

DISTANT HYBRIDS IN F₄ (*VITIS VINIFERA L.* X *MUSCADINIA ROTUNDIFOLIA* MICHX.) AND OF CULTIVARS OF *VITIS VINIFERA L.* AND OF CONCERNING THE CONTENT OF SOME BIOCHEMICAL COMPOUNDS

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Abstract

The process of obtaining distant hybrids, as well as any crossing of cultivars of *Vitis vinifera L.* with representatives of species possessing the necessary qualities (resistance to diseases and pests, low temperature, etc.) may change the spectrum of chemical and biochemical compounds responsible for flavour, colour and taste of grapes, obtained juice and wine. Botanical description of distant hybrids was performed during all phases of the vegetative stages; the organs of the plants were studied from spring, at bud unfolding, until early autumn, at the fall of the leaves. For the determination of diglucoside-3,5-malvidin, the fluorimetric method, for determining the methyl anthranilate, the gas chromatographic method was applied. Based on the analyzes of biochemical constituents of grapes of the distant hybrids: DRX-M4-578; -502; -571; -660; -609; -580; etc., compared to the traditional cultivars „Feteasca albă” and „Rară neagră”, it has been found that these varieties are similar. So, the distant hybrids of grapevine haven't inherited unwanted characters for vines, some of them are strictly limited (diglucoside-3,5-malvidol). These hybrids don't have the specific characteristics of direct production hybrids, characterised by the foxat taste of the grape berries, caused by the presence of the methyl anthranilate. The distant hybrids studied according to the classical uvologic and technological principles can be classified as follows: 5 distant hybrids are attributed to the table vine species and 2 distant hybrids have mixed properties. According to the physical and biochemical indices of the grapes of the studied distant hybrids, their characteristics are similar to European vine species.

Key words: anthocyanin, diglucoside-3,5-malvidin, grape, methyl anthranilate

INTRODUCTION

The process of obtaining distant hybrids, as well as any crossing of cultivars of *Vitis vinifera L.* with representatives of species possessing the necessary qualities (resistance to diseases and pests, low temperature, etc.) may change the spectrum of chemical and biochemical compounds responsible for flavour, colour and taste of grapes, obtained juice and wine [5, 8].

As a result of numerous studies over the years, the most chemicals that are found in different anatomical parts of the vine have been identified. The acids, tannins and pigments are chemicals that determine the taste, aroma and color of berries.

Physicochemical peculiarities of grape berries are varied and depend on the characteristics of the soil, the pedo-climatic conditions of the region, agro technical works undertaken and the time of harvest.

Scientific studies have shown that certain plants, such as grapes, blueberries, pomegranate etc. contain a substance called resveratrol, which determines the plant resistance to various unfavorable environmental factors [4, 12].

It is well known that the concentration of diglucoside-3,5-malvidin (malvin) in the grape juice of the new cultivar of grapevine “Negru de Ialoveni” is about 45 mg/dm³ - 60 mg/dm³, exceeding the allowable limit in the European Union – 15 mg/dm³, almost 3-4

times. Recently the international Organisation of Vine and Wine discussed the issue of reducing this index in wines at the limit of 5 mg/dm³, which requires to be monitored in distant hybridization selection in order to try and approve only the varieties with low content of phenolic compound diglucoside-3,5-malvidin.

Another important component of grape juice of hybrids of any type, including the distant ones, is methyl anthranilate (3,4-benzoxazole), which has the main role in the creation of taste and smell (flavour) of foxate (of naphthalene or/and phenol) [9, 17, 13].

Methyl anthranilate is a nitrogen compound from the group of benzoxazoles, it is formed in grapes (especially at direct producing hybrids) in quantities of 0.2 to 3.5 mg/dm³ of juice. It is found in wine in the same concentrations along with another volatile aromatic chemical component - isoamyl acetate [17]. That's why this important chemical constituent of grape juice of new hybrids of intraspecific selection needs to be determined, studied and considered as a criterion for preselection.

As a result of crossing the cultivated vine (*Vitis vinifera* L.), with the set of chromosomes 2n = 38, with the American vine (*Muscadinia rotundifolia* Michx.), with the set of chromosomes 2n = 40, scion-rooted distant hybrids with increased resistance to phylloxera were created, with the diploid set of chromosomes of 2n = 38 [2, 3, 5].

