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BEHAVIOR OF VINE VARIETIES WITH BIOLOGICAL RESISTANCE UNDER THE SOUTH ROMANIAN CONDITIONS

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Abstract

Main behavior of vine varierieties with biological resistance in the south romanian climatic conditions were analyzed during 3 years of study. Thus they was determined: phenology varieties, fertility and productivity for table and wine varieties, behavior of these varieties at the main attack of major diseases and pests attack, physico-mechanical characteristics, the technological attributes of varieties, the physico-chemical characteristics of wines. For content of grapes in volatile compounds was used the gas chromatography/mass spectrometry method. The wine varieties studied were: 'Moldova' and 'Andrevit' (table wine varieties), 'Admira', 'Radames' and 'Brumariu' (varieties of wine).In ecopedoclimatic terms from the southern Romania, varieties mature later, in maturation ages IV ('Andrevit', V ('Admira') and VI ('Moldova', 'Radames' and 'Brumariu'). From the point of view of fertility and productivity varieties, variety Admira had the best behavior, also the same variety with the table wine 'Moldova' had the lowest degree of the main attack of vine diseases (powdery mildew, downy mildew, grey mold) and phylloxera attack. Regarding the accumulation of sugars in the grape, sugar content varied between 164 and 190 g/L at the wine varieties and between 154 and 171 g/L of table wine varieties, distinguishing varieties are 'Admira' and 'Radames'. Regarding the analysis of the main volatile compounds shows that limonene, hexanol, 2-methyl propanol and 3-methyl butanol is found in highest concentration in all varieties; as regarding terpenes, at the expression of olfactory characteristics of grapes, in the highest proportion is limonene, in lower concentration being found terpens as: cymene, pinene, myrcene.

Key words: *gas chromatography method, downy mildew, powdery mildew,grey mold, phylloxera attack*

INTRODUCTION

Vine varieties with biological resistance are improved varieties, derived by crossing varieties of *vinifera* vines with American hybrid direct producers (Grecu V., 2010).
They are also called green varieties because they require a much smaller number of treatments against diseases and pests compared with *vinifera* varieties.
Although their quality doesn't equal the noble varieties, these varieties have their importance in winemaking, both in improving vine and obtaining green products (juice, alcoholic and non-alcoholic drinks, in different type of food industry).
Using organic varieties are suitable for industrialization in getting juices is a well-known practice in countries like Europe, USA etc.
These drinks, originating from a healthy raw material, the green environment have been the subject of study of many researchers and nutritionists as an outstanding source of antioxidants, vitamins, minerals etc. (Visan et al., 2007).
The behavior of these varieties, and here we refer to their biological resistance, productivity and applied technology depends on several factors including crop area, year of harvest, ecopedoclimatic conditions etc.

MATERIALS AND METHODS

A detailed study on some of vine varieties with biological resistance was conducted in ecopedoclimatic conditions in southern Romania.
The studied grapevine varieties were 'Andrevit' and 'Moldova' (table varieties), 'Admira', 'Radames' and 'Brumariu' (wine varieties).
The study, conducted over a period of three years referred to determining phenology variety, fertility, the agrobiological characterization of varieties (percentage of fertile shoots, the fertility coefficients, productivity indices, reaction to major diseases and pests of the vine) and technological

characterization of variety (total production grapes/ha, physical and mechanical characteristics of the grapes, technological indices).

Grape musts were analyzed under sugar and total acidity terms (after the standardized methods in effect) and characterized in terms of concentration in volatile compound by gas chromatography method coupled with mass spectrometry.

The extraction of compounds was achieved by *headspace* technique under the *vacuum dynamic* method (Serot T. et al., 2001) with Tekmar device and identification of volatile compound and their quantification were achieved using complex devices Varian Star 3400 gas chromatograph with FID detector CX/gas system Hewlett Packard 5890 Series II chromatograph/mass spectrometer Hewlett Packard 5971 Series II.

