Romanian Biotechnological Letters *Vol. 18, No.4, 2013*

ORIGINAL PAPER

Evaluation of rosehip fruit productivity and total acidity in response to climatic factors

Received for publication, January 20, 2013
Accepted, March 13, 2013

CREȚESCU IULIANA[1], ROPCIUC SORINA[2], ANA LEAHU[2]
[1]*Faculty of Animal Science and Biotehnologies, Banat's University of Agricultural Sciences and Veterinary Medicine, Calea Aradului street 119, Timişoara, Romania (contact.iuliana.cretescu@gmail.com)*
[2]*Faculty of Food Engineering, Stefan cel Mare University, Street. Universitatii no. 13, 720229, Suceava, Romania(contact. sorinaropciuc@yahoo.com)*

Abstract

In this study we have investigated rosehip fruit productivity and total acidity in response to rainfall for 2007-2010 period of time. The annual average rainfall had a value of 765.6 mm and 98.6 mm during the growing season, the maximum being recorded in June 2010 (226.5 mm) and the minimum in April 2009 (8.4 mm). Evolution of average weight during the four years studied, remained the same at all resorts, small weight differences were observed between 2007 and 2008. Average weight resorts and between resorts ranged from values between 210-170 g. Rosehip fruits are of interest for the food, cosmetics and health industries. From the point of view of phytotherapy it is important to determine the content of vitamin C but also other organic acids (e.g., citric acid, malic acid - commonly used in food processing as an acidity regulator and antioxidant). Total titratable acidity provides information on organic acid content in fruits of rosehip preserved by drying. Total acidity value in 2009 ranged between 2.1 and 3.5 g malic acid. The average value for 2009 was 3.063 g malic acid. Determination of titratable acidity in 2010 showed values that ranged around the mean of 2.46 g malic acid.

Key words: rosehip, fruit productivity, acidity, malic acid, stationary factors

Introduction

Rosa canina L. is a thorny pentaploid xeromesophytic shrub of the *Rosaceae* family, native to Europe, northeastern Africa and western Asia, (AGOPIAN, 1997 [1]; PÂRVU, 2000 [2]; TIȚĂ, 2003[3]; PETROVA & al., 2007[4]; ORHAN & al., 2009[5]). Rosehip species are important plants, due to containing many important vitamins and minerals for public health and nutrition. This species is important to the traditional and also to modern medicine for its therapeutical properties: colagogue, choleretic, diuretic, vitaminisant, antioxidant, astringent, anti-inflammatory, antidiabetic etc., which are due to its phytocompounds of the fruit (Pârvu, 2000[2]; DEMIR AND OZCAN, 2001[6]; TIȚĂ, 2003[3]; STĂNESCU & al., 2004[7]; KILICGUN AND DEHEN, 2009[8]). In our country, *Rosa canina* L. is the most widespread of the many species of *Rosa*, common in all areas (POPESCU, 1984 [9]). This plant material is generally considered to be the most abundant natural source of pharmacologically active compounds such as organic acids (including ascorbic acid – vitamin C), flavonoids, carotenoids (vitamin A precursors) and tannins (ERENTRUK,2005[10]; KOBUS & al., 2005[11]; ADAMCZA & al., 2012[12], NOWAK, 2006[13], GAO & al., 2005[14]; NOVRUZOV & SHAMSIZADE, 2005[15]; OLSSON& al., 2005[16]; BOJOR,2003[17]; DEMIR & ÖZCAN, 2001[6]; ERCIŞLI & EŞITKEN, 2004[18]; ORHAN & al.,2009[5]; ERCISLI & GULERYUZ, 2005[19]; ERCIȘLI, 2007[20]). Such nutrients are considered very important in food industry, medicine and in cosmetology ([KAZAZ& al., 2009[21]; ERENTRUK, 2005[10]; MAMADRIZOHONOV, 1994[22]; REIN & al., 2004[23]; UGGLA, 2004[24]). The flavonoids and organic acids inhibit the oxidation of vitamin C, increase its stability and bioavailability in humans (PADAYATTY & LEVINE, 2001[25]; KOBUS & al.,

2005[11]). From the point of view of phytotherapy it is important to determine the content of vitamin C but also other organic acids (e.g., citric acid, malic acid commonly used in food processing as an acidity regulator and antioxidant) and flavonoids.

It is known that rosehip species that grow in the hills and lowlands have a vitamin C content between 0.3-0.80 g% and the submountainous hilly area and can reach 2.5-3.5 g%. Also, vitamin C content varies altitude. Organic acids taste sour fruit print. Usually, a fruit acidity is the result of this many acids and acid salts of there. Acid taste, slightly sour is a major component and appreciated organoleptic quality fruit. Because of it is tart taste, it is seldom eaten raw. Rosehips are typically gathered wild, dried, de-seeded, and shipped as dried pulp. They are often ground into powder and sold in health-food stores, or added to other foods as a supplement. Acidity knowledge allows us to better appreciate the evolution of a product, from time to harvest until the end of processing or capitalization. Also, total titratable acidity provides information on organic acid content in fruits of rosehip preserved by drying. The purpose of this study is to evaluate titratable acidity characteristic of de rosehip fruits.

