

ASSESSMENT OF CONSUMER PREFERENCES ON TABLE GRAPES OF NEW *VITIS VINIFERA* L. CULTIVARS

R.V. FILIMON^{1*}, Doina DAMIAN¹, Roxana FILIMON¹, Liliana ROTARU²

* E-mail: razvan_f80@yahoo.com

Received: May 20, 2016. Accepted: July 29, 2016. Published online: October 31, 2016

ABSTRACT. Studying consumer behaviour became a concern of grape producers and grapevine breeders since they can learn how consumers choose their products and which are the factors influencing their choice. In this study, 98 respondents from Iași County, NE of Romania, aged between 18 and 61 years and grouped in four age categories, were surveyed in order to determine through sensorial analysis their perception on table grapes of seven new *Vitis vinifera* L. cultivars created in Romania. Respondents' perception differed with age category. Subjects between 18 and 27 years were the most demanding, grape colour uniformity and aromas being considered very poor. Contrariwise, seeds perception and skin thickness were not assessed as negative features. Respondents from 28 and 35 years appreciated positively the grapes of Napoca and Gelu cultivars, aromatic sensation being noted as very intense for most cultivars. The 36-45 years group considered that grapes of studied cultivars have neutral aroma and seeds perception is unpleasant, grapes of

Cetățuia cultivar being preferred. Respondents between the 46-61 years age group rated positively the grapes of Transilvania and Napoca cultivars, especially for the intensity of aromatic sensation, colour and bloom uniformity. Mean data analysis, revealed that the respondents preferred black grapes with lighter and uniform shades of colour, with large and crunchy berries covered by a uniform wax layer, a balanced sugar/acidity ratio and fewer seeds, grapes of Transilvania cultivar being the closest to their demands. The study revealed that table grapes of the studied *V. vinifera* L. cultivars created in Romania possess valuable features highly appreciated by consumers and superior characteristics, that can be further use in vine breeding programmes.

Keywords: respondent survey; age groups; sensorial analysis; table grapes; autochthonous cultivars.

REZUMAT. Evaluarea preferințelor consumatorilor privind strugurii de masă

¹ Research-Development Station for Viticulture and Winemaking, Iași, Romania

² University of Agricultural Sciences and Veterinary Medicine, Iași, Romania

ai unor soiuri noi *Vitis vinifera* L. Studiarea comportamentului consumatorului a devenit o preocupare a producătorilor de struguri și a amelioratorilor, fiind observat modul în care cumpărătorii își aleg produsele și care sunt stimulii și factorii care le influențează alegerea. În studiul de față, 98 de respondenți din județul Iași, cu vârste între 18 și 61 de ani, grupați în patru categorii de vârstă, au fost chestionați în vederea determinării prin analiză senzorială a percepției acestora asupra strugurilor de masă, proveniți de la șapte soiuri noi *Vitis vinifera* L., create în România. Percepția respondenților a variat în funcție de categoria de vârstă. Subiecții cu vârste între 18 și 27 de ani au fost cei mai exigenți, uniformitatea culorii strugurilor și aroma acestora fiind considerate deficitare. În mod contrar, percepția semințelor și grosimea pielii nu au fost evaluate ca negative. Respondenții din grupa 28-35 de ani au apreciat pozitiv strugurii soiurilor Napoca și Gelu, senzația aromatică fiind notată ca foarte intensă pentru majoritatea soiurilor. Grupul cu vârste între 36 și 45 de ani a considerat că strugurii au o aromă neutră, iar percepția semințelor a fost neplăcută, fiind preferați strugurii soiului Cetățuia. Respondenții din grupa 46-61 de ani au notat pozitiv strugurii soiurilor Transilvania și Napoca, în special pentru intensitatea aromatică, uniformitatea culorii și a stratului de pruină. Analiza datelor medii a relevat faptul că respondenții au preferat strugurii negri cu nuanțe mai deschise și uniforme ale culorii, cu boabe mari și crocante, acoperite de un strat uniform de pruină, un raport zaharuri/aciditate echilibrat și cu puține semințe, strugurii soiului Transilvania fiind cel mai apropiat de cerințele acestora. Studiul a indicat că strugurii de masă, provenind de la noile soiuri *V. vinifera* L. create în România, posedă caracteristici valoroase, foarte apreciate de către consumatori, și pot fi utilizați, ulterior, în programele de ameliorare a viței de vie.

Cuvinte cheie: investigarea respondenților; grupuri de vârstă; analiză

senzorială; struguri de masă; soiuri autohtone.

INTRODUCTION

Grapes are one of the main crops in the world, with an annual production of over 69 million tons, of which about 35% is used for fresh consumption (OIV, 2015). In Romania, annual harvested production of table grapes is about 57 thousand tons and to ensure the market needs are imported over 26 million tons (NIS, 2014). According to OIV, table grape consumption in Romania, in 2012, was 3.5 kg per person, being three times lower than in Italy (9.9 kg) (OIV, 2014).

Along with yield capacity and resistance to diseases and pests, grape quality, represented mainly by their organoleptic features, remains one of the most important breeding objectives for grapevine (Sestraș *et al.*, 2008). In the last decades, through plant breeding in Romania were created 58 *Vitis vinifera* L. cultivars, of which 23 are for table grapes (Oprea and Moldovan, 2007). In 2015, in the official catalogue of crop plant cultivars from Romania appear 22 new *Vitis vinifera* L. cultivars for table grapes, of which four are seedless (***, 2015). However, development of a new cultivar usually takes more than 20 years from the original cross to the introduction into the market (Akkurt *et al.*, 2007). Although this it is a very difficult process, due to the reduced number of studies concerning fresh grape quality and consumers acceptance it is very

ASSESSMENT OF CONSUMER PREFERENCES ON TABLE GRAPES OF NEW CULTIVARS

difficult for new table grape genotypes to spread within vineyards and to enter the market.

Studying consumer behaviour became a concern of grape producers and grapevine breeders, as they can learn how buyers choose the grapes to satisfy their needs and which are the stimuli and the factors that influence their choice. However, consumers' choice can be influenced by many different factors (e.g., culture, social status, motivation, attitude, personality etc.) (Morariu and Pizmaş, 2001). Therefore, besides their concern related to plant yield and resistance, breeders and grapevine growers must also have the ability to understand consumers' choice and to select and create new genotypes based on the data provided by studies analysing consumer preferences.

