Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 16, Issue 1, 2016
PRINT ISSN 2284-7995, E-ISSN 2285-3952

INTERSPECIFIC HYBRIDS OF VINES (*VITIS VINIFERA* L.x *MUSCADINIA ROTUNDIFOLIA* MICHX.) AND HEAVY METALS

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Abstract

The heavy metals, that are found in foods and in particular in wine, can lead to negative consequences for a significant excess of allowable doses. This the research study has been achieved aiming to determine the concentration of heavy metals in the berries juice of vines of the interspecific hybrids Vitis vinifera L. x Muscadinia rotundifolia Michx. compared to some varieties of the culture vines. The obtained results proves that berries juice of the hybrids distant of vines, hold heavy metals: Fe, Cu, Zn, Pb, Cd, As and Hg within limits lower than those accepted by the World Organisation of Vine and Wine. The concentration of heavy metals Fe, Cu, Zn, Pb, Cd, As and Hg from the juice of grapes of vines of the interspecific hybrids (Vitis vinifera L. x Muscadinia rotundifolia Michx.) Is much lower than the maximum allowable limits approved by the World Vine and Wine (OMVV). The quality of the products derived of vegetable origin is conditional upon a number of factors: the quality of the substrate on which the develops the plants used in irrigation aquatic resources, atmospheric air, the techniques for combating diseases and pests etc.

Key words: *interspecific hybrids, juice of vines, heavy metals, vines*

INTRODUCTION

The heavy metals, that are found in foods and in particular in wine, can lead to negative consequences for a significant excess of allowable doses.

The development of the living organisms it is closely in line with the factors that influences of the environment and use of derived products both of vegetal origin and also of animal origin condition the level of development of society.

The heavy metals have a toxic effect on all living organisms. Thus, the plants accumulates heavy metals from soil, air, water. The animals, particularly herbivores consumes the plants for feeding. The people consumes products derived from plant and animal origin, ambient air, water etc. The presence of the heavy metals in the organism in concentrations inadmissible put in danger its good functioning and consequently lead to perish.

For the development of a healthy society it is necessary for derived products used in food production technologies, have admissible concentrations of the chemical compounds. The World Health Organisation has established maximum permitted concentrations of heavy metals in wine-derived products.

An imperative of modern oenology is the presence of metals in wines, especially the heavy metals. Today, great attention is given to identifying the sources which makes the presence of heavy metals in wine and reducing the content of these metals by applying treatments permitted by current legislation.

It is necessary get to know each very well influence of various kinds endogenous factors such as the variety, location of vines crops, soil, climatic conditions of the year. It is also necessary to know as much as possible quantitative exogenous influence factors: growing techniques, harvesting, winemaking technology, oenological technique applied, of wines storage conditions [8].

Order to obtain high quality wines, the dosing of microelements have to be done allowable quantities. A series of investigations were performed to determine heavy metals in wines

produced from clones untreated raw Europe, widely planted in the period 1998-2013 in various micro zones in the country: Tigheci din Codrii de sud, Mindreşti din Codrii - Centru etc. Among the high quality table wines produced from clones of European Union countries were studied: Pinot noir, Merlot, Muscat ottonel, şi Traminer roz.

MATERIALS AND METHODS

In this study were included distants hybrids of vine *Vitis vinifera* L. x *Muscadinia rotundifolia* Michx. (DRX-M3-3-1; DRX-M4-502; -512; -571; -578; -580; -609; -640). The vines varieties of cultivated in the Republic of Moldova: Aligote, Feteasca Albă, Cabernet-Sauvignon, Merlot. The vines varieties of cultivated in France: Pinot noir, Merlot, Muscat ottonel şi Traminer roz. [2, 3, 4, 5, 8].

Younger wines at after a month completion of alcoholic fermentation and the malolactic, without being subject to conditioning of through various treatments and manipulations were investigated by the methods of atomic spectroscopy Centre of Metrology and Automation of Scientific Research of the Academy of Sciences Moldova.

Determination of content of heavy metals in juice of vineyards of the hybrids distance (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) was performed in the Laboratory of physico-chemical automation of Higher School of Agronomic Research (ENSRAM) in Montpellier, France, by using the atomic spectroscopy methods [1, 6, 11, 12, 13].