MATERIALS AND METHODS

The grapevine distant hybrids (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) of F4 (DRX-M4-578; -502; -571; -660; -609;-580;-512) and the grapevine cultivars "Feteasca albă", "Rară neagră" and "Negru de Ialoveni" were the object of study [2, 6, 7].

For the quantitative and qualitative determination of diglucoside-3,5-malvidin, the quantitative and qualitative fluorimetric method was applied.

Qualitative determination (identification of diglucozid-3,5-malvidol). In an Erlenmeyer flask, 10 mL of control wine with 15 mg/L of diglucozid-3,5-malvidin, which have been

treated with 1,5 mL of solution of acetic aldehyde, are taken. It is stirred about 20 minutes for combining free SO₂ in wine with acetic aldehyde. In a centrifuge tube with a capacity of 20 mL is introduced 1 mL of wine treated with acetic aldehyde, to which is added a drop of 1 M hydrochloric acid and 1 mL sodium nitrite solution. The tube content is stirred; it is expected for 2-5 minutes the oxidation-reduction reaction of malvin and then 10 mL of ammonia solution are added. Under the same conditions, in another centrifuge tube, we treat 10 mL of the control wine containing 15 mg or 5 mg malvin/litre. It is stirred and then we wait 10 minutes and then centrifuge it.

We decant the clear liquids from the two centrifuge tubes, two calibrated tubes with ground glass stopper. The fluorescence of the analyzed sample of wine compared with the control sample is examined in UV light at 365 nm.

The wine samples which do not give fluorescence or their fluorescence is far below the control wine, are considered as lacking diglucoside-3,5-malvidin. In case of a slightly lower, equal or higher fluorescence in comparison with the control wine, the quantitative determination of diglucoside-3,5-malvidin is necessary [12, 13, 14, 15, 16, 17]. For determining the methyl anthranilate, the gas chromatographic method was applied. Extraction of methyl anthranilate was performed by absorption on a resin of the type Amberlite XAD-2, followed by elution with azeotropic mixture of pentam-dichloromethane solvent (2:1 ratio by volume). The organic extract is half concentration and injected into a chromatography capillary column of fused silica. When leaving the column the terpineols get into the mass spectrometer to be detected. In the chromatography column are injected 2 µL of organic extract obtained from must or wine and 2 µL of each internal standard. The scanning area of the mass spectrometer is between 30 m/z and 300 m/z, at an interval of 1 sec./cycle. The spectrum obtained is compared with that of the internal standards of reference and the terpineols content is calculated. [10, 11, 14, 15, 16, 17].

Distant hybrids of vine (*Vitis vinifera* L. x *M. rotundifolia* Michx.) served as study material. Botanical description of distant hybrids was performed during all phases of the vegetative stages; the organs of the plants were studied from spring, at bud unfolding, until early autumn, at the fall of the leaves. The biomorphological characteristics of the organs were studied at the stages of: - bud unfolding – leaf and shoot growth - blossoming – berries growth - grapes ripening, wood maturing and leaf drop. [1, 2, 3, 4]

RESULTS AND DISCUSSIONS

In the specialized literature (biological, uvological and oenological) is also described another series of substances communicating vegetal or herbaceous flavour: 2-methoxy-3-isobutyl pyrazine and 2-methoxy-3-methylethyl pyrazine, both of the pyrazines group which is formed in grapes. They are found as volatile free forms in the grape juice of hybrids and in the obtained wine.

Their sensory perception threshold is 10 mg/dm³ and at a content of more than 24 mg/dm³ in total they are easily detected by smell.

Furanol with taste and flavour of "strawberry" was also detected in the juice and wine obtained from hybrids. The gustatory perception threshold is high, at the level of 700 mg/dm³. Next to it, another natural chemical compound, namely aminoacetophenone with smell and taste of phenol was detected [9, 10, 11, 13].

But the content of the last constituents from the must and wine of direct producing hybrids and North American grapevine species (*Vitis labrusca*: Concord, Delavar, Izabela etc.) is quite low and it is difficult to assess exactly their influence on the aromatic spectrum of products from grapes (must, juice and wine).

