

Effects of air pollution on cell membrane integrity, spectral reflectance and metal and sulfur concentrations in lichens

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Abstract

The fruticose lichen *Ramalina duriaei* is generally considered to be sensitive to air pollution. In the present study we sought to determine whether thalli of this lichen collected in a remote unpolluted site (the HaZorea Forest, northeast Israel) and transplanted to the Ashdod region (southwest Israel) could provide information on the quality of the air in this area. For this purpose, the concentrations of Pb, Cu, Cd, Ni, Mn, Fe, S, Ca, Mg, Na, and K were determined in in situ thalli collected in the HaZorea Forest in March 1993 and in in situ and transplanted thalli retrieved in June 1993. The concentration of these elements in *R. duriaei* thalli was analyzed in comparison with physiological parameters such as the integrity of cell membranes, chlorophyll content, and alterations in reflectance responses from lichen thalli. Thalli transplanted to several industrial sites in the town of Ashdod for a period of 100 d accumulated high concentrations of Pb, Cd, Ni, Fe, S, Mg, Na, Ca, and K. The concentration of S in thalli transplanted to the Ashdod region was found to correlate with damage caused to cell membranes and showed an inverse correlation with the chlorophyll content and with the reflectance response of the lichen. The electrical conductivity values corresponding to membrane integrity in the lichen thallus showed an inverse correlation with the ratio of chlorophyll a to pheophytin a, indicating the integrity of the photobiontic chlorophyll and with normalized-difference vegetation index values corresponding to the reflectance response of the thallus. The chlorophyll integrity correlated with the reflectance response. Magnesium accumulated in the lichen thalli in dusty sites and was found to correlate with damage caused to membranes.