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Morphological characteristics of selected fruit parts and naked seeds of *Cucurbita pepo* var. *styriaca*

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The study aimed to determine the variability of some morphological characters on fruits of selected plants within the population of ESO variety of Styrian oil pumpkin (*Cucurbita pepo* var. *styriaca*). For experimental evaluation, we used two years (2020–2021) measurements of 165 selected fruits from individual plants grown in the field conditions in Kolíňany (Slovak Republic). We determined for all samples the range for the weight of fruits (521.50–12744.70 g), length of fruits (85.00–285.00 mm), width of fruits (114.00–320.00 mm), exocarp thickness on the left side (0.10–4.86 mm), exocarp thickness on the right side (0.33–4.56 mm), pericarp thickness on the left side (9.13–57.02 mm), pericarp thickness on the right side (9.77–46.05 mm), placenta weight (89.00–870.00 g), fresh seed weight (17.30–638.50 g), seed weight after drying (4.53–187.36 g), seed length (12.91–24.00 mm), seed diameter (6.56–14.41 mm), seed thickness (0.41–3.62 mm), the weight of one thousand seeds (15.41–475.66 g). The results document that in our collections there are plants suitable for the next cultivation, and further selective improvement. In practice, only seeds of the ESO variety are used for oil production. The percentage of the weight of the seeds from the total weight of the fruits is only 3–4%. Other parts of the fruit remain in the field after harvesting. After their decomposition and ploughing into the soil, they improve the physico-chemical properties of the soil. However, the results of the experiments confirm that many parts of the fruit, such as the pulp and the placenta, are important raw material sources for use in the food industry, pharmaceuticals, cosmetics, and other areas. When growing butter pumpkin in large areas, it is also possible to collect and use flowers and young – unripe fruits from the plants during the growing season in the food industry and other areas.

Keywords: Styrian oil pumpkin, varieties, morphometric analysis, variability

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Introduction

Cucurbita spp. (pumpkins) is collectively ranked among the 10 leading vegetable crops worldwide. China and India are the world's leading producers. Other major producers are the U.S.A, Egypt, Mexico, Ukraine, Cuba, Italy, Iran and Turkey (FAOSTAT, 2013). *Cucurbita* spp. are members of the economically important Cucurbitaceae Juss. This family is also called "Cucurbits" popularly known as the "Gourd family". There are three economically important *Cucurbita* species, namely *Cucurbita pepo* L., *Cucurbita maxima* Duch. and *Cucurbita moschata* Duch., which have different climatic adaptations and are widely distributed in agricultural regions worldwide (Robinson and Decker-Walters, 1997; Paris and Brown, 2005; Wu et al., 2007; Balkaya et al., 2010). These species belong to the melon family Cucurbitaceae which is a diverse class of plants that consists of at least 8 tribes, 119 genera and over 825 species (OECD, 2016; Andres, 2003).

Domesticated *Cucurbita* has been remarked as one of the plant genera with the highest diversity in colour, shape and fruit dimensions. Five species in decreasing order of importance are now cultivated worldwide, i.e., *C. pepo*, *C. moschata*, *C. maxima*, *C. argyrosperma* and *C. ficifolia*, and, in production, they are positioned among the ten most important world vegetable crops (Esquinas- Alcazar and Gulick, 1983; Smith, 2006; Ferriol and Picó, 2008).

Cucurbita pepo is indigenous to warm and temperate regions of Central and North America and is cultivated there. It also exists in the wild form in Europe and Asia. The origin is uncertain. The common ancestor of all the current *Cucurbita pepo* varieties originates probably from Mexico as confirmed by archaeological findings (King, 1985; Paris, 1989).

Cucurbita pepo subsp. *pepo* var. *styriaca* is a phylogenetically young member of the *Cucurbita* spp. whereas arose only in the 19th century in Austria's south-eastern province Styria. This mutation defined the so-called Styrian oil pumpkin and facilitated the production of Styrian pumpkin seed oil. This pumpkin variety is called "Styrian oil pumpkin" and has been formed by an accidental natural mutation that led to tremendous morphological changes in the seed architecture. This mutation, which is the result of a single recessive gene (Stuart, 1983), led to a very thin outer hull (naked or hull-less seeds), which highly facilitates the production of this regional speciality oil and also leads toits dark green colour. In these seeds, the amounts of lignin and cellulose in the hypodermis, sclerenchyma and parenchyma tissues of the seed coat are reduced (Loy, 2000, 2004).

