

Biatora troendelagica new to North America from Alaska, USA

TOR TØNSBERG and CHRISTIAN PRINTZEN

Tønberg, T. & Printzen, C. 2018. *Biatora troendelagica* new to North America from Alaska, USA. *Graphis Scripta* 30 (9): 161–165. Oslo. ISSN 2002-4495.

Biatora troendelagica is reported new to North America from Kenai Fjord National Park, Alaska, USA, where it was found on a *Picea sitchensis* snag, on driftwood, and lignicolous on a branch of *Tsuga mertensiana*. The species was previously known only from the type locality in Norway.

Tor Tønberg, Department of Natural History, University Museum, University of Bergen, Allégaten 41, P.O. Box 7800, NO-5020 Bergen, Norway. E-mail: tor.tonsberg@uib.no (corresponding author)

Christian Printzen, Department of Botany and Molecular Evolution, Senckenberg Research Institute and Natural History Museum Frankfurt, Senckenberganlage 25, D-60325 Frankfurt am Main, Germany. E-mail: christian.printzen@senckenberg.de

Introduction

Fieldwork in USA, Alaska, in 2015, yielded three sorediate lichen specimens which on closer examination were identified as *Biatora troendelagica*, a species not reported from North America before (see Esslinger 2018). The species was previously known only by the type specimen from Norway (Printzen et al. 1998, see also Timdal (2018) and the current Nordic checklist (Nordin et al. 2018)). As the North American specimens represent a major range extension, they are commented on here.

Material and Methods

The material is based on fieldwork by one of us (TT) in Kenai Fjord National Park, Alaska, in 2015. The collections are deposited in BG with a duplicate of one specimen in ALA. As apothecia are scarce, and mostly small and not well-developed, we have only made a few sections for the anatomical descriptions. Thin-layer chromatography (TLC) was carried out according to Culberson and Kristinsson (1970), Culberson (1972), and Menlove (1974). All the three solvents recommended by these authors were used, with aluminium plates in solvents A and B' and, to allow for the detection of fatty acids, glass plates in solvent C. As references for 'gracilenta unknown 1', we used *Chaenotheca gracilenta* (Ach.) Mattsson & Middelb. For the field GPS data, the geodetic datum was set to WGS84.

The Species

***Biatora troendelagica* Holien & Printzen**

Type: Norway, Sør-Trøndelag [*Trøndelag*]: Meldal, N-facing slope of Stavelitjørn, on decaying wood of *Picea abies* in spruce forest, c. 260 m, 1991-10-01, H. Holien 4785 (TRH L-2635, holotype!).

Description of the North American material: (Fig. 1.) Thallus effuse, sorediate, mottled brown due to a pigment in the external soredia, or where the external soredia have been shed, mostly light green when fresh, becoming straw-coloured in the herbarium, endosubstratal in esorediate parts, to 6.5 cm in diameter (Tønsberg 45452; comprising only a part of the original specimen since the thallus margin is lacking). Soralia punctiform, single or some becoming confluent; soredia farinose, mostly simple, 14–29 µm in diameter; sometimes forming consoredia to 41 µm in diameter; external soredia with a brown, K+ olivaceous pigment. Apothecia (present in Tønsberg 45452 only, Fig. 1), to 0.6 mm; disc brown to dark brown in well-developed apothecia, light brown in juvenile ones, mostly slightly convex; margin paler than disc. Exciple 35–40 µm wide laterally, 55–75 µm wide basally, of relatively strongly branched, colorless, strongly gelatinized hyphae, filled with grayish brown granules. Hypothecium 85 µm high, colorless. Hymenium 35 µm high, colorless at base, upper parts with vertical stripes of light brown granules that form an epipsamma on top. Paraphyses sparingly branched, to 2 µm wide; tips to 2.5(–3) µm, unpigmented in small and pale colored apothecia, with a dark brown cap, sometimes only laterally, in large and dark brown apothecia. Spores eseptate, ellipsoid, sometimes narrowly so, or cylindrical with rounded ends, mostly straight, sometimes slightly curved, 6–12.5 × (2.5–)3–4 µm (n = 20; all from the same apothecium). Conspecific pycnidia not with certainty seen. Photobiont chlorococcoid, 7–10 µm.

