THE ACTION OF UV RADIATION ON MITOTIC INDEX AND MITOTIC DIVISION PHASES AT *PHASEOLUS VULGARIS* L.

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Key words: *Phaseolus vulgaris*, cultivars, UV-B, radiation, mitosis.

Abstract: In this work, damaging effects of UV radiations on bean *Phaseolus vulgaris* L. plantule root tips were investigated. Our study proves that by bean plants, the decrease of cell division frequency appears to be part of protection mechanism against especially the short waved UV radiation, with variations depending on cultivar.

INTRODUCTION

It is known that due to the increased UV radiation level on earth surface in the last decades of the 20th century, plants as sessile organisms had to develop different protective mechanism to adapt to the changing climatic conditions. Depending on duration, intensity or quality of light irradiation (including UV radiations), plants are able to react by inhibitions of developmental or growing processes (Whitelam and Millar, 1998; Batschauer 1999). The aim of the study was to investigate and compare the changes (occured either due to damaging effect or like beeing part of protective mechanism against inducing possible damages) in the mitotic division at the level of meristematic root tips of six romanian cultivars of *Phaseolus vulgaris* L. as an answer of UV irradiation.

MATERIAL AND METHODS

Biological material: *Phaseolus vulgaris* L., 6 romanian cultivars: Avans, Ardeleana, Star, Ami, Diva, Vera. Seeds were obtained from Podu Iloaie Seed Center.

Mutagenical agent: UV radiation with different wavelength.

Light sources as described by Surugiu and Maniu, 2002.

Filters: WG360, WG320, WG305, WG275; Q (Schott and Gen., Mainz, Germany), with 50% transmision for the given wavelength and cutting off the shorter wavelengths.

Working steps: Seeds germination: for each cultivar, 20 seeds for each experimental variant were sawn in Vermiculite, in 9/9 cm transparent plastic boxes and than placed in dark at 25°C. When seedlings root lengh was about 1,00-1,5cm, irradiation treatment was applied for 10 seedlings for each variant, in plastic boxes covered with different cutt-off filters. Experimental variants for each cultivar depending of UV iradiation: control, WG360, WG320, WG305, WG275, Q, for different time periods: 0,5h; 1,5h; 3h. For control coresponding to each experimental variant, 10 seedlings were kept in dark, coresponding time periods.

After irradiation, roots were prelucrated by Feulgen method for cytogenetical studies. All determinations were performed accordind literature protocols (Tudose et al., 1991; Tudose et al., 1996).

RESULTS AND DISCUSSIONS

As can be observed in Fig.1., for 0,5h irradiation durate, at the experimental variants including UV-C and UV-B in addition to UV-A (WG275; Q), for each of the 6 cultivars the cell division frequency descrease comparing with the dark controle and also comparing with the WG360 variant (considered as contole for potential damaging short wave UV like UV-B and UV-C) containing just non damaging long wave UV (UV-A).

Regarding cell division frequency for irradiation variants including just UV-B as potential damaging radiation in addition to non damaging UV-A (WG320; WG305), it can be observed that comparing with dark controle it can be noticed a descrease for all the six cultivars. Comparing with UV-B controle (WG360), it can be observed that excepting Ardeleana cultivar where frequency increase with a non signifiant low percent (0,43%), for all the other cultivars cell division frequency descrease.

For 1,5h irradiation durrate, as shown in Fig.2., in the case of UV-A, UV-B and UV-C irradiation, (WG275; Q), the mitotic index descrease comparing with dark contole for all six cultivars and comparing with UV-B controle (WG360) descrease for all cultivars excepting Diva where for WG275 variant it can be noticed an non signifiant increase (0,23%).

For irradiation variants including just UV-B in addition to non damaging UV-A (WG320; WG305), it can be observed that comparing with either dark or UV-B controle it can be noticed a descrease for Ardeleana, Star, Diva and Vera in the frequency of cells division. For Avans by the WG320 variant the mitotic index is practically the same with the one for WG360 (higher with 0,09%), and for Ami the cell division frequency increase in the case of WG320 variant with 1,39% comparing with dark controle and with 1,86% comparing with WG360.

