



# ASSESMENT OF PIGMENT CONTENT ON WILD GROWING PLANTS IN MOUSSALA PEAK



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### Introduction

Rila Mountain is the highest mountain on the Balkan Peninsula whose peak Moussala is high 2925 m a. s. l. Its climate conditions depends on the geographic location, peculiarities of relief and atmospheric circulation, and a specific microclimate is formed. In alpine regions conditions become extremely variable with the increase of the altitude. Plants which are growing in alpine conditions are exposed to combined impact of environmental factors such as altitude, prolonged UV irradiation, low temperature and etc. The aim of this study is to compare and assess whether pigment content of wild growing species at Moussala peak changes in two following years.

## Material and Methods Experimental site and plant material:

(Asteraceae)

Saxifraga
cymosa
Waldst.&
Kif

Festuca
valida
R. Uechti
Penzes
(Poaceae)

Moussala Peak
(2925 m a.s.l)
Rila Mountain

Sibiriam L.
(Lithreae)

Achillea
clusiala L.

Deronicum
columnae

Tab

**Table 1**. Chlorophyll *a/b* ratio in wild genotypes growing at Moussala Peak, presented as mean value

(Asteraceae

	$\pm$ SEM	
Genotype	Chlorophyll a/b ratio	
	2020	2021
Control (Hordeum vulgare L.)	3.141 ± 0.290	3.141 ± 0.290
Saxifraga cymosa Waldst & Kit	2.387 ± 0.229	1.951 ± 0.226
Anthemis carpatica Waldst. & Kit. ex Willd	2.610 ± 0.279	2.408 ± 0.221
Geum repens L.	$2.504 \pm 0.239$	$2.607 \pm 0.276$
Doronicum columnae Ten.	$2.110 \pm 0.109$	$2.145 \pm 0.355$
Achillea cluisiana L.	$2.420 \pm 0.098$	$2.699 \pm 0.315$
Allium sibiricum L.	$2.237 \pm 0.078$	$1.866 \pm 0.215$
Festuca valida (R.Uechtr.) Pénzes	$2.002 \pm 0.333$	$3.425 \pm 0.696$

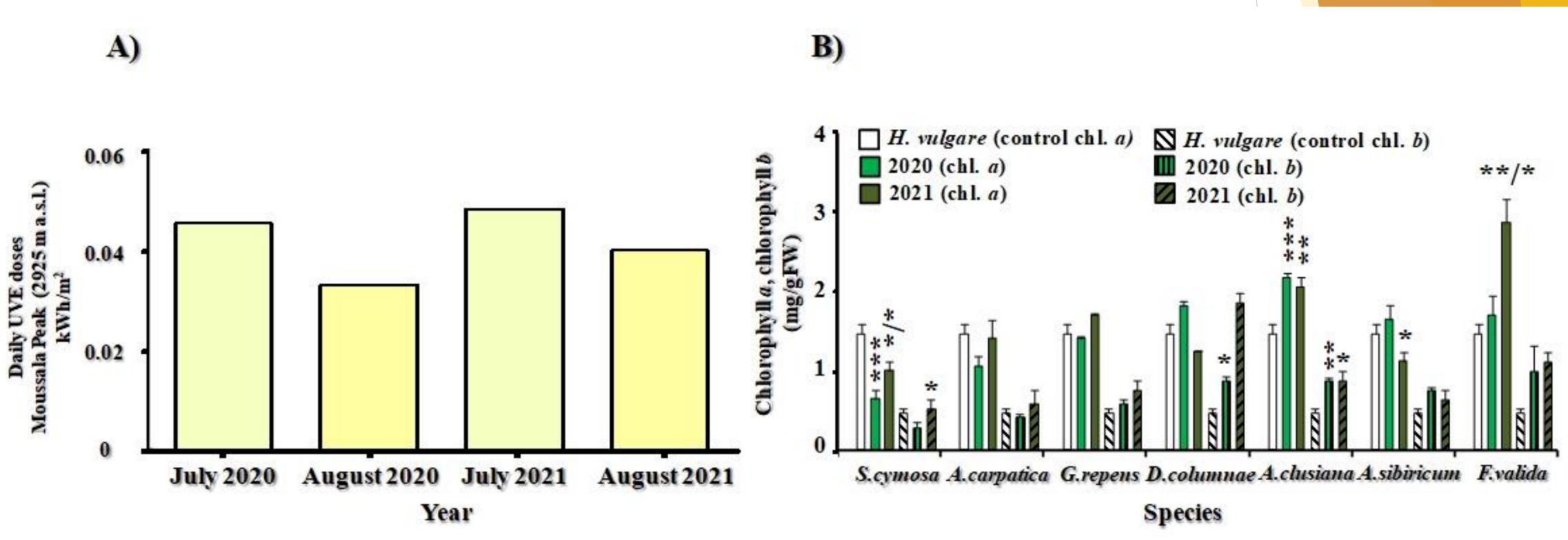
Data for UV irradiation at Moussala peak for period of two following years 2020-2021 (for months July and August) show insignificant change (Fig. 1A). The levels of total chlorophylls, chl. a, chl. b and total carotenoids for most of the studied alpine plants measured for 2021 were insignificantly higher in comparison with those measured for 2020 (Fig. 1B, Fig. 2).

