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THE AROMATIC SPECTRUM OF THE BERRIES OF THE INTERSPECIFIC RHIZOGENE GENOTYPES OF GRAPEVINE

Annotation. *The aromatic compounds are formed in the berries, and during the development and ripening of the berries, depending on the fluctuations of the climatic factors, they form the aroma specific to the grapevine genotype and, as a result of the processing, they form the bouquet of the derived product. Grape vine berries mostly contain the same aromatic chemical compounds, the specific aroma is only due to their different weight within the aromatic complex of each genotype. The purity and accent of the aromas of a certain genotype depends on the degree of ripening of the berries, the phytosanitary level and the climatic factors of the cultivation environment. The aim of the present study is to determine and analyze the aromatic spectrum of the chemical compounds in the bacilli of interspecific rhizogenic vine genotypes.*

Keywords: aroma, berry, chemical compound, genotype, rhizogen.

Introduction. During the development and ripening of berries, depending on the fluctuations of climatic factors, the aroma characteristic of the grape genotype is formed, and as a result of processing the grapes, a bouquet of young wine is formed. Grape berries contain, for the most part, the same aromatic chemical compounds, however, the specific aroma is due not only to their different mass concentrations, but also to their ratios in the aromatic complex of each genotype. The specific shade of the aromas of the specific genotype and the accent of the aromas of the specific genotype depend to a greater extent on the transfer of hereditary traits from the parent pairs of crossing, the degree of ripening of the berries, the phytosanitary level of the plantations and the influence of the factors of the growing environment. The purpose of this research is the definition and comparative analysis of aromatic compounds in berries of rhizogenic interspecific grape genotypes in comparison with intraspecific genotypes.

Materials and methods. The interspecific rhizogenic grapevine genotypes (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) approved in the Republic of Moldova served as the object of study: Amethyst (blue-violet berry); Alexandrina, Augustina, Malena, Nistreana, Algumax, Sarmis (green-yellow berry) [1, 2]. From the *Vitis vinifera* L. group, the indigenous varieties: Feteasca alba and Feteasca neagra, Malbec and Cabernet-Sauvignon. Complex interspecific genotypes Rithon and Legenda. The Shimadzu GC analysis system and the GC/MS-QP2010 Plus mass spectrometer, equipped with the AOC-500 sample injection complex, were used to determine the volatile compounds with aromatic potential. For micro-extraction in the solid phase, Carboxen PDMS with dimensions of 100 µm was used, with which the volatile compounds were extracted in concentrations of 10 ppv and 10 ppm. Data analysis was performed using the Software GC/MS Solution system (Shimadzu), equipped with SCAN/SIM (FASST) [3, 4].

Results and discussion

Aromatic compounds (odorant chemicals) accumulate in the berries, which in turn form the aroma specific to the genotype. During the period of development and ripening of the berries, primary (varietal) aromas are formed, then secondary aromas are formed as a result of processing and alcoholic fermentation, finally, as a result of keeping the derived product in wooden vessels (maturation) and then keeping it in glass vessels (aging) tertiary aromas are formed, and these in turn finalize the bouquet of the derived product. The purity and accent of the aromas of a certain genotype depends on the degree of ripening of the berries, the phytosanitary level and the climatic

factors of the cultivation environment. However, the final aromatic bouquet depends on the initial volatile chemical compounds.

The qualitative comparative analysis regarding the concentration of odorant substances allows the detection of increased concentrations of cis-3-hexenal-1-ol ($31.3 \pm 0.21 \text{ mg/dm}^3$ for the Amethyst variety and $66.9 \pm 0.08 \text{ mg/dm}^3$ for Cabernet-Sauvignon), which reproduces the shade of grass or unripe fruit. An essential component, such as linolol, is present in an amount of $20.1 \pm 0.6 \text{ mg/dm}^3$ in the Feteasca Neagră variety and $42.0 \pm 0.11 \text{ mg/dm}^3$ in the Cabernet-Sauvignon variety, which renders shades of basil or lavender. But quite high concentrations were found for chemicals such as nodientiol -1 ($113.4 \pm 0.007 \text{ mg/dm}^3$ in the berries of the Amethyst variety and much lower $78.8 \pm 0.03 \text{ mg/dm}^3$ in the Malbec variety). It is also necessary to mention that diethylsuccinate is present in an amount of $550.3 \pm 0.029 \text{ mg/dm}^3$ in the Malbec variety and $447.0 \pm 0.03 \text{ mg/dm}^3$ in the Amethyst variety, and gamma-butyrolactone in the berries of the Amethyst variety add up to $1139.0 \pm 0.0029 \text{ mg/dm}^3$, and for the Malbec variety – $970.4 \pm 0.019 \text{ mg/dm}^3$.