Chemistry: Divaricatic acid (major) and gracilenta unknown 1 (the latter substance was not demonstrated in all solvents for all specimens).

Ecology and Distribution: The specimens were found on trunk of a completely decorticate *Picea sitchensis* snag in a river otter (*Lontra canadensis* (Schreber 1777)) latrine area (see Ben-David et al. 1998) at a terrestrial-marine interface, on a decorticate branch of *Tsuga mertensiana* in a muskeg (a North American expression for boreal and Arctic wetlands dominated by *Sphagnum*), and on driftwood at inner part of a sea-shore, sandy beach.

Associated species (present in the herbarium packets) were sparse or poorly developed and included on *Picea sitchensis* snag: a sterile, sorediate crust with protocetraric and (probably) fumarprotocetraric acids (too sparse for identification); on *Tsuga mertensiana*: *Mycoblastus affinis* (Schaer.) T. Schauer, and on driftwood: cf. *Loxosporopsis corallifera* Brodo, Henssen & Imshaug (too sparse for TLC), *Mycoblastus affinis*, and *Ochrolechia* sp. (esorediate, fertile; apothecia few and poorly developed). The altitude ranged from near sea-level (2 specimens) to 70–75 m.

The specimens were found in Kenai Fjord National Park, Alaska, between latitudes 59.56235°N–59.76338°N and longitudes 149.60137°W–150.52325°W.



Figure 1. *Biatora troendelagica*. Tønsberg 45452 (BG). Scale 1 mm. Photo: Einar Timdal.

Discussion

The North American material agrees well with the description of the hitherto only known (type) specimen of *Biatora troendelagica* from Norway (Printzen et al. 1998), with two limitations. The range of the ascospore sizes is extended a little, and at least on some of the tips of the paraphyses a brown pigment cap was observed. Printzen et al. (1998) described the apices of the paraphyses in *B. troendelagica* to be unpigmented, as is typical for species of *Biatora* with pale brown apothecia (Printzen 1995). In the North American specimen with apothecia the apices of the paraphyses are unpigmented in small and pale coloured apothecia, but may have a brown cap in large, dark brown apothecia. The presence of divaricatic acid is another character unusual for a species of *Biatora* (see also Printzen et al. 1998). We were unable to generate DNA sequence data but recommend the future use of molecular methods to confirm the generic affinity of *B. troendelagica*.

Within *Biatora*, *B. troendelagica* is a distinct species on account of the presence of divaricatic acid (Printzen et al. 1998). Based on the thallus morphology only, the species recalls species of *Xylographa* (see Spribille et al. 2014). The morphology and the substrate (wood) point to species such as the commonly occurring *X. soralifera* Holien & Tønsberg and *X. vitiligo* (Ach.) J.R. Laundon. Divaricatic acid, the major chemical constituent of the specimens is not known

from *Xylographa* (Spribille et al. 2014) and, more important, the study of the apothecia in the fertile specimen left *Xylographa* out as a possible genus.

As two of the three North American specimens were found in sites with a strong marine influence, i.e. at inner part of a sea-shore beach and just above sea-shore rocks, *Biatora troendelagica* must be salt water spray tolerant. The most well-developed in thalline characters and also the only fertile specimen (TT 45452) was found in a river otter latrine area (pointed out to TT in the field by James Walton). In such areas the “coastal river otters transfer marine-derived nitrogen into the beach-fringe forest and thus fertilize the terrestrial vegetation in the terrestrial-marine inter face” (Ben-David et al. 1998, sic!). It could well be that this fertilization has some influence on the lichen flora at the site, even on the epixylic flora on the snag. Other lichen species collected at this particular site include *Arctomia delicatula* Th. Fr., *Bryoria bicolor* (Ehrh.) Brodo & D. Hawksw., *Gyalideopsis muscicola* P. James & Vězda (fertile), *Lopadium pezizoideum* (Ach.) Körb., *Phylliscum demangeonii* (Moug. & Mont.) Nyl., *Pilophorus acicularis* (Ach.) Th. Fr. with *Dactylospora parasitica* (Flörke) Zopf, and *Scytinium lichenoides* (L.) Otálora et al.

