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SURVEY ON CONSUMERS PREFERENCE IN THE NEW ACCLIMATIZED SPECIE IN ROMANIA: *BENINCASA HISPIDA*

Ovidia Loredana AGAPIE, Costel VÎNĂTORU, Elena BARCANU, Bianca Elena TĂNASE, Ion GHERASE, Georgiana DOBRE

Vegetable Research and Development Station Buzău, 23 Mesteacănului Street, Zip code 120024, Buzău, Romania

Corresponding author email: dobre.ovidia@yahoo.com

Abstract

In the climate change scenario, growing adequate food is a major challenge for food security. To provide food to the population, introduction of new vegetable crops and extending newer assortments are important tasks of breeding programs. One of the recently acclimatized species in Romania by VRDS Buzau is Benincasa hispida, a multi-purpose and nutritious vegetable. In this study, a consumers preference survey was conducted to inform local smallholder farmers, traders and other stakeholders on opportunities for expanding production and commercialization of Benincasa hispida. Three genotypes of wax guard, G1, G2, G3 were taken into study. Data was collected from 57 participants aged between 16 and over 45 years from urban and rural areas. Results indicated that 43 participants were interested to eat the fruit due to its nutritional properties. Consumers are also interested in growing winter melon because this crop is easy to grow. Of the three genotypes tasted, G1 was preferred by participants, followed by G3 and G2. G1 variety was registered in the Official Catalogue of Romanian Crop Plants, under the name of Zefir.

Key words*: breeding, climate change, winter melon.*

INTRODUCTION

In last years, the agriculture sector has been under growing pressure to produce sufficient food, biofuel and feed on insufficient land for the planet's predicted 9 billion people by 2050 (Dhaliwal et al., 2020). At the same time, climate change affects agriculture and food production in complex ways. (Schmidhuber and Tubiello, 2007). So, in the developing world, climate change is a significant driver of change for food security, because it threatens food production and its stability as well as other aspects of food systems such as food access, storage, and utilization (Vervoort et al., 2014. In the climate change scenario, growing adequate food is a major challenge for food security (Dhaliwal et al., 2020).

To provide food to the population, introduction of new vegetable crops and extending newer assortments are important tasks of breeding programs (Dahlia et al., 2012). The Vegetable Research Development Station (VRDS) Buzău is an important research centre for acclimation and breeding vegetable species in Romania (Vînătoru et al., 2021). One of the recently acclimatized species by VRDS Buzau is *Benincasa hispida*, a multi-purpose and nutritious vegetable (Nimbal et al., 2011; Zaini et al., 2011; Vînătoru et al., 2021). It provides a good source for natural sugars, organic acids, aminoacids, vitamins and mineral elements (Zaini et al., 2011).

The fruit of *Benincasa hispida* (Thunb.) Cogn., commonly called as ash gourd, wax gourd, white gourd, winter melon, fuzzy melon, hairy melon (Doharey et al., 2021), belongs to the Cucurbitaceae family. This is employed as a main ingredient in kusmanda lehyam, a product which is used in numerous nervous disorders in the Ayurvedic medicine (Sabale et al., 2011).

A number of medicinal properties such as anti-diarrheal (Bhyrapur et al., 2005), anti-obesity (Kumar and Vimalavathini, 2004), anti-inflamatory (Shetty et al., 2008: Park et al., 2009; Gill et al., 2010), anti-ulcer (Grover et al., 2001; Rachchh and Jain, 2008: Rachchh, 2011), anti-compulsive (Girdhar et al., 2010), anti-histaminic, anti-ageing (Sabale et al., 2011), antioxidant and diuretic (Jayasree et al., 2011; Mandana, 2012; Samad et al., 2013) have been ascribed to winter melon pulp. Also, it prove to have beneficial effects in allergic inflammation, epilepsy and insanity (Bhalodia

et al., 2009), preventive and curative effects in nervous disorder, diabetic, leucorrhoea (Lee et al. 2005), intestinal worms, jaundice, stomach and bile problems, potential uses as, laxative, aphrodisiac, diuretic, clearing heat and detoxificant, used for Alzheimer disease treatment (Roy et al., 2008), facial eruption, inhibition of angiotensin converting enzyme (ACE) (Huang et al., 2004) and nootropic effects (Zaini et al., 2011.

Usually, deep pharmacological activities are performed on the entire wax gourd plant, including flower, leaves, fruit peel, and seed (Huang et al., 2004; Doharey et al., 2021).

