

UNIDENTIFIED MULTIABERRANT CELLS AS EVIDENCE OF γ -IRRADIATION IN *Allium cepa* L.

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ABSTRACT

It is known that the cells with a large number of chromosome aberrations are sometimes detected during cytogenetic observation in people exposed to different damage factors. Such the cells are frequently termed multiaberrant, "loaded" or the cells with plural aberrations of chromosomes. These lesions are not always good identified then there are many lesions in cell and in some works such the cells are excluded then scored the number of aberrations on aberrant or total cells. In this case cytogenetic parameters are underestimated and this become especially apparent when exposed to strong mutagenic damage. The purpose of our work was to analyze the appearance of unidentified multiaberrant cells (UMAC) as a marker of high doses of γ -irradiation in *Allium cepa* L.

Air-dry seeds of *A. cepa* L. were γ -irradiated in dose range 1 – 50 and 100 – 300 Gy using arrangement with the ^{60}Co isotopes. The seeds were soaked and germinated during 72 hours. The control seedlings were germinated in the same conditions but without γ -irradiation. The root tip cells test-system for the cytogenetic effects studying was used.

In cytogenetic study were shown effects on all parameters were analyzed: mitotic index (MI), the frequency of aberrant anaphases (FAA), spectrum and distribution of chromosome aberrations number in cells. These effects were intensified gradually when dose increased. Thus, then dose range was high MI was around 1 % and FAA – around 100 %. The UMAC were detected then the dose was 40 Gy and higher and gradually increased with dose range increasing from 0,98 to 83,3 % and from 3,48 to 83,3 % from total amount of analyzed and aberrant cells accordingly. Appearance the UMAC are very rare in *A. cepa* young seeds as our long-term observations are demonstrated.

Then, studying cytogenetic effects of γ -irradiation in anaphase method in root tip cells of *Allium cepa* L. we determined the presence of a great amount of UMAC. The number of these cells was increased with dose increasing. This fact evidenced on inexpediency of UMAC exception as unidentified, then scoring some cytogenetic parameters. Additionally, it is supposed the presence the UMAC itself might indicate on strong cytogenetic effect of mutagenic factor.

INTRODUCTION

It is known that the cells with a large number of chromosome aberrations are sometimes detected during cytogenetic observation in people exposed to different damage factors. Such the cells are frequently termed "rogue", multiaberrant, "loaded" or the cells with plural aberrations of chromosomes [Neel, et al., 1996, Pilinskaya et. al., 1994, Geraskin et. al., 1995]. There isn't generally admitted terminology and classification for such the cells. Multiaberrant cells are rarely detected during spontaneous mutagenesis in vertebrates [Chebotarev, 2002, Mitrofanov, 1994]. The causes of generation the cells with a lot of aberrations are not elucidated. The most interesting supposition is on "infection process" what can results to induction additional aberrations in aberrant cell [citing by

Bochkov et al., 1972]. The mutations in genes of repair are supposed to be such the factor due to their capacity to induce the generation of a great number of aberrations [Chebotarev, 2002]. Another interesting hypothesis of appearance the multiaberrant cells in cases without any obvious mutagenic factor is virus mutagenesis [Neel, 1996].

The cells with multiaberrant lesions are not always good identified then there are many lesions in such cells. In some works such the cells are excluded then scored the number of aberrations on aberrant or total cells. In this case cytogenetic parameters are underestimated and this became especially apparent when exposed to strong mutagenic damage.

The purpose of our work was to analyze the appearance of cells with unidentified plural aberrations (UPA) as a marker of high doses of γ -irradiation in *Allium cepa* L.

MATERIALS and METHODS

Air-dry seeds of *A. cepa* L. were γ -irradiated in dose range 1 – 40 and 50 – 300 Gy using arrangement with the ^{60}Co isotopes. The seeds were soaked and germinated on distilled water or Hoagland and Arnon's solutions during 72 hours. The control seedlings were germinated in the same conditions but without effluence of mutagenic factor. Temporary squashed acetoorsein slides of meristems were prepared for microscopically analysis. The root tip cells test-system for the cytogenetic effects studying was used The first mitoses were analyzed on the mitotic index (MI), the frequency of aberrant anaphases (FAA), average number of chromosome aberrations on aberrant cell (NCAAC) and distribution of chromosome aberrations number in cells [Kutsokon et. al., 2002, Gostimsky et. al., 1974]. The data were processed statistically. Comparison of the experimental variants and control were conducted by X^2 - method and t-test [Urbakh, 1964].