Identification of volatile compounds was realized based on retention index and standard database. In order to extract the aromatic compounds was chosen version of 10 mL sample that is mixed with 0,02 mg/mL of the internal standard *2-methyl-2-patenal*, the extraction temperature below 40°C (35°C) and the extraction time of 20 minutes. To identify the isolated aromatic compounds we use the GC/MS system (Guth, 1997). For each sample were made every two repeats.

RESULTS AND DISCUSSIONS

The 'Andrevit' table variety, genitors *SV 23-18* x *Queen vineyards*, with selection in F_1 (Oprea et al., 1994) breaking leaf buds around 30 April (Table 1) and has the shortest vegetation of 184 days (Fig.1) fits in IV maturation era.

'Moldova' table variety (genitors *Guzali kara* x *Villard blanc*) is a variety with a late breaking leaf buds, in early May (Table 1) has a vegetation period of 187 days and fits in the VI maturation era. Both varieties have large force, a percentage of 64-67% fertile shoots (Fig.2), weighing more than 250 g (Table 2) and productivity index with high values, grater in 'Andrevit' variety. The total production from the 2 grape varieties exceed 14-15 t/ha, the highest production from the studied varieties (Figure 3).

Physico-chimical analysis of grapes showed a higher sugar content at 'Andrevit' variety (171 g/L) towards 'Moldova' (154 g/L) and a glucoacidimetric index of 32.9 due to an optimum total acidity of 5.2 g/L sulphuric acid (Figure 4).

Behavior at diseases and Phylloxera is different at the two table variety, the 'Andrevit' being characterized by a higher biological resistance. The highest degree of infection was recorded in 'Moldova' variety in case of powdery mildew on grapes (Table 3).

'Admira' variety (genitors *Villard noir* x *Pearl Csaba*) breaking leaf buds on April 30, has a vegetation period of 189 days and fits in the V maturation era.

'Radames' variety, genitors *Traminer Pink* x descendant *Villard blanc* x *Queen vineyards* (Moldovan et al., 1994) breaking leaf buds earlier, on April 12 but has the longest vegetation period (209 days) thus sweeping later, in the VI maturation era.

'Brumariu' variety breaking leaf buds on April 27, has vegetation period of 194 days and fits in VI maturation era.

The last three vine varieties with technological traits shows the average force ('Admira' and 'Brumariu') and high force ('Radames'), a greater percentage of fertile shoots in 'Admira' and 'Brumariu' varieties and quite low at 'Radames' variety (60%).

The Grape weight had record optimum values for category in which the 3 varieties are (146-177 g). Among wine varieties the largest production was recorded for the 'Admira' variety (13.9 t/ha), 'Radames' records a smaller production under 10 t/ha.

Regarding the potential of the alcoholic variety, the highest concentration of sugars was recorded in 'Admira' variety with 190 g/L sugars, so with a 11 vol% alcohol potential, followed by 'Radames' with 175 g/L sugars. Wine analysis results confirmed evaluating the alcoholic potential, wine variety 'Admira' recorded a 11 vol% alcohol (Fig.5).

Wine obtained from 'Admira' variety presented the best characteristics of the varieties of wine; thus, on an alcoholic background concentration comparable with some *vinifera* wine varieties, total acidity was 5 g/L sulfuric acid and total extract of 21.55 g/L. Regarding the biological resistance of wine varieties the best behavior

