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PHYSICAL AND CHEMICAL PARAMETERS OF THE FRUIT IN FOUR *PRUNUS DOMESTICA* LOCAL POPULATIONS FROM BUZĂU COUNTY

Daniel Constantin POTOR, Aurora DOBRIN, Mihaela Ioana GEORGESCU, Dorel HOZA

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Mărăşti Blvd, District 1, Bucharest, Romania

Corresponding author email: mihaelaigeorgescu@yahoo.com

Abstract

The four local populations of Prunus domestica, T1, T2, T3, respectively T4, selected for observations and measurements are distinguished by a series of particular attributes of fruit: one of the four populations matures their fruits early in August while the remaining populations are ripening during September; the endocarp is not adherent to the T3 population, whereas the remainder has different degrees of adhesion; the average weight of fruit varies clearly from species to species, and the ratio between fruit weight and fruit diameter is relatively close for the 3 populations; the sugar content, with one exception, is close to the average of 15.95, and the dry matter content is also variable depending on the population.

Key words*: Prunus domestica, fruit, physical parameters, chemical parameters.*

INTRODUCTION

Among the fruit species cultivated in our country, the plum is on the first place both for the cultivated area and for the fruit yield obtained (Coman et al., 2012, http://www.fao.org/).

The pedo-climatic factors can influence the pomological, physical and biochemical proprieties of the local biotypes or genotypes of the cultivated fruit tree species (Ionica et al., 2013; Iordanescu and Costea, 2014).

It is important to have information about these particularities, useful to the breeding or growing processes, or to enlarge the assortment of local fresh, conditioning or preserved fruits (Vitanova et al., 2004; Okatan et al., 2017).

There are different researches on fruits proprieties from acquainted cultivars or local varieties, such as the nutritional characteristics of local cultivars (Rop et al., 2009), the changes that occur in their physical or chemical characteristic during the fruits ripening or keeping (Usenik et al., 2008; Miletic et al., 2012; Oltenacu and Oltenacu, 2014), the chemical compounds and their contribution to the fruit aroma, color (Usenik et al., 2009; Pino and Quijano, 2012) or to the antioxidant activity (Donovan et al., 1998); these features, related to local environmental factors, are valuable information for fruit growers when they want to broaden their range of varieties.

By their content in antioxidant substances, along with vitamin C and minerals like calcium, potassium or magnesium (https://ndb.nal.usda.gov/), the plum fruits have a significant nutritional role in our diet.

Researches on the physical and chemical characteristics of the local varieties of plum will contribute to the desired objective, the improvement of the cultivar assortment (Botu et al., 2012).

Following this direction, our study presents the morphological and chemical characteristics of four local plum varieties from Buzău County.

MATERIALS AND METHODS

The fruits of four local populations in Pătârlagele (Buzău County) (Potor et al., 2017) were collected in full maturity in 2017.

For their characterization the following physical and chemical parameters were used: diameter, weight, respiratory intensity, the dry matter contents, titratable acidity, soluble solid and total anthocyanins content.

Figure 1. Fruit of T3 population

The four populations are distinct from the moment of fruit maturation and the degree of adherence of the mesocarp, as follows:

- the T1 population - the mesocarp partially adherent; early ripe period, in the second decade of August;
- T2 population - adherent mesocarp; the ripe period situated in the first decade of September;
- T3 population - non-adherent mesocarp (figure 1); the ripe period situated in the first decade of September, too;
- T4 population - adherent mesocarp; the latest ripe period between the 4 populations, at the end of September.

Fresh fruits were used for physical and chemical analysis.

The diameter average value was determined by measuring of 20 fruits / population with the fruit caliber; the results were expressed in mm.

The average weight was determined by weighing 30 fruits / population with the Partner-PS 600 R2 technical balance, the result being expressed in g.

Respiratory intensity, based on the CO_2 measurement of the plant material and expressed in mg CO_2 / $kg^{-1}h^{-1}$, was determined with the CO_2 analyzer. Determination of the dry matter content was achieved by weighing the fresh vegetable material and drying at 105°C with the moisture analyzer MAC 50 PARTNER, the result being expressed as a percentage.

