UDC 575.630
https://doi.org/10.2298/GENSR1701193P
Original scientific paper

SENSORY, CHEMICAL AND MORPHOLOGICAL CHARACTERIZATION OF *Cucurbita maxima* AND *Cucurbita moschata* GENOTYPES FROM DIFFERENT GEOGRAPHICAL ORIGINS

Galina PEVICHAROVA and Nikolay VELKOV

Department of Breeding, Variety Maintenance and Introduction, Maritsa Vegetable Crops Research Institute, Plovdiv, Bulgaria

Pevicharova G. and N. Velkov (2017): *Sensory, chemical and morphological characterization of Cucurbita maxima and Cucurbita moschata genotypes from different geographical origins*.- Genetika Vol 49, No1, 193-202.

Cucurbita spp. is one of the most important vegetable crops in the world. They are characterized by great polymorphism according plants and fruits traits. The fruits are consumed in different ways as boiled, baked, dried or processed in puree and juice. The aim of the study was to assess variation of fruit sensory, chemical and morphological characteristics of *Cucurbita* genotypes in order to find appropriate parental components for the future high quality breeding programme. During 2-year period nine winter squash (*Cucurbita maxima* Duch.) and three pumpkin (*Cucurbita moschata* Duch.) genotypes originating from different geographical regions were tested on their morphological characters, basic chemical components and sensory profile. Cluster analysis and Principle component analysis were applied in order to identify similarities of different genotypes. According to the fruit characteristics and plant habitus significant differences were recorded. Considerable variation in the content of dry matter, ascorbic acid, total sugars, total pigments, beta-carotene and sensory assessment of the boiled fruits was established. Accession Moskatna carotina had the best flavour and chemical composition. The studied *Cucurbita* genotypes are a good basis for performing a breeding program to improve the sensory quality of fruits and increase basic chemical components especially those with antioxidant effect.

Key words: ascorbic acid beta-carotene, flavour, squash, total sugars

INTRODUCTION

Cucurbita spp. belongs to *Cucurbitaceae* family is among widespread vegetables all over the world. They are originated from North and South America. The most common species are

Corresponding author: Nikolay Velkov, Department of Breeding, Variety Maintenance and Introduction, Maritsa Vegetable Crops Research Institute, Brezovsko shosse Str. 32, 4003 Plovdiv, Bulgaria, Tel.:+35932952296, Fax:+35932960177, e-mail: velkov_n@abv.bg

Cucurbita maxima, *Cucurbita moschata* and *Cucurbita pepo* which are characterised with great polymorphism of fruit and plant traits (WHITAKER and DAVIS, 1962). Determination of the degree of variation of these traits is one of the keys for plant breeding programs.

Cucurbita spp. is known as the "king of beta-carotene" and are distinguished by good nutritive and mineral value (ALIU *et al*., 2012; ZINASH *et al*., 2013). The fruits are a rich source of carotenoids and vitamin C, besides higher amounts of sugars, starch and total proteins proteins (SHARMA and RAO, 2013; MARTÍNEZ-VALDIVIESO *et al*., 2015). They possess components and functional properties of dietary fibres as well (PAULAUSKIENE *et al*., 2006; ESCALADA *et al*., 2007).

Winter squash and pumpkin fruits are consumed boiled, baked, dried or processed in puree and juice. They have numerous culinary uses either as a vegetable or as an ingredient in pies, soup, stews, bread and many other dishes. The flesh is a delicious and fully appreciated additive in a diversity of products for children and adults (ATEF *et al*., 2012).

The large use of *Cucurbita* spp. at home and for industrial processing requires development of new varieties with improved quality that meets the consumer's preferences. Pumpkin is well accepted vegetable crop in Bulgaria. Research work on it in our country started in 1950 with a breeding program for developing of pumpkin varieties. Several varieties were created up to 1987 (ALEXANDROVA *et al*., 1994). A new project for maintenance and introduction of new genetic plasma for winter squash and pumpkin breeding has been ongoing since 2011 at Maritsa Vegetable Crops Research Institute in Plovdiv.

The aim of the present study was to assess *Cucurbita maxima* and *Cucurbita moschata* genotypes from different geographical origins on their chemical, sensory and morphological traits in order to find appropriate parental components for the future high quality breeding programme.