Few years ago the visual quality of the fruits was the main factor that influenced the consumer behaviour (Dannehl and Josuttis, 2014). Nowadays, with the occurrence of the scientific evidences related to health benefits derived from eating grape, selection of fruits based on the nutritional quality has become more obvious for all categories of consumers (Moreno-Montoro *et al.*, 2015). Features like the presence of seeds or skin thickness, that few years ago were considered negative (Brar *et al.*, 1991), became less discussed or even appreciated by the consumers which understood the beneficial health effects promoted by the consumption of grapes, due to

phenolic compounds (Georgiev *et al.*, 2014).

The quality of table grapes is generally evaluated through sensorial analysis and in particular using sight, smell, taste and touch (OIV, 2010). However, the approaches used for sensorial analysis may be different. This study was designed as a descriptive analytical approach. Considering that consumers are those who ultimately decide whether a grapevine cultivar is valuable or not, the aim of this work was to provide relevant insights for grape growers and grapevine breeders concerning the consumer perception on table grapes of new *Vitis vinifera* L. cv. created in Romania, and to understand the differences in perception of grape quality by the respondents from different age categories.

MATERIALS AND METHODS

Research has been carried out on seven *Vitis vinifera* L. cultivars (cv.) for table grapes created in Romania (Tab. 1), growing in the Ampelographic collection of the University of Agricultural Sciences and Veterinary Medicine Iaşi, N-E of Romania (27°53' East longitude and 47°09' North latitude). Grapevines were 10 years old, grafted on the hybrid rootstock Kober 5 BB (*V. berlandieri* Planch. × *V. riparia* Michx.). For all cultivars, planting distances were 2.2 m between rows and 1.2 m between plants, half-high training system (trunk of 0.7-0.8 m), bilateral cordon, with pruning in fructification rings providing an average load of 35 to 40 buds/vine. The plot was planted on a slight slope (3%), with southern exposition.

Table 1 – Characterisation of table grapes from new *Vitis vinifera* L. cultivars considered for the study (according to Țârdea and Rotaru, 2003)

No.	Cultivar	Genitors	Year	Characters	Aspect
1	Gelu	Coarnă neagră hybrid seeds irradiated with X-rays*	1999	Grapes are medium to large (275-310 g), uniaxial, winged, semi-compact. Berry is elliptical, medium-sized (4 g), blue-purple skins.	
2	Milcov	Coarnă neagră × Muscat de Hamburg**	1988	Grapes are medium to large (235 g on average), lax, with branches. Ovoid medium-sized berries, purplish-black skins, with a fine layer of bloom.	
3	Someșan	Muscat de Hamburg × Regina viilor***	1987	Medium-sized uniaxial grapes (275 g), cylindro-conical, semi-compact. Ovoid elongated berries, dark red, with bloom and discreet Muscat flavour.	
4	Transilvania	Black rose × Cardinal***	1984	Grapes are medium (386-475 g), cylindro-conical, semi-compact. Berry is large (4-6 g), ovoid, thick-skinned, black-purple, with bloom.	
5	Splendid	Black rose × Regina viilor***	1984	Grapes are large (436-600 g), cylindro-conical, semi-compact. Berry is large (5 g), ovoid, uneven red-purple colour. Pulp is crunchy and slightly pink.	
6	Napoca	Alphonse Lavallée × (Regina viilor × Muscat de Hamburg)***	1984	Grapes are large (350-580 g), winged, with rare berries. Medium-size berry (3.8-4.6 g), ovoid, black skin, with a thick layer of bloom.	
7	Cetățuia	Crâmpoșie × Frumoasă de Ghioroc***	1979	Medium-sized compact grapes (280-360 g), cylindrico-conical. Berry of 2.8-3.7 g, ovoid, dark-red, with bloom, crisp flesh and Muscat flavour.	

Authors/Institution: *Calistru Gh. and Damian Doina / Research-Development Station for Viticulture and Winemaking Iași; **Bădițescu Margareta / Research-Development Station for Viticulture and Winemaking Odobești-Vrancea; *** Oprea Șt. / Horticultural Research Station Cluj-Napoca.

ASSESSMENT OF CONSUMER PREFERENCES ON TABLE GRAPES OF NEW CULTIVARS

Grape sampling was conducted according to Resolution OIV/VITI 371/2010. Five grapes from 10 vine stocks were harvested manually from both sides of the stocks, with the first cluster taken from the central shoot of a fruiting cane. Grapes collected were clean, visually free of diseases or other damages. Uniformity of grape sampling was taken into account. Berries for tasting were taken from the central part of the cluster.

In accordance to OIV (2010), table grape quality can be evaluated by sensorial analysis. Samples were assessed using a number of *visual* indicators (concerning grapes, stalk and berries), *olfactive* (in berry section), *gustative* and *tactile* (berry pulp, skin and seeds) (Tab. 2). In addition, as a summary of sensorial analysis, a general assessment is given taking into account all the features evaluated. For all descriptors were given ratings from 1 to 5 (5 was the highest).

Table 2 - General form for the sensorial analysis of table grapes

	Descriptors	Scale
Visual	Cluster - General appearance	1=badly shaped; 5=well shaped
	Cluster - Detachment of berries	1=low resistance; 5=high resistance
	Cluster - Uniformity of colour	1= $\geq$ to 30% defects; 5=all coloured
	Stalk - Colour	1=brown; 5=bright green
	Stalk - Turgidity	1=shrivelled; 5=turgid
	Rahis - Presence of rot and/or lesions	1=all rotten; 5=all healthy
	Stalk - Browning of the peduncle	1=all brown; 5=all green
	Berry - Uniformity of colour	1= < to 30% coloured; 5=all coloured
	Berry - Presence of shrivelling	1=all shrivelled; 5=all healthy
	Berry - Ease of detachment from the pedicel	1=low resistance; 5=very resistant
	Skin - Marks of pesticide or black mould	1=completely covered; 5=no marks
	Skin - Browning of the skin	1=clearly visible; 5=not visible
	Bloom - Distribution	1= irregular; 5=uniform
	Pulp - Browning of the flesh	1=clearly visible; 5=not visible
	Flesh - Presence of seeds (in dissected berry)	1=clearly visible; 5=not visible
Olfactive	Intensity of aromas (in dissected berry)	1=neutral; 5=many aromas
Gustative and tactile	Berry - Crispness	1=low; 5=very crisp
	Pulp - Consistency	1=deliquescent; 5=very firm
	Pulp - Intensity of aromatic sensation	1=not very intense; 5=very intense
	Pulp - Gustative balance (sweet/acid)	1=not balanced; 5=very well balanced
	Skin - Thickness	1=thick; 5=thin
	Skin - Astringency	1=astringent; 5=not tannic
	Skin - Persistence of skin in mouth	1=very persistent ; 5= little persistent
	*Seeds - Perception (sensation of dimensions)	1=unpleasant; 5=not perceptible
	*Seeds - Hardness (resistance to crushing)	1=very hard; 5=little resistance
General assessment	*Seeds - Astringency	1=astringent; 5=not tannic
		1=minimum; 5=maximum

The group of respondents was consisted from 98 subjects, aged between 18 and 61 years, grouped into four age categories, from Iași County, NE of Romania (Tab. 3). There were at least 18 people randomly selected for each age

category, trying to maintain a balance between the genders. Subjects age was the only criterion considered for the study. Further studies on the social status of the respondents may be conducted.

