# AROMATIC COMPOUNDS OF WINE OBTAINED FROM THE NEW VARIETY OF DOMESTIC SELECTION VIORICA

***Rusu Emil, Obadă Leonora, Dumanov Veronica, Cibuc Mariana**

„Practical Scientific Institute of Horticulture and Food Technology" – Chişinău, Moldova

***Rusu Emil, oenologie_vdo@mail.ru**

**Abstract:** The aromatic compounds of the wine obtained from the new variety of domestic selection Viorica have been subjected to researches. The analysis was carried out on gas chromatograph with mass spectrometer Clarus 600 T. About 100 compounds have been identified. The identification of chromatographic peaks (drops) has been conducted under the general library of NIST mass spectrometer. The researches have shown that the composition of aroma (flavor) of Viorica wine is very complex and consists of compounds of different classes: aldehydes, ketones, higher alcohols, esters, terpenes, organic acids, lactones etc. The main compounds of aroma are the higher alcohols: isoamylic and 2-phenylethanol, the percentage share of which is 46%. These compounds form the basis (core) of wine flavor, which is completed by other aromatic compounds such as esters, terpenes, acetals etc.
**Key words:** aroma complex, aldehydes, ketones, chromatograph, high alcohols.

The aromatic substances have a special role to form the wine quality. It is known the fact that [Ţîrdea C., 2007; Rusu E., 2011] the wine aroma consists of compounds (aromatic (flavored) substances) which derive from grapes (primary aromas (flavors), arisen during the alcoholic fermentation (secondary aromas (flavors) and during the period of maturation-storage of wine (tertiary aromas (flavors).

In turn, the aromatic complex of wines is very rich and consists of substances that are part of different classes. So far there have been identified more than 500 odorous substances which, individually or in combination within a great diversity and complexity of mixtures, are able to give about 10.000 fragrant scents to wine [Cotea, V. D. and col., 2009].

On the other hand, the established range of varieties is always subject to the review and completion with new varieties that are of interest. In recent times, on a worldwide scale, more and more countries outline some varieties, so-called "national", on account of which the wine brand is being created. Most of these are local varieties, less known to wine consumers. At this compartment the Republic of Moldova also has some new varieties of domestic selection, which are invaluable (Ţuţuc V. and col., 1998; Apruda P., Berezicov M., 2002).

Unlike wines made from classic varieties, the aromatic complex of those derived from new varieties of selection has not been studied at the fair value thereof. In this context, there shall be mentioned the study of aromatic compounds of Viorica wine conducted by Ajoghina B.A. and Agheeva N.M. (1998). There have been identified 29 compounds belonging to different classes.

Unlike the methods of analysis of aromatic compounds from the 90's, the methods used today are much more sophisticated, especially when coupling the mass spectrometer to the chromatograph. In this context, we consider it appropriate to conduct a study on the aromatic composition of the Viorica wine using such modern devices.

**Materials and methods**

The object of researches was the sample of wine derived from the new variety of selection Viorica during the wine campaign in 2010.

For a depth research of the aromatic complex, the obtained wine was passed through a cartridge type DIAPAC which consists of extra-reticulated polystyrene of hydrophobic nature, activated pursuant to a special treatment scheme. The elution of aromatic substances adsorbed on the surface of cartridge was performed with a mixture of acetated ethyl and pentane in a 1:1 ratio. The analysis of eluent was made by means of the gas chromatograph with the mass spectrometer Clarus GooT, column PE-WAX ETER with a length of 50 m and inner diameter of 0.32 mm. Analysis conditions: bearer of gas-helium, evaporation room temperature – $220^0$C, column temperature – $75^0$C, heating range – $4^0$C/min up to the temperature of $225^0$C. The identification of chromatographic peaks (drops) was made according to the general library of NIST mass spectrometer.

The researches have been carried out in the laboratory of Oenology and Wines with Origin Name of the Practical Scientific Institute of Horticulture and Food Technologies and the Practical Scientific Institute of Fruit Growing (Pomiculture) and Viticulture of Northern Caucasia of the Agricultural Academy of Russia, Russian Federation.

**Results and discussions**

The wine obtained from Viorica variety, from olfactory point of view, is characterized by a very fine aroma (flavor), with intense scents of savory (thyme) in combination with the balsamic ones.

