

BIOMARKERS OF HEAVY METAL POLLUTION IN BRYOPHYTA

Adriana Basile

Department of Biology University Federico II Napoli Italy

KEYWORDS: Heavy metal; Ultrastructural alterations; Oxidative stress; DNA; Phytochelatins

INTRODUCTION:

Bryophyta show a high metal storage capacity due to the high surface / volume ratio and the presence of a thin cuticle. It is known that these organisms have no roots and that their rhizoids do not contribute mainly to the absorption of substances from the substrate; therefore, most of the elements absorbed by bryophytes come from atmospheric deposition or aquatic uptake, so the levels of specific elements in bryophytes reflect total deposition or their presence in aquatic systems and can be used to monitor air or aquatic pollution in space and time. Many studies have used bryophytes to study environmental pollution levels (Tyler 1990; Harmens et al. 2012) and pollution tolerant species have been used to study environmental pollution in highly contaminated sites (Basile et al. 2001, 2008, 2012, 2013, 2017; Maresca et al. 2018, 2020; Esposito et al 2018). Some examples are: the notorious "Land of fires", so called because of the burning of waste and fraudulent dumping, that show an alarming increase in the incidence of chronic-degenerative diseases and tumors and Regi Iagni and Fiume Sarno, considered among the most polluted watercourses in Europe. These areas are located in the Campania Region (Southern Italy)

OBJECTIVES:

Mosses such as *Leptodictyum riparium* and *Scorpiurium circinatum* and liverworts such as *Lunularia cruciata* and *Conocephalum conicum*, known to be pollution tolerant species, have been used to investigate the rate of accumulation of heavy metals from air or water in systems characterized by strong risk to human health. Furthermore, the cytophysiological effects due to the presence of pollutants were have been studied with the aim of use them as a biomarker of environmental pollution

METHOD / DESIGN:

The response chain to environmental pollution was investigated considering: ultrastructure, vitality, photosynthetic efficiency, chlorophyll degradation, Reactive Oxygen Species production and localization, activity of antioxidant enzymes, DNA damage, heat shock protein 70 (Hsp70) induction and gene expression levels, presence of chelating molecules (phytochelatins).

RESULTS:

The biological modifications studied generally show a good correlation with the degree of heavy metal pollution considered and can be proposed as biomarkers of environmental stress.

CONCLUSIONS:

We discuss the data considering the possibility of using these biological changes as environmental pollution biomarkers. Finally, it is underlined the importance of phytochelatins due to of their specificity for metal pollution.

Harmens, H et al. 2012.. Environ. Pollut. 166, 1e9

Basile A. et al. 2008. Environmental Pollution 151: 401-407

Basile, A et al. 2009. Environ. Pollut. 157, 2255e2260. [https:// doi.org/10.1016/j.envpol.2009.04.001](https://doi.org/10.1016/j.envpol.2009.04.001).

Basile A. et al. 2013. Environmental Pollution 182 209e216

Basile, A., et al. 2017. Environ. Sci. Pollut. Res. 24, 26185e26193. <https://doi.org/10.1007/s11356-017- 9304-y>.

Esposito S. et al. 2018. 2018 PLOS ONE 13(4),0195717 doi:10.1371/journal.pone.0195717

Maresca, V., et al. 2018. Ecotoxicol. Environ. Saf. 163, 665e673. <https://doi.org/10.1016/j.ecoenv.2018.07.122>.

Tyler G. 1990. Botanical Journal of the Linnean Society 104: 231-253.