

Dacicus, new grape cultivar for white wines, with genetic resistance to cryptogamic diseases

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ABSTRACT

In the context of the current global and zonal climate changes, the practice of sustainable viticulture by capitalizing on the ecopedoclimatic conditions specific to each viticultural area and reducing the amounts of pesticides applied through phytosanitary treatments, requires the obtaining and promoting practice of new vine cultivars with complex biological resistance, with qualitative potential and superior productivity, with good tolerance to biotic and abiotic stress factors. To respond to this desire, at R.D.S.V.O. Odobesti, using the direct sexual hybridization between the cultivar 'Traminer roz' and the interspecific hybrid 'Isabelle', was obtained and approved in 2022 the 'Dacicus' cultivar. This new creation is characterized by medium to large sized grapes (227 g), with medium sized berries (1.64 g), with pink skin, and more intense on the sunny side. The pulp is juicy, with low firmness, without anthocyanin coloration. The average production of grapes is 6.10 kg/vine, respectively 23.0 tons/ha. It presents high biological resistance to the main cryptogamic diseases. The grapes reach full maturity in the 5th epoch. From this cultivar one can obtain high-quality white wines, dry or semi-dry, with a slight aromatic tinge, with high alcoholic potential (12.7 - 13.9 vol % alcohol), a total acidity of 5.9 - 6.5 g/L tartaric acid and a high values of the non-reducing dry extract (19.8 - 23.6 g/L).

Keywords: vines, breeding, resistance, cultivar, sustainable viticulture

INTRODUCTION

Practicing sustainable viticulture in tandem with environmental and health concerns is currently one of the most important goals of the wine world. That also involves the diversification of genetic resources by creating new v cultivars which have an important role in protecting the environment, being known that native cultivars have genes with tolerance and resistance to disease and pests, ensuring its sustainable development at the national, regional and local level (Fregoni, 1998; Mestre *et al.*, 2018; De Nardi *et al.*, 2019; Giacomelli *et al.*, 2019). In this context, the research carried out in the last four decades in our country led to the creation of several grapevine genotypes with increased disease tolerance and resistance to stress factors (frost, drought), and the results led to the creation of a base with valuable genetic material and the homologation of many cultivars (Calistru and Damian, 1999; Damian *et al.*, 2012; Culcea *et al.* 2004; Bosoi *et al.*, 2020, Bosoi *et al.*, 2022).

Following this direction for creation of new resistant genotypes, a new cultivar for white wine, called 'Dacicus', has been approved at Research and Development Station for Viticulture and Oenology Odobesti. This cultivar was obtained by direct sexual hybridization between the cultivar 'Traminer roz' and the interspecific hybrid 'Isabelle'. This paper presents the agrobiological and technological potential of this cultivar and the main characteristics of the obtained wine.

MATERIALS AND METHODS

The research was carried out in a plantation of over 30 years old located on a leached chernozem type soil, in the biological field of the Research and Development Station for Viticulture and Oenology (RDSVO) Odobesti, with geographical coordinates 45°45' north latitude, 27°06' east length, and an altitude of 150 m. The study was conducted during the years 2020-2022.

The biological material was represented by the new resistant cultivar 'Dacicus', grafted on Kobber 5 BB rootstock, placed in three repetitions with five vine plants each. The pruning system practiced was the Dr. Guyot system, using a fruit load of between 38-44 buds/vine, distributed on canes with 8-9 buds and spurs with 2 buds. The training system was semi-high. To establish the agrobiological potential, observations and determinations were made regarding: the phenological spectrum by monitoring the vegetation phases, the vigor of growth by measuring the shoots during the period of intense growth; elements of fertility and productivity by calculating the percentage of fertile shoots (FS%), fertility coefficients (Cfa and Cfr) and productivity indices (Ipa and Ipr); behavior to the main vine diseases and stress factors (frost, drought) by scoring from 1 to 9 according to the resistance scale developed by OIV (2009). To establish the technological potential, determinations were made regarding the quantity (kg/vine, t/ha) and quality of grape production (g/L sugars, g/L tartaric acid). The general compositional profile of the wines was obtained by performing the main physico-chemical analyzes: alcoholic concentration (% vol. alc), total acidity (g/L tartaric acid), non-reducing dry extract (g/L). The 'Băbească gri' cultivar was taken as a control for comparison.

