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Identification, characterization, and marketing of local grape cultivars from Sibiu County, Romania

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Abstract
The study was conducted during 2021-2022 growing seasons in the Cisnădioara area of Sibiu County, focusing on the identification of some local grape cultivars. The research involved ampelographic description but also the determination of biometric characteristics to establish the physical-mechanical properties of the grapes, and the yield of grape juice. Most cultivars, apart from the local cultivar 'Țâța caprei' the other cultivars exhibited chemical profiles suitable for use as both table grapes and wine production. Standard research methods were applied in the field and for samples analysis in the laboratory. Most of these cultivars yielded table grapes and for winemaking using simple technology, resulting in the well-known "home wine". This type of wine is increasingly popular among consumers who appreciate light wines with lower alcohol content and persistent aromas, which are rarely found in wines made from noble varieties.

Keywords: ampelographic description, local cultivar, table grapes, wine

Introduction

Viticulture addresses a wide range of theoretical and practical considerations concerning grapevine growing, including technologies for getting planting material, the vineyards establishment and management, as well as technologies for the vineyard maintenance [10]. Grapevine crop is important to the national economy both socially and economically. Socially, grapevine cultivation serves as a vital source of dietary improvement and nourishment for human livelihoods [19]. The economic importance can be appreciated through the effective utilization of some poorly productive lands (slope and sand lands), the supply of raw materials for other industries, stimulation of industrial production development, source of income, facilitation of international trade relations, and enhancement of environmental aesthetics [17]. Significant presence in almost all stages of the human society evolution, wide spread areas in the world, diversified and constantly increasing grape production, are convincing arguments that grapevine can and must be appreciated as particularly very important crop and economically viable [16]. When left unmanaged, the vine produces, like the wild one, many small grapes with small berry, with little and sour must, the yield is gradually far away on the climbing vine [4]. A constant population is necessary to ensure the complicated agro-technical procedures that regulate and guide the growth and fruiting processes, consequently avoiding such a phenomenon [14]. An unaltered population is the only way to guarantee the complicated agro-technical procedures that regulate and guide the growth and fruiting processes, thereby preventing such a phenomenon [13]. This statement is supported by the proofs that ancient peoples had a sophisticated grapevine growing, with a special ranking of vineyard management [11]. The grapevine growing and winemaking knowledge that was passed down and enhanced from generation to generation helped to continuously raise the quality of the grapevine by-products, bringing the respective locations the kind of notoriety that could only be attained by continuous human habitation [18]. The researches of the great Romanian academician and botanist Emil Pop, contributed to the discovery on the Romania territory of over 300 locations, where the grapevine can be found in its wild form [8]. Therefore, it can be stated that in this territory the cultivated grapevine (*Vitis vinifera sativa*) was found, from the beginning, in its original, own area [15]. The objective of the research was to identify local varieties from several locations in Sibiu County.

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Material and Method

The study was conducted from 2021 to 2022, in several private properties in the area of Sibiu County. At an average height of 411 meters, the landscape is made up of hills and terraces. Local grape varietals in the area include Fetească Albă, Traminer Rose, Sauvignon Blanc, Muscat Ottonel, Fetească Regală, and Italian Riesling. Climate in Cisnădioara, Sibiu County, may vary depending on the season, weather conditions and environment specific to each location. Sibiu and the surrounding area experience a moderate continental climate characterized by notable seasonal fluctuations.

