

REZULTATE PRIVIND ANALIZA BIOSTATISTICĂ COMPARATIVĂ A UNOR CARACTERISTICI ALE BIOTIPURILOR DE CASTAN COMESTIBIL DIN ZONA OLTENIEI DE NORD

RESULTS ON COMPARATIVE STATISTICAL ANALYSIS OF THE CHARACTERISTICS OF THE SWEET CHESTNUT BIOTYPES FROM NORTH OLTENIA

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Abstract

In Northern Oltenia, the sweet chestnut may be found in semi-spontaneous and cultivated state, usually around the Monasteries of Polovragi, Tismana, Horezu, Bistrița, Frăsinei, Turnu, etc. Between 2012 - 2016 period, 66 biotypes of chestnut were selected and studied, aged between 15 and 350 years, from the semi-spontaneous flora of the following locations: Dăești Călimănești, Bistrița and Horezu (Valcea) and Polovragi (County Gorj). As for the size of fruits, it was observed that the variability between the biotypes of sweet chestnut from Dăești (coefficient of variation = 8.4%), Bistrița (8.2%) and Horezu (10.2%) is very low, while for the biotypes from Polovragi is very high (20.2%). If we relate at all locations in the area, chestnut biotypes show a high variability in the size of fruit (21.7%). In case of fruit weight, the variability is higher within populations of each locality (17.3 to 28.4%), but the most obvious variability is found across the entire area (34.5%). This high variability of fruit weight signals that chestnut biotypes come from different populations.

Cuvinte cheie: *Castanea sativa*, castan comestibil, selecții

Key words: *Castanea sativa*, sweet chestnut, selections

1. Introduction

The European chestnut or the sweet chestnut (*Castanea sativa* Mill.) is originated in Europe and Asia Minor, mainly along the Mediterranean Basin and adjacent areas, along the Southern shore of Black Sea and Caucasus Mountains. Nowadays, sweet chestnut is widely distributed in Italy, Spain, Portugal, France, Greece, Turkey, Switzerland, and at a smaller extend, in United Kingdom, Belgium, Netherlands, Germany, Austria, Hungary, Romania, Slovenia, Slovakia, Croatia, Albania, Bulgaria, Macedonia, Bosnia & Herzegovina, Georgia, Azerbaijan, Russian Federation, etc.

In Romania, the sweet chestnut can be found in Northern part of Oltenia region (Gorj and Vâlcea counties), in Banat region and in Maramureș county (Alec and Botu, 2013).

Sweet chestnut is a nut crop, with an invaluable historical and cultural heritage, that plays an important role in the economic and environmental context of mountain areas (Torelo Marinoni et al., 2013).

The cultivation of chestnut was mainly linked with the numerous and versatile uses of the products that can be obtained. In fact, fruits were commonly eaten, leaves were used in the foods, trunk were employed by road people for building, and the tannin was extracted for pharmaceutical purposes (Riccardi and Giacco, 2005).

The preservation of this germplasm from the genetic erosion due to the changes in socio-economic structure rural areas and specific pathogen attacks (Sartor et al., 2009) is an important objective in the agro biodiversity conservation strategy (CBD, 2002). Adaptive potential and phenotypic plasticity determine the capacity of the species to adapt to the environmental situations (Mace et al., 2003).

2. Material and methods

The biological material for this study consists of sweet chestnut selections from Northern area of Oltenia. The biotypes have been selected from adjacent areas of the following locations: Dăești, Călimănești, Bistrița and Horezu (in Vâlcea county) and Polovragi (in Gorj county).

66 biotypes of sweet chestnut were selected and are presented in this study. The sweet chestnut trees that have been selected from semi-cultivated flora have ages between 15 to 35 years old.

During 2012 – 2016 period, observations have been carried out regarding phenology, productivity and also behaviour to main diseases and pests.

Fruit samples have been harvested in order to evaluate their quality. The fruit samples were weighted and fruits measured. Fruit size index have been calculated as mean of large diameters, small diameters and heights.