The composition of aromatic compounds examined shows that the highest percentage share is reached by the higher alcohols, and namely the isoamylic alcohol – 31,853%, 2-phenylethanol – 15,773% and isobutanol – 1,143%. But the olfactory characteristics of these alcohols are not far balsamic ones. The isoamylic alcohol is distinguished by its fruitiness, the 2-phenylethanol has a general pleasant aroma (flavor), and the isobutanol has no flavor. As mentioned by Cotea V. D. and col. (2009) the 2-phenylethanol plays an essential role in the formation of wine aroma (flavor), but without giving a certain characteristic feature. From the total number of identified compounds, 27 belong to esters, those with a higher proportion being the mono-Ethyl succinate, ethyl lactate, ethyl propanoate, isoamyl acetate, diethyl succinate, ethyl-4-hydroxy butanoate, 1,4-butanediol-diacetate. From these esters, the mono-Ethyl succinate has a great contribution to the formation of aroma (flavor), the ethyl acetate has a pleasant and fine flavor, the isoamyl acetate – flavor of banana, pear, wild strawberries, diethyl succinate – bunch of maturation, diethyl malate – pleasant odor.

About half of the percentage proportion of compounds identified in the aromatic extract of Viorica wine constitutes the higher alcohols. Of these compounds, three compounds outline to have the large proportion: isoamylol (31,253%), 2-phenylethanol (15,773%) and isobutanol (1,143%). The proportion of the other higher alcohols is under 1%. Given the large share of higher alcohols we suppose that they have an important role in creating the olfactory peculiarities of wine. In this context there shall be noted the influence of some higher alcohols on aroma (flavor), such as: 2-phenylethanol which has a pleasant characteristic odor, the phenylethanol with a pleasant aroma, heptane-2-ol,-1,7,7-trimethyl – canfor aroma, the isoamylol which has a pleasant characteristic (fruitful) odor.

The results obtained as regards the proportion of some higher alcohols in the aroma (flavor) composition are confirmed and supported by data from literature. Thus, Ajoghina B.A. and col. (1995) confirms that, from the summary quantity of those 29 compounds determined in Viorica wine, 54% fall on those three higher alcohols (isoamylic, 2-phenylethanol, isobutanol).

A key contribution on the aromatic character belongs to the terpenic compounds, although the content thereof is low. The following terpenes have been identified in the aroma of Viorica wine: β-mircene, limonene, cimene, cis-Linalool oxide, linalool, hotrienol, 2,6-dimethyl-3,7-octadien-2,6-diol, geraniol, 3,7-dimethyl-1,7-octadien-3,6-diol, α-Terpineol. These compounds have pleasant aromas (flavors) of Muscat, coriander, lilac, rose and positively influence upon wine flavor.

The ketones identified in the aromatic extract are: α-butanone, 3-methyl-2-butanone, 2-pentanone, 2-methyl-3-pentanone, 3-methyl-2-pentanone, 3-etoxy-2-butanone, 2,2-dimethyl-4-hydroxy-3-hexanone, 2-heptanone, 1-methoxy-1-octen-4one. Despite the fact that the ketones are in small quantities, they give to wine a pleasant flavor, dominated by scents of fruits, conveyed by 2-heptanone.

As concerns the aldehydes, there shall be outlined that only four substances have been found in the aromatic extract, and namely the nonanal, possessing an odor of rose, flags (irises) and mandarins, the furfuralul with a pleasant fragrant of fresh bread, benzaldehyde – bitter almonds and 2-phenylacetaldehyde with odor of Zambia.

Among the organic acids the percentage proportion falls on the acetic acid – 9,290%. The presence of this acid in a relatively large quantity is benefic for wine aroma (flavor), because, in the opinion of Cotea V. D. and col. (2009), it is a good solvent for oils, amplifying the olfactory sense. An another organic acid which shall be mentioned is the hexanoic acid with a pineapple flavor, the propanoic acid with a very characteristic flavor, n-butyric acid – fragrant flavor, 3-methylbutyric acid – valerian scent. The other saturated and unsaturated acids have a lower influence on the composition of aroma (flavor).

There have been identified two compounds from the category of lactones: butyrolactone, which has a complex, wine-like odor, and (S)-(+)-2,3-dideoxy ribonolactone, which gives a pleasant flavor to the wine. The percentage share of the last lactones is relatively high and is 0,929%.