**Radiation conditions at experimental site:** Data for average daily value of "Erythemal UV irradiance" response (UVE) for experimental site at Rila Mountain (2925 m a. s. l.) is given for a period of two following years 2020 and 2021 (kWh/m²). Average daily values for July and August are calculated. The UVE response is measured by UV sensor and defined by ISO/CIE 17166:2019. UVE is typically made up of about 17% UVA and 83% UVB for a clear sky around solar noon. The UVA/UVB sensor can typically measure the daily total of UVE irradiance with an uncertainty of 5%.

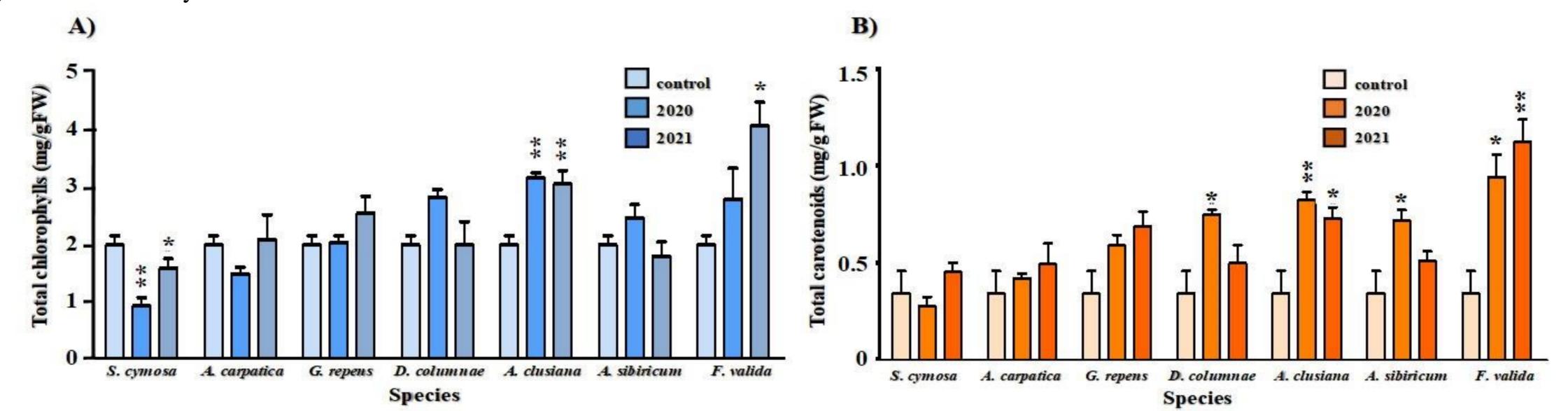
**Endpoint**: Photosynthetic pigment content (total chlorophylls, chlorophyll a, chlorophyll b, total carotenoids and chlorophyll a/b ratio) is determined (Arnon, 1949).

**Statistical data analysis:** One-way ANOVA with Tukey multiple comparison tests (GraphPad Prism 6.04 software, San Diego, USA) were used to assess differences among samples.

### Results



**Figure 1. A)** Daily UVE doses on Moussala peak for July, August 2020 and 2021 (kWh/m²). **B)** Chlorophyll *a* and chlorophyll *b* content. Statistically significant differences between: control vs. values for year (\*p<0.05, \*\* p<0.01, \*\*\* p<0.001 (for all species and before slash); values for 2020 vs. 2021 (\*p<0.05) for *S. cymosa*-chl. *a* (after slash), chl. *b*; *A. sibiricum*-chl. *a*; *F. valida*-chl. *a* (after slash). Model plant, *Hordeum vulgare* L. (Poaceae), grown at laboratory conditions is used as control.



**Figure 2. A)** Total chlorophylls content. **B)** Total carotenoids content. Statistically significant differences between: control vs. values for year (\*p<0.05, \*\* p<0.01); values for 2020 vs. 2021 (\*p<0.05) for *S. cymosa*-total chlorophylls. *H. vulgare* L. (Poaceae), grown at laboratory conditions is used as control.

Genotype response varies depending on the environmental conditions of the studied year. Only for *S. cymosa* were measured significantly higher pigment levels for 2021 than these of 2020. For 2021 were detected lower levels of total chlorophylls, chl. *a*, chl. *b* and total carotenoids for *A. sibiricum* than the ones measured for 2020. Chlorophyll a/b ratio was stable for all studied wild species growing at this altitude (Table 1). Chlorophyll a/b ratio also varies depending on the studied genotype and different radiation conditions of the years studied.

#### **Conclusion:**

Data for radiation conditions at Moussala peak show that both years differed in UVE response but probably this small change of UV irradiation for one year period is insignificant. Change in pigment content in some of the studied alpine genotypes propose their different adaptive strategies to overcome the environmental stress at this altitude. Based on the knowledge of the high mountain conditions prevailing at the Moussala peak and the impact of these extreme environmental factors on the pigment content of plants, further studies are needed to understand the mechanisms of interaction of factors and plant response in the long-term aspect of time.

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