3. Results and discussions

Sweet chestnut selections from Northern Oltenia proved to have important variability. In case of sweet chestnut selections from Dăești area important variability between selections, but also inside them in terms of the size and weight of fruits have been observed (Table 1).

Maximum and minimum amplitude is relatively high within each biotypes (fruit size index from 21,1 to 30,8 mm) and (3,4 to 18,4 g in fruit weight).

To determine the degree of variability and uniformity of fruits variance (s^2), standard deviation (s) and the coefficient of variation (s%) have been calculated. Variance ranged from 1.1 to 19.9, while standard deviation from 1.0 (D 1007) to 4.5 (D 1008).

Out of 13 biotypes selected in the Dăești area 3 of them have coefficients of variation of fruit size ranging from 11.8 to 19.0%, the remaining 9 biotypes have coefficients of variation under 10.0%. Regarding fruit weight, 5 biotypes showed coefficients of variation over 20% (D 1005, D 1009, D 1010, D 1012 and D 1013), 5 selections have coefficients of variation between 10.0 and 20.0% and only two biotypes show low coefficient of variation (D 1002 and D 1003) emphasized coefficients of variation under 10.0%.

Fruit weight of Dăești sweet chestnut selections varied from 6.0 to 13.9 grams. The most uniform fruits have been observed in case of D 1002 and D 1003 selections. Standard deviation proved very low (0.7 to 3.8).

In case of the chestnut biotypes from Călimănești, the 3 selections (C 1051, C 1054 and C 1055) have shown quite low variability for fruit size index, standard deviation varied from 1.2 (C 1054) to 1.5 (C 1051), while the coefficients of variation did not overpass 6.6% (C 1051). Mean fruit weights vary from 7.0 to 7.9 grams and each fruit sample had coefficients of variations from 11.6% (C 1054) to 15.0% (C 1051 and C 1055).

A number of 8 sweet chestnut selections have been investigated in Bistrița (Table 3). Fruit weights oscillate from 7.8 g (B 1106) to 13.3 g (B 1103). B 1103 selection have had the largest fruits, although variability within the fruit sample is quite large (the coefficient of variation s% = 24.8%). The rest of 7 selections analysed had more uniform fruits (s% varied from 6.4 to 17.9%).

The chestnut biotypes selected in Horezu have shown that the amplitude of the character fruit size index varied between 19.3 (H 1207) to 32.9 mm (H 1205) and the fruit weight has values from 6.1 (H 1207) to 16.6 g (H 1204).

Standard deviation (s) ranged from 1.3 to 8.3 for fruit size index while in case of fruit weight from 1.0 to 2.0 (Table 3).

The coefficient of variation (s%) has low values for fruit size index and only the H 1207 biotype attains 12.8%

In terms of fruit weight the variation coefficients oscillate between 9.5 to 21.7% showing medium to large variability within samples. 2 biotypes had coefficients lower than 10%, and 5 between 10 to 20%. The highest coefficient was recorded in case of H 1207 biotype (21.7%).

The 25 sweet chestnut biotypes selected in Polovragi expressed great variability in fruits. The fruit size index variability is low to medium. The standard deviation show low levels, from 0.8 to 1.9 (Table 5).

Coefficients of variation for fruit weight ranged between 13.9% (PO 1311) and 40.0% (PO 1301) expressing very high variability within most fruit samples, which is due to the arrangement of biotypes in the coppice.

In order to evaluate the variability existing inside the sweet chestnut populations we considered the fruit size index and weights of fruit per location and on all areas.

The variability between biotypes from Dăești (coefficient of variability of 8.4%), Bistrița (8.2%) and Horezu (10.2%) is very small, in contrast to large variability of biotypes from Polovragi (20.2%).

If we relate to all locations in the area, the sweet chestnut biotypes emphasize large variability in fruit size index (21.7%).

