THE EFFECT OF GENOTYPE ON SOME QUALITY TRAITS IN RED CHERRY TOMATO

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Abstract

Four different varieties of red cherry tomatoes (*Lycopersicon esculentum* var. *cerasiformae*, *L. esculentum* var. *pyriformae, L. esculentum* var. *grandifolium*, and *L. esculentum* var. *racemigerum*) were evaluated for their potential to serve as a source of genes for improvement of some quality traits in cultivated varieties. Physical and chemical properties like pH, moisture (M), dry matter content (DM), ash (AS), titratable acids (TA), ascorbic acid (AA), and total carbohydrates (TCH) were investigated on the rape fruit at varieties grown under the same agro-ecological conditions. The mean values obtained for pH, TA, AA, DM, M, AS, and TCH were 4.52 ± 0.11, 0.56 ± 0.06%, 20.56 ± 1.32 mg/100 gfw, 7.14 ± 0.45%, 92.86 ± 0.45%, 0.65 ± 0.11 %, and 5.23 ± 0.80 %, respectively. Statistically significant differences were observed in AA and AS content in all varieties. Varieties of *pyriformae* and *grandifolium* significantly differ regarding pH, DM and M content. The variety of *cerasiformae* showed the greatest content of DM, AS, and AA, and the lowest content of moisture and TA. The greatest content of TCH and moisture was observed at the variety of *grandifolium*. The highest AA and the lowest moisture content in the variety of *cerasiformae* indicate that this variety will have a longer shelf life compared to other investigated varieties and according to the other investigated quality traits it can be considered that this variety is the most promising source for genes that control AA, DM, and AS content in the fruit.

Genetic improvements, control of environmental factors, and optimization of agricultural practices are precursors for achieving high-quality products (Pant et al. 2002). The cultivar selection is the first step towards the improvement of phytonutrient content. This study evaluated some compositional differences between four red cherry tomato varieties obtained from the germplasm bank in the Republic of North in order to be exploited in the process of selection and designing of breading programs to create improved cherry tomato cultivars with better commercial and processing characteristics.

Table 1. Descriptive statistics analysis of investigated varieties

	Mn	Md	Min	Max	S	CV	SW p-value(A)	SW p-value(B)
M	92.86	92.91	92.1	93.36	0.45	0.48	0.53	-
DM	7.14	7.10	6.64	7.90	0.45	6.27	0.53	-
AS	0.65	0.65	0.49	0.83	0.11	16.81	0.88	-
pH	4.52	4.56	4.34	4.62	0.11	2.45	0.002	0.392
TA	0.56	0.53	0.51	0.66	0.06	10.83	0.004	0.317
AA	20.56	20.57	18.70	22.3	1.32	6.43	0.17	-
TCH	5.23	5.06	4.74	7.74	0.80	15.33	<0.001	0.987

It is considered that wild cherry tomato species originate from the Andes of Chile, Bolivia, Peru, Ecuador, and Colombia (Nuez, 1999). Because of the pleasant taste, suitable shape, and size as well as a great content of nutrients beneficial for human health the demand of cherry tomatoes in the world and domestic market has increased. Based on the statistical data from the Central Intelligence Agency's World Factbook for 2019 the total exports of tomato in the world, was estimated at $9 billion, while in the Republic of North Macedonia the export was estimated to more than $11,576,000

Table 2. Last Significant Difference (LSD test) between the investigated varieties

	LSD post Hoc test					
	DM	**Ash**	**AA**	**pH**	**TA**	**TCH**
pyriformae vs *cerasiformae*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
pyriformae vs *grandifolium*	0.443	0.004	<0.001	<0.001	<0.001	0.018
pyriformae vs *racemigerum*	<0.001	<0.001	<0.001	0.001	0.017	0.019
cerasiformae vs *grandifolium*	<0.001	<0.001	<0.001	<0.001	1.000	<0.001
cerasiformae vs *racemigerum*	0.008	0.001	<0.001	0.005	0.017	0.008
grandifolium vs *racemigerum*	<0.001	0.01	<0.001	<0.001	0.017	0.001

The TCH content is a vital feature of the taste of tomatoes. According to the descriptive analysis in this study, the TCH in the investigated varieties raged from 4.74 to 7.74%. The highest content was observed in the variety of *grandifolium* followed by the varieties of *cerasiformae*, *racemigerum*, and *pyriformae* (Tab. 1)

The content of TA in investigated varieties is high and ranges between 0.51 – 0.66%. The highest content of TA was observed in the variety of pyriformae where the content of TCH was the lowest, but still enough high to result in favorable taste followed by the varieties of racemigerum, grandifolium, and cerasiformae. High TCH and high TA contribute to rich and favorable taste in all investigated varieties. The TCH and TA ratio suggests that the variety of grandifolium has the sweetest taste of the investigated varieties (Table 1) while the variety of pyriformae the less..