Naked pumpkin seeds are a popular ingredient in many snacks, bread, breakfast cereals, soups, and other edible goods (Loy, 2004; Baxter et al., 2012). Vegetable oil derived from the seeds can be purchased by the bottle for culinary/condiment use or as capsules in health food stores (Stevenson et al., 2007). Unlike conventional hulled pumpkin seeds, naked seeds lack a complete seed coat and thus are preferred for snacking and oil production because they eliminate the need for manual dehulling prior to use.

Pumpkin seeds are rich in oil (50% w/w), protein (35%), unsaturated fatty acids (86%) (Meru et al., 2018), and antioxidants that have many health benefits, including a reduced risk of certain cancers (Nesaretnam et al., 2007; Stevenson et al., 2007; Lelley et al., 2009), treatment of enlarged prostate, and lowering cholesterol levels (Thompson and Grundy, 2005; Fruhwirth and Hermetter, 2007).

Styrian pumpkin seed oil is also of considerable economic importance for the province of Styria. The Styrian oil pumpkin is the third most important field fruit in Styria with 13,000 ha of cultivable land yielding 11,100 tons in the year 2006, as reported Fruhwirth and Hermetter (2007). The average yield of pumpkin seeds of this variety strongly depends on the weather conditions, ranging from approximately 400 kg.ha^{-1} (under drought) up to 1000 kg.ha^{-1} under optimal conditions, with an average yield of 500–600 kg.ha^{-1}. To produce 1 L of this speciality oil, an average of 2.5 kg of pumpkin seeds is required, which corresponds to an amount of 30–40 oil pumpkins. However, this value is heavily influenced by cultural conditions and by the breeding line itself (FAOSTAT, 2013).

Data on phytochemistry and pharmacological activity of reported *Cucurbita pepo* chemical constituents extracted, partly used, and types of pharmacological activity performed so far. These activities of *C. pepo* might be due to the existence of certain classes of compounds including flavonoids, terpenoids, cardiac glycosides and cucurbitacins glycoside. *C. pepo* is also rich in nutritional components like carbohydrates, proteins, lipids and minerals (Adnan et al., 2017). Such differences may be caused by variations in cultivar or origin (Tsaknis et al., 1997). The content of amino acids, fatty acids and minerals may vary considerably depending on different conditions (Glew et al., 2006).

Cucurbita pepo is widely used like food and in folk medicine around the world (Perez-Gutierrez, 2016).

This aim is comprehensive of the pharmacological, chemical constituents, and clinical uses. Also have been identified the medicinally important phytoconstituents belonging mainly to cucurbitosides, multiflorane-type triterpenoids, carotenoids, ent-kaurane-type diterpene, and cucurbita glycosides. Extracts and metabolites of this plant, particularly those from seeds and fruits possess useful pharmacological activities. A survey of the literature shows *C. pepo*, is mainly known for its improvement in prostatic hyperplasia (Abdel-Rahman, 2006; Gossell-Williams et al., 2006), urinary dysfunction and cytotoxic properties (Bombardelli and Morazoni, 1997), also been used extensively as a hypoglycaemic agent (Zhang, 2004; Quanhong et al., 2005; Sesti, 2006). Many pharmacological studies have demonstrated hepatoprotection (Nkosi et al., 2006a,b), inhibit benign prostatic hyperplasia (Gossell-Williams et al., 2006), antioxidant (Nawirska-Olszanska et al., 2013; Song et al., 2015), anticancer (Matus et al., 1993), antimicrobial (Dubey et al., 2010; Noumedem et al., 2013), anti-inflammatory (Park et al., 2004), antidiabetic (Sesti, 2006; Bharti et al., 2013), antiparasitic (Jiang and Du, 2011), and antiulcer activities supporting its traditional uses (Gill and Bali, 2011).

