

## Pomological characterisation of pear varieties of “Lubenicarka” group

Nikola Mičić<sup>1,2</sup>, Gordana Đurić<sup>2,1</sup>, Besim Salkić<sup>3</sup>

<sup>1</sup> *Faculty of Agriculture, University of Banjaluka*

<sup>2</sup> *Genetic Resources Institute, University of Banjaluka*

<sup>3</sup> *Nursery Srebrenik – Spionica*

### Summary

Pomological characterisation of pears of the so-called “Lubenicarka” (watermelon pear) group has been based on three genotypes identified in numerous vegetative progeny as part of the native assortment of Bosnia and Herzegovina. “Krupna Lubenicarka” (common watermelon pear) variety was recommended for the expansion of production at the beginning of the XX century, and there were two more genotypes (“Crna Lubenicarka” (black watermelon pear) and “Bijela Lubenicarka” (white watermelon pear)) that were listed under the common name of “Lubenicarka”. The research results show that “Krupna Lubenicarka” variety has vegetative progeny characterised by stable pomological features which clearly and reliably determine this variety. “Crna” and “Bijela Lubenicarka” genotypes are characterised by certain pomological distinctions that clearly make them different, but also by some similarities, whose variability raises up the question of their reliable pomological and genetic characterisation. Morphometric analyses of the fruit and leaf of “Krupna Lubenicarka” variety and “Crna” and “Bijela Lubenicarka” genotypes represent their first pomological characterisation that can be adopted as a reliable foundation for collecting, further pomological studies and genetic characterisation.

*Key words:* “Krupna lubenicarka”, “Crna lubenicarka” and “Bijela lubenicarka”

### Introduction

According to the specific fruit features, pear varieties are traditionally divided into a number of different groups: “Maslovka”, “Vodenjaca” (“Jeribasma”), “Bergamotka” (Bergamot), “Karamanka”, “Muskatnica”, “Lubenicarka”, “Mostaca”, etc. (Todorović, 1899; Vitolović, 1949; Bubić, 1952). This classification of pear varieties is not up to date in terms of contemporary fruit production,

primarily because culinary use, post-harvest handling and marketing led to the introduction of completely new assortments in the production; hence most varieties that the said classifications were based on practically became extinct. However, realising the importance of biodiversity conservation and development of modern genetic methods, the old or abandoned varieties, as well as the native ones, are of more interest to geneticists and selectors, for the most part as a potential source of genes, but also because of possible patenting and protection of copyright. This renewed interest in abandoned and native varieties has opened up a number of questions, chiefly methodological ones, that need to be cleared out before general confusion arises that may bring about far-reaching adverse consequences. Namely, every genetic characterisation of such assortment, that is, assortment with no established nor identified pomological standard, including native and autochthonous genotypes that need to be preserved because of their properties or recognised as a new variety, must be done according to the following algorithm: collecting (vegetative progeny with the aim of verification of inheritable properties) → morphological – pomological characterisation (identification of specific inheritable and pomological properties central to fruit growing science and production) → genetic characterisation (molecular marking of specific genetic properties – genes), that is, the genotype standard defined and verified – varieties. In this paper, the pears of “Lubenicarka” group served as an example for discussion of the said algorithm.

“Lubenicarka” pear varieties include those that accumulate anthocyanins in the flesh and seed cases in the final stages of physiological ripening so the flesh acquires red colour similar to that of watermelons. In the current literature and fruit growing practice, there is neither scientifically, nor professionally elaborated pomological characterisation, nor specific genotype standardisation of “Lubenicarka” pears based on which characterisation of their numerous vegetative progeny could be done. However, a lot of information can be found under the name “Lubenicarka” at ardent local fruit growers, especially on the Internet, that, under a unique name “Lubenicarka”, refers to a number of various pear genotypes with red coloured flesh, but also, completely incorrectly, to some genotypes having bright red skin, and even to some commercial varieties.