Analyzing some chemical compounds from the wine obtained from the Amethyst variety, the following was found: alcohol 14.6% vol., sum of phenolic substances 972 – 1002 mg/dm^3 , drawable acidity 5.3 g/dm^3 , ph – 3.63-3.64, sum of sugars – 2.2-2.4 g/dm^3 , tartaric acid – 5.3 g/dm^3 , malic acid – 0.39-0.46 g/dm^3 , volatile acidity – 0.45-0.47 g/dm^3 , dibutyl glycerol – 11.2-11.4 g/dm^3 .

From an organoleptic point of view, the dry red wine obtained from the grapes of the Amethyst variety is characterized by an increased intensity of astringency and extravitality. In the young wine, nuances of aromas of black berries can be felt.

Based on the exposed results of the odorant nuances, it was found that the aromatic spectrum of the Amethyst variety does not differ essentially compared to the classic varieties such as Feteasca Neagră, Cabernet-Sauvignon and Malbec.

The aromatic samples showed that in all analyzed grapevine genotypes aromas with fruity nuances dominate. Analyzing the aromatic spectrum of the juice of the yellow-green berries of the grapevine genotypes included in the study, it was found that the nuances of vegetable and floral aromas of the interspecific grapevine genotypes do not yield to varieties such as Feteasca Albă, Riton and Legenda.

Conclusions

1. Climatic changes impose the need to review the assortment and areas of vine cultivation.
2. The chemical analysis of the aromatic spectrum of the interspecific rhizogenic variety Amethyst allowed to establish the fact that little differs from the aromatic spectrum of grapevine varieties such as Cabernet-Sauvignon, Feteasca Neagra and Malbec.
3. The interspecific rhizogenic genotypes of vines Amethyst, Alexandrina, Sarmis, Augustina, etc. can be used in the creation of organic vine plantations.

Table 1.1

The chemical compounds in blue-violet berries that form floral aromas

Flavor	Chemical compounds	Grapevine genotypes			
		Ametist	Feteasca Neagră	Cabernet-Sauvignon	Malbec
Citrus – floral	Nerol	7,5+/-0,3	6,9+/-0,4	6,3+/-0,31	2,9+/-0,14
Basil – floral – levander	Linalool	21,4+/-0,14	20,1+/-0,8	4,2+/-0,11	3,8+/-0,09
Bergamot – floral – orange	Alpha - terpeniol	6,3+/-0,4	4,9+/-0,3	7,2+/-0,2	5,4+/-0,7
Floral	Trans - 8 dihydrosilinalool	14,1+/-0,1	10,7+/-0,9	19,4+/-0,7	17,6+/-0,3
Floral – lily of the valley	Endiol	5,4+/-0,3	4,1+/-0,2	6,6+/-0,4	3,9+/-0,4
Floral – pelargonium – rose	Geraniol	9,6+/-0,9	8,8+/-0,4	11,7+/-0,09	7,8+/-+/-0,9
Rose	Cis - 8 - dihydrosiralol	29,2+/-1,3	19,4+/-0,7	21,3+/-0,06	17+/-0,09
Rose – fruits	Citronellol	11,4+/-0,8	7,3+/-0,3	17,9+/-0,07	14,4+/-0,03
Viola – forest fruit	Beta - ionone	< 1,0+/-0,1	< 1,0+/-0,1	2,9+/-0,07	3,1+/-0,05
Floral – fruits	3 - oxo - alpha - ionol	3,7+/-0,3	2,5+/-0,6	3,9+/-0,4	2,8+/-0,6
Rose – bee honey	Beta - damascenon e	2,9+/-0,2	1,1+/-0,1	2,2+/-0,3	1,7+/-0,7
Viola – fruits	Beta - ionone	1	1	2,3+/-0,2	0,9+/-0,8
Rose – bee honey – tabaco	Ethyl-phenyl-acetate	3,9+/-0,6	2,7+/-0,3	3,3+/-0,6	2,0+/-0,02
Carnation	Eugenol	2,3+/-0,2	1,9+/-0,1	4,9+/-0,7	2,4+/-0,9
Orange flowers - honey bees	Phenyl acetate-aldehyde	5,5+/-0,9	3,9+/-0,3	6,2+/-0,2	4,4+/-0,8