In case of fruit weight the variability is medium to high within populations of each locality (17.3 - 28.4%), but the most obvious variation is found for the entire area (34.5%). This high variability of fruit weight might signal that the biotypes come from different populations.

Investigation of sweet chestnut populations from Northern Oltenia have to be continued, including other traits and using also molecular tools.

4. Conclusions

As for the size of fruits, it is found that the variability between the biotypes of sweet chestnut from Dăești, Bistrița and Horezu is low, while for the biotypes from Polovragi, it is high. If we relate at all locations in the area, biotypes show a high variability for fruit size due also to environmental conditions.

In case of fruit weight, the variability is higher within populations of each locality (17.3 to 28.4%), but the most obvious variability is found across the entire areas (34.5%).

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Tables

Table 1. Biostatistical analysis for the fruits of sweet chestnut selections from Dăești area

No.	Area	Selections	Fruit size index (mm)						Fruit weight (g)					
			Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)	Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)
				Max	Min					Max	Min			
1	Dăești	D 1001	24.1	28.1	21.0	4.1	2.0	8.3	10.7	13.5	8.2	3.9	2.0	18.7
2		D 1002	28.6	30.0	26.6	2.9	1.7	5.9	13.3	14.7	12.0	0.8	0.9	6.7
3		D 1003	21.7	23.2	21.2	1.4	1.2	5.5	6.0	5.8	7.2	0.2	0.4	6.6
4		D 1004	25.3	27.3	24.6	3.7	1.9	7.5	9.2	11.5	6.9	1.9	1.4	15.2
5		D 1005	22.6	21.4	23.5	18.8	4.3	19.0	9.5	15.1	10.1	6.3	2.5	26.3
6		D 1006	22.6	21.1	25.2	2.5	1.5	6.6	6.1	7.7	4.9	0.5	0.7	11.4
7		D 1007	27.1	30.4	26.3	1.1	1.0	3.7	13.9	18.7	11.8	4.4	2.1	15.1
8		D 1008	26.9	30.8	25.3	19.9	4.5	16.7	11.4	13.8	9.6	2.3	1.5	13.1
9		D 1009	26.5	27.0	23.7	5.1	2.3	8.6	8.0	10.7	6.4	6.8	2.6	32.5
10		D 1010	27.4	32.3	24.4	10.0	3.2	11.8	13.8	18.7	8.9	14.5	3.8	27.5
11		D 1011	26.5	27.5	25.2	2.6	1.6	6.0	10.2	11.9	9.4	3.8	1.9	18.6
12		D 1012	27.5	29.3	25.9	3.9	2.0	7.3	6.1	9.4	3.4	5.1	2.2	36.0
13		D 1013	26.0	29.3	24.6	4.8	2.2	8.5	10.2	13.1	8.1	5.4	2.3	22.5

Table 2. Biostatistical analysis for the fruits of sweet chestnut selections from Călimănești area

No.	Area	Selections	Fruit size index (mm)						Fruit weight (g)					
			Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)	Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)
				Max	Min					Max	Min			
1	Călimănești	C 1051	22.6	24.4	20.3	2.3	1.5	6.6	6.0	7.8	5.3	0.8	0.9	15.0
2		C 1054	21.7	23.8	19.8	1.4	1.2	5.5	6.0	7.0	4.9	0.5	0.7	11.6
3		C 1055	20.0	22.7	18.3	1.1	1.4	7.0	6.0	7.9	4.4	0.9	0.9	15.0

Table 3. Biostatistical analysis for the fruits of sweet chestnut selections from Bistrița area