RESULTS and DISCUSSION

As we expected, γ -irradiation of seeds influenced on cytogenetic parameters were analyzed. Thus, then dose range was 250 and 300 Gy, MI was very low - around 1 % (in control - 9,41 %). The level of cells with aberrations was gradually increased with dose range increasing. Beginning from the dose 5 Gy FAA was significant higher in irradiated cells then compared with those in control (Fig. 1 and 2). At the same time, the level of NCAAC was revealed significant increase only in doses 50 Gy and higher. This comparative analysis denotes that both parameters have different dynamics characterizing different mechanism of chromosome instability in *Allium cepa* L. The distributions of chromosome aberrations number in cells were changed with dose changing. These changes are most obvious in dose range 50 Gy then the part of cells with more then 2 aberrations was high. This data are presented on Fig. 3 and 4.

The distinctive feature of γ -irradiation of *A. cepa* in dose 40 Gy and higher was the appearance of cells with unidentified plural aberrations (UPA) (Fig. 5). The level such the cells was gradually increased with dose range increasing from 1,29 to 83,3 % and from 4,52 to 83,3 % from total amount of analyzed and aberrant cells accordingly (Fig. 6). We revealed one cell with UPA only then the seeds in dose from 1 to 30 Gy were irradiated. Particularly a great deal of such the cells (> 60 %) was revealed then seed were irradiated in doses 150 - 300 Gy.

Then, studying cytogenetic effects of γ -irradiation in anaphase method in root tip cells of *Allium cepa* L. we determined the presence of a great amount of cells with UPA. The

number of these cells was increased with dose increasing. This fact evidenced on inexpediency of cells with UPA exception from analysis as unidentified, then scoring some cytogenetic parameters. Appearance of cells with UPA are very rare in *A. cepa* young seeds as long-term observations are demonstrated [Kutsokon et. al., 2003 (in press)]. Additionally, it is supposed the presence the cells with UPA itself might indicate on strong cytogenetic effect of mutagenic factor.

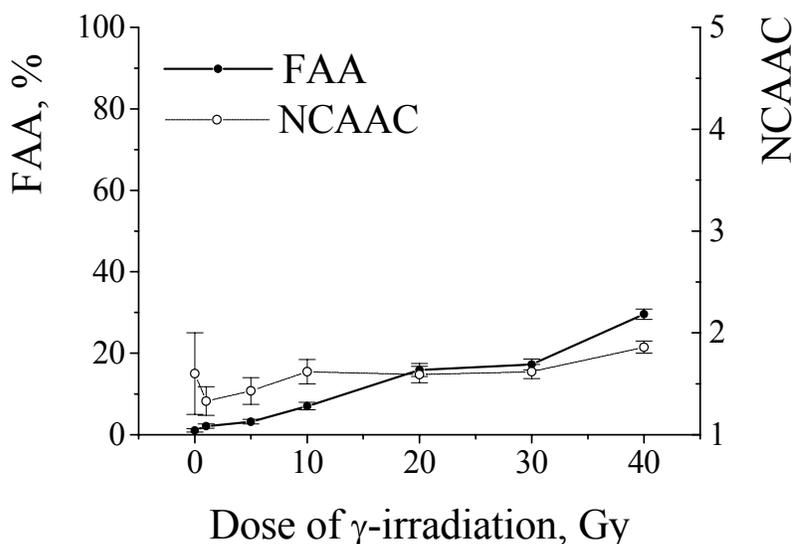


Figure 1. Effects of γ -irradiation in dose 0 and 1 - 40 Gy on frequency of aberrant anaphases (FAA) and average number of chromosome aberrations on aberrant cell (NCAAC) in *Allium cepa* L.

