

IN SITU SELECTION OF LOCAL SOUR CHERRY VARIETIES RESISTANT TO THERMOHYDRIC STRESS

Silvia NICOLAE¹, Corina GAVĂȚ², Mihai CHIVU¹, Adelina Ioana STAN¹

¹Research Institute for Fruit Growing Pitești - Mărăcineni, 402 Mărului Street, RO 117450,
Mărăcineni, Pitești, Argeș County, Romania

²Research Station for Fruit Growing Constanța, 25 Pepinierei Street,
RO 907300, Valu lui Traian, Constanța, Romania

Corresponding author email: silvia_eu2001@yahoo.com

Abstract

*The sour cherry (*Prunus cerasus*) is a tetraploid tree species native to Central Asia, which is found in semi-spontaneous form in all inhabited areas with favorable conditions for cultivation, especially in hilly areas. The fruits are consumed both fresh, having therapeutic properties, but also in processed form.*

The current climate trend of increasing average temperatures and decreasing amounts of precipitation makes the existing varieties suffer to a greater or lesser extent. In order to cope with climate changes, breeding programs also aim to identify valuable genotypes adapted to thermohydric stress conditions.

The research in this paper aims at the in situ identification of some local sour cherry varieties in areas with high temperatures and low rainfall. Such an area is the one in southern Romania, more precisely in the southeast of Dolj county, located at an altitude slightly higher than 100m. Of the 24 selected local varieties, 45.83% have a caliber over 21 mm, the largest being the 24.9 mm at SLV-24-Dj-1.2 selection. In terms of taste and aroma, SLV-24-Dj-2.5 stood out and received the highest score at the tasting.

Key words: local varieties, resistant, sour cherry, southern Romania.

INTRODUCTION

The sour cherry (*Prunus cerasus*) is a tetraploid fruit species native to Central Asia, presumed to be the result of a cross between *Prunus avium* and *Prunus fruticosa* Pall (Loescher, 2003). It is smaller in size than the sweet cherry tree, and can reach a height of up to 6 meters. The sour cherry does not grow spontaneously, but because it easily propagates through seeds and suckers, it is found in a semi-wild form in all inhabited areas with favorable growing conditions, especially in hilly areas. It develops normally in most types of soil, especially in loamy, clayey-sandy, sandy soils, and less so in clayey (compact) soils or those rich in sodium salts. It has similar requirements to the sweet cherry regarding environmental factors, although there are differences in thermal and precipitation optima. For sour cherry, the thermal optimum is lower than for sweet cherry, ranging between 15 and 25°C, and it struggles to withstand high temperatures. During the dormant period, it can withstand frosts of up to -29°C. Regarding water

requirements, it is a species with high precipitation needs, between 700 and 1200mm/year. In Romania, the counties most favorable for this crop based on climatic and pedological conditions are Sălaj, Vâlcea, Gorj, Maramureș, and Caraș-Severin Counties while the least favorable are Harghita, Tulcea, Brăila, and Covasna Counties (Coman et al., 2014).

The red-purple fruits, with blackish hues, sweet-sour, reach harvest maturity in Romania from early June to late July or even the beginning of August, depending on the area and climatic conditions. They are appreciated for fresh consumption due to their composition with therapeutic properties. Thus, the antioxidant content contributes to the prevention of cancer and cardiovascular diseases, melatonin regulates the sleep-wake cycle, anthocyanins reduce inflammatory processes (muscle and joint pain), anthocyanins and fibers maintain blood vessel elasticity and reduce cholesterol, and by the slow release of sugars into the blood, it can help manage weight and prevent insulin resistance (Blando and Oomah, 2019). Being a perishable fruit, a

large part of the production is industrialized, resulting in a variety of processed products (soft drinks, cookies, jam, compote, syrups, liqueurs, candies, etc.). In addition, it is also a very good mellifer species, yielding approximately 30-40 kg of honey per hectare of orchard (Bura, 2009).

