

STUDY OF PHYSIOLOGICAL INDICES ON THE NEW VARIETIES OF VINE GRAPES GROWN IN THE WINE-GROWING CENTER COPOU IAȘI

STUDIUL UNOR INDICI FIZIOLOGICI LA SOIURILE NOI DE VIȚĂ DE VIE PENTRU STRUGURI DE MASĂ CULTIVATE ÎN CENTRUL VITICOL COPOU IAȘI

ALEXANDRU L.C.¹, ROTARU Liliana¹, DAMIAN Doina², ZAMFIRACHE Maria Magdalena³, OLTEANU Zenovia³, NECHITA Ancuța²
e-mail: lulu75cata@yahoo.com

Abstract. In the process of photosynthesis an important role have chlorophyll assimilators pigments a and b, which comprise two photosynthetic systems involved in photosynthesis. The purpose of this study was the quantitative determination of chlorophyll and carotenoids pigments in leaves of new table grape varieties Paula and Gelu compared to control variety "Aromat de Iași", all our creations. The results obtained after processing data using formulas proposed by Lichtenhaler (1987), showed a higher chlorophyll content on variety Paula (4.057 mg/g), followed by Gelu (3.057 mg/g) both higher than Iași (2.441 mg/g). The same trend was recorded for chlorophyll b and carotenoids -ratio 3 /1 or 4/1. The content of photosynthetic pigments (mg/g) as compared to the reference values was influenced primarily by the grape variety: the anatomical structure and morphology of the leaves.

Key words: carotenoids, chlorophyll, new varieties

Rezumat. În procesul de fotosinteză un rol important revine pigmenților asimilatori clorofilieni (a și b) care intră în alcătuirea celor două sisteme fotosintetice care participă la procesul de fotosinteză. Scopul acestui studiu l-a constituit determinarea cantitativă a pigmenților clorofilieni și carotenoizi, din frunzele soiurilor noi pentru struguri de masă Paula și Gelu, comparativ cu soiul martor Aromat de Iași, toate fiind creații proprii. Rezultatele obținute după prelucrarea și calcularea datelor utilizând formulele propuse de Lichtenhaler (1987) au arătat un conținut în clorofilă mai mare la soiul Paula (4,057 mg/g), urmat de soiul Gelu (3,057 mg/g), superioare soiului de comparație Aromat de Iași (2,441 mg/g). Aceiași tendință s-a înregistrat în cazul clorofilei b și a carotenoizilor păstrându-se raportul de 3/1, respectiv 4/1. Conținutul în pigmenți fotosintetici (mg/g) față de valorile de referință a fost influențat în primul rând de factorul soi și anume de structura anatomică și morfologică a frunzei.

Cuvinte cheie: compuși carotenoizi, clorofila, soiuri noi

INTRODUCTION

¹ University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

² Research and Development Station for Viticulture and Winemaking Iasi, Romania

³ "Al. I. Cuza" University of Iasi, Romania

During the growing season the vines carry out a number of physiological processes (fluid and mineral absorption, photosynthesis, respiration, transpiration) vital to achieve growth and development. They are closely related to a number of factors, such as: genetic (variety), ecological (light, temperature, air humidity and soil) as well as the agrotechnical measures.

An important role in the development of the plant physiological processes lies to the leaf by focusing all of these factors and affecting their activity, ultimately conditioning the phenomenon of development, production and quality (Stoiev, 1979). The leaf is the only organ of the vine that has ability to synthesize organic substances from inorganic under the influence of solar energy. In the leaves there are important changes regarding dry matter and water content, especially quantitative changes in the assimilators chlorophyll and carotenoid pigments involved in photosynthesis.

Research conducted to date on the chlorophyll pigments in the vine leaf shows that *Vitis vinifera* varieties, reach a maximum at Incept vegetation period when the ratio chlorophyll a/chlorophyll b is 3/1, decreasing during ripening grapes and the ratio chlorophyll/carotenoids can record values 1.4 (Toma and Jitäreanu, 2007). Generally for the vines total amount of chlorophyll and carotenoid pigments may have values between 1.05 and 1.58 mg/g leaf, and from 0.33 to 0.65 mg/g leaf (Burzo et al. 2005; Acatrinei and Andor, 2006).