The results were statistically interpreted through the Anova test (analysis of variance) using Microsoft Excel. Climate data for the study period were provided by the AgroExpert weather station and the multi-year climate database of the R.D.S.V.V. Odobesti.

RESULTS AND DISCUSSIONS

Climatic conditions. The research period (2020-2022) was characterized by high heliothermal availability, the thermal regime expressed by the average annual temperatures (°C) and the sum of the useful temperature degrees ($\Sigma^{\circ}\text{tu}$) registering values much higher than the multiannual values in the years 2020 and 2022, and close value by the multiannual average in 2021. Compared to the multiannual values for these climatic elements (11.1 °C and 1630.8 °C respectively), the annual average temperature recorded an excess of 2.3 °C in 2020 and 1.6°C in 2022 and for the sum of useful temperature degrees ($\Sigma^{\circ}\text{tu}$), a thermal excess of 359.8°C was recorded in 2020 and 403.3°C in 2022 (Table 1).

The precipitation regime in all three years of study was deeply deficient, both during the year and during the vegetation period. Compared to the multiannual values recorded for the entire period of a year and during the vegetation period (621.3 mm, respectively 391.4 mm), the amount of precipitation recorded represented only 68.4%, respectively 55.8% in the year 2020, 81.7%, respectively 74.0% in the year 2021 and 57.4%, respectively 65.1%

in the year 2022. Another negative characteristic of the precipitation during the three years of the study was represented by the defective quantitative distribution, especially during the vine vegetation period. These aspects show the fact that the study period (2020-2022) was a dry one for the Odobesti wine-growing area.

Table 1. The main climatic parameters from the study period (Odobesti, 2020 - 2022)

Climate parameter / Month	Average temperature (°C)				The sum of the useful temperature degrees (°C)				Rainfall (mm)			
	Multi annual	2019/2020	2020/2021	2021/2022	Multi annual	2019/2020	2020/2021	2021/2022	Multi annual	2019/2020	2020/2021	2021/2022
XI	5.2	9.0	5.3	7.6	9.9	49.4	0.0	11.7	46.8	68.2	12.2	12.0
XII	0.3	3.0	2.5	1.5	0.5	0.0	0.0	0.0	40.0	42.8	98.6	76.2
I	-1.5	1.7	0.6	1.9	0.1	0.0	0.0	0.0	32.5	0.4	47.0	6.4
II	0.0	5.6	1.6	4.9	0.9	2.3	2.0	0.8	32.4	9.0	4.4	4.8
III	4.5	8.6	4.6	4.9	12.3	30.8	0.4	23.3	33.0	20.2	46.8	1.2
IV	11.2	12.2	8.9	11.6	70.8	82.1	15.3	76.1	48.9	5.2	41.0	65.8
V	16.8	15.8	16.5	17.7	218.7	179.6	200.5	239.6	73.5	55.6	22.8	31.6
VI	20.2	21.8	20.3	22.7	312.5	353.3	309.0	380.6	84.6	85.2	134.6	48.2
VII	22.1	23.5	24.3	24.0	375.6	419.1	443.5	432.5	78.6	28.2	40.0	51.0
VIII	21.6	24.3	22.9	24.3	360.3	441.8	398.6	442.2	60.2	13.0	45.0	31.6
IX	17.0	20.6	16.7	17.2	212.1	317.5	199.8	214.6	45.6	31.4	6.2	26.8
X	11.0	14.2	10.6	13.8	66.1	123.7	35.1	221.7	45.2	66.0	9.4	1.2
Annual average amount	11.1	13.4	11.2	12.7	1639.8	1999.6	1604.2	2043.1	621.3	425.2	508.0	356.8
vegetation period	18.2	19.7	18.3	19.6	1550.0	1793.4	1568.7	1785.6	391.4	218.6	289.6	255.0