The largest producer of sour cherries in the world in 2023 is the Russian Federation with a production of 268,256 tons on an area of 41,377 hectares, followed by Turkey with a production of 211,291 tons on an area of 26,000 hectares and Poland with 168,700 tons on an area of 25,300 hectares. In Romania, as of 2023, a production of 29,000 tons was recorded on an area of 2,760 hectares (FAOSTAT data, 2025). Classic sour cherry plantations can reach ages of up to 30-35 years, and 20-25 years for intensive ones. Within the research centers in Romania, especially at RIFG Pitești (located in the south of Romania) and at RSFG Iași (located in the northeast of Romania), there has been interest in selecting local varieties, with which *ex situ* collections of sour cherries have been established. To these, indigenous hybrids and varieties from abroad, both older and newer, were added (Branște, 2006). In the process of selecting local varieties, vigor, crown type, and fruiting branches of the tree, physical and sensory characteristics of the fruits, tolerance to specific diseases, as well as resistance to pedo-climatic factors were taken into account. The current climatic trend of increasing average temperatures (Lindsey and Dahlman, 2024) and the increase in drought periods causes existing varieties to suffer to a greater or lesser extent. To cope with climate change, breeding programs also aim to identify valuable genotypes adapted to these thermo-hydric stress conditions.

The research in this paper aims to identify *in situ* local varieties of sour cherry in areas with high temperatures and precipitation deficits. Such an area is in the southeastern part of Dolj County, in the region known as the 'Sahara of Oltenia' specifically in Daneți, Dobrotești, and Amărăștii de Jos villages situated at an altitude slightly above 100m.

MATERIALS AND METHODS

The southeastern area of Dolj County is characterized by a temperate-continental climate with very hot summers and moderate winters, with multiannual temperatures of approximately 11.5°C and average annual precipitation amounts totaling up to 500mm.

In the warm season of the year, in the southern part of Dolj County, the higher intensity of winds blowing from the West causes the increased mobility of sand dunes (Ghinea, 2025 February, 3).

The soil, similar to that found in Dăbuleni village (it is located in the southeast of Dolj County), is sandy with low natural fertility, being poorly supplied with nitrogen and phosphorus and moderately supplied with potassium (www.scdcpndabuleni.ro/ro/istoric/4).

The main activity of the locals in the southern part of Dolj County is agriculture, as these areas are favorable for the cultivation of tobacco, watermelons, peaches, apricots, etc. The selection of local sour cherry varieties was done in the households of locals from Daneți, Dobrotești, and Amărăștii de Jos villages, on trees with their own roots.

Following observations on the local varieties of sour cherries from the households of the locals, 24 biotypes were selected. The selection was made at the beginning of June, 2024, on an average sample of 30 fruits.

The studied indicators were vigor, suckering capacity, and productivity in the tree, and for the fruit, skin color, pulp color, fruit weight, stone weight, caliber, firmness, and soluble dry matter.

The assessment of suckering capacity was done on a scale from 1 to 3 as follows: 1-no suckers, 2-weak suckering (1-2 suckers), 3-medium (3-4 suckers). Productivity was estimated on a scale from 1 to 5 as follows: 1 - very low, 2 - low, 3 - medium, 4 - high, 5 - very high. Caliber was determined with an electronic caliper, measuring the larger diameter of the fruit.

Firmness was measured with a nondestructive HPE Qualitest penetrometer, with a 0.25 cm² tip, and is expressed in HPE units.

The soluble dry substance in sour cherry fruits was determined using a portable refractometer with automatic temperature compensation and is expressed in °Brix. The pulp yield (%) represents the percentage of pulp relative to the weight of the fruit with the peduncle. The dates were processed using the Excel database and SPSS 14 software. The differences between means were highlighted at a probability level of 0.05%

RESULTS AND DISCUSSIONS

In the selection process of sour cherries in this study, the pursued objectives are low to medium tree vigor, tolerance to specific diseases and pests, good fruit quality with a weight over 4g/fruit and good taste, as well as

resistance to high temperatures and precipitation unevenly distributed throughout the entire growing season. All the selected types are trees on their own roots, not grafted, with fruits that ripened in early June. They did not show symptoms of specific sour cherry diseases caused by *Monilinia fructigena*, *Monilinia laxa*, *Monilinia fruticola*, *Stigmina carpophila*, *Xanthomonas campestris* pv. *pruni*, *Blumeriella jaapii*, *Capnodium salicinum*, *Venturia cerasi*, *Apiognomonina erythrostoma*, *Chondrostereum purpureum*. The selected local varieties have variable vigor and an age ranging from 5 to even over 15 years. In general, the trees had very high productivity, with the fruit skin color varying from red to dark red. More than half of the selected local varieties did not show a tendency to sucker (Table 1).