Sreenivas et al., 2011 showed that winter melon peel is a good source of edible wax having a potential application in shelf life improvement of fruits. After wax extraction, these defatted peels can be utilized for adsorption of Cr (VI) from water (Sreenivas et al., 2014).

Benincasa hispida is a particularly valuable species in term of its use as a rootstock. The specie is compatible with most cucumber and melon cultivars. At the same time, the plant has genetic resistance to specific soil pests and insects (Vînătoru et al., 2019).

The aim of this study was to acknowledged the consumer preference about the wax gourd fruit benefits and to inform local smallholder farmers, traders or other stakeholders on opportunities for expanding production and commercialization of *Benincasa hispida*.

MATERIALS AND METHODS

The Breeding and Biodiversity Laboratory from Vegetable Research Development Station Buzău has taken into study this species after year 1996. The research began with purchase of genetic material from various area of origin, followed by acclimatization of the species. After year 2005, valuable genotypes have been subject to intensive breeding work and the research completed so far with obtaining of three genotypes noted G1, G2 and G3 (Figure 1).

These three genotypes of wax guard, with distinct phenotypic expressiveness, especially in terms of fruit shape and size, were taken into study.

The breeding method used was repeated individual selection. The seedlings were produced in alveolar pallets with 70 cubes with a volume of 50 cm^3 in a mixture a peat and sand. After 60 days, the seedlings were planted in the greenhouse. The planting scheme used was 70 cm between plants and 300 cm between rows. The special care works were the one specific to Cucurbitaceae species. The plants were vertically support. A particular attention has been paid to isolation distance between genotypes in order to prevent their impurity, knowing that the species is allogamous and preferred by the insect.

Figure 1. Crop detail of G2 (left) and G3 (right) genotypes

The fruits were harvested at physiological maturity and were analysed by our colleagues from Department of Chemistry, Physics and Environment, "Dunărea de Jos" University of Galati. The biochemical results (Busuioc et al., 2020) have shown that *B. hispida* fruit has a high content in vitamin C and is rich in gallic acids which are linked with its ability to reduce Type II diabetes.

Our survey included 20 questions, in the first part was described the demographic profile of the respondents, followed by the main characteristics of the fruits and a comparison between them. The last section focused on the nutritional and medicinal properties and on the price of fruit.

The tasting panel was formed by 57 respondents with ages from 18 to over 45 years old, both males and females, from rural and urban area. The resulted data were analysed with descriptive statistic methods.

RESULTS AND DISCUSSIONS

Benincasa hispida is a monoecious vine and is easy to grow in the greenhouse condition.

Mature fruits of *Benincasa hispida* are covered with a waxy coat which allows them long-term storage. One of the unique characteristics of winter melon, if there is no injury to the fruits, in that it can be stored for many months, in dry and cool atmospheres (Vînătoru et al., 2019).
The fruits of the three genotypes of wax guard, G1, G2 and G3 (Figure 2), were harvested at technological maturity and were share within our respondents.

Figure 2. Mature fruit of G1 (left), G2 (middle) and G3 (right) genotypes

For a better understanding of respondents opinion and preferences on the Table 1 is presented their socio-demographic profile. The interviewed respondents were from 18 to more than 45 years old. From our study, 47.4% were women and 52.6% men. In 50.8% of the cases people were from the urban area and 49.2% of them from the rural area. Mainly are people with college (38.6%) and high school (35.1%) studies.
Sensorial analyses were organized in September 2021 for the three genotypes and the results are presented in the Table 2 for each criterion: fruit smell, taste and texture.
So, 54.38% consumers think that winter melon has a cucumber-like smell, while others (24.56%) assimilate the smell to squash or watermelon (14.05%) and for 7.01% the smell remind of fresh cut grass. The fruit taste was sweet-sour for 26.7% consumers, while others found it neutral (39.2%), aromatic (10.5%) or sour (13.72). Concern to fruit taste, 9.8% participants found taste bitter or easy spicy.

Table 1. The socio-demographic profile of respondents

Variable	Consumers	
	No.	%
Sex		
- Men	30	52.6
- Women	27	47.4
Area		
- Urban	29	50.8
- Rural	28	49.2
Age		
- 18-24	21	36.8
- 25-35	9	15.8
- 35-45	6	10.6
- Over 45	21	36.8
Studies		
- Elementary school	15	26.3
- High school	20	35.1
- College	22	38.6

The fruit texture was meaty (40.3%) crispy (26.6%) and fleshy 19.2%. The fruit texture was watery or spongy for 7.6% respondents. The fruit taste reminds of cucumber to 48.07% of respondents while others assimilate with squash (24%) or watermelon (20%). For 7.9% consumers, the fruit taste reminds of Galia watermelon.

