Santessoniella saximontana, a new lichen species from British Columbia

Toby Spribille¹, Per Magnus Jørgensen², Matthias Schultz³ & Isabelle Houde⁴

¹ Albrecht-von-Haller-Institut für Pflanzenwissenschaften, Universität Göttingen, Untere Karspüle 2, D-37073 Göttingen, Germany (tspribi@uni-goettingen.de)
² Department of Natural History, Botanical Museum, University of Bergen, Allégaten 41, N-5007 Bergen, Norway
³ Botanischer Garten und Biozentrum Klein Flottbek, Universität Hamburg, Ohnhorststrasse 18, D-22609 Hamburg, Germany
⁴ Department of Forest Sciences, University of British Columbia, 3041–2424 Main Mall, Vancouver, BC, V6T 1Z4, Canada

Abstract: Santessoniella saximontana T. Sprib., P. M. Jørg. & M. Schultz, sp. nova is described from bark of Thuja plicata from the Rocky Mountains of south-eastern British Columbia. It is similar to S. luctuosa but differs in its blackish brown thallus, smaller, convex apothecia and differently shaped, non-ornamented ascospores. A revised key is provided to the species of Santessoniella sensu lato in North America.

Key words: Conservation; cyanolichens; key; old-growth forest; Pannariaceae; plasmodesmatoid connections

Introduction

Although botanists have been studying the lichens of British Columbia for over 100 years, the diversity of its lichen flora is only beginning to be appreciated. Several previously unknown species have come to light in recent years from studies of old-growth inland Thuja plicata-Tsuga heterophylla rainforests (e.g. Lobaria silvae-veteris, Goffinet & Goward 1998; Spilonemella americana, Henssen & Tønsberg 2000; Sticta oroborealis, Tønsberg & Goward 2001). Since 2004, the first and last authors have been involved in an assessment of lichen diversity in an old-growth Thuja plicata forest located in the Albert River watershed along the border of British Columbia and Alberta, south of Banff National Park. This forest is unusual within the inland rainforest formation for several reasons, notably (1) its occurrence at the extreme eastern periphery of this forest type; (2) its isolation of over 100 km and several mountain ranges from the nearest comparable stands, and (3) its occurrence over Devonian limestone (most rainforests in north-western North America occur over acidic parent material). An account of some of the lichen species found during this assessment is provided by Houde et al. (2007).
One of the most unusual species found in the Albert River study was a blackish, rather gelatinous lichen on stumps of *Thuja plicata* at the edge of an ancient forest stand, which on closer examination did not match any hitherto described species. It is similar in appearance and anatomy to the Japanese *Santessoniella luctuosa* (Hue) Henssen, differing mainly in ascospore size and thallus colour and texture. It has become apparent that the lichen is the latest addition to a growing list of cyanophilic species found in close association with the old-growth inland rainforests of British Columbia. We here describe it as a new species within the genus *Santessoniella*.

**Material and methods**

Characteristics of the apothecia and thallus were investigated by light microscopy on hand-cut or microtome sections made with a Leitz Kryomat 1703, mounted in water and 10% KOH, and stained with I$_{Lugol}$ (Merck 1.09261) or lactophenol cotton blue (LCB; Merck 1.13741). Photos were taken with a Zeiss Axioskop digital camera. Microscopic measurements were made at 1000 × magnification in water and are given as smallest single measurement–mean–largest single measurement. Thin layer chromatography was carried out according to Culberson (1972) and Culberson & Johnson (1982).

Comparison material used for this study: *Santessoniella luctuosa* (Hue) Henssen – Japan, Kanita, 1902, Faurie no. 5302 [W–isotype!].

**Results**

*Santessoniella saximontana* T. Sprib., P. M. Jørg. & M. Schultz, sp. nova

*Santessoniellae luctuosae* similis sed thallo opaco et sporis minoribus differt.

**Type:** **Canada.** British Columbia, Rocky Mountains, Albert River drainage, c.10 air km north of confluence with Palliser River, c.6 air km west of British Columbia/Alberta provincial boundary, west side of valley, 50° 37.693’ N 115° 32.973’ W, on bases of stumps of *Thuja plicata* at edge of oldgrowth forest, elev. 1220 m, 1. viii. 2006, T. Spribille no. 21173 & I. Houde [CANL–holotype; BG, GZU, H, TNS, UBC–isotypes]; ibid., on cut-bank on plant detritus, 30. vii. 2005, T. Spribille no. 16823 & I. Houde [HBG–paratype].