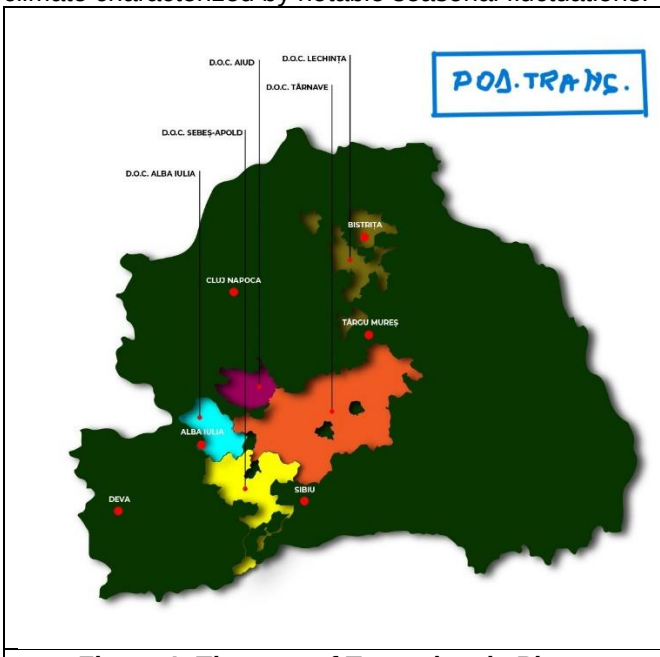

Figure 1. The map of Transylvania Plateau (https://winenews.ro/podgorii/transilvania)

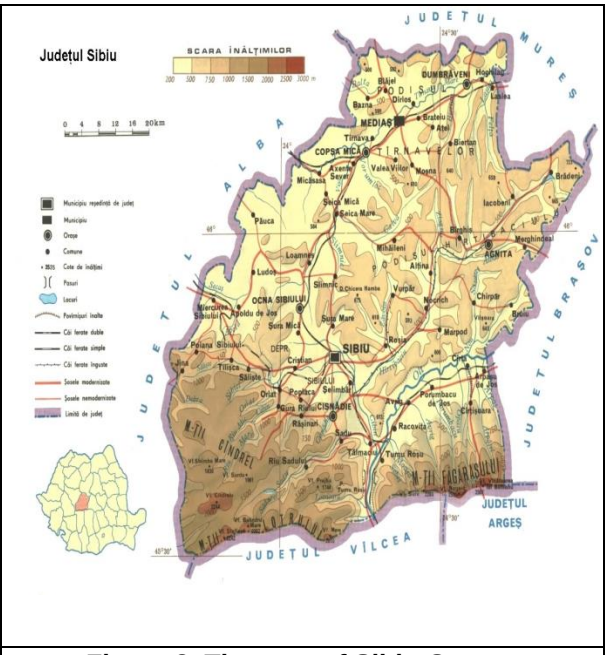

Figure 2. The map of Sibiu County (https://pe-harta.ro/sibiu/)

The research focused on identified local grape varieties, as regards their descriptions and determining their biometric characteristics, with the aim of establishing the physical-mechanical characteristics of the clusters, as well as the grape juice yield. Except for the local cultivar Tâța Caprei, the other cultivars exhibited chemical characteristics that could qualify them as mixed varieties suitable for both table grapes and winemaking. The study employed standard methods typically used in this type of research. Local cultivars identified as interesting for further study were taken to the laboratory, where collected clusters were initially photographed alongside the corresponding leaves and described from an ampelographic perspective. The clusters were then separated into component parts, respectively: rachis, berries, skin, and seeds. Each component was weighed and recorded separately. The physical and mechanical analysis of grapes is particularly important for wine grape varieties, as the ratio between components highlights the must yield of the grapes.

Results and Discussion

The physical-mechanical characteristics of the grapes from the studied local varieties reveal the proportions between the components of the clusters, which are particularly important, especially when considering flesh weight, as this determines the must yield. A cluster has the same structure as the inflorescence from which it originates and is formed from the rachis, the peduncle, pedicel and berries [7].

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Figure 3. Cisnădioara cultivar