The only previously known specimen of *Biatora troendelagica* was found on a snag of *Picea abies* in an old-growth *Picea abies* forest in Norway (Printzen et al 1998). Accordingly, *Picea sitchensis* and *Tsuga mertensiana* are new phorophytes, and driftwood a new substrate for the species. The Alaskan habitats, the inner part of a sea-shore beach, the forest fringe above sea-shore rocks, and a muskeg, are all new habitats for the species.

The North American localities are within the Northwest Gulf climate division of southern Alaska (Bieniek et al. 2012) which is characterized by moderate monthly average temperatures and average precipitation amounts with the monthly maximum (slightly more than 200 mm) generally occurring in late autumn and winter. On the Pacific Coast of North America the area in which the specimens were found, the forest is classified as subpolar (boreal) rainforest (Schoonmaker et al. 1997, DellaSala et al. 2011a). The only known Norwegian site for the species is in the southern part of the area for the boreal rainforest in coastal Europe (DellaSala et al. 2011b). Here the species can be assigned to the Trøndelag Phytogeographical Element (for a discussion of this element, see Holien & Tønsberg 1996). With the presently reported specimens from Alaska, *B. troendelagica* shows a central Norway to northwestern North America disjunct distribution. Other examples of this distribution pattern include *Biatora kodiakensis* Printzen & Tønsberg (Holien & Tønsberg 2012), *B. toensbergii* Holien & Printzen (Printzen et al. 1998), and *Rinodina disjuncta* Sheard & Tønsberg (Tønsberg 1992, Holien & Tønsberg 1996). *Biatora troendelagica* is here recorded as new to North America, USA, and Alaska.

Specimens studied: USA, Alaska: Kenai Peninsula County, Kenai Fjords National Park, near North Arm Nuka Bay, 59.56235°N, 150.52325°W, alt. 5 m, lignicolous on driftwood on inner part of seashore beach, 2015-07-06, T. Tønsberg 45176 (BG); Verdant Cove, north side at shoreline, 59.70922°N, 149.74587°W, alt. 4 m, lignicolous on snag of *Picea sitchensis* at the maritime seashore rock/*Picea sitchensis* fringe interface, in river otter (*Lontra canadensis*) latrine area, 2015-07-09, T. Tønsberg 45452 (ALA, BG); peninsula into Three Hole Bay off Aialik Bay, 59.76338°N 149.60137°W, alt. 70–75 m, lignicolous on twig of *Tsuga mertensiana* (‘dwarf tree’) in muskeg with *Picea sitchensis* and *Tsuga* in steep slope facing sea, 2015-07-10, T. Tønsberg 45500 (BG).

Acknowledgements: TT thanks Bruce McCune, Oregon State University, for the invitation to do lichenological field work in Kenai Fjords National Park in 2015; the National Park Service (NPS), Southwest Alaska Network, Anchorage, for funding, Amy Miller and James Walton (both NPS) for project coordination and for organizing and executing field logistics; the curator of herbarium TRH for admission to study the type of *Biatora troendelagica*; and Trevor Goward, Clearwater/herbarium UBC), Håkon Holien (Nord University), and James Walton, for discussions and information. The photo was taken by Einar Tindal, University of Oslo.

