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STATISTICAL EVALUATION OF BIOMETRIC AND PHYSICOCHEMICAL VARIABILITY IN THE FRUITS OF FIVE SWEET CHERRY CULTIVARS (*PRUNUS AVIUM* L.)

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Abstract

The cherry (Prunus avium L.) is a fruit tree belonging to the genus Prunus of the Rosaceae family, originating around the Caspian and Black Seas, on the border between Europe and Asia, and thriving best in temperate or Mediterranean climates. Sweet cherries are grown commercially in over 40 countries worldwide (Webster and Looney, 1996). In 2025, cherry production in Romania was severely affected by April frosts, which compromised orchards by up to 100% in some areas. For this study, 5 cherry varieties were analyzed (Inima de Porumbel, Van, Boambe de Cotnari, Bigarreau Burlat, Rosii de Bistrita), originating from a family plantation established 7 years ago in the town of Bistrita, Bistrita-Nasaud County, Romania. The following fruit quality indicators were studied for these varieties: large fruit diameter (mm), small diameter (mm), fruit height (mm), weight (g), soluble dry matter (^{0}Bx), sugar percentage (%), fruit pH, and firmness (25 fruits of each variety, from the experimental year 2025). All statistical analyses were performed using R statistical software [v4.4.1; RCoreTeam, 2024]. Comparisons of means were performed using Duncan's multiple-range test (DMRT).

Key words*: cherry varieties, biometric characteristics, physicochemical, fruit quality.*

INTRODUCTION

Sweet cherries are part of the Rosaceae family, subfamily Prunoideae, and are among the most important and delicious fruits in temperate regions of the world (Wunsch and Hormaza, 2004). They are available on the market from mid-May to July, and there is little competition among different fruit crops in temperate areas (Zheng et al., 2016). Although characterization and evaluation of selected sweet cherry varieties have been previously carried out by several researchers (Scedei et al., 2023; Asanica et al., 2013).

The objective of this study was to verify the quality and physico-chemical performance of the fruits in the context of current climate change (Perju et al., 2024), in the experimental year 2025, the fruits of five varieties (Inima de Porumbel, Van, Boambe de Cotnari, Bigarreau Burlat, Rosii de Bistrita) from a family plantation with an age of 7 years since planting, located in the Bistrita locality, Bistrita – Năsaud County, Romania (47°08′20″N 24°30′01″E).

In Romania, for a long time, cherry cultivation was limited in extent to the few trees existing in family gardens or in small orchards around large cities, intended to satisfy the requirements of strictly local markets where small quantities of fruit were valued (Budan and Grădinariu, 2000; Corneanu et al., 2021; Petre et al., 2005). Currently, in our country, about 7 thousand ha are still cultivated, most of them in the private sector, yielding a production of about 60 thousand tons (Budan and Grădinariu, 2000; Petre et al., 2005).

Sweet cherry (*Prunus avium* L.) is a crop of great importance in the northwest region of Romania due to the favorable cultural conditions and tradition found in this area. Romanian sweet cherry production shows a growth trend (Hrotko, 2016; Bujdoso and Hrotko, 2017). Sweet cherry orchards, according to FAO data, occupy approximately 7,058 ha and produce 90,837 tons annually (FAOSTAT, 2018; FAOSTAT 2021), placing our country among the world's top sweet cherry-producing countries, along with Turkey, Chile, Italy,

Spain, and others. Of the area occupied by sweet cherry orchards in Romania, the main producing counties are Iași, Galați, Vrancea, Vaslui, Botoșani, Neamț, and Arad (Coman & Chițu, 2014; Petre et al., 2005).

According to Grădinaru (2002), sweet cherry cultivation has specific requirements, and their fulfillment is necessary for the success of orchards. In terms of soil characteristics, cherries require well-drained, aerated soil but can tolerate soils ranging from sandy to loamy, as long as drainage is good (Roper and Frank, 2004). Cherry has also been successfully cultivated and has yielded well in soils with organic matter content ranging from less than 1% in sandy soils of warm, semi-arid regions to 10% in cooler temperate regions (Neilsen et al., 2017).

The addition of new local varieties, developed at research stations in the area, together with foreign varieties, is a method of improving the sweet cherry assortment across different orchard management systems (Zlati et al., 2019). For cherry growers, the concept of "fruit quality" depends on the product itself and, of course, on consumer preferences (Romano et al., 2006). It is widely accepted that the main characteristics of sweet cherry quality are fruit weight, color, firmness, sweetness, acidity, taste, and aroma, with important differences between varieties (DíazMula et al., 2009). Pérez-Sánchez et al. (2008 and 2010) show that for consumers, they must have distinct agronomic characteristics (Chivu et al., 2024), such as resistance to fruit cracking, high levels of soluble matter (^{0}Brix), ripening time at the extremes of the sweet cherry ripening season, and high resistance (Corneanu et al., 2012).