Table 3 - Data on the group of respondents

Age category (years)	No. of persons	Of which (%):	
		Women	Men
18–27	38	52.63	47.37
28–35	22	54.55	45.45
36–45	20	55.00	45.00
46–61	18	55.56	44.44
Total	98	54.08	45.92

Analysis of variance ANOVA test (Microsoft® Excel, Data Analysis) was initiated to investigate significant differences between data. The method used to discriminate among the means (positive and negative) was Fischer's least significant difference procedure at 95% confidence level. P -values lower than 0.05 ($p < 0.05$) were considered to be significant. Coefficient of variation ($CV\% = \pm/\text{mean}$) was calculated. At $CV\% < 10$ analysed data are homogeneous in terms of dispersion, while at $CV\% > 20$ the data do not behave uniformly in relation to feature studied (Pomohaci and Pârlea, 2008).

RESULTS AND DISCUSSION

Sensorial analysis by age groups

Ratings for the sensorial analysis of table grapes by the respondents from different age categories are presented in Table 4.

Persons included in the **18-27 years age group** have given the highest scores for grape general appearance of Splendid, Cetățuia and

Napoca cultivars. Grape colour uniformity was appreciated as very weak for Splendid and Gelu cultivars, this category of respondents giving the lowest ratings for colour uniformity at all cultivars. On the contrary, the presence and distribution of bloom (cuticular wax) received the best feedback, especially for Napoca and Milcov berries.

The intensity of aromas in dissected berries of Cetățuia and Milcov cv. were most appreciated by the youngest group of the survey, but with ratings which not exceeded 3.4. Moreover, persons between 18 and 27 years were not satisfied with the aroma of grapes selected for the study, giving lower ratings for this feature at most cultivars, Splendid and Gelu grapes being more affected. Sweet/acid gustative balance in the pulp was considered very well equilibrated at Cetățuia and Milcov cv. The crispiest berries were considered those of Transilvania cv. (4.4).