These values are mainly influenced by the climatic factors mostly atmospheric and soil moisture, temperature and light. Thus, the results obtained in controlled environmental conditions Cabernet Sauvignon grafted on five rootstocks showed a significant reduction in the content of chlorophyll pigments in leaves under water stress, both pedological and atmospheric, and from 11.66 mg chlorophyll/1 g d.s. at 7.56 mg/1 g d.s. Chlorophyll content lower deficit is caused not only fluid but also the effect of high temperatures producing a general disturbance of the physical condition of the colloids in the leaves, where the water contained in the leaves becomes physiologically inactive in the formation of chlorophyll pigments (Şerdinescu et al, 1994). The favorable climatic conditions allow the formation of assimilating pigments (chlorophylls and carotenoids), differences arise between the amount of chlorophyll or carotenoids and is due to genetic factors or variety, the morphological and anatomical leaf (Stoiev, 1979).

MATERIAL AND METHOD

The biological material for research has been the new varieties of Paula and Gelu table grapes, created in the Station of Research and Development for Winegrowing and Wine Production of Iaşi, which are compared to another new variety – Aromat de Iaşi used as control.

The varieties mentioned here are the research plantations - being grown on stems 70 cm tall, the governance bilateral cordon system, short cut, ensuring 35-45 buds / vine. The applied technology is recommended by agrotechnics viticulture, all varieties benefiting from the same ecopedoclimatic conditions.

The research was conducted in 2014, before flowering phenophase in terms of average daily temperatures of 22.7 to 25.1°C and air humidity of 51-56%. To conduct

experiments were harvested leaves from the middle third of the shoot (internodes 5-8) in the same time for all the varieties analyzed.

For the quantitative determination of the assimilating pigments in leaves varieties studied using the method of solvent extraction. From the leaves were harvested weighed 0.5 g plant material which has been milled in the presence of CaCO₃ and quartz sand. Quartz sand has the ability to prevent distortion by transforming them into Pheophytin chlorophylls. The milled was washed with 25 ml of acetone 80% by half, to the bleaching plant material. The extract obtained was filtered with suction, and the filtrate was passed quantitatively a 25 ml volumetric flask. The extract was spectro photocolimetre done a Shimadzu UV-VIS spectro photocolimeter. Reading was done at three wavelengths: 663 nm, 646 nm and 470 nm, compared to 80% acetone. The values obtained were introduced into the corresponding equations that calculate assimilating pigments developed by Lichtenhaler (1987):

$$\text{chlorophyll a} = (11,24 \times A_{663}) - (2,04 \times A_{646});$$

$$\text{chlorophyll b} = (20,13 \times A_{646}) - (4,19 \times A_{663});$$

$$\text{carotenoids} = (1000 \times A_{470}) - (1,90 \times \text{chlorofila a}) - (63,14 \times \text{chlorofila b} / 214)$$

In order to obtain conclusive results for each variety were made 10 determinations that allowed statistical and mathematical interpretation of experimental data. The results were expressed in mg / g leaf pigment to three decimal places.

RESULTS AND DISCUSSIONS

After reading the spectrophotometer and after the calculation performed by using the equations above were found large highlighted differences both between the two varieties studied and the control variety. The Paula leaf variety with large, trisectat tongue with thick mesophyll and epidermis was recorded the highest quantitative values both chlorophyll a and b and the carotenoids.

The data demonstrates the ability of this kind to accumulate a larger amount of assimilating pigments than the other species studied (Table 1). The leaves analyzed were recorded 4,056 mg / g plant material chlorophyll a, 1.273 mg / g chlorophyll b and 2.051 mg / g carotenoids, almost double to the values of control - Aromat de Iași.

Table 1

The content in assimilating pigments

Variety	Chlorophyll a			Chlorophyll b			Carotenoids		
	mg/1 g leaf	Diff.	Means.	mg/1 g leaf	Diff.	Means	mg/1 g leaf	Diff.	Means.
Paula	4,056	+1,612	***	1,273	+0,448	**	2,051	+0,703	**
Gelu	3,058	+0,614	***	0,934	+0,109		1,610	+0,262	
Aromat de Iași	2,444	-	-	0,825	-	-	1,348	-	-
LSD 5%	0,030			0,150			0,372		
LSD 1%	0,050			0,248			0,616		
LSD 0,1%	0,094			0,464			1,153		

Differences from the control were significant for chlorophyll a and chlorophyll b significant distinct and carotenoids, keeping the ratio of 1.3 for chlorophyll and b but not in the case report of chlorophylls and carotenoids 4.1

indicated Burzo et al., 2005 in terms of the total content of assimilatory pigments (chlorophyll a and b + carotenoids) found that all sorts Paula synthesized largest assimilating pigments content in leaves 7.380 mg / g plant material and the offset to the variety of compared Aromat de Iași (4.617 mg / g leaf) is significant, and hence this variety has high capacity to synthesize chlorophyll pigments organic substances necessary for growth, development and fructification (table 2).

