Analyzing Senescence with White Mustard Germination

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1. Introduction

Senescence is a type of programmed cell death (PCD) and it is a natural death process in life of plants. The PCD is well-studied in animals, but our knowledge about senescence of plant is limited. Senescence is indispensable for plant survival and development. During this process nutrients of died organs can be reused in other organs of plants [1]. It accompanies various processes starting as early as embryogenesis. It can be observed in the tissues of germinating seeds, in the root cap, during the formation of aerenchyma, during the differentiation of tracheary elements as well as in various tissues and senescence of leaf. The process of senescence can be influenced by natural stressors as well [2]. Analyzation of this processes could be important in the pharmaceutical industry, biotechnology and in plant production including plant protection, too.

2. Research Methods

Process of senescence was examined on white mustard (*Sinapis alba*) germination. My hypothesis was that during the progress, the cotyledons are going through changes which include the senescence. This process is very complex because the nutritional value and the number of pigment change in the plant development stages. During the germination, the stored biological substances run out, the content of chlorophyll and carotenoids change. My other hypothesis was that the senescence can be influenced by chemical treatments. I used a microcystin toxin (MCY) to examine the effects of natural stressors on the plant senescence (treated plants). Peroxidase enzyme activity, chlorophyll and carotenoids contents were measured by spectrophotometry. The appearance and disappearance of new enzymes were detected by polyacrylamide gel electrophoresis. I used protease and nuclease gels. I collected 4 samples from the untreated and 3 samples from the treated plants.

3. Results

Senescence of treated plants (23 days) was faster than senescence of untreated plants (37 days). The ratio of chlorophyll and carotenoids contents increased during senescence, the chlorophyll content decreased significantly in the studied period. The peroxidase enzyme activity increased (*Figure 1*), but the difference was higher in the case of treated plants. I found three protease isoenzymes and four nuclease isoenzymes. New isoenzymes were not detected in the treated samples. However, the senescence was faster in the case of MCY treatment.

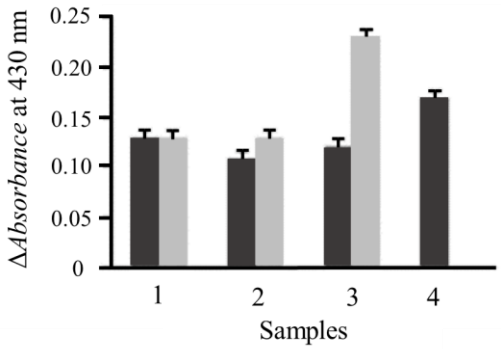

Figure 1 – The peroxidase enzyme activities in the case of untreated (**darker**) and MCY treated (**lighter**) white mustard *(Sinapis alba)* plants.

4. Conclusion

The white mustard *(Sinapis alba)* is a good test plant to examine the senescence and the natural death processes. Due to the oxidative stress process the peroxidase enzyme activity increased, this activity was higher in case of the MCY treatment. Natural stressors can affect negatively the reusing of nutrients during senescence and can inhibit the normal growing of plants. The MCY as a natural stressor speeded up the process of senescence. The intensive stress process and the shorter period of senescence can lead to nutrient loss in plants. All in all examination of white mustard *(Sinapis alba)* is an adequate system to test the effects of various environmental problems.

5. References

[1] Love A.J., Milner J.J., Sadanandom A. (2008): Timing is everything: regulatory overlap in plant cell death. *Trends Plant Sci.* 13: 589–595.

[2] M-Hamvas M., Ajtay K., Beyer D., Jámbrik K., Vasas G., Surányi Gy., Máthé Cs. (2017): Cylindrospermopsin induces biochemical changes leading to programmed cell death in plants. *Apoptosis* 22: 254–267.