No.	Area	Selections	Fruit size index (mm)						Weight fruit (g)					
			Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)	Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)
				Max	Min					Max	Min			
1	Bistrița	B 1101	25.8	28.6	23.4	4.0	2.0	7.7	12.0	14.4	10.4	1.7	1.3	10.8
2		B 1102	27.6	29.7	25.4	2.5	1.5	5.4	12.2	14.6	9.9	0.7	0.8	6.5
3		B 1103	28.7	31.5	25.1	8.6	2.9	10.1	13.3	17.2	9.4	10.6	3.3	24.8
4		B 1104	25.4	26.4	24.4	3.0	1.7	6.7	9.4	10.5	7.9	0.5	0.7	7.4
5		B 1105	27.8	29.1	25.3	5.1	2.3	8.2	12.5	13.9	10.1	1.9	1.4	11.2
6		B 1106	23.9	27.1	22.4	2.0	2.1	8.7	7.8	10.1	6.1	0.3	0.5	6.4
7		B 1107	26.7	29.2	25.9	3.0	1.7	6.4	10.8	14.1	9.6	1.4	1.2	11.1
8		B 1108	22.3	24.1	26.2	1.8	1.3	5.8	8.9	12.1	7.1	2.5	1.6	17.9

Table 4. Biostatistical analysis for the fruits of sweet chestnut selections from Horezu area

No.	Area	Selections	Fruit size index (mm)						Weight fruit (g)					
			Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)	Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)
				Max	Min					Max	Min			
1	Horezu	H 1201	26.1	29.3	24.0	2.8	1.7	6.5	9.2	12.8	6.9	2.9	1.7	18.4
2		H 1202	26.4	30.4	24.7	3.9	2.0	7.7	10.5	12.4	9.2	1.1	1.0	9.5
3		H 1203	29.2	31.9	28.4	2.8	1.3	4.4	12.9	14.9	10.7	2.3	1.5	11.6
4		H 1204	29.3	31.9	28.7	4.2	1.4	4.7	13.1	16.6	11.9	1.7	1.3	9.9
5		H 1205	30.3	32.9	28.7	3.0	1.7	5.6	15.5	18.4	12.8	3.2	1.7	10.9
6		H 1206	25.1	27.9	23.8	2.8	1.7	6.7	9.2	11.5	7.4	4.1	2.0	21.7
7		H 1207	21.9	25.6	19.3	8.3	2.8	12.8	7.7	12.0	6.1	2.2	1.4	18.2
8		H 1208	25.9	28.6	23.6	6.2	2.5	9.6	12.2	16.1	9.4	2.8	1.7	13.9

Table 5. Biostatistical analysis for the fruits of sweet chestnut selections from Polovragi area