Sweet cherry is an important fruit species, cultivated and distributed globally (Palasciano et al., 2022). In addition to the traditional and modern varieties known in Europe, a multitude of varieties have been developed through genetic improvement in growing countries, providing a means to expand and enhance the current assortment (Iurea et al., 2019). Sweet cherries are among the first fresh fruits of the year and among the most appreciated for their organoleptic characteristics (color, aroma) and recognized benefits for human health (biochemical composition) (Blando & Oomah, 2019; Meland et al., 2014). Although sweet cherry is an economically profitable crop, it also has several characteristics that subject it to multiple risks in the context of current climate change (Lang, 2019; Păltineanu & Chitu, 2020; Quero-Garcia et al., 2017).

To limit climatic stress factors (high temperatures, drought) and improve production and its quality, genetic (rootstocks) and horticultural (training systems) research is needed (Whiting et al., 2005; Asănică et al., 2013).

Regarding the rootstock, the adaptability of *Prunus* mahaleb to the continental climate, drought tolerance, and hot summers due to the root system increases its importance for sweet cherry cultivation in the future (Martins et al., 2021; Hrotkó et al., 2023), becoming increasingly used in European countries, Central Asia, and Northwest China (Ercisli et al., 2006; Hrotkó, 2016; Sansavini and Lugli, 2008). These traits are gaining greater importance due to accelerated climate change and replanting conditions. Although researchers agree that rootstocks affect fruit quality, the growth control of mahaleb rootstocks can be managed through frequent pruning and maintaining an optimal crown for optimal production (Tabakov et al., 2020; Martins et al., 2021).

The recent increase in cherry production worldwide has given new importance to fruit quality (Malchev et al, 2022). Thus, recent studies emphasize the value of balancing crop load but also increasing fruit size and quality. For sweet cherries, fruit size and color remain the most important attributes, and the development of strategies to improve fruit quality by researching rootstocks, cultivars, crop load, environmental factors, and final production is of great interest (Whiting & Ophardt, 2005; Zhang & Whiting, 2011; Díaz-Mula et al., 2009).

The objective of this study was to compare five cherry varieties originating from a family plantation in Bistrita, Bistrita-Nasaud County, Romania, in terms of the biometric and physicochemical variability of the fruits, in the context of current climate change (Perju et al., 2024).

The physicochemical characteristics of the fruit are the first elements that attract the consumer and are the basis for varietal selection. The success of the variety is ensured by fruits with

attractive color, large size, firm, tasty pulp, and resistance to transportation (Pérez-Sánchez et al., 2010). These characteristics generally depend on the genetic profile and are also strongly influenced by the environment. Finally, the quality of cherries and consumer preferences are influenced by chemical profiles such as titratable acidity (TA) and total soluble solids (TSS), which are very important parameters for determining the harvest date (Fazzari et al., 2008; Pérez-Sánchez et al., 2010; El Kettabi et al., 2025)

Modern sweet cherry orchards are equipped with rain cover systems, which can affect fruit quality, especially by reducing rain-induced fruit cracking.

The positive effect of covered plantations is that the fruits are larger and heavier, which increases cherry prices and the marketability of the production.

Nowadays, retail chains and consumers demand large-sized cherries, with a fruit width of more than 30 mm (Measham et al., 2014). This size (size) can be achieved by using rain cover systems (Vávra Radek, 2020). These trends in improving the assortment structure should be followed by positive developments in cultivation technology and the application of appropriate pomotechnical and agro-management practices (Radičević et al., 2022).

In the marketing process, fruit size is one of the most important quality indicators, with larger cherries being more valuable on the market. Thus, factors that limit production and satisfy market demands for superior cherry quality, such as rootstock choice and tree pruning system, become of major importance (Balan et al., 2022; Cimpoieș, 2018).

MATERIALS AND METHODS

The biological material

For this study, fruits from five cherry varieties with different origins were analyzed. They were harvested from the Bistrita locality, Bistrita-Nasaud County (in 2025), Romania. This year, cherry production was very low due to spring frost. The varieties studied were Inima de Porumbel (origin: Germany), Van (origin: Canada), Boambe de Cotnari (origin: Romania), Bigarreau Burlat (origin: France), and Rosii de Bistrita (origin: Romania).The biometric and physico-chemical characteristics of the fruits were studied for these varieties, such as average fruit weight, height, and diameter (large diameter, small diameter) of the fruits, fruit firmness, soluble dry matter content, sugar percentage, and fruit acidity (pH).