MATERIALS AND METHODS

Experimental design and plant material

The experiment was carried out at Maritsa Vegetable Crops Research Institute, Plovdiv during the period 2013-2014. Eleven *C. maxima* and *C. moschata* genotypes originating from different geographical regions were studied. The following accessions were kindly supplied by National Plant Germplasm System USDA: PI 199033 - NE9; PI 318429 - NE9; PI 318430 - NE9; PI 318433 - NE9; PI 470933 - NE9; PI 518678 - NE9 (*C. maxima)*; PI 267752 - S9; PI 560946 - S9 (*C. moschata)*. Three Bulgarian breeding lines SB-2, SB-3 (*C. maxima)* and Moskatna carotina (*C. moschata)* were evaluated.

The seeds were sown in 0.5 L pots at the end of March under greenhouse conditions. The seedlings were transplanted at 2.00 x 2.00 m scheme at the end of April. The soil of the experimental field was of sandy loam type with a pH of 7.0. The fertilizers were applied according to the agrochemical analysis of the soil. The fruits were harvested at full maturity at the beginning of September.

Morphological analysis

Morphological observations covering the requirements of UPOV (The International Union for the Protection of New Varieties of Plants, TG/155: *Cucurbita maxima* Duch. 2007; TG/234: *Cucurbita moschata* Duch. 2007) were performed on the experimental accessions. The morphological description of 20 plants from each genotype was made in the period of fruitage. The following main characters were recorded: plant habit, flowering type, fruit shape and size, presence of grooves, skin colour, flesh colour and pericarp thickness.

Chemical analysis

Samples of five full ripped fruits from each accession were analyzed for dry matter, ascorbic acid, total sugars (GENADIEV *et al*., 1969), total pigments, lycopene and beta-carotene (MANUELYAN, 1991).

Sensory analysis

For the sensory analysis the fruits were boiled in water till the slices were ready for consumption. Then they were cooled to the ambient temperature. The panel test was performed on the traits: colour, aroma, lack of different flavour, sweetness, texture and overall taste. A five point scale with 0.25 step was used. The same four trained taste panelists participated during the two experimental years. The analysis was performed in two replications. The following sensory descriptors were applied: colour (1 – light; 5 – dark orange); aroma (1- not detectable or atypical; 5 – saturated, typical); lack of different flavour (1 – undesirable wild flavour; 5 – total lack of different flavour); sweetness (1 - not detectable; 5 – intensive); texture (1 – fibrous, tough or very watery; 5 – homogenous, succulent); overall taste (1 – insipid, atypical; 5 – very intensive, typical, rounding).

Data analysis

Duncan's multiple range test, Correlation analysis, Cluster analysis by average linkage (between groups) and Principal Component Analysis (PCA) were applied using software programme SPSS version 12.

RESULTS AND DISCUSSION

Significant polymorphism in investigated morphological characters of winter squash and pumpkin collection was observed (Table 1 and 2). Three plant growth habit types (trailing, bush and semitrailing) were established which could be used in different breeding directions. Male and female flower formation on one and the same plant is the most common type of flowering (WHITAKER and DAVIS, 1962).

Table 1 a. Morphological characterization of Cucurbita maxima accessions.

Accessions	Origin	ID	Flowering type	Plant growth habit	Fruit characters					
					Fruit shape	Grooves	Main skin colour	Ripe flesh colour	Pericarp thickness (cm)	Fruit weight (kg)
Cucurbita maxima										
PI 199033	Turkey	No10624	monoecious	trailing	globular	present	white	yellow	4-4.5	16-20
PI 318429	USA	Ames 720	monoecious with *ms*	bush	transverse	present	orange	orange	3.5-4	3.5-4
PI 318430	USA	Ames 721	monoecious	bush	elliptical	present	dark green	orange	2.5-3	2.5-3
PI 318433	USA	Ames 724	monoecious	semitrailing	transverse	present	orange	orange	2.5-3	1.5-2
PI 470933	Peru	-	monoecious	trailing	elliptical	present	white	yellow	3.5-4	10-14
SB-2	Bulgaria	Breeding line	monoecious	trailing	elliptical	present	whitish	orange	5-6	8-10
SB-3	Bulgaria	Breeding line	monoecious	trailing	globular	present	whitish	orange	5-6	8-10

Table 1 b. Morphological characterization of Cucurbita moschata accessions.