Styrian oil pumpkin has become the object of study in many countries of the world. In general, research focuses on the morphological characteristics of characters on fruits and flowers, chemical composition, antioxidant activity (Brindza et al., 2011, 2014; Muntean et al., 2012; Oleárová et al., 2013), conservation of genetic resources (Mendel et al., 2019; Avagyan et al., 2020) and other possibilities of practical use. Pumpkin also produces a lot of pollen, which can be collected by bees in the form of bee pollens (Chlebo et al., 2017).

The experiment aimed to determine the production and variability of some morphological characters on fruits taken from selected individual plants within the ESO variety of oil pumpkin (*Cucurbita pepo* var. *styriaca*).

Material and methodology

Biological material

In the experiments, 165 fruits from randomly selected plants from the cultivated population of *Cucurbita pepo* var. *styriaca* on an area of 150 ha were evaluated. Fruits were taken in September and October 2020, and 2021 and analysed in the morphometric laboratory at the Institute of Plant and Environmental Sciences in Nitra (Slovak Republic).

Morphometrical analysis

The following characters were evaluated:

A total of 10 quantitative characters were evaluated in the fruits and 4 quantitative characters in the seeds:

a) fruits – 121 fruits were evaluated in 2020 year and 44 fruits in 2021:
   - fruit weight (g), fruit length (mm), fruit width (mm), exocarp thickness on the left side (mm), exocarp thickness on the right side (mm), pericarp thickness on the left side (mm), pericarp thickness on the right side (mm), placenta weight (g), fresh seed weight (g), seed weight after drying (g);

b) seeds – 30 seeds were evaluated from each plant (n = 30);
   - seed length (mm), seed diameter (mm), seed thickness, weight of one thousand seeds (g).

The weights were determined by digital scale (Kern ADB-A01S05, Germany; KERN DS – type D-72336, Kern and Sohn GmbH, Germany), accurate to 0.01 g. Fruits were measured by ruler and seeds were measured by a digital calliper (METRICA 111 – 012, Czech Republic) accurate to 0.02 mm.

Image analysis

a) Shape and colour of fruits.

b) Shape and colour of seeds.

Images were obtained using the stereomicroscope ZEISS SteREO Discovery.V20 (Microlmaging GmbH 37081 Göttingen, Germany), Fuji FinePix S 7000 and Panasonic DMC FZ50 digital cameras.

Statistical analysis

It was evaluated the variability of each character using descriptive statistics. For the characteristics, it was used the basic descriptors of variability: average, minimum measured value, maximum measured value, and the coefficient of variation (%). The degree of variability was determined by the coefficient of variation values. The given parameter is independent of the unit of the evaluated character. Theoretically, they can acquire different values (Stehlíková, 1998). We used analysis of variance (ANOVA) in the program STATISTICA 1.10 to determine the dependence between individual characters.

Results and discussion

Variability of fruit characters

The basic indicators of the variability of quantitative traits are presented in Table 1.

Weight of fruits and weight of placenta (g)

In the experimental year 2020, the weight of the fruit was determined in the range from 521.5 g to 8,698.3 g, and the value of the coefficient of variation indicated a high degree of variability between plants. In 2021, the tested plants reached values of the given trait from 1,031.1 g to 12,744.7 g, and the value of the coefficient of variation indicated a high degree of variability between plants (Table 1).

The weight of the placenta was determined from 20.70 g to 643.6 g, and finally, in 2021, the range of the trait was determined in the range from 89 g to 870 g. The value of the coefficient of variation indicates a high degree of variability between plants in both experimental years. Previously reported fruit mass ranged from 3.5 to 5.0 kg among *Cucurbita landraces* of northern KwaZulu-Natal (Ntuli et al., 2017).

