CYTOGENETICALLY EFFECTS INDUCED BY THE SALTS OF HEAVY METALS UPON THE MITOTIC DIVISION OF *PAPAVER SOMNIFERUM L.*

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The paper presents the influence of heavy metals upon the mitotic division of Papaver somniferum L. specie. The treatment with salts of heavy metals determined the lessening of the mitotic index and the appearance of chromosome modifications whose rate was different. This rate depends upon the concentration level and the period of action for the above mentioned substances in this experiment.

The salts of heavy metals used in this experiment are: $CuSO_4$, $CoSO_4$, $Zn(NO_3)_2$. Copper, cobalt and zinc are known as heavy metals, which make part of the category of essential oligominerals.

The treatments were applied for four hours, at Papaver somniferum L., in different concentrations. The concentrations we used were 1% and 5% for each substance.

After the germination of Papaver somniferum seeds, in laboratory conditions at 22°C, the genetically displays were made. For each display, 40 microscopically fields were studied and there were counted all cells from each field in different division phases and chromosomal aberrations which appeared after the treatment.

In order to study the chromosomal frequency aberrations in ana – telophases, there can be observed the frequency of division cells and there were counted the ana – thelophases which presented chromosomal aberrations.

After the examination of the displays we observed the appearance of various chromosomal aberrations in ana – thelophases, like: micronuclei, retardate chromosomes, tripolar ana – telophases, bridges, fragments.

***Keywords**: root meristem, poppy, mitotic division, chromosomal aberration.*

These substances used in the experiment are known as polluting agents for the environment that affect the plants and the animals. The foreign compounds that penetrate into the living organisms, plants and animals, through different ways, bring about changes or structural and functional deteriorations; they could be considered toxic substances and they can produce aberrations at the chromosomal level.

In consequence, we proposed to point out the cytogenetically effects of these three heavy metals.

MATERIAL AND METHOD

The biological material used in the experiment was represented by the seeds of *Papaver somniferum L.*, harvested from a local population, Botoşani, cultivated at the Experimental Station of the University of Agriculture and Veterinary Medicine, Iaşi.

The seeds were treated with $CoSO_4$, $CuSO_4$ and $Zn(NO_3)_2$ for four hours, in two concentrations: 1% and 5%.

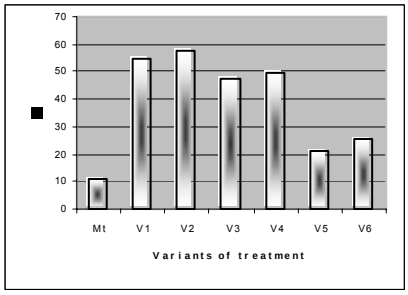
Taking into account the substances used, with that particular time of action, 6 variants resulted. These variants were compared to the control variant, with no treatment applied to the seeds.

For further cytogenetically investigations, the treated and non treated seeds were put to germinate in laboratory conditions. When the roots reached 15-17 mm length, they were fixed in Carnoy fixing solutions for 24 hours at 4°C, then hydrolyzed with HCl and colored with the basic coloring mixture Carr.

The root meristem was displayed using squash technique. There were examined 15 displays and 40 microscopically fields/display for all variants and also for the control variant.

RESULTS AND DISCUSSIONS

The inhibiting effect of the substances used in the experiment is expressed by the high percentage of the cells in interphase and a strong inhibition upon the mitotic division (*fig. 1, 2*).



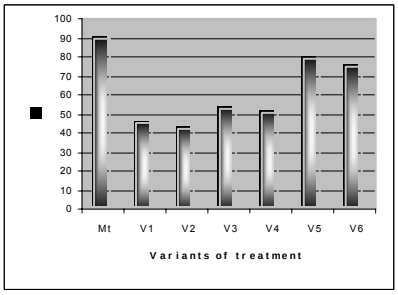


Figure 1. **Proportion of cells in interphase** Figure 2 **Proportion of cells in division**

The percentage of the cells in prophase is lower than at the control for the treatment with $CoSO_4$ and $CuSO_4$. For the variants treated with $Zn(NO_3)_2$, the percentage of the cells in prophase increased compared to the control (*fig. 3*).

The variants treated with $CuSO_4$ had the biggest percentage in the metaphase and anaphase. In telophase the variant with $CoSO_4$ had the biggest percentage (*fig. 4, 5, 6*).

$CuSO_4$ induced between 1% and 5% aberrant metaphases. We can observe that the control variant have 0.68% aberrant metaphase, represented by the retardate chromosomes.

The proportion of the cells in aberrant ana-telophase registered values between 0,7% and 2,31% for the treated variants and 0,15% for thecontrol.

The maximum percentage of the cells in aberrant ana-telophase was induced by the treatments with $CuSO_4$ and $Zn(NO_3)_2$ (*fig. 7, 8*).

