

The first record of *Ramalina obtusata* in the Komi Republic, north-eastern European Russia

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Ramalina obtusata is reported from the Komi Republic, east of its previously known range in Europe. The Komi Republic is bounded by the Ural mountains to the east and by the Timan range to the west. The species was found on a trunk of *Picea obovata* on the bank of the Izhma River, Ukhta. This discovery was made as part of a wider study which investigated the abundance and diversity of lichen communities at sites in the taiga forest of the Pechora Basin, to assess local impacts of oil and gas operations on lichen biodiversity.

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Ramalina obtusata (Ach.) Bitter occurs in the boreal regions of Europe and North America (Thomson 1984, Santesson et al. 2004). In Europe the species is known from eastern and central parts of Fennoscandia (Tønsberg et al. 1996, Santesson et al. 2004) and the central European mountains (Nimis 1993). The species is widespread but scattered in Norway and Finland, and found most commonly in the eastern parts. In Sweden it has a similar range as *Ramalina dilacerata*, but is much rarer and red-listed (Thor 1999). *Ramalina obtusata* grows on twigs of conifers, mainly *Picea*, but occasionally also on deciduous trees, and rarely on rock (Thomson 1984). In northern Fennoscandia the species exclusively grows in spruce forests, often near waterfalls. In central Europe it occurs in humid montane forests (Nimis 1993). In North America it often grows close to running water and lakes with ample

light (Goward & Ahti 1992).

The Pechora river basin in the Komi Republic has abundant natural resources, both renewable (e.g. forests) and non-renewable (e.g. minerals, coal, oil and gas) (Lausala & Valkonen 1999, Virtanen et al. 2004). Coal combustion has been the principal source of SO₂ and heavy metal pollution in the Pechora basin (Solovieva et al. 2002, Walker et al. 2003a, b), but other sources include gas and oil extraction (State of the Environment of the Komi Republic 1992–1998). Exploitation of coal is in decline (Lausala & Valkonen 1999), and recently the oil and gas industries have boomed and are expected to expand, bringing about significant risks of environmental pollution (Vilcheck & Tishkov 1997). In recent years there have been extensive collections and identifications of lichens in the Komi Republic (Hermansson, et al. 1998). Due to their

susceptibility to SO₂ and other phytotoxic air pollutants, epiphytic lichens have been used for decades to monitor air pollution (Hawksworth & Rose 1970, Thor 1998). The development of gas and oil industries has potential to increase pollution in taiga forests of the Komi Republic and the Pechora. As part of a wider study we sought to find if pollution impacts are already detectable and to seek evidence of environmental impacts in the vicinity of a booming petrochemical industry in the Pechora region by measuring alpha (α) biodiversity of epiphytic lichens in close proximity to both putative pollution 'hot spots' and unpolluted 'reference' sites with broadly comparable community structures (Walker et al. 2005). We therefore report here the first record of a threatened species in the Komi Republic and discuss the likely ecological impacts of pollution on lichen abundance.

Materials and methods

The Ukhta site was chosen as part of a wider study to quantify environmental impacts in close proximity to perceived pollution 'hot spots' and unpolluted 'reference' sites of broadly comparable community structure (Walker et al. 2005). The Ukhta area (63°44'10"N, 53°42'57"E), is characterized by a petrochemical industry, forestry and fragmented lowland taiga. Nine mature spruce trees (*Picea obovata*) were selected ≥ 100 m apart based on accessibility of trunks and representative nature of the stand. An estimate of abundance and cover of each lichen species was made on trunks and branches, upto a height of 1.7 m. Estimates were made according to the scale used by Kauppi and Halonen (1992): 7 = >50% cover, 6 = 26–50%, 5 = 11–25%, 4 = 3–10%, 3 = poor cover, < 3% of total trunk area, 2 = little, many specimens, but not constituting any real cover, 1 = extremely little, only one or two specimens per trunk. Other studies have also used estimates of abundance of epiphytes (McCune 1990, Halonen et al. 1991, Aamlid & Venn 1993).

All macrolichen species were identified in the field according to Dobson (1979), Moberg & Holmåsén (1982), Goward et al. (1994) and McCune & Geiser (1997). Where this was not possible, specimens were collected and brought to the Institute of Biology, Komi Science Centre, Syktyvkar for detailed examination. A voucher specimen of *R. obtusata* has been deposited in the herbarium at the Institute of Biology, Komi Science Centre, Syktyvkar. Identification was made in the field by T.N.P. and was verified in Syktyvkar by Olga Lavrinenko.

