CYTOGENETICS EFFECTS INDUCED BY NITRITE OF SODIUM ON MITOTIC DIVISION AT *ALLIUM CEPA* L.

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key words: nitrite of sodium, *Allium cepa* L., root meristem, cells in mitotic division, chromosomial aberrations.

Abstract: The paper presents the influence of nitrite of sodium upon the mitotic division of *Allium cepa* L. The treatment with nitrite of sodium has determined the lessening of the mitotic index and the chromosomial mutations.. The experiment prowed that nitrite of sodium, known as a polluting agent has a mutagenic potential on the plants.

INTRODUCTION

It is known that the nitrites are polluting agents very toxic for plants and animals (Ciplea, Ciplea,1978; Heggestad,1968; Kihlman,1966; Natarajan, Ahnström,1969). The effects concerning the division cells, of the nitrites are in the same manner as another polluting agents (Pădureanu, 2004, Pădureanu, 2004; Pădureanu, 2005; Pădureanu, Cîmpeanu, 2005).

THE AIM OF INVESTIGATIONS

Our investigations focused the determination of the mitotic index, the determination of the frequency of the types of chromosomial aberrations from metaphases and aberrant ana-telophases.

MATERIAL AND METHODS

The biological material used in the experiment, was represented by seeds of *Allium cepa* L., harvested from a local population cultivated at the Experimental Didactic Station “V. Adamachi” from the University of Agricultural Sciences and Veterinary Medicine, Iaşi.

The seeds were put to germination in lab conditions. When the roots reached 15 – 17 mm in length, they were treated with nitrite of sodium.

Nitrite of sodium was used in the form of watery solutions in three concentrations: 5%, 1%, 0.1%.

The time of action of the respective solutions on the radicular meristems was differentiated as follows: 5% solutions acted for 48 hours, 24 hours, 4 hours, 2 hours; 1 % and 0.1% solutions acted for 4 hours and 2 hours.

Taking into account the concentration and the time of action of the solutions 8 variants have resulted.

Besides these eight experimental variants, there was also used a control plot and in this case no treatments were applied to the radicular meristems.

For further cytogenetic investigations, the treated and non/treated roots (control) were fixed in Carnoy fixing solution for 24 hours at 4°C then hydrolised with HCl and coloured with the basic colouring matter Carr.

The radicular meristem was displayed using squash technique.

15 preparations and 10 microscopical fields/preparation were examined for all the variants and control.

The microscopical examination was carried out using the optic microscope Nikon Eclipse 600.

The microphotographies were made with the camera from the endowment of the microscope.

RESULTS AND DISCUSSIONS

The analysis of the mitotic index

The percentage of cells in division is over ration with the increased the concentrated and time of action of nitrite of sodium (fig. 1).

The percentage of the cells in prophase is very small by comparison with control at all variants experimental (fig. 2).

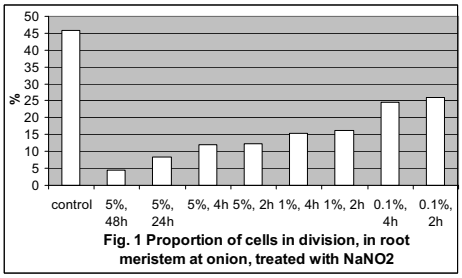

Fig. 1 Proportion of cells in division, in root meristem at onion, treated with NaNO2

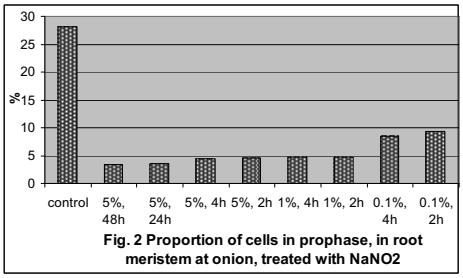

Fig. 2 Proportion of cells in prophase, in root meristem at onion, treated with NaNO2

In metaphase, the percentage of cells is small at the variants with 5%, 48 hours (0.19%) and highest at the variant with 0.1%, 2 hours (5.2%) (fig. 3).

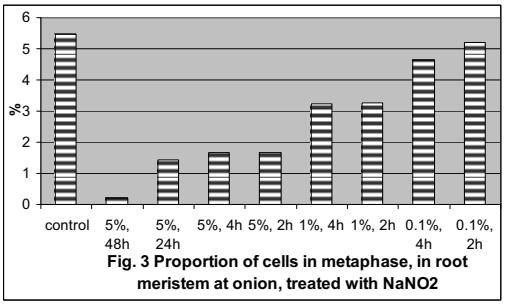

Fig. 3 Proportion of cells in metaphase, in root meristem at onion, treated with NaNO2

The proportion of cells in anaphase registering the minimal values at the variant with 5%, 48 hours (0.37%), while at the variants with 1% and 0.1% concentratd, the values exceed that control (1%, 4 hours – 4.23%; 1%, 2 hours – 4.37%; 0.1%, 4 hours – 4.77%; 0.1%, 2 hours – 5.33%) (fig. 4).