Ruelas Hernándes et al. (2015) studied various *Cucurbita* spp. (*C. pepo*, *C. ficifolia*, *C. argyrosperma*, *C. moschata*). *C. pepo* had the lowest values in weight (0.54–0.8 ±0.22 kg) and width characteristics of fruit, stems and fewer seeds per fruit and with lower values than the other accessions and species. Balkaya et al. (2010) obtained the average weight of fruit *C. maxima* Duch in the interval 3.2–11.8 kg (7.4 ±0.2). Abd El-Hamed (2015) reported three *C. pepo* genotypes and observed fruit weight in the interval 63–242 g with middle and high degree correlation coefficients (14.08–21.4%).

Length and diameter of fruit (mm)

In 2020, the average value of the length of fruit was determined in the range from 85 mm to 246 mm. The value of the coefficient of variation (19.67%) indicates a medium degree of variability. In the experimental year 2021, the plants reached values ranging from 119 mm to 285 mm, and the value of the coefficient of variation indicates a high degree of variability (Table 1).

In 2020, we set the width of the fruit from 114 mm to 3,200 mm and determined a high degree of variability. In the experimental year 2021, the character value was

Table 1 Main statistical indicators of the variability of evaluated fruit traits in the experimental population of *Cucurbita pepo* var. *styriaca*

Traits	Year	min	max	x̄	V%
Weight of fruit (g)	2020	521.50	8698.30	3353.63	55.92
	2021	1031.1	12744.70	4513.32	49.40
Length of fruit (mm)	2020	85.00	246.00	157.07	19.67
	2021	119.00	285.00	181.87	20.11
Width of fruit (mm)	2020	114.00	320.00	204.11	22.43
	2021	135.00	305.00	229.73	18.32
Thickness of exocarp – right side (mm)	2020	0.33	4.56	1.35	51.15
	2021	0.52	2.38	1.30	34.84
Thickness of exocarp – left side (mm)	2020	0.10	4.86	1.16	58.39
	2021	0.58	3.98	1.33	43.47
Thickness of pericarp – right side (mm)	2020	9.77	46.05	26.51	32.77
	2021	13.12	45.85	28.53	29.45
Thickness of pericarp – left side (mm)	2020	9.13	48.41	26.34	32.86
	2021	15.33	57.02	30.42	27.72
Weight of placenta (g)	2020	20.70	643.60	214.45	58.13
	2021	89.00	870.00	340.60	43.11
Weight of fresh seeds (g)	2020	17.30	638.50	134.61	56.57
	2021	67.20	270.00	148.21	38.41
Weight of dried seeds (g)	2020	4.53	187.36	72.02	49.85
	2021	11.57	159.35	67.78	52.31

Note: n – the number of measurements; min, max – minimal and maximal measured values; x̄ – arithmetic mean; V – coefficient of variation (%)

determined in the range from 135 mm to 305 mm with a medium degree of variability.

The ranges for fruit length (27.4–38.6 cm) and fruit diameter (51.8–68.5 cm) were observed among the *Cucurbita landraces* in the previous study (Ntuli et al., 2017). Ruelas Hernándes et al. (2015) reported the width of *C. pepo* in the interval 9.63–9.97 cm. For comparison values from other *Cucurbita* spp. Balkaya et al. (2010) studied *C. maxima* collected from the Black Sea Region of Turkey and determined fruit length and fruit diameter in the interval 26.0–49.8 and 35.1–56.5 cm, respectively. The variation in the fruit length and fruit diameter may be attributed to genetic differences existing among the landraces. Aruah et al. (2010) and Balkaya et al. (2010) reported that *Cucurbita* plants produce fruits of various sizes as detected by the genetic constitution. Abd El-Hamed (2015) observed in *C. pepo* genotypes fruit length in the interval 7–16 cm with small and middle correlation coefficients (7.00–18.24%).

Thickness of exocarp and thickness of pericarp (mm)

The thickness of the exocarp was determined in the first experimental year from 0.10 mm to 4.86 mm and the next year 2021 in the range from 0.52 to 3.98 mm. In general, a high value of the coefficient of variation in this trait was determined in both years.

In 2020, thickness of pericarp was in the range of 9.13 mm to 48.41 mm and 2021 in the range from 13.12 mm to 57.02 mm was recorded for the evaluated trait. High variability prevailed in both evaluated traits.