Consulting the literature from the time when “Lubenicarka” varieties were part of the then assortment (Lolić, 1934; Lukman, 1937), it is evident that the general term “Lubenicarka” mainly refers to “Krupna Lubenicarka” variety that was widely recommended in the former Yugoslavia in the first half of the XX century. Apart from “Krupna Lubenicarka” variety, the same authors specifically mention “Lubenicarka” variety, as a variety of no particular interest to the fruit production of that period. Seventy years later, “Lubenicarka” pear varieties appeared again in the fruit growing literature, although this time, they were included into the native assortment of Serbia and Bosnia and Herzegovina (Mratinić, 2000; Beširević, 2009; Kanlić, 2010). These sources of literature provide description of “Krupna Lubenicarka” variety and “Lubenicarka” variety in terms of visual description of the fruit and some consumption properties, but without pomological description and scientific characterisation of the morphometric and organoleptic ones. Further,

Beširević (2009) only gives a short account of “Bijela” and “Crna Lubenicarka” as “sisters” of “Krupna Lubenicarka” variety. According to the literature cited, it can be concluded that, as part of old i.e. native assortment, there are numerous vegetative progeny of “Krupna Lubenicarka” variety in the field, which spread as a recommended variety, as well as vegetative progeny of a group of genotypes under the common name of “Lubenicarka”, mainly comprised of “Crna Lubenicarka” and “Bijela Lubenicarka” genotypes.

## Materials and methods

Pomological characterisation of “Krupna Lubenicarka”, “Crna Lubenicarka” and “Bijela Lubenicarka” fruits was conducted from 2010–2012 on the fruits taken from the variety collection in Spionica in Srebrenik, the collection of Vahid Beširević from Gradacac, and *in situ* conserved accessions in the Genetic Resources Institute, University of Banjaluka.

Anatomic–morphological features and fruit description (according to Mičić and Đurić, 2008) were completed in the Pomological Laboratory of the Horticulture Institute within the Faculty of Agriculture in Banjaluka.

The samples of 50 fruits for each variety were delivered successively to the laboratory and analysed. All fruit samples were photographically documented. 10 samples of each variety were examined in terms of vertical and horizontal cross-section as to be scanned and graphically analysed for the fruit shape parameters whereas 20 fruits were analysed in terms of fruit mass, flesh firmness and total soluble solids content in cell juice (% Brix). At the same time, morphometric analysis of 30 leaves for each was conducted by scanning the leaf blade thus measuring the leaf surface and leaf stalk length. In addition, leaf edge serration was photographically documented.

## Results and discussion

The pomological analyses of pear fruit of “Lubenicarka” group collected in Bosnia and Herzegovina confirm the presence of a number of different genotypes whose properties are being transferred to vegetative progeny in a steady manner. By identifying the trees *in situ* and carrying out pomological analysis of their fruits as well as the fruits from two variety collections, a genotype under the name “Krupna Lubenicarka” was confirmed and at least two genotypes under the common name “Lubenicarka”, thus complying with the claims of Lolić (1934), Lukman (1937) and Beširević (2010). Besides the fruit size, these genotypes are also visually very distinct in terms of the fruit shape, main and auxiliary skin colour, length of fruit stalk and a number of other elements of pomological characterisation (Fig. 1).

The graphic analysis of the fruit confirmed differences between the common fruit shape as well as the specific content of anthocyanins in the flesh during the physiological stage of fruit ripening (Fig. 2.). The most coloured flesh was found in “Krupna Lubenicarka” variety, indicating the highest content of anthocyanins in the fruit flesh. A comparison of the coloured flesh in “Crna Lubenicarka” and “Bijela

Lubenicarka” genotypes showed the lowest amount of anthocyanins in the flesh of “Bijela Lubenicarka” genotype. “Bijela Lubenicarka” also differs in regard with its skin colour which altogether strongly suggests the origin of its name.



Fig.1. Appearance of pear fruits of “Lubenicarka” group which are dominant in numerous vegetative progeny throughout Bosnia and Herzegovina. “Krupna Lubenicarka” genotype (1) spread considerably at the beginning of the XX century across fruit growing regions.