Table 1. Observations on the external characteristics of the trees and fruits of selected local sour cherry varieties in the southeastern part of Dolj County

Selection code	Tree vigor	Suckering capacity	Productivity	Fruit skin color	Fruit pulp color
SLV-24-Dj-1.1	low	2	5	red	light red
SLV-24-DJ-1.2	high	1	2	dark red	light red
SLV-24-Dj-1.3	low	2	5	red	red
SLV-24-Dj-1.4	high	3	5	red	red
SLV-24-Dj-1.5	low	3	5	dark red	red
SLV-24-Dj-1.6	medium-high	1	5	red	red
SLV-24-DJ-1.7	low-medium	1	5	red	red
SLV-24-Dj-1.8	medium	1	5	red	red
SLV-24-Dj-1.9	low	2	5	red	light red
SLV-24-Dj-1.10	low-medium	1	5	dark red	red
SLV-24-Dj-2.1	high	2	5	red	red
SLV-24-Dj-2.2	high	2	5	dark red	dark red
SLV-24-Dj-2.3	low	-	5	red	red
SLV-24-Dj-2.4	low	1	5	red	red
SLV-24-Dj-2.5	low	3	5	dark red	dark red
SLV-24-Dj-2.6	medium	1	5	red	red
SLV-24-Dj-2.7	high	1	5	dark red	red
SLV-24-Dj-2.8	low	1	5	dark red	dark red
SLV-24-Dj-2.9	low-medium	1	5	dark red	dark red
SLV-24-DJ-2.10	low	1	5	dark red	red
SLV-24-Dj-2.11	low-medium	1	5	dark red	dark red
Selection code	Tree vigor	Suckering capacity	Productivity	Fruit skin color	Fruit pulp color
SLV-24-Dj-2.12	low	1	5	dark red	red
SLV-24-Dj-3.1	high	1	5	dark red	red
SLV-24-Dj-3.2	medium-high	3	5	Red	red

In addition to external observations of the trees and fruits, physicochemical determinations were also made on the fruits, specifically

determining pulp yield, fruit size, firmness, and soluble dry matter, with the average values being summarized in Table 2.

Table 2. Physical and chemical indicators monitored in the fruits of selected local varieties in situ from the southeastern area of Dolj County (average values)

Selection code	Pulp yield (%)	Weight of fruit without peduncle (g)	Fruit caliber (mm)	Firmness of the fruit (HPE)	Soluble dry matter (⁰ Brix)
SLV-24-Dj-1.1	90.76	3.67hi	19.99ij	20.23abc	13.60hijkl
SLV-24-Dj-1.2	93.54	7.10a	24.90a	14.83cd	13.43ijkl
SLV-24-Dj-1.3	91.14	4.40defg	20.61fghij	16.60bcd	17.70a
SLV-24-Dj-1.4	91.96	4.77bcde	21.03defghi	14.60cd	13.67ghijkl
SLV-24-Dj-1.5	90.75	3.30i	18.47k	15.77bcd	15.00defghi
SLV-24-Dj-1.6	92.55	4.80bcde	20.87efghij	24.10a	17.07ab
SLV-24-Dj-1.7	91.58	3.90ghi	20.07hij	13.93cd	13.83fghijkl
SLV-24-Dj-1.8	90.83	3.80ghi	19.60j	14.17cd	14.37efghijk
SLV-24-Dj-1.9	94.62	5.23bc	22.46bc	11.33d	12.77l
SLV-24-Dj-1.10	93.87	5.23bc	22.67b	11.83d	13.20jkl
SLV-24-Dj-2.1	91.43	4.70bcde	21.33cdefgh	11.53d	12.67l
SLV-24-Dj-2.2	91.88	5.07bcd	21.91bcde	20.13abc	14.60efghij
SLV-24-Dj-2.3	91.30	4.20efgh	20.74efghij	21.83ab	15.33cdef
SLV-24-Dj-2.4	92.21	4.87bcde	21.57bcdefg	13.97cd	14.03efghijkl
SLV-24-Dj-2.5	94.64	3.83ghi	19.88ij	15.67cd	16.23bcd
SLV-24-Dj-2.6	92.94	5.23bc	22.00bcde	13.97cd	15.13defgh
SLV-24-Dj-2.7	93.32	4.60cdef	20.90efghij	16.23bcd	15.23defg
SLV-24-Dj-2.8	91.73	4.23efgh	20.00ij	19.80abc	16.73abc
SLV-24-Dj-2.9	91.55	4.27efgh	20.71efghij	16.20bcd	12.80kl
SLV-24-Dj-2.10	92.02	3.93fghi	20.39ghij	16.37bcd	14.40efghij
SLV-24-Dj-2.11	91.51	3.97fghi	20.31ghij	15.50cd	15.53cde
SLV-24-Dj-2.12	93.22	5.37b	22.25bcd	12.33d	14.80defghi
SLV-24-Dj-3.1	92.68	6.87a	24.59a	25.33a	13.07jkl
SLV-24-Dj-3.2	92.25	5.00bcd	21.85bcdef	13.93cd	14.00efghijkl

