The Lichenologist **46**(6): 829–832 (2014)
doi:10.1017/S0024282914000413

Xanthomendoza poeltii is a synonym of *X. oregana* (*Teloschistaceae*, lichen-forming ascomycetes)

The original description of *Xanthoria poeltii* S. Y. Kondr. & Kärnefelt was based on morphological and anatomical characters (Kondratyuk & Kärnefelt 1997). The new species was reported from a few European localities from Hungary to southern Sweden (Kondratyuk & Kärnefelt 1997). The authors provided detailed information on how the new species was distinguished from the other European species in the *Xanthoria candelaria* group (Poelt & Petutschnig 1992*a*, *b*), *viz*. *X. borealis* R. Sant. & Poelt, *X. candelaria* (L.) Th. Fr., *X. fallax* (Hepp) Arnold, *X. fulva* (Hoffm.) Poelt & Petutschnig, and *X. ulophyllodes* Räsänen.

However, when Kondratyuk & Kärnefelt (1997) described *X. poeltii* they were apparently unaware of the species *X. oregana* Gyeln., which was described from Oregon, USA, over 60 years earlier (Gyelnik 1934). Thus, they did not compare *X. poeltii* and *X. oregana* and discover the similarities between the two taxa. Shortly after the publication of *X. poeltii*, in a taxonomic revision of the genus *Xanthoria*, the species *X. oregana* was resurrected with a description that revealed it to be morphologically identical to *X. poeltii* (Lindblom 1997). Both species were later transferred to the genus *Xanthomendoza* (Søchting *et al*. 2002). The currently accepted circumscription of *Xanthomendoza* includes 15 to 20 mainly foliose species. This genus is mainly characterized by true rhizines and bacilliform conidia (Arup *et al*. 2013).

Lindblom (2006) noted that morphological characters indicated that *X. oregana* may be closely related to *X. poeltii*, but avoided explicitly formulating her hypothesis that they are conspecific. Hence, it is interesting to note that in subsequent molecular phylogenetic analyses by Arup *et al*. (2013) and Leavitt *et al*. (2013), which included both taxa, they are recovered intermixed in a single well-supported monophyletic clade. Results from these phylogenetic analyses and the lack of diagnostic morphological characters show that there are no character traits that can justify maintaining the taxa as separate, apart from their being distributed in two widely separate geographical areas of the world. Our conclusion is that *X. poeltii* should be treated as a synonym of *X. oregana*.

To provide a DNA sequence for identifying the species (Schoch *et al*. 2012), we collapsed existing ITS (ITS1-5.8S-ITS2) sequences of *X. oregana* and *X. poeltii* using the TCS v. 1.21 software (Clement *et al*. 2000). All seven ITS sequences in GenBank labelled *X. oregana* and *X. poeltii* were downloaded (GenBank nos. AM697875, AM697876, AY081158, EU681361, JQ301689, KC179141, KC179142). We considered the specimens from which the sequences had been obtained as reliably determined by experts in the group (see Søchting *et al*. 2002; Fedorenko *et al*. 2009; Gaya *et al*. 2012; Arup *et al*. 2013). We added one additional *X. poeltii* ITS sequence generated following the methods of Lindblom & Ekman (2005) [GenBank no KJ396108: Norway, Østfold, Aremark, Rive søndre, UTM(ED50): PL 518 736 (M711: 2013 IV), Alt.: 120 m, På spisslønn i gårdstun, 1998.05.10, Løfall, Bjørn Petter bpl-L3678 – Det. Lindblom, L. 2002 <Merk: LL: DNA extraction 399> (Hb. O-L-35242)]. Both ends were trimmed to remove stretches with ambiguous nucleotides, which resulted in an alignment of *c*. 330 bp. Sequences were collapsed into only two haplotypes, which are separated by a single point mutation (a transversion in ITS1). The first haplotype includes four sequences: three from specimens identified as *X. oregana* and one from a specimen representing *X. poeltii* (Table 1). The second haplotype includes sequences from four specimens of *X. poeltii* (Table 1). In addition to aiding in molecular identification of the species using the ITS barcode marker (Schoch *et al*. 2012), the results corroborate previous studies indicating that *X. oregana* and *X. poeltii* are conspecific (Arup *et al*. 2013; Leavitt *et al*. 2013).

Xanthomendoza oregana (Gyeln.) Søchting, Kärnefelt & S. Y. Kondr.