All statistical procedures to evaluate the biometric and physicochemical parameters of the five sweet cherry cultivars were conducted in R Statistical Software (v4.4.1; R Core Team, 2024). For post-hoc pairwise comparisons among cultivars, Duncan's Multiple Range Test (DMRT) was performed to establish significance levels for differences between any pair of means. This procedure operates independently of a prior significant F-value from the initial ANOVA. Furthermore, the relationships between the fruit quality indicators were analyzed through Pearson linear correlation coefficients and linear regression models.

The analyzed biometric and physicochemical properties

The fruits (25 fruits/variety) were harvested from different parts of the trees (10 trees/variety). The diameter and length of the fruits were measured using a caliper. The weight was determined using an analytical balance. The sugar content of the fruits, expressed as soluble carbohydrates (Brix %), was measured with a digital refractometer (Kruss DR 201-95). The firmness of the fruit pulp was determined with a penetrometer (Force Gauge PCE-FM 200), and the results were expressed in pounds (lbs). The acidity of the fruit juice was determined using a multiparameter analyzer (pH, Consort C-933). The variability in biometric and physicochemical characteristics among cherry varieties is essential for understanding their quality, nutritional value, and suitability for different uses.

This analysis synthesizes results from several studies to provide a comprehensive overview of differences in biometric traits (diameter, weight, height) and physicochemical traits (firmness, Brix index, sugar, and pH) across different cherry cultivars.

RESULTS AND DISCUSSIONS

From the data in Figure 1, it can be seen that the Bigarreau Burlat cherry variety had the highest average large fruit diameter in 2025.

A one-way ANOVA was performed to compare the effect of different types of cherry on the large diameter. It was revealed that there was a statistically significant difference in large-diameter measurements across at least two groups. The main effect of cherry varieties is statistically significant and large ($F(4, 45) = 13.91$, $p < .001$; Eta2 = 0.55, 95% CI [0.36, 1.00]). Duncan's test was performed to compare group means. Significant differences ($p < 0.05$) were found between the following groups: Bigarreau_Burlat and Boambe de Cotnari, with a mean difference of 2.72 ($p = 0.0107$, 95% CI [0.65, 4.79]). A significant difference was observed between Bigarreau Burlat and Inima de Porumbel, with a mean difference of 5.26 ($p < .001$, 95% CI [3.12, 7.4]). A significant difference was observed between Bigarreau Burlat and Rosii de Bistrita, with a mean difference of 6.36 ($p < .001$, 95% CI [4.17, 8.55]). A significant difference was observed between Boambe de Cotnari and Inima de Porumbel, with a mean difference of 2.54 ($p = 0.0127$, 95% CI [0.57, 4.51]). A significant difference was observed between Boambe de Cotnari and Rosii de Bistrita, with a mean difference of 3.64 ($p < .001$, 95% CI [1.57, 5.71]). A significant difference was observed between Inima de Porumbel and Van, with a mean difference of -3.46 ($p = 0.0014$, 95% CI [-5.53, -1.39]).

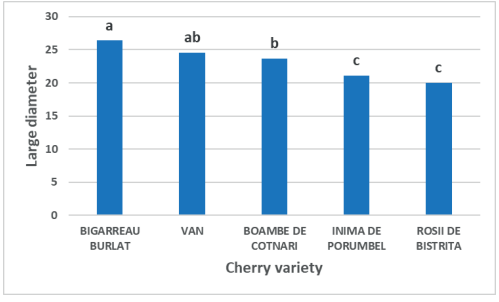

Figure 1. Evaluation of the large diameter (mm) of the fruits of the studied cherry varieties

A significant difference was observed between Rosii de Bistrita and Van, with a mean difference of -4.56 ($p < .001$, 95% CI [-6.7, -2.42]) (Figure 1).

In the experimental year 2025, the cherry varieties Bigarreau Burlat and Boambe de Cotnari recorded the highest average small-diameter values, according to measurements (Figure 2).