There are numerous processes where moisture, temperature or both affect rosehip product quality. Among the stationary factors that are important in rosehip fruit productivity is precipitation. Atmospheric precipitation are crystallization and condensation of water vapor from the atmosphere. Meteorological stations is done both visual observations (type, intensity and duration of rainfall) and instrumental (quantity measuring and recording the amount of water still hanging). Rainfall expressed in mm (1 mm=1l/m^2) and represents the thickness of the water that would accumulate on a surface, would not intervene if the leakage, infiltration or evaporation. (BALLIF . & al., 1979[26])

The study area is represented by the route Suceava- Palma and includes the resorts Suceava – Pătrăuţi – Lunca Sucevei (Dărmăneşti) – Costîna - Părhăuţi – Todireşti – Cajvana- Arbore – Solca – Clit - Marginea – Rădăuţi - Sucevița – Palma. From a geomorfologic point of view the resorts Suceava – Pătrăuţi – Lunca Sucevei (Dărmăneşti) – Costîna - Părhăuţi – Todireşti – Cajvana- Arbore belong to the hills and the platform plateaus of Suceava Plateau. The resorts Arbore – Solca – Clit - Marginea – Rădăuţi - Sucevița – Palma fits into the region Bukovina's Obcina, defined as a geographical unit whose specificity is given by a succession of parallel ridges, slightly high and wooded separated by broad valleys and flat meadows. The lack of Subcarpathians allows to the Obcina to come into direct contact with Suceava Plateau.

Materials and methods

The studied biological material is the fruit of the species Rosa canina L., fruit whose scientific name is Cynosbati Fructus. In order to harvest the Rose hips samples corresponding to the study there was conducted a prior research, consulting the pharmacognistical and phytochemical research methodology of plant products, according to the Pharmacognosy Treaty (CIULEI & al., 1993[27]). This unitary research methodology provides simple analysis which by their nature can be grouped into qualitative and quantitative analyses. The rosehip fruits for biometric and chemical analyses were harvested from the spontaneous flora from populations that showed no anthropogenic influence. For this purpose we have chosen 14 observation resorts that were marked with the letter S and were numbered in Arabic digits. In each of them were marked three biotopes (bushes), noted with T and Arabic digits.

Weight determination was made by weighing 100 beans randomly harvested from three bushes in the resort. It was considered the fruit would be free of external moisture. The weight of fresh fruit was determined using the analytical balance Kern Model EW2200-2NM Germany. The result was expressed in grams (Căpriță & Crețescu,2000[28]). The data about the rainfall were processed from the Weather Station Suceava and from the weather

observation points Rădăuţi and Poiana Stampei. For the resorts Suceava, Pătrăuţi, Dărmăneşti, Costîna, Părhăuţi, Todireşti and Cajvana were used the weather data from the Weather Station Suceava. The resorts Arbore, Solca, Clit, Marginea, Rădăuţi and Sucevița entered in the weather observation area of Rădăuţi and the resort of Palma used the weather observations from Poiana Stampei.

Titratable acidity is the sum of acid reaction substances (organic acids, acid salts) that can be titrated with an alkaline solution. Determination of the titratable acidity was according to STAS 3164-99:

The method principle: Determination of the titratable acidity consists in titrating the sample with sodium hydroxide solution (NaOH) with known titre.

Apparatus and reagents: Potentiometer with glass electrode; sodium hydroxide; buffer solution with known pH.

Sample preparation for analysis: Remove the seeds from the dry sample and mix well the sample.

Manner of working: Take from the thus obtained sample 20 g weighed with a precision of 0.01g. 20g finely chopped product is stirred well in a 250 ml conical flask with 50 ml distilled water. Using a pipette take 25 - 100ml of obtained sample and place it in a beaker. The potentiometer is inserted in the solution and titrate with hydroxide up to pH 6. Slowly add sodium hydroxide up to pH 7. Next insert sodium hydroxide in fractions up to pH 8.3.

Calculation: Total acidity: $c = \frac{V_1 V_3\, 0,1}{V_2 m} \quad 100$, cm^3NaOHn/100g

where: V_1- the total volume of the tested solution obtained from the quantity of product taken for analysis, cm^3 ; V_2- the volume of the tested solution, taken for determination, cm^3; V_3- the volume of sodium hydroxide solution 0,1 n used in titration, cm^3; m – the weight of the product taken for analysis, g; Total acidity expressed as g of malic acid by multiplying by 0.067 (meq malic acid).

The studied biological material is the fruit of the species *Rosa canina* L. Rosehip fruits were harvested in the Region of Moldova by the route Suceava- Palma and includes the resorts Suceava - Pătrăuţi - Lunca Sucevei (Dărmăneşti) - Costîna - Părhăuţi - Todireşti - Cajvana- Arbore - Solca - Clit - Marginea - Rădăuţi - Sucevița - Palma, resorts which are part to the hills and the platform plateaus of Suceava Plateau. From a geomorfologic point of view the resorts Suceava – Pătrăuţi – Lunca Sucevei (Dărmăneşti) – Costîna - Părhăuţi – Todireşti – Cajvana- Arbore belong to the hills and the platform plateaus of Suceava Plateau. The resorts Arbore – Solca – Clit - Marginea – Rădăuţi - Sucevița – Palma fits into the region Bukovina's Obcina, defined as a geographical unit whose specificity is given by a succession of parallel ridges, slightly high and wooded separated by broad valleys and flat meadows. The lack of Subcarpathians allows to the Obcina to come into direct contact with Suceava Plateau.