Table 1.2

The chemical compounds in blue-purple berries that form vegetable flavors

Flavor	Chemical compounds	Grapevine genotypes			
		Ametist	Ametist	Ametist	Ametist
Unripe fruits – herbs	Cis - 3 - hexene - 1 - ol	31,3+/-0,21	51,9+/-0,7	66,9+/-0,08	55,3+/-0,07
Camphor – woody	Actindiolo 1	< 1	< 1	< 1	< 1
Camphor – woody	Actindiolo 2	1,7+/-0,2	1,9+/-0,1	2,7+/-0,3	2,9+/-0,8
Camphor – eucalyptus	Vitispirin - 1	2,0+/-0,2	< 1,0+/-0,1	2,7+/-0,2	0,9+/-0,3
Camphor – eucalyptus	Vitispirin - 2	3,2+/-0,1	1,9+/-0,3	3,3+/-0,6	2,4+/-0,4
Woody – divin	Ethyl - lactat e	1494+/-0,0039	1424+/-0,0021	1559+/-0,0043	1434,4+/-0,029
Birch tree	Ethyl - 3 - hydroxybutanoate	231+/-0,019	217+/-0,014	420,7+/-0,091	370,7+/-0,039
Peppermint	Methyl - salicytat	4,3+/-0,7	5,6+/-0,8	7,9+/-0,3	4,4+/-0,07
Green tea	Methyl - vanillin	28,7+/-0,12	35,6+/-0,18	49,3+/-0,06	33,0+/-0,06

Table 1.3

The chemical compounds in the blue-purple berries that form fruity flavors

<i>Flavor</i>	<i>Chemical compounds</i>	<i>Grapevine genotypes</i>			
		<i>Ametist</i>	<i>Ametist</i>	<i>Ametist</i>	<i>Ametist</i>
Muscat	No - diendiol - 1	113,4+/-0,007	79,3+/-0,09	83,8+/-0,07	71,8+/-0,03
Muscat	No - diendiol - 2	5,9+/-0,6	3,1+/-0,1	4,4+/-0,6	3,9+/-0,7
Fruits	Diehyil succionat	447+/-0,051	523+/-0,049	490,7+/-0,037	550,3+/-0,029
Coconut	Gamma - nanolactone	10,8+/-0,17	9,6+/-0,9	21,1+/-0,012	18,8+/-0,07
Peach	Gamma - butyrolactone	1139+/-0,029	1055+/-0,077	1017,2+/-0,0013	970,4+/-0,019
Banana	Ethyl - 2 - hydroxyvalerianate	5,5+/-0,3	6,6+/-0,7	7,9+/-0,6	5,4+/-0,8
Fruit – apple	Ethyl - hexanoate	159+/-0,011	143+/-0,05	219+/-0,013	198,2+/-0,039
Fruit – vine grapes	Ethul - decanoate	88,9+/-0,02	77,1+/-0,03	168+/-0,044	90,3+/-0,37
Kiwi – banana – pineapple	Ethyl - butanoate	107,3+/-0,031	91,4+/-0,04	99,3+/-0,03	87,8+/-0,21
Pear – apple – pineapple	Ethyl - acetate	9,0+/-0,3	7,8+/-0,2	17,7+/-0,09	12,0+/-0,07
Fruity – balsamic	Benzyl alcohol	417+/-0,031	431+/-0,034	569,4+/-0,029	467,1+/-0,072
Fruity – herbaceous – apple	Trans - 3 - hexen - 1 - ol	33,7+/-0,22	51,4+/-0,25	67,7+/-0,09	49,0+/-0,06
Bitter almond	Benzaldehyde	8,1+/-0,4	8,7+/-0,5	11,0+/-0,02	13,7+/-0,09
Vanilla	Vanillin	14,3+/-0,19	11,5+/-0,15	21,6+/-0,07	17,3+/-0,04

Table 2.1

The chemical compounds in the yellow-green berries that form floral aromas

<i>Flavor</i>	<i>Chemical compounds</i>	<i>Augustina</i>	<i>Malena</i>	<i>Nistreaă</i>	<i>Alexandrina</i>	<i>Algumax</i>	<i>Sarmis</i>	<i>Feteasca Albă</i>	<i>Riton</i>	<i>Legenda</i>
Orange flowers – bee honey	Phenyl – acetate – aldehyde	3,4	3,1	4,0	3,9	2,9	3,3	4,1	4,4	5,7
Flowers – herbs	1–hexanal	1120	1188	1730	1449	1340	1517	1498	1537	1548
Rose – bee honey	B – phenyl – ethyl – acetate	141	179	149	192	129	163	407	498	551
Carnation	Eugenol	3,4	3,9	1,9	2,3	2,9	1,2	2,9	4,0	4,4
Rose – bees honey – tobacco	Ethyl – phenyl – acetate	3,7	3,0	2,7	3,2	2,9	2,0	3,7	4,0	4,7