References

- Culberson, C. F. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113–125.
- Culberson, C. F. & Kristinsson, H. 1970. A standardized method for the identification of lichen products. *Journal of Chromatography* **46**: 85–93.
- Ben-David, M., Bowyer, R. T., Duffy, K., Roby, D. D. & Schell, D. M. 1998. Social behavior and ecosystem processes: river otter latrines and nutrient dynamics of terrestrial vegetation. *Ecology* **79** (7): 2567–2571.
- Bieniek, P. A., Bhatt, U. S., Thoman, R. L., Angeloff, H., Partain, J., Papineau, J., Fritsch, F., Holloway, E., Walsh, J. E., Daly, C., Shulski, M., Hufford, G., Hill, D. F., Calos, S. & Gens, R. 2012. Climate Divisions for Alaska Based on Objective Methods. *Journal of applied meteorology and climatology* **51**: 1276–1289.
- DellaSala, D., Alaback, P., Drescher, A., Holien, H., Spribille, T. & Ronnenberg, K. 2011b. Temperate and Boreal Rainforest Relicts of Europe. In: DellaSala, D. (ed.), *Temperate and boreal rainforests of the world. Ecology and conservation*. Island Press, pp 154–180.
- DellaSala, D., Moola, F., Alaback, P., Paquet, P. C., Schoen, J. W. & Noss, R. F. 2011a. Temperate and Boreal Rainforests of the Pacific Coast of North America. In: DellaSala, D. (ed.), *Temperate and boreal rainforests of the world. Ecology and conservation*. Island Press, pp 42–81.
- Esslinger, T. L. 2018. A Cumulative Checklist for the Lichen-forming, Lichenicolous and Allied Fungi of the Continental United States and Canada, Version 22. *Opuscula Philolichenum* **17**: 6–268 [<http://www.ndsu.edu/pubweb/~esslinge/chcklst/chcklst7.htm>].
- Holien, H. & Tønsberg, T. 1996. Boreal regnskog i Norge – habitatet for trøndelagselementets lavararter. *Blyttia* **54**: 157–177.
- Holien, H. & Tønsberg, T. 2012. *Biatora kodiakensis* confirmed from Europe. *Graphis Scripta* **24** (2): 49–52.
- Menlove, J. E. 1974. Thin-layer chromatography for the identification of lichen substances. *British Lichen Society Bulletin* **3**: 3–5.
- Nordin, A., Moberg, R., Tønsberg, T., Vitikainen, O., Dalsätt, Å., Myrdal, M., Snitting, D. & Ekman, S. 2018. *Santesson's online checklist of Fennoscandian lichen-forming and lichenicolous fungi*. Museum of Evolution, Uppsala University. <http://www.evolutionsmuseet.uu.se/databaser/santesson.html>. [Latest consultation on 2018-04-21.]
- Printzen, C. 1995. Die Flechtengattung *Biatora* in Europe. *Bibliotheca Lichenologica* **60**: 1–275.
- Printzen, C., Holien, H. & Etayo, J. 1998. Two new *Biatora* species from western Norway and Madeira. *Lichenologist* **30** (3): 213–219.
- Schoonmaker, P. K., von Hagen, B. & Wolf, E. C. 1997. Introduction. In: Schoonmaker, von Hagen, B. & Wolf, E. C., (eds), *The rain forests of home. Profile of a North American Bioregion*. Ecotrust/Interrain Pacific. Island Press, pp 1–6.
- Spribille, T., Resl, P., Ahti, T., Pérez-Ortega, S., Tønsberg, T., Mayrhofer, H. & Lumbsch, H. T. 2014. Molecular systematics of the wood-inhabiting, lichen-forming genus *Xylographa* (Baeomycetales, Ostropomycetidae) with eight new species. *Symbolae botanicae upsalienses* **37** (1): 1–87.
- Timdal, E. 2018. *Norwegian Lichen Database*. <http://nhm2.uio.no/lav/web/index.html>. [Latest consultation on 2018-09-29.]
- Tønsberg, T. 1992. The sorediate and isidiate, corticolous, crustose lichens in Norway. *Sommerfeltia* **14**: 1–331.