

ANTHOCYANIN CONTENT VARIATION UNDER THE INFLUENCE OF TREATMENTS WITH GIBBERELLIC ACID (GA₃) AT SOME TABLE GRAPE VARIETIES (*VITIS VINIFERA L.*) GROWN IN IASI VINEYARD AREA

VARIATIA CONȚINUTULUI DE ANTOCIANI SUB INFLUENȚA TRATAMENTELOR CU ACID GIBERELIC (AG₃) LA UNELE SOIURI DE VIȚĂ DE VIE (*VITIS VINIFERA L.*) PENTRU STRUGURI DE MASĂ CULTIVATE ÎN AREALUL PODGORIEI IAȘI

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Abstract. The aim of the study is to evaluate anthocyanins content of hydroalcoholic extracts obtained from berry skins of some table grape varieties (*Vitis vinifera L.*) grown in the areal of Iasi vineyard, after the treatment with gibberellic acid (GA₃). At the analyzed varieties, total anthocyanins content varied under the influence of genetic factor, concentration of gibberellic acid applied and the year of harvest. It was registered an upward trend in anthocyanins at the varieties Coarnă Neagră and Coarnă Neagră Selectionată once with increasing of GA₃ concentration. According to the results, anthocyanin content values of Gelu and Moldova treated variants are lower then control sample. The data obtained represents a reference point in establishing the optimal dosage of gibberellic acid applied in the cultivation technology of the table grape varieties, to increase productivity, quality and their commercial aspect.

Key words: anthocyanins, gibberellins, biostimulating substances, *Vitis vinifera L.*

Rezumat. Scopul studiului este evaluarea conținutului în antocianii din extractele hidroalcoolice obținute din pieleța bacelor unor soiuri de viță de vie (*Vitis vinifera L.*) pentru struguri de masă, cultivate în arealul podgoriei Iași, după tratarea cu acid giberelic (AG₃). Conținutul total de antocianii la soiurile analizate, a variat sub influența factorului genetic, a concentrației de acid giberelic aplicat, precum și a anului de recoltă. A fost înregistrată o tendință ascendentă a conținutului în antocianii la soiurile Coarnă Neagră și Coarnă Neagră Selectionată odată cu creșterea concentrației de AG₃. Conform rezultatelor obținute, valorile conținutului de antocianii la soiurile Gelu și Moldova tratate cu giberelină sunt inferioare variantei martor. Datele obținute reprezintă un punct de reper în stabilirea dozelor optime de acid giberelic aplicate în cadrul tehnologiilor de cultură a viței de vie pentru struguri de masă la soiurile analizate, în vederea creșterii productivității, calității și aspectului comercial al acestora.

Cuvinte cheie: antocianii, gibereline, substanțe biostimulatoare, *Vitis vinifera L.*

INTRODUCTION

Anthocyanins (gr. *anthos* - flower and *kyanos* - blue) are natural pigments, secondary products of vegetal metabolism, belonging to the class of flavonoids

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responsible for the red-blue-violet colour of fruits, flowers and some vegetables, being the most important group of hydrosoluble vegetal pigments visible to the human eye (Kähkönen et al., 2003; Davies, 2004; Horbowicz et al., 2008).

Anthocyanins of grapes represents approximately 38% of total phenolic compounds, this percentage varies by variety (Tărdea, 2007). In black grapes varieties of *Vitis vinifera* L. amount of anthocyanins varies in the range 30-1100 mg cy-3-gl/100 g f.w. (Mazza and Miniati, 1993; Rein, 2005). Plant hormones (phytohormones) are a class of organic substances which in low concentrations influence the physiological processes of growth, differentiation and development of plants. Phytohormones are multifunctional substances that participate in the adjustment of many physiological processes (Davies, 2004).

The introduction of hormonal treatments in the cultivation technology of vine aims to achieving high quality viticultural products in sufficient quantities, and at affordable prices for consumers.

MATERIAL AND METHOD

Were selected five varieties of table grapes (*Vitis vinifera* L.) in order to cover the variety of forms existing within the specie, as follows: two romanian new creations, Gelu and Coarna neagra selectionata, variety Coarna neagra, cosmopolitan variety Muscat de Hamburg and resistant variety Moldova, all grown in Iasi vineyard area, in the Ampelographic Collection of Faculty of Horticulture, belonging to the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" Iasi, Romania. Rootstock used was Berlandieri × Riparia Kober 5 BB. Planting distances were 2.2/1.2 m, half-high leading form, bilateral cord with cutting in fructification rings. Soil maintenance was "black field" and maintenance operations of vines were specific to industrial vineyard ecosystem.

The observations were conducted in 2011 and 2012. Scheme of experience was the following: control sample V_m - H₂O, V₁ - 25 ppm gibberellic acid (GA₃), V₂ - 50 ppm GA₃, V₃ - 100 ppm GA₃. The experience was organized in three repetitions, with five stocks in each plot. Applying of GA₃ was performed by spraying the inflorescences in the flowering phenophase, when 70% of corollas were fallen.