***Table.*** Volatile compounds determined in the aromatic extract of Viorica wine

| No. | Aromatic compound | Share | Category |
|---|---|---|---|
| **1** | **2** | **3** | **4** |
| 1 | Acetone | 0,043 | Ketones |
| 2 | 1,1-dietoxymetan | 0,029 | Acetals |
| 3 | 2-butanone | 2,361 | Ketones |
| 4 | 3-methyl-2-butanone | 0,449 | Ketones |
| 5 | 2,4,5-trimethyl-1,3-dioxolane | 0,003 | Odor oxides |
| 6 | Ethyl propionate | 0,801 | Esters |
| 7 | Propanoic acid | 0,008 | Organic acids |
| 8 | Propyl acetate | 0,011 | Esters |
| 9 | 2-butyl acetate | 0,016 | Esters |
| 10 | 2-pentanone | 0,019 | Ketones |
| 11 | 2-methyl-3-pentanone | 0,014 | Ketones |
| 12 | Isobutyl acetate | 0,008 | Esters |

| 13 | 2-butanol | 0,123 | Higher alcohols |
|---|---|---|---|
| 14 | 2-methyl-3-buten-2-ol | 0,010 | Higher alcohols |
| 15 | 3-methyl-2-pentanone | 0,006 | Ketones |
| **1** | **2** | **3** | **4** |
| 16 | Propanol | 0,082 | Higher alcohols |
| 17 | 1,1-detoxybutan | 0,004 | Acetals |
| 18 | Ethyl butyrate | 0,056 | Esters |
| 19 | Butyl acetate | 0,018 | Esters |
| 20 | Isobutanol | 1,143 | Higher esters |
| 21 | 3-etoxy-2-butanone | 0,012 | Ketones |
| 22 | Isoamyl acetate | 0,403 | Esters |
| 23 | Butanol | 0,057 | Higher alcohols |
| 24 | 2,2-dimethyl-4-hydroxy-3-hexanone | 0,009 | Ketones |
| 25 | β-mircen | 0,021 | Terpenes |
| 26 | 2-heptanone | 0,022 | Ketones |
| 27 | Isoamylol | 31,853 | Higher alcohols |
| 28 | Limonene | 0,022 | Terpenes |
| 29 | Ethylhexanoate | 0,122 | Esters |
| 30 | Pentanol | 0,023 | Higher alcohols |
| 31 | 3-Methyl-3-buten-1-ol | 0,003 | Higher alcohols |
| 32 | Hexyl Acetate | 0,006 | Esters |
| 33 | Ethyl pyruvate | 0,011 | Esters |
| 34 | Cimene | 0,001 | Terpenes |
| 35 | Cyclohexane | 0,009 | Hydrocarbons |
| 36 | 2-Heptanol (standard sol.) | 12,187 | - |
| 37 | 3-Methyl-1-pentanol | 0,024 | Higher alcohols |
| 38 | Hexanol | 0,317 | Higher alcohols |
| 39 | Ethyl lactate | 1,819 | Esters |
| 40 | trans-3-hexenol | 0,051 | Higher alcohols |
| 41 | 3-etoxypropanol-1 | 0,013 | Higher alcohols |
| 42 | cis-3-Hexen-1-ol | 0,014 | Higher alcohols |
| 43 | 1-methoxy-1-octen-4-one | 0,013 | Ketones |
| 44 | Nonanal | 0,012 | Pelargonic aldehyde |
| 45 | Ethyl Octanoate | 0,081 | Esters |
| 46 | cis-Linalool-oxide | 0,019 | Acyclic terpenes |
| 47 | Acetic acid | 9,290 | Volatile acids |
| 48 | Furfural | 0,001 | Aldehydes |
| 49 | Ethyl-3-hyroxibutanoate | 0,027 | Esters |
| 50 | Linalool | 0,173 | Terpenes |
| 51 | 2,3-Butanediol | 0,048 | Polyhydroxilic alcohols |
| 52 | Ethyl-2-hydroxycaproate | 0,014 | Esters |
| 53 | 1-Octanol | 0,007 | Higher alcohols |
| 54 | Benzaldehyde | 0,002 | Aldehydes |
| 55 | 2-methyltetrahdroxytiofen-3-ol | 0,014 | Sulfur compounds |
| 56 | Acetoin | 0,017 | Saturated ketones |
| 57 | Isobutyric acid | 0,094 | Organic acids |
| 58 | Hotrienol | 0,184 | Acyclic terpenes |
| 59 | 1-Methoxy-2-Butanol | 0,005 | Higher alcohols |
| 60 | Ethyl decanoate | 0,022 | Esters |
| 61 | Heptan-2-ol,1,7,7-trimethyl | 0,006 | Higher alcohols |