ASSESSMENT OF CONSUMER PREFERENCES ON TABLE GRAPES OF NEW CULTIVARS

Table 4 - Sensorial analysis of table grapes by the group of respondents

Descriptors	Splendid					Napoca					Cetățuia					Gelu								
	18-27	28-35	36-45	46-61	Mean	±	18-27	28-35	36-45	46-61	Mean	±	18-27	28-35	36-45	46-61	Mean	±	18-27	28-35	36-45	46-61	Mean	±
Cluster - General appearance	4.0	3.6	4.0	4.0	3.9	0.2	3.5	3.1	3.1	3.5	3.3	0.2	4.0	2.9	4.2	3.5	3.7	0.6	3.7	4.2	3.5	3.1	3.6	0.5
Cluster - Detachment of berries	3.2	2.6	3.5	3.5	3.2	0.4	3.2	4.0	4.0	3.3	3.6	0.4	3.1	3.1	3.3	3.6	3.3	0.3	3.5	3.5	2.7	4.0	3.4	0.5
Cluster - Uniformity of colour	3.3	3.4	3.2	3.6	3.4	0.2	3.9	4.0	3.8	3.9	3.9	0.1	3.5	3.7	3.1	3.0	3.3	0.3	2.9	3.4	3.0	2.9	3.1	0.2
Stalk - Colour	3.7	3.2	2.9	3.9	3.4	0.5	3.6	3.5	3.5	3.2	3.5	0.2	3.5	3.2	4.0	3.6	3.6	0.3	3.6	4.0	3.4	3.9	3.7	0.3
Stalk - Turgidity	3.3	4.0	4.0	3.6	3.7	0.3	3.5	3.3	3.9	3.3	3.5	0.3	4.1	4.0	3.9	3.6	3.9	0.2	3.6	4.2	4.0	3.7	3.9	0.3
Stalk - Presence of rot / lesions	4.4	5.0	4.3	5.0	4.7	0.4	3.7	3.8	4.5	4.3	4.1	0.4	3.7	3.3	3.9	4.2	3.8	0.4	3.8	3.7	4.1	4.0	3.9	0.2
Stalk - Browning of the peduncle	3.8	3.1	4.2	4.2	3.8	0.5	3.3	3.9	3.7	3.8	3.7	0.3	3.2	3.9	3.8	3.6	3.6	0.3	3.6	4.0	3.7	3.5	3.7	0.2
Berry - Uniformity of colour	3.2	3.0	3.2	3.1	3.1	0.1	3.9	4.0	3.6	3.9	3.9	0.2	3.5	3.6	3.1	3.4	3.4	0.2	3.5	3.8	3.3	3.9	3.6	0.3
Berry - Presence of shrivelling	3.9	5.0	4.2	3.2	4.1	0.7	3.8	3.8	4.1	3.9	3.9	0.1	3.7	4.0	3.9	3.4	3.8	0.3	3.6	3.9	3.3	3.3	3.5	0.3
Berry - Pedicel detachment	3.3	3.0	3.4	3.5	3.3	0.2	3.4	3.8	4.0	3.9	3.8	0.3	3.0	3.2	3.1	3.6	3.2	0.3	3.6	3.8	3.3	3.6	3.6	0.2
Skin - Marks of pesticide / mould	4.1	4.9	4.0	4.0	4.3	0.4	3.9	5.0	3.9	3.7	4.1	0.6	3.7	5.0	3.1	3.4	3.8	0.8	3.6	4.6	3.7	3.2	3.8	0.6
Skin - Browning of the skin	3.9	4.7	4.2	4.2	4.3	0.3	3.8	4.5	4.3	4.0	4.2	0.3	3.6	3.7	4.3	3.7	3.8	0.3	3.9	4.9	4.1	3.9	4.2	0.5
Bloom - Distribution	3.6	3.5	4.0	4.1	3.8	0.3	3.9	4.2	3.9	3.9	4.0	0.2	3.6	3.7	3.5	3.7	3.6	0.1	3.6	4.6	4.0	4.1	4.1	0.4
Pulp - Browning of the flesh	4.1	4.7	4.1	3.8	4.2	0.4	3.7	4.8	3.2	2.7	3.6	0.9	4.0	3.9	4.0	3.2	3.8	0.4	3.8	4.8	4.0	3.7	4.2	0.5
Pulp - Presence of seeds	2.9	1.7	1.5	3.4	2.4	0.9	2.9	1.9	2.5	3.3	2.7	0.6	2.1	2.0	2.8	3.0	2.5	0.5	2.3	2.1	2.0	2.3	2.2	0.2
Intensity of aromas	2.8	3.1	2.1	2.9	2.7	0.4	3.1	3.9	3.1	3.3	3.4	0.4	3.4	3.3	3.2	3.3	3.3	0.1	3.0	2.9	2.7	3.2	3.0	0.2
Berry - Crispness	2.7	4.0	4.2	3.7	3.7	0.7	3.0	4.1	3.2	3.2	3.4	0.5	3.0	3.5	3.6	3.1	3.3	0.3	3.6	3.9	3.9	4.1	3.9	0.2
Pulp - Consistency	3.5	4.0	3.7	3.4	3.7	0.3	3.5	4.0	2.9	3.1	3.4	0.5	3.3	4.2	2.9	3.2	3.4	0.6	3.6	4.3	4.0	3.9	4.0	0.3
Pulp - Aromatic sensation	2.7	3.8	3.5	3.1	3.3	0.5	3.3	3.7	3.4	3.3	3.4	0.2	3.3	4.1	3.9	3.3	3.7	0.4	3.0	3.5	3.2	3.4	3.3	0.2
Pulp - Gustative balance	3.4	4.0	3.5	3.4	3.6	0.3	3.9	4.2	3.9	3.5	3.9	0.3	3.9	3.9	3.7	3.6	3.8	0.2	3.1	3.9	3.8	3.1	3.5	0.4
Skin - Thickness	3.0	3.9	3.0	2.9	3.2	0.5	3.0	4.0	2.8	2.8	3.2	0.6	3.2	3.2	3.0	3.1	3.3	0.3	3.1	3.7	2.9	3.0	3.2	0.4
Skin - Astringency	3.0	3.0	2.4	2.5	2.7	0.3	3.2	3.2	2.8	2.9	3.0	0.2	3.1	3.2	3.0	2.9	3.1	0.1	3.1	3.1	2.4	2.6	2.8	0.4
Skin - Persistence in mouth	2.7	3.3	2.6	2.3	2.7	0.4	2.8	3.0	2.3	3.1	2.8	0.4	2.8	3.5	3.0	2.9	3.1	0.3	2.6	3.9	3.6	3.2	3.3	0.6
*Seeds - Perception (dimensions)	2.9	3.2	2.3	3.9	3.1	0.7	3.2	3.2	2.3	3.9	3.2	0.7	2.9	3.3	2.8	3.6	3.2	0.4	2.7	3.1	2.0	2.9	2.7	0.5
*Seeds - Hardness (resistance)	2.6	4.1	1.5	2.4	2.7	1.1	3.2	4.8	2.0	3.2	3.3	1.1	2.9	4.2	3.0	3.2	3.3	0.6	2.8	3.4	3.1	2.6	3.0	0.4
*Seeds - Astringency	3.2	4.0	2.2	3.0	3.1	0.7	3.1	3.3	2.3	3.1	3.0	0.4	2.7	3.3	3.3	3.5	3.2	0.3	2.9	3.5	3.2	3.3	3.2	0.3
General assessment	4.0	3.1	3.2	3.8	3.5	0.4	3.4	3.2	3.5	4.2	3.6	0.4	3.6	3.4	3.9	3.6	3.6	0.2	3.6	3.7	4.1	3.8	3.8	0.2

For all descriptors were given ratings from 1 to 5 (5 was the highest).

Table 4 - Sensorial analysis of table grapes by the group of respondents (continuation)