Accessions	Origin	ID	Fruit characters							
			Flowering type	Plant growth habit	Fruit shape	Grooves	Main skin colour	pe flesh colour	Pericarp thickness (cm)	Fruit weight (kg)
					Cucurbita moschata					
PI 267752	USA	Miniature cushaw	monoecious	trailing	pear shaped	absent	orange	orange	2.5-3	3-3.5
PI 560946	Bolivia	Joco	monoecious	trailing	cylindrical	absent	dark green	orange	2.5-3	1.2-1.5
Moskatna carotina	Bulgaria	Breeding line	monoecious	trailing	pear shaped	absent	orange	orange	3-4	4.5-6

In our investigation all genotypes were of *monoecious* flowering type. Only PI 318429 had male sterility (*ms*) which is of great importance for heterosis breeding. Male sterility is one of the genetic tools that allow female flowers to be easily cross-pollinated, as well the highest rate of hybrid seeds production.

The studied accessions of *C. maxima* were distinguished by globular, transverse elliptical, club shape and elliptical shapes of the fruits while in *C. moschata* pear shaped and cylindrical ones were observed (Figure 1). Skin colour varied in large limits from white to orange. Flesh colour was orange in the predominant part of the genotypes except of PI 199033 and PI 470933 with yellow colour. Significant variation was detected regarding pericarp thickness. In *C. maxima* it range from 2.5-3 cm to 5-6 cm. Fruit weight ranged in dependence of inheritance features from 1.5-2 kg in PI 318433 to 16-20 kg in PI 199033. These results confirm that the great diversity of fruit traits is very typical in the genus *Cucurbita* (ARUAH *et al*., 2010; BALKAYA *et al*., 2010). On the base on morphological and molecular characterization of *C. maxima* landraces it is established eighth morphological types (FERRIOL *et al*., 2004). From breeding point of view the available collection of cucurbits possesses valuable morphological characters. Wide variety of them is good basis for successful breeding programme.

Figure 1. *C. maxima* and *C. moschata* collection – fresh and boiled fruits.

The studied basic chemical components of the winter squash and pumpkin fruits varied in large limits (Table 2). Lycopene was the most variable one. However, having in mind its very low content we could accept that it is not important for the biological value of the fruits.

Table 2. Basic chemical composition in cucurbit fruits.

Genotypes	DM	AA	TS	TP	L	BC
PI 199033	5.70 cde	5.01 b	2.61 d	0.85 c	0.07 n.s.	0.73 c
PI 318429	5.26 de	9.51 ab	2.98 cd	5.06 b	0.25 n.s.	4.46 bc
PI 318430	9.74 a-d	13.44 a	5.22 abc	7.17 b	0.55 n.s.	6.12 b
PI 318433	4.22 e	4.95 b	1.58 d	3.95 c	0.12 n.s.	3.56 bc
PI 470933	10.67 abc	13.10 a	5.20 abc	5.13 b	0.30 n.s.	4.47 bc
PI 518678	7.35 b-e	7.53 ab	3.76 bcd	5.08 b	0.12 n.s.	4.61 bc
SB-2	8.59 a-e	13.09 a	3.84 bcd	5.35 b	0.47 n.s.	4.51 bc
SB-3	10.79 abc	10.43 ab	4.98 bc	5.30 b	0.45 n.s.	4.48 bc
PI 267752	10.28 a-d	6.05 ab	5.39 abc	6.43 b	0.29 n.s.	5.69 b
PI 560946	12.54 ab	7.38 ab	5.70 ab	6.36 b	0.20 n.s.	5.71 b
Moskatna carotina	13.58 a	8.03 ab	7.40 a	14.68 a	0.48 n.s.	13.18 a
$\overline{X}$ ± sd	8.97 ± 0.92	8.96 ± 0.96	4.42 ± 0.50	5.94 ± 1.0	0.29 ± 0.05	5.23 ± 0.91
CV (%)	33.85	35.71	37.29	56.10	62.23	57.41

DM (%) - dry matter; AA (mg.100g^{-1}) – ascorbic acid; TS (%) – total sugars; TP (mg.100g^{-1}) – total pigments; L (mg.100g^{-1}) – lycopene; BC (mg.100g^{-1}) – β-carotene, a. b. c… - Duncan.s multiple range test ($p<0.05$). n.s. – not significant $\overline{X}$ - average; sd – standard deviation; CV – coefficient of variation