Notes: The values are compared vertically. Means with a different letter are statistically different (p≤0.05)

The selected varieties, in most cases, have high productivity and did not show symptoms of diseases or viruses. The pulp yield calculated by the ratio between the pulp weight compared to the fruit weight with the peduncle ranged from 94.64% in the 'SLV-24-Dj-2.5' selection to 90.75% in the 'SLV-24-DJ-1.5' selection.

The selections with the highest average fruit weight without the peduncle are 'SLV-24-Dj-1.2' with 7.1g and 'SLV-24-Dj-3.1' with 6.87g. On the opposite end is the selection 'SLV-24-Dj-1.5', whose fruit has an average weight of 3.3 g. Out of the 24 local varieties, 70% had an average fruit weight greater than 4 g. Just like the fruit weight, the size was largest in the selections 'SLV-24-Dj-1.2' with 24.9 mm and 'SLV-24-Dj-3.1' with 24.59 mm, significantly larger than the other local varieties. The smallest fruit caliber was recorded in the selection 'SLV-24-Dj-1.5' at 18.47 mm. According to the marketing standard SR

3155:1995, extra quality fruits are those with a minimum caliber of 21 mm, while those in class I are those with a minimum caliber of 18 mm (www.scrigroup.com). From the data obtained from the measurements, 45.83% of the selected varieties fall into the extra class and 54.17% into class I.

The firmness of the fruits varied from 25.33 HPE in the selection 'SLV-24-Dj-3.1' to 11.33 HPE in the selection 'SLV-24-Dj-1.9'. Observations in the following days showed that the fruits from the selection with the lowest firmness spoiled the fastest.

The soluble dry matter content expressed in ⁰Brix, was varied between 17.7⁰Brix for the 'SLV-24-Dj-1.3' selection and 12.67⁰Brix for the 'SLV-24-Dj-2.1' selection. The fruits were stored in the refrigerator, and 2-4 days after harvesting, a tasting was organized to assess the organoleptic quality of the fruits in 23 selections. During this tasting, both external

characteristics (ease of peduncle detachment, size, shape, and color of the fruit) and pulp characteristics (texture, stone size, acidity, adherence to the stone, taste, and flavor) were noted. The scoring was done on a scale from 1 to 9 (1-3 unsatisfactory, 4-6 good, and 7-9 very

good). There were seven tasters, researchers from RIFG Pitești, aged between 27 and 56 years. The average scores for external characteristics and pulp characteristics for each selection are presented in Table 3.

Table 3. Appreciation of the quality of fruits from selected local sour cherry varieties in the southeast of Dolj County (average scores given by 7 tasters)

