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Polysporina lapponica in Southern California

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ABSTRACT. – The occurrence of *Polysporina lapponica* (Acharius *ex* Schaerer) Degelius is reported for Southern California. *Sarcogyne bicolor* H. Magnusson is recognized as a new synonym of *Polysporina lapponica***.** The species is discussed as a possible lichenized fungus and as an opportunistic parasite.

Polysporina lapponica (Acharius *ex* Schaerer) Degelius

Lecidea lapponica Schaerer, Enum. Crit. Lich. Europ. 125, 1850.
Polysporina lapponica (Acharius *ex* Schaerer) Degelius, Acta R. Soc. Scient. Litt. Gothobur., Bot, 2: 103, 1982.

Syn. nov. *Sarcogyne bicolor* H. Magnusson, Ann. Crypt. Exot., 7:130-131, 1935. TYPE: "With *Acarospora fuscata*", Ocean Bluffs at Point Dome, Santa Monica Mountains, California, USA.; August.1898; *H.E. Hasse s.n.* (FH!).

Additional Synonyms (after Martellos & Nimis, 2001)**:** *Sarcogyne canasiacensis* (Hue) H. Magnusson; *Polysporina dubia* (H. Magnuson) Vězda; *Sarcogyne dubia* H. Magnusson; *Acarospora lapponica* (Schaerer) Th. Fries; *Lecidea lapponica* [Acharius *ex*] Schaerer; *Acarospora sernanderi* H. Magnusson; *Acarospora silesiaca* H. Magnusson; *Acarospora subfuscescens* var. *sordida* (Wedd.) H. Magnusson; *Acarospora sordida* Wedd.; *Acarospora subfuscescens* (Nylander) H. Magnusson; *Acarospora tromsoeensis* Norman; *Acarospora sordida* var. *urbana* H. Magnusson.

Polysporina lapponica (Acharius *ex* Schaerer) Degelius is currently considered a lichenicolous fungus (Triebel, Rambold & Nash, 1991). Two stages in the development of the relationship of *P. lapponica* to host are recognizable in epilithic thalli.

It is usually collected in the first stage when carbonized *Polysporina* apothecia erupt from the thallus of another species such as an *Acarospora*. At this stage *P. lapponica* exists within the thallus of the host as hyaline prosoplectenchymatous hyphae. This endokapylic growth form was not recognized until the late 20th century (Triebel et al. 1991) and several species were described in Europe based on the different thalli of the hosts on rock or wood (Magnusson 1929).

The key characteristic for determining *P. lapponica* are mature spores in water which measure 4-5.5(-6.0) x 2.0-2.2(-3.0)µm. Mature spores were not abundant in specimens I examined and are generally found clumped among paraphyses outside of asci. In the development of the concept of *P. lapponica* there was much confusion about spore size in descriptions of *P. lapponica* and some of the synonyms of *P. lapponica* have spore ranges in the 1-2µm width (Magnusson 1929). Reliance on spore size is important in determining different species of *Polysporina* combined with substrate or growth form because of the general similarity of the carbonized apothecia. In the specimens examined by the author of *P. lapponica* some spores 1.0-1.7µm in width were seen in water but were apparently immature spores released by sectioning. This is the probable source of the discrepancies.

In the second stage of development, the epilithic thalli of the hosts are degraded. *Polysporina lapponica* breaks down the thallus of the host, slowly dissolving the cortex, medulla and algae, and produces a subcorticate transparent gelatinous layer over the host like a sack. The parasitized thallus appears whitish or gray, sometimes vaguely areolate or in clumps eventually reduced to small areas around the apothecia. The degraded medullary plectenchyma of the host can be observed as a matrix through which the abundant hyphae of *P. lapponica* are thick and intricate. Algae are scattered throughout the thallus in small clumps. The

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apothecia of *P. lapponica* erupt from these thalli as they do in the first developmental form of the parasitic process described above and sometimes appear to be immersed or to have a thalline margin. In the English flora the following description at the end of *Polysporina simplex* (Davies) Vězda, applies to this developmental form: "Specimens with ± immersed apothecia on a thick, gray to brown, ±areolate thallus from inland localities in N. England, N. Wales and Scotland, may be parasitic on unidentified (sterile) host" (Purvis et al., 1992). It would be a regression in our conception of *P. lapponica* to consider this second stage of parasitized epilithic thallus as representing an independent existence.

It should be noted at this point that *P. lapponica* is pathogenic to its host.

Sarcogyne bicolor H. Magnusson, was described by Magnusson (1935) from a single collection made by Hasse in August, 1898 from the ocean bluffs at Point Dome (modern Point Dume) on the coast in the Santa Monica Mountains in Los Angeles County, California. The holotype (FH!) is on beautiful and unusual white and relatively hard rock (not "farinose white sandstone" as Magnusson reports) with an epilithic *Acarospora* growing among the discontinuous bleached and irregular thallus and black carbonized apothecia of *S. bicolor*. The *Acarospora* is not determined by Magnusson and Hasse's determination as *Acarospora fuscata* (Acharius) Arnold, is wrong. There was not enough material for a completely confident determination of the *Acarospora* but it appears to match a local variation of *Acarospora badiofusca* (Nylander) Th. Fries, but lacking as yet the distinctive development of a thalline margin around an expanded apothecium.

In the English description after the terse protologue Magnusson (1935) described the spores as 2-4 x 1µm. This is smaller than average width of spores in *Polysporina simplex*. The actual size of the mature spores in water of the holotype of *S. bicolor*, which are rare, are ca. 4-5.5 x 2.0-2.3µm.