High variation in total pigments was due predominantly to the variation of beta-carotene. It ranged from 0.73 mg.100g^{-1} in PI 199033 where the fruit flesh was of slight yellow-orange colour to 13.18 mg.100g^{-1} in Moskatna carotina with saturated and homogenous orange colour. Ascorbic acid - the other component with antioxidant effect on human body – started from 5.01 mg.100g^{-1} and reached over 12 mg.100g^{-1} in PI 560946 and Moskatna carotina. The total sugars and the dry matter followed one and the same tendency. The basic criteria for quality breeding of pumpkin in Bulgaria initially were established by MIHOV (1957). The dry matter should be over 12 percent and the beta-carotene should exceed 8-10 percent. Only Moskatna carotina met these requirements for both components. Other four accessions had dry matter over 10 percent. The richest of ascorbic acid was PI 470933.

The investigated cultivars were separated in three basic groups of similarity after applying cluster analysis (Figure 2). The accessions of *C. moschata* PI 267752, PI 560946 and of *C. maxima* PI 318430, PI 470933, SB-2 and SB-3 belonged to the first group. They were characterized with relatively high content of dry matter, ascorbic acid and total sugars but low content of total pigments and beta-carotene. The accessions of *C. maxima* PI 199033, PI 318429, PI 318433 and PI 518678 which were distinguished by low content of analysed chemical

components belonged to the second group. The dendrogram separated line Moskatna carotina in the third group because of the highest values of chemical composition.

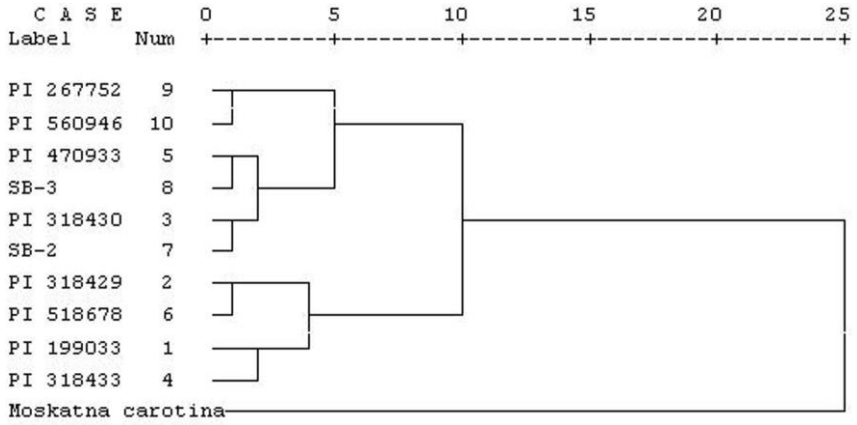

Figure 2. Hierarchical cluster analysis on the base of six chemical components in pumpkin fruits.

Principal Component Analysis showed that the first two components explained 89.37% of the total variation (Table 3). Dry matter, total sugars, total pigments and beta-carotene had the highest correlation coefficients with the first principal component and they possessed the highest relative loading for the genotype separation – 68.75%. The second principal component which had the highest correlation coefficients with ascorbic acid and lycopene explained 20.62% of the total variation. The high degree of variation in the two PC axes indicates a high degree of variation for these characters.

Selection of cultivars based on the first factor may increase dry matter, total sugars, total pigments and beta-carotene. Genes controlling ascorbic acid and lycopene contents should be located at a distance in the genome compare to the other characters in the first PC. This is important for developing breeding programme on high ascorbic acid content in *Cucurbita* fruits.

Table 3. Component matrix using method of Principal Component Analysis for the studied basic chemical composition.

Chemical composition	Components	
	1	2
Dry matter	**0.843**	0.299
Ascorbic acid	0,031	**0.976**
Total sugars	**0.902**	0.288
Total pigments	**0.948**	0.120
Lycopene	0.500	**0.798**
β-carotene	**0.951**	0.079
Total variance explained (%)	68.75	20.62
Cumulative explained (%)	68.75	89.37

The studied accessions were distinguished by specific sensory characteristics (Figure 3). Flesh colour was detected on a low level for all investigated samples. Sweetness and overall taste were the most variable traits with evaluation amplitude from 1.9 to 4.6 and from 2.1 to 4.7 respectively. Moskatna carotina was the most palatable variety because of the very concentrated colour, typical aroma, saturated taste with intensively sweet components, homogenious texture and lack of undesirable flavour. The sensory scores of all investigated traits were over 4.5.