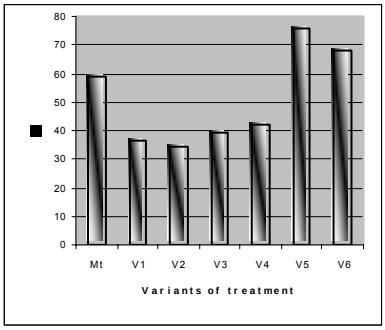


Figure 3. **Proportion of cells in prophase**

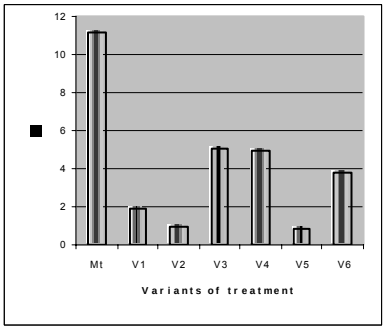


Figure 4. **Proportion of cells in metaphase**

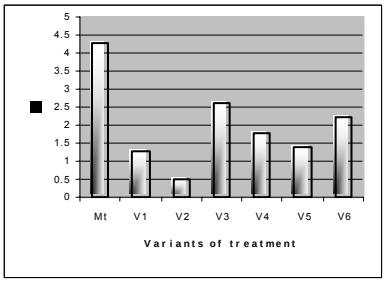


Figure 5. **Proportion of cells in anaphase**

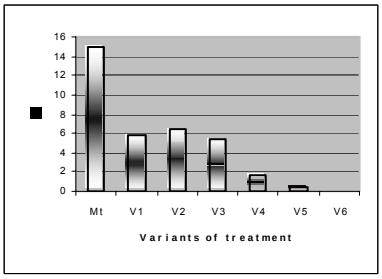


Figure 6. **Proportion of cells in telophase**

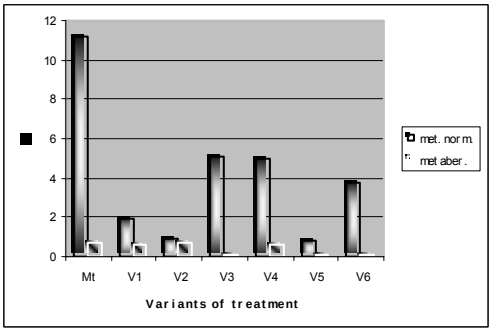


Figure 7. **Proportion of cells in normal and aberrant metaphases**

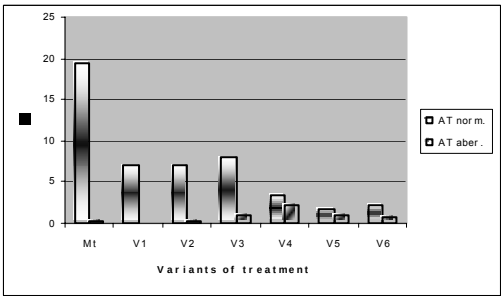


Figure 8. **Proportion of cells in normal and aberrant ana-telophases**

The proportion of the chromosomal aberration types induced by the substances used in the experiment is graphically represented in figure 9. The chromosomal bridges appeared with the biggest percentage at the treatment variants with $Zn(NO_3)_2$.

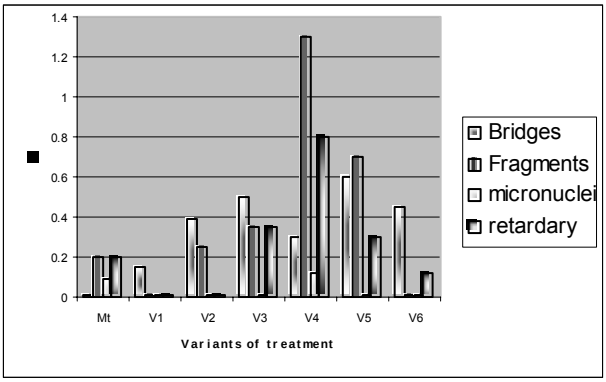


Figure 9. **Proportion of chromosomal aberration types**

The fragments had an increasing percentage at treatment variants with $CuSO_4$, 5%. Micronuclei are present only in the variants treated with $CuSO_4$.

CONCLUSIONS

1. The substances used in the experiment, known as salts of heavy metals have a strong inhibitory effect on mitotic division of *Papaver somniferum* L.

2. The cells reacted differently in each phase of the mitotic division to the action of different substances and in different concentrations.

3. $CuSO_4$, $CoSO_4$, $Zn(NO_3)_2$ have a real mutagenic potential, confirmed by the diversity of the induced chromosomal aberrations.

REFERENCES

1. Acatrinei, Gh., 1970 – *Diviziunea celulelor la Allium cepa L. sub influența adonitului*, Analele şt. ale Universității Cuza, t. XVI, s II-a, Biologie vegetală, Iaşi, p. 39-42;
2. Băra, I. I., 1999 – *Genetica*, Ed. Corson, Iaşi, p. 194-197;
3. Nicolae, I. 1978 – *Mutageneza experimentală*, Ed. Ceres, Bucureşti, p. 23-54;
4. Raicu, P., Naghtigal, M., 1969 – *Citogenetica. Principii şi metode*, Ed. Academiei Române, Bucureşti, p. 24-29;
5. Raicu, P., 1964 – *Genetica*, Ed. Didactică şi Pedagogică, Bucureşti, p. 9-11, 62-63, 375, 385.
6. Țîrdea, Gh., Crețu, L., 1998 – *Genetică, lucrări practice*, Ed. USAMV Iaşi, 25-29, 49-64.