The results of investigations of the harvest of 2014, whose direct aim was to verify whether by obtaining distant hybrids were not transmitted through hereditary trait specific characteristics of varieties of direct producing hybrids, whose index of methyl anthranilate concentration ranged from 0.30 mg/dm³ of juice up to 3.6 mg/dm³ [17].

The data presented in the Table. 1, Fig. 1. show a similarity between the distant hybrids and classic cultivars: at cultivars with green-yellow grapes of distant hybrids, this index attests 0.08 mg/dm³ - 0.17 mg/dm³. These results reveal a similarity of distant hybrids DRX-M4-571; -578; - 609; DRX-M3-3-1, at the content of methyl anthranilate, with the classic grapevine cultivar "Fetească albă" of the species *Vitis vinifera* L.

At the new cultivars – the distant hybrids DRX-M4-660 and DRX-M3-3-1 of red-violet colour (like pomegranate), with the content of this biochemical constituent of 0.21 mg/dm³ - 0.24 mg/dm³, is observed a similarity to the classic cultivar "Rară neagră" of the species *Vitis vinifera* L. that has accumulated in fresh juice 0.27 mg/dm³ of methyl anthranilate.

The organoleptic assessments of the quality of grapes of the eight distant hybrids and classic cultivars allowed us to note the absence of the foxate flavour (smell) and taste typical of direct producing hybrids and especially of the North American cultivars of the species *Vitis labrusca* (Concord, Izabela, Noah, Lidia, Delaware, Othelo and others).

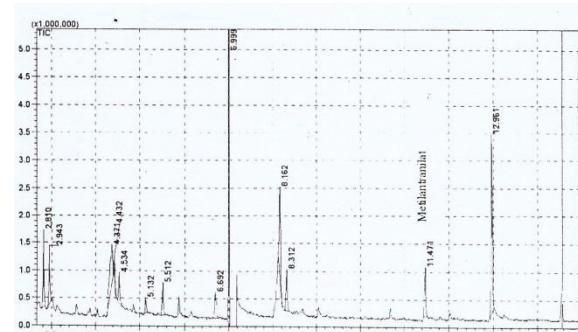


Fig. 1. The content of methyl anthranilate in grape juice of distant hybrids of grapevine *Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.

Only in the intraspecific hybrid "Negru de Ialoveni" from the vine section of the National Institute of Vine and Wine was determined by the same gas chromatography method [17] an increased concentration of methyl anthranilate of 0.49 mg/dm³, which reaches values close to some direct producer hybrids [8].

Another important feature of hybrids of any provenance (intra-, extraspecific selection, etc.) is the concentration of the phenolic compound - anthocyanic diglucoside-3,5-

malvidin, which is strictly limited to wine exports to the markets of the European Union; the limit is of $\leq 15 \text{ mg/dm}^3$ [11, 12].

In this context, they started the determination of this anthocyanic component (colouring in grapes) by a known and widely used method [16] in EU countries.

The results in the table show that this index in the fresh juice of the distant hybrid ranges between $7.7 \text{ g/dm}^3 - 9.3 \text{ g/dm}^3$ of diglucoside-3,5-malvidin (DRX-M4-660; DRX-M3-3-1), while in the classic cultivar "Rară neagră" (S.A. „Cricova”, v. Lucești, d. Cahul) - only 4.9 mg/dm^3 of diglucoside-3,5-malvidin. (Table 1., Fig. 2.) These results allow us to affirm that according to the index values – diglucosid-3,5-malvidin concentration - the distant hybrids F_4 of cultivars obtained at the Botanical Garden (Institute) of the ASM do not differ substantially at the same index of the classic cultivar "Rară neagră".

The intraspecific hybrid "Negru de Ialoveni" is an exception in the conducted investigations with 74.0 mg/dm^3 of diglucoside-3,5-malvidin in grape juice of this cultivar from the Vine Collection of the National Institute of Vine and Wine.

According to the content of phenolic compounds, including anthocyanins from grape juice of direct hybrids compared with that of classical cultivars of *Vitis vinifera* L.: "Fetească albă" and „Rară neagră", these varieties do not differ radically, but only within the limits of $184 \text{ mg/dm}^3 - 260 \text{ mg/dm}^3$ at phenolic compounds in green-yellow grapes: DRX-M4-571; DRX-M4-512 etc. and $1987 \text{ mg/dm}^3 - 2316 \text{ mg/dm}^3$ at distant hybrids DRX-M3-3-1 and DRX-M4-660 respectively.