Mitt. Inst. Allg. Bot. Hamburg **30–32:** 237 (2002).—*Xanthoria oregana* Gyeln., *Ann. Mus. Nat. Hungarici* **28:** 284 (1934); type: USA, Oregon, Corvallis, on maple, 1932, *Sipe* 654 (BP!—holotype).

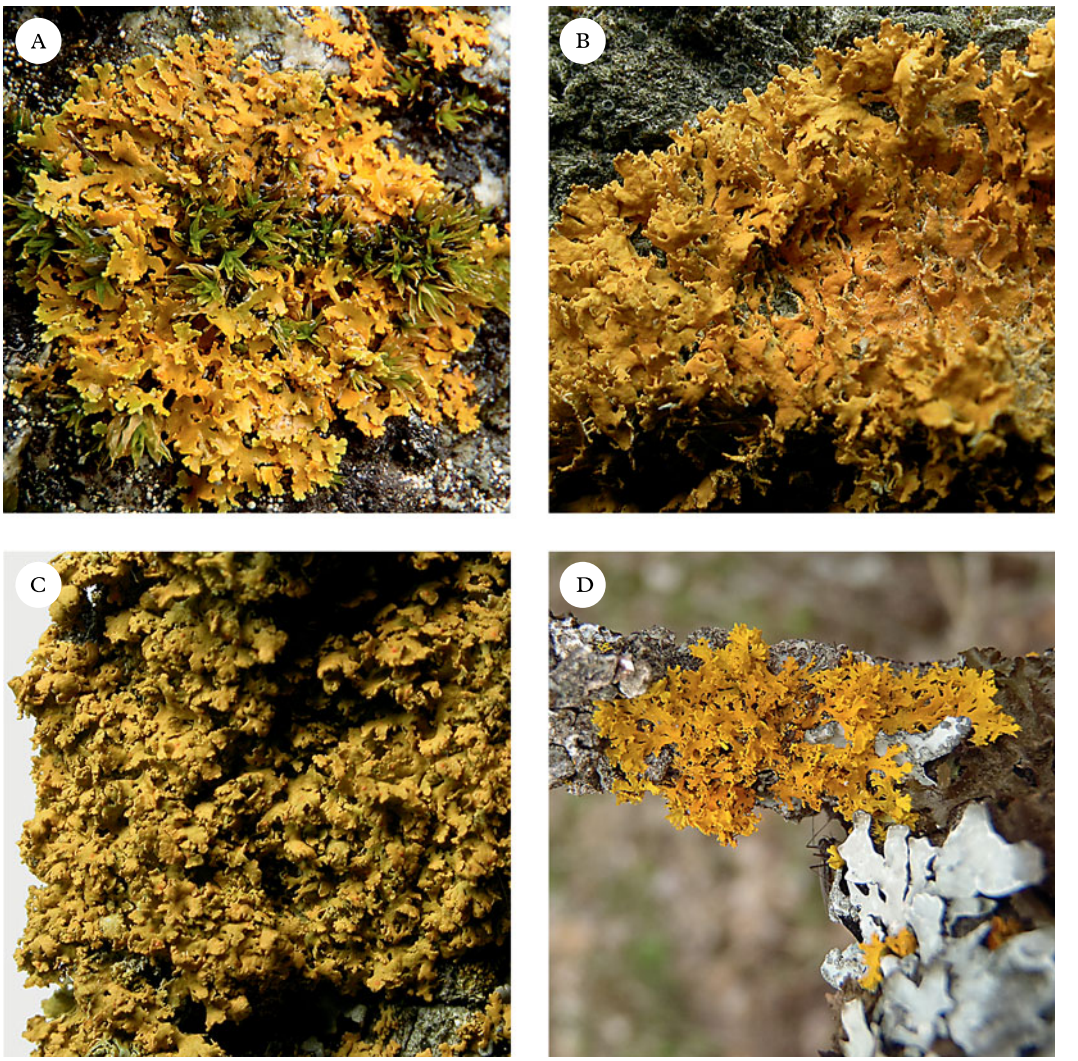

FIG. 1. A–D, *Xanthomendoza oregana*. A, Canada, British Columbia, southern Vancouver Island, near Victoria; B, Sweden, Skåne, Vomb, *Arup & Ekman* (LD-1034601); C, Sweden, Skåne, S. Sandby, *Kondratyuk* (LD-1008720, isotype); D, USA, Washington, Spokane County, Little Spokane River Natural Area. Photographs A & D, C. Björk; B & C, E. Timdal. In colour online.