As shown in Fig.3., for 3h irradiation durate, at the experimental variants including potential damaging UV (UV-C, UV-B) in addition to UV-A (WG275; Q), for each of the six cultivars the cell division frequency descrease comparing with the dark controle and also comparing with the WG360 variant .

For WG320 and WG305 variants, excepting Avans where mitotic index is for WG305 higher with 0,84%than the UV-B controle index and Diva where for WG320 the value is with 0,77% increased comparing with dark controle, for all the other experimental variants, the cell division frequency descrease compared either with dark or with UV-B controle.

In corelations with mitotic index it can be noticed (Fig.4., Fig.5., Fig.6., Fig.7., Fig.8., Fig.9.) that regarding the distribution of frequency on different mitotic division phases, for all the experimental variants, the highest percent belongs to prophases. An inhibition occures at anaphase level. The increase of telophase percent compared with the percent of the coresponding anaphases can be explained with a delay in begining a new cell cicle for the new formed cells from the previous cell cicle.

CONCLUSIONS

For each investigated cultivar, not depending of irradiation duration, the cell division frequency was strongly inhibated in the case of irradiation with low waved UV, beeing either plant protective mechanism or damage consequence.

In correlation with mitotical index values, it can be observed that an inhibition of cell division frequency occures at anaphase level.

Regarding the distribution on phases of cell division frequency, for all variants, it can be observed that the UV irradiation had no influence, comparing with controle.

It is no obviouse difference between investigated six bean cultivars regarding the effects of UV radiation at mitotic cell division level.

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Fig.1. MI variation for each cultivar, depending of irradiation time, for 0,5h.

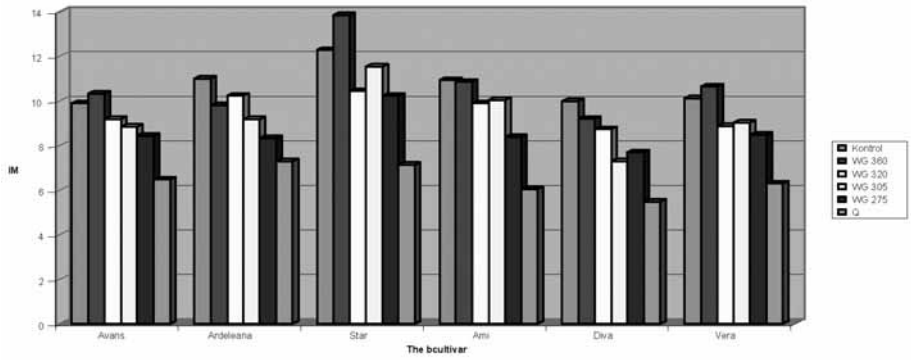

Fig. 2. MI variations for different cultivars, depending on irradiation variant for 1,5h