In telophase, the percentage of cells is small at the variants with 5% (48 hours and 24 hours), intermediary at the variants with 5% (4 hours and 2 hours and with 1% (4 hours, 2 hours) and highest at the variants with 0.1% (4 hours, 2 hours), but under level at control (8.17%) (fig. 5).

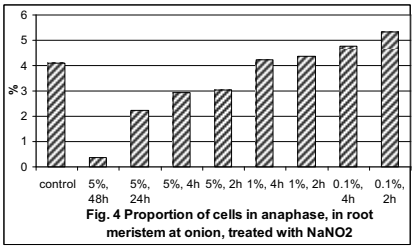

Fig. 4 Proportion of cells in anaphase, in root meristem at onion, treated with NaNO2

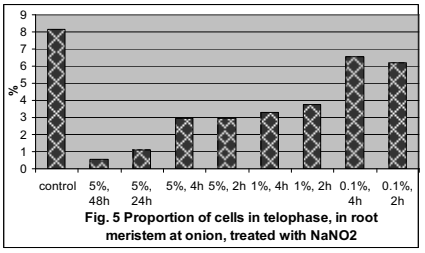

Fig. 5 Proportion of cells in telophase, in root meristem at onion, treated with NaNO2

The analysis of the cells in aberrant ana-telophase

The figure number 6 present the situation of the percentage of cells in ana-telophases influenced by the action of nitrite of sodium. The aberrant ana-telophases were induced at all

experimental variants with different frequences: minimum at the variants with 5%, 48 hours (which produced an strong inhibition at the division), highest at the variants with 5%, 4 hours.

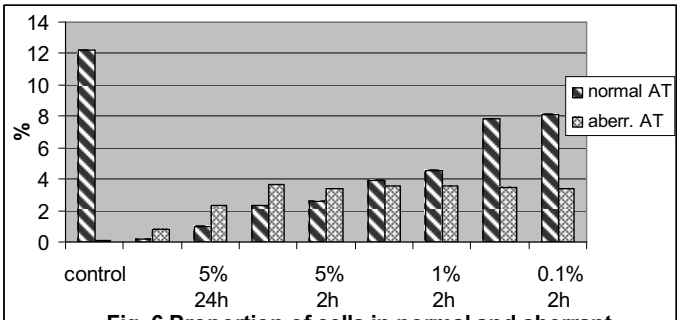

Fig. 6 Proportion of cells in normal and aberrant ana-telophases, in root meristem at onion, treated with NaNO2

The analysis of the types of chromosomial aberrations

The proportion of the types of chromosomial aberrations induced by nitrite of sodium on onion root meristem is graphically represented in figure 7.

Chromosomial bridges in ana-telophases appear at all variants, being good performance by percentage over ration value at most cases.

The chromosomial fragments were present at majority variants, having the biggest percentage at the variants with 5%, 2 hours (1.21%).

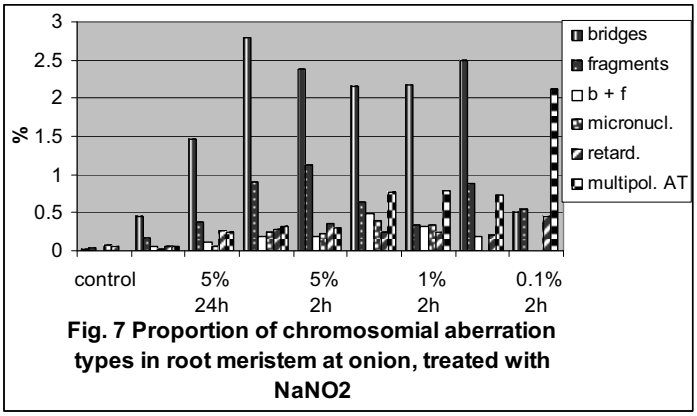

Fig. 7 Proportion of chromosomial aberration types in root meristem at onion, treated with NaNO2

The associations between bridges and fragments appeared at majority variants, excepting the variant 0.1%, 2 hours.

The micronuclei associated with the interphasic nuclei, absent only at variants with 0.1% (4 hours, 2 hours).

Retardatary chromosomes appeared at all variants.

Multipolar ana-telophases induced by nitrite of sodium are very strange by comparison with the multipolar ana-telophases induced by another polluting agents. The percentage of this increased while the concentration ant the time of action at the polluting diminish.