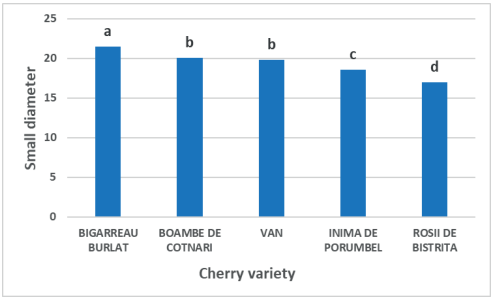

Figure 2. Evaluation of the small diameter (mm) in the fruits of the studied cherry varieties

A one-way ANOVA was performed to compare the effect of different types of cherry on the small diameter. It was revealed that there was a statistically significant difference in small-diameter measurements across at least two groups. The main effect of cherry varieties is statistically significant and large ($F(4, 45) = 22.07$, $p < .001$; Eta2 = 0.66, 95% CI [0.51, 1.00]) (Figure 2). Duncan's test was performed to compare group means. Significant differences ($p < 0.05$) were found between the following groups: Bigarreau Burlat and Boambe de Cotnari, with a mean difference of 1.47 ($p = 0.0067$, 95% CI [0.43, 2.51]). A significant difference was observed between Bigarreau Burlat and Inima de Porumbel, with a mean difference of 2.95 ($p < .001$, 95% CI [1.82, 4.08]). A significant difference was observed between Bigarreau Burlat and Rosii de Bistrita, with a mean difference of 4.57 ($p < .001$, 95% CI [3.41, 5.73]). A significant difference was observed between Bigarreau Burlat and Van, with a mean difference of 1.69 ($p = 0.0029$, 95% CI [0.6, 2.78]). A significant difference was observed between Boambe de Cotnari and Inima de Porumbel, with a mean difference of 1.48 ($p = 0.0086$, 95% CI [0.39, 2.57]). A significant difference was observed between Boambe de Cotnari and Rosii de Bistrita, with a mean difference of 3.1 ($p <.001$, 95% CI [1.97, 4.23]). A significant difference was observed between

Inima de Porumbel and Rosii de Bistrita, with a mean difference of 1.62 (p = 0.003, 95% CI [0.58, 2.66]). A significant difference was observed between Inima de Porumbel and Van, with a mean difference of -1.26 (p = 0.0188, 95% CI [-2.3, -0.22]). A significant difference was observed between Rosii de Bistrita and Van, with a mean difference of -2.88 (p < .001, 95% CI [-3.97, -1.79]).

Regarding the average height of cherry fruits, we can see from Figure 3 that the Van and Bigarreau Burlat varieties had the highest average values for this parameter.

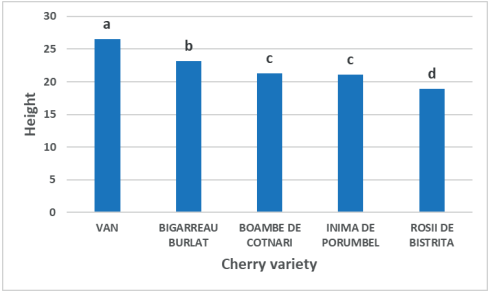

Figure 3. Evaluation of fruit height (mm) in the studied cherry varieties

A one-way ANOVA was performed to compare the effect of different types of cherry on height. It was revealed that there was a statistically significant difference in height between at least two groups. The main effect of cherry varieties is statistically significant and large (F(4, 45) = 63.18, p < .001; Eta2 = 0.85, 95% CI [0.78, 1.00]). Duncan's test was performed to compare group means. Significant differences (p < 0.05) were found between the following groups: Bigarreau Burlat and Boambe de Cotnari, with a mean difference of 1.89 (p < .001, 95% CI [0.86, 2.92]). A significant difference was observed between Bigarreau Burlat and Inima de Porumbel, with a mean difference of 2.03 (p < .001, 95% CI [0.95, 3.11]). A significant difference was observed between Bigarreau Burlat and Rosii de Bistrita, with a mean difference of 4.26 (p < .001, 95% CI [3.14, 5.38]). A significant difference was observed between Bigarreau Burlat and Van, with a mean difference of -3.43 (p < .001, 95% CI [-4.46, -2.4]). A significant difference was observed between Boambe de Cotnari and Rosii de Bistrita, with a mean difference of 2.37 (p < .001, 95% CI [1.29, 3.45]). A significant difference was observed between Boambe de Cotnari and Van, with a mean difference of -5.32 (p < .001, 95% CI [-6.4, -4.24]).A significant difference was observed between Inima de Porumbel and Rosii de Bistrita, with a mean difference of 2.23 (p < .001, 95% CI [1.2, 3.26]). A significant difference was observed between Inima de Porumbel and Van, with a mean difference of -5.46 (p < .001, 95% CI [-6.58, -4.34]). A significant difference was observed between Rosii de Bistrita and Van, with a mean difference of -7.69 (p < .001, 95% CI [-8.83, -6.55]).

From the results, we can conclude that the highest average fruit weight was observed in the Bigarreau Burlat and Van varieties (Figure 4).