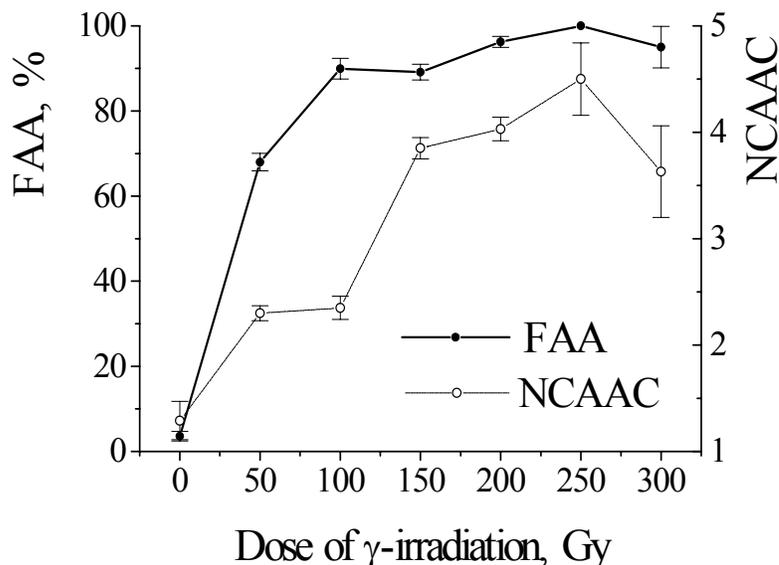


Figure 2. Effects of γ -irradiation in dose 0 and 50 - 300 Gy on frequency of aberrant anaphases (FAA) and average number of chromosome aberrations on aberrant cell (NCAAC) in *Allium cepa* L.

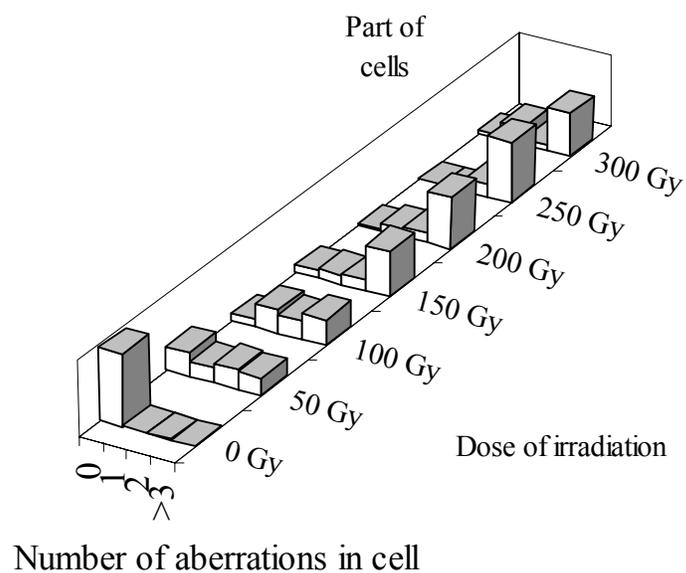


Figure 3. Intercellular distribution of chromosome aberration number in *A. cepa* under γ -irradiation in dose range 50 - 300 Gy.

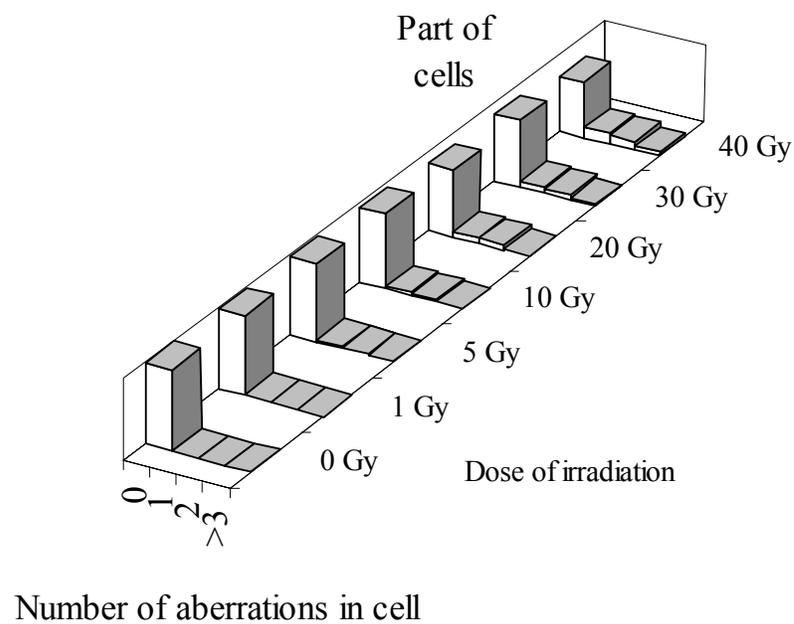


Figure 4. Intercellular distribution of chromosome aberration number in *A. cepa* under γ -irradiation in dose range 1 - 40 Gy.