Figure 4. Ţâţa Caprei cultivar

Figure 5. Ananas cultivar

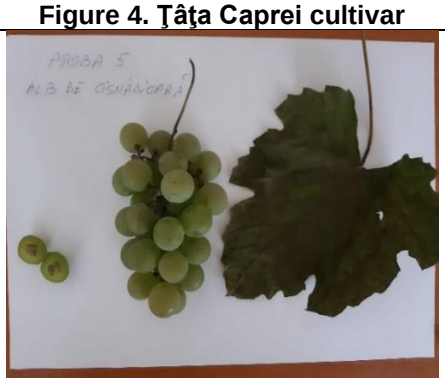

Figure 6. Alb de Cisnădioara cultivar

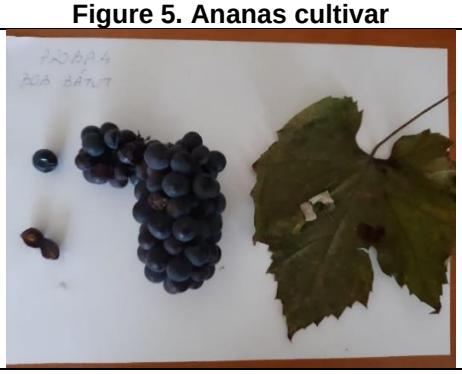

Figure 7. Bob bătut

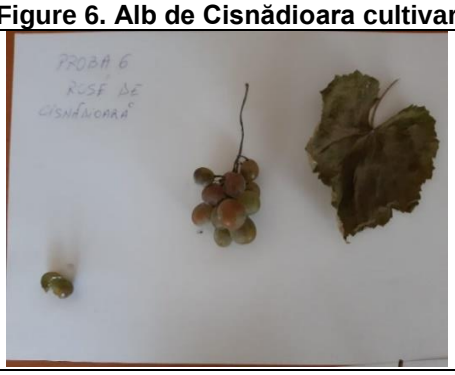

Figure 8. Rose de Cisnădioara

Table 1. Physical-mechanical characteristics of the grapes, in local cultivar Cisnădioara

Sample	Cluster weight (g)	Healthy berries		Skin (g)	Seeds		Flesh (g)	Injured berries		Rachis (g)	Sugar (g/l)
		No.	g		No.	g		No.	g		
Cisnădioara 1	108.5	47	107.0	42.0	65	7.0	36.0	2	1.0	1	127.0
Cisnădioara 2	103.0	42	101.5	39.0	56	5.0	31.0	1	0.5	0.5	124.0
Cisnădioara 3	104.0	43	101.0	38.0	58	6.0	33.0	2	1.0	1.5	128.0
Cisnădioara 4	89.5	32	86.0	32.0	39	3.0	29.0	3	1.5	1.0	130.0
Cisnădioara 5	95.0	37	93.0	34.0	42	4.0	30.0	2	1.0	1.0	121.0
Cisnădioara 6	100.0	40	98.0	37.0	52	5.0	31.0	2	1.0	1.0	126.0

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Table 2. Physical-mechanical characteristics of the grapes, in local cultivar Ţâţa caprei

Sample	Cluster weight (g)	Healthy berries		Skin (g)	Seeds		Flesh (g)	Injured berries		Rachis (g)	Sugar (g/l)
		No.	g		No.	g		No.	g		
Ţâţa caprei 1	33.0	18	32.0	8.0	23	3.0	30.0	-	-	0.5	144.0
Ţâţa caprei 2	34.0	17	33.0	7.0	22	3.0	32.0	-	-	0.5	137.0
Ţâţa caprei 3	39.0	19	38.0	9.0	27	5.0	37.0	-	-	0.5	151.0
Ţâţa caprei 4	32.5	16	32.0	6.0	20	2.0	31.0	-	-	0.5	143.0
Ţâţa caprei 5	31.0	15	30.0	6.0	18	2.0	29.0	-	-	0.5	135.0
Ţâţa caprei 6	33.5	17	33.0	7.0	22	3.0	31.0	-	-	0.5	142.0

The mechanical and chemical composition of the grapes is influenced by the climatic conditions, cultivation practices, grape ripening and maturity, soil structure, and crop health [6]. It should be noted that all the mechanical components of the grapes are important for the winegrowers and especially winemakers' requirements [16].

For a viticulturist, it is extremely important to understand the components of the cluster, respectively the ratio between certain components [5]. For example, rachis accounts for 2.0% to 10.0% of the total cluster weight. As the berries advances in ripening and the dormant phase approaches, the weight of the rachis decreases, reaching the mentioned values, although in the dormant phase its weight varies between 10.0 and 20.0%. The ratio between cluster and flesh weight can be considered as mark for classifying certain grape types into technological classes.