A one-way ANOVA was performed to compare the effect of different types of cherry on weight. It was revealed that there was a statistically significant difference in the weight between at least two groups. The main effect of cherry varieties is statistically significant and large (F(4, 45) = 22.49, p < .001; Eta2 = 0.67, 95% CI [0.52, 1.00]). Duncan's test was performed to compare group means. Significant differences (p < 0.05) were found between the following groups: Boambe de Cotnari and Burlat, with a mean difference of -2.71 (p < .001, 95% CI [-3.9, -1.52]). A significant difference was observed between Boambe de Cotnari and Pietroase, with a mean difference of 2.08 (p < .001, 95% CI [0.89, 3.27]).A significant difference was observed between Boambe de Cotnari and Van, with a mean difference of -1.73 (p = 0.0034, 95% CI [-2.86, -0.6]). A significant difference was observed between Burlat and Inima de Porumbel, with a mean difference of 3.15 (p < .001, 95% CI [1.93, 4.37]). A significant difference was observed between Burlat and Pietroase, with a mean difference of 4.79 (p < .001, 95% CI [3.54, 6.04]). A significant difference was observed between Inima de Porumbel and Pietroase, with a mean difference of 1.64 (p = 0.0053, 95% CI [0.51, 2.77]). A significant difference was observed between Inima de Porumbel and Van, with a mean difference of -2.17 (p < .001, 95% CI [-3.36, -0.98]). A significant difference was observed between Pietroase and Van, with a mean difference of -3.81 (p < .001, 95% CI [-5.03, -2.59]) (Figure 4).

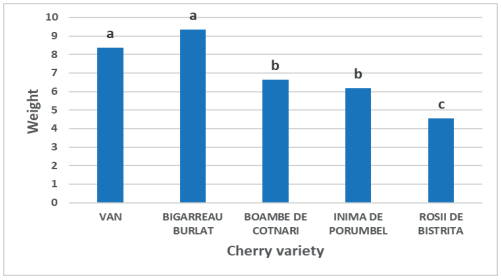

Figure 4. Evaluation of fruit weight (g) of the studied cherry varieties

Among the cherry varieties studied, we can see in Figure 5 that the highest values were obtained by the Boambe de Cotnari and Rosii de Bistrita varieties for the soluble dry matter parameter (^{0}Brix - %).

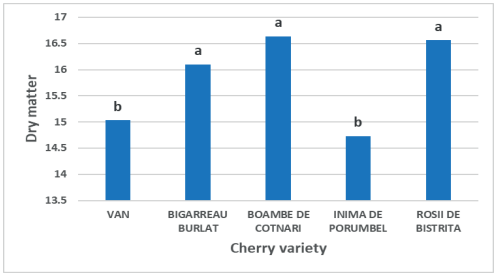

Figure 5. Soluble dry matter (^{0}Brix - %) of the fruits of the studied cherry varieties

A one-way ANOVA was performed to compare the effect of different types of cherry on dry matter. It was revealed that there was a statistically significant difference in the dry matter between at least two groups. The main effect of cherry varieties is statistically significant and large ($F(4, 45) = 7.78$, $p < .001$; Eta2 = 0.41, 95% CI [0.19, 1.00]). Duncan's test was performed to compare group means. Significant differences ($p < 0.05$) were found between the following groups: Bigarreau Burlat and Inima de Porumbel, with a mean difference of 1.37 ($p = 0.0049$, 95% CI [0.43, 2.31]). A significant difference was observed between Bigarreau Burlat and Van, with a mean difference of 1.07 ($p = 0.0206$, 95% CI [0.17, 1.97]). A significant difference was observed between Boambe de Cotnari and Inima de Porumbel, with a mean difference of 1.9 ($p < .001$, 95% CI [0.9, 2.9]). A significant difference was observed between Boambe de Cotnari and Van, with a mean difference of 1.6 ($p = 0.0015$, 95% CI [0.63, 2.57]). A significant difference was observed between Inima de Porumbel and Rosii de Bistrita, with a mean difference of -1.83 ($p < .001$, 95% CI [-2.8, -0.86]). A significant difference was observed between Rosii de Bistrita and Van, with a mean difference of 1.53 ($p = 0.0018$, 95% CI [0.59, 2.47]) (Figure 5).

Regarding the average sugar percentage, the data (Figure 6) show that the varieties Inima de Porumbel and Van recorded the lowest value for this parameter, while the opposite pole are the varieties Boambe de Cotnari and Rosii de Bistrita.

