CHLOROPLASTS ULTRASTRUCTURAL CHANGES AS BIOMARKERS OF ACID RAIN AND HEAVY METALS POLLUTION

Vodka M. V.

Kholodny Institute of Botany of the National Academy of Sciences of Ukraine, Kyiv
The aim of the work was to confirm the possibility of structural changes of *Spinacea olearacea* L. chloroplasts usage as biomarkers for assessing of environmental pollution by acid rain and heavy metals. Chloroplasts ultrastructural changes were recorded by transmission electron microscopy. Data on changes in the structure of chloroplasts under the influence of these factors are obtained, in particular the heterogeneity of thylakoid grana packing, the membranes thickness, the starch grains presence, and the lumen space increase as compared with the control. These structural changes can be applied as markers of abiotic stresses influence, notably acid rain and heavy metals, and for the creation of new sustainable high-tech varieties of agricultural crops.

**Key words:** *Spinacea olearacea* L., imitated acid rains, heavy metals, chloroplast structure, biomarkers..

© Palladin Institute of Biochemistry of National Academy of Sciences of Ukraine, 2017

{spoiler title=References}


[https://doi.org/10.1007/BF00477180](https://doi.org/10.1007/BF00477180)

[https://doi.org/10.1007/BF00663157](https://doi.org/10.1007/BF00663157)

[https://doi.org/10.1016/S0168-9452(02)00447-8](https://doi.org/10.1016/S0168-9452(02)00447-8)


https://doi.org/10.1016/j.jplph.2014.01.015


https://doi.org/10.1016/j.envexpbot.2012.02.008

https://doi.org/10.1093/pcp/pcp067

https://doi.org/10.1007/s004250000458