The obtained results were statistically processed using the Principal Component Analysis (PCA) method. Principal Component Analysis (PCA) is a well known technique the aim of which is to synthesize huge amounts of numerical data by means of a low number of unobserved variables, called components.

Results and discussions

Within analysed populations was quantitatively determined the weight of 100 beans, feature biophysics which contributes to the fruit quality evaluation and the bushes productivity. The results of the measurements are revealed in Table 1. The obtained data reveal minimal values of beans weight in the resorts Arbore and Marginea and maximum values in the resorts Suceava, Părhăuţi, Todireşti, Cajvana and Sucevița. At the bush level,

minimum values are found in Arbore and Costîna, while maximum values are found in Pătrăuţi, Costîna, Părhăuţi and Sucevița.

The variation in the average beans weight throughout Suceava-Palma route is shown in Figure 1. It is noted that the average weight development during the four years remains the same at all resorts, small weight differences are observed between 2007 and 2008. Average weight in resorts and between resorts is between the values 210 and 170 g.

Table 1. 100 beans weight in g, in resorts

RESORTS	Average weight of 100 beans in resorts, g			
	2007	**2008**	**2009**	**2010**
SUCEAVA	179.3	185.3	179.3	190.6
PĂTRĂUȚI	185.3	205.2	183.3	197.7
DĂRMĂNEŞTI	163.4	172.3	169	154.7
COSTÎNA	208.1	138.5	176.8	189.7
PĂRHĂUȚI	163.2	171.3	183.5	223.7
TODIREŞTI	172.6	197.8	174	200.9
CAJVANA	188.9	194.1	168.1	205
ARBORE	107	121	105.9	137.6
SOLCA	166.4	180.8	155.9	179
CLIT	161.2	164.9	144	169.8
MARGINEA	174.1	160.6	138.7	155.8
RĂDĂUȚI	162.7	139.76	146.4	161.3
SUCEVIȚA	199.3	205.75	192.3	207.3
PALMA	141.7	150.1	150.7	147.1

The results obtained by weighing 100 freshly harvested beans are specified in the given interval and other studies showing the weight of 1.88-4.95 g/fruit (SINDRAK Z &. al., 2012[29]; F.CELIK & al., 2009[30]), 158.5-100.3 g/100 beans (ERCİŞLİ & EŞİTKEN, 2004[18]; A. MABELLINI, 2011[31]).

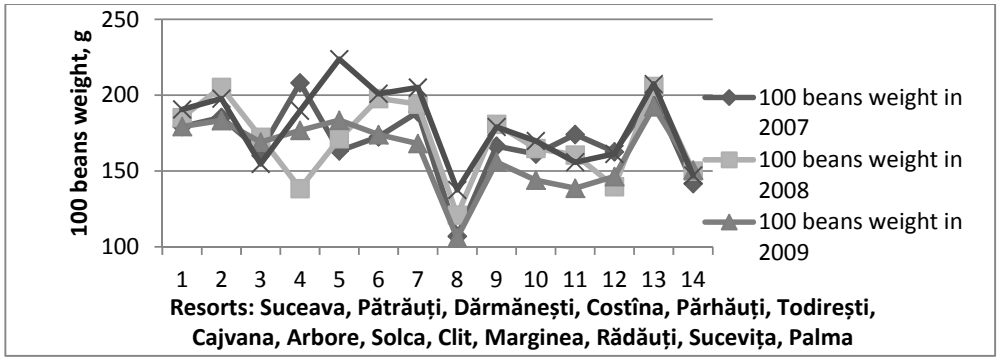

Figure 1. Graphical representation of the average beans weight variation on the Suceava-Palma route over the years 2007-2010

The calculated values of the variation coefficient indicate homogeneous to medium variability in terms of beans weight at the resort level (Table 2). The homogeneous results with V% < 10 are the same throughout the years in the resort of Palma. Homogeneous to medium variation is found in Dărmănești, Costîna and Clit. Homogeneous variation throughout the studied years can be seen in the resorts Suceava, Pătrăuţi, Părhăuţi, Rădăuţi and Sucevița.

Table 2. Coefficient of variation in resorts and bushes for variable weight of 100 grains

Coefficient of variation (CV), %				
Resort	Study years			
	2007	**2008**	**2009**	**2010**
S1- Suceava	21.21	24.35	24.34	18.45
S2- Pătrăuţi	22.4	21.77	10.23	20.25
S3Dărmăneşti	9.4	21.9	10.22	20.44
S4- Costîna	8.82	11.13	16.92	33.43
S5- Părhăuţi	18.92	20.87	20.65	19.86
S6- Todireşti	20.81	22.27	15.62	20
S7- Cajvana	24.5	24.27	13.1	10.92
S8- Arbore	16.57	14.38	13.14	30.26
S9- Solca	5.83	7.83	11.4	4.12
S10- Clit	4.05	4.75	15.77	14.49
S11Marginea	51.28	43.42	38.54	40.36
S12- Rădăuţi	29.55	10.06	11.31	26.06
S13- Sucevița	24.92	18.14	22.79	17.54
S14- Palma	8.81	6.2	8.18	7.07

The relationship between average grain weight between resorts during the four years was determined by Pearson correlation coefficients matrix (Table 2). In figure 2 it is showed the values distribution as following: in dial a (counter clockwise) there are grouped the resorts Arbore, Clit, Palma and Dărmănești, being associated as low weight. In dial c there are grouped the resorts Cajvana and Costîna, similar in weight values. The remaining resorts are grouped in dial d. The resorts Solca, Todirești, Sucevița și Părhăuți are significantly correlated.

