

THE EFFECT OF THE TREATMENTS WITH GAMMA RADIATIONS ON THE CONTENT OF NUCLEIC ACIDS TO THE SPECIES OF *HYPERICUM PERFORATUM* L. AND *ECHINACEA PURPUREA* (L) MOENCH

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Abstract: The gamma radiations determined to the species of *Echinacea purpurea* (L) Moench on increase of the quantity of DNA, comparatively to control and to the species of *Hypericum perforatum* (L.), the decrease of the quantity of DNA (excepting the 30 Gy dose which had a stimulative effect).

INTRODUCTION

The mechanism of action of the radiations is a very complex one and it is not still explained. Perhaps it is the most important chapter in radiobiology. Even if the acquired data in radiobiology have been some substantial ones for more than a century of investigations, there are still insufficient data about the effect of radiations on the control of the activity of genes.

The most important component part of the cell is the nucleus where we find the genetic material, which by its functions it represents a unique structure, so that the majority of the effects induced by the radiations in cells will have repercussions on it in some way or another.

The current researches focus on the use of the plant in the treatment of SIDA and of other types of cancer. *Echinacea purpurea* (L) Moench belongs to the family of *Asteraceae* and it is native to North America being intensively studied at present for its immunostimulatory effect.

Taking into consideration the world wide importance of this plant which in Romania was not known as a medicinal one, it was introduced in a culture, in Cluj, in 1982 by the researchers of the Faculty of Agronomy who established the adequate agrotechnics.

Our study intends to emphasize some effects induced by gamma radiations to the two species of medicinal herbs, *Hypericum perforatum* and *Echinacea purpurea* (L) Moench, namely as to the quantity of DNA.

We have referred to the possibility of the use of mutations induced in the improvement of the two species, directing it to the objectives of economic interest.

MATERIAL AND METHOD

There were used leaves of the 2nd year of vegetation plants, namely the period of fructification of the species of *Hypericum perforatum* L.

These plants were from the seeds obtained from the Agricultural and Zootechnic Researches Department of Secuieni, Neamț, harvested in 2001.

The mutagenic agent used was represented in the Nuclear Department of Chemical and Pharmaceutical Researches Institute, Bucharest (CPRI).

The doses of radiation were 10Gy, 30Gy, 50Gy, 75Gy, 100Gy, 120Gy and the power of irradiation was 5Gy / minute.

There were used 20days old plantlets of the species of *Echinacea purpurea* (L) Moench, taken from the seeds obtained in the Agricultural and Zootechnic Researches Department of Secuieni, Neamț, harvested in 2003 and in Potatoes Institute, Brașov, harvested also in 2003.

The seeds were irradiated within the institute mentioned above and the doses of radiations were: 10Gy, 30Gy, 50Gy, 75Gy, 100Gy, 120Gy.

The power of the dose of gamma radiations was: 1,8k Gy/hour (measured by Fryck dosimeter and confirmed by ECB one).

The radiation was accomplished in normal conditions (pressure, temperature, humidity) of laboratory.

The germination was assured in Petri plates, on filter plates, on filter paper soaked in distilled water, at 24°C 20°C room temperature.

The purification of total DNA was realized with a SIGMA purification kit (Elite Plant Genomic DNA kit Type), according to the method recommended by the producer.

The establishment of the concentration of isolated genomic DNA was realized by the spectrophotometric method, to a wave s length of $1 \approx 280 \mu m$.

The amounts of bichain DNA found on the basis of the exactions values were subsequently registered to 100 μy tissue.

RESULTS AND DISCUSSIONS

The doses of radiation used determined an increase of the DNA amount, comparatively to control, in the species of *Echinacea purpurea* (L) Moench.

The double amount of DNA, comparatively to control (8, 36 comparatively to 4, 275) was recorded to the dose of 75Gy, increased values of the DNA amount being recorded also to the doses of 10Gy, 30Gy and 100Gy.

It is possible that when the DNA amount doubles itself to be produced a phenomenon of polyploidy, which could be used in the improvement of the species.

Further researches about the DNA amount and also about some enzymes activity, using vegetal material from the plants obtained from conventional cultures are possible answers in this sense.

It was recorded an increase of the DNA amount, comparatively to control, to all the studied variants of Secuieni population which belongs to the species of *Echinacea purpurea* (L) Moench but this increase was not a very important one.

The maximum value of the DNA amount was recorded this time to the dose of 120Gy (9,255 comparatively to 6,33).

The increase of the DNA amount to the variants studied is possible to be associated with the phenomenon of aneuploidy. In this case, the improvement of the species could be hardly accomplished.

In conclusion, the gamma radiations determined an increase of the DNA amount, comparatively to control to all the studied variants of the two populations of the species of *Echinacea purpurea* (L) Moench.

The highest value of the DNA amount was recorded to Secuieni population, to the dose of 120 Gy, but a double amount of DNA, comparatively to control was recorded to the dose of 75Gy, to Brașov population (table 1 and figure 1).

The dose of 30Gy had a stimulative effect to the species of *Hypericum perforatum* (L), being recorded a maximum value, comparatively to control (15, 31 comparatively to 10,595).

The DNA amount was lower comparatively to control, to all the other doses of radiation, especially to the dose of 120 Gy (6,075 comparatively to 10,595). (table 2 and figure 2).