Table 3. Physical-mechanical characteristics of the grapes, in local cultivar Ananas

Sample	Cluster weight (g)	Healthy berries		Skin (g)	Seeds		Flesh (g)	Injured berries		Rachis (g)	Sugar (g/l)
		No.	g		No.	g		No.	g		
Ananas 1	138.0	59	135.0	68.0	85	8.0	51.0	-	-	0.5	130.0
Ananas 2	126.0	52	127.0	53.0	77	5.0	47.0	-	-	1.0	147.0
Ananas 3	114.0	44	113.0	43.0	74	3.0	43.0	-	-	1.0	161.0
Ananas 4	129.0	54	128.0	64.0	83	7.0	49.0	-	-	1.5	168.0
Ananas 5	118.0	46	117.0	52.0	76	7.0	45.0	-	-	1.0	164.0
Ananas 6	125.0	51	124.0	56.0	79	6.0	47.0	-	-	1.0	154.0

Table 4. Physical-mechanical characteristics of the grapes, in local cultivar Bob bătut

Sample	Cluster weight (g)	Healthy berries		Skin (g)	Seeds		Flesh (g)	Injured berries		Rachis (g)	Sugar (g/l)
		No.	g		No.	g		No.	g		
Bob bătut 1	121.0	105	120.0	43.0	202	15.0	35	13	7.0	4.0	21.0
Bob bătut 2	128.0	92	117.0	38.0	180	13.0	30.0	5	3.0	2.0	24.0
Bob bătut 3	127.0	78	116.0	35.0	153	8.0.	32.0	5	2.0	2.0	26.0
Bob bătut 4	120.0	91	116.0	36.0	157	9.0	29.0	7	4.0	2.0	21.0
Bob bătut 5	129.0	92	119.0	38.0	163	10.0	33.0	11	6.0	3.0	25.0

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Bob bătut 6	125.0	90	117.0	38.0	171	11.0	31.0	10	5.0	3.0	23.4

Table 5. Physical-mechanical characteristics of the grapes, in local cultivar Alb de Cisnădioara

Sample	Cluster weight (g)	Healthy berries		Skin (g)	Seeds		Flesh (g)	Injured berries		Rachis (g)	Sugar (g/l)
		No.	g		No.	g		No.	g		
Alb de Cisnădioara 1	116.0	35	111.5	55.0	94	7.0	38.0	1	0.5	1.0	180.0
Alb de Cisnădioara 2	105.0	30	99.5	50.0	88	6.0	32.0	-	-	1.5	190.0
Alb de Cisnădioara 3	124.5	40	122.0	60.0	102	8.0	40.0	2	1.0	1.0	175.0
Alb de Cisnădioara 4	119.0	36	112.0	52.0	90	7.0	37.0	-	-	0.5	195.0
Alb de Cisnădioara 5	93.0	30	105.5	53.0	96	7.0	33.0	1	0.5	1.0	170.0
Alb de Cisnădioara 6	111.5	34	110.0	54.0	94	7.0	36.0	1	0.5	1.0	182.0

Because samples were collected at full ripeness and sometimes even at over-ripeness, the clusters had relatively low weights, ranging from 3-4 grams for the Bob batut cultivar, to 0.5 grams for most other cultivars. Regarding the cluster weight, most of the cultivars were categorized as medium to small-sized; the highest weight was registered for the Cisnădioara cultivar clusters and the lowest for Rose de Cisnădioara. Although these cultivars do not have very high weight, or very pleasant appearance, their organoleptic qualities which are derived from their fragrant compounds as well as their acidity and sugar content, make them very special.

For local cultivars grown using simple technology, without diseases control treatments, it is very important to monitor the number and percentage of healthy berries and those showing signs of disease or pest damage, as well as injuries from hail, or berries cracking due to rainfall [3]. All the analyzed local cultivars demonstrated more than satisfactory performance, with a vast majority presenting a good resistance to diseases and pests attack, despite receiving only a single treatment with Bordeaux mixture. These local cultivars also showed good skin resistance to cracking because it was found that, in the rainy autumns in the Sibiu area, during the full ripening in most cases, only 1-2 berries per cluster had cracked skin. Resistance to cracking is an important trait as it reduces the risk of gray rot damage in the final ripening stage when disease control treatments are nearly impossible, and late onset of rot can degrade the quality of both must and wine [12].