By beside the types of chromosomial aberrations presented, nitrite of sodium induced the forming of prolonged nuclei (21-62 μm) and picnotic, not-functionally nuclei (different by comparison prolonged nuclei habitual from the caliptra). The proportion of this variated over ration with the concentration and time of action of the polluting.

Different aspects of chromosomial aberrations induced by nitrite of sodium are presented in figures 8-17.

Fig. 8 Multipolar ana-telophase in root meristem at onion, treated with nitrite of sodium 5%, 4 h (1000X)

Fig. 9 Multipolar ana-telophase with retardatary and fragment chromosome, in root meristem at onion treated with nitrate of sodium 1%, 4 h (1000X)

Fig. 10 Multipolat ana-telophase with two bridges in root meristem at onion, treated with nitrite of sodium 0.1%, 2 h (1000X)

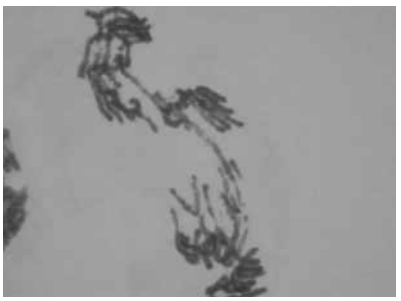

Fig. 11 Complex multipolar ana-telophase in root meristem at onion, treated with nitrite of sodium 0.1%, 2 h (1000X)

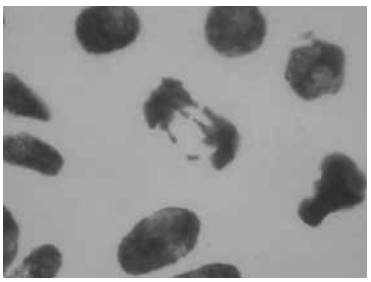

Fig. 12 Anaphase with three ragged bridges in root meristem at onion, treated with nitrite of sodium 1%, 4 h (1000X)

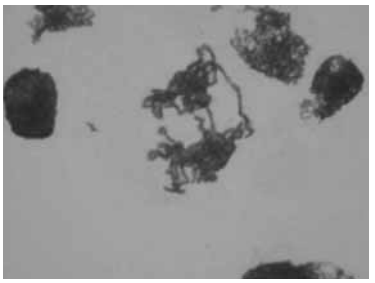

Fig. 13 Incipient telophase with bridges, in root meristem at onion, treated with nitrite of sodium 5%, 24 h (1000X)

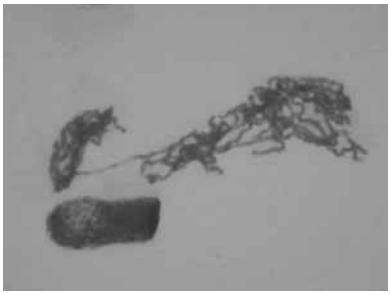

Fig.14 Asymmetrical incipient telophase with bridge, in root meristem at onion, treated with nitrite of sodium 0.1%, 4 h (1000X)

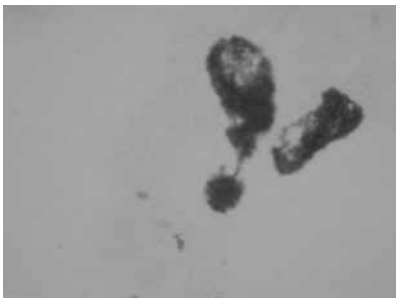

Fig. 15 Asymmetrical telophase with bridge, in root meristem at onion, tresated with nitrite of sodium 0.1%, 2 h (1000X)

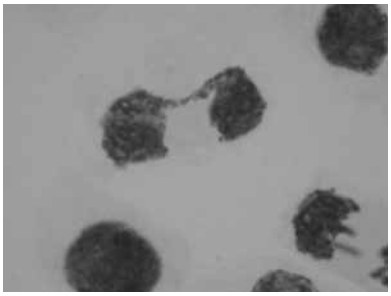

Fig. 16 Telophase with bridge, in root meristem at onion, treated with nitrite of sodium 5%, 4 h (1000X)

Fig. 17 Prolonged nucleus in root meristem at onion, treated with nitrite of sodium 5%, 2 h (1000X)

CONCLUSIONS

Nitrite of sodium, known as a polluting agent has a strong inhibitory effect on mitotic division of *Allium cepa* L.

Nitrite of sodium has a real mutagenic potential, proof is diverse chromosomial aberrations, especially complex multipolar ana-telophases.

The side of habitual prolonged nuclei at the caliptra, appeared very prolonged nuclei and picnotic nuclei consequence of nitrite of sodium.

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