

Radioprotective Effect of the Extract of Plant Collection on Gamma Irradiated Seeds of Wheat

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Abstract – The effect of the extract of the collection medicinal grasses on the morphological and physiological characteristics and activity of antioxidant enzymes in seedlings obtained from gamma irradiated seeds of wheat was studied. It was shown that an extract derived from the St. John's wort (*Hypericum perforatum* L.), dandelion (*Taraxacum officinale* L.), and marigold (*Calendula officinalis* L.), stimulates the germination of irradiated seeds and activity of superoxide dismutase in wheat seedlings.

Keywords – Gamma Irradiation, Wheat, Seedlings, Germination, Superoxidedismutase, Catalase.

I. I. INTRODUCTION

In recent years intensively conducted research aimed at studying the radioprotective properties of extracts of plant origin. The interest in medicinal plants due to the fact that they have radiosensibilisation and radioprotective properties, non-toxic, easy to use, accessible and cost effective (1,2). Most natural bioactive substances of vegetable origin contain compounds having antioxidant properties which slow down or prevent the oxidation of organic metabolites, provide optimal conditions for the metabolism and provide normal growth and development of cells of the tissue (1, 4). Furthermore, plant substances, obtained in the form of extracts, have a complex effect the patient's body as they contain biologically active substances of different groups in a concentrated form (4). Intensity of the pharmacological effects of the extracts depends on contain natural compounds in them. The antioxidant properties of plants associated with the activity of the enzymes superoxide dismutase, catalase and peroxidase.

Superoxide dismutase (SOD) is the primary line of defense system against oxidative damage, interrupting the oxidation of cellular macromolecules at the stage of initiation [5]. Under the influence of unfavorable factors increases the formation of reactive oxygen species, including superoxide radicals, but SOD activity varies in different directions [5,6].

The aim of this work was to study the morphological and physiological characteristics and activity of antioxidant enzymes gamma irradiated wheat seedlings pretreated with plant extracts.

II. MATERIALS AND METHODS

The objects of study were the seeds of varieties of durum wheat Barakatli purchased from the Institute of Agriculture of Azerbaijan. After surface disinfection with a 1% solution of hydrogen peroxide, the seeds were kept in water (control), in 0.1, 0.01, 0.001% solutions of extract obtained from the plant's wort (*Hypericum perforatum* L.), dandelion (*Taraxacum officinale* L.) calendula (*Calendula officinalis* L.), within 12 hours. Then seed dried and irradiated with gamma radiation at 200 Gray on the setting "RHUND". The radiation source is a radioactive Co60. The irradiated seeds were sown in plastic containers filled with 2 kg of dry soil containing no mineral elements. Vessels with soil initially poured 250 ml of culture medium Gelrygel and later with plain water. Germination, germination energy, the pigment content and the activity of antioxidant enzymes had been determined. The chlorophyll content was measured on the spectrophotometer (Multiskan GO) according to Arnon [7], the activity of SOD according to Syrota [8], the activity of catalase on the polarography (OH-103, Hungryradelkis), according to oxygen evolution.

III. RESULTS

Table 1 shows the effect of the extract of plants and irradiation on the germination and energy of germination of wheat seeds. In non-irradiated seeds germination and energy of germination were 90 and 20 percent respectively.

Table 1: Influence of plant extract on the germination of irradiated wheat seeds.

Variants	Germination (%)
control	90
Irradiated control	20
0.1% extract	40
0.01% extract	30

In the irradiated control these characteristics have decreased to 68%. In pre-treated seeds both of the parameters were higher than the irradiated control. The effect of the effect of the extract at a concentration of 0.01% was stronger in compare with other variants. The

same picture was observed in determining the content of chlorophyll in the leaves of seedlings. From the used concentrations the most effective was 0.01% extract (Fig. 1).

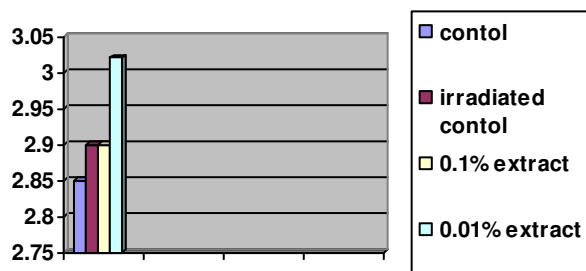


Fig.1. The effect of plant extract on total content of chlorophyll (mg/g).

The activity of SOD of the irradiated control was more, than at usual. Processing 0.01% extract contributed to some increase in the activity of the enzyme (Fig. 2).



Fig.2. Effect of plant extract on the activity of SOD

Catalase activity compared with the other variants was higher in normal control (Fig.3).



Fig.3. Influence of plant extract on the activity of catalase

Table 2 shows the effect of gamma radiation on the activity of photosystem 2 (PS2). As can be seen from the table, gamma irradiation reduces the activity of PS2 40 percent. The seedlings, obtained from the pretreated seeds activity of PS 2 had been recovered.