The concentration index of anthocyanins in the coloured cultivars does not reveal an essential difference between the distant hybrids and the classic cultivars "Rară neagră": from 513 mg/dm^3 to 640 mg/dm^3 for the distant hybrids of grapevine and a (regular) content of 469 mg/dm^3 at "Rară neagră" from the group *Vitis vinifera* L.

The grape juice of intraspecific hybrids "Negru de Ialoveni" contains high amounts of phenolic compounds of about 2790 mg/dm^3 and anthocyanins of 861 mg/dm^3 , a fact

confirmed by the scientists E.Scorbanov and A.Zemşman in their research carried out in 2001-2003.

Analyzing the features of the distant hybrids of vine (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) in comparison with common species of table grapes, which are characterized primarily by large berries (length, weight, diameter), it has been found that the distant hybrids DRX-M4-502 and DRX-M4-578 have medium-sized berries (20 mm.), DRX-M4-571 and DRX-M4-640 have berries of 21 mm and DRX-M4-512 has berries of 22 mm in length (Table 3.).

According to the consistency of the pulp it has been found that the grapes of the distant hybrid DRX-M3-3-1 can be used both for direct consumption and for industrial processing, the same as the vine species „Chasselas Rose” and „Muscat Hamburg”, which are used for consumption and light wines production.

The distant hybrid DRX-M4-578 has typical properties of the vine species *Vitis vinifera* L. - berries with a slight floral aroma with savour of quince.

According to the taste and aroma characteristics, the distant hybrids DRX-M3-3-1; DRX-M4-502; DRX-M4-512 etc. can be attributed mainly to the species of table grapes.

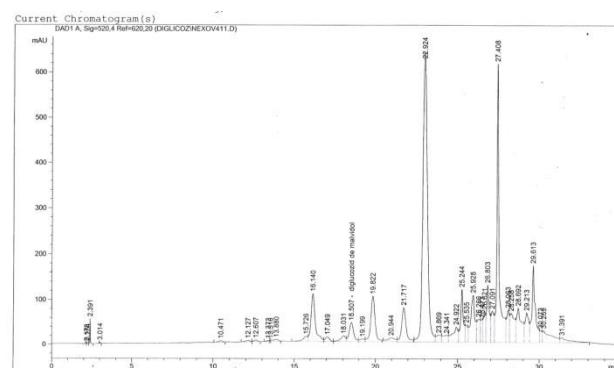


Fig. 2. The methyl diglucoside-3,5-malvidin content in grape juice of distant hybrids of grapevine *Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.

It has been attested that the distant hybrid DRX-M4-580 has obvious herbaceous nuances, in their structure the flavour of melissa prevails. For this hybrid, an optimal, balanced ratio of acidity, sugars and tannin

substances is characteristic. The distant hybrid DRX-M₄-502 is characterized by the crisp pulp of the berry with pronounced taste features typical for table grapes. The berry juice of most distant hybrids has a pleasant fresh taste (with moderate acidity), and some have a harmonious, sweet, soft taste, (DRX-M₄-609, DRX-M₃-3-1).

Organoleptic assessments of the fresh juice obtained from hybrids created at the Botanical Garden (Institute) of the ASM in comparison with the grape juice of classic varieties "Feteasca albă" and „Rară neagră" from JSC Cricova made during the harvest from 2014 (appreciation of flavour - smell and taste etc.) allowed us to attest a likeness of berries colour, of flavour and taste of the juice extracted from them, with little nuances at each investigated cultivar (Table 1., Fig. 1.).

Table 1. The content of methyl anthranilate, diglucoside-3,5-malvidin in grapes of distant hybrids of grapevine (*Vitis vinifera L. x Muscadinia rotundifolia* Michx.)