has 'Admira' variety, recording the lowest level of attack both hand, mildew and mold. Varieties 'Radames' and 'Brumariu' shows a lower resistance at mold. The GC/MS analysis of volatile compounds revealed a number of compounds that characterize the studied varieties, some of these compounds can be found in higher concentration in comparison with the other compound identified (Table 4).
Thus, regarding esters were identified: Ethyl acetate, Methyl hexanoate, Ethyl hexanoate, Methyl caprylate (Figure 6).
Esters are formed in grape fermentation process in large quantities by enzymatic esterification and in the process of maturation and aging of wine by chemical esterification (Chisholm et al., 1994). It distinguishes these varieties a very small number and a low concentration of esters compared with *vinifera* varieties (Baek et al., 1997). Among aldehyde were identified 2-Methylpropanal, in the highest concentration of all examined varieties, 2-Methyl butanal, 3-Methyl butanal, Pentanal, 2-hexenal, 2-Heptenal, Octanal, 2-Octen-1-al, Benzaldehyde, Nonanaldehyde etc. (Figure 7).
The higher alcohols were represented by: Propan-1-ol, 2-Methyl-1-propanol, 2-Methyl-1-butanol, 2-Ethyl-1-butanol, Ethyl propyl carbinol, 3-Hexanol; This alcohol that leave a taste of greenery is found in highest concentration in the studied varieties (Fig.8). The terpenes identified were, in order of concentration traced at most of studied varieties: limonene, p-cymene, β-pinene, α-pinene, β-myrcene etc. We can observe a higher concentration of limonene, in all varieties of case, this terpene being majority, with exception of 'Andrevit' variety, that 2 terpenes characterized this variety: limonene and p-Cymene (Figure 9).

Table 1. Phenology of the biological resistant varieties

Variety	Average data of phenophases				
	breaking leaf buds	flowering	veraison	maturation	fall leaves
Andrevit	30.04	6.06	11. 08	12.09	31.10
Moldova	4.05	8.06	16.08	6.10	7.11
Admira	30.04	8.06	12.08	25.09	5.11
Radames	12.04	5.06	20.08	15.10	7.11
Brumăriu	27.04	4.06	15.08	10.10	7.11

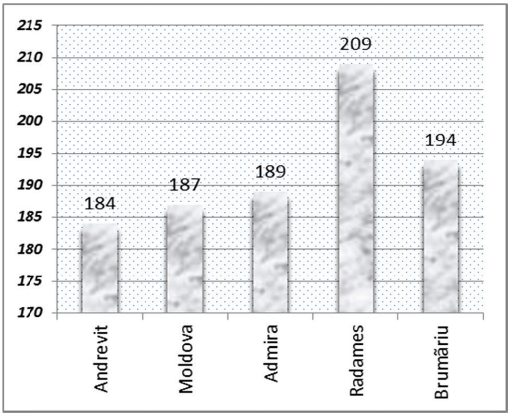

Figure 1. Vegetation period of the varieties (days)

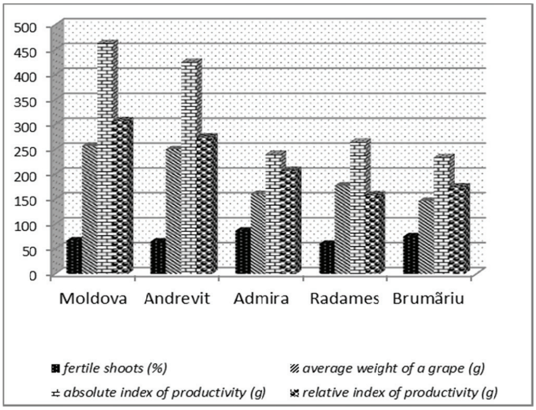

Figure 2. Fertility and productivity of organic varieties

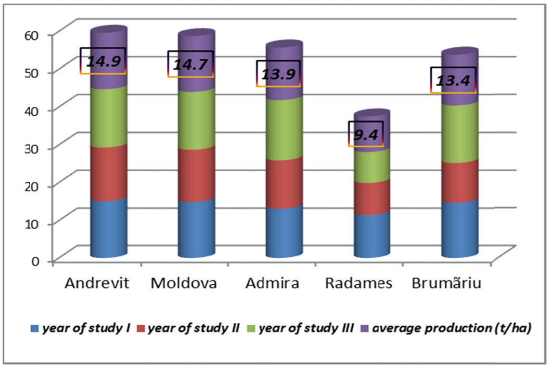

Figure 3. Production of varieties with biological resistance (t/ha)

Table 2. The physico-mechanical and technological indices of biological resistant varieties