The phenological spectrum. The phenology of the new cultivar with biological resistance 'Dacicus' and the control cultivar 'Băbească gri' are presented in Table 2. In the climatic conditions specific to the study period (2020 - 2022) the growth and development processes of the vine evolved relatively normally (**Figure 1**). The vegetation phases for the two cultivars were initiated and completed 5 to 15 days earlier in the years 2020 and 2022 compared to 2021.

Table 2. The dynamic of the main phenological stages (Odobesti, 2020 -2022)

The cultivar of vine	Year	The phenological stages								Active vegetation period (days)
		Budburst		Flowering		Veraison		Full ripening		
		Date	Σtu (°C)	Date	Σtu (°C)	Date	Σtu (°C)	Date	Σtu (°C)	
'Dacicus'	2020	13.IV	60.3	04. VI	256.0	06.VIII	833.5	11.IX	497.6	152
	2021	29.IV	12.9	11.VI	296.1	15.VIII	876.2	18.IX	338.3	143
	2022	15.IV	60.6	01.VI	291.6	29.VII	1077.4	09.IX	537.0	148
Average		19.IV	44.6	05.VI	281.2	06.VIII	929.0	13.IX	457.6	148
'Băbească gri' (Control)	2020	12.IV	56.4	04.VI	259.9	09.VIII	884.4	17.IX	528.2	159
	2021	28.IV	12.2	14.VI	318.0	17.VIII	886.5	23.IX	320.9	151
	2022	15.IV	54.5	01.VI	284.0	06.VIII	1160.1	11.IX	467.3	150
Average		18.IV	41.0	06.VI	287.3	11.VIII	977.0	17.IX	438.8	154

For the two grape cultivars the budburst and flowering phenophases are close, instead the phenophases of veraison and full ripening of the grapes were recorded 4 - 5 days earlier in case of the new vine cultivar. The duration of the active vegetation period varied between

143-152 days for the 'Dacicus' cultivar and 150-159 days for the 'Băbească gri' cultivar (control).

The average value calculated over the study period (2020-2022) shows that for the initiation and development of the budburst phenophase, the 'Dacicus' cultivar needed a sum of useful temperature degrees of 44.6 °C, a value close to that recorded for the control cultivar (41.0°C). The flowering phenophase occurred after an accumulation of a sum of useful temperature degrees of 281.2 °C for the new grape cultivar, a value close to that recorded for the control cultivar (287.2°C.). On the other hand, for reaching the veraison phase, the new grape-cultivar 'Dacicus' required a lower value of $\sum t_u$ (929.0 °C) compared to that recorded for the control (977.0 °C). For the full ripening of the grapes, the 'Dacicus' cultivar needed 457.6 °C $\sum t_u$, a value higher than 18.8 °C compared to the control cultivar (Figure 1).



Figure 1. The grape 'Dacicus' cultivar (young shoot, adult leaf)

Fertility and productivity characteristics. The fertility and productivity characteristics of the new grape 'Dacicus' cultivar were evaluated by the percentage of fertile shoots, fertility coefficients (absolute and relative) and productivity indices (Table 3).