Table 6. Physical-mechanical characteristics of the grapes, in local cultivar Rosé de Cisnădioara

Sample	Cluster weight (g)	Healthy berries		Skin (g)	Seeds		Flesh (g)	Injured berries		Rachis (g)	Sugar (g/l)
		No.	g		No.	g		No.	g		
Rosé de Cisnădioara 1	20.0	16	20.0	11.0	23	5.0	10.0	1	0.5	0.5	154.0
Rosé de Cisnădioara 2	22.0	18	22.0	13.0	26	3.0	11.0	-	-	0.5	150.0
Rosé de Cisnădioara 3	19.0	16	19.0	10.0	22	4.0	10.0	1	0.5	0.5	160.0
Rosé de Cisnădioara 4	23.0	21	24.0	14.0	28	6.0	12.0	2	1.0	0.5	148.0

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Rosé de Cisnădioara 5	21.0	14	17.5	12.0	16	2.0	7.0	-	-	0.5	148.0
Rosé de Cisnădioara 6	21.0	16	20.0	12.0	23	4.0	10.0	1	0.5	0,5	152.0

When examining the grape must yield of the studied local cultivars, the percentage of berry flesh is an essential factor in analyzing the mechanical structure of the grapes. This analysis is important for several reasons: it aids in selecting winemaking approaches based on grape components, assesses harvest health and must yield, and helps to guide the development of winemaking processes such as fermentation and storage [2, 9]. Additionally, this analysis allows the determination of the grape's structural index, which typically ranges from 10.00 to 50.00, with lower values observed in grape wine cultivars and higher values in table grape cultivars. It also enables the calculation of the compositional index of the berry, which has similar characteristics across table and wine grapes.

Table 7. Potential yield in must in the grapes samples collected from Cisnădioara cultivar

Cultivar 1 Cisnădioara	Seeds weight (g)	No. seeds	Berry			Berry flesh weight (g)
			No.	Weight (g)	1 berry (g)	
Sample No. 1	7.5	65	49	108.0	3.0	36.0
Sample No. 2	6.0	56	43	102.0	2.0	31.0
Sample No. 3	6.5	58	45	103.0	2.0	33.0
Sample No. 4	2.0	39	35	88.0	1.0	29.0
Sample No. 5	3.0	42	38	94.0	1.0	30.0
Sample No. 6	5.0	52	42	99.0	3.0	31.0

The yield index, representing the ratio between the must weight and the pomace weight, is particularly significant in grape wine cultivars [1]. In this study, the yield index was highest in the local Bob Bătut cultivar, which, based on its composition and description, belongs to the category of grape wine varieties.

Table 8. Potential yield in must in the grapes samples collected from Ţâţa caprei cultivar

Cultivar 2 Ţâţa caprei	Seeds weight (g)	No. seeds	Berry			Berry flesh weight (g)
			No.	Weight (g)	1 berry (g)	
Sample No. 1	3.0	23	18	32.0	2.0	30.0
Sample No. 2	3.0	22	17	33.0	2.0	32.0
Sample No. 3	4.0	27	19	38.0	4.0	37.0
Sample No. 4	3.0	20	16	32.0	2.0	31.0
Sample No. 5	2.0	18	15	30.0	1.0	29.0
Sample No. 6	3.0	22	17	33.0	3.0	31.0

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Table 9. Potential yield in must in the grapes samples collected from Ananas cultivar

Cultivar 3 Ananas	Seeds weight (g)	No. seeds	Berry			Berry flesh weight (g)
			No.	Weight (g)	1 berry (g)	
Sample No. 1	9.0	85	59	135.0	9.0	51.0
Sample No. 2	6.0	77	52	127.0	7.0	47.0
Sample No. 3	3.0	74	44	113.0	5.0	43.0
Sample No. 4	8.0	83	54	128.0	8.0	49.0
Sample No. 5	4.0	76	46	117.0	6.0	45.0
Sample No. 6	6.0	79	51	124.0	7.0	47.0