| 62 | Ethyl methyl succinate | 0,004 | Esters |
|---|---|---|---|
| 63 | N-butyric acid | 0,270 | Organic acids |
| 64 | Butyrolactone | 0,040 | Lactones |
| **1** | **2** | **3** | **4** |
| 65 | Diethyl succinate | 0,383 | Esters |
| 66 | 3-methyl butyric acid | 0,205 | Monocarboxylic acids |
| 67 | 2,6-dimethyl-3,7-octadien-2,6-diol | 0,089 | Terpenic alcohols |
| 68 | α-Terpineol | 0,166 | Terpenic alcohols |
| 69 | Methyl-3-tio-propanol | 0,012 | Thioether + alcohol |
| 70 | 1,3-propanediol diacetate | 0,124 | Esters |
| 71 | Citronellol | 0,010 | Terpenic alcohols |
| 72 | 2,7-dimethyl-4,5-octandiol | 0,011 | Polyhydroxilic alcohols |
| 73 | Diethyl glutarate | 0,003 | Esters |
| 74 | i-butyric acid | 0,066 | Saturated fatty acids |
| 75 | Ethyl-4-hydroxybutanoate | 0,128 | Esters |
| 76 | Methyl-2-hydroxybenzoate | 0,008 | Esters |
| 77 | Ethyl-2-fenilacetate | 0,040 | Esters |
| 78 | Geraniol | 0,233 | Terpenes |
| 79 | Hexanoic acid | 1,952 | Unsaturated mono-carboxylic acids |
| 80 | N-methyl butyl acetamide | 0,082 | Amides |
| 81 | 1,4-butanediol diacetate | 0,142 | Esters |
| 82 | Phenyl-methanol | 0,048 | Higher alcohols |
| 83 | 2-phenylethanol | 15,773 | Higher alcohols |
| 84 | 2,6-dimethyl-7-octen-2,6-diol | 0,126 | Unsaturated diols |
| 85 | S-N-(1-cyclohexanethyl)-acetamide | 0,008 | Amides |
| 86 | Diethyl malate | 0,997 | Esters |
| 87 | Octanoic acid | 2,501 | Unsaturated acids |
| 88 | 3,7-dimethyl-1,7-octadien-3,6-diol | 0,034 | Polyhydroxylic terpinolene |
| 89 | Diethyl-2-hydroxypentanedionate | 0,527 | Esters |
| 90 | 2-methoxy-4-vinylphenol | 0,356 | Volatile phenols |
| 91 | (S)-(+)-2,3-dideoxy ribonolactone | 0,929 | Lactones |
| 92 | Decanoic acid | 0,588 | Unsaturated acids |
| 93 | Ethyl-2-hydroxy-3-phenylpropanoate | 0,007 | Esters |
| 94 | 2-phenylethanal (2-Phenylacetaldehyde) | 0,047 | Aldehydes |
| 95 | trans-Geranic acid | 1,072 | Monocarboxylic acids |
| 96 | Mono-ethyl succinate | 7,968 | Esters |
| 97 | 2,3-Dihydrobenzofuran | 1,815 | Furans |
| 98 | Benzoic acid | 0,156 | Organic acids |
| 99 | N-(2-Phenylethyl)-acetamide | 0,017 | Amides |
| 100 | Ethyl-5-oxo-2-pirolidin Carboxylate | 0,835 | Amine + ester |

The aromatic extract of Viorica wine also consists of other compounds, such as 2,3-dihydrobenzofuran, which is the derivative of furan, having also a relatively large percentage share – 1,815%, methyl-3-thiopropanol, which is part of the category of thioethers and which has an odor of mown hay, 2,6-dimethyl-7-octen-2,6-diol, representative of diols and which is characterized by a terpenic character and 2-methoxy-4-vinylphenol, which is part of the volatile phenols.

## Conclusions

The study carried out has shown that the composition of aroma of Viorica wine is very complex and consists of compounds of different categories: aldehydes, acetones, higher alcohols, esters, terpenes, organic acids, lactones etc. The main compounds of aroma are the higher alcohols, isoamylic, 2-phenylethanol and isobutanol, which share percentage is 48,769%. The nominated compounds form the basis (core) of wine aroma, which is completed by other aromatic compounds. It was found that a numeric and quantitative representative class of wine aroma is the esters. Although the share percentage of terpenes in the aromatic composition is low, their contribution to the formation of aroma character of Viorica variety shall not be neglected. We assume that the balsamic character with scents of thyme is determined more by the interaction of aromatic compounds, in a large number, on the ground of main constituents – isoamylic, 2-phenylethanol and izobutanol acids.

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