No.	Area	Selections	Fruit size index (mm)						Weight fruit (g)					
			Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)	Mean	Amplitude		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)
				Max	Min					Max	Min			
1	Polovragi	PO 1301	18.2	23.6	19.1	3.1	1.7	9.6	4.0	6.1	3.0	2.7	1.6	40.0
2		PO 1302	20.1	24.4	19.5	5.9	2.4	12.0	5.1	7.2	3.0	1.4	1.2	23.2
3		PO 1303	20.9	26.5	21.3	2.2	1.5	7.1	5.8	7.3	4.4	3.7	1.9	26.3
4		PO 1304	20.8	26.3	19.4	7.8	2.8	13.4	5.5	7.8	4.5	0.8	0.9	16.2
5		PO 1305	19.9	24.3	20.1	2.0	1.4	7.1	5.2	7.3	4.2	0.8	0.9	17.3
6		PO 1306	15.3	20.0	17.9	0.6	0.8	5.0	5.0	6.6	4.4	2.4	1.6	30.9
7		PO 1307	21.6	23.2	21.3	5.1	2.2	10.4	7.1	8.9	5.6	1.8	1.3	18.8
8		PO 1309	23.1	25.8	22.3	1.2	1.1	4.7	8.6	13.0	6.6	0.8	0.9	10.4
9		PO 1310	19.9	24.3	20.3	2.3	1.5	0.2	6.3	9.9	4.2	2.8	1.7	26.6
10		PO 1311	19.9	24.3	20.3	1.7	1.3	6.5	6.0	7.7	5.0	0.7	0.8	13.9
11		PO 1312	22.9	26.7	22.2	4.5	2.1	9.2	9.0	12.8	5.7	4.5	2.1	23.5
12		PO 1314	20.2	24.3	20.2	1.6	1.3	6.3	7.0	8.1	6.6	1.6	1.3	18.0
14		PO 1315	21.3	23.2	19.6	1.7	1.3	7.9	7.2	8.1	6.2	1.7	1.3	18.1
15		PO 1317	22.3	25.6	21.8	2.9	1.7	7.6	7.6	10.5	5.5	2.9	1.7	22.4
16		PO 1318	21.0	24.7	21.8	3.0	1.7	8.2	8.1	10.7	6.3	3.0	1.7	21.3
17		PO 1319	22.1	23.6	20.6	4.8	2.2	9.9	7.2	8.5	5.0	4.8	2.2	30.4
18		PO 1320	20.6	23.9	20.1	1.6	1.3	6.1	8.8	10.2	6.0	1.6	1.3	14.3
19		PO 1321	18.8	22.3	18.6	2.0	1.4	7.5	5.6	8.1	4.8	2.0	1.4	24.2
20		PO 1324	19.5	22.7	20.4	1.4	1.2	6.1	5.4	9.7	4.3	1.4	1.2	21.9
21		PO 1325	20.5	25.8	21.5	3.9	1.9	9.6	6.7	7.9	5.4	3.9	1.9	29.4
22		PO 1326	19.8	22.7	18.7	2.5	1.6	7.9	5.2	7.8	4.2	2.5	1.6	30.4
23		PO 1327	18.2	22.0	19.7	1.5	1.2	6.7	6.0	9.1	4.4	1.5	1.2	20.4
24		PO 1329	17.6	22.8	16.4	2.4	1.5	8.8	5.4	7.2	4.1	2.4	1.5	28.6
25		PO 1330	21.3	24.5	19.8	1.7	1.3	6.1	8.3	11.2	5.4	1.8	1.3	16.1
26		PO 1332	20.2	23.3	20.9	0.8	0.8	4.4	6.0	7.4	4.1	0.8	0.9	14.9
27		PO 1333	19.5	22.0	17.4	2.8	1.7	8.6	5.7	7.0	3.6	1.6	1.3	22.2
28		PO 1334	18.4	23.6	20.5	0.9	0.9	5.1	6.7	8.0	4.2	0.7	0.8	12.5
29		PO 1335	19.7	23.3	19.6	1.1	1.0	5.3	5.5	7.4	4.4	1.3	1.1	20.7
30		PO 1336	16.7	21.4	16.0	4.3	2.1	12.4	4.0	5.3	3.0	1.6	1.3	31.6
31		PO 1337	24.1	26.8	22.4	1.7	1.3	5.4	8.1	10.1	7.3	1.7	1.3	16.1
32		PO 1338	16.3	19.3	15.3	2.8	1.7	10.3	3.9	4.7	3.7	1.8	1.3	34.4
33		PO 1339	17.3	22.0	18.7	2.9	1.7	9.8	4.6	6.0	4.0	0.8	0.9	19.4
34		PO 1340	22.0	25.2	21.7	0.4	0.6	2.8	6.8	9.2	5.6	1.3	1.1	16.7

Table 6. Genetic variability of sweet chestnut selections from Northern Oltenia depending on the size and weight of the fruits

No.	Areas	Fruit size index (mm)			Weight fruit (g)		
		Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)	Variance (s ²)	Standard deviation (s)	Coef. of variation (s%)
1	Dăești	4.7	2.16	8.4	7.8	2.79	28.4
2	Bistrița	4.6	2.14	8.2	3.9	1.97	24.6
3	Horezu	7.5	2.74	10.2	6.7	2.59	22.9
4	Polovragi	16.3	4.04	20.2	1.2	1.09	17.3
5	Populations from all areas analysed	26.9	5.19	21.7	9.2	3.04	34.5