RESULTS AND DISCUSSIONS

Younger wines from 2004 in 2007 and 2013 harvest, over one month after the alcoholic fermentation and the malolactic that appreciated by 8.8 to 9.2 points without being subject to conditioning of through various treatments and manipulations were investigated by methods atomic spectroscopy of the Centre of Metrology and Automation of Scientific Research of the Academy of Sciences Moldova.

The analysis of the results obtained shows evidence of a high degree of hygienic wines obtained from French clones cultivated in the Central region: Codrii of the Moldova in which concerning of the index of content of the heavy metal, all the samples investigated in the content of Pb, Cd, As, Hg, Cu, Zn, Fe. Identified the values are much lower than those admissible under current rules established by the World Health Organisation (WHO) with the Agreement of the International Vine and Wine Organisation (OIVV).

Table 1. The content of heavy metals in young wines obtained from vineyards clones of French origin, perspectives for the Codrii of the Centre of Moldava (2004 harvest)

The content of the heavy metals, mg/kg	Varieties				
	Pinot noir	Merlot	Muscat Ottonel	Traminer roz	Maximum allowable concentration of the World Health Organization
Fe	2.30	1.35	0.50	0.44	15.8
Cu	0.06	0.08	0.09	0.08	5.0
Zn	0.30	0.32	0.25	0.27	10.0
Pb	0.049	0.052	0.043	0.,080	0.30
Cd	0.0029	0.0030	0.0022	0.0024	0.3
As	< 0.01	< 0.01	< 0.01	< 0.01	0.2
Hg	<0.0016	<0.0016	<0.0016	<0.0016	0.005

Table 2. The content of heavy metals in the wines from varieties Aligote, Feteasca Albă, Cabernet Sauvignon, Merlot (2004 harvest)

The content of the heavy metals, mg/kg	Varieties				
	Aligote	Feteasca Alba	Cabernet-Sauvignon	Merlot	Maximum allowable concentration of the World Health Organization
Fe	2.30	1.35	0.50	0.44	15.8
Cu	0.06	0.08	0.09	0.08	5.0
Zn	0.30	0.32	0.25	0.27	10.0
Pb	0.048	0.052	0,050	0.080	0.30
Cd	0.0033	0,0040	0.0070	0.0070	0.3
As	<0.01	<0.01	<0.01	<0.01	0.2
Hg	<0.0016	<0.0016	<0.0016	<0.0016	0.005

The analysis of the results obtained shows evidence of a high degree of hygienic wines obtained from French clones cultivated in the Central region: Codrii of the Moldova in which concerning of the index of content of the heavy metal, all the samples investigated in the content of Pb, Cd, As, Hg, Cu, Zn, Fe. Identified the values are much lower than those admissible under current rules established by the World Health Organisation (WHO) with the Agreement of the

International Vine and Wine Organisation (OIVV).

In the laboratory of testing by the methods of atomic spectroscopy Center for Metrology and Automation of Scientific Researches of the Academy of Sciences of Moldova was determined the content of heavy metals in the wines: Aligote, Feteasca Alba, Cabernet-Sauvignon, Merlot (the 2004 harvest) .

During 2004, climatic conditions have been favorable for the cultivation of vines, in the course of the vegetation period of only four treatments were conducted anti - mildium powdery mildew and *Botrytis cinerea*. Therefore, the concentrations of heavy metals in the wines: Aligote, Feteasca albă, Cabernet-Sauvignon and Merlot from the Central region of Republic of Moldova (Ialoveni) is much less than the amounts allowed by the WHO (Table 2). Is worth mentioning that that the content of toxic metals Pb, Cd, As, Hg, Cu is significantly lower (about 10 times) than health and hygiene limits approved worldwide. The test report from the laboratory of control of wine products (NIVW) accredited National System of the Republic of Moldova, indicates not significant concentrations of in dry wines, of grapes a raw material to determination of content of copper, zinc, lead, cadmium, iron by atomic absorption.

Table 3. The content of heavy metals in grapes of the interspecific hybrids of grapevine (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.)