TABLE 1. *DNA barcoding of* Xanthomendoza oregana. *The two haplotypes are separated by one point mutation (a transversion in ITS1, position 176 in our alignment).*

Haplotype 1	Haplotype 2
AM697875	AY081158
AM697876	EU681361
JQ301689	KC179142
KC179141	KJ396108

Xanthoria poeltii S. Y. Kondr. & Kärnefelt, *Lichenologist* **29:** 425 (1997)—*Xanthomendoza poeltii* (S. Y. Kondr. & Kärnefelt) Søchting *et al.*, *Mitt. Inst. Allg. Bot. Hamburg* **30–32:** 237 (2002); type: Sweden, Skåne, Lund, S. Sandby par., Eliselund, on *Ulmus* sp., 1995, *Kondratyuk* (LD!—holotype).

(Fig. 1A–D)

Diagnostic features of *X. oregana* are the bright yellow colour of the upper cortex,

https://doi.org/10.1017/S0024282914000413 Published online by Cambridge University Press

loosely adpressed to ascending lobes that are smooth or sometimes slightly wrinkled, and developing marginal to submarginal blastidia. Apothecia are rare, though abundant on some individual specimens. Pycnidia are frequently present, and usually contain conidia that vary in shape from ellipsoid to bacilliform (*cf.* Lindblom 1997, Fig. 3C; Søchting *et al.* 2002). Secondary chemistry: chemosyndrome A (*sensu* Søchting 1997).

More information on characters of *Xanthomendoza oregana* and how it is distinguished from other morphologically similar species, for example *X. candelaria* and *X. fulva*, is found in the original description (Kondratyuk & Kärnefelt 1997: 429) as well as in later descriptions and keys by Lindblom (1997, 2004, 2006).

Xanthomendoza oregana in this sense belongs to the western Europe–western North America disjunct biogeographical element (Schofield 1969, 1988; Nash 2008). In western North America it is widespread in the Pacific oceanic and suboceanic areas (Lindblom 2006). In Europe it has been reported (as *X. poeltii*) from Hungary (Kondratyuk & Kärnefelt 1997), Germany (Wirth *et al.* 2013, as *Gallowayiella poeltii*), Denmark (Søchting & Alstrup 2008), southern Sweden, and southern Norway (Nordin *et al.* 2014). However, its geographical distribution is still incompletely known. Notably, *X. oregana* seems to differ from most lichens and bryophytes of this disjunct element in being a species of lowland temperate areas (*cf.* Schofield 1988; Nash 2008). *Xanthomendoza oregana* grows on deciduous trees in open sites. In southern Sweden it is frequent on trees in parks and churchyards.

A comprehensive revision including phylogenetic investigation integrating molecular and morphological characters of the species in the genus *Xanthomendoza* is much needed, as has previously been pointed out (Lindblom 2006).

We are grateful to Curtis Björk and Einar Timdal for kindly letting us use their photographs, and to Ulf Arup for authorizing our use of photographs of material in herbarium LD.

References

Arup, U., Søchting, U. & Frödén, P. (2013) A new taxonomy of the family *Teloschistaceae*. *Nordic Journal of Botany* **31:** 16–83.

Clement, M., Posada, D. & Crandall, K. A. (2000) TCS: a computer program to estimate gene genealogies. *Molecular Ecology* **9:** 1657–1660.

Fedorenko, N. M., Stenroos, S., Thell, A., Kärnefelt, I. & Kondratyuk, S. (2009) A phylogenetic analysis of xanthorioid lichens (*Teloschistaceae*, Ascomycota) based on ITS and mtSSU sequences. *Bibliotheca Lichenologica* **100:** 49–84.

Gaya, E., Högnabba, F., Holguin, Á. , Molnar, K., Fernández-Brime, S., Stenroos, S., Arup, U., Søchting, U., van den Boom, P., Lücking, R., *et al.* (2012) Implementing a cumulative supermatrix approach for a comprehensive phylogenetic study of the *Teloschistales* (Pezizomycotina, Ascomycota). *Molecular Phylogenetics and Evolution* **63:** 374–387.

Gyelnik, V. (1934) Lichenes Sipeani ex Oregon. *Annales Historico-Naturales Musei Nationalis Hungarici* **28:** 278–284.