We recorded a relatively large variability in the shape and colour of fruits of 165 evaluated pumpkins *Cucurbita pepo* var. *styriaca* (Figure 1).

Variability of traits on seeds

At the seed level, a total of four quantitative characters such as the length, width and thickness of the seed and the weight of one thousand seeds were evaluated. Statistical indicators of the variability of the evaluated quantitative traits are presented in Table 2.

Weight of fresh and dried seeds (g)

From the experimental data, the weight of fresh seeds was determined in 2020 in the range from 17.3 g to 638.5 g with a high value of the coefficient of variation (56.57%), which indicates a high degree of variability. In 2021, the values of the given character were reached in the range from 67.2 g to 270 g, and a high value of the coefficient of variation was determined (Table 2).

In the first year, the values of the weight of the seeds after drying were determined in the range from 4.53 g to 187.36 g. The coefficient of variation indicates a very high degree of variability, and thus significant differences between plants. In the second year, the values of the weight of the seeds after drying were determined in the range from 11.57 g to 159.35 g.

The weight ratio of individual parts of the fruit was also evaluated during the years 2020 and 2021 (Figure 2). From the obtained experimental data, the ratio of the basic anatomical parts of the fruit was determined, represented by 89–90% pericarp, 6–8% placenta, and 3% to 4% is the most economically used part of the fruit – seeds.

Table 2 Main statistical indicators of character variability on seeds *Cucurbita pepo* var. *styriaca*

Traits	Year	min	max	$\bar{x}$	V%
Width of seeds (mm)	2020	6.56	14.41	9.23	12.54
	2021	7.24	11.45	9.29	10.42
Length of seeds (mm)	2020	12.91	24.00	17.46	9.76
	2021	14.22	20.53	17.48	9.15
Thickness of seeds (mm)	2020	0.41	3.19	2.22	21.47
	2021	1.43	3.62	2.40	20.03
Weight of thousand seeds (g)	2020	15.41	475.66	191.54	39.32
	2021	21.87	471.44	192.37	42.42

Note: n – the number of measurements; min, max – minimal and maximal measured values; $\bar{x}$ – arithmetic mean; V – coefficient of variation (%)

Figure 1 Variability in the shape and colour of fruits of evaluated pumpkins *Cucurbita pepo* var. *styriaca*

