INFLUENCE OF RADIATIONS UV ON THE ENZYMATIC ACTIVITY OF THE *ZEA MAYS L.* PLANTS

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Abstract

The activity increase of the antioxidant defense system, due to negative effects of environmental stressors, develops over a long period of time, a process called adaptation.

Many agricultural plants of subtropical origin (eg, corn, rice, tomatoes, peppers, squash, cucumbers etc.) are also grown in the temperate zone, but in less optimal conditions. In this case, the reproduction of these plants must also take into consideration selecting genotypes tolerant to the new conditions, and through them creating tolerant varieties

The elevated levels of the reactive oxygen species (ROS), determine the significant increase of the antioxidant enzymes' activity, a process by which the plants are protected against the damaging effects of the oxidative stress.

Key words: Activity enzymatic,zea mays plants,antioxidant system,protect ,oxidative stress.

INTRODUCTION

In literature, there are some data obtained from superior plants, according to which low temperatures determine a severe photoinhibition, under the influence of the available photosynthetic radiation (Kremer 1988, 1994).

Based on the data available from the literature, we questioned whether the low temperatures and UVB influence induce changes dependent on the spectrum used on the antioxidant system on plants (Ankley et al. 1994).

Radiation UV belongs to the invisible solar spectrum, having a wavelength ranging from 100 to 400 nm, but the maximum mutagenic effect has UV radiation with a wavelength of 258 nm because the DNA absorption spectrum corresponds to that wavelength.(Bötteher et al 1998.)

The UV-B level reaching organisms should not be equal to the range of light spectrum (Antofie et al 2010,Apahidian et al, 2004)

In recent years, considerable interest has been shown regarding the UV radiations in the aquatic systems from regions with low temperatures, where there can be noticed a significant increase in the UVB level (280-310 nm) resulting from the depletion of the protective ozone layer. (Borowska.et.al,1987,Bornman et al 1984)

Our experiments we sought to answer the question whether the treatment with UV-B type radiations, of different wavelengths of 280-310 nm, under low temperature conditions (6-8 ^{0}C), has a stressful effect on plants and induces the activation of the antioxidant enzymes, and if there are differences in this regard between the control and treated plants.(Rajendiran, et al 2004, Rab. et al,1996)

UV-B radiations act on biological media through oxidative mechanisms, correlated with the formation of reactive oxygen species such as singlet oxygen, hydroxyl radicals (OH-), superoxide anions (-O2-), hydrogen peroxide (H2O2).(Bötteher, et al 1987)

It is believed that cellular changes, including those caused by UV-B radiation of different wavelengths, are associated with overproduction of reactive oxygen species such as superoxide (O2-) and hydrogen peroxide (H2O2) (Madronich., et al, 1994).

During the transport of electrons to molecular oxygen, or in the hydroxylation and oxygenation reactions, toxic products can be formed by the partial reduction of oxygen, highly reactive capable of destroying the biological activity of some macromolecules. (Prewitt, 1970, Raicu 1997)

Along with the destructive effect that free oxygen radicals produce in plants, they also appear to have a critical role in cellular transduction signals (Quaite et al 1994).

MATERIAL AND METHOD

In order to extract and evaluate the activity of the enzymes, 0.5 g of plant material (leaves without the main nervure) was triturated with quartz sand, adding 2.5 ml of MgCl2 solution, with a concentration of 3 mM, cold, EDTA 1 mM, containing 0.5 mM of TRIS-HC1 (pH 7.4) buffer solution, in a chilled mortar.

The homogenized mixture was centrifuged (4°C, 20 minutes, 1500 rpm), then the supernatant was divided into Eppendorf tubes. Until measurements were due, the samples were stored on ice, measurements being conducted at room temperature.

RESULTS AND DISCUSSION

When plants are subjected to a biotic or abiotic stress, the reactive oxygen species will accumulate excessively leading to the oxidative alteration of the cells. In this respect, the antioxidants and the antioxidant enzymes function to interrupt the uncontrolled oxidation in each organ.

