ASPECTS REGARDING THE MORPHOLOGICAL AND DECORATIVE CHARACTERISTICS OF *ECHINOPS RITRO* PLANTS OBTAINED FROM SEEDS EXPOSED TO GAMMA RADIATION

ASPECTE PRIVIND CARACTERELE MORFOLOGICE ŞI DECORATIVE ALE PLANTELOR DE *ECHINOPS RITRO* OBŢINUTE DIN SEMINŢE TRATATE CU RADIAŢII GAMMA

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Abstract. *The experiments were carried out during 2016-2017, aimed to determine the influence on morphological characters of Echinops ritro, obtained from seeds, subjected to gamma radiations treatments. The gamma radiation used in experiments was 50, 100 and 250 Gy. In 2017, determinations and observation were made regarding the starting of vegetation and appearance of floral stems, the height of the plants, the number of leaves/plants, and the number of inflorescences/plants. In most of the analyzed characters the positive influence were notice at seeds kept at room temperature and irradiated at 50 Gy.*
Key words: *Echinops ritro*, seeds, gamma radiations, morphological characters

Rezumat. *Experienţele desfăşurate în perioada 2016-2017 au avut ca scop determinarea influenţei tratamentelor cu radiaţii gamma a seminţelor de Echinops ritro asupra caracterelor morfologice ale plantelor obţinute Dozele de radiaţii gamma la care seminţele au fost supuse au fost de 50, 100 şi 250 Gy. În anul 2017 s-au efectuat determinări şi observaţii privind pornirea în vegetaţie a plantelor şi apariţia tijelor florale, înălţimea plantelor, numărul de frunze/plantă, numărul de inflorescenţe/plantă. La majoritatea caracterelor analizate s-a constatat influenţa pozitivă a iradierii seminţelor cu doze de 50 Gy.*
Cuvinte cheie: *Echinops ritro*, seminţe, radiaţii gamma, caractere morfologice

INTRODUCTION

In order to improve the floral assortment, it is important to introduce new and interesting plants. *Echinops* species draw attention through the globular form of inflorescences and their colours, ranging from gray, blue to purple (Ondra, 2009).

Most of these plants have modest requirements than growing conditions, being adapted to temperate climate, the perennial being resistant to low temperatures.

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To obtain plants with high ornamental value is very important to apply appropriate technologies. Studies show that low temperatures treatments applied to seeds help the plants to blossom uniformly. Appropriate plant development occurs when seeds are exposed for some weeks at a temperature of 4-5°C (Iversen *et al.,* 1989). According to the results obtained in other species of plants, other treatments can be interesting (irradiation).

Gamma rays have immense potential for various agricultural applications as evidenced from their interaction at crop, plant, tissue and cellular level. Gamma radiation does interact with the bio-molecules in the plant, thus may cause a reduction or an increase in the level of respective molecules and lead to apparent morphological and physiological changes to impact growth, vigour and yield of plants. There are still gaps in our knowledge, uncertainty and lack of information on the radiation dose–effect relationship for different crops and agro-applications (Ilyas and Naz, 2014).

Ionized radiations penetrated into living organisms may give rise to mutations or may cause lethal lesions. Into cells, radiation can influence plant growth and development, through cytological, genetic and biochemical changes (Gunckel, 1961). Studies show that gamma rays on plants can cause changes in growth, development, metabolism and DNA (Esnault, 2010; Kovalchuk *et al.*, 2007, Vandenhove *et al.,* 2010).

The study of the effects of gamma radiation on plants is a broad and complex field. Work is being done in many areas on a large number of plant species. The morphological, structural and the functional changes depend on the strength and duration of the gamma irradiation stress. The results from one species or varieties should not be applied to others because different types of responses are to be expected in different plants (Aynehband and Afsharinafar, 2012).

The objective of the present study was to investigate the influence of the pre-treatment of seeds different doses of gamma radiations on morphological characteristics of *Echinops ritro* (globe thistle).

MATERIAL AND METHOD

The experiment was conducted in two consecutive seasons of 2016 and 2017 in field of Floriculture discipline, at the University of Agricultural Sciences and Veterinary Medicine from Iaşi, Romania.

The material used in the experiment was represented by *Echinops ritro* plants (fig. 1). *E. ritro* is an herbaceous perennial thistle, which reaches heights between 40-60 cm, with prickly leaves and steel-blue flowers in spherical inflorescences (2.5 cm – 4.5 cm in diameter).