Table 2. Sensorial analyses of the fruits

Variable	Consumers					
	G1		G2		G3	
	No	%	No	%	No	%
Fruit smell						
- Squash	8	14	8	14	12	21.5
- Cucumber	40	70.2	37	65	21	36.8
- Watermelon	8	14	12	21	21	36.8
- Other	1	1.8			3	5.3
Fruit taste						
- Aromatic					4	7.1
- Sweet-sour	45	78.9	32	56.1	4	7.1
- Sour	8	14	4	7.1	8	14
- Neutral	4	7.1	31	36.8	32	56.1
- Other					9	15.7
Fruit texture						
- Crispy	4	7.1	8	14	4	7.1
- Fleshy	20	35.7	13	22.8	17	29.7
- Meaty	25	43.7	32	56.1	32	56.1
- Other	8	14	4	7.1	4	7.1
What does the fruit taste remind you of?						
- Watermelon	13	22.8	4	7.1	13	22.8
- Squash	9	15.8	17	29.7	17	29.7
- Cucumber	35	61.4	35	61.4	20	47.5
- Other			1	1.8		

Fruit mass was different for each genotype. The value ranges from 2.39 kg to 4.39 kg for G1, from 8.21 kg to 9.33 kg for G2 and between 12-16.84 kg for G3 variety (Figure 2) (Vînătoru și col., 2021).

Considering this aspect, 38.59% of people are tempted to buy G1 variety, 24.57% are tempted to buy G2 variety and 22.8 % G3 variety, while 14.03% would not be willing to buy any variety.

Regarding the commercial aspect of the fruit, wax guard was tempted to buy for 22.8% of respondents, while for 36.6% participants were in between 15.9% of respondents people were not interested in buying the fruit and 24.5% where barely inclined to purchase the fruit. However, 75.5% of participants would be tempted to buy winter melon due to its nutritional and medicinal proprieties.

Table 3. Potential utilization of *B. hispida* fruit

Variable	Consumers	
	No.	%
Do you find the fruit easy to consume?		
- No	14	24.6
- Yes	43	75.4
If you knew that kiwano has a lot of vitamins, and other medicinal properties, will you consume it daily?	23	40.3
- No	34	59.7
- Yes		
If you knew that winter squash has a lot of nutritional proprieties, will consume it daily?		
- No	26	45.6
- Yes	31	54.4
Will you recommend the fruit to other people?		
- No	13	22.8
- Yes	44	77.2
Which one of the variants did you like most?		
- G1	24	42.1
- G2	13	22.8
- G3	20	35.1
Winter melon is an easy crop to grow. Would you cultivate it?		
- No	20	35.1
- Yes	37	64.9

After a short presentation of the winter melon fruit benefits, we discussed about the introduction of winter melon fruit in the daily diet of consumers for its nutritional and medicinal proprieties. Also, we had questions about how easy is to consume *B. hispida* fruit and if they will recommend it to other people (Table 3). In this case, 75.4% of respondents find the fruit easy to consume while 77.2% of consumers will recommend it to other people.

Winter melon is an easy crop to maintain and during vegetation period, no serious insects or disease problems were recorded, as a result, 64.9% respondents would like to grow it.

After the sensorial analyses, G1 variety was the most preferred by consumers (42.1%), followed by G3 (35.1) and G2 (22.8%) cultivar. G1 variety was registered in the Official Catalogue of Romanian Crop Plants, under the name of Zefir (Figure 3).

Figure 3. Crop details of Zefir

In the near future, genotypes G2 and G3 will be proposed for registration. The Vegetable Research Development Station Buzau has promoted the species with its health benefits and the demand for seeds and seedlings had increased significantly from year to year among growers and also the consumers demand (Vînătoru et al., 2021).

In the last part of our survey, it was an open-ended question about how much money are the consumer able to spend per kilogram. The mean results of the respondents were about 50 cent/fruit kg.

As yet, in Romanian fruit of wax gourd has not been sold in specialized stores, even if in the survey made by Dobre and Toma (2013), regarding the perception of *Benincasa* fruit it

was shown that with a proper promotion the vegetable can be introduced in Romanian consumer's behaviour.

CONCLUSIONS

From our research it can be concluded that *Benincasa hispida* has commercial potential due to its nutritional and medicinal properties.
After the sensorial analyses, Zefir was the most preferred by consumers followed by G3 and G2 cultivar. In the near future, genotypes G2 and G3 will be proposed for registration.
We recommend winter melon crop to be grown also in organic farming.

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