Table 3. The fertility and productivity characteristics (Odobesti, 2020-2022)

The cultivar of vine	Year	Fertile shoots (%)	Fertility coefficients		Average weight of grape (g)	Productivity indices	
			Relative	Absolute		Relative	Absolute
'Dacicus'	2020	61,7	0,75	1.22	254,0	191	310
	2021	69,9	0.89	1.27	236.5	210	300
	2022	46,9	0.57	1.22	190.0	108	232
Average		59.5	0.73	1.23	226.8	170	281
'Băbească gri' (Control)	2020	62.1	0.70	1.13	268,2	188	303
	2021	66,7	0.73	1,10	282,4	206	311
	2022	62,7	0,68	1,09	263.6	179	287
Average		63,8	0.70	1,10	271.4	191	300
Anova test - analysis of variance (p-value)		p=0,56315	p=0,74012	p=0,00319*	p=0,08886	p=0,54513	p=0,48358

Although the average value obtained for the percentage of fertile shoots was lower compared to the control cultivar (59.5%), the fertility coefficients (relative and absolute) recorded slightly higher values compared to the control (Cfr - 0.73; Cfa - 1.23). Due to the lower average weight of the grapes, the 'Dacicus' cultivar showed slightly lower productivity index values (Ipr - 170; Ipa - 281) compared to the control cultivar.

The statistical interpretation of the data obtained for the main fertility elements (% 115 fertile, fertility coefficients, productivity indices) was carried out by analysis of variance using the Anova test. The values obtained for the probability - p value show that between the two grape cultivars there are no significant differences in terms of % of fertile shoots, relative fertility coefficient, and productivity indices ($p > 0.05$). However, a significant positive difference compared to the control 'Băbească gri' cv. was recorded for the absolute fertility coefficient ($p < 0.05$).

Behavior to the main diseases of the vine. The assessment of biological resistance to the main cryptogamic diseases of the grapevine (downy mildew, powdery mildew, gray rot) was carried out in each year of the study on the leaves and grapes, by calculating the following indicators: frequency of attack (F%); attack intensity (I%) and attack degree (GA%). Based on the values obtained for the degree of attack, the classification was made regarding the resistance to the main cryptogamic vine diseases, according to OIV descriptors 452, 453, 455 456, 458 and 459 (Table 4).

Table 4. The behavior of the main diseases of the vine

The grape cultivar	Downy mildew (<i>Plasmopara viticola</i>)		Powdery mildew (<i>Uncinula necator</i>)		Gray rot (<i>Botrytis cinerea</i>)	
	Leaf OIV 452	Grape OIV 453	Leaf OIV 455	Grape OIV 456	Leaf OIV 458	Grape OIV 459
'Dacicus'	9	7-9	7-9	9	7-9	7
'Băbească gri' (Control)	7	5-7	7	5-7	7	5

During the study period (2020-2022), the vegetation period recorded favorable climatic conditions for the attack of cryptogamic diseases, especially for powdery mildew. According to the OIV descriptors, the new grape 'Dacicus' cv. presented high (7), high to very high (7-9) and very high (9) resistance to downy mildew, powdery mildew and gray rot, compared to the control 'Băbească gri' cv.

Technological characteristics. The study of the technological characteristics of grape production completed the elements which characterize the new grape cultivars (Table 5).

Table 5. The quantitative and qualitative characteristics of grapes and juice (Odobesti, 2020-2022)

The vine cultivar	Year	No. bunch/ vine	Weight of grape (g)	Weight of 100 berries (g)	Kg/vine	The juice	
						Sugars g/L	Acidity g/L acid tartaric
'Dacicus'	2020	28.0	254,0	181	7,11	235	6.00
	2021	30.1	236.5	185	7.12	214	7.77
	2022	21.5	190.0	125	4.09	253	5.63
Average		26.5	226.8	164	6.10	234	6.46
'Băbească gri' (Control)	2020	22.8	268,2	240	6.00	213	7.34
	2021	23.8	282,4	223	6.54	212	8.11
	2022	21.6	263.6	246	6.65	230	7.13
Average		22.7	271.4	236	6.39	218	7.52
Anova test - analysis of variance		$p=0,22713$	$p=0,08886$	$p=0,02412^*$	$p=0,79188$	$p=0,28465$	$p=0,29079$