**Etymology:** This species is named for its occurrence in the Canadian Rocky Mountains.

(Figs 1–10)

*Thallus* medium brown in exposed parts, lighter brown in shaded areas, matte or with a finely textured lustre, not glossy, ± translucent when wet, microfruticose, forming extensive loosely attached crust, continuous or (especially in older parts) becoming areolate, areoles consisting of interlocked granules, 13.5 mm diam., margins not well defined; thallus cushions 0.3–1.0 mm thick, with black hypothallus to 0.6 mm thick, this not visible in surface view; branching pattern densely cauli-flower-like, with knob-like segments that are usually wider than long, 60–120 (–150) × 50–80 µm, these connected by stout branches, breaking off readily when dry; thallus in section paraplectenchymatous, not stratified, lacking cortex or rarely a few outer cells ± differentiated; *photobiont Nostoc*, borne in chains, individual cells 3–5.5 µm diam., ± evenly distributed in thallus section.
Apothecia rounded, single or in groups of 2–3, rarely with marginal fissures, weakly to usually strongly convex, 0.3–0.7–0.9 mm diam., disc reddish-brown to reddish-black or black, margin evident on young apothecia, concolourous with the disc, retreating and not visible in surface view on mature apothecia; proper exciple thick in young apothecia, becoming thinner and restricted to basal parts of apothecia in section in older apothecia, 80–120 µm thick, with hazy reddish and grayish pigments; consisting of radiating septate hyphae, these similar to paraphyses when adjacent to hymenium but becoming strongly differentiated with increasing distance from hymenium, becoming moniliform, with ± rounded or broadly ellipsoid lumina, 10–16 × 3.0–8.0 µm, cells becoming larger towards margins; lumina of excipular cells often connected to those of adjacent cells through plasmodesmatoid structures; hypothecium hyaline, to 100 µm tall, of loose, tangled hyphae to 2.5 µm diam., cells longer than wide, with lumina to 2 µm diam.; subhymenium with hazy reddish-brown and diffuse grayish pigments, differentiated from hypothecium, to 60 µm tall, consisting of dense, tangled hyphae, cells not much longer than wide in section, often ± rounded, mixed with larger, thickened ascogenous hyphae; hymenium hyaline, 85–100 µm tall, with abundant paraphyses and usually well spaced asci, mid-hymenium paraphyses free with light pressure in water; upper hymenium consisting of 15–20 µm tall zone within hymenium, of densely conglutinated paraphysis tips, pigmented reddish brown to dark slate gray; paraphyses simple, rarely branched in apical portion, septate, 1.5–3.0 µm wide with lumina (1.0–)1.5–2.0 µm wide, individual cells 7–15 µm long, terminal cells often expanded to 5–7 µm diam., with lumina 2.0–3.5 µm wide; paraphyses towards outer part of hymenium with plasmodesmatoid cell wall connections especially in lower third of hymenium; asci broadly cylindrical, widest above the middle, 60–70 × 10–15 µm, with inner ascus wall to 2 µm thick, inner and outer ascus walls weakly amyloid (I<sub>lugol</sub> + pale blue after pretreatment with K), tholus with a thick, strongly amyloid ring structure (I<sub>lugol</sub> + deep blue after K-pretreatment) which is sometimes crossed by 1–2 thin, non-amyloid lines near inner ascus wall; ascospores simple, ellipsoidal, 14–17.7–22 × 7.0–8.1–11.5 µm, often with ± pointed ends, walls to 1 µm thick.

Pycnidia: Not seen.

Chemistry: Thallus: no substances were detected by thin layer chromatography; all macroscopic spot tests negative; thallus with yellowish to golden pigment in section that is K + golden intensifying, C + clearing, Pd −; hypothallus with dark grayish, HNO₃ + mauve-purplish pigment; upper hymenium, proper exciple and subhymenium with two pigments, one hazy reddish, the other grayish, K + turning grayish, C + clearing, Pd −; HNO₃ + intense reddish purple.

Habitat and distribution: S. saximontana is known only from the type locality, in a sheltered, high montane valley along the west side of the Continental Divide in south-eastern British Columbia. The species was found most abundantly on bark at the bases of <i>Thuja plicata</i> stumps, but was also observed growing on plant detritus on the ground around the stumps, on highly decayed wood and on detritus on undercut soil banks. The habitats were on the edge of an isolated oldgrowth forest located on the toe slope of a high mountain and bounded on the sides by avalanche tracks; the entire area is situated over Devonian limestone.
Discussion

*Santessoniella saximontana* is obviously closely related to *S. luctuosa*, a species known only from the 105-year-old type collections from Japan (fig. 11). The translucency of those specimens, as pointed out by Henssen (1997), may be a result of the condition they were in when collected or poor drying conditions when preserved, which is often the case with Faurie’s specimens. This character thus cannot be used at the moment to differentiate between the two species. However, there are several other well marked characters with which to distinguish *S. saximontana* from *S. luctuosa*. First of all, *S. saximontana* possesses a distinctly different branching pattern. *S. saximontana* is more cauliflower-like, with thick, flattened, knob-like segments that tend to be wider than long, with stout, short narrow branches connecting each ‘knob’ (figs 3 + 4). In *S. luctuosa*, by contrast, the branching pattern recalls some *Polychidium* species, with open branches and opuntioid thalline ‘buds’ developed on branch ends (see Henssen 1997, fig. 7C). Secondly, *S. saximontana* differs from *S. luctuosa* in the rudimentary thalline cortex of small cells c. 3 µm diameter (cortex well developed, to 6–18 µm thick in *S. luctuosa*), the apothecia, which are strongly convex and usually borne singly (rather than flat and confluent), and the ascospores, which generally are smooth (instead of ornamented) and mostly shorter and narrower than those of *S. luctuosa* (14–22 × 7–11.5 µm instead of 18–23 × 9–11 µm).