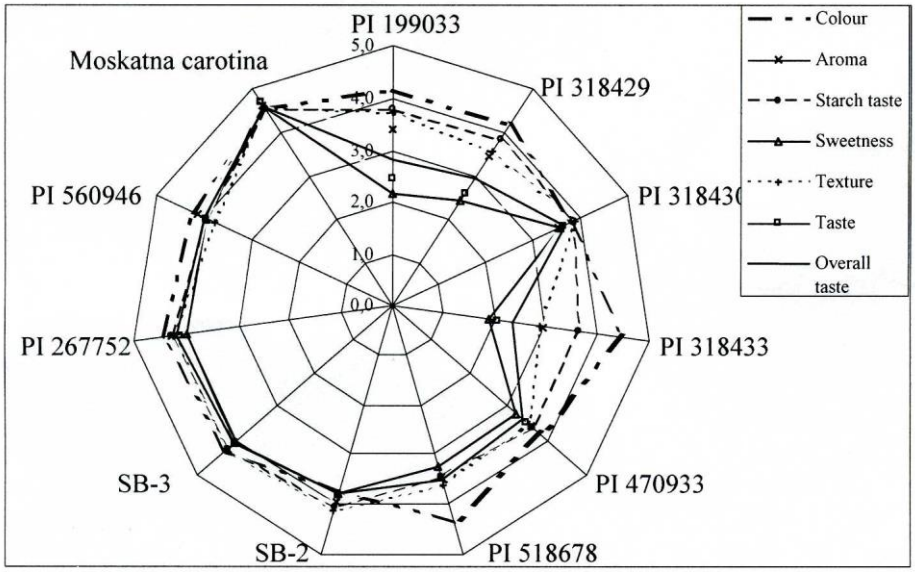

Figure 3. Sensory evaluation of boiled fruits.

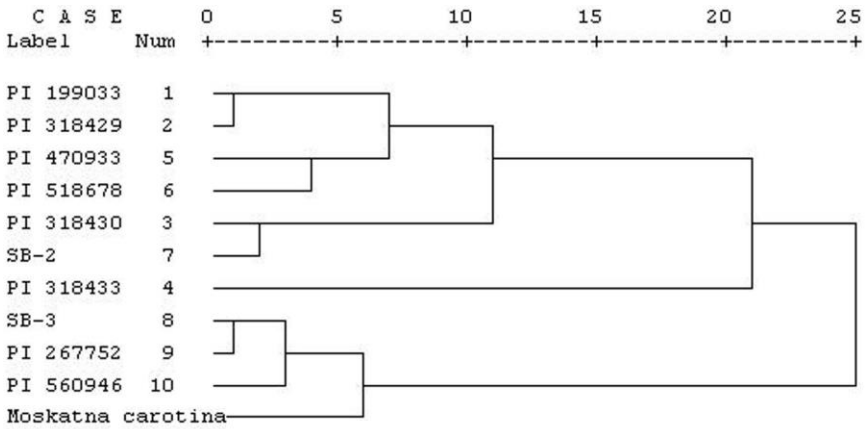

Figure 4. Hierarchical cluster analysis on the base of seven sensory characters of boiled pumpkin fruits.

The cluster analysis separated the studies genotypes in three groups of similarity in dependence of sensory evaluations on seven traits (Figure 4). The first group contained PI 199033, PI 318429, PI 470933, PI 518678, PI 318430 and SB-2 which was characterized by comparatively low assessments for sweetness, texture, overall taste and total sensory evaluation (TSE) but high evaluation for colour. Accession PI 318433 was in the second group because of low evaluation of the sensory traits except colour. The third group consisted of SB-3, PI 267752, PI 560946 and Moskatna carotina with the best sensory profile.

Principal Component Analysis showed that the first two components explained 92.86 % of the total variation (Table 4). The first principal component comprised of aroma, starch taste, sweetness, texture, overall taste and TSE with relative loading of 77.74 % of the total variation. The second principal component consisted of colour with relative loading of 15.12 %.

Table 4. Component Matrix using method of Principal Component Analysis for the studied sensory traits.