Form	The content of the compounds, mg/dm ³		
	methyl anthranilate	Diglucoside-3,5-malvidin	anthocyanins
DRX-M4-578	0.15	-	-
DRX-M4-502	0.08	-	-
DRX-M4-571	0.17	-	-
DRX-M4-660	0.21	7.7	640
DRX-M4-609	0.16	-	-
DRX-M4-580	0.09	-	-
DRX-M4-512	0.13	-	-
DRX-M3-3-1	0.24	9.3	513
Feteasca albă	0.11	-	-
Rară neagră	0.27	4.9	469
Negru de Ialoveni	0.49	74.0	861

At the overall score, the hybrids with green-yellow grapes are gustatory-olfactory distinguished: DRX-M4-609 with 9.5 points and DRX-M4-502 with 9.0 points. Among those with red-purple grapes (like pomegranate), the hybrid DRX-M3-3-1 stood out with 9.3 points.

Obviously, the representatives of the species *Vitis vinifera L.*: "Feteasca albă" and „Rară neagră" scored 9.9 points and 9.8 points, respectively, which fall within their traditional and typical values.

The intraspecific variety "Negru de Ialoveni" did not exceed the score of 8.9 points, being too tannic in taste and practically neutral in flavour.

Table 2. Organoleptic features distant hybrids of grapevine (*Vitis vinifera L. x Muscadinia rotundifolia* Michx.)

Form	Colour of grapes	Organoleptic features		
		Aroma	Taste	points
DRX-M4-578	Green-yellow	Floral	White fruits	8.9
DRX-M4-502	Green-yellow	White fruits	Summer apple	9.0
DRX-M4-571	Green-yellow	Floral	White sweet cherries	8.7
DRX-M4-660	Red-violet	Red fruits	Early plums	9.1
DRX-M4-609	Green-yellow	Neutral, light floral	Fruity	8.5
DRX-M4-580	Green-yellow	Wild flowers	Aronia, currant	9.5
DRX-M4-512	Green-yellow	Neutral, light floral	Quince, white fruits	8.8
DRX-M3-3-1	Red-violet	Blackthorn flowers	Early plums	9.3
Feteasca albă	Green-yellow	Wild flowers	Harmonious	9.9
Rară neagră	Red-violet	Black fruits	Rich, red fruits	9.8
Negru de Ialoveni	Red-violet	Neutral	Incense, red fruits	8.9

Table 3. Biomorphological features of distant hybrids of grapevine (*V.vinifera L. x M.rotundifolia* Michx.)

Form	Bunch of grapes		Grape	Seed		
	Length (cm.)	Compact.	Size (mm)	Number	Length (mm)	Weight (mg)
DRX-M4-578	17	130	20.0	1-2	7.0	50.0
DRX-M4-502	12	70	20.0	1-2	6.0-7.0	40.0
DRX-M4-571	17	130	21.0	1-2	6.0-7.0	50.0
DRX-M4-660	20-25	130-150	21.0	1-2	5.0-6.0	50.0
DRX-M4-609	16	100	19.0	1-2	6.0	40.0
DRX-M4-580	15	90	17.0	1-2	7.0	40.0
DRX-M4-512	14	90	22.0	1-2	7.0	55.0
DRX-M3-3-1	10	70	10.0	1-2	4.0	40.0

As for the biochemical and physicochemical indicators, according to the concentration of organic acids (tartaric and malic acid) all distant hybrids can be attributed to European vine species *Vitis vinifera L.*, the tartaric acid varying in the range of 3.2 g /dm³ up to 4.7 g/dm³ and malic acid varying from 1.9 g/dm³ up to 3.1 g/dm³ (Table 4.).

Table 4. Acidity

Hybrid	Titratable acidity, g/dm ³	pH	Tartaric acid, g/dm ³	Malic acid, g/dm ³
DRX-M ₃ -3-1	5.5	3.6	4.7	2.9
DRX-M ₄ -502	6.0	3.5	3.7	2.4
DRX-M ₄ -512	6.8	3.1	4.1	3.1
DRX-M ₄ -571	6.6	2.9	4.1	2.7
DRX-M ₄ -578	6.1	3.3	3.2	2.1
DRX-M ₄ -580	6.2	3.1	4.3	2.4
DRX-M ₄ -609	5.9	3.4	3.7	1.9
DRX-M ₄ -640	6.4	3.0	4.5	2.9

The glucose and fructose concentration constitute on average 95.5 - 99.3% of the total concentration of sugars (100%).

The glucose / fructose ratio is typical for European vine varieties, varying in the range of 1.04 - 1.17 (Table 5.).

