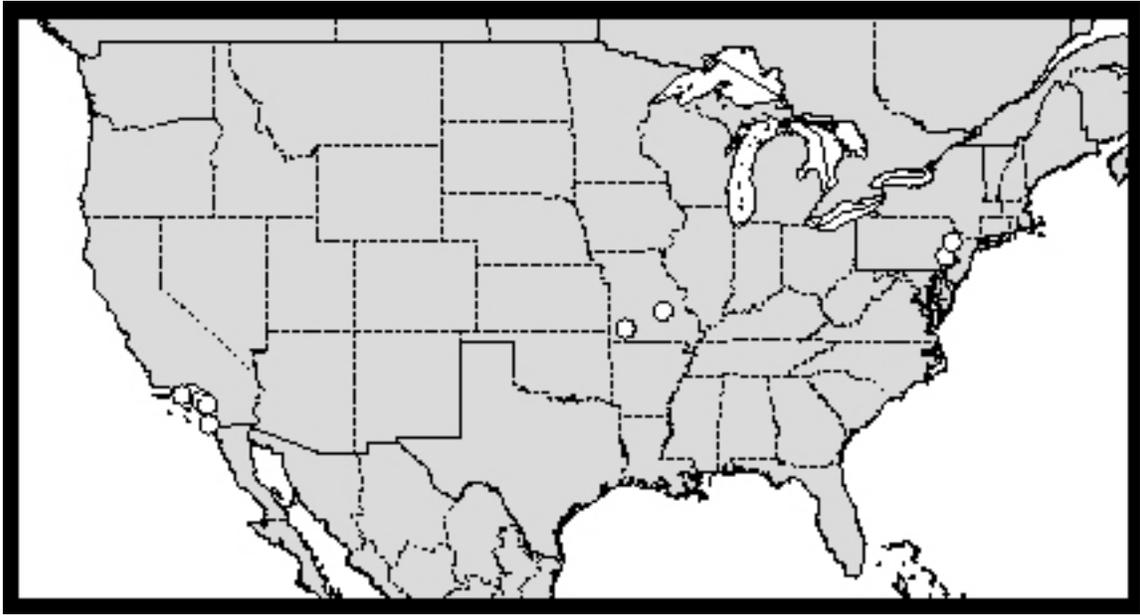


Figure 3. Distribution of *Lepraria adhaerens* in North America.



Figure 4. *Lepraria adhaerens*. Malibu Canyon. Image by Rolf Muertter.

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