Selection code	External characters				Characteristics of the pulp						Average
	The ease of peduncle detachment	Size	Shape	Fruit color	Texture	Size of the stone	Acidity	Adhesion to the stone	Taste	Flavor	
SLV-24-Dj-1.2	7.71a	8.43a	8.14ab	8.14a	7.29a	6.14a	6.14a	5.71ab	6.29ab	5.43a	6.94a
SLV-24-Dj-1.3	7.57a	7.00abcdef	7.14abc	7.57a	7.00a	7.14a	7.00a	7.29ab	6.71ab	7.00a	7.14a
SLV-24-Dj-1.4	7.57a	7.43abcd	7.57abc	7.14a	6.86a	6.71a	6.71a	6.57ab	5.00b	5.29a	6.69a
SLV-24-Dj-1.5	7.43a	5.71ef	6.57abc	7.00a	6.00a	6.43a	6.14a	6.57ab	6.00ab	5.57a	6.34a
SLV-24-Dj-1.6	7.57a	7.00abcdef	7.71abc	7.57a	6.71a	6.43a	6.14a	7.43ab	6.00ab	5.57a	6.81a
SLV-24-Dj-1.7	7.57a	5.57f	6.71abc	6.86a	6.71a	6.57a	6.71a	6.86ab	6.14ab	5.86a	6.03a
SLV-24-Dj-1.8	7.86a	6.00def	6.57abc	7.14a	7.14a	6.86a	6.57a	7.29ab	6.43ab	6.43a	6.83a
SLV-24-Dj-1.9	8.14a	7.86abc	7.86abc	7.86a	6.43a	6.43a	6.14a	6.71ab	5.71ab	5.71a	6.89a
SLV-24-Dj-1.10	7.72a	6.81bcdef	7.30abc	7.45a	6.82a	6.73a	6.37a	7.08ab	6.21ab	5.89a	6.84a
SLV-24-Dj-2.1	7.86a	7.14abcdef	7.14abc	7.14a	6.43a	6.29a	6.57a	6.14ab	5.86ab	5.43a	6.60a
SLV-24-Dj-2.2	7.86a	7.29abcde	7.43abc	7.29a	6.71a	6.57a	5.71a	7.29ab	5.71ab	6.14a	6.80a
SLV-24-Dj-2.3	7.43a	6.29cdef	7.14abc	7.14a	6.29a	6.71a	6.71a	6.14ab	6.57ab	5.71a	6.61a
SLV-24-Dj-2.4	7.43a	7.00abcdef	6.86abc	6.86a	6.57a	6.86a	6.14a	6.71ab	6.00ab	6.14a	6.66a
SLV-24-Dj-2.5	7.86a	6.14cdef	6.86abc	7.29a	6.86a	7.29a	7.00a	7.50a	7.71a	7.29a	7.17a
SLV-24-Dj-2.6	8.29a	7.86abc	7.71abc	7.86a	7.00a	6.86a	7.43a	6.86ab	7.14a	6.43a	7.34a
SLV-24-Dj-2.7	7.57a	7.14abcdef	7.14abc	7.14a	6.43a	7.14a	6.26a	7.43ab	6.57ab	6.29a	6.91a
SLV-24-Dj-2.8	7.71a	5.57f	6.43bc	7.29a	6.00a	6.86a	5.86a	6.71ab	6.57ab	6.43a	6.54a
SLV-24-Dj-2.9	7.57a	6.00def	7.00abc	7.29a	6.86a	6.86a	6.14a	6.00ab	6.29ab	5.43a	6.54a
SLV-24-Dj-2.10	7.86a	6.71bcdef	6.86abc	6.86a	6.43a	6.43a	6.00a	6.71ab	6.14ab	5.43a	6.54a
SLV-24-Dj-2.11	6.86a	5.86def	6.14c	6.71a	6.57a	6.57a	6.00a	6.86ab	5.86ab	5.57a	6.30a
SLV-24-Dj-2.12	7.29a	7.71abc	7.43abc	7.86a	6.57a	6.14a	6.71a	7.00ab	6.57ab	5.57a	6.89a
SLV-24-Dj-3.1	7.71a	8.14ab	8.29a	7.86a	7.00a	6.00a	5.86a	5.43b	5.86ab	5.71a	6.79a
SLV-24-Dj-3.2	7.57a	7.29abcde	7.00abc	7.14a	6.43a	6.29a	6.86a	6.71ab	6.43ab	6.14a	6.79a

Regarding the ease of peduncle detachment, there were no significant differences between the local varieties, with average scores ranging from 8.29 for 'SLV-24-Dj-2.6' to 6.86 for 'SLV-24-Dj-2.11'. In terms of size, the highest score (8.43) was given to the selection 'SLV-24-Dj-1.2' (Figure 1) which is also confirmed by the weight measurements (7.1 g) and caliber (24.9 mm) of the fruits. In terms of taste and aroma, the selection 'SLV-24-Dj-2.5' (Figure 2.a and 2.b) stood out, receiving the highest scores of 7.71 and 7.29, respectively. Out of the 23 local varieties tasted, 3 selections 'SLV-24-Dj-1.3' (Figure 3), 'SLV-24-Dj-2.5', 'SLV-24-Dj-2.6' (Figure 4.a and 4.b) had an average score higher than 7, placing them in the 'very good' category, while the rest were rated as 'good' with an average tasting score between 6.03 and 6.94.