Table 5. Sugars

Hybrid	Sugars, g/dm ³	Glucose, g/dm ³	Fructose, g/dm ³
DRX-M ₃ -3-1	166	84.2	80.5
DRX-M ₄ -502	163	85.5	74.1
DRX-M ₄ -512	159	82.0	70.3
DRX-M ₄ -571	144	77.1	65.8
DRX-M ₄ -578	158	81.3	69.7
DRX-M ₄ -580	167	84.8	80.7
DRX-M ₄ -609	163	83.7	78.3
DRX-M ₄ -640	151	78.8	70.5

The concentration of phenolic substances denotes the belonging of the obtained distant hybrids to the varieties of table grapes. The amount of these substances in distant hybrids of vine with green-yellow berries varies within the limits from 201 mg/dm³ up to 293 mg/dm³ and for hybrids with berries with a red-violet hue - from 777 mg/dm³ up to 809 mg/dm³ (Table 6.)

Table 6. Chemical properties

Hybrid	Phenolic substances, mg/dm ³	Resveratrol, mg/dm ³	Pectins, mg/dm ³
DRX-M ₃ -3-1	809	8.5	714
DRX-M ₄ -502	292	8.1	580
DRX-M ₄ -512	288	6.6	517
DRX-M ₄ -571	263	5.7	703
DRX-M ₄ -578	274	7.3	647
DRX-M ₄ -580	293	6.8	439
DRX-M ₄ -609	201	7.7	516
DRX-M ₄ -640	777	11.7	697

It is worth mentioning that the resveratrol concentration, as a biological compound for human nutrition, is relatively higher compared to classical vine varieties (4.1 - 5.3 mg/dm³) and it varies at distant hybrids within the limits from 5.7 mg/dm³ to 11.7 mg/dm³ (Table 6.)

According to physical and biochemical indices of the berries of the studied distant hybrids, their characteristics are similar to European vine varieties: the total nitrogen varies within the limits from 563 mg/dm³ until 740 mg/dm³, phosphorus - 179-263 mg/dm³, calcium 107-156 mg/dm³, potassium - 1367-2013 mg/dm³ and magnesium - 103-144 mg/dm³ (Table 7.).

The colour of vine berries is a very stable morphological character. This index has not only a practical significance for winemaking, but is also used as a character of determination and classification of species and varieties of vine. Some grape varieties can be distinguished only by the colour of the berries.

Table 7. Chemical properties

Hybrid	N, mg/dm ³	P, mg/dm ³	Ca, mg/dm ³	K, mg/dm ³	Mg, mg/dm ³
DRX-M ₃ -3-1	563	263	156	2013	109
DRX-M ₄ -502	590	199	117	1710	123
DRX-M ₄ -512	591	240	109	1907	151
DRX-M ₄ -571	621	213	121	1415	103
DRX-M ₄ -578	640	240	131	1800	110
DRX-M ₄ -580	611	179	127	1881	144
DRX-M ₄ -609	583	186	141	1919	119
DRX-M ₄ -640	740	223	107	1367	127

Analyzing the physicochemical characteristics of the berries of distant hybrids of vine (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.), in comparison with the berry colour, it was found that the concentrations of chemical substances: phenolic substances, resveratrol, pectin etc. vary depending on the colour of berries.

The concentration of phenolic substances in berries of distant hybrids of vine varies depending on their colour: distant hybrids with green-yellow berries contain on average 268.5 mg/dm³ phenolic substances and distant hybrids with red-violet berries contain on average 793 mg/dm³.

The resveratrol concentration also varies from 7.03 mg/dm³ in berries with a green-yellow hue to 10.1 mg/dm³ in berries with a red-violet hue.

The mass concentration of pectins also varies from the 567 mg/dm³ in berries with a green-yellow hue to 705.5 mg/dm³ in berries with a red-violet colour. (Fig.3.)