Table 2: Influence of gamma radiation on the activity of photosystem 2

Variants	Activity of Photosystem II
Control (Non-irradiated)	90 ± 4.5
Control (irradiated)	61 ± 1.2
0.1% extract	76 ± 4.2
0.01% extract	84 ± 2.4
0.001% extract	74 ± 3.5

At action 0.1, 0.01 and 0.001% solutions of extract activity was reduced by 23, 13 and 20%, respectively. Thus, pre-treatment of seed extract collecting herbs helped reduce the effect of gamma irradiation on PS 2 wheat seedlings.

IV. DISCUSSION

Reducing germination and energy of germination of irradiated wheat seeds can be explained by inhibition of the processes of moving sugars from storage materials, due to the activity of glycolytic enzymes. The formation of reactive oxygen species and superoxide radicals increase under the influence of unfavorable factors, including gamma radiation [5, 6]. Many experiments conducted by different authors show, that under the influence of unfavorable factors activity of SOD and peroxidase may decrease or increase depending on the degree of anthropogenic impact. [5, 6, 8, 9] Usually, with increase of oxidative stress to a certain level activity of SOD, catalase and peroxidase increases for repayment of reactive oxygen species and super radicals. Increasing the length of time of the stress was reduced the activity of these enzymes, as it has been shown in experiments with wheat leaves [10]. In the early period of drought increased the activity of antioxidant enzymes, but in the continuation of this period their activity decreased. Studies with heavy metals and ultraviolet irradiation shown, that reducing the activity of antioxidant enzymes may occur immediately after the effect of these factors [11, 12]. Apparently the reduction of activity is associated with repression of the expression of genes responsible for the synthesis of subunits of antioxidant enzymes under the influence of heavy metals, radionuclides, and gamma radiation, which had been observed in our experiments.

V. CONCLUSION

Based on these results we can conclude that we have used the extract of composition of herbs in concentrations 0.01% have a positive effect on the morphological and physiological parameters, the content of pigments, the activity of antioxidant enzymes and PS2 in wheat seedlings obtained from gamma irradiated seeds.

REFERENCES

- [1] I.V. Azizov, S. A.. Abdullayev, E. N. Shamilov, A. A. Rzaev, I. D. Akhmedov, "Effect of Hypericum extracts (Hiperacum perforatum L.) and harmala (Pegassum Harmola L.) on grow of wheat seedlings," transactions of Botanical Institute of National Academy of Science of Azerbaijan. XXXI, 2010, pp. 339-342.
- [2] S.V. Karipanov, T.Q. Openko, "Radiomodifying activity of extracts of medicinal plants by irradiating in experiment," world of science, culture and edition. № 4 (29), 2011, pp. 234-239.
- [3] A. A.. Lapin, M. F. Borsenkov, A. P. Karmanov, I. V. Berdnik, L.S. Kochevy, R. Z. Musin, I. M. Magdeyev, "Evaluation of the antioxidant properties of aqueous extracts of some medicinal plants and natural lignins," plant resources. Edition № 1, pp.136-139.
- [4] S.M. Nikolayev, I.P. Ledneva, I.A. Samilina, N.V. Ivashenko, "Studying of spasmolytic and diuretic activity of the drug



- charge,” reserves of perfection of medicinal maintenance of population RSFSR, thes. rep.Vladimir, 1991, pp. 21-22.
- [5] V.V. Baranenko, SOD in plant cells, sitology, 48, № 6, 2006, pp. 465-474.
- [6] E. Kaminska-Ruzek, P. Pukaaki, “Effect of water deficit on oxidative stress and degradation of cell membranes in needles of Norway Spruce,” Acta physiol. plant 20, 2004, pp. 491- 492.
- [7] V.F. Qavrylena, T.V. Jigalova, “Large workshop on photosynthesis of plant,” M .Academbook, 2003, pp. 255.
- [8] T.V. Syrota, “A method of determining the activity of superoxide dismutase and antioxidant chemicals,” Pathent RF № 2144674 from 20.01.2000.
- [9] F. Navari-Izzo, M. F. Quartacci, C. Pinzino, F. D. Vecchia, C. L. Sgheri, “Thylukoid-lound and stromal antioksidative enzymes in wheat treated with excess cuper,” Physiol plant 104, 1998, pp. 630-638.
- [10] J. Zhang, M.B. Kirkham, “Drought-stress-induced changes in activities of superoxidedismutase, catalase and peroxidaze in wheat specres,” plant cell physiol 35, 1994, pp. 785-791.
- [11] E. A. Barka, “Protective enzymes against reactive oxygen species during ripening of tomato (*Licopersicon esculentum*) fruits in response to low amonts at U.V.C.,” Aust. J. Plant physiol 28, 2001, pp. 785-791.
- [12] A. Mishra, M. A. Choudhuri, “Effects of salicycle acid on heavy metall-induced membrane deterioration mediated by lipoxygenase in rice,” biol. plant 42, 1999, pp. 409-415.

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