For the total anthocyanin content, the adapted method was used after Giusti et al., 2001, respectively, the extraction in acidified methanol with 1% hydrochloric acid and spectrophotometric dosing at the wavelength of 530 nm. Results were calculated based on the formula: Total anthocyanins = DO530~~540~~ x F, where DO530~~540~~ is absorbance at wavelength λ = 530~~540~~ nm and factor F = 11.16 and expressed in mg/100g plant material (Bezdadea Cătuneanu et al., 2017).

The titratable acidity was determined according to AOAC official method 942.15 and Saad et al., 2014: 10 g of the sample were diluted with 50 ml of water and titrated with 0.1 N sodium hydroxide to pH 8.1. The formula for calculation is:

$$Titratable\ acidity = \frac{\mathrm{V\ x\ N\ x\ C\ x100}}{\mathrm{m}}$$

V = volume of titrant; N = normality of titrant; C= Citric acid equivalent; m = mass of the sample.

The analysis was performed with TitroLine easy titrator.

0.1 is the normality of NaOH (N), 0.064 is the conversion factor for citric acid, V is the volume of NaOH used (mL) and m is the mass of plum sample used (g).

The results were expressed in mg citric acid/100 g fresh sample

Total soluble solids (TSS) were determined from plum juice (Bezdadea Cătuneanu et al., 2017), with Kruss DR301-95 Digital Handheld Refractometer and the results were expressed in % Brix.

RESULTS AND DISCUSSIONS

Diameter, weight and dry matter content

Table 1. Fruits diameter, weight and dry matter content to the T1-T4 Pătârlagele local populations

Population	Diameter (mm)	Weight (g)	Dry matter content (%)
T1	28,82 ± 1.01	15,32 ± 2.05	16,99
T2	33,41 ± 2.40	18,94 ± 3.52	27,05
T3	44,29 ± 3.50	45,50 ± 7.64	18,24
T4	33,06 ± 1.48	21,14 ± 1.72	21,71

Data of Table 1 and Figure 1 show that the T3 population form the largest fruits in size and weight, but with a content in dry matter lower, 18.24%, relative to the T2 and T4 populations.

The T1 population has small fruits with a low dry matter content compared to the rest of the populations.

The ratio between dry matter content and fruit diameter is obviously higher in T1 and T3 populations, while in T2 and T4 populations the differences are smaller (Figure 2).

Comparing the data in the table 1 with those from Ionică et al., 2013, it can be noticed that 3 of the 4 populations, namely T1, T2 and T4, form smaller fruit, the average of the weight between 15.32 g and 21.14 g, are outside of the average weight range of the fruit from the mentioned paper work.

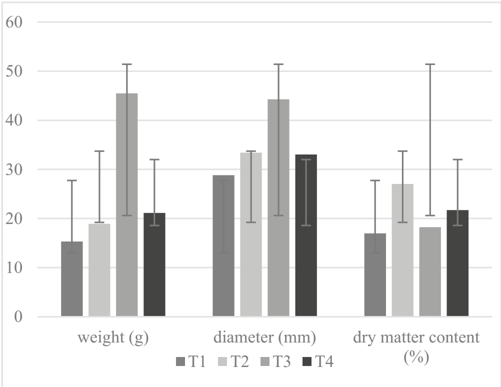

Figure 1. Physical parameters and dry matter content of fruits of the T1-T4 populations

With an average weight of 45.50 g, the fruits of the T3 population account for the highest value among the local populations of Pătârlagele; the dry matter content for T1, T3, T4, ranging from 16.99% to 21.71%, is according with the results obtained by Ionică et al.; the fruits of the T2 population, with an average of the dry matter content of 27.05%, are above the values recorded by the other populations (table 1, figure 1).

Titratable acidity, soluble solids and dry matter content

The citric acid content ranges from 0.11 mg / 100 g fresh sample to T4 and 0.81 mg / 100 g fresh sample at T1 (Table 2).