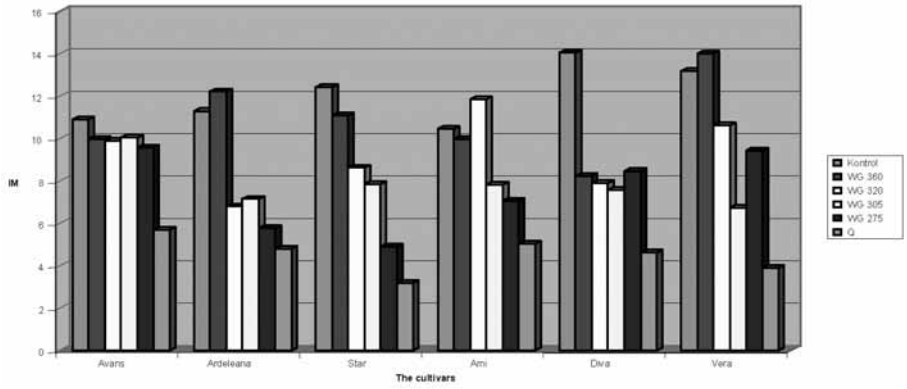

Fig. 3.MI variation for each cultivar, depending on irradiation variant, for 3h

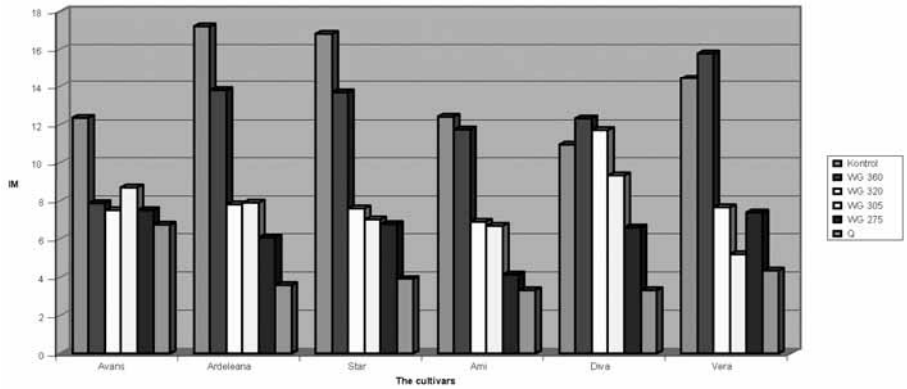

Fig.4. The percentage of division phases, depending on irradiation period, at Avans cultivar

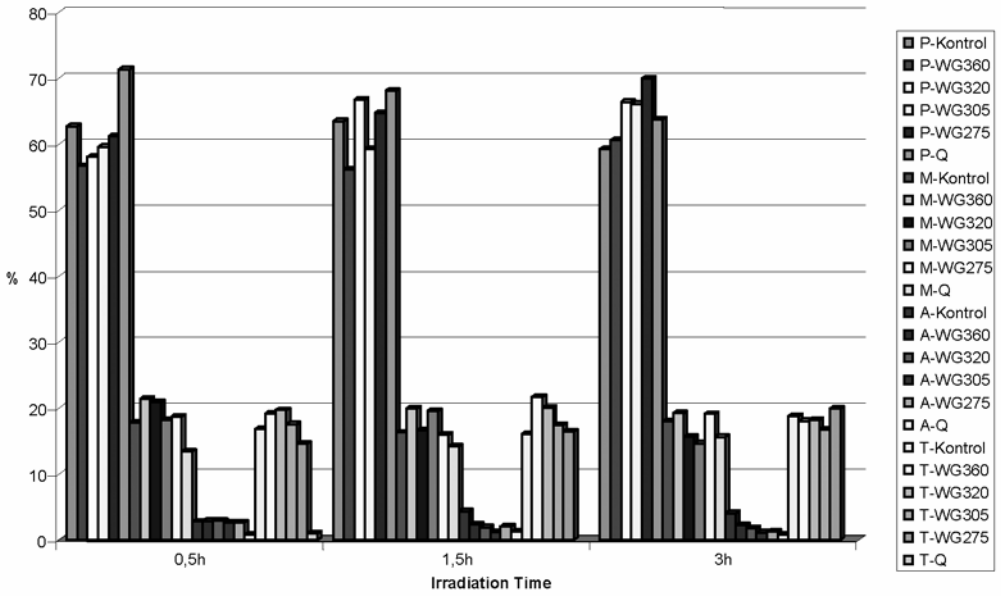

Fig.5. The percentage of division phases, depending on irradiation period, at Ardeleana cultivar