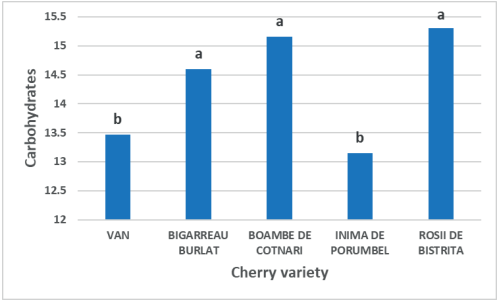

Figure 6. Evaluation of the sugar percentage (%) in the fruits of the studied cherry varieties

A one-way ANOVA was performed to compare the effect of different types of cherry on carbohydrates (Figure 6). It was revealed that there was a statistically significant difference in the carbohydrates between at least two groups. The main effect of cherry varieties is statistically significant and large ($F(4, 45) = 8.51$, $p < .001$; Eta2 = 0.43, 95% CI [0.22, 1.00]). Duncan's test was performed to compare group means. Significant differences ($p < 0.05$) were found between the following groups: Bigarreau Burlat and Inima de Porumbel, with a mean difference of 1.46 ($p = 0.0053$, 95% CI [0.44, 2.47]). A significant difference was observed between Bigarreau Burlat and Van, with a mean difference of 1.14 ($p = 0.0217$, 95% CI [0.17, 2.1]). A significant difference was observed between Boambe de Cotnari and Inima de Porumbel, with a mean difference of 2.02 ($p < .001$, 95% CI [0.97, 3.06]). A significant difference was observed between Boambe de Cotnari and Van, with a mean difference of 1.7 ($p = 0.0013$, 95% CI [0.69, 2.71]). A significant difference was observed between Inima de Porumbel and Rosii de Bistrita, with a mean

difference of -2.17 ($p < .001$, 95% CI [-3.23, -1.1]). A significant difference was observed between Rosii de Bistrita and Van, with a mean difference of 1.85 ($p < .001$, 95% CI [0.8, 2.89]). From the results obtained regarding the pH of the analyzed cherry fruits, we can state that the varieties Boambe de Cotnari and Rosii de Bistrita recorded the highest values (Figure 7).

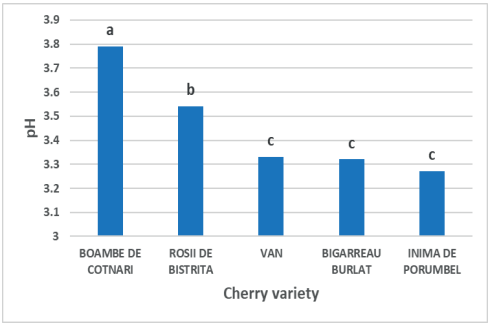

Figure 7. Evaluation of average pH values in the fruits of the studied cherry varieties

A one-way ANOVA was performed to compare the effects of different cherry types on pH (Figure 7). It was revealed that there was a statistically significant difference in the pH between at least two groups. The main effect of cherry varieties is statistically significant and large ($F(4, 10) = 172.72$, $p < .001$; Eta2 = 0.99, 95% CI [0.96, 1.00]). Duncan's test was performed to compare group means. Significant differences ($p < 0.05$) were found between the following groups: Bigarreau Burlat and Boambe de Cotnari, with a mean difference of -0.47 ($p < .001$, 95% CI [-0.53, -0.42]). A significant difference was observed between Bigarreau Burlat and Rosii de Bistrita, with a mean difference of -0.22 ($p < .001$, 95% CI [-0.27, -0.17]). A significant difference was observed between Boambe de Cotnari and Inima de Porumbel, with a mean difference of 0.52 ($p < .001$, 95% CI [0.46, 0.57]). A significant difference was observed between Boambe de Cotnari and Rosii de Bistrita, with a mean difference of 0.25 ($p < .001$, 95% CI [0.2, 0.31]). A significant difference was observed between Boambe de Cotnari and Van, with a mean difference of 0.46 ($p < .001$, 95% CI [0.41, 0.52]). A significant difference was observed between Inima de Porumbel and Rosii de Bistrita, with a mean difference of -0.26 ($p < .001$, 95% CI [-0.32, -0.21]). A significant difference was observed between Rosii de Bistrita and Van, with a mean difference of 0.21 ($p < .001$, 95% CI [0.16, 0.26]).

Regarding the average firmness of the cherry fruits studied, the varieties Inima de Porumbel and Van recorded the highest values (Figure 8).