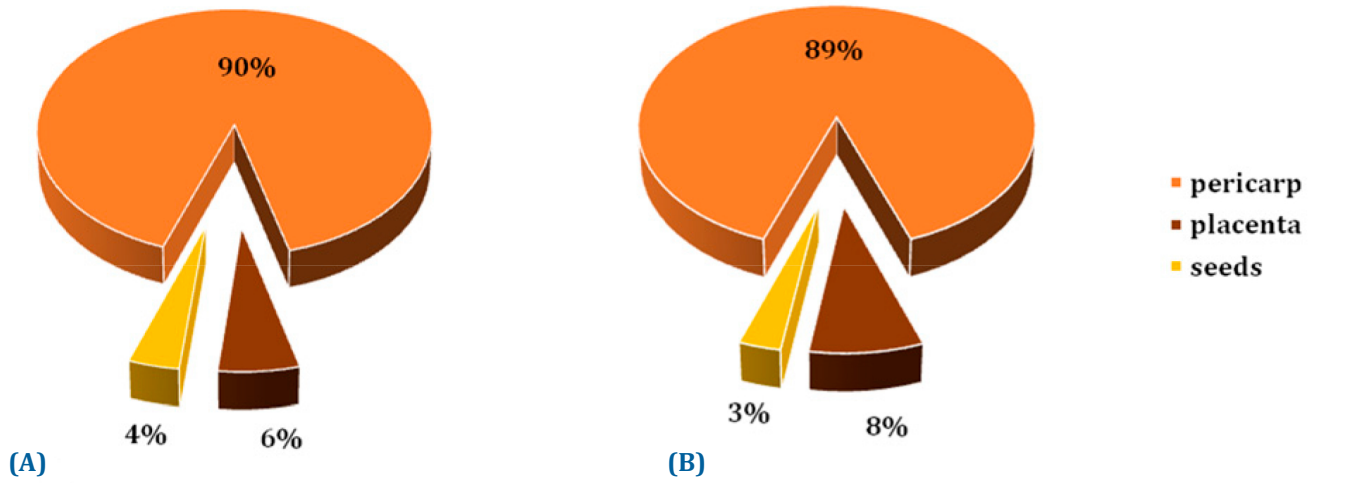

Figure 2 The average weight ratio of the individual basic anatomical parts of the fruits of *Cucurbita pepo* var. *styriaca* from the total average weight of the fresh fruit (A) 2020 and B (2021) (%)

Width and length of seed (mm)

In the first year, the range of seed width was determined from 6.56 to 14.41 mm with a medium degree of variability. In the second experimental year, the value of the trait was determined in the range from 7.24 to 11.45 mm with a medium degree of variability.

Experimental evaluation of another quantitative trait, seed length, in 2020 determined a range from 12.91 to 24.00 mm. And in the next year 2021, the trait was determined in the range from 14.22 to 20.53 mm. In general, a low value of the coefficient of variation was determined in both years (Table 2).

In the previous study by Ruelas Hernándes et al. (2015) length of seed was reported in the interval 12.8–17.4 ±0.59 mm and the width of seed in the interval 9.63–9.97 ±0.76 mm. Abd El-Hamed (2015) determined *C. maxima* seed length and width in the interval 12.68–14.67 mm and 6.66–9.37 mm, respectively with low correlation coefficients (3.15–4.46 and 5.81–7.09%). Paris and Nerson (2003) studied seed samples of 174 accessions of pumpkins, squash as gourds of *Cucurbita pepo* and measured mean seed length ranged from 8.8 to 23.3 mm, mean seed width from 5.0 to 12.5 mm and mean seed thickness from 1.2 to 3.8 mm.

Thickness of seed (mm)

In the first year, the values were determined in the range from 0.41 to 3.19 mm and in the second year in the range from 1.43 to 3.62 mm. High variability prevailed in the evaluated character.

Ruelas Hernándes et al. (2015) observed and measured the thickness of *C. pepo* in the range of 2.43–2.67 ±0.25 mm. Abd El-Hamed (2015) determined *C. maxima* seed thickness ranged from 1.70–3.0 mm with low and middle correlation coefficients (9.80–12.55%).

Weight of one thousand seeds (g)

In the last evaluated character, the weight of one thousand seeds in the range from 15.41 to 475.66 g was recorded in the experimental set in the first year. The coefficient of variation indicates a very high degree of variability and thus significant differences between plants. In the second year, the values of the trait were determined in the range from 21.87 to 471.44 g. A high degree of variability was determined.

Ruelas Hernándes et al. (2015) determined 148–177 ±86 pcs of seeds per fruit and weight of 100 seeds in the range 8.65–13.49 ±6.16 g. The mass of the total fully developed seeds per fruit varied from 48.3 to 70.2 g among *Cucurbita landraces* in northern KwaZulu-Natal and the weight of a 100 seeds of *C. pepo* was in the interval 10.7 ±0.9 – 14.7 ±1.0 g (Ntuli et al., 2017). Abd El-Hamed (2015) determined in *C. maxima* 100 seed weight in the range of 7.89–14.30 g with the law and middle correlation coefficients (8.91–16.46%).

The shape of seeds and colour of seeds are also variable within *Cucurbita pepo* var. *styriaca* plants (Figure 3).

Phenotypic correlation (r) and significance level between fruit morphological traits in *Cucurbita pepo* var. *styriaca* L. evaluated plants are reported in Table 3.