Characteristics	Variety: Andrevit	Moldova	Admira	Radames	Brumariu
	Mechanical composition / kg grapes (g)				
Grain weight	981	975	967	962	967
Weight of must	721	725	720	629	635
Skin and pulp	241	218	208	288	310
Rahis	19	25	33	38	33
Seeds	19	32	39	45	22
Marc	279	275	280	371	265
The composition of 100 berries (g)					
grain weight	375	390	240	160	135
Skin weight	56	46	35	36	45
pulp weight	311	328	195	114	84
seed weight	8	16	10	10	6
Technological indices					
Index structure of the grape	51.6	39.0	29.3	25.3	29.3
Index berry	28.0	28.0	39.0	40.0	55.0
Index composition of berry	4.8	5.3	4.3	2.5	1.6
Yield index	2.6	2.6	2.6	1.7	1.7

Table 3. Behavior of vine varieties with biological resistance to major diseases and pests of the vine

Variety	behavior of vine diseases: downy mildew	powdery mildew: on leaves	powdery mildew: on grapes	grey mold	phylloxera attack: galicola
	(attack degree %)				
Andrevit	1	1	2	4	0
Moldova	2	2	10	0	0
Admira	0	1	1	2	0
Radames	2	2	2	4	0
Brumăriu	0.8	2	2	4	0