Results and discussion

Complete listings of epiphytic lichen species assessed on the trunks and branches of *P. obovata* for the Ukhta area are given in Table 1. The first record of *Ramalina obtusata* in the Komi Republic was made on the bank of the Izhma River, 10 km from Ukhta (63°44'10"N, 53°42'57"E). The species was found on a single tree on the trunk of *Picea obovata*. *Ramalina obtusata* has now been updated in the checklist for the lichen and lichenicolous fungi for the Komi Republic and Nenetskiy national okrug (including the Archangelsk region) in European Russia (Hermansson et al. 1998). For North America *R. obtusata* is frequently cited (e.g. Thomson 1984, DeBolt & McCune 1993, Goward 1999) including British Columbia and elsewhere in Canada. *R. obtusata* is pollution sensitive and is considered threatened (DeBolt & McCune 1993, Tønsberg et al. 1996). The Izhma River is located approximately 10 km from petrochemical operations, principally oil processing, around Ukhta and the nearby gas processing operations in Sosnogorsk, which is also affected by forestry, and has left the taiga fragmented, with forest stands of different ages (Gimadi 2002). Due to the sensitivity of *R. obtusata* to pollution and proximity to the oil and gas industry the Izhma River site could be considered a monitoring site for future industrial impacts in the area.

Table 1. Epiphytic lichen species and their mean cover abundance recorded on 9 *Picea obovata* trunks and branches up to 1.7 m. Strecken i Table 1 fortsätter In i högerspalten

Species	Ukhta
<i>Alectoria sarmentosa</i> *	–
<i>Bryoria capillaris</i> *	3.6
<i>B. furcellata</i> *	1.0
<i>B. fuscescens</i> *	4.5
<i>B. fremontii</i> *	0.1
<i>B. nadvornikiana</i> *	0.3
<i>B. simplicior</i> *	–
<i>E. mesomorpha</i>	1.8
<i>E. prunastri</i>	0.3
<i>Hypogymnia bitteri</i>	0.5
<i>H. physodes</i>	4.5
<i>H. tubulosa</i>	2.0
<i>Imshaugia aleurites</i>	0.4
<i>Melanelia exasperatula</i>	0.5
<i>M. olivacea</i>	1.6
<i>Parmelia sulcata</i>	2.8
<i>Parmeliopsis ambigua</i>	1.0
<i>P. hyperopta</i>	1.0
<i>Physcia aipolia</i>	–
<i>Plastimatia glauca</i>	1.0
<i>Ramalina dilacerata</i>	1.4
<i>R. obtusata</i>	0.1
<i>R. roesleri</i>	0.4
<i>R. thrausta</i>	0.8
<i>Tuckermanopsis chlorophylla</i>	1.8
<i>T. sepincola</i>	0.4
<i>Usnea filipendula</i> *	3.0
<i>U. glabrescens</i> *	0.1
<i>U. lapponica</i> *	0.9
<i>U. scabrata</i> *	–
<i>U. subfloridana</i> *	2.0
<i>Vulpicida pinastri</i>	1.0
Sum of mean abundance	38.5
Mean number of species	17.6

* Epiphytic species which are pollution sensitive according to Hawksworth & Rose (1970).

Specimen examined: **Russia.** Komi Republic, bank of the Izhma River, 10 km from Ukhta, 2001, T. Pystina (SYKT).

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References

- Aamlid, D. & Venn, K. 1993. Methods of monitoring the effects of pollution on forest and vegetation of eastern Finnmark, Norway. *Nowegian Journal of Agricultural Sciences* 7: 71–87.
- Anonymous. *State of the Environment of the Komi Republic 1992–1998*. Reports of the Ministry of Environmental Resources and Conservation. Komi Republic, Syktyvkar.
- DeBolt, A. & McCune, B. 1993. Lichens of Glacier National Park, Montana. *Bryologist* 96: 192–204.
- Dobson, F. S. 1979. *Lichens, an illustrated guide to the British and Irish species*. Cambrian Printers, Aberystwyth, Wales.
- Gimadi, I. 2002. *The Preliminary variant of the social-economical development scenarios*. Unpublished report of the Institute of Economy, Ural Division, Russian Academy of Sciences, Yekaterinburg.
- Goward, T. 1999. *The lichens of British Columbia, illustrated keys part 2 fruticose species*. Research Program British Columbia Ministry of Forests, Victoria.
- Goward, T. & Ahti, T. 1992. Macrolichens and their zonal distribution in Wells Gray Provincial Park and its vicinity, British Columbia, Canada. *Acta Botanica Fennica* 147: 1–60.