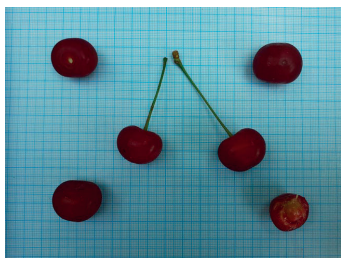


Figure 1. SLV-24-Dj-1.2

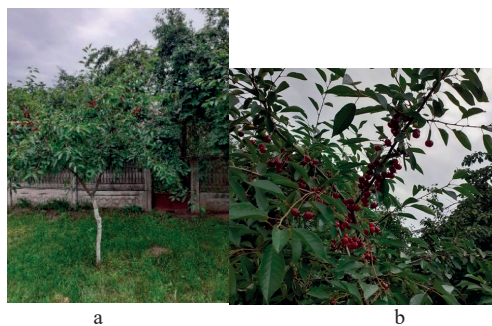


Figure 2. SLV-24-Dj-2.5 (a, b)

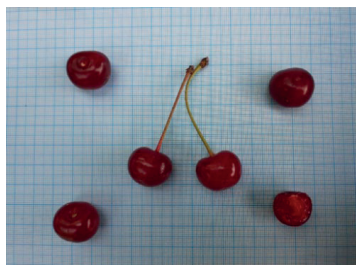


Figure 3. SLV-24-Dj-1.3

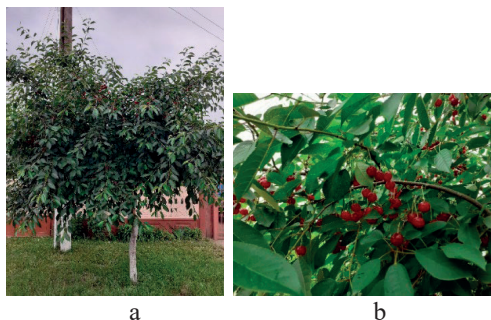


Figure 4. SLV-24-Dj-2.6 (a, b)

CONCLUSIONS

Out of the 24 selections, 'SLV-24-Dj-1.2' with 7.1g and 'SLV-24-Dj-3.1' with 6.87g stood out for fruit size, while 'SLV-24-Dj-2.5' stood out for taste and flavor. However, the varieties with an average fruit weight greater than 4g and very good productivity should not be overlooked either. The selected local varieties will be monitored again this year to see if the productivity and quality of the fruits remain consistent.

ACKNOWLEDGEMENTS

This research is part of the project ADER 6.1.1/2023 'Studies on the conservation, evaluation, and breeding of pomological biodiversity represented by species tolerant to thermo-hydric stress' and was supported by Romanian Ministry of Agriculture and Rural Development.

REFERENCES

- Braniște N. (2006). *Vișinul. Fondul de germoplasmă la speciile pomicele, de arbuști fructiferi și căpșun din colecțiile din România*, Editura Pământul, ISBN: 973-8280-87-7.
- Bura M. (2009, april, 8). Plante melifere care înfloresc în aprilie și mai. *Ferma*. Retrieved January 24, 2025, from <https://revista-ferma.ro/plante-melifere-care-infloresc-in-aprilie-si-mai>,
- Coman Mihai, Chițu Emil,..., Petre Valeria, Durău Anica (2014). Zonarea speciilor pomicele în funcție de condițiile pedoclimatice și socio economice ale României: 69-72, ISBN 978-973-1886-93-0
- Criterii de apreciere a calității fructelor și bazele standardizării lor - <https://www.scripgroup.com/casa-masina/pomicultura/CRITERII-DE-APRECIERE-CALITATI161414.php>

- FAOSTAT data (2025, January, 15) Retrieved from <https://www.fao.org/faostat/en/#data/QCL>
- Federica Blando, B. Dave Oomah (2019). Sweet and sour cherries: Origin, distribution, nutritional composition and health benefits - a review. *Trends in Food Science & Technology*, vol. 86: 517-529 <https://doi.org/10.1016/j.tifs.2019.02.052>
- Ghinea D. (2025, February, 3) - Dolj, România geografică. Retrieved from <https://romaniadategeografice.net/unitati-admin-teritoriale/judete/judete-d/dolj/>
- Istoric. SCDCPN Dăbuleni. Retrieved from <https://www.scdcpndabuleni.ro/ro/istoric/>
- Loescher, W. (2003). *Cherries. Encyclopedia of Food Sciences and Nutrition (Second Edition)*, Ed. Academic Press.
- Lindsey R. and Dahlman L. (2024, January, 18). Climate Change: Global Temperature. Retrieved February 7, 2025, from <https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>