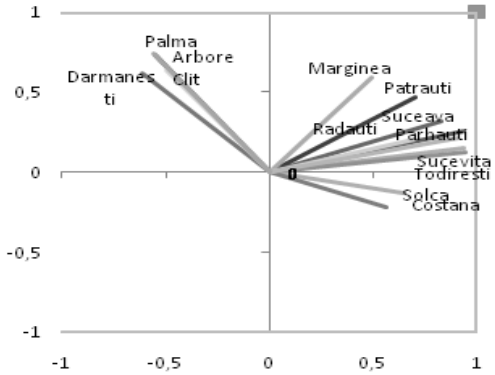

Figure 2. Graphical representation of the principal components analysis of the distribution of beans weight on the Suceava-Palma route

Significant correlations are represented in the correlation coefficients matrix. Very good correlation is formed between Pătrăuţi and Suceava (r=0.807***), between Părhăuţi and Suceava (r=0.838***); Todireşti and Suceava (r=0.841***) and Rădăuţi and Sucevița (r = 0.903***). Regarding the distribution of values obtained over the whole route was highlighted by the principal component analysis, confirming the idea that most resorts are very close in value. The evolution of annual average rainfall in resorts for the years 2007-2010 is represented in figure 3. The maximum rainfall is recorded in 2008, when the summed rainfall reach the rate of 883.2 l/m^2. Also in 2010 there is recorded high annual average rainfall comparable to those of 2008. Correlations between the studied productivity feature and monthly average rainfall is calculated by the Pearson matrix, according to Table 4.

Table 3. Correlation coefficients matrix for the feature weight of 100 beans

	Suceava	Patrauti	Darmanes	Costina	Parhauti	Todirest	Cajvana	Arbore	Solca	Clit	Marginea	Radauti	Sucevita	Palma
Suceava	1	**0,807**	-0,329	0,189	**0,838**	**0,841**	0,070	-0,314	**0,790**	-0,218	0,399	**0,787**	**0,879**	-0,297
Patrauti	**0,807**	1	-0,176	0,180	**0,746**	**0,668**	0,079	0,031	**0,634**	-0,269	**0,582**	**0,672**	**0,731**	-0,166
Darmanest	-0,329	-0,176	1	-0,398	-0,410	-0,434	-0,402	**0,703**	-0,464	**0,706**	0,100	-0,400	-0,447	**0,724**
Costina	0,189	0,180	-0,398	1	**0,620**	**0,667**	**0,953**	-0,355	**0,723**	-0,264	0,484	0,087	0,419	-0,330
Parhauti	**0,838**	**0,746**	-0,410	**0,620**	1	**0,933**	**0,534**	-0,340	**0,940**	-0,271	**0,654**	**0,612**	**0,869**	-0,309
Todiresti	**0,841**	**0,668**	-0,434	**0,667**	**0,933**	1	**0,550**	-0,415	**0,984**	-0,287	0,495	**0,570**	**0,829**	-0,392
Cajvana	0,070	0,079	-0,402	**0,953**	**0,534**	**0,550**	1	-0,384	**0,604**	-0,266	0,488	-0,062	0,296	-0,363
Arbore	-0,314	0,031	**0,703**	-0,355	-0,340	-0,415	-0,384	1	-0,414	**0,633**	0,192	-0,285	-0,399	**0,888**
Solca	**0,790**	**0,634**	-0,464	**0,723**	**0,940**	**0,984**	**0,604**	-0,414	1	-0,307	0,493	**0,590**	**0,848**	-0,384
Clit	-0,218	-0,269	**0,706**	-0,264	-0,271	-0,287	-0,266	**0,633**	-0,307	1	0,085	-0,289	-0,296	**0,778**
Marginea	0,399	**0,582**	0,100	0,484	**0,654**	0,495	0,488	0,192	0,493	0,085	1	0,221	0,475	0,181
Radauti	**0,787**	**0,672**	-0,400	0,087	**0,612**	**0,570**	-0,062	-0,285	**0,590**	-0,289	0,221	1	**0,903**	-0,276
Sucevita	**0,879**	**0,731**	-0,447	0,419	**0,869**	**0,829**	0,296	-0,399	**0,848**	-0,296	0,475	**0,903**	1	-0,370
Palma	-0,297	-0,166	**0,724**	-0,330	-0,309	-0,392	-0,363	**0,888**	-0,384	**0,778**	0,181	-0,276	-0,370	1

