International Journal of Plant & Soil Science

32(5): 36-42, 2020; Article no.IJPSS.56413
ISSN: 2320-7035

Comparison of Pomological and Chemical Properties of Autochthonous Pear Varieties with Standard Pear Varieties

Besim Salkić[1*], Ramzija Cvrk[2], Emir Imširović[1], Ahmed Salkić[3] and Ensar Salkić[1]

[1]Department of Agronomy, Faculty of Technology, University of Tuzla, Bosnia and Herzegovina.
[2]Department of Food Technology, Faculty of Technology, University of Tuzla, Bosnia and Herzegovina.
[3]Voćni Rasadnik d.o.o. Srebrenik, Bosnia and Herzegovina.

Authors' contributions

This work was carried out in collaboration among all authors. Author BS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors RC and EI managed the analyses of the study. Authors AS and ES managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2020/v32i530280
Editor(s):
(1) Davide Neri, Polytechnic University of Marche, Italy.
Reviewers:
(1) Kamila Łucja Bokszczanin, Warsaw University of Life Sciences, Poland.
(2) Omaima Mohamed Hafez, National Research Centre, Egypt.
Complete Peer review History: http://www.sdiarticle4.com/review-history/56413

Original Research Article

Received 24 February 2020
Accepted 29 April 2020
Published 26 May 2020

ABSTRACT

Indigenous fruit varieties are the wealth and natural resource of every country. Their importance is reflected, in addition to economic and biological, through the growing consumer interest in consuming fruits produced without the use of chemicals. Proper and accurate identification and preservation of valuable assortment has resulted in studies of the physicochemical and pomological properties of the fruits of ten pear varieties and their comparison with standard varieties. The usable value of pear fruits is multiple. It is used for liqueurs, vinegar, fruit salads, jams, jam, as dried fruit. The aim of the study is to determine the pomological and chemical properties of indigenous pear varieties and their comparison with standard pear varieties grown in northern Bosnia. The size of the fruit was quite different in the tested varieties and ranged from very small to extremely large fruits with the content of total acids slightly lower than the standard varieties. The

**Corresponding author: E-mail: besim.salkic@untz.ba;*

research was supported by the Federal Ministry of Education and Science as part of a scientific research project entitled "Investigation of phenological and pomological characteristics of indigenous pear varieties in north-eastern Bosnia".

Keywords: Autochthonous varieties pears; phenological and pompological characteristics.

1. INTRODUCTION

Pear as a fruit species shows a high degree of tolerance from the point of view of adaptation to different agro ecological conditions. It is widespread in temperate regions of Asia, Africa and Europe except the far north. It grows in hilly areas of deciduous forests, up to 1500 m above sea level.

The richness of the pear gene pool, its importance and value, can be emphasized by the fact that in the territory of Bosnia and Herzegovina today, about 20,000 pear seedlings per year have been grafted and sold.

This seedlings are spontaneously outspread and have received the status of autochthonous varieties. Although till today this question has not been scientifically addressed and confirmed whether it really is a genetic material that can be identified as a variety or a population of genotypes under a common name or the same genotypes which were given different local names [1].

It should be noted that pear production faces a number of problems related to the occurrence of pathogens and pests that greatly compromise pear fertility [2].

Traditional cultivars in Bosnia and Herzegovina are a valuable source of desirable genetic characteristics including important pomological, nutritional and technological characteristics of the fruit [3].

Fruit quality is an important feature in choosing starting material in the selection and breeding process [4].

Fruit characteristics such as pH, soluble solids content in the fruit juice (SSC) and firmness are important indicators of quality of the pear fruit [5] but also decisive factors from the consumer's point of view [6].

A large number of indigenous pear varieties are of local importance. It is evident that the same varieties in different localities come under different names (synonyms) or different varieties come under the same name (homonyms), so it is important to determine the fruits on a scientific basis. Indigenous fruit varieties represent significant plant genetic resources that will be particularly significant in the future. The BiH area has been exposed to different impacts over time. The first written data on fruit growing came from the Ottoman Empire [7], but the first official data came from the Austro-Hungarian Empire [8]. Over time, significant fruit collections have been created, both native and introduced from the West and the East. Often the same variety is called with many different names, in different local conditions.

