EFFECT OF PROLONGED UV IRRADIATION ON MODEL AND WILD POACEAE SPECIES IN LABORATORY AND IN MOUNTAIN CONDITIONS

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Introduction

This study aims to assess the potential of prolonged UV irradiation both in laboratory and mountain conditions to induce genotoxic alteration in model and wild Poaceae plants. It is well known that changes in natural environment increase at a great extend with the altitudes. As sessile, photosynthetic organisms plants in nature are exposed to more than one environmental factor (increased levels of UV irradiation, altitude, temperature, humidity and etc.). Plant response differ when environmental factor is single or in combination with other abiotic stress factors.

Material and Methods

Plant material:

Model plant

***Hordeum vulgare* L.**
(2n = 14)

Wild Poaceae plants, characteristic of the ecosystems in Rila Mountain, collected at three altitudes in three successive growing seasons (2017, 2018, 2019).

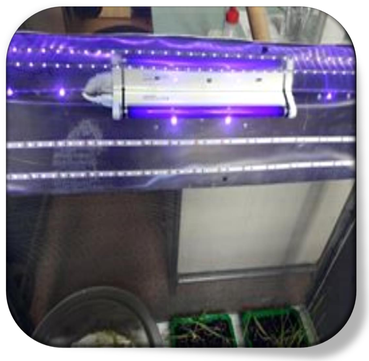
***Poa alpina* L.**

***Sesleria coerulans* Friv.**

***Festuca valida* (R. Uechtr.) *Dactylis glomerata* L.**

Endpoint: Micronucleus assay (Jovtchev et al., 2002). The micronucleus test was adapted for the leaves and roots of *H. vulgare* L. (Angelova et al., 2019).
Statistical data analysis: two-tailed Fisher's exact test for group comparison of different plant species (Jovtchev et al., 2001).

UV treatment in laboratory conditions



UV simulator setup
-ventilated container with approx. area 1 m² and solar UV light simulator (UV A light source: UV LED diodes; total installed power 15 W; max emitting wavelength 395 nm; UV B light source: UV fluorescent tube of 8 W; max emitting wavelength 310 nm).
-5 days old plants were irradiated for periods of 10, 20, 30 and 43 days;
-daily UV dose 90 mW.h/m² for 5 hours/day illumination;
-900 mW.h/m² for 10 days;
-total accumulated dose 3870 mW.h/m²

Mountain conditions (experimental sites)

1500 m Skakavcite

1782 m III Window

2925 Moussala

Results

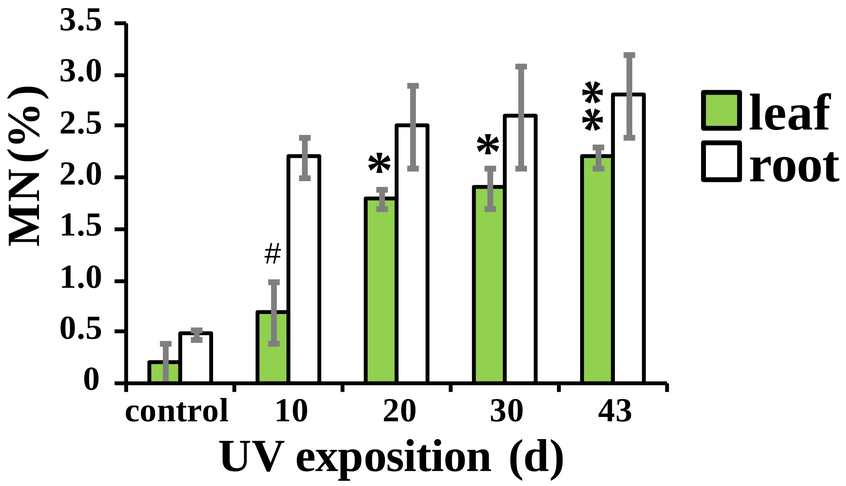


Figure 1. The exposure time - dependent formation of MN in barley leaves and roots. *p<0.05, ** p<0.01. Significance level between roots and leaves after UV exposition # p<0.01

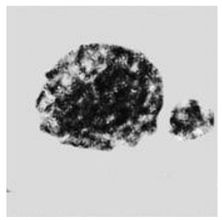


Table 1. Micronuclei induced by UV radiation, IR and other abiotic stress factors in wild plant species from three altitudes in Rila Mountain, Bulgaria

Species	Altitude (m a.s.l.)	MN (%) mean ± SD		
		2017	2018	2019
Dactylis glomerata	1500	$0.066 \pm 0.033^{a***}$	$0.100 \pm 0.020^{a**}$	$0.167 \pm 0.024^{a**}$
Dactylis glomerata	1782	$0.100 \pm 0.030^{a***}$	$0.100 \pm 0.030^{a***}$	$0.100 \pm 0.034^{a**}$
Poa alpina	2925	$0.033 \pm 0.033^{a***}$	n.d.	n.d.
Sesleria coerulans	2925	$0.033 \pm 0.033^{a***}$	n.d.	n.d.
Festuca valida	2925	n.d.	n.d.	$0.034 \pm 0.033^{a***}$

n.d. – not done
***p ≤ 0.001; **p ≤ 0.01

Frequency of MN increased in a time-dependent manner and plant organs susceptibility (Fig. 1) was observed in laboratory conditions (for leaves – 0.7% ± 0.3 for 10h; 1.8% ± 0.1 for 20h; 1.9% ± 0.2 for 30h and 2.2% ± 0.1 for 43h, respectively). The larger UV intensity on Moussala Peak supposed a higher frequency of MN, but the yield of induced MN was relatively low (Table 1). Variability in the response between model and wild plant species was found to UV irradiation alone or in combination with other abiotic stress factors. The frequency of MN was higher in laboratory conditions than that in mountain conditions.

Conclusion: Probably higher induced MN could be due to the fact that in laboratory conditions was studied the effect of a single factor, while in natural environment, effect of prolonged UV irradiation is combined with other abiotic stress factors. It is well known that plants response is modified while effect of UV irradiation is combined with other factors. It could be concluded that further studies are needed for better understanding the mechanisms of interaction between factors and plant response to the changing environmental conditions. Based on this and future monitoring studies could be possible to select sensitive monitor/model Poaceae species for the following comparative environmental impact assessments in laboratory and in mountain conditions.

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