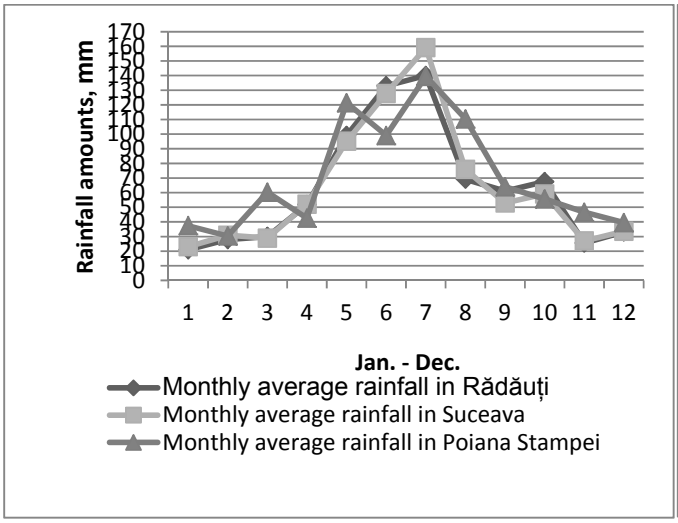

Figure 3. Variation of monthly average rainfall in resorts over the years 2007-2010

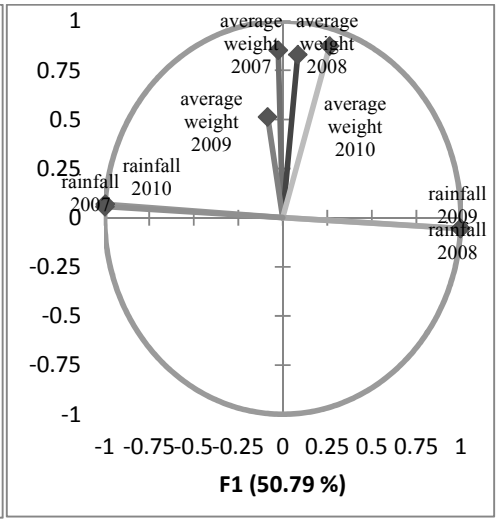

Figure 4. Principal components analysis of fruit weight and monthly average rainfall

Table 4. Pearson matrix for the weight feature of 100 beans and monthly average rainfall

Variables	average weight 2007	average weight 2008	average weight 2009	average weight 2010	rainfall 2007	rainfall 2008	rainfall 2009	rainfall 2010
average weight 2007	**1**	**0.573**	0.303	**0.675**	0.080	-0.067	-0.066	0.067
average weight 2008	0.573	**1**	0.226	**0.696**	-0.020	0.030	0.030	-0.029
average weight 2009	0.303	0.226	**1**	0.317	0.089	-0.089	-0.089	0.089
average weight 2010	**0.675**	**0.696**	0.317	**1**	-0.186	0.203	0.204	-0.202
rainfall 2007	0.080	-0.020	0.089	-0.186	**1**	-0.999	-0.999	0.999
rainfall 2008	-0.067	0.030	-0.089	0.203	-0.999	**1**	1.000	-1.000
rainfall 2009	-0.066	0.030	-0.089	0.204	-0.999	1.000	**1**	-1.000
rainfall 2010	0.067	-0.029	0.089	-0.202	0.999	-1.000	-1.000	**1**

The correlation coefficients calculated by Pearson matrix indicate no correlation between the weight of 100 grains and rainfall amount. Also by principal component analysis there is no good correlation between the studied productivity feature and the average content of rainfall. Total acidity expressed in g of malic acid. Malic acid ($C_4H_6O_5$-hidroxisuccinic acid) is a weak organic acid that is abundant in many plant juices, but especially in the juice derived

from berries, apple and grape (FAO, [32]). It has many uses including the role of stabilizing the content of vitamin C. The results of the measurements are revealed in Table 5. In table 6 is presented the classification on the ranks of the resorts Suceava – Palma depending on the acidity of rosehip powder.

Table 5. Total titratable acidity values, g of malic acid.

Stations	Total acidity, g of malic acid /100 g powder	
	2009	2010
S1 Suceava	2.1	2
S2 Pătrăuți	3.2	3
S3 Dărmănești	3.3	2.8
S4 Costîna	2.6	1.8
S5 Părhăuți	3.4	2.4
S6 Todirești	3	2.7
S7 Cajvana	2.9	2
S8 Arbore	3.1	2
S9 Solca	3.2	2.5
S10 Clit	3.5	3
S11 Marginea	3.2	3.2
S12 Rădăuți	3.1	2.7
S13 Sucevița	2.9	1.6
S14 Palma	3.3	2.8

Table 6. Classification on ranks of the resorts Suceava- Palma according to the acidity of the rosehip powder.