During the Ottoman rule, native and Asian varieties of noble pear were widespread in our region. The Asia Minor varieties are: Akcha (Istanbul armudu), Karamanka or Buzdohanlija, Jeribasma, Bergamot (pear from Bergamo, Asia Minor), Karamut or to be exact - Kara Armudu (black pear), Malatija from Malatia, Asia Minor and some others. There are probably mutants of these varieties that originated in our country.According to Bubić [9], the quality of our domestic pear varieties is much inferior to that of the noble western European varieties. Of the large number of domestic pear varieties, only three can be compared to Western European species, with the quality of the pulp and the size of the fruit, with lesser quality. These are first and foremost Jeribasma, followed by Karamanka and Ilinjača (if this is really a native variety). Bubić also points out: "The native varieties also have their advantages: much better adaptation to worse climatic and soil conditions, high productivity, longevity and, in many, high sugar content, and therefore good nutritional value.Old pear varieties, although not of great commercial value, do make a contribution and importance to the biodiversity of the rural area [10]. Recent scientific studies of old apple varieties indicate that they contain significantly more polyphenols than commercial varieties [11].

2. MATERIALS AND METHODS

Ten varieties of pear were included in the research: Ahmetova, Crna izmirka, Debelkora, Hambarka, Jeribasma, Kaličanka, Karamut, Ljeskovača, Takiša and Zimnjača.

Pomological studies were processed on the basis of European Cooperative Programme for Plant Genetic Resources (ECP / GR) descriptors for the *Pyrus* genus through the following characteristics: Fruit ripening time (technological maturity), fruit size, general fruit shape, general fruit taste, fruity tenderness, natural tree appearance, petiole indentation.

The fruits were harvested and delivered, as some varieties matured, at the Food Technology Laboratory of the Faculty of Technology in Tuzla. The samples to be analyzed represented the average fruit composition of a particular variety, and the result was expressed as the mean of the three samples.

The method for determining the pH value is based on measuring the potential difference between two electrodes immersed in the test liquid, by directly immersing the value with an accuracy of 0.03 by immersing the electrode in a homogenized sample on the instrument [12]. In this work, the pH meter Mettler-Toledo was used to determine the pH value.

An indicator color change method was used to determine the total acidity, which is based on titration with sodium hydroxide solution in the presence of phenolphthalein indicator [13].

Total acidity is expressed in mill moles of monobasic acid per 100 ml of product and as a percentage of malic acid.

Titratable acidity (TA) was determined by titrating 50 ml of 1:5 diluted pear pulp with 0,1mol L-1 NaOH. Three titration analyses per sample were performed. Titratable acidity was expresed in percentage of malic acid. The soluble solid content/titrable acidity ratio (SSC/TA ratio) was used as an indicator of taste quality [14]. Total acidity is expressed as a percentage.

3. RESULTS AND DISCUSSION

The ripening time of the indigenous pear varieties tested, up to consumption maturity (Graph 1), ranged from summer varieties (Ahmetova, CrnaIzmirka and Hambarka) to winter varieties such as Debelkora, Takiša and Zimnjača. The test did not cover early pear varieties.

Fruit size of tested pear varieties (Graph 2.) is different and size of fruit goes from really small (Takiša) to really big (Zimnjačai CrnaIzmirka).

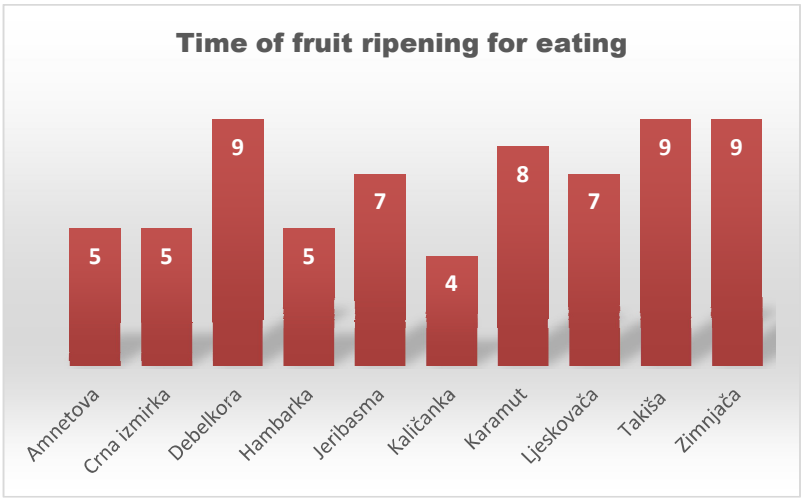
The overall taste of the fruit of the tested varieties of pears (Graph 3.) showed a slightly acidic taste (Crnaizmirka, Hambarka, Jeribasma, and Kaličanka) (4 and 5) to sweet (6 and 7). Most of the pear varieties tested did not show bitter taste except Debelkora which had bitter taste.