Magnusson (1935) wrote of the thallus: "Thallus (in the single specimen seen) covering an area 6x4 cm., large, though not continuously, dirty whitish, areolae 0.5-1 mm. large, 0.2-0.4 mm. thick, very irregular in shape, separated by distinct cracks, their surface very uneven, opaque. – Cortex indistinct. Gonidia 8-15µ. large, in a stratum, 50-60µ thick, but gonidia scattered also below the apothecium. Medulla 200-300µ thick, somewhat yellowish gray with scattered granules. Hyphae very intricate, difficult to observe."

The thallus of the holotype is a white epilithic crust that appears more like melted wax then his description of an "areolate" thallus. It is "irregular" "the surface very uneven," indeterminate and discontinuous. It is sub-areolate at best and the "sub-areoles" are even imbricate. The thallus is subcorticate. The medulla contains intricate hyphae in an opaque and whitish matrix mixed with abundant crystals and scattered clusters of algae rather than the continuous layer that Magnusson reported. The medullary plectenchyma of the *Acarospora* on the holotype showed a similarity of structure with the matrix of the *S. bicolor* thallus though degraded. Algal cells were the same range, about 7-14 microns in diameter, in the *S. bicolor* thallus and the *Acarospora* squamules.

My conclusion is that *Sarcogyne bicolor* is the second stage of the process of parasitic development of the endokapylic *P. lapponica* in the epilithic thallus of an *Acarospora*. *Sarcogyne bicolor* H. Magnusson, is a new synonym of *Polysporina lapponica*.

Though not currently reported from California (S.C. Tucker, per. comm.) this represents the first report of *P. lapponica*. I made further collections of *P. lapponica* in Riverside, San Diego, and Los Angeles Counties. J.C. Lendemer collected *P. lapponica* in San Diego County in Laguna Mountains. It appears to be localized and more reports are expected.

Polysporina lapponica is considered an endokaplic lichenicolous fungus but the species concept is still in development (Triebel et al. 1991).

The collection *Knudsen 1318* (FH, NY) may be specimens of free-living *P. lapponica*. The thalli are chasomolithic and the areolate thallus is distinct. The subcortex and medulla are colorless, with a medulla of prosoplectenchyma woven around soft sandstone particles running horizontal to the substrate surface in a clear matrix and there are scattered clumps of lichenized algae not occurring in a well-formed stratum. It should be noted that at Torrey Pines in San Diego County where *P. lapponica* was collected usually endolithic *Lecidea laboriosa* Müll. Arg., and the chasmolithic *Buellia sequax* (Nylander) Zahlbruckner, were common.

Based on these specimens, it is possible that *Polysporina lapponica* is a lichenized fungus, adapted for chasmolithic growth in soft sandstone and decomposing granite. Its intricate hyphae of prosoplectenchyma, which can form a stable thallus in eroding substrates, is apparently able to penetrate the thalli of chasmolithic and endolithic lichens as an opportunistic parasite and continue on to find other hosts. If this is *P. lapponica*'s primary niche, a pathogenic relationship to host would not be limiting.

P. lapponica could also develop as an endokapylic fungus when spores are lodged on the thallus of a host and could on porous or weathered rock move from host into the substrate to independent existence and to seek other hosts.

Whether it is lichenized or not, *P. lapponica* produces abundant apothecia.

At this moment in the evolutionary history of *P. lapponica*, if it has the ability to lichenize algae, it is not possible to decide whether we are witnessing a processional stage in the loss of lichenization or toward

lichenization. But because of its distribution in at least Europe and North America it is likely we are witnessing a stable species. If it is lichenized and is not an obligatory parasite, this versatility would give *Polysporina lapponica* the advantage of not having to develop stable non-pathogenic relations with its hosts, becoming host specific, as well as the capacity to seek out hosts as a chasmolithic lichen without being totally dependent on hosts for its survival and reproduction.

I hope the examination of further collections and specimens will answer the question of whether the occurrence of *Polysporina lapponica* as a chasmolithic lichenized fungus is a verifiable observation and whether this free-living form exists in other parts of its range.

Additional Specimens Examined: **USA. CALIFORNIA. Los Angeles Co.:** Santa Monica Mountains, Topanga, Canyon, Ed Edelman Park, 34° 07.323'N, 118° 35.148'W, 375 m., on sandstone and *Acarospora obpallens*, in full sun, mixed chaparral with coastal sage scrub, 15.August.2004, *Knudsen 1552 & Sager* (H, UCR, hb. Bungartz). **Riverside Co.:** Wildomar, Menifee Hills, 33° 37.019'N, 117° 13.997'W, 634 m., granite rocks in rubble on hillside with western exposure, chamise chaparral, 17.July.2004, *Knudsen 1434* (UCR). **San Diego Co.:** Cleveland National Forest, upper portion of Scove Canyon, along abandoned section of Sunrise Highway, 32° 49' 42"N, 116° 29' 44"W, ca. 4600 ft., shale cliffside, *Lendemer 2852 & Knudsen* (hb. Lendemer); Torrey Pines, 32° 55.110'N, 117° 15.250'W, 92 m., sandstone rocks on east-facing slope, maritime chaparral, 1.July.2004, *Knudsen 1318* (FH, NY). **WYOMING. Fremont Co.:** Wind River Range, Shoshone National Forest, along Stough Creek Lakes Trail, 42° 41'N, 109° 01'W, ca. 3000 m, "on *Candelariella* sp. (scarce!)" (D. Triebel & G. Rambold, 1991 annotation), on granite at Stough Pass, 24.July.1983, *Nash 21,397* (ASU).

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