Stations	Place at station level		Rank
S1 Suceava	10	7	D
S2 Pătrăuți	5	2	D
S3 Dărmănești	3	3	A
S4 Costîna	9	8	B
S5 Părhăuți	2	6	E
S6 Todirești	7	4	D
S7 Cajvana	8	7	B
S8 Arbore	6	7	B
S9 Solca	4	5	B
S10 Clit	1	2	B
S11 Marginea	4	1	D
S12 Rădăuți	6	4	C
S13 Sucevița	8	9	B
S14 Palma	3	3	A

Titrable acidity determined in the rosehip powder in each resort indicates values between the maximum value of 3.5 g of malic acid in biotopes Clit resort and minimum value of 2.1 g malic acid from Suceava resort biotopes. Malic acid content variation is plotted using the application of the Homogeneity test. The average value for 2009 is 3.063 g of malic acid to which the values are below average and above average (Figure 5). From the graph, it is noted the big difference between the acidity obtained from the Suceava resort fruit powder (2.18 g of malic acid) compared with rosehip powder acidity in fruit harvested from the Clit resort (3.5 g of malic acid).

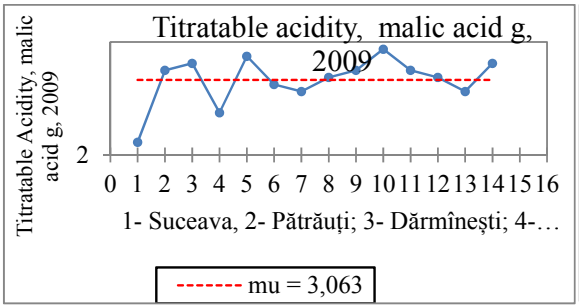

Figure 5. Variation of titratable acidity rosehip powder in 2009.

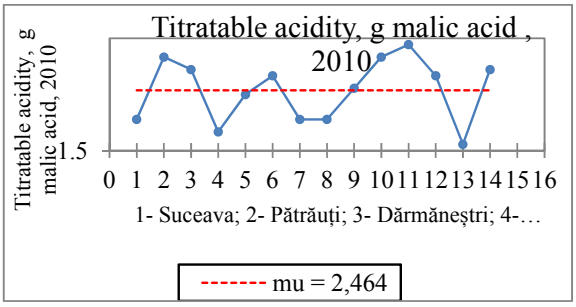

Figure 6. Variation of titratable acidity rosehip powder in 2010.

Determination of titratable acidity in 2010 indicates values that are within the average of 2.46 g of malic acid /100g. The highest value was obtained in the rosehip powder from Marginea resort (3.2 g of malic acid /100g) and the lowest content of malic acid was found in fruit powder from the Suceviţa resort (1.6 g of malic acid / 100g) (Figure 6).

It should be noted that rosehip powder acidity in the two years remains constant in the Marginea resort (3.2 g of malic/100g acid). It was analyzed, too, and the correlation between titratable acidity expressed as malic acid and vitamin C content of rosehip powder. Correlation between vitamin C content and malic acid was determined by simple linear regression (Figures 7. and 8.).

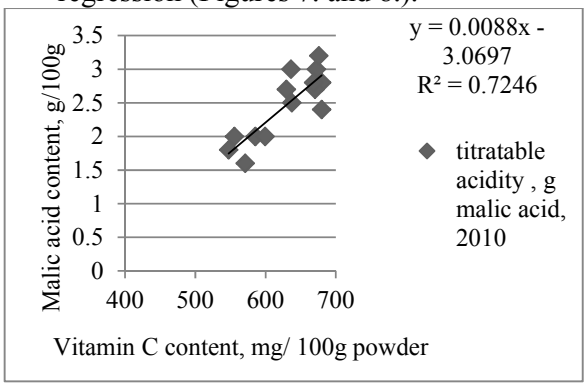

Figure 7. Correlative connection between the content of vitamin C and titratable acidity expressed as malic acid in 2009.

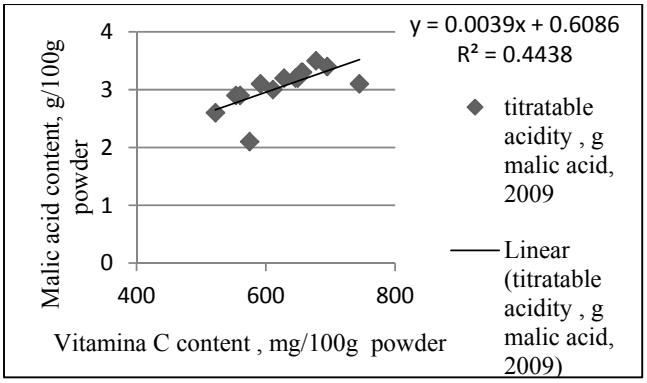

Figure 8. Correlative connection between the content of vitamin C and titratable acidity expressed as malic acid in 2010.

Regression coefficient r^2= 0. 443 indicates a less significant correlation ratio (44%) in the year 2009. In 2010, the regression coefficient attributed the report of determination significantly between the two variables, r^2= 0.724. To determine the influence of the stationary factors on the studied variable, we used Pearson correlation coefficients matrix, which is shown in Table 7.