Fig. 1 *Echinops ritro* (original)

The seeds used in the experiment were exposed to gamma radiations and have resulted four variants (tab. 1). Radiation was applied with the sources of Cobalt-60, Cesium-137 and Europium-151. As a control is the variant V_1 (non-irradiated). For the experiments, a randomized design with three replicates was used.

Table1

Experimental scheme

Experimental factors	Specification	Variants
Irradiation seeds	Gamma radiations 50, 100, 250 GY	V_1 – non-irradiated
		V_2 - 50 Gy
		V_3 - 100 Gy
		V_4 - 250 Gy

Biometric determinations were made on the main morphological characters (average leaf number, plant height, number of inflorescences) and were analyzed from ornamental perspective value of the plants. The data obtained were statistically analysed using the variance analysis and the interpretation of the results was made using the limit differences.

RESULTS AND DISCUSSIONS

From the synthesis of the results, the applied treatment with gamma radiations influenced differently the morphological characters of *Echinops ritro*.

For the studied species, the treatment applied to the seeds gave different

results on the number of leaves, height and number of inflorescences, compared to the control variant of the experience.

The influence of gamma radiations on the leaf counts was higher, compared to the control, very significant in the positive sense, for all the studied variants (tab. 2).

Differences between the irradiated variants and control recorded values such as 10.4 for V_2, 4.2 for V_3 and 4.4 for V_4.

Table 2

The influence of gamma radiations on the number of leaves

Variants	Number of leaves		d (±)	Significance of differences
	Absolute value	Relative value (%)		
V_1-control	25.3	100.00	0.0	-
V_2	35.7	141.11	10.4	***
V_3	29.5	116.60	4.2	***
V_4	29.7	117.39	4.4	***
	LSD 5% = 1.1 LSD 1% = 1.6 LSD 0.1% = 2.6			

The treatment with 50 Gy showed very significant positive differences, resulted in a higher height of the flowering stem with 18.1 cm more than the control variant of the experience (tab. 3).

Compared to the control variant, the plants whose height resulted in distinctly significant in the positive sense, belonged to the experimental variant V_4 (250 Gy), having the value of 96.5 with a difference from the control variant of 2.2 cm. The influence of gamma radiation on the plant height for variants V_3 (100 Gy), recorded statistically insignificant values.

The number of inflorescences was mainly influenced by the variant V_2 (50 Gy), where the results showed very significant differences in the positive sense, showing values of 25.4 and a difference from the control variant of 4.4 inflorescence (tab. 4).

In case of variant V_4 (250 Gy), there were distinctly significant differences in negative sense, were observed with 8.1% fewer inflorescences than the control variant.

Statistically insignificant values were also recorded for experimental variant V_3 (100 Gy), with values of 94.8 inflorescences.

Table 3

The influence of gamma radiations on plant height

Variants	Plant height		d (±)	Significance of differences
	Absolute value (cm)	Relative value (%)		
V_1-control	94.3	100.00	0.0	-
V_2	112.4	119.19	18.1	***
V_3	94.8	100.53	0.5	ns.
V_4	96.5	102.33	2.2	**
	LSD 5% = 1.3 LSD 1% = 1.9 LSD 0.1% = 3.0			

Table 4

The influence of the gamma radiations on the number of inflorescences

Variants	Number of inflorescences		d (±)	Significance of differences
	Absolute value	Relative value (%)		
V_1-control	21.0	100.00	0.0	-
V_2	25.4	120.95	4.4	***
V_3	20.9	99.52	-0.1	ns
V_4	19.3	91.90	-1.7	oo
	LSD 5% = 1.0 LSD 1% = 1.5 LSD 0.1% = 2.5			

CONCLUSIONS

1. Gamma radiation can influence differently the growth and developments of plants.

2. Plants whose seeds were irradiated with gamma rays at doses of 50 Gy exhibited more leaves, higher heights of floral stems and more inflorescences.

3. The influence of gamma radiations on the leaf counts and plants height was higher, compared to the control, for all the studied variants.

4. In case of number of inflorescences, gamma rays at doses of 250 Gy (variant V_4) caused the decrease in the number of inflorescences (with 8.1% fewer inflorescences than the control variant).

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