Sensory traits	Components	
	1	2
Colour	0.047	**0.984**
Aroma	**0.959**	0.190
Starch taste	**0.836**	0.331
Sweetness	**0.974**	-0.051
Texture	**0.949**	0.042
Overall taste	**0.968**	-0.025
TSE	**0.985**	0.052
Total variance explained (%)	77.74	15.12
Cumulative explained (%)	77.74	92.86

Table 5 Coefficients of correlations between some sensory traits and studied chemical components

	Colour	Starch taste	Sweetness	Texture	Overall taste	TSE	Dry matter	Total sugars	Total pigments	Beta-carotene
Colour	♦	0.292	0.026	0.063	0.061	0.123	0.034	0.052	0.231	0.261
Starch taste		♦	0.729*	0.857**	0.706*	0.776**	0.660*	0.681*	0.649*	0.637*
Sweetness			♦	0.867**	0.994**	0.988**	0.917**	0.911**	0.738**	0.723*
Texture				♦	0.868**	0.911**	0.735*	0.766**	0.584	0.566
TSE						♦	0.900**	0.907**	0.730*	0.718*
Dry matter							♦	0.969**	0.709*	0.699*
Total sugars								♦	0.802**	0.793**
Total pigments									♦	0.999**
β-carotene										♦

The total sensory evaluation was in strong correlation with starch taste and very strong correlation with sweetness, texture and overall taste (Table 5). Sweet taste impression strongly correlated with sugar content and dry matter but also with overall taste and carotenoid content. These results confirm the opinion that cucurbit fruits of high sugars and carotenoid content are regarded as the better quality products (CORRIGAN *et al*., 2000; GAJEWSKI *et al*., 2008).

As a result of this study significant differences in investigated sensory, chemical and morphological traits of winter squash and pumpkin collection were observed. They indicate the presence of sufficient genetic variability in the studied genotypes which is useful for effective selection. Moskatna carotina was the most valuable cultivar taken into account nutritional parameters and organoleptic assessment. Total sensory impression of boiled fruits could be predicted using analysis of some chemical components. The studied cucurbit genotypes are a good basis for performing the breeding programme to improve the sensory quality of fruits and to increase basic chemical components especially those with antioxidant effect.

ACKNOWLEDGEMENTS

The authors thank to the people who were involved in maintenance and supply *Cucurbita* spp. seeds in National Plant Germplasm System USDA.

Received March 11th, 2016
Accepted December 25th, 2016

REFERENCES

ALEXANDROVA, M., D. KOSTOVA, N. HRISTOV, D. ANGELOV, H. HRISTOVA, D. IVANOV (1994): State and problems in breeding of species on cucurbits (*Cucurbitaceae*). Plant Sci., *31* (3-4): 127-131.

ALIU, S., I. RUSINOVCI, S. FETAHU, S. SALIHU, R. ZOGAJ (2012): Nutritive and mineral composition in a collection of *Cucurbita pepo* L. grown in Kosova. Food and Nutri. Sci., *3*: 634-638.

ARUAH, C. B., M. I. UGURU, B. C. OYIGA (2010): Variations among some Nigerian *Cucurbita* landraces. African Jour. of Pla. Sci., *4* (10): 374-386.

ATEF, A., A. NADIR, M. RAMADAN (2012): Studies on sheets properties made from juice and puree of pumpkin and some other fruit blends. Journal of Appl. Sci. Res., *8* (5): 2632-2639.

BALKAYA, A., M. ÖZBAKIR, E. KURTAR (2010): The phenotypic diversity and fruit characterization of winter squash (*Cucurbita maxima*) populations from the Black Sea Region of Turkey. African Jour. of Biotech., *9* (2): 152-162.

CORRIGAN, V., E. IRVING, J. POTTER (2000): Sugars and sweetness in buttercup squash. Food Quality and Preference, *11* (4): 313-322.

ESCALADA, P. M., N. PONCE, C. STORTZ, L. GERSCHENSON, A. ROJAS (2007): Composition and functional properties of enriched fiber products obtained from pumpkin (*Cucurbita moschata* Duch. ex Poiret). Lebensmittel-Wissenschaft and Technologie, *40* (7): 1176–1185.

FERRIOL, M., B. PICO, F. NUEZ (2004): Morphological and molecular diversity of a collection of *Cucurbita maxima* landraces. Journal of the American Society for Horticultural Science, *129* (1): 60-69.

GAJEWSKI, M., J. RADZANOWSKA, H. DANILCENKO, E. JARIENE, J. CERNIAUSKIENE (2008): Quality of pumpkin cultivars in relation to sensory characteristics. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, *36* (1): 73-79.