After grape harvesting, were achieved ethanolic extracts. Plant material/solvent ratio was 1:30 (2 g skins/60 mL extraction solution). The containers were stored in the dark at room temperature (20±2°C), overnight (14 hours). Extraction solution was EtOH-HCl-H₂O (96:1:3) (pH 1.5). The three extraction fractions were pooled and stored at low temperatures (6±1°C) in the dark. For determining the total amount of anthocyanins was used pH differential method, which is based on the following principle: in an acidic environment is a balance between the colorless and colored forms of anthocyanins (Wrolstad R.E., 2001). This balance is a function of pH (Lee J. et al., 2008). A (absorbance) = (A_{520nm} - A_{700nm})pH 0.68 - (A_{520nm} - A_{700nm})pH 3.5. Variation of extract color between the two pH values is proportional to the total amount of anthocyanins in the sample (mg antocyanins/100 g skins).

Measurements were made using a UV-vis spectrophotometer Shimadzu 1700 series Pharmaspec. Statistical analysis (ANOVA) of the experimental data was performed with Microsoft Excel™ software, Data Analisys.

RESULTS AND DISCUSSIONS

Anthocyanin content values of grape varieties analyzed revealed a similar evolution of this parameter in the two years of study. In 2012 there was an

increase of anthocyanin content at all variants of the experience, under the influence of the climatic factors specific to the harvest year.

In the case of Gelu variety, total anthocyanin content determined spectrophotometrically has evolved once with the increasing of gibberellic acid dose. The highest quantity of anthocyanins was recorded in variant V₃-100 ppm (538.45 mg/100 g skins). At this variety, the values obtained at all three variants treated with gibberellins were lower compared with the control variant (Fig. 1). Although may appear the necessity of the application of some higher concentrations of gibberellic acid to stimulate the accumulation of anthocyanin pigments, this fact may be contradictory with the influence that these higher doses have on marketed production and grape quality indicators.

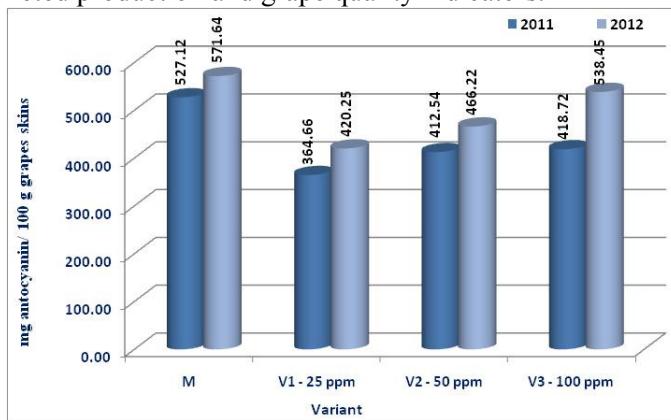


Fig.1 - Anthocyanin content of Gelu variety under the influence of gibberellic acid

Anthocyanin content at grape variety Muscat de Hamburg has evolved inversely proportional to the dose of stimulator applied, the trend being the same in both years of study (Fig. 2). Thus reduced concentrations of gibberellic acid (25 ppm) have led to an intense accumulation of anthocyanins at this variety.

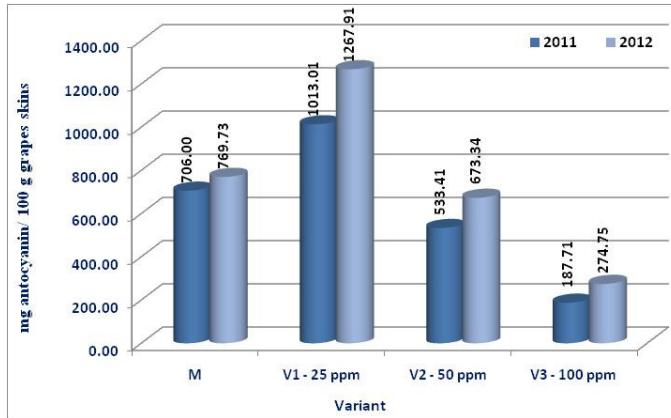


Fig. 2 - Anthocyanin content of Muscat de Hamburg variety under the influence of gibberellic acid

Increasing the concentration of GA₃ applied on inflorescences resulting in a reduction of the content of anthocyanins in grape skins and reaches the variant V₃- 100 ppm to 274.75 mg/100 g skins, respectively an content of anthocyanins reduced by about 40% compared to the control variant.

Anthocyanin content of table grape variety Coarna neagra has registered values statistically insignificant influenced ($p\text{-value} > p=0.05$) by applying of bio-stimulating treatments with gibberellic acid. Variant V₂-50 ppm presented the most significant value of anthocyanin concentration compared to the control variant, with a yield of about 29%, in 2012 (Fig. 3).