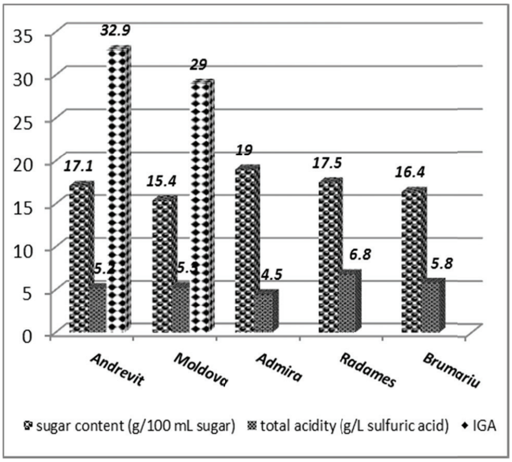

Figure 4. Composition characteristics of grapes

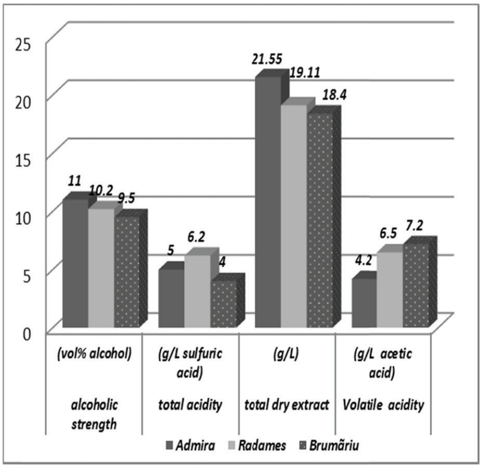

Figure 5. The Main Physico-Chemical Parameters Analyzed wines

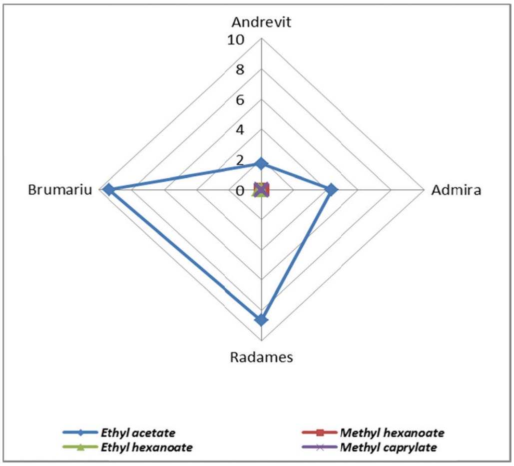

Figure 6. The main esters of a Analyzed musts

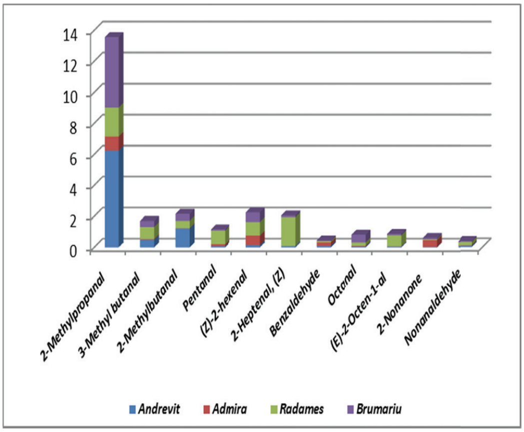

Figure 7. Aldehydes concentration in musts

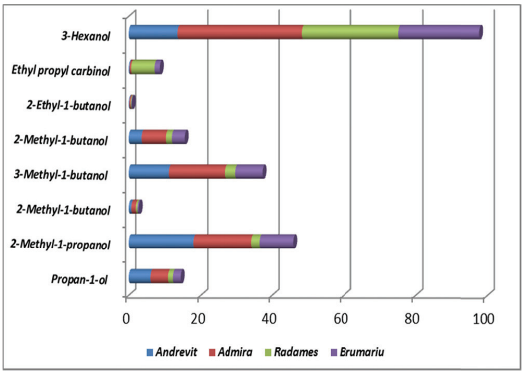

Figure 8. Concentration of higher alcohols

CONCLUSIONS

The longest period of vegetation was recorded by variety 'Radames'; Wine varieties have force average and large and a higher percentage of fertile shoots in wine varieties, especially the variety 'Admira'.

Table varieties, 'Andrevit' and 'Moldova' shows a weight of grapes beyond 250 g and an production index with high values, production of variety exceeds 14-15 t/ha.

At wine varieties the most production was recorded by 'Admira' variety with 13.9 t/ha, 'Radames' records the lowest production between studied varieties.

The concentration of grape sugars record the highest values at 'Admira' variety, resulting wine reaching a degree of alcohol above 11 vol% alcohol and a high value of extract.

Although with increased biological resistance to disease and *phylloxera*, the varieties had different degrees of attack, the best behaved variety was 'Admira'; 'Moldova' variety registered higher attack degree mildew on grapes. GC/MS analysis of volatile compounds revealed a number of compounds that characterize the varieties studied; so, identified esters are: Ethyl acetate, Methyl hexanoate, Ethyl hexanoate, Methyl caprylate. Is distinguished from these varieties a very small number and a low concentration of esters compared with *vinifera* varieties.

Among aldehyde were identified: 2-Methylpropanal, in the highest concentration examined in all varieties, 2 and 3-Methyl butanal, Pentanal, 2-hexenal, 2-Heptenal, Octanal, 2-Octen-1-al, Benzaldehyde, Nonanaldehyde etc. Higher alcohols found: Propan-1-ol, 2-Methyl-1-propanol, 2-Methyl-1-butanol, 2-Ethyl-1-butanol, Ethyl propyl carbinol, 3-Hexanol; this alcohol that leaves a taste of greenery is found in the highest concentration of studied varieties.

Identified terpenes were, in order of traced concentration at the majority of studied varieties: limonene, p-cymene, β-pinene, α-pinene, β-myrcene, etc. We can observe a higher concentration of limonene, in all varieties of case, this terpene being majority, with exception of 'Andrevit' variety, to that 2 terpenes characterized this variety: limonene and p-Cymene.