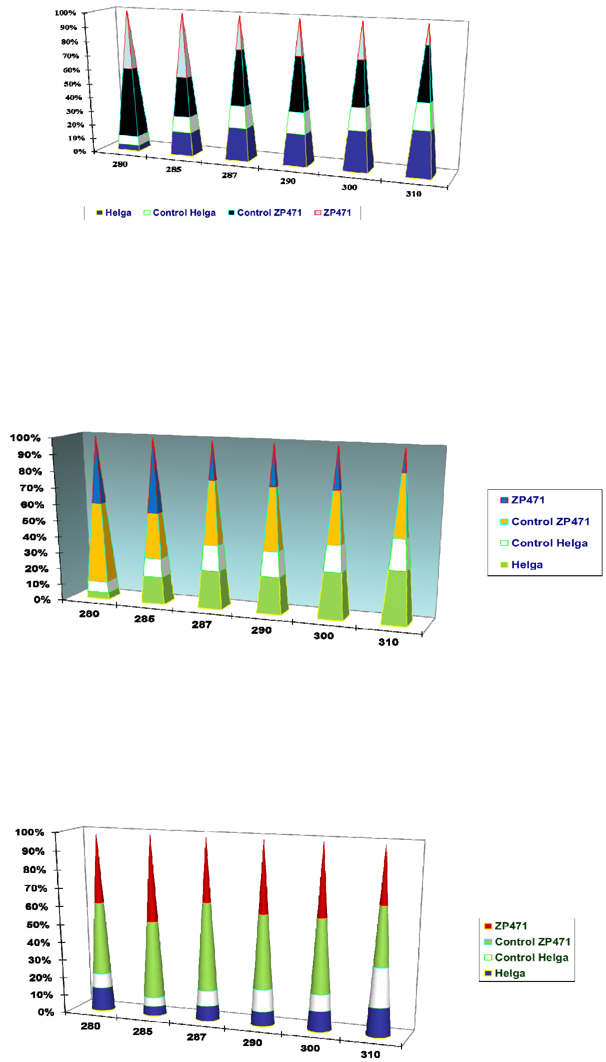

Fig. 1. The degree of change of the antioxidant system enzymes' activity in the plant extract of Zea mays L., hybrids Helga and ZP471, under the influence of the UV-B type radiation and of low temperatures

CONCLUSIONS

The studied UVB spectrum determines the increase of the APX concentration from the plant extract at low temperatures, indicating the high level of peroxide at the cellular level, compared to the plants irradiated under normal temperature circumstances.

We should note that in the specialty literature there is no data regarding the complex characterization of the 287 nm UVB effect, and our data bring an important contribution to the characterization of the UVB spectrum from a biochemical point of view.