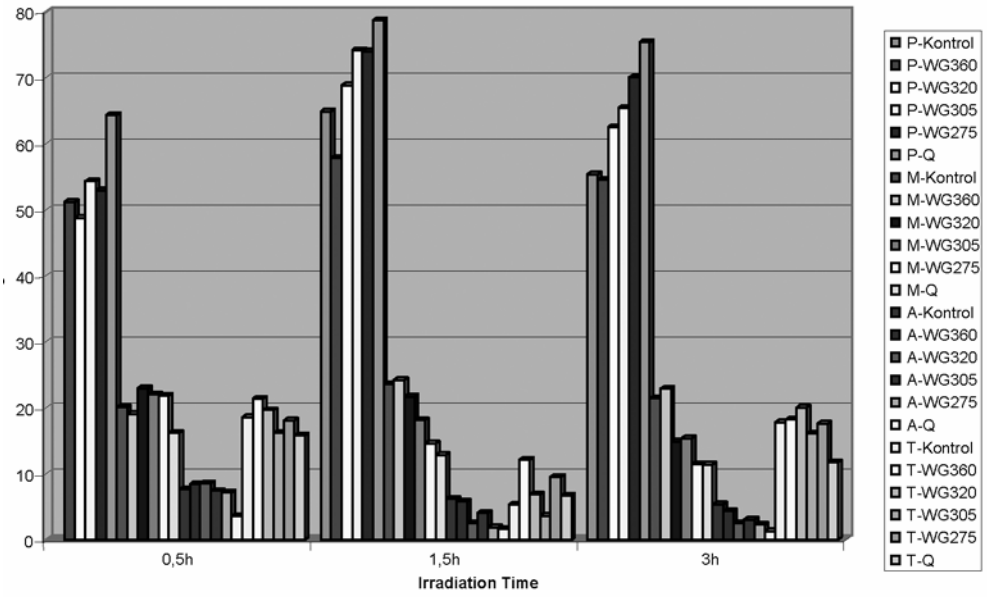

Fig. 6. The percentage of division phases, depending on irradiation period, at Star cultivar

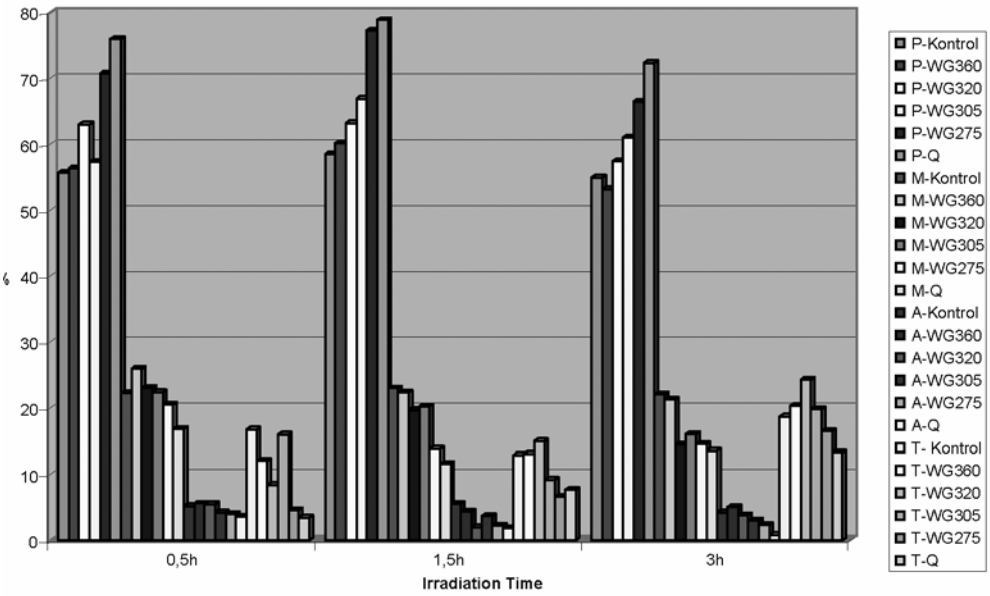

Fig. 7. The percentage of division phases, depending on irradiation time, at Ami cultivar