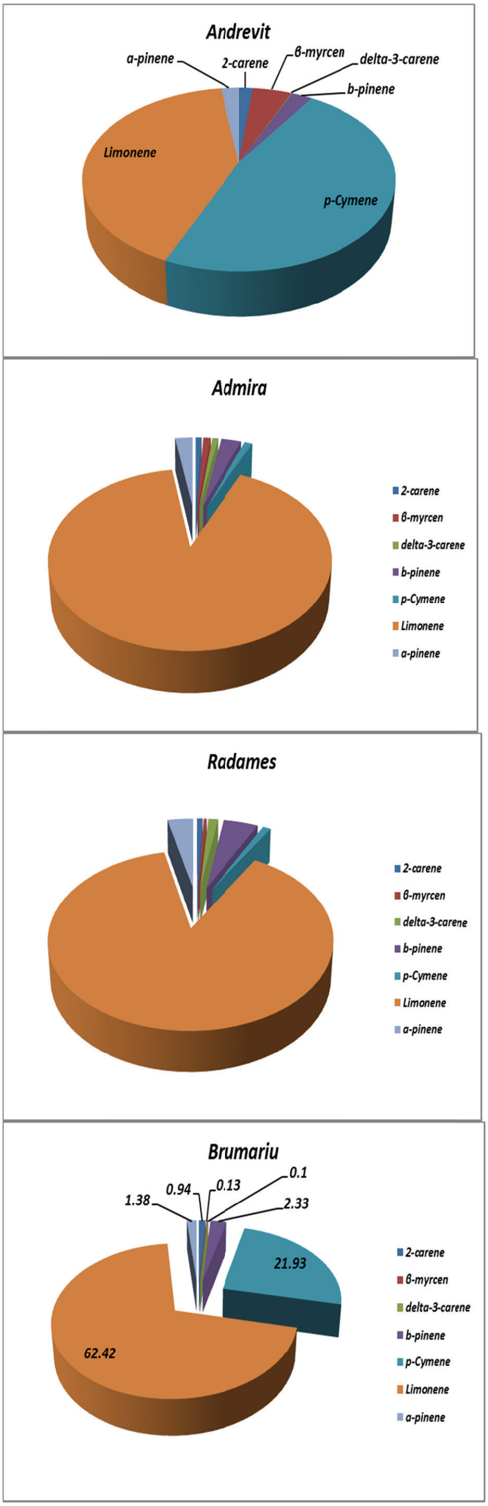

Figure 9. Concentration of terpenes

Table 4. Volatile compounds from musts analyzed

Volatile compounds	*Andrevit*	*Admira*	*Radames*	*Brumariu*
	µg equivalence I.S			
2-Methylpropanal	6.24	0.91	1.87	4.54
Propan-1-ol	6.04	4.86	1.35	2.17
Ethyl acetate	1.70	4.32	8.67	9.36
n-Butanoic acid	0.81	0.06	4.13	0.05
2-Methyl-1-propanol	17.93	16.27	2.32	9.35
3-Methyl butanal	0.49	0.05	0.77	0.39
2-Methylbutanal	1.22	0.02	0.47	0.45
2-Methyl-1-butanol	0.74	1.25	0.44	0.37
Pentanal	0.08	0.13	0.87	0.08
3-Methyl-1-butanol	11.13	15.57	3.07	7.60
2-Methyl-1-butanol	3.57	6.75	1.64	3.57
2-Ethyl-1-butanol	0.17	0.34	0.20	0.16
1-Hexanol	0.42	0.19	4.22	3.14
(Z)-2-hexenal	0.14	0.62	0.87	0.62
Ethyl propyl carbinol	0.24	0.45	6.47	1.47
3-Hexanol	13.52	34.74	26.90	22.59
3-Methyl-1-butanol acetate	0.09	0.09	0.04	0.04
Heptan-2-one	0.07	0.32	0.13	0.05
Methyl hexanoate	0.04	0.05	0.00	0.04
2-Heptenal (Z)	0.09	0.00	1.85	0.12
Benzaldehyde	0.10	0.22	0.08	0.05
2-carene	0.22	0.21	0.24	0.94
2-octanone	0.10	0.08	0.22	0.44
β-myrcen	0.6	0.26	0.13	0.13
Ethyl hexanoate	0.00	0.04	0.05	0.11
Octanal	0.06	0.04	0.21	0.51
delta-3-carene	0.01	0.20	0.42	0.10
β-pinene	0.32	0.72	1.53	2.33
p-Cymene	5.93	0.28	0.35	21.93
Limonene	5.17	22.94	27.91	62.42
(E)-2-Octen-1-al	0.06	0.01	0.71	0.09
α-pinene	0.28	0.61	1.10	1.38
2-Nonanone	0.02	0.46	0.05	0.08
Nonanaldehyde	0.08	0.04	0.21	0.06
Methyl caprylate	0.06	0.05	0.14	0.01
Naphthalene	0.04	0.04	0.02	0.10

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