The data about the effect of gamma radiations on the quantity of nucleic acids was contradictory in the biological studies.

Javed (1976), quoted by Ghiorghită (2002) obtained a gradual decrease of the amount of nucleic acids, by a process of irradiation with 10 to 100 Gy doses to pepper, especially to the high doses of radiation.

But, in other investigations it was obtained the increase of the amount of nucleic acids. Selieva and Guschinov (1971), quoted by Ghiorghită (2002) obtained an increase of the amount of nucleic acids to alfalfa (*Medicago sativa*) and to trefoil (*Trifolium*), using 5 to 1000 Gy doses of radiation.

CONCLUSIONS

The doses of radiation determined the increase of the DNA amount comparatively to control, to both populations (Brașov and Secuieni ones), possibly because of the phenomenon of aneuploidy, the maximum value recorded being that of 120 Gy (9,255 to Secuieni population) and double DNA amount was recorded, comparatively to control, to the dose of 75 Gy (Brașov population), possibly because of the phenomenon of polyploidy.

The doses of irradiation used determined the decrease of the DNA amount, comparatively to control to the species of *Hypericum perforatum*, excepting the 30Gy dose which had a stimulative effect.

Both species behaved differently to the action of gamma radiations as to the DNA amount.

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Table 1 The total ADN amount to the populations of the species of *Echinacea purpurea* (L.)

Origin zone	Control	10 Gy	30Gy	50Gy	75Gy	100Gy	120Gy
Brașov	4,275	8,075	7,67	5,425	8,36	7,205	5,09
Secuieni	6,33	7,545	7,56	7,44	7,49	7,365	9,255

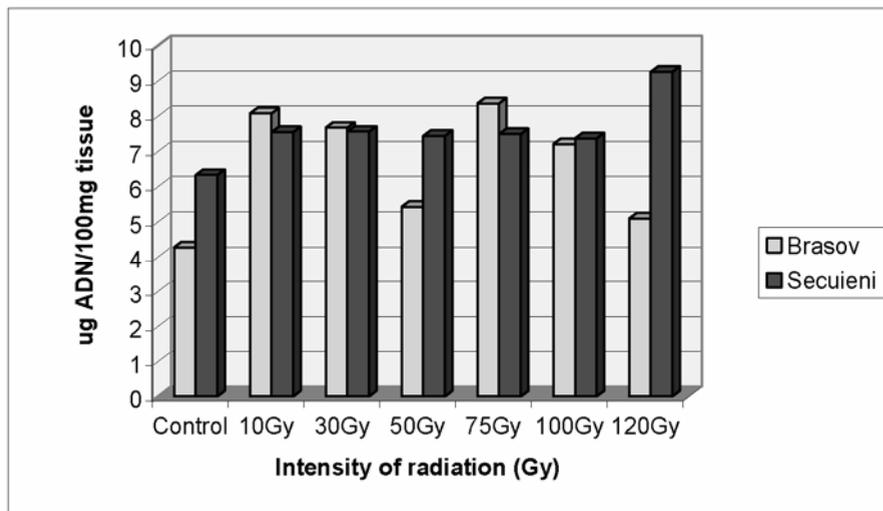


Figure 1 The Comparative Graphic Representation of the total ADN amount to the populations of the species of *Echinacea purpurea* (L.)

Table 2 The total ADN amount to the populations of *Hypericum perforatum* (L.)

Origin zone	Control	10 Gy	30Gy	50Gy	75Gy	100Gy	120Gy
Secuieni	10,595	9,25	15,31	7,61	9,025	8,845	6,075

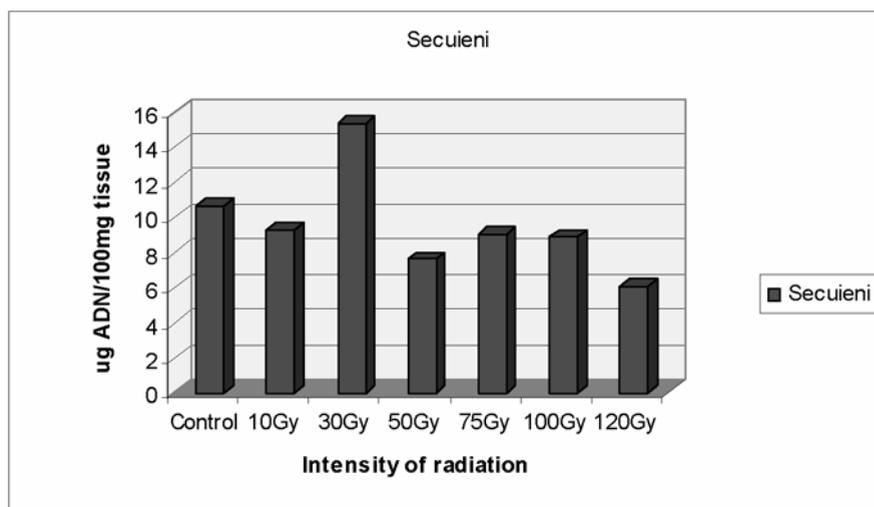


Figure 2 The total ADN to the population of the *Hypericum perforatum* (L.)