Table 2.2

The chemical compounds in the yellow-green berries that form vegetable flavors

<i>Flavor</i>	<i>Chemical compounds</i>	<i>Augustina</i>	<i>Malena</i>	<i>Nistoreană</i>	<i>Alexandrina</i>	<i>Algumax</i>	<i>Sarmis</i>	<i>Feteasca Albă</i>	<i>Riton</i>	<i>Legenda</i>
Peppermint – spices	Metil – saliacetat	7,3	6,6	5,9	7,8	7,9	4,6	2,5	3,1	2,8
Woody – divin	Etil – lactat	2231	2114	2300	2278	2170	1949	2340	2248	2349
Green tea	Metil – vanilin	22,5	20,7	16,3	19,1	11,7	10,1	16,6	21,9	23,4

Table 2.3

The chemical compounds in the yellow-green berries that form fruit flavors

<i>Flavor</i>	<i>Chemical compounds</i>	<i>Augustina</i>	<i>Malena</i>	<i>Nistoreană</i>	<i>Alexandrina</i>	<i>Algumax</i>	<i>Sarmis</i>	<i>Feteasca Albă</i>	<i>Riton</i>	<i>Legenda</i>
Fruity – balsamic	Benzyl alcohol	43,5	37,4	39,2	40,0	41,4	50,2	56,2	59,3	60,3
Fruity - herbaceous - apple	Trans – 3 hexaen – 1 – ol	50,3	54,2	61,4	59,2	61,1	66,9	51,3	49,3	50,4
Fruity – apple	Ethyl – hexanoate	149	123	151	133	147	130	155	163	169
Fruity – vine grapes	Ethyl – decanoate	70,7	63,9	77,7	69,9	557	50,5	60,3	69,8	72,7
Kiwi - banana - pineapple	Ethyl – butanoate	261	244	229	266	240	179	240	233	251
Pear - apple - pineapple	Ethyl – acetate	9,3	10,4	11,3	14,2	7,9	7,3	11,8	10,9	12,4
Bitter almond	Benzaldehyde	3,3	2,9	2,8	3,6	3,3	2,9	2,7	2,2	2,4
Strawberry	Furaneol	15,7	14,3	16,3	15,5	14,7	13,4	16,3	17,0	19,7
Vanillin	Vanillin	11,7	12,4	10,9	11,1	10,9	9,3	13,3	14,9	15,5

Table 2.4

The chemical compounds in the yellowish-green bath, which form specific aromas

<i>Flavor</i>	<i>Chemical compounds</i>	<i>Augustina</i>	<i>Malena</i>	<i>Nistoreană</i>	<i>Alexandrina</i>	<i>Algumax</i>	<i>Sarmis</i>	<i>Feteasca Albă</i>	<i>Riton</i>	<i>Legenda</i>
Boiled potato	Methionol	1137	1049	1207	1216	1141	1316	1014	1037	1011
Bese	Etil – 3 – hidroxibutonoat	148	113	140	188	193	201	258	266	249
Burnt	Furorurool	10,4	11,0	9,7	8,8	7,3	9,2	10,4	9,2	8,8
Pressed cheese	Hexanoic acid	1437	1520	1240	1340	1341	1144,9	1244	1349	1149
Pressed cheese	Octanoic acid	2349	2916	2130	3040	2411	2179	2140	2749	3020
Of smoke	Phenol	1,7	1,4	1,6	1,4	1,9	2,0	1,5	1,3	1,6

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АРОМАТИЧНИЙ СПЕКТР ЯГІД МІЖВИДОВИХ РИЗОГЕННИХ ГЕНОТИПІВ ВИНОГРАДУ

Ароматичні сполуки утворюються в ягодах, а в процесі розвитку і дозрівання ягід, залежно від коливань кліматичних факторів, формують аромат, властивий генотипу виноградної лози, а в результаті обробки формують букет похідного продукту. Ягоди виноградної лози містять здебільшого однакові ароматичні хімічні сполуки, специфічний аромат зумовлений лише різною вагою в ароматичному комплексі кожного генотипу. Чистота й акцент ароматів певного генотипу залежить від ступеня стиглості ягід, фітосанітарного рівня і кліматичних факторів середовища вирощування. Метою даного дослідження є визначення та аналіз ароматичного спектра хімічних сполук у бацилах міжвидових ризогенних генотипів винограду.

Ключові слова: аромат, ягода, хімічний склад, генотип, ризоген.