Table 7. Pearson correlation matrix between titratable acidity, solar radiation and topographic indicators

Variables	Titratable acidity, g of malic acid, 2009	Titratable acidity, g of malic acid, 2010	RAD2009 Wh/mp	RAD2010Wh/mp	Altitude, m	Slope
Titratable acidity, g of malic acid, 2009	**1**					
Titratable acidity, g of malic acid, 2010	0,638*	**1**				
RAD2009,Wh/mp	0,445	0,300	**1**			
RAD2010,Wh/mp	0,545	0,534*	0,957	**1**		
Altitude, m	0,216	0,115	-0,365	-0,126	**1**	
Slope	-0,130	-0,018	-0,690**	-0,522*	0,686**	**1**

Note: *significant level at the limit value of 10%; ** significantly distinct at limit values of 1%;*** very significant at limit values of 0.1%.

From analyzing the Pearson matrix can be seen that titratable acidity is significantly positive, correlated with the solar radiation in 2010 (r = 0.534*). In 2009, the two variables have a correlation index r = 0.445, indicating a significantly weak correlation.

Data obtained from the quantitative determination of titratable acidity are consistent with previous results indicating acidity content expressed as 3% malic acid PÂRVU, 1997[33]; around 3% NOWAK, 2005[34]; ÖZCAN, 2002[35]; MABELINI& al., 2011[31] and as 1.7-3.2% (with a average of 2.4) for *Rosa Canina* L. and 1.2-2.4% for different genotypes of rosa GÜNES, 2010[36]). The results obtained by the correlation matrix confirm that solar radiation can positively influence rosehip fruit acidity. It was observed a correlation between the amount of vitamin C and the global radiation during the growing season (ROPCIUC & al, 2013[37]). With increasing global solar radiation, fruits are richer in malic acid. Vitamin C content correlates significantly with malic acid content, the correlation coefficient has a value of 0.742**. Increasing vitamin C content leads to increased malic acid content in the resorts studied in the years 2009 - 2010, between them there is a directly proportional relationship. UGGLA(2004) [24] found a linear relationship between vitamin C and harvest dates. Also, she found a relationship between harvest dates and total acidity showed both linear and quadratic regressions, relationship wich is influenced by climatic factors.

Analyzing the Pearson correlation matrix in terms of topographic factors, it can be seen that the altitude and slope of land do not affect malic acid content of fruit, the correlation coefficient indicates very low values, insignificant. Dărmăneşti, Părhăuţi, Marginea, Rădăuţi and Palma resorts, have high content of malic acid, results which offer the possibility of assessing appreciation by this feature. The demand for rosehips is currently met by people living in forest villages who collects the fruit from wild plants. Since rosehips are used to make valuable products such as marmalade, juice and tea, they are an important fruit species and should be considered for commercial cultivation.

Conclusion

Average weight resorts and between resorts is ranged from 210 to 170 g, were consistent with data found in the literature. The correlation coefficients calculated by Pearson matrix indicate no correlation between the weight of 100 grains and rainfall amount. The results obtained in this study are considered significant for having shown that solar radiation can positively influence rosehip acidity. Vitamin C content correlates very significantly with malic acid content, implicitly, the increase of the content of vitamin C leads to increase of the malic acid content. The altitude and slope of land (as stationary factors) do not affect malic acid content of fruit, the correlation coefficient indicates very low values, insignificant. In conclusion, harvested resorts Dărmăneşti, Părhăuţi, Marginea, Rădăuţi and Palma, have high content of malic acid, which offers the possibility of assessing appreciation by this feature.

References

1. A. AGOPIAN, Medicinal Plants of spontaneous and their substitutes. Editura Recoop., Bucureşti 1997, pp. 251.
2. C. PÂRVU, Universul plantelor. Mică Enciclopedie. Edit. „Enciclopedică", Bucureşti, 2000, pp. 360-362.
3. I. TIŢĂ, Botanică farmaceutică. Edit. Did. şi Ped., Bucureşti, 2003, pp. 680-681.
4. A. PETROVA, J. ZIELINSKI, R. NATCHEVA, Chromosome numbers of woody plants from Bulgaria. Phytologia Balcanica, **13**(3), 371–378(2007).
5. N. ORHAN, M. ASLAN, S. HOSBAS, O. D. DELIORMAN, Antidiabetic effect and antioxidant potential of *Rosa canina* fruits. *Pharmacognosy Magazine,* **5**(20), 309 -315(2009).
6. F. DEMIR & OZCAN, M., Chemical and technological properties of rose (*Rosa canina L*) fruits grown wild in Turkey. *Journal of Food Engineering*, **47**, 333-336(2001).
7. U. STĂNESCU &al., Plantele medicinale de la A la Z; Monografii ale produselor de interes terapeutic. Vol. I. Edit. „Gr. T. Popa", Iaşi, 2004, pp. 176-177.