Descriptors	Someşan					Transilvania					Milcov							
	18-27	28-35	36-45	46-61	Mean	s	18-27	28-35	36-45	46-61	Mean	s	18-27	28-35	36-45	46-61	Mean	s
Cluster - General appearance	3.5	4.4	3.1	3.2	3.6	0.6	3.5	3.9	3.7	4.3	3.9	0.3	3.5	3.7	4.0	3.9	3.8	0.2
Cluster - Detachment of berries	3.0	3.7	2.5	2.7	3.0	0.5	3.7	4.2	3.9	4.0	4.0	0.2	3.2	2.8	4.0	3.9	3.5	0.6
Cluster - Uniformity of colour	3.0	3.5	2.8	3.7	3.3	0.4	3.0	3.3	3.0	3.4	3.2	0.2	3.2	3.3	4.1	3.9	3.3	0.4
Stalk - Colour	3.4	4.2	3.6	3.0	3.6	0.5	3.8	3.8	4.0	4.3	4.0	0.2	4.0	3.6	3.5	4.2	3.8	0.3
Stalk - Turgidity	3.6	3.2	3.8	3.4	3.5	0.3	3.4	3.9	3.9	3.9	3.8	0.3	3.9	3.7	3.6	3.2	3.6	0.3
Stalk - Presence of rot / lesions	4.1	4.0	3.9	4.4	4.1	0.2	3.7	3.8	3.6	4.5	3.9	0.4	3.8	3.3	3.1	4.2	3.6	0.5
Stalk - Browning of the peduncle	3.5	3.7	3.9	3.7	3.7	0.2	3.4	3.5	3.4	3.6	3.5	0.1	3.5	3.7	2.8	3.8	3.5	0.5
Berry - Uniformity of colour	3.0	3.3	2.9	3.4	3.2	0.2	3.2	3.2	2.9	3.0	3.1	0.2	3.6	4.0	3.3	3.9	3.7	0.3
Berry - Presence of shrivelling	3.4	4.2	3.4	3.3	3.6	0.4	3.4	4.0	3.8	3.3	3.6	0.3	3.7	4.0	3.9	4.1	3.9	0.2
Berry - Pedicel detachment	3.2	3.6	3.1	2.9	3.2	0.3	3.0	3.5	2.8	3.7	3.3	0.4	3.4	3.3	3.9	3.7	3.6	0.3
Skin - Marks of pesticide / mould	4.0	4.8	4.0	3.5	4.1	0.5	4.2	4.8	3.9	4.2	4.3	0.4	3.9	4.7	3.5	4.0	4.0	0.5
Skin - Browning of the skin	3.2	3.7	3.9	3.8	3.7	0.3	3.5	4.0	4.0	4.0	3.9	0.3	3.0	4.2	3.9	4.0	3.8	0.5
Bloom - Distribution	3.3	4.0	3.1	4.0	3.6	0.5	3.2	3.4	3.3	3.8	3.4	0.3	3.8	4.1	3.2	3.5	3.7	0.4
Pulp - Browning of the flesh	3.6	4.2	3.4	3.6	3.7	0.3	3.4	4.3	3.5	3.9	3.8	0.4	4.1	4.0	3.1	4.3	3.9	0.5
Pulp - Presence of seeds	1.9	1.9	2.1	3.2	2.3	0.6	2.0	1.0	1.6	2.1	1.7	0.5	2.6	1.2	2.3	2.3	2.1	0.6
Intensity of aromas	2.3	2.1	1.9	2.8	2.3	0.4	3.6	4.0	3.4	4.5	3.9	0.5	3.3	3.2	2.8	3.1	3.1	0.2
Berry - Crispness	3.8	3.9	2.9	4.3	3.7	0.6	4.4	4.2	4.1	4.4	4.3	0.2	3.3	2.8	2.9	3.9	3.2	0.5
Pulp - Consistency	4.1	4.1	3.8	3.8	4.0	0.2	4.1	4.4	4.2	4.1	4.2	0.1	3.3	3.2	2.8	3.5	3.2	0.3
Pulp - Aromatic sensation	3.5	3.9	3.2	4.2	3.7	0.4	3.5	4.1	3.6	4.4	3.9	0.4	3.6	3.5	3.6	3.2	3.5	0.2
Pulp - Gustative balance	3.4	3.1	3.5	4.1	3.5	0.4	3.4	3.5	3.0	4.0	3.5	0.4	3.6	3.3	3.2	3.8	3.5	0.3
Skin - Thickness	3.2	2.9	2.4	2.3	2.7	0.4	2.1	3.9	3.2	3.2	3.1	0.7	3.3	2.9	3.1	3.7	3.3	0.3
Skin - Astringency	2.8	3.0	1.9	2.3	2.5	0.5	3.0	3.2	2.5	3.0	2.9	0.3	2.6	2.5	2.8	2.3	2.6	0.4
Skin - Persistence in mouth	2.8	3.3	2.8	3.8	3.2	0.5	2.7	4.0	3.9	4.0	3.7	0.6	2.6	2.5	3.2	3.1	2.9	0.4
*Seeds - Perception (dimensions)	2.4	3.2	1.7	2.0	2.3	0.7	3.5	4.0	3.2	3.2	3.4	0.4	2.9	2.3	3.0	3.3	2.9	0.4
*Seeds - Hardness (resistance)	2.3	2.7	2.1	2.1	2.3	0.3	2.4	4.2	3.3	3.6	3.4	0.8	2.9	2.8	2.7	3.1	2.9	0.2
*Seeds - Astringency	2.9	4.1	2.9	3.2	3.3	0.6	2.9	3.6	3.6	3.9	3.5	0.4	2.8	3.5	3.2	3.0	3.1	0.3
General assessment	3.9	3.2	3.9	3.2	3.6	0.4	3.4	3.7	3.7	4.1	3.7	0.3	3.8	3.9	3.1	3.9	3.7	0.4

For all descriptors were given ratings from 1 to 5 (5 was the highest)

ASSESSMENT OF CONSUMER PREFERENCES ON TABLE GRAPES OF NEW CULTIVARS

Only for Transilvania cv. the berry skin was noted as thick, the differences compared to other age groups being very high. Perception of seeds (sensation of their dimensions) was not appreciated as a negative feature, but their astringency was considered very unpleasant at Cetățuia, Gelu, Transilvania and Milcov cv. General assessment at this age category highlighted the cultivars Splendid and Someșan, while Transilvania cv. was the least appreciated.

Respondents from the **28-35 years age group** appreciated positively the grape general appearance of Gelu and Someșan cultivars. Uniformity of grape colour was best rated at the majority of samples, Someșan, Cetățuia and Milcov being the most popular cultivars in this regard.

Resistance to detachment of berry from the pedicel was considered very high for cultivars Gelu, Someșan and Transilvania. Bloom distribution on berry skin was appreciated as uniform only at Gelu, Milcov and Napoca cv. grapes. In the same time, the intensity of aromas was best noted (many aromas) at Splendid and Napoca berries, the differences compared to other age groups being higher than one rating point (≥ 1) for this two cultivars. Aromatic sensation in the pulp was noted as very intense for most cultivars, and sweet/acid ratio was appreciated as well balanced for Napoca, Splendid, Cetățuia and Gelu cultivars. Regarding berry

crispness, only grapes of Napoca cv. were noted as very crispy (4.1).

The respondents in this age group appreciated grape skins as thin for all cultivars, differences from other groups of respondents being significant ($p < 0.05$). Also, the perception, hardness and astringency of seeds were positive aspects for this category of respondents.

Grape general appearance was best noted at cultivars Cetățuia and Milcov by the respondents from the **36-45 years age group**, while colour uniformity of grapes and berries was ranked as the poorest for most cultivars, a large percentage of berries being considered with colour defects. Bloom distribution on grape berry skins was appreciated as irregular for Cetățuia, Someșan and Milcov cv.

Olfactive examination of dissected berries revealed that the respondents aged between 36 and 45 years considered that all studied cultivars have neutral aroma, giving the lowest ratings for this descriptor among all age groups.

Splendid and Cetățuia cv. grapes were noted as very crispy, while pulp was appreciated as deliquescent at Napoca, Cetățuia and Milcov cultivars. Skins were perceived as more astringent, while the presence of seeds was evaluated as a negative feature for all cultivars.

Concerning the general assessment of grapes, the respondents noted with the highest ratings cultivars Gelu (4.1) and Cetățuia (3.9) (Tab. 4).

Respondents from the **46-61 years age group** preferred the grape general appearance of Transilvania cv., with large berries, while Gelu cv. grapes received the lowest ratings for this descriptor.

Gelu and Cetățuia cv. were appreciated as having berries with high resistance at detachment. Withal, the grapes of cultivars Splendid, Someșan and Transilvania were considered more uniform coloured and with a uniform distribution of bloom on berry skins. At this age category, seeds were noted as less visible at all cultivars.