Table 10. Potential yield in must in the grapes samples collected from Bob Bătut cultivar

Cultivar 4 Bob Bătut	Seeds weight (g)	No. seeds	Berry			Berry flesh weight (g)
			No.	Weight (g)	1 berry (g)	
Sample No. 1	15.0	202	118	127.0	5.0	35.0
Sample No. 2	13.0	180	98	120.0	4.0	30.0
Sample No. 3	8.0	153	83	118.0	3.0	32.0
Sample No. 4	9.0	157	98	120.0	4.0	29.0
Sample No. 5	10.0	163	103	125.0	4.0	33.0
Sample No. 6	11.0	171	100	122.0	5.0	31.0

The local analyzed cultivars are primarily cultivated in family gardens using a very simple growing technology that typically involves pruning and possibly one or two treatments with copper sulphate. These practices do not include fertilization or summer pruning. Under these conditions, the cultivars exhibited good to excellent resistance to fungal diseases and pests, rarely showing minimal signs of damage that did not significantly impact grape production or quality.

Table 11. Potential yield in must in the grapes samples collected from Alb de Cisnădioara

Cultivar 5	Seeds weight (g)	No. seeds	Berry			Berry flesh weight (g)
			No.	Weight (g)	1 berry (g)	
Sample No. 1	8.0	94	36	112.0	9.0	38.0
Sample No. 2	6.0	88	30	99.5	6.0	32.0
Sample No. 3	9.0	102	42	123.0	11.0	40.0
Sample No. 4	6.0	90	36	112.0	8.0	37.0
Sample No. 5	6.0	96	31	106.0	6.0	33.0
Sample No. 6	7.0	94	35	110.5	8.0	36.0

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Table 12. Potential yield in must in the grapes samples collected from Rose de Cisnadioara

Cultivar 6 Rosé de Cisnădioara	Seeds weight (g)	No. seeds	Berry			Berry flesh weight (g)
			No.	Weight (g)	1 berry (g)	
Sample No. 1	3..0	23	16	20.0	4.0	10.0
Sample No. 2	5.0	26	18	22.0	5.0	11.0
Sample No. 3	3.0	22	16	19.0	4.0	10.0
Sample No. 4	7.0	28	21	24.0	8.0	12.0
Sample No. 5	2.0	16	14	17.5	4.0	7.0
Sample No. 6	4.0	23	17	20.5	5.0	10.0

Most of these cultivars produce grapes that can be consumed fresh or for wine by using basic winemaking techniques to produce the increasingly popular homemade wines. Such wines, favoured by a growing number of consumers, are characterized by their lighter alcohol content and persistent aromas, which are increasingly rare in wines from noble varieties that tend to accumulate more sugar due to lower thermal balances.

While the physical and mechanical characteristics of these local cultivars may not match the yield and efficiency of noble varieties, they offer unique qualities and are a source of distinctiveness. From such local cultivars may be produced less processed wines with minimally invasive cultivation practices that are more environmentally sustainable.

Conclusions

Most of the local analyzed cultivars are grown in family gardens using a very simple technology that involves pruning and, at most, one or two applications of copper sulphate. These practices do not include fertilization or summer pruning. Under these conditions, local cultivars demonstrated well to excellent resistance to fungal diseases and specific grapevine pests, with minimal signs of damage that did not significantly influence grape production or quality.

Many of these cultivars produce grapes suitable for both fresh consumption and basic vinification methods, resulting in the well-known homemade wines that are increasingly popular among consumers. These wines are lighter in alcohol and have persistent aromas, which are becoming rarer in wines made from noble varieties. This is due to the lower thermal balances causing increased sugar accumulation and, consequently, higher alcohol in the wine.

While the physical and mechanical structures of these local cultivars may not offer the yield and efficiency of noble varieties, they should be considered for their typicality and ability to produce less processed wines. Moreover, their cultivation follows less invasive technologies that align well with environmental sustainability.

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