The habitus of the tested varieties (Graph 4) was generally expanded only Jeribasma exhibited the appearance of branch bending.

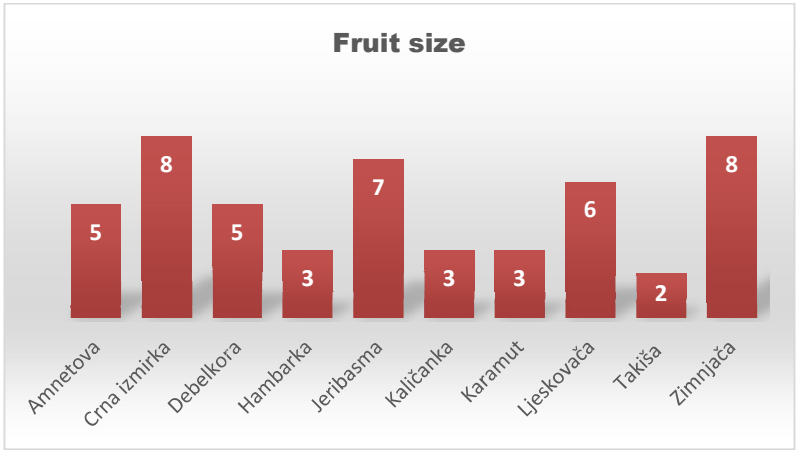
The taste of the fruit in general is to a large extent influenced by the content of the fruit acids (total acidity) and the sugar content, and soluble dry matter. For the tested pear varieties, values of total acidity (Table 1) were obtained from 0.10% (Takiša), 0.18% (Ahmetova), up to 0.27 (Crnaizmirka), and 0.28 (Ljeskovača).

Table 1. Minimum descriptors specific to Pyrus

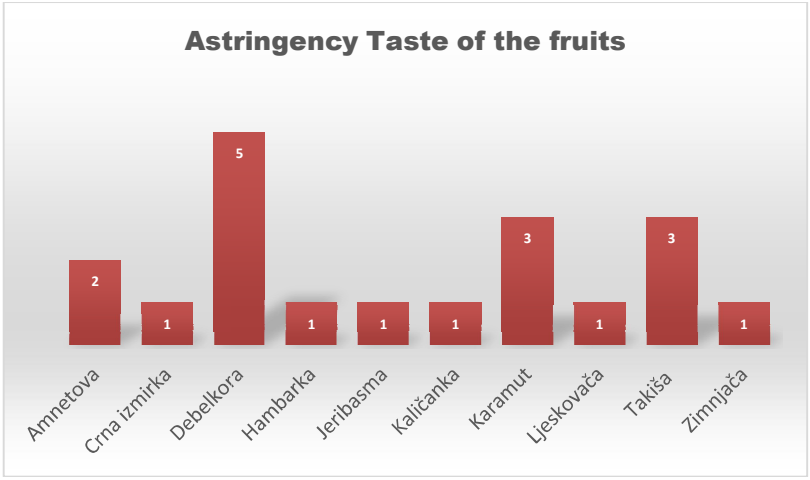
Variety	Time of fruit ripening for eating (harvest maturity)	Fruit size	Global fruit shape	Global taste of flesh	Astringency Taste of the fruits	Natural habit of an untrained tree	Fruit cavity of stalk
Ahmetova	5	5	3,3	6	2	5	4
Crna izmirka	5	8	1,3	6	1	5	4
Debelkora	9	5	1,5	4	5	3	5
Hambarka	5	3	1,4	7	1	5	3
Jeribasma	7	7	3,3	7	1	7	5
Kaličanka	4	3	1,3	7	1	4	6
Karamut	8	3	1,6	6	3	5	3
Ljeskovača	7	6	1,6	6	1	5	6
Takiša	9	2	1,5	4	3	4	5
Zimnjača	9	8	1,3	5	1	4	7