- Goward, T., McCune, B. & Meidinger, D. 1994. *The Lichens of British Columbia, Illustrated keys, Part 1 Foliose and squamulose species*. Ministry of Forests, British Columbia.
- Halonen, P., Hyvärinen, M. & Kauppi, M. 1991. The epiphytic lichen flora on conifers in relation to climate in the Finnish middle boreal subzone. *Lichenologist* 23: 61–72.
- Hawksworth, D. L. & Rose, F. 1970. Qualitative scale for estimating sulphur dioxide air pollution in England and Wales using epiphytic lichens. *Nature* 227: 145–148.
- Hermansson, J., Pystina N. T. & Kudrejasheva, D. I. 1998. *A provisional checklist of the lichens of Komi Republic*. Syktyvkar (In Russian), 136pp.
- Kauppi, M. & Halonen, P. 1992. Lichens as indicators of air pollution in Oulu, northern Finland. *Annales Botanici Fennici* 29: 1–9.
- Lausala, T. & Valkonen, L. 1999. *Economic geography and structure of the Russian territories of the Barents region*. Arctic Centre Report No. 33, University of Lapland, Rovaniemi.
- McCune, B. 1990. Rapid estimation of abundance of epiphytes on branches. *Bryologist* 93: 39–43.
- McCune, B. & Geiser, L. 1997. *Macrolichens of the Pacific Northwest*. Oregon State University Press, Corvallis.
- Moberg, R. & Holmåsén, I. 1982. *Lavar*. Interpublishing, Stockholm (in Swedish).
- Nimis, P. L. 1993. *The Lichens of Italy*. Museo Regionale di Scienze Naturali, Torino.
- Santesson, R., Moberg, R., Nordin, A., Tønsberg, T. & Vitikainen, O. 2004. *Lichen-forming and lichenicolous fungi of Fennoscandia*. Museum of Evolution, Uppsala University.
- Solovieva, N., Jones, V. J., Appleby, P. G. & Kondratenok, B. M. 2002. Extent, environmental impact and long-term trends in atmospheric contamination in the Usa basin of East-European Russian Arctic. *Water, Air & Soil Pollution* 139: 237–260.
- Thomson, J. W. 1984. *American Arctic lichens I. The Macrolichens*. Columbia Univ. Press, New York.
- Thor, G. 1998. Red-listed lichens in Sweden: habitats, threats, protection, and indicator value in boreal coniferous forests. *Biodiversity and Conservation* 7: 59–72.
- Thor, G. 1999. *Ramalina obtusata* – trubbig brosklav. In: Thor, G. & Arvidsson, L. (eds), *Rödlistade lavar i Sverige. Artfakta*. Artdatabanken, SLU, Uppsala, pp. 450–451.
- Tønsberg, T., Gauslaa, Y., Haugan, R., Holien, H. & Timdal, E. 1996. The threatened macrolichens of Norway – 1995. *Sommerfeltia* 23: 1–258.
- Vilcheck, G. E. & Tishkov, A. A. 1997. Usinsk oil spill. In: Crawford, R. M. M. (ed.), *Disturbance and Recovery in Arctic Lands*, Kluwer Academic, Dordrecht, pp. 411–420.
- Virtanen, T., Mikkola, K., Nikula, A., Christensen, J. H., Mazhitova, G. G., Oberman, N. G. & Kuhry, P. 2004. Modeling the location of the forest line in northeast Russia with remotely sensed vegetation and GIS-based climate and terrain data. *Arctic Antarctic and Alpine Research* 36: 313–321.
- Walker, T. R., Crittenden, P. D. & Young, S. D. 2003a. Regional variation in the chemical composition of winter snowpack and terricolous lichens in relation to sources of acid emissions in the Usa river basin, northeast European Russia. *International Journal of Environment and Pollution* 125: 401–412.
- Walker, T. R., Young, S. D., Crittenden, P. D. & Zhang, H. 2003b. Anthropogenic metal enrichment of snow and soil in north-eastern European Russia. *International Journal of Environment and Pollution* 121: 11–21.
- Walker, T. R., Crittenden, P. D., Young, S. D. & Pystina, T. 2005. An assessment of pollution impacts due to the oil and gas industries in the Pechora basin, north-eastern European Russia. *Ecological Indicators*. (in press).