REFERENCES

1. Ankley GT, Collyard SA, Monson PD, Kosian PA., 1994, Influence of ultraviolet light on the toxicity of sediment contaminated with polycyclic aromatic hydrocarbons. Environ Conta Toxicol 13:p. 1791–1796.
2. Antofie M. M., D.Constantinovici, M.R. Pop, P.Iagaru, C.Sand, G. Cirotea, 2010, Theorethical methodology for assessing the status of conservation of crop landcraces in Romania. Analele Universităţii din Oradea, Fascicula Biologie, TOM XVII, Issue2, p.313-317.
3. Apahidean Al.S., Apahidean, M., 2004, Cultura legumelor şi ciupercilor, Ed. Academic Pres, Cluj-Napoca, p. 177-187
4. Borkowska, B., Michalczuk, L., 1987, The physiological disorders of sour cherry cultures: necrosis and vitrification, Acta Hortic nr. 212, p. 235-237.
5. Bornman, C.H., Vogelmann, T.C., 1984, Effect of rigidity of gel medium on benzyladenine-induced adventitions bud formation and vitrification in Picae abies,, Physiol Plants nr. 61, p. 505-512.
6. Bötteher, I., Göring, H., 1987, Die Vitrifokation der Pflanzen bei der in vitro-Kultur als Infiltration problem, Biol Rundsch nr. 25, p. 191-193.
7. Bötteher, I., Zougauer, K., Göring,H., 1988, Induction and reversion of vitrification of plants cultured in vitro, Physiol Plant nr. 72, p. 560-564.
8. Boxus, P., Pâques, M., 1987, Métode et composition de lutte contre le phénomène de vitrification au cours de la micropropagation in vitro des plantes. Demande de brevet européen 878770054.1 22.04.87 publication 0 247018 European Patent Office.
9. Kramer, P., J., 1983, Water relations of plants. Academic Press, New York.
10. Krupa, SV, Kickert, RN. 1989, The Greenhouse effect: impacts of ultraviolet-B (UV-B) radiation, carbon dioxide (CO2), and ozone (O3) on vegetation"Environ Pollut. 61(4), p. 263–393
11. Madronich, S., McKenzie, R.L., Caldwell, M.M., Bjorn, L.O., 1995. Changes in ultraviolet radiation reaching the earth's surface. Ambio, p. 143-152.
12. Marmur, J. 1961. A procedure for the isolation of deoxyribonucleic acid from microorganiisms. J.Mol. Biol. 3, p.208-218.
13. McCloskey JT, Oris JT. 1993, Effect of anthracene and solar ultraviolet radiation exposure on gill ATPase and selected hematologic measurements in the bluegill sunfish (*Lepomis macrochirus*) Aquat Toxicol. p. 207–218
14. Mraz C E; Muresan M; Micle O, Vicas L, Pallag A,, Coltau M, Puscas I, 2012, Effect of vitamin D on carbonic anhydrase activity experimental reasearch in vitro and in vivo, Farmacia; **60**(2): 264-271.
15. Pallag A, Jurca T, Sirbu V, Honiges A, Jurca C, 2018, Analysis of the Amount of Polyphenols, Flavonoids and Assessment of the Antioxidant Capacity of Frozen Fruits, REV CHIM. (Bucharest); **69**(2): 445-448.
16. Pallag A, Jurca T., Pasca B., Sirbu V., Honiges A., Costuleanu M., 2016, Analysis of Phenolic Compounds Composition by HPLC and Assessment of Antioxidant Capacity in Equisetum arvense L. Extracts REV CHIM .(Bucharest), **67**(8): 1623-1627
17. Pallag A., Paşca B., Jurca T., Suciu R., Nemeth S., Vicaş L., 2016, Comparative histo-anatomical researches on the vegetative organs and assessment of antioxidant capacity of two species from Equisetum Genus. Farmacia; **64**(3): 372-377.
18. Prakken, R., 1959, Induced mutation". Euphytica 8: p. 270-322.
19. Prewitt, J.M.S. 1970, Object enhancement and extraction" In A.,Rosenfeld and B.S. Lipkin, editors, Picture Processing and Psychophysics, Academic Press, New York, p. 75-149,
20. Raicu, P., 1980, Genetica. Editura Didactică şi Pedagogică, Bucureşti, p.320-330, 353-356.
21. Raicu, P., 1997, Genetică generală şi uman. Ed. Humanitas, Bucureşti, p.182-187.
22. Rab A., Saltveit M.E., 1996, Differencial chilling sensitivity in cucumber (Cucumis sativus) seedlings". Physiol. Plant. 96., p. 375-382.
23. Rajendiran, K., Ramanujam, M.,P., 2004., Improvement of biomass partitioning flowering and yield by triadimetion in UV-B stressed Vigna radiata(L)", Wilezek- Biol. Plant. 48, p.145-148.
24. Quaite, F.E., Takayanagi, S., Ruffini, J.,Sutherland, J.C., and Sutherland, B.M., 1994, DNA damage levels determine cyclobutyl pyrimidine dimer repair mechanisms in alfalfa seedlings". Plant Cell 6, p. 163-164