Fruit weight was highly correlated with fruit length (r = 0.966) and fruit width (r = 0.983), and also positively correlated with thickness of exocarp (r = 0.919, r = 0.933) on both sides. Weight of dried

Figure 3 Variability in the shape and colour of seeds of evaluated plants of *Cucurbita pepo* var. *styriaca*

Table 3 Phenotypic correlation and significance level between fruit morphological traits in *Cucurbita pepo* var. *styriaca* L. evaluated plants

Parameters	WF	LF	WF	T TER	TEL	TPR	TPL	WP	WFS	WDS	WS	LS	TS
LF	0.966**	1											
WF	0.983**	0.949**	1										
TER	0.721	0.691*	0.705*	1									
TEL	0.675*	0.634*	0.609*	0.831**	1								
TPR	0.919**	0.947**	0.913**	0.739*	0.593	1							
TPL	0.933**	0.966**	0.925**	0.632*	0.554	0.983**	1						
WP	-0.053	-0.227	-0.101	-0.388	-0.315	-0.179	-0.132	1					
WFS	0.853**	0.797*	0.855**	0.684*	0.489	0.689*	0.676*	-0.075	1				
WDS	0.635*	0.479	0.634*	0.807*	0.720*	0.442	0.368	-0.040	0.754*	1			
WS	0.867**	0.885**	0.879**	0.883**	0.760*	0.932**	0.885**	-0.405	0.667	0.601	1		
LS	0.820**	0.780*	0.907**	0.665*	0.444	0.761*	0.748*	-0.249	0.817*	0.656	0.808*	1	
TS	0.632*	0.530	0.601*	0.789*	0.878**	0.417	0.376	-0.251	0.677*	0.916**	0.619	0.560	1
WST	0.692*	0.606*	0.682*	0.926**	0.867**	0.569	0.489	-0.319	0.729*	0.942**	0.764*	0.677*	0.954**

Notes: WF – weight of fruit; LF – length of fruit; WF – width of fruit; TER – thickness of exocarp right side; TEL – thickness of exocarp left side; TPR – thickness of placenta right side; TPL – thickness of placenta left side; WP – weight of placenta; WFS – weight of fresh seeds; WDS – weight of dried seeds; WS – width of seeds; LS – length of seeds; TS – thickness of seeds; WST – weight of 1000 seeds. **Correlation is significant at p ≤0.01; *correlation is significant at p ≤0.05

seeds was highly correlated with thickness of seeds (r = 0.916). Weight of fresh seeds was non-significantly correlated but with high (r) values with width of seed (r = 0.667), length of seed (r = 0.877) and thickness of seed (r = 0.677). Placenta weight has shown the only negative correlation and non-significant relation with length of fruit (r = -0.227), width of fruit (r = -0.101), thickness of exocarp (r = -0.388, r = -315), thickness of placenta (r = -0.179; r = -0.132) and weight of seeds (r = -0.405).

Conclusions

It is generally known that various types of pumpkins are used in all countries of the world, primarily for the preparation of various simple dishes and various other food products. Of the fruits of pumpkins, pulp and seeds are used the most. Because pumpkins are grown without problems, they are mainly used by poorer groups of the population. That's why pumpkins were given the epithet that they are the "Bread of the Poor". The object of the work was the Styrian pumpkin, which produces valuable and economically important naked seeds. The seeds are the main raw material to produce high-quality oil with high nutritional value. Therefore, *Cucurbita pepo* var. *styriaca* growers usually use only the seeds from the pumpkin fruits, and the pulp and other parts of the fruits remain in the field after harvesting and are then ploughed into the soil. It follows from our results achieved in the experiment that the percentage of the weight of fresh seeds is only 3–4% of the total weight of *Cucurbita pepo* var. *styriaca* fruits. This means that the seed yield is from 300 to 1000 kg from one hectare. While the total harvest of *Cucurbita pepo* var. *styriaca* fruits reaches from 40 to 100 tons per hectare. This means that 95% of the produced biomass remains unused in the field every year. At the same time, results from many literary sources prove that all other parts of unused fruits are very valuable resources for use in the food industry, pharmaceuticals, cosmetics as well as feeding farm animals. The results of our study also unequivocally prove that, although the fruits of the *Cucurbita pepo* var. *styriaca* are not balanced in the evaluated morphological characters and are characterized by a high degree of variability (9.15–58.39%), they are practically usable.

Ethical statements

This article does not contain any studies that would require an ethical statement.

Conflict of interest

None declared.

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