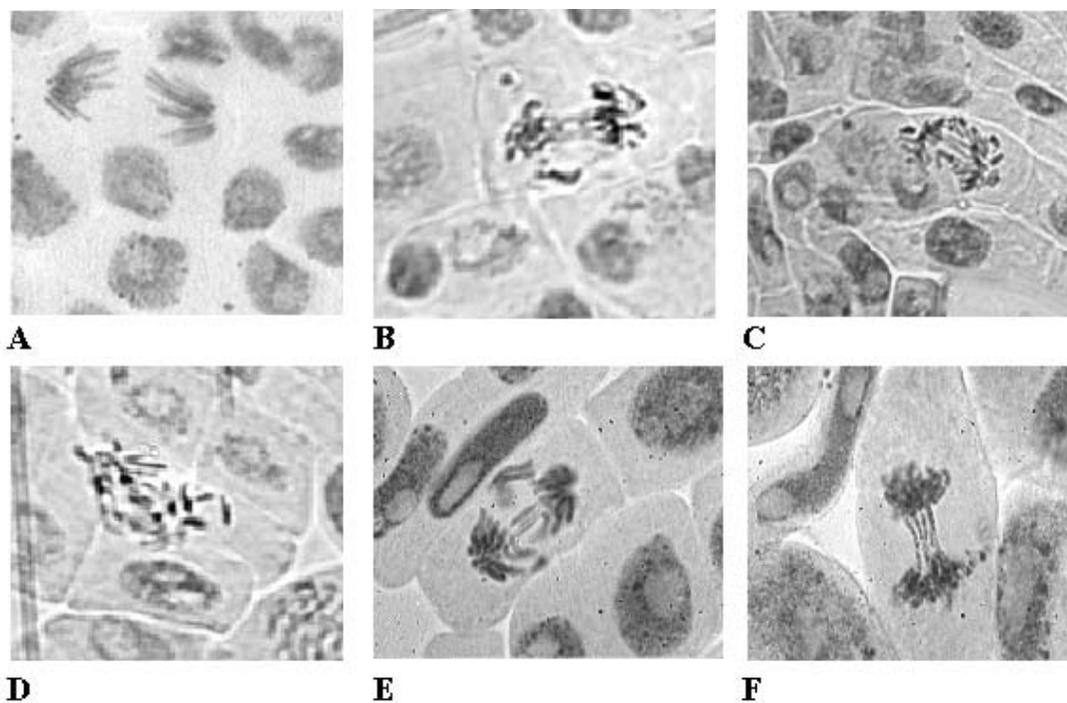


Figure 5. Normal anaphase of *Allium cepa* L. (A) and cells with chromosome aberrations induced by high doses of γ -irradiation of seeds: cells with unidentified plural aberrations (B -E) and plural bridges (F)

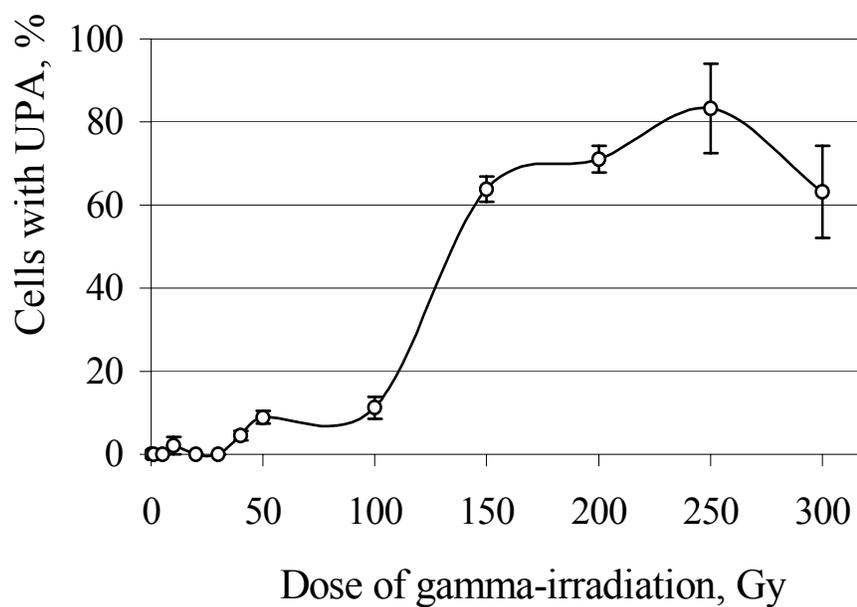


Figure 6. frequency of cells with unidentified plural aberrations (UPA) (among the cells with aberrations) under γ -irradiation of *A. cepa* seeds.

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