Kondratyuk, S. & Kärnefelt, I. (1997) Notes on *Xanthoria* Th. Fr. II. *Xanthoria poeltii*, a new lichen species from Europe. *Lichenologist* **29:** 425–430.

Leavitt, S. D., Lumbsch, H. T. & St Clair, L. L. (2013) Contrasting demographic histories of two species in the lichen-forming fungal genus *Xanthomendoza* (*Teloschistaceae*, Ascomycota). *Bryologist* **116:** 337–349.

Lindblom, L. (1997) The genus *Xanthoria* (Fr.) Th. Fr. in North America. *Journal of the Hattori Botanical Laboratory* **83:** 75–172.

Lindblom, L. (2004) *Xanthomendoza*. In *Lichen Flora of the Greater Sonoran Desert Region Vol. 2* (T. H. Nash III, B. D. Ryan, P. Diederich, C. Gries & F. Bungartz, eds): 583–588. Tempe, Arizona: Lichens Unlimited, Arizona State University.

Lindblom, L. (2006) *Xanthomendoza galericulata*, a new sorediate lichen species, with notes on similar species in North America. *Bryologist* **109:** 1–8.

Lindblom, L. & Ekman, S. (2005) Molecular evidence supports the distinction between *Xanthoria parietina* and *X. aureola* (*Teloschistaceae*, lichenized Ascomycota). *Mycological Research* **109:** 187–199.

Nash III, T. H. (2008) *Lichen Biology*. Cambridge: Cambridge University Press.

Nordin, A., Moberg, R., Tønsberg, T., Vitikainen, O., Dalsätt, Å., Myrdal, M., Snitting, D. & Ekman, S. [date of consultation 2014-02-20] *Santesson's Checklist of Fennoscandian Lichen-forming and Lichenicolous Fungi*. Uppsala: Museum of Evolution, Uppsala University [http://130.238.83.220/santesson/home.php]

Poelt, J. & Petutschnig, W. (1992*a*) Beiträge zur Kenntnis der Flechtenflora des Himalaya IV. Die Gattungen *Xanthoria* und *Teloschistes* zugleich Versuch einer Revision der *Xanthoria candelaria*-Gruppe. *Nova Hedwigia* **54:** 1–36.

Poelt, J. & Petutschnig, W. (1992*b*) *Xanthoria candelaria* und ähnliche Arten in Europa. *Herzogia* **9:** 103–114.

Schoch, C. L., Seifert, K. A., Huhndorf, S., Robert, V., Spouge, J. L., Levesque, C. A., Chen, W., Bolchacova, E., Voigt, K., Crous, P. W., *et al*. (2012) Nuclear ribosomal internal transcribed spacer (ITS) region as a universal DNA barcode marker for Fungi. *Proceedings of the National Academy of Sciences of the United States of America* **109:** 6241–6246.

Schofield, W. B. (1969) Phytogeography of northwestern North America: bryophytes and vascular plants. *Madroño* **20:** 155–207.

Schofield, W. B. (1988) Bryophyte disjunctions in the Northern Hemisphere: Europe and North America. *Botanical Journal of the Linnean Society* **98:** 211–224.

Søchting, U. (1997) Two major anthraquinone chemosyndromes in *Teloschistaceae*. *Bibliotheca Lichenologica* **68:** 135–144.

Søchting, U. & Alstrup, V. (2008) *Danish Lichen Checklist*. *Version 2*. Copenhagen: Faculty of Science, University of Copenhagen. Available at http://www.bi.ku.dk/lichens/dkchecklist/Danish_Lichen_Checklist_2008.pdf

Søchting, U., Kärnefelt, I. & Kondratyuk, S. (2002) Revision of *Xanthomendoza* (*Teloschistaceae*, *Lecanorales*) based on morphology, anatomy, secondary metabolites and molecular data. *Mitteilungen aus dem Institut für Allgemeine Botanik in Hamburg* **30–32:** 225–240.

Wirth, V., Hauck, M. & Schultz, M. (2013) *Die Flechten Deutschlands*. Stuttgart: Ulmer.

Louise Lindblom and Hans H. Blom

L. Lindblom: Department of Natural History, University Museum of Bergen, University of Bergen, P.O. Box 7800, NO-5020 Bergen, Norway.
Email: louise.lindblom@um.uib.no
H. H. Blom: Norwegian Forest and Landscape Institute, Fanaflaten 4, NO-5244 Fana, Norway.