Table 2
The total content of assimilatory pigments and the relations between them(mg/g)

Variety	chlorophyll a / Chlorophyll b	Chlorophylls (a + b) / carotenoids	Total pigments (mg/1g leaf)	Diff.	Means
Paula	3,186	2,598	7,380	+2,763	***
Gelu	3,274	2,544	5,602	0,985	*
Aromat de Iași	2,962	2,425	4,617	-	-
LSD 5%			0,739		
LSD 1%			1,223		
LSD 0,1%			2,229		

According to the specialty literature it is considered that chlorophyll pigments in the leaves of the vine are the only components that have the ability to create organic matter from the inorganic. Regarding Gelu variety, in the same climate and soil conditions, and the same applied agricultural technology, the amount of assimilating pigments in leaves was lower than the previous variety, but higher than the control - Aromat de Iași. This difference is attributed to the size of the leaf and its morphological structure (lower leaf mesophyll and epidermis with thick middle).

The amount of synthesized chlorophyll pigments in the leaves of the Gelu variety was 3.058 mg / g leaf chlorophyll a, 0.934 mg / g leaf chlorophyll b and 1.610 mg / g carotenoid pigments. The differences from the control are evident, but only in chlorophyll a case, they are assured of statistical and mathematical point of view as significant.

Report of the two chlorophylls had a value of 3,274 and 2,574 between chlorophylls and carotenoids, lower than that found in the literature, probably due to situation higher carotenoid pigments content. Determined total assimilating pigments content in Gelu leaves variety had a value of 5,602 provided statistically significant.

A study on the variety Gelu on its ability to assimilate photosynthetic pigments in the presence of stimulators show their positive influence on the growth of chlorophyll content (from 1,36mg / g to 1.65 mg / g) and carotenoids (from 0,43mg / g to 050 mg / g) but not chlorophyll b that positively reacted only on an average concentrations of stimulators (Cotovanu, 2014).

Regarding on the Aromat de Iași variety which is also SCDVV Iași creation, the content noticeably decreased in chlorophyll and carotenoid pigments can be explained by anatomical and morphological structure of the leaves that are smaller, sections, with smooth and thin mesophyll.

An overall analysis of the results obtained on some physiological indices on varieties studied, points out that they have the ability to synthesize large amounts of chlorophyll and carotenoid pigments (beyond the limits found in the literature) and the ability to intensify work accumulation of photosynthetic and biological processes and metabolic equivalents needed during the growing season.

For that the degree of hydration of leaf assimilating pigments analyzed, the research has been complemented by measurements on the amount of water contained in them (Table 3).

Table 3

The dry substance and the free water content in the leaves of the varieties studied

Variety	Free Water %	Dry substance %
Paula	77,35	22,07
Gelu	80,45	19,55
Aromat de Iași	79,35	20,65

The results obtained after drying at 105 ° C and repeated weighings revealed a free water content between 77.93% (Paula) and 80.45% (Gelu). These values indicate a degree of leaf hydration favorable to assimilation of photosynthetic pigments which in the literature is stated as being between 80-82%.

CONCLUSIONS

1. The studied biological material has been the new varieties of Paula and Gelu table grapes, created in the Station of Research and Development for Winegrowing and Wine Production of Iași, which are compared to another new variety – Aromat de Iași.

2. The method used for quantitative evidence of chlorophyll and carotenoid pigments was the extracting solvent and the measurements were performed spectrophotometrically (Shimadzu UV-VIS) with readings at wavelengths of 663 nm, 646 nm and 470 nm.

3. The results obtained by calculating the experimental data revealed Paula variety that has higher potential for accumulation of chlorophyll pigments (chlorophyll a 4,056 mg/1 g leaf, chlorophyll b 1.273 mg/1 g leaf and carotenoids 2,051 mg/1 g leaf) values significant and distinctly significant in terms of statistical and mathematical.

4. The chlorophyll ratio a and b was within the limit of 1.3 in both varieties while the ratio between chlorophylls and carotenoids was less than 1.4, and this is due to the higher content of carotenoid pigments.

5. On both varieties studied, the anatomical and morphological leaf is capable of assimilating pigments as required to support an intense photosynthesis and thus the biochemical and metabolic processes that promote growth, development and fruition.

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