Table 2. Titratable acidity, total soluble solids and dry matter content of fruits of the T1-T4 Pătârlagele local populations

Population	Titratable acidity (mg citric acid /100 g)	Total soluble solids (% Brix)	Dry matter content (%)
T1	0.81 ± 0,089	15.78 ± 1.91	16,99
T2	0,45 ± 0,010	25.30 ± 2.76	27,05
T3	0,67 ± 0,028	15.87 ± 3.64	18,24
T4	0,11 ± 0,004	15.95 ± 1.28	21,71

The content of total soluble substances is very close to 16% in the T1, T3 and T4 populations, while T2 have the highest value of the populations studied: 25.30%.

T1 and T2 populations have the values of dry matter and total soluble solids content very close, the T3 population is showing a small difference of the two components, while to the T4 population the dry matter content is obviously higher than that in soluble solids (Figure 2).

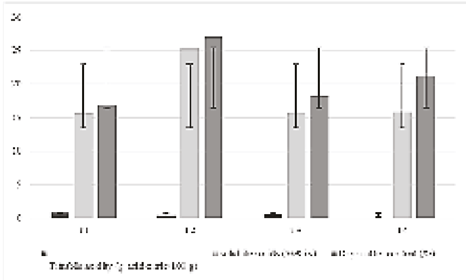

Figure 2. Acid citric, Brix and dry matter content

The higher value of the citric acid content of the T1 and T3 populations (Table 2) corresponds to a low content of total soluble solids; in the fruits of the T4 population, the citric acid content is small, similar to the content of total soluble solids, while in the fruits of the T2 population the content of total soluble solids is high and the value of the citric acid is at the medium level comparative to the rest of populations (Table 2, Figure 2).

With the exception of the T4 population where the difference between the dry matter content and the total soluble solids content is significant, to the rest of the populations the ratio between citric acid content and dry matter content is similar to the total soluble solids content (Figure 2).

Respiratory intensity and dry matter content

Table 3. Respiratory intensity and dry matter content of fruits of the T1-T4 Pătârlagele local populations

Population	Respiratory intensity (mg CO_2/kg^{-1}h^{-1})	Dry matter content (%)
T1	149.60 ± 29.43	16.99
T2	64.85 ± 10.93	27.05
T3	104.66 ± 27.66	18.24
T4	61.90 ± 7.94	21.71

The respiratory intensity (Table 3) is between 61.90 mg CO_2 / $kg^{-1}h^{-1}$ (T4) and 149.60 mg CO_2 / $kg^{-1}h^{-1}$ (T1). Populations T2 and T3 have an intensity of fruit respiration approx. 2 times smaller than T4.

From Figure 3 it can be seen that the two populations with less of the respiratory intensity have the higher dry substance content.

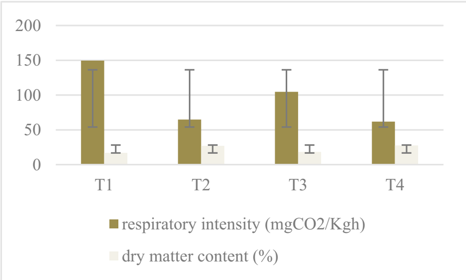

Figure 3. Respiratory intensity and dry matter content

Total anthocyanins content

With an important role in attracting consumers (Ionica et al., 2013) and in the antioxidant activity (Bezdadea Cătuneanu et al., 2017), anthocyanins are one of the significant components of plum fruits.

In the fruits of the four Pătârlagele populations the content of anthocyanins is relatively reduced, the values in ascending order from T1 to T4 range from 0.84 mg to 4.00 mg /100 g (Table 4).

Table 4. Total anthocyanins of fruits of the T1-T4 Pătârlagele local populations

Population	Total anthocyanins (mg/100 g fresh weight)
T1	0.84 ± 0.04
T2	1.45 ± 0.02
T3	1.92 ± 0.09
T4	4.00 ± 0.10

CONCLUSIONS

Three of the four populations, namely T1, T2 and T4, form small fruit; T3 population account for the highest value among the local populations of Pătârlagele.

The dry matter content for T1 – T4 populations is above 12.5%, the lower limit accepted by consumers.

The highest content of citric acid is at T1 population, and the highest content of total soluble substance is at T2 population.

High respiratory intensity is found in T1 and T3 populations.

In the fruits of the four Pătârlagele populations the content of anthocyanins is relatively reduced.

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