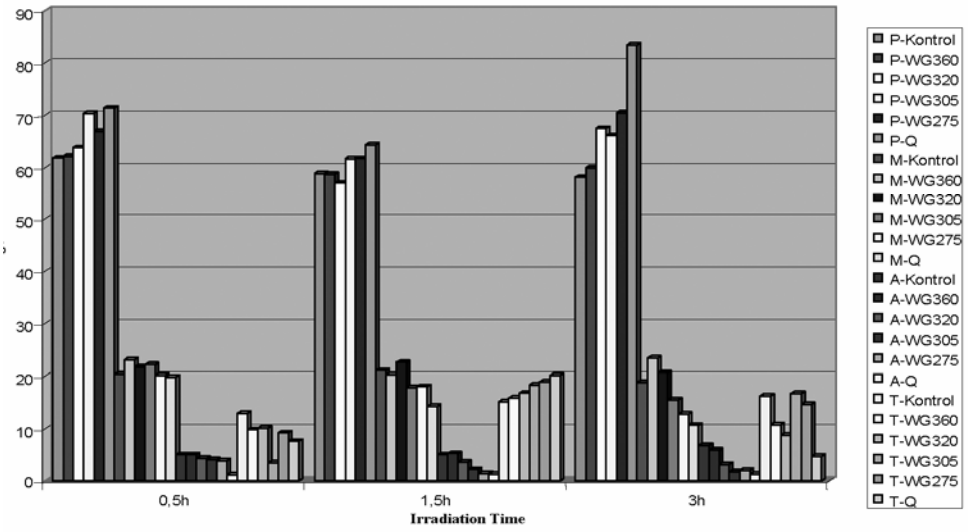

Fig. 8. The percentage of division phases, depending on irradiation time, at Diva cultivar.

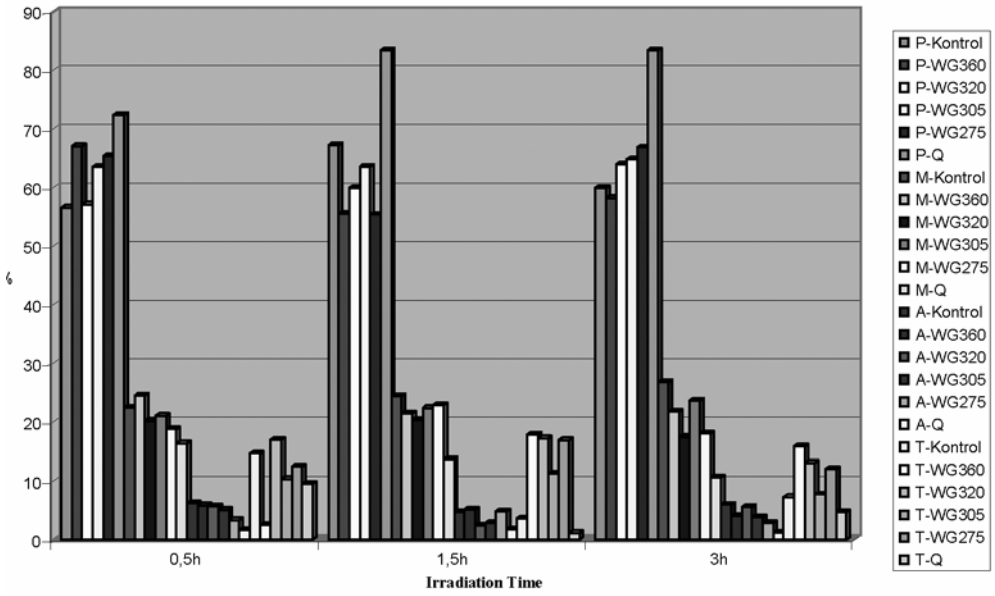

Fig.9. The percentage of division phases, depending on irradiation period, at Vera cultivar