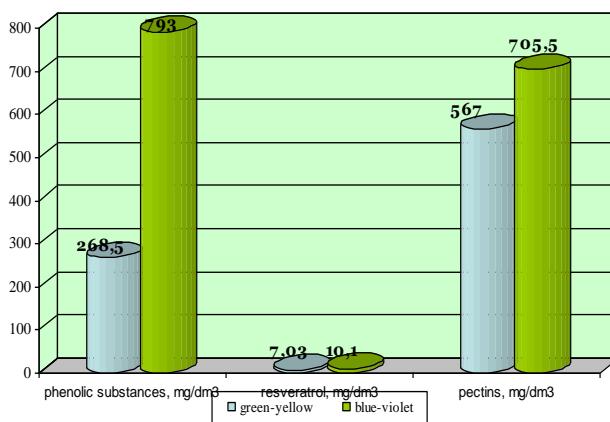


Fig. 3. Physico-chemical peculiarities depending on the color of distant hybrids berries (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.)

Climatic conditions characteristic, the average air temperature for the period from June to August, in Moldova, was higher than normal values with 3.0 to 4.5 °C and it was +21.7 ...

+24.8 °C.

In June, the average air temperature was higher than normal values with 2.9 - 4.4 °C, and, it was +20.7 ... +24.0 °C.

The average daily air temperature in June reached +29 ... +31 °C on the territory of Republic of Moldova and the maximum air temperature this month reached +37.2 ...+40.1 °C.

July was the warmest month of this year, with a monthly average air temperature of +23.7...+26.7 °C, exceeding the norm with 4.3 - 5.7 °C.

The abnormally warm weather continued in the first 10 days of august. The average air temperature was +24.1...+27.5 °C; so, it was with 4.1 - 5.6 °C higher than the normal temperature at this time.

In the summer, the maximum soil surface temperature reached the value of 71 °C. The number of days with the maximum air temperature of +30 °C and higher in this summer was 39-62 days (while the norm is about 8-27 days). The number of days with temperatures of 35 °C and higher was generally 16-35 days (the norm is about 1-2 days). Values of air temperature of +40 °C and higher were registered on 40% of the country for the first time, the number of days with such values being 1-3 days.

The quantity of rainfall during the summer in the country was basically 70-145 mm (35-70% of the norm). The total number of days without precipitations throughout the season was about 60 days.

Taking into account the weather conditions during June - August 2012, it was established that the most part of the country showed strong and very strong drought. The hydrothermal coefficient for that period averaged 0.5, which corresponds to strong and very strong drought.

In such climatic conditions, mixed vine varieties acquire easily specific characteristics of table grape varieties and acquire less characteristics of the varieties used in industrial processing (they have less juice and berries are crunchy).

In the years with high humidity and moderate temperatures, the opposite phenomena are observed: pulp is less crunchy and is juicier;

the juice is more acidic, with lower carbohydrate concentration [12].

CONCLUSIONS

The distant hybrids of vine (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) are scion-rooted, are resistant to phylloxera; from organoleptic point of view, these hybrids don't have the specific characteristics of direct production hybrids, characterised by the foxat taste of the grape berries (caused by the presence of methyl anthranilate) or herbaceous taste (hexane, hexene, and cis- and trans-derivates).

The distant hybrids of vine (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.), studied according to classical uvologic and technological principles, are classified in the following way: 5 distant hybrids are attributed to the table grapes varieties and 2 distant hybrids possess mixed properties (for current consumption and industrial processing).

From organoleptic point of view, the studied distant hybrids of vine (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) don't posses characteristic features of direct production hybrids, which have a specific taste of foxat (due to the presence of the methyl anthranilate) or herbaceous taste (hexanal, Hexenal, cis-and trans-derivates).

According to the concentration of organic acids (tartaric and malic acid), all distant hybrids can be attributed to European vine species *Vitis vinifera* L., the tartaric acic ranging from 3.2 g/dm³ to 4.7 g/dm³ and the malic acid - from 1.9 to 3.1 g/dm³.

The most distant hybrids have crunchy pulp and the taste of the juice is pleasant, harmonious, fresh (with moderate acidity), sometimes sweet and soft (DRX-M₄-609; DRX-M₃-3-1).

Based on analyzes of biochemical constituents of grapes of distant hybrids DRX-M4-578; - 502; -571; -660; -609; -580; -512; - M3-3-1 etc. in comparison with the classic cultivars „Feteasca albă” and „Rară neagră” it was found that these cultivars are similar.

The distant hybrids of grapevine *Vitis vinifera* L. x *Muscadinia rotundifolia* Michx. haven't

inherited unwanted characters for vines, some of them are strictly limited (diglucoside-3,5-malvidin).

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