There are relatively few species with which *S. saximontana* could be confused in its native habitats. The species is most likely to be overlooked as an odd form of *Placynthiella uliginosa* in the field, but it is quickly distinguished from this species even with a hand lens on account of its different thallus structure, convex, reddish apothecia and occurrence on bark.

The type locality of *S. saximontana* is a highly calcareous site with an unusual lichen flora (Houde et al. 2007). Among epiphytic macrolichen species, the site supports the inland-most localities of *Lobaria scrobiculata*, *Pseudocyphellaria anomala* and *Sticta fuliginosa* in western Canada. Directly associated species on the bases of *Thuja plicata* stumps at the type locality included *Cladonia* spp., *Megaspora verrucosa* and *Placynthiella icmalea*. Another collection made in 2005 at the type locality came from highly organic plant detritus on an overhanging cut-bank, where it was associated with *Lepraria eburnea*.

*Santessoniella* as presently defined is in need of further research, as the type species, *S. polychidioides*, is nested within species of *Psoroma* in the molecular studies of Ekman & Jørgensen (2002), and the genus is heterogeneous as pointed out by Jørgensen (2003). Presently four species of this genus in its broad, original sense are known from North America. In the western parts *S. arctophila* has been reported by Henssen (1997) from Alaska; it is mainly an arctic species. *S. grisea*, another species described from Japan based on Faurie’s material, was recently reported from the Olympic Peninsula by Tønsberg & Henssen (1999). Yet another species, *S. crossophylla*, appears to be endemic to the eastern United States (Jørgensen 2001). A revised key to the North American species of *Santessoniella* s.l. is as follows:
Key

1  Thallus saxicolous, forming discrete rosettes with distinct marginal lobes; apothecia single; eastern ........................................................... S. crosophylla

1’ Thallus bryophilous (on soil or on tree stumps) forming effuse crusts without distinct marginal lobes; apothecia often proliferating; northern or western .... 2

2  Thallus granular, of adglutinated, gelatinous lobes; over moss on arctic soils . . .......................................................... S. arctophila

2’ Thallus of partly branched, semigelatinous squamules; over mosses or on trees .......................................................... 3

3  Thallus brownish grey, often with branched, isidioid squamules; apothecia large, to 2.5 mm; ascospores large, 18–25 µm long, uneven; lowland Pacific . . .......................................................... S. grisea

3’ Thallus blackish brown, partly minutely subfruticose; apothecia small, to 1 mm; ascospores smaller, 14–22 µm long, smooth; Rocky Mountains ....................... .......................................................... S. saximontana

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References


Figs 1, 2 Santessoniella saximontana. (1) Habit in surface view: granules (arrows bottom) and convex apothecia (arrow top) [isotype, BG]; (2) section of thallus granule in LCB with rudimentary cortex (black arrow bottom left, upper arrow bottom right), chains of Nostoc-photobiont (arrows top left and bottom right) and short-celled hyphae (arrow center) (Spribille 16823); scale bars: (1) = 1 mm, (2) = 10 µm.
Figs 3, 4 Santessoniella saximontana (cont.). (3) Habit, slide preparation of section showing microfruticose growth form (arrows top) and dark hypothallus (arrows bottom) [holotype, CANL]; (4) habit with part of apothecium in section, microfruticose granules (arrows top) and dark hypothallus (arrow bottom) in LCB (Spribille 16823); scale bars = 100 µm.
Figs 5, 6 Santessoniella saximontana (cont.). (5) Section of apothecium in LCB; (6) exciple, section in LCB; note the plasmodesmatoid cell wall connections (arrows); scale bars: (5) = 50 µm, (6) = 10 µm; both photos from Spribille 16823.
Figs 7–10 Santessoniella saximontana (cont.). (7, 8) Asci stained in IKI after pretreatment with K (arrows indicate amyloid ring), with paraphyses; (9) immature ascospores in water; (10) ascospores in immature ascus; figs. 7–9 from isotype [BG], fig. 10 from Spribille 16823; scale bars = 10 µm.
Fig. 11  *Santessoniella luctuosa*, habit [isotype, W]; scale bar = 1 mm.