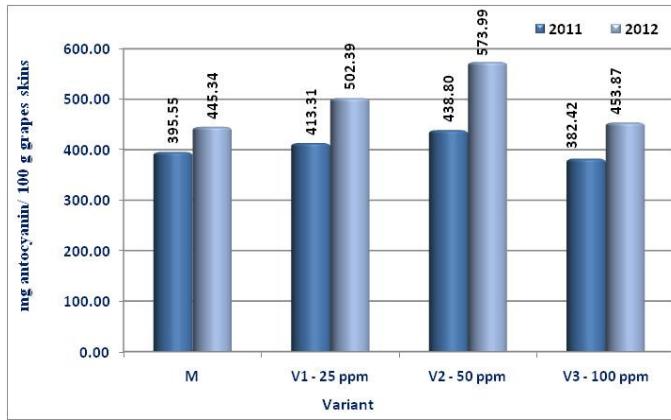


Fig. 3 - Anthocyanin content of Coarna neagra variety under the influence of gibberellic acid

The subsequent increase of GA₃ doses led to a discolouring in berry skins and consequently the quantities of anthocyanins determined.

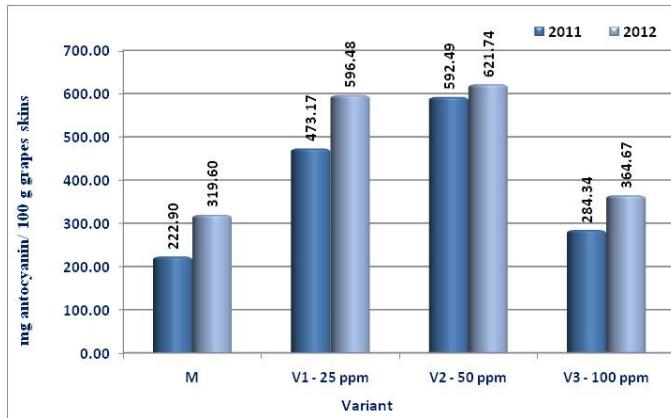


Fig. 4 - Anthocyanin content of Coarna neagra selectionata variety under the influence of gibberellic acid

According to the recorded spectra, anthocyanin concentration of Coarna neagra selectionata grape skins has reached maximum values at the variant treated

with average concentrations of GA₃ (V₂-50 ppm), as in the case of Coarna neagra variety, evolution of anthocyanin pigment content being similar (Fig. 4).

It may be noted that the increasing of GA₃ concentration to 50 ppm at the variety Coarna neagra selectionata, resulted in a major diminution in anthocyanin content of extracts, however, the values were upper to control variant.

In the case of variety Moldova, the use of gibberellic acid led to a decrease in the anthocyanin content of grapes. Thus, the concentration levels of berry anthocyanins of the variants treated with GA₃ were lower than control in all studied cases (Fig. 5).

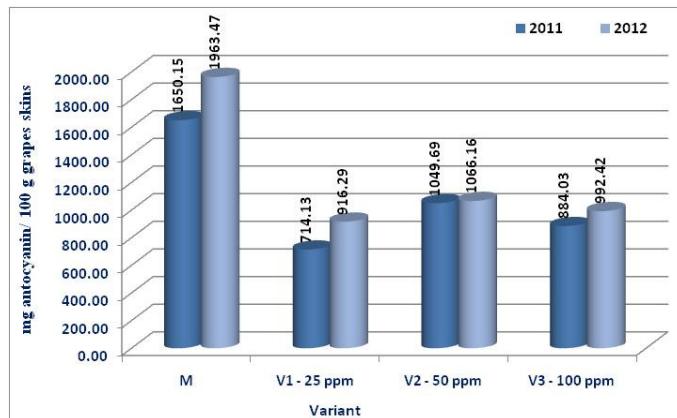


Fig. 5 - Anthocyanin content of Moldova variety under the influence of gibberellic acid

The concentration of 50 ppm GA₃ (V₂) resulted in the accumulation of higher amounts of anthocyanins of over 1000 mg/100 g skins, both decreasing and increasing of gibberellins doses leading to a decrease in the content of anthocyanins in berries in the detriment of the commercial aspect of grapes.

CONCLUSIONS

1. Accumulation of anthocyanins in grapes under the influence of gibberellic acid presented a series of specific characteristics for each variety, average concentrations of gibberellic acid (50 ppm) leading generally to an increase in the total amount of pigment.
2. In the case of Gelu and Moldova varieties there has been a reduction in the concentration of anthocyanins simultaneous with the application of biostimulating treatments with gibberellic acid, values recorded being in all cases lower than those of untreated variant.
3. Muscat de Hamburg variety had the best response at gibberellic acid treatments in terms of the berries pigmentation. Low concentrations of gibberellins (25 ppm) lead to an increased accumulation of anthocyanins in the epicarp cells.

4. Anthocyanin content of Coarna neagra grapes has registered values insignificantly influenced by the application of the gibberellins treatments. The use of GA₃ at the related variety Coarna neagra selectionata, led to an accumulation of significant amounts of anthocyanins compared to untreated variant and thus to a more intense and uniform berries color, regardless of the applied dose.

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