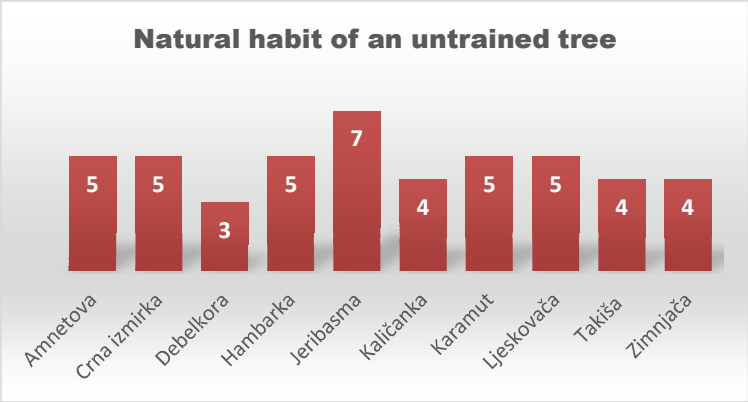
Graph 1. Time of fruit ripening for eating



Graph 2. Fruit size



Graph 3. AstringencyTaste of the fruits



Graph 4. Natural habit of an untrained tree

Table 2. The pH values and total acidity

Variety	pH value	Totalacidity(%)
Ahmetova	4,09	0,18
Crnaizmirka	4,04	0,27
Debelkora	4,90	0,21
Hambarka	4,88	0,24
Jeribasma	4,15	0,14
Kaličanka	4,60	0,25
Karamut	4,08	0,22
Ljeskovača	3,57	0,28
Takiša	5,71	0,10
Zimnjača	4,12	0,24

Considering the values of total acidity of the examined varieties of autochthonous pears, it can be observed that the lowest acidity values are those of Takisha (0,1), Jeribasma (0,14) and Ahmetova (0,18), and can be considered as low acidity, these three varieties have both low value of dry matter also. Takiša (13.00), Jeribasma (10.25) and Ahmetova (11.25) - Can they be considered low acidity varieties anyway?

Varieties with a medium acidity value Debelkora (0.21), Hambarka and Zimnjača (0.24), and Karamut (0.22) can be considered as varieties of medium acidity level. The varieties of autochthonous pears that showed the highest acidity level are Ljeskovača (0.28), Crna Izmirka (0.27) and Kaločanka (0.25).

The obtained mesocarp pH in the tested pear varieties ranged from 3.57 (Ljeskovača) to 5.71 (Takiša). For standard varieties, based on research [15], pH values were measured from 3.24 for the Williams variety, to 4.44 for the Bella di Giugno variety, and studies [16] obtained a pH value from 3.75 for the Santa Marie variety up to 4 , 30 for the variety Bella di Giugno.

Based on the comparison of the results of the research, it can be concluded that the pH of the mesocarp of the fruit of the indigenous varieties tested shows significantly lower values compared to the standard cultivars, except for the Takiša variety, where the pH value is significantly higher (5,71). It is important to emphasize that the total acidity, that is, the content of fruit acids in the fruit studied, is a more significant indicator of taste and ripeness than the pH value itself.

Based on the comparison of the total acidity value of standard pear varieties (Table 3), a lower value of total acidity in native pear varieties is evident compared to standard varieties.The soluble dry matter (° Brix) and refractive index were directly read on an Abbe refractometer scale.

The study of soluble dry matter (° Brix) in autochthonous pear varieties (Table 4) shows high values, with the highest value is the variety Hambarka (20.50 ° Brix), then Debelkora (18.50 ° Brix), Karamut (17.25° Brix), Kaličanka (15.50 ° Brix), while the Jeribasma variety (10.25 ° Brix) had the lowest solubility value. Comparing with

Table 3. pH value– results of other researchers

Variety	Kulina M.	Šebek G.
Bella di Giugno	4,44	4,30
Santa Maria	3,53	3,75
Williams	3,24	4,07

Table 4. Total acidity – results of other researchers

Variety	Kulina M.	Šebek G.
Bella di Giugno	0,17	0,23
Santa Maria	0,35	0,54
Williams	0,20	0,36

Table 5. Soluble dry matter (°Brix)

Variety	Soluble dry matter (°Brix)
Ahmetova	11,25
Crnaizmirka	13,50
Debelkora	18,50
Hambarka	20,50
Jeribasma	10,25
Kaličanka	15,50
Karamut	17,25
Ljeskovača	11,00
Takiša	13,00
Zimnjača	10,75

Table 6. Soluble dry matter – results of other researchers

Variety	Kulina M.	Šebek G.
Bella di Giugno	13,99	17,05
Santa Maria	10,00	16,66
Williams	14,00	16,75

soluble dry matter values of standard pear varieties (Table 5), it can be observed that the obtained soluble dry matter values for the investigated autochthonous pear varieties showed significantly high soluble dry matter values (° Brix).