8. H. KILICGUN & A. DEHEN, *In vitro*-antioxidant effect of *Rosa canina* different antioxidant test systems. *Paharmacognosy Research*, **1**(6), 417-420(2009).
9. H. Popescu, Medicinal flora resources in Romania, Dacia Publishing House, Cluj, 1984, pp. 184.
10. S. ERENTURK, M. S. GULABOGLU and S. GULTEKIN, The effects of cutting and drying medium on the vitamin C content of rosehip during drying. *Journal of Food Engineering,* **68**, 513–518(2005).
11. M. KOBUS, M. WŁODARCZYK, E. POGORZELSKI, P. DZIUGAN and J. LASKOWSKA, Koncentraty z dzikiej róży (*Rosa rugosa*) otrzymane rożnymi metodami. *Folia Universitatis Agriculturae Stetinensis Scientia Alimentaria,* **246**(4), 205–216(2005).
12. A. ADAMCZA, W. BUCHWALD, J. ZIELIŃSKI and S. MIELCAREK, Flavonid and organic acid content in rose hips (*ROSA* L., SECT. *CANINAE* DC. EM. CHRIST.). *Acta Biologica Cracoviensia, Series Botanica,* **54**(1), 105–112(2012).
13. R. NOWAK, Badania Fitochemiczne Wybranych Gatunków z Rodzaju Rosa L. *Analiza Biologicznie Aktywnych Składników*. Akademia Medyczna, Lublin, 2006.
14. X. GAO, M. UGGLA and K. RUMPUNEN, Antioxidant activity of dried and boiled rose hips. *Acta Horticulturae,* **690**, 239–243(2005).
15. E.N. NOVRUZOV, Pigments of species in the genus *Rosa* and their chemotaxonomic value. *Acta Horticulturae,* **690**, 225–230(2005).
16. M. E. OLSSON, S. ANDERSSON, G. WERLEMARK, M. UGGLA, and K. E. GUSTAVSSON, Carotenoids and phenolics in rose hips. *Acta Horticulturae,* **690**, 249–252(2005).
17. O. BOJOR, O. POPESCU, Traditional and modern Phytotherapy, Ed. Fiat Lux, 2003, pp. 212.
18. S. ERCIŞLI & A. EŞITKEN, Fruit characteristics of native rose hip (*Rosa* spp) selections from the Erzurum province of Turkey. *New Zealand Journal of Crop and Horticultural Science*, **32**(1), 51-53(2004).
19. S. ERCISLI, M. GULERYUZ, Rose hip utilization in Turkey. Acta Horticulturae, **490**, 77–83(2005).
20. S. ERCISLI, Chemical composition of fruits in some rose (*Rosa* spp.) species, *Food Chem*., **104**, 1379–1384(2007).
21. S. KAZAZ, H. BAYDAR and S. ERBAS, Variations in Chemical Compositions of Rosa damascena Mill. and Rosa canina L. Fruits, *Czech J. Food Sci*., **27**(3), 178–184(2009).
22. A. A. MAMADRIZOHONOV, R. Sh. MIRZOBEKOV, Z. H. BURIBEKOV, Storage of rose-hip, *Acta Horticulturae 368*, P. Sass Editor, Kecskemét, Hungary, 1994.
23. E. REIN, A. KHARAZMI, K. WINTHER, A herbal remedy, Hyben Vital (stand. powder of a subspecies of Rosa canina fruits), reduces pain and improves general wellbeing in patients with osteoarthritis - a double-blind, placebo-controlled, randomised trial. *Phytomedicine,* **11**, 383(2004).
24. M. UGGLA, Domestication of wild roses for fruit production. Doctoral thesis. Swedish University of Agricultural Sciences. Alnarp, Sweden (2004).
25. S. J. PADAYATTY and M. LEVINE, New insights into the physiology and pharmacology of vitamin C. *Canadian Medical Association Journal,* **164**, 353–355(2001).
26. S. BALLIF, Instrumente, observații și coduri meteorologice, Ed. Did. si Ped.., Bucuresti, 1979.
27. I. Ciulei & al., *Plante medicinale. Fitochinie și fitoterapie* – volumul 2, Editura Medicală, București, 1993, pp. 690 – 722.
28. R. CAPRITA & I. CRETESCU, Tehnnici şi metode în biofizică, Ed Mirton, Timisoara 2000, p.
29. Z. ŠINDRA & al., Fruit quality of dog rose seedlings *(Rosa canina L*). *Journal of Central European Agriculture*, **13**(2), 321-330(2012).
30. F. CELIK & al., Fruit characteristics of some selected promising rosehip (*Rosa spp*.) genotypes from Van region of Turkey. *African Journal of Agricultural Research*, **4**(3), 236-240(2009).
31. A. MABELLINI & al., Chemical and Physical Characteristics of Several Wild Rose Species Used as Food or Food Ingredient, *International Journal of Industrial Chemistry,* **2**(3), 158-171(2011).
32. FAO Nutrition Meetings, Report Series 40A, B, C, WHO/Food Add./67.29 http://www.inchem.org/documents/jecfa/jecmono/40abcj45.htm
33. C. PÂRVU, Universul Plantelor, Mică enciclopedie, Ediția a IIa, Editura Enciclopedică Bucureşti, 1997.
34. R. NOWAK, Fatty acids composition in fruit of wild rose species. Acta Societatis Botanicorum Poloniae, **74**, 229–235(2005).
35. M. OZCAN, Nutrient composition of rose (Rosa canina L.) seed and oil, *J. Med. Food*, **5**, 137-140(2002).
36. M. GÜNES, Pomological and phenological characteristics of promising rose hip (*Rosa*) genotypes, African *Journal of Biotechnology*, 9(38), 6301-6306, (2010).
37. S. ROPCIUC & al., The influence of solar radiation on the vitamin C content in *Rosa Canina* fruits, *Romanian Biotechnological Letters,* 18(1), 8026-803, (2013)