GENADIEV, A., D. KALCHEVA, N. NENCHEV, D. TEVEKELIEV, N. CHAVDAROVA (1969): Food analyses, Technique, Sofia, pp. 250.

MANUELYAN, H. (1991): Express methods for assessing the carotenoid composition of tomato fruits (in G.Kallo ed. Genetic improvement of tomato), Spring–Velag, pp.193-195.

MARTÍNEZ-VALDIVIESO, D., P. GÓMEZ, R. FONT, A. ALONSO-MORAGA, M. DEL RÍO-CELESTINO (2015): Physical and chemical characterization in fruit from 22 summer squash (*Cucurbita pepo* L.) cultivars. LWT - Food Science and Technology, *64* (2): 1225–1233.

MIHOV, A. (1957): New sorts of moschat squash (*Cucurbita moschata* Duch.). Scientific works of Maritsa Vegetable Crops Research Institute – Plovdiv. Zemizdat, *1*: 137-154.

PAULAUSKIENE, A., H. DANILCENKO, E. JARIENE, M. GAJEWSKI, A. SEROCZYNSKA, P. SZYMCZAK, A. KORZENIEWSKA (2006): Quality of pumpkin fruits in relation to electrochemical and antioxidative properties. Vegetable Crops Research Bulletin, *65*: 137-144.

SHARMA, S., R. RAO (2013): Nutritional quality characteristics of pumpkin fruit as revealed by its biochemical analysis. International Food Research Journal, *20* (5): 2309-2316.

UPOV (2007). Descriptors for pumpkin (*Cucurbita maxima* Duch.). Guidelines for the conduct of tests for distictness, uniformity and stability. TG/155/4 Rev. http://www.upov.int/en/publications/tgrom/tg155/tg_155_4_rev.pdf).

UPOV (2007). Descriptors for pumpkin (*Cucurbita moschata* Duch.). Guidelines for the conduct of tests for distictness, uniformity and stability. http://www.upov.org/edocs/mdocs/upov/en/tc_edc/2007/tg_cuc_mos_proj_3_e.pdf

WHITAKER, T., G. DAVIS (1962) Cucurbits In: POLUNIN N. (Ed.), Interscience Publishers, Inc., New York, pp. 250.

ZINASH, A., T. WORKNEH, K. WOLDETSADIK (2013): Effect of accessions on the chemical quality of fresh pumpkin. African Journal of Biotechnology, *12* (51): 7092-7098.

SENZORNA, HEMIJSKA I MORFOLOŠKA KARAKTERIZACIJA *Cucurbita maxima* I *Cucurbita moschata* GENOTIPOVA RAZLIČITOG GEOGRAFSKOG POREKLA

Galina PEVICHAROVA i Nikolay VELKOV

Departman za oplemenjivanje, introdukciju i održavanje sorata, Maritsa Istraživački institut za povrće, Plovdiv, Bugarska

Izvod

Cucurbita spp. je jedna od najznačajnijih povrtarskih vrsta u svetu, koja se karakteriše velikim polimorfizmom biljaka i ploda. Plodovi se koriste za kuvanje, pečenje, sušenje ili prerađene za pire i sokove. Cilj ovog istraživanja bio je da se prouči varijabilnost senzornih, hemijskih i morfoloških karakteristika genotipova *Cucurbita*, kako bi se pronašle odgovarajuće roditeljske komponente za buduće oplemenjivačke programe za visok kvalitet. Tokom dve godine, 9 zimskih tikava (*Cucurbita maxima* Duch.) i tri bundeve (*Cucurbita moschata* Duch.), iz različitih područja, testirano je za morfološke karakteristike, hemijski sastav i senzorni profil. Primenjene su klaster analiza i analiza glavnih komponenti (PCA) za utvrđivanje sličnosti ispitivanih genotipova. Utvrđene su značajne razlike za karakteristike ploda i habitus biljke, kao i u sadržaju suve materije, askorbinske kiseline, ukupnih šećera, ukupnih pigmeneta, beta-karotena i senzornih osobina kuvanih plodova.

Moskatna carotina je imala najbolji ukus i hemijski sastav. Proučavani genotipovi *Cucurbita* su dobra osnova za oplemenjivačke programe za poboljšanje senzornih osobina plodova i poboljšan hemijski sastav, posebno onih koji imaju antioksidativni efekat.

Primljeno 11. III. 2016.
Odobreno 25. XII.2016.