Grapes of Transilvania (4.5), Gelu (3.2) and Someșan (2.8) cultivars were best appreciated in respect to the intensity of aromatic sensation, being characterised by many aromas. Concerning the general assessment, grapes of Napoca and Transilvania cultivars were best appreciated by the group of respondents aged over 45 years.

Mean values per sections and age groups

Mean values per section of descriptors, for each age group of respondents are presented in *Table 5*. Regarding the visual assessment, cultivars with large, semi-compact grapes (400-600 g) like Napoca and Splendid were best rated. Transilvania cv. grapes were by far the most appreciated at the olfactive, gustative and tactile examination, being

characterized as having many and intense flavours, crispy berries with consistent pulp and a balanced taste.

In terms of grape general assessment, best rated by all age groups was Gelu cv., with uniaxial semi-compact medium to large grapes and blue-purple medium-sized berries. According to Damian *et al.* (2006), Gelu is the earliest cultivar which ripens blue-violet grapes in the NE of Romania.

Analysing the differences in appreciation between cultivars by each group of respondents was observed that persons between 18 and 27 years did not particularly appreciated none of the analysed cultivars, however, Milcov cv. (3.44 ± 0.31) having a better mean value than other cultivars.

Respondents between 28 and 35 years noted with the highest ratings the grapes of cultivars Napoca (3.67 ± 0.32), Gelu (3.55 ± 0.46), Cetățuia (3.48 ± 0.17) and Splendid (3.41 ± 0.35), while the group between 36 and 45 years appreciated positively grapes of Cetățuia cv. (3.48 ± 0.34), being the group least satisfied by the features of analysed grapes. Moreover, respondents between 46 and 61 years preferred grapes of cultivars Transilvania (4.03 ± 0.35), Milcov (3.51 ± 0.38) and Someșan (3.17 ± 0.27).

Coefficient of variation indicates large differences in appreciation among different age groups.