The average value for the number of grapes per bunch was 26.5, being with 14.3% higher compared to the control cultivar. The value for the average weight of the grape calculated during the three years of the study was 226.8 g, 16.4% lower compared to the control (Figure 2). The average value obtained for grape production per vine for the new vine cultivar was 6.1 kg/vine, with 0.29 kg lower than the control cultivar- 6.39 kg/but. (Figure 2). Regarding the quality of grape production, the new grape accumulated a large amount of sugars in the juice (234 g/L), compared to the control cultivar (218 g/L), and the acidity of the juice expressed in tartaric acid had an average values of 6.46 g/L in the new grape 'Dacicus' cv. and 7.52 g/L in the control 'Băbească gri' cv, which represents one of the reference cultivars for high acidity.



Figure 2. The grape 'Dacicus' cultivar (grape, berry)

The statistical interpretation of the data obtained for the main technological elements of grape production through the analysis of variance shows that there are no significant differences between the two grape cultivars (p-value >0.05), which proves that the new grape cultivar with biologically resistance 'Dacicus' presents a valuable technological potential similar to vinifera cultivars.

The values of the technological indices resulted from the mechanical analysis of 1 kilogram of grapes, completing the qualitative properties of the new cultivar 'Dacicus' (Table 6).

Table 6. Mechanical composition of grapes for 'Dacicus' cultivar (average data 2020 – 2022)

Elements determined		'Dacicus'	'Băbească gri' (Mt.)
1 kg grapes:	berries g	974.5	975.3
	bunch, g	25.5	24.7
	no. berry normally developed	658.7	422.7
	must, g	778.3	792.7
	volume of juice, cm ³	715.3	725.0
100 berries:	average weight, g	163.7	236.3
	skin weight, g	19.2	18.8
	core weight, g	136.9	210.4
	seeds weight, g	7.6	7.1
	number of seeds	216.7	217.7
	weight of 100 seeds, g	3.5	3.1
Technological indices	berry index	65.9	46.5
	structure of the grape index	38.2	39.5
	composition of berry index	5.8	4.2
	yield index	4,9	4,2

The values obtained for the main technological indexes (grape structure index, berry index, composition of berry index and yield index) show that the new grape with biological resistance 'Dacicus' can be qualified as a cultivar for wine grapes (Figure 3).



Figure 3. The grape 'Dacicus' cultivar (productive potential)

The compositional profile of the wine obtained from the new vine cultivar 'Dacicus', established by performing the main physico-chemical analyses, shows a valuable oenological potential. Quality white wines, dry or semi-dry, can be obtained, with a slight aromatic tinge reminiscent of the maternal parent 'Traminer roz', with a high alcoholic concentration (12.7 – 13.9% vol. alc), supported by a fairly good acidity (5.99 - 6.50 g/L tartaric acid) and a high non-reducing dry extract value (19.8 – 23.6 g/L).

CONCLUSIONS

From a climatic point of view, the experimental period (2020-2022) was characterized by a surplus of thermal regime along with a quantitative and distributive deficient rainfall regime, which determined the installation of the atmospheric drought phenomenon and the accentuation of the pedological drought.

In these conditions, the new grape cultivar with biological resistance 'Dacicus' showed valuable agrobiological and technological characteristics, close in value to the control vinifera cultivar.

Being a genetically resistant cultivar, it showed high (7) and very high tolerance (9) to the main cryptogamic vine diseases compared to the control.

In experimental conditions characterized by a prolonged drought, were obtained from the Dacicus grape high quality dry or demi-dry white wines, with high alcoholic potential (over 12% vol. alc), with good average acidity (6.2 g/L tartaric acid) and good extractivity (21.8 g/L non-reducing dry extract).

The valuable agrobiological, technological and oenological potential demonstrated by the new grape cultivar recommends it to be tested in different wine-growing areas in order to introduce and expand it in practice to diversify the assortment of cultivars for quality white wines with high ecological plasticity.

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