Influence of cultivation conditions relating to climatic change on the selected polyphenols content in grapevine plants

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Introduction

Climate is very important to the viability and success of the wine industry worldwide. At any location, the daily, seasonal, and annual patterns of temperature, precipitation, wind, and humidity characterize the weather. In the vineyard or winery, if you want to know how a new irrigation regime will affect your grapes or wine, it's possible to conduct an experiment. It is possible try the new regime on a few rows of vines or a small lot of wine and compare the results to the business-as-usual control, then decide which results will be the best. Literature data regarding phenolic compounds variation during climatic change are rather limited. Influence of climatic conditions on the phenolic composition of *Vitis vinifera* variety Graciano was recently studied by Ferrer - Gallego et al. (2012). One of effective method to prevent rainfall damage during grape harvest is rain-shelter cultivation (Meng et al., 2013). The main goal of our contribution is to study effects of irrigation intensity and comparison of greenhouse and vineyard cultivation on the content of *trans*-resveratrol and *trans*-piceid in grapevine berries and in addition also in rachis and pedicels.

Material and methods

All analyses were performed by HPLC. The separations were carried out using Hewlett Packard HPLC system model 1050 with diode-array detector (model 1040A) and Luna Phenomenex C18(2) column (2x150 mm, 3µm) in gradient acetonitrile- *o*-phosphoric acid-water.

Trans-resveratrol and *trans*-piceid were purchased from Sigma-Aldrich, acetonitrile and methanol were purchased from Merck, *o*-phosphoric acid from Fluka. The vineyards belong to the category II, and in this case the plant age is in the range of 11 – 15 years. The irrigation was realized as a drop irrigation during the whole July – August period.

Ajvaz (foto R.Sotolář)

Results and discussion

We have studied the effect of irrigation, especially droplet irrigation, in two varieties of *Vitis vinifera* plants (Zweigeltrebe and Pinot Gris) in 2004. The results are shown in the Table 1. Lower irrigation leads to higher content of *trans*-piceid and *trans*-resveratrol in the variety Zweigeltrebe and even by the cultivation without irrigation is the content of both compounds the highest. Distribution of both *trans*-piceid and *trans*-resveratrol is in favour of rachis and pedicels, where the content of both compounds is approximately one order of magnitude higher as in the berries.

Tab. 1 Mean concentration of *trans*-piceid and *trans*-resveratrol (µg/g fresh material) in rachis and pedicels cultivated in different cultivation conditions.

Variety	Irrigation	*trans*-piceid	*trans*-resveratrol
Zweigeltrebe	Without irrigation (control)	7.69	7.71
	Lower irrigation (1.6 L/h)	12.26	24.97
	Normal irrigation (2.3 L/h)	7.59	9.25
	Maximal irrigation (3.5 L/h)	10.50	7.18
Pinot Gris	Without irrigation (control)	28.19	77.59
	Lower irrigation (1.6 L/h)	20.87	55.08
	Normal irrigation (2.3 L/h)	26.45	70.70
	Maximal irrigation (3.5 L/h)	17.46	49.93

Tab. 2 Mean concentration of *trans*-piceid and *trans*-resveratrol (µg/g fresh material) in rachis and pedicels cultivated in vineyard and greenhouse conditions.

Variety	Growing conditions	*trans*-piceid	*trans*-resveratrol
Aivaz	vineyard	17.30	34.18
	green house	22.66	12.07
Dacnyj	vineyard	16.87	54.04
	green house	17.51	44.58
Strasenskij	vineyard	14.15	37.69
	green house	25.02	30.67

In the case of greenhouse cultivation in comparison to the open air cultivation (see Table 2) is the difference relatively very small. In the case of *trans*-piceid the lower amount is always in the vineyards while the opposite is true in the case of *trans*-resveratrol. Lower amount of *trans*-resveratrol could be due to the influence of external conditions, e.g. sun irradiation, infestation by molds and fungi etc.

Tab. 3 Mean concentration of *trans*-piceid and *trans*-resveratrol (µg/g fresh material) in the berries cultivated in vineyard and greenhouse conditions.

Variety	Growing conditions	*trans*-piceid	*trans*-resveratrol
Aivaz	vineyard	0.74	0.39
	green house	0.67	0.11
Dacnyj	vineyard	1.02	0.81
	green house	0.63	0.44
Strasenskij	vineyard	1.15	0.08
	green house	0.52	0.10

The berries of the three varieties under study were also analyzed for the content of both *trans*-piceid and *trans*-resveratrol. The tendency is the same only in the case of phytoalexin resveratrol, but in the case of *trans*-piceid the lower amount of the compound is always in the greenhouse. The data are shown in the Table 3.

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