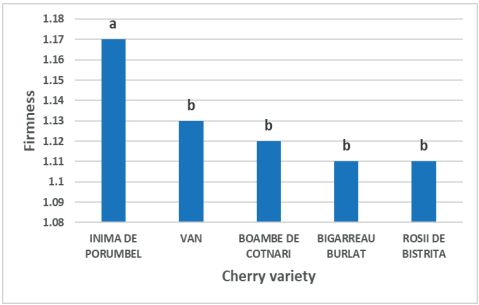

Figure 8. Evaluation of average firmness values in the fruits of the studied cherry varieties

A one-way ANOVA was performed to compare the effect of different types of cherries on firmness (Figure 8). It was revealed that there was a statistically significant difference in firmness between at least two groups. The main effect of cherry varieties is statistically significant and large ($F (4, 20) = 4.08$, $p = 0.014$; Eta2 = 0.45, 95% CI [0.08, 1.00]). Duncan's test was performed to compare group means. Significant differences ($p < 0.05$) were found between the following groups: Bigarreau Burlat and Inima de Porumbel, with a mean difference of -0.06 ($p = 0.0047$, 95% CI [-0.09, -0.02]). A significant difference was observed between Boambe de Cotnari and Inima de Porumbel, with a mean difference of -0.05 ($p = 0.0147$, 95% CI [-0.08, -0.01]). A significant difference was observed between Inima de Porumbel and Rosii de Bistrita, with a mean difference of 0.06 ($p = 0.0041$, 95% CI [0.02, 0.1]). A significant difference was observed between Inima de Porumbel and Van, with a mean difference of 0.04 ($p = 0.0321$, 95% CI [0, 0.07]).

The Pearson's product-moment correlation between CHO and DM (Carbohydrates and Dry Matter) is positive, statistically significant, and very large ($r = 0.99$, 95% CI [0.91, 1.00], $t(3) = 15.47$, $p < .001$) (Figure 9).

Pearson's product-moment correlation between FW and LD (Weight and Large Diameter) is positive, statistically significant, and very large

(r = 0.96, 95% CI [0.51, 1.00], t(3) = 5.95, p = 0.009).

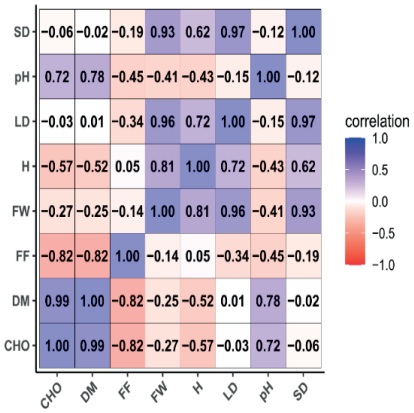

Figure 9. Correlation between biometric and physicochemical characteristics of the studied cherry varieties

Pearson's product-moment correlation between FW and SD (Weight and Small Diameter) is positive, statistically significant, and very large (r = 0.93, 95% CI [0.26, 1.00], t(3) = 4.33, p = 0.023) (Figure 10). Pearson's product-moment correlation between LD and SD (Large Diameter and Small Diameter) is positive, statistically significant, and very large (r = 0.97, 95% CI [0.58, 1.00], t(3) = 6.59, p = 0.007).

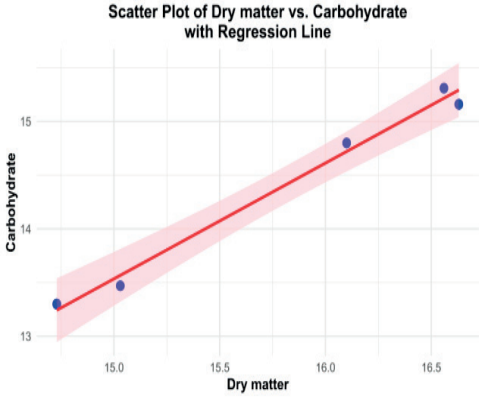

Figure 10. Scatter Plot of Dry Matter vs. Carbohydrate with Regression Line

Simple linear regression analysis was conducted to evaluate the extent to which Dry matter could predict Carbohydrate (Figure 10).

A significant regression was found (F(1, 3) = 239.36, p = < 0.001). The R^2 was 0.99, indicating that Dry matter explained approximately 99% of the variance in Carbohydrate.

The regression equation was: Carbohydrate = -2.64 + 1.08 (Dry matter). That is, for each one % increase in Dry matter, the predicted Carbohydrate increased by approximately 1.08%. Confidence intervals indicate that we can be 95% certain that the slope predicting Carbohydrate from Dry matter is between 0.86 and 1.30.