Looking at the measured dry matter values of the tested pear varieties (Table 5), it can be concluded that the medium and high acidity varieties also had high dry matter values (Brix °), indicating that they were at a high degree of ripeness during harvest.

4. CONCLUSIONS

The size of the fruit is quite different in the varieties tested and ranged from very small to extremely large fruits. The test did not cover early varieties but intermediate and extremely late pear varieties. The pH of the mesocarp of the fruit of the indigenous varieties tested shows lower values compared to the standard varieties but also significantly higher values in Takisha- (*** this may not be necessary, as acidity is more important to emphasize) In the case of autochthonous varieties, the total acidity is slightly lower than the standard ones, while soluble dry matter has significantly higher values in the tested indigenous pear varieties compared to the standard ones. Pomological-morphometric characteristics, if the pear is grown under the same or similar agro-ecological conditions, can be related to the genetic characteristics of the variety.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Salkić B. Karakterizacija autohtonog genofonda kruške u Bosni i Hercegovini, doktorska disertacija iz oblasti poljoprivrednih nauka. Univerzitet u Banja Luci, Poljoprivredni fakultet, Banja Luka. 2012;237.
2. Mratinić E. Kruška. Beograd: Veselin Masleša i Partenon. 2000;463.
3. Begić-Akagić A, Spaho N, Gaši F, Drkenda P, Vranac A, Meland M, Salkić B. Sugar and organic acid profiles of the traditional And international apple cultivars for processing, Journal of Hygienic Engineering and Design, UDC. 2014; 634(11):190-196.
4. Selamovska A, Milevska ME, Najdenovska O. Genetic resources of traditional pear varieties in the region of Skopje. Section of Natural, Mathematical and Biotechnical Sciences. 2013;34:93–100.
5. Costa G, Noferini M, Andreotti C. Non-destructive determination of internal quality in intact pears by near infrared spectroscopy. Acta Horticulturae (ISHS). 2002;596:821–825.
6. Li J, Huang W, Zhao C, Zhang B. A comparative study for the quantitative determination of soluble solids content, pH and firmness of pears by Vis/NIR spectroscopy. Journal of Food Engineering. 2013;116:324–332.
7. Vitolović V. Specijalno voćarstvo, Poljoprivredno izdavačko preduzeće, Beograd. 1949;251.
8. Đurić Gordana. Fruit genetic resources in Republika Srpska. Acta Agriculturae Serbica. 2009b;XIV(28):31-40.
9. Bubić Š. Specijalno voćarstvo. Svjetlost, Sarajevo, str. 1977;724.
10. Skendrović Babojelić M, Bogdanović S, Voća S, Šic Žlabur J, Značaj očuvanja i morfološka karakterizacija tradicionalnih sorata jabuka u Republici Hrvatskoj, Zbornik sažetaka 4. Simpozija s međunarodnim sudjelovanjem Kopački rit jučer, danas, sutra. 2015;47-48.
11. Jakobek L. Ancient apple varieties from Croatia as a source of bioactive polyphenolic compounds, Journal of Food Composition and Analysis. 2015;45.
12. Zavadlav S. Priručnik za vježbe iz kolegija „ Tehnologija bezalkoholnih pića; 2015. [ISBN: 978-953-7343-84-2]
13. Pravilnik o metodama uzimanja uzoraka i vršenja hemijskih i fizičkih anliza radi kontrole kvaliteta proizvoda od voća i povrća (“Sl. list SFRJ”, br. 29/83)
14. Cvrk R, Begović A, Marić S, Nils V, Juul. The Effect of Technological Process on Physico-Chemical and Nutritional Properties of Sour Cherries Products’’. 2009;507-512. [ISBN 978-3-319-90892-2]
15. Kulina M, Radović M, Berjan S, Kraišnik V. Pomološke i hemijske osobine ploda nekih sorti krušaka gajenih u uslovima Bratunca,Agroznanje. 2013;14(3):357-365.
16. Šebek G. Chemical and pomological characteristics of fruit of some commercial pear cultivars grown in conditions of Bjelo Polje, UDC. 2010;634:13-152.61(497.16).

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/56413