The pH of the investigated varieties ranged between 4.34 – 4.62 (Table 1). The variety of grandifolium showed the highest pH followed by the varieties of *cerasiformae*, *racemigerum*, and *pyriformae* . pH 4.4 is the maximum desirable acidity for safety when tomatoes are processed.

Higher levels of AA in tomatoes enhance postharvest fruit quality. Some authors found that AA is responsible for improved tolerance of biotic and abiotic stress in plants. Therefore, the increased content of AA in tomato fruit is of particular interest. Literature data showed that AA content in cherry tomatoes may vary considerably. In our study, the highest content of AA was observed in the variety of *cerasiformae* (med 22.27 mg/100g), and the lowest in the variety of *pyriformae* (med 18.81 mg/100g) (Table 1). .

The desirable feature of tomato fruit is a higher percent of DM content. The percentage in investigated varieties ranged between 6.64 – 7.90% (Table 1). The highest percent was observed in the variety of cerasiformae (med 7.70). This variety was also characterized by the highest content of AA and AS.

The highest AS content indicates the more mineral content in the investigated variety (Nielsen 2002). The average AS content in the investigated varieties was relatively high and ranged from 0.49 – 0.83%. The moisture was the highest in the variety of *grandifolium* followed by the varieties of *pyriformae*, *cerasiformae*, and *racemigerum* (Tab.1). The lowest moisture content in the variety of *racemigerum* suggests that this variety will have a longer shelf life compared with other investigated varieties.

Table 3. One way ANOVA single factor analysis between the investigated varieties regarding investigated quality parametrers (α=0.05)

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
			AA mg/100gfw			
Between Groups	19.21	3	6.40	1829.11	$1.10\ e^{-11}$	4.07
Within Groups	0.028	8	0.0035			
Total	19.23	11				
			AS %			
Between Groups	0.13	3	0.04	53.97	$1.19\ e^{-05}$	4.07
Within Groups	0.01	8	0.0008			
Total	0.13	11				
			DM %			
Between Groups	2.13	3	0.71	69.29	$4.6\ e^{-06}$	4.07
Within Groups	0.08	8	0.01			
Total	2.21	11				
			M %			
Between Groups	2.12	3	0.71	69.29	$4.6\ e^{-6}$	4.07
Within Groups	0.08	8	0.01			
Total	2.21	11				
			pH			
Between Groups	0.112	3	0.037	74.578	< 0.001	4.07
Within Groups	0.004	8	0.001			
Total	0.116	11				
			TA			
Between Groups	0.033	3	0.011	16.642	< 0.001	4.07
Within Groups	0.005	8	0.001			
Total	0.038	11				
			THC			
Between Groups	4.175	3	1.392	31.407	< 0.001	4.07
Within Groups	0.310	7	0.044			
Total	4.485	10				

Table 4. Pearse correlation analysis of investigated traits. Significant values(p<0.05) are bolded

	M	DM	AS	pH	TA	AA	TCH
M	1.00						
DM	1.00	1.00					
AS	**0.89**	**0.89**	1.00				
pH	-0.02	-0.02	0.27	1.00			
TA	-0.30	-0.33	0.03	0.00	1.00		
AA	**0.88**	**0.88**	0.00	0.21	0.02	1.00	
TCH	**0.93**	**0.93**	0.00	**0.77**	0.62	0.01	1.00

CONCLUSION

The investigation showed that all investigated varieties have suitable pH of less than 4.6. The lowest acidity level was observed at the variety of pyriformae followed by, cerasiformae, racemigerum and grandifolium. The content of moisture was the lowest at the variety of cerasiformae followed by the variety of racemigerum, pyriformae, and grandifolium while the content of DM was the highest at the variety of cerasiformae followed by varieties racemigerum, pyriformae, and granadifolium. Significant differences for M and DM content were observed between all varieties except between the varieties of pyriformae and grandifolium. The variety of cerasiformae showed the highest content of minerals followed by racemigerum, grandifolium and pyriformae. Each variety significantly differ, regarding this trait. Total acid content showed the highest value in the variety of pyriformae followed by racemigerum, grandifolium and cerasiformae. No significant differences were observed between varieties regarding TA content except cerasiformae and grandifolium. Each variety significantly differ, regarding AA content. The variety of cerasiformae showed the highest AA content followed by racemigerum, grandifolium and pyriformae. Strong positive association was observed between the content of AA, AS, TCH with DM and M content. The content of TCH was high and significantly differ between varieties. Positive association of TCH was observed with M, DM, and pH. The highest DM, AA, and AS as well as the lowest TA and moisture content in the variety of cerasiformae suggest that this variety will have longer shelf life and have the greatest potential to be used as gene source for improving AA, DM, and AS in the commercial cultivars.