ASSESSMENT OF CONSUMER PREFERENCES ON TABLE GRAPES OF NEW CULTIVARS

Table 5 - Mean values per section of descriptors

Cultivars	Age group	Visual	Olfactive	Gustative / tactile	General assessment	Mean ($\pm$)
Splendid	18 - 27	3.65 $\pm$ 0.43 ^{oo}	2.80 $\pm$ 0.38 [*]	2.97 $\pm$ 0.31 ^{ns}	4.00 $\pm$ 0.34 ^{***}	3.35 $\pm$ 0.56
	28 - 35	3.69 $\pm$ 0.99 ^{ns}	3.10 $\pm$ 0.24 ^{***}	3.73 $\pm$ 0.40 ^{***}	3.10 $\pm$ 0.43 ^{ooo}	3.41 $\pm$ 0.35
	36 - 45	3.65 $\pm$ 0.74 ^{oo}	2.10 $\pm$ 0.61 ^{ooo}	2.89 $\pm$ 0.83 ^{oo}	3.20 $\pm$ 0.54 ^{ooo}	2.96 $\pm$ 0.65
	46 - 61	3.81 $\pm$ 0.48 ^{***}	2.90 $\pm$ 0.43 ^{***}	3.06 $\pm$ 0.55 ^{ns}	3.80 $\pm$ 0.31 ^{***}	3.39 $\pm$ 0.48
	Mean ($\pm$)	3.71 $\pm$ 0.08	2.73 $\pm$ 0.43	3.02 $\pm$ 0.06	3.53 $\pm$ 0.44	-
	CV%	2.05	15.96	2.11	12.55	-
Napoca	18 - 27	3.60 $\pm$ 0.30 ^{ooo}	3.10 $\pm$ 0.38 ^{ooo}	3.22 $\pm$ 0.30 ^{ns}	3.40 $\pm$ 0.41 ^{ooo}	3.33 $\pm$ 0.22
	28 - 35	3.84 $\pm$ 0.74 ^{***}	3.90 $\pm$ 0.47 ^{***}	3.75 $\pm$ 0.57 ^{***}	3.20 $\pm$ 0.28 ^{ooo}	3.67 $\pm$ 0.32
	36 - 45	3.73 $\pm$ 0.50 ^{ns}	3.10 $\pm$ 0.31 ^{ooo}	2.79 $\pm$ 0.59 ^{ooo}	3.50 $\pm$ 0.31 ^{oo}	3.28 $\pm$ 0.42
	46 - 61	3.64 $\pm$ 0.41 ^{oo}	3.30 $\pm$ 0.43 ^o	3.21 $\pm$ 0.31 ^{ns}	4.20 $\pm$ 0.47 ^{***}	3.59 $\pm$ 0.45
	Mean ($\pm$)	3.70 $\pm$ 0.11	3.35 $\pm$ 0.38	3.24 $\pm$ 0.39	3.58 $\pm$ 0.43	-
	CV%	2.88	11.30	12.13	12.17	-
Cetățuia	18 - 27	3.49 $\pm$ 0.50 ^o	3.40 $\pm$ 0.41 ^{***}	3.11 $\pm$ 0.34 ^{ooo}	3.60 $\pm$ 0.35 ^{ns}	3.40 $\pm$ 0.21
	28 - 35	3.55 $\pm$ 0.66 ^{ns}	3.30 $\pm$ 0.36 ^{ns}	3.69 $\pm$ 0.39 ^{***}	3.40 $\pm$ 0.41 ^{ooo}	3.48 $\pm$ 0.17
	36 - 45	3.60 $\pm$ 0.48 ^{**}	3.20 $\pm$ 0.29 ^{ooo}	3.22 $\pm$ 0.38 ^{ooo}	3.90 $\pm$ 0.29 ^{***}	3.48 $\pm$ 0.34
	46 - 61	3.50 $\pm$ 0.30 ^o	3.30 $\pm$ 0.48 ^{ns}	3.24 $\pm$ 0.26 ^{ooo}	3.60 $\pm$ 0.38 ^{ns}	3.41 $\pm$ 0.17
	Mean ($\pm$)	3.54 $\pm$ 0.05	3.30 $\pm$ 0.08	3.32 $\pm$ 0.26	3.63 $\pm$ 0.21	-
	CV%	1.43	2.47	7.74	5.69	-
Gelu	18 - 27	3.51 $\pm$ 0.40 ^{ooo}	3.00 $\pm$ 0.39 [*]	3.05 $\pm$ 0.34 ^{ooo}	3.60 $\pm$ 0.39 ^{ooo}	3.29 $\pm$ 0.31
	28 - 35	3.97 $\pm$ 0.69 ^{***}	2.90 $\pm$ 0.51 ^o	3.63 $\pm$ 0.38 ^{***}	3.70 $\pm$ 0.57 ^{oo}	3.55 $\pm$ 0.46
	36 - 45	3.47 $\pm$ 0.59 ^{ooo}	2.70 $\pm$ 0.28 ^{ooo}	3.21 $\pm$ 0.65 ^{oo}	4.10 $\pm$ 0.44 ^{***}	3.37 $\pm$ 0.58
	46 - 61	3.54 $\pm$ 0.50 ^{ooo}	3.20 $\pm$ 0.38 ^{***}	3.21 $\pm$ 0.50 ^{oo}	3.80 $\pm$ 0.35 ^{ns}	3.44 $\pm$ 0.29
	Mean ($\pm$)	3.62 $\pm$ 0.23	2.95 $\pm$ 0.21	3.28 $\pm$ 0.25	3.80 $\pm$ 0.22	-
	CV%	6.44	7.06	7.58	5.68	-
Someșan	18 - 27	3.31 $\pm$ 0.51 ^{ooo}	2.30 $\pm$ 0.51 ^{ns}	3.12 $\pm$ 0.59 ^{ns}	3.90 $\pm$ 0.50 ^{***}	3.16 $\pm$ 0.66
	28 - 35	3.76 $\pm$ 0.67 ^{***}	2.10 $\pm$ 0.39 ^o	3.42 $\pm$ 0.53 ^{***}	3.20 $\pm$ 0.28 ^{ooo}	3.12 $\pm$ 0.72
	36 - 45	3.30 $\pm$ 0.57 ^{ooo}	1.90 $\pm$ 0.27 ^{ooo}	2.72 $\pm$ 0.69 ^{ooo}	3.90 $\pm$ 0.41 ^{***}	2.96 $\pm$ 0.85
	46 - 61	3.45 $\pm$ 0.44 ^{ns}	2.80 $\pm$ 0.38 ^{***}	3.21 $\pm$ 0.94 ^{***}	3.20 $\pm$ 0.27 ^{ooo}	3.17 $\pm$ 0.27
	Mean ($\pm$)	3.46 $\pm$ 0.21	2.28 $\pm$ 0.39	3.12 $\pm$ 0.29	3.55 $\pm$ 0.40	-
	CV%	6.21	16.98	9.41	11.38	-
Transilvania	18 - 27	3.36 $\pm$ 0.49 ^{ooo}	3.60 $\pm$ 0.41 ^{ooo}	3.20 $\pm$ 0.72 ^{ooo}	3.40 $\pm$ 0.33 ^{ooo}	3.39 $\pm$ 0.16
	28 - 35	3.64 $\pm$ 0.84 ^{**}	4.00 $\pm$ 0.36 ^{***}	3.91 $\pm$ 0.37 ^{***}	3.70 $\pm$ 0.42 ^{ns}	3.81 $\pm$ 0.17
	36 - 45	3.42 $\pm$ 0.64 ^{ooo}	3.40 $\pm$ 0.22 ^{ooo}	3.46 $\pm$ 0.53 ^{ooo}	3.70 $\pm$ 0.38 ^{ns}	3.50 $\pm$ 0.14
	46 - 61	3.73 $\pm$ 0.61 ^{***}	4.50 $\pm$ 0.28 ^{***}	3.78 $\pm$ 0.51 ^{***}	4.10 $\pm$ 0.31 ^{***}	4.03 $\pm$ 0.35
	Mean ($\pm$)	3.54 $\pm$ 0.18	3.88 $\pm$ 0.49	3.59 $\pm$ 0.32	3.73 $\pm$ 0.29	-
	CV%	4.97	12.53	8.92	7.71	-
Milcov	18 - 27	3.55 $\pm$ 0.41 ^o	3.30 $\pm$ 0.47 ^{***}	3.09 $\pm$ 0.38 ^{ns}	3.80 $\pm$ 0.28 ^{***}	3.44 $\pm$ 0.31
	28 - 35	3.63 $\pm$ 0.81 ^{ns}	3.20 $\pm$ 0.42 ^{***}	2.93 $\pm$ 0.43 ^{ooo}	3.90 $\pm$ 0.36 ^{***}	3.41 $\pm$ 0.43
	36 - 45	3.47 $\pm$ 0.50 ^{ooo}	2.80 $\pm$ 0.34 ^{ooo}	3.05 $\pm$ 0.27 ^o	3.10 $\pm$ 0.41 ^{ooo}	3.10 $\pm$ 0.28
	46 - 61	3.75 $\pm$ 0.51 ^{***}	3.10 $\pm$ 0.39 ^{ns}	3.29 $\pm$ 0.47 ^{***}	3.90 $\pm$ 0.29 ^{***}	3.51 $\pm$ 0.38
	Mean ($\pm$)	3.60 $\pm$ 0.12	3.10 $\pm$ 0.22	3.09 $\pm$ 0.15	3.68 $\pm$ 0.39	-
	CV%	3.32	6.97	4.84	10.51	-

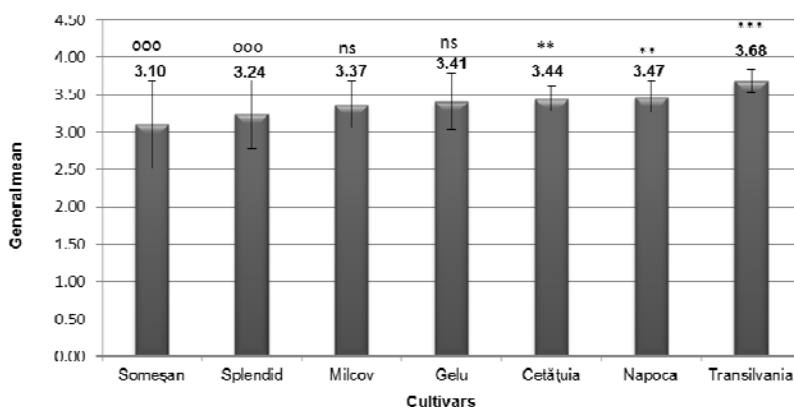
Ratings accorded from 1 to 5 (5 is the highest); ^{n.s.}, ^{*}, ^{**}, ^{***} indicate non-significant and positive significant at $p \leq 0.05$, 0.01, 0.001; ^o, ^{oo}, ^{ooo} indicate negative significant at $p \leq 0.05$, 0.01, 0.001, compared to the mean of the same category of descriptors; CV% represents the coefficient of variability (%).