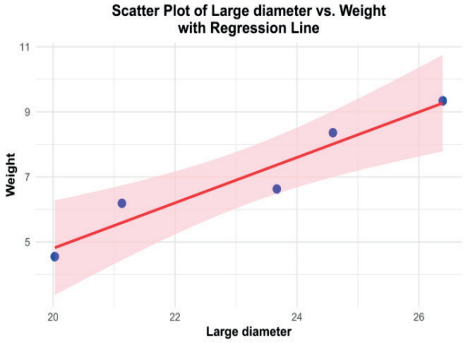

Figure 11. Scatter Plot of Large Diameter vs. Weight with Regression Line

Simple linear regression analysis was conducted to evaluate the extent to which Large diameter could predict Weight (Figure 11). A significant regression was found (F(1, 3) = 35.40, p = 0.009). The R^2 was 0.92, indicating that Large diameter explained approximately 92.2% of the variance in Weight. The regression equation was: Weight = -9.17 + 0.70(Large diameter). That is, for each one mm increase in Large diameter, the predicted Weight increased by approximately 0.70 g. Confidence intervals indicate that we can be 95% certain that the slope for predicting Weight from Large diameter is between 0.33 and 1.07.

Simple linear regression analysis was conducted to evaluate the extent to which Small diameter could predict Weight (Figure 12).

A significant regression was found (F(1, 3) = 18.76, p = 0.023). The R^2 was 0.86, indicating that Small diameter explained approximately 86.2% of the variance in Weight. The regression equation was: Weight = -12.69 + 1.02 (Small diameter).

That is, for each one mm increase in Small diameter, the predicted Weight increased by approximately 1.02 g.

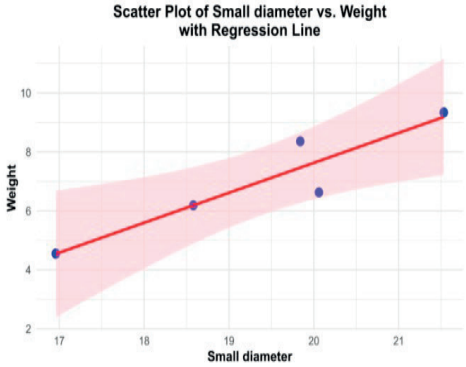

Figure 12. Scatter Plot of Small Diameter vs. Weight with Regression Line

Confidence intervals indicate that we can be 95% certain that the slope for predicting Weight from Small Diameter is between 0.27 and 1.76.

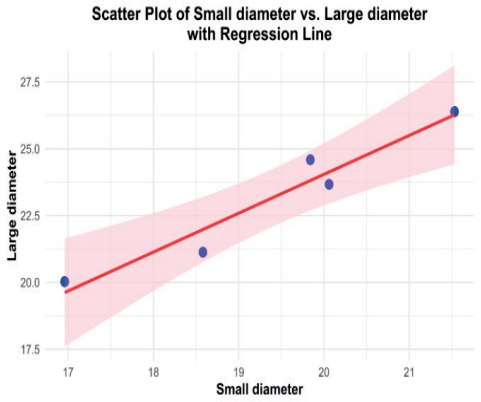

Figure 13. Scatter Plot of Small Diameter vs. Large Diameter with Regression Line

Simple linear regression analysis was conducted to evaluate the extent to which Small Diameter could predict Large Diameter (Figure 13). A significant regression was found ($F(1, 3) = 43.49$, $p = 0.007$). The R^2 was 0.94, indicating that Small Diameter explained approximately 93.5% of the variance in Large Diameter. The regression equation was: Large Diameter = -5.04 + 1.45(Small Diameter). That is, for each one mm increase in Small Diameter, the predicted Large Diameter increased by approximately 1.45 mm. Confidence intervals indicate that we can be 95% certain that the slope predicting Large Diameter from Small Diameter lies between 0.75 and 2.16.

CONCLUSIONS

In conclusion, the evaluation of the five sweet cherry cultivars during the 2025 experimental year revealed significant biometric and physicochemical variability, highlighting their distinct phenotypic responses in a post-frost context. From a commercial sizing perspective, **'Bigarreau Burlat'** and **'Van'** demonstrated superior biometric performance, recording the highest values for fruit weight, height, and diameter, making them highly suitable for markets demanding large-caliber fruits. Conversely, regarding the internal fruit quality and taste profile, the local Romanian varieties **'Boambe de Cotnari'** and **'Rosii de Bistrita'** exhibited exceptional physicochemical traits, yielding the highest concentrations of soluble dry matter (Brix) and total sugars. **'Inima de Porumbel'**, alongside 'Van', distinguished itself through superior pulp firmness, an essential trait for post-harvest handling and transport durability.

Furthermore, the robust statistical modeling conducted in this study provides valuable predictive tools for orchard management. The highly significant linear regressions demonstrate that non-destructive field measurements (such as large and small equatorial diameters) can reliably predict final fruit weight ($R^2 > 0.86$), while dry matter content acts as an almost perfect predictor for total carbohydrate accumulation ($R^2 = 0.99$). These correlations offer growers and researchers efficient, rapid assessment methods for sweet cherry quality monitoring under changing climatic conditions.

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