Hybrid	The content of the heavy metals, mg/kg						
	Fe	Cu	Zn	Pb	Cd	As	Hg
DRX-M3-3-1	2.39	0.07	0.28	0.051	0.0075	0.01	0.0019
DRX-M4-502	1.12	1.01	0.41	0.079	0.0043	0.01	0.0015
DRX-M4-512	0.73	0.09	0.39	0.066	0.0039	0.01	0.0011
DRX-M4-571	1.44	0.08	0.23	0.059	0.0068	0.01	0.0016
DRX-M4-578	2.61	1.32	0.39	0.049	0.0079	0.01	0.0013
DRX-M4-580	0.83	1.47	0.40	0.086	0.0058	0.01	0.0011
DRX-M4-609	1.91	0.12	0.29	0.049	0.0071	0.01	0.0016
DRX-M4-640	2.93	1.17	0.49	0.057	0.0044	0.01	0.0019
Maximum allowable concentration of the World Health Organization	*15.8*	*5.0*	*10.0*	*0.3*	*0.3*	*0.2*	*0.005*

The obtained results reveals that the juice from the grapes of interspecific hybrides of vineyards studied have a degree hygienic high in all the cases the contents of heavy metals Fe, Cu, Zn, Pb, Cd, As and Hg, is much smaller, the permissible limits in force, approved by the World Organisation of Vine and Wine (OMVV) (Table 3).

Similar results were obtained in joint studies conducted during the years 2004-2012 through collaboration Practical Scientific Institute of Horticulture and Food Technologies with the Centre for Metrology and Automation research Academy of Sciences, now part of the Institute of Chemistry of the ASM [8, 9, 10, 12, 13].

By determining the heavy metals in juices and wines from clones of vines of European origincultivated Republic of Moldova was formulated the same conclusion: the concentrations of these elements - heavy metals are well below allowable values internationally by WHO and OMVV [9, 11].

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/dm^3 up to 293 mg/dm^3 and for hybrids with berries with a red-violet hue - from 777 mg/dm^3 up to 809 mg/dm^3 (Table 4.)

Table 4. Phenolic substances

Hybrid	Phenolic substances, mg/dm^3
DRX-M_3-3-1	809
DRX-M_4-502	292
DRX-M_4-512	288
DRX-M_4-571	263
DRX-M_4-578	274
DRX-M_4-580	293
DRX-M_4-609	201
DRX-M_4-640	777

It is known that phenolic substances capable to accumulate heavy metals and form stable complexes with them. We carried out a correlation between the content phenolic substances and heavy metals in various wines.

Soil is the not anything other than a deposit of all of the chemical compounds, including the heavy metals released into the environment and depending on the modality actuator the substances present in the soil are taken up through brought to ways the particulate air and water absorbed by plants

Upon performing an analysis of the soil, the concentration of heavy metals in the territory where they grow interspecific hybrids of the

vines it was concluded that the concentration of heavy metals (Cu, Ni, Zn, Pb, Mn) not exceed the maximum limit be admissible (fig. 1).

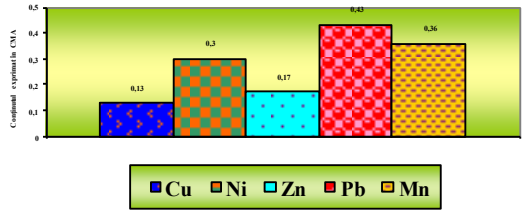

Fig. 1. The content of heavy metals in soil, Chisinău, Republic of Moldova.

The quality of the products derived of vegetable origin is conditional upon a number of factors: the quality of the substrate on which the develops the plants used in irrigation aquatic resources, atmospheric air, the techniques for combating diseases and pests etc.

CONCLUSIONS

The concentration of heavy metals Fe, Cu, Zn, Pb, Cd, As and Hg from the juice of grapes of vines of distance hybrids (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.)
It is much lower than the maximum allowable limits approved by the World Vine and Wine (OMVV).
Thus, studies have shown that the heavy metal content is within acceptable limits, and different metals are accumulated in different of hybrids the grape differently.
The correlation was revealed that the interspecific hybrids of the grape berries with peel blue-violet hue content of phenolic substances higher than the hybrids with green-yellow shade peel the berries and consequently also concentration of heavy metals was more pronounced.

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