The data were considered homogeneous ($CV\% < 10$), when were assessed the visual and gustative features of grapes, the respondents behaving more unitary in respect to this categories of descriptors. Regarding the olfactive feature of grapes respondents' opinion varied widely from one age group to another ($CV\% > 10$). Someșan and Splendid cultivars showed the highest coefficient of variation in the

evaluation of olfactive feature of grapes (Tab. 5).

General mean values

General mean of the sensorial analysis (as average for all four categories of descriptors), highlighted the grapes of Transilvania cv. as the most appreciated, followed by Napoca, Cetățuia and Gelu cultivars (Fig. 1).



Error bars represents standard deviation ($\pm$) between mean values per section of descriptors ($n=4$); n.s., *, **, *** indicate non-significant and positive significant at $p \leq 0.05$, 0.01 , 0.001 ; °, °°, °°° indicate negative significant at $p \leq 0.05$, 0.01 , 0.001 , compared to the data mean.

Figure 1 - General mean for sensorial analysis of table grapes from Romanian cultivars

Analysis of variance (ANOVA test) showed statistically significant differences between cultivars (p -value $0.02 < 0.05$) in respect to general mean. Someșan cv. grapes presented the lowest general mean (3.1) and the highest standard deviation (± 0.58), the opinion of the respondents on the sensorial analysis of this cultivar varying within wide limits.

CONCLUSIONS

Respondent's perception on table grapes of new Romanian *Vitis vinifera* L. cultivars was evaluated through sensorial analysis and varied depending on age category. For subjects between 18 and 27 years, grape colour uniformity and intensity of aroma were considered very poor, while seed perception and skin

thickness were not assessed as negative features. Respondents between 28 and 35 years appreciated positively the grapes of Napoca and Gelu cultivars, aromatic sensation being noted as very intense for most cultivars. The 36-45 years group considered that grapes of studied cultivars have neutral aroma and seeds perception is unpleasant, grapes of Cetățuia cultivar being best noted. Subjects from the 46-61 years age group rated positively the grapes of Transilvania and Napoca cultivars, especially for the intensity of aroma, berry colour and bloom uniformity, being the category of respondents less affected by the presence of seeds. Mean data analysis indicates that the group of respondents preferred black grapes with lighter shades of skin colour, with large and crunchy berries covered by a uniform wax layer, a balanced sugar/acidity ratio and fewer seeds, grapes of Transilvania cultivar being the closest to their demands. The study revealed that table grapes of the studied new *V. vinifera* L. cultivars created in Romania possess valuable features highly appreciated by consumers and superior characteristics that can be further use in vine breeding programmes.

Acknowledgements: This paper was published under the European Social Fund, Human Resources Development Operational Programme 2007-2013, project no. POSDRU/159/1.5/S/132765.

REFERENCES

- Akkurt M., Welter L., Maul E., Töpfer R., Zyprian E., 2007** - Development of SCAR markers linked to powdery mildew (*Uncinula necator*) resistance in grapevine (*Vitis vinifera* L. and *Vitis* sp.). Mol. Breed. 19 (2), 103-111.
- Brar S.J.S., Singh Z., Gosal S.S., 1991** - *In ovulo* embryo culture in seedless grapes (*Vitis vinifera* L.). In: Prakash J. and Pierik R.L.M. (Eds), Horticulture - New Technologies and Applications, Kluwer Academic Publishers, Netherlands, 249-254.
- Damian Doina, Calistru Gh., Savin C., Vasile A., Zaldea G., 2006** - Agrobiological and technological value of new cultivars and clones of grapevine created in SCDVV Iași. Lucr. Științifice USAMV Iași, Seria Horticultură, 49 (1): 743-748.
- Dannehl D., Josuttis M., 2014** - Cultivar and production effects on bioactive polyphenols. In: Watson R.R. (Ed.). Polyphenols in plants isolation, purification and extract preparation. Academic Press, San Diego, 3-13.
- Georgiev V., Ananga A., Tsoleva Violeta, 2014** - Recent advances and uses of grape flavonoids as nutraceuticals. Nutrients, 6 (1): 391-415.
- Morariu Daniela, Pizmaș Diana, 2001** - Comportamentul consumatorului (Consumer behaviour). Edit. Bibliofor, Deva, 60 p.
- Moreno-Montoro M., Olalla-Herrera M., Gimenez-Martinez R., Navarro-Alarcon M., Rufián-Henares J.A., 2015** - Phenolic compounds and antioxidant activity of Spanish commercial grape juices. J. Food Comp., 38: 19-26.
- NIS, 2014** - Monthly statistical bulletin 10/2014. National Institute of Statistics, Romania. Available at: <http://www.insse.ro/cms/en/content/statistical-bulletins>.

- OIV, 2010** - Resolution OIV/VITI 371/2010. General form for the sensorial analysis of table grapes. International Organisation of Vine and Wine, Paris. Available at: <http://www.oiv.int/public/medias/385/viti-2010-2-en.pdf>.
- OIV, 2014** – Stat. OIV extracts. Databases and statistics. International Organisation of Vine and Wine, Paris. Available at <http://www.oiv.int/en/databases-and-statistics/statistics>.
- OIV, 2015** - World vitiviniculture situation. International Organisation of Vine and Wine, Paris. Available at: <http://www.oiv.int/oiv/info/enpublications/statistiques>.
- Oprea Șt., Moldovan S.D., 2007** - Ameliorarea viței de vie în România (Grapevine breeding in Romania). Edit. Poliam, Cluj-Napoca.
- Pomohaci Cr., Pârlea Daniela, 2008** - Analiza datelor (Data analysis). 2nd ed. Edit. Fundației România de Măine, București, 183 p.
- Sestraș R., Moldovan S.D., Popescu C.F., 2008** - Variability and heritability of several important traits for grape production and breeding. Not. Bot. Horti Agrobot. Cluj-Napoca, 36 (1): 88-97.
- Țârdea C., Rotaru Liliana, 2003** - Ampelografie (Ampelography). Vol. 2. Edit. Ion Ionescu de la Brad, Iași, 246 p.
- ***, 2015** - Catalogul oficial al soiurilor de plante de cultură din România pentru anul 2015 (The official catalogue of crop plant cultivars from Romania for 2015). Institutul de Stat pentru Testarea și Înregistrarea Soiurilor (ISTIS), București. Available at: http://istis.ro/image/data/download/catalog-oficial/catalog_2015.pdf.