At the same time, at least two genotypes: “Crna Lubenicarka” (2) and “Bijela Lubenicarka” (3) spread throughout BiH under the name “Lubenicarka”.

*Izgled plodova krušaka iz grupe Lubeničarki koje su dominantno prisutne u brojnom vegetativnom potomstvu na prostoru Bosne i Hercegovine. Genotip Krupna lubeničarka (1) početkom XX veka značajno je proširena u voćarskim regionima. Istovremeno pod nazivom Lubeničarka na prostoru BiH raširena su i najmanje dva genotipa: Crna lubeničarka (2) i Bijela lubeničarka (3).*

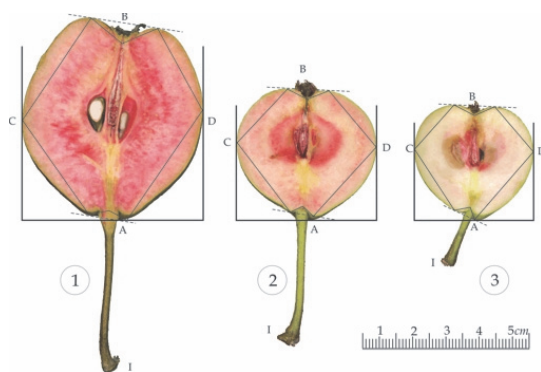


Fig. 2. The graphic analysis of the fruit shape and specific content and distribution of anthocyanins in the flesh of the “Lubenicarka” genotypes studied: 1) “Krupna Lubenicarka”; 2) “Crna Lubenicarka”; and 3) “Bijela Lubenicarka”.

*Grafička analiza oblika ploda i karakteristična zastupljenost i distribucija antocijana u mesu ploda proučavanih genotipova lubeničarki: 1) Krupna lubeničarka; 2) Crna lubeničarka; i 3) Bijela lubeničarka.*

A comparative review of morphometric and pomological parameters of the fruit concerning the three genotypes of “Lubenicarka” under study is given in Table 1.

Tab. 1. Main pomological parameters of the fruit and leaf of the “Lubenicarka” genotypes studied.

*Osnovni pomološki parametri ploda i lista proučavanih genotipova lubeničarki.*

Fruit and leaf properties	“Lubenicarka” varieties – genotypes		
	“Krupna lubenicarka”	“Crna lubenicarka”	“Bijela lubenicarka”
Fruit mass (g)	71,59 ± 2,35	53,65 ± 2,06	38,3 ± 2,14
Fruit height - AB (mm)	61,64 ±	44,28 ±	45,61 ±
Fruit diameter – CD (mm)	55,91 ±	45,03 ±	48,27 ±
Fruit stalk length – AJ (mm)	42,37 ±	44,35 ±	27,38 ±
Flesh firmness (kg/cm <sup>2</sup> )	4,95 ±	8,33 ±	5,19 ±
Total soluble solids content (Brix %)	11,81 ± 0,36	13,47 ± 0,55	12,01 ± 0,48
Anthocyanins in fruit flesh (visual)	4 - 5	2 - 3	1 – 2
Leaf edge serration	Serrate	Entire	Entire
Leaf blade surface (cm <sup>2</sup> )	20,48 ± 0,89	39,64 ± 2,17	35,43
Leaf stalk length (cm)	3,87 ± 0,99	4,86 ±	5,05

Taking into account the data from Table 1, the observed distinctions concerning fruit size as well as some common properties are evident and clearly confirmed. A striking difference in the average fruit mass between “Crna Lubenicarka” and “Bijela Lubenicarka” was not confirmed in regards with the average fruit shape parameters which can be linked with the specific fruit mass, that is, the difference in the occurrence of stone cells. This was further confirmed through pronounced difference in flesh firmness with values being considerably higher for “Crna Lubenicarka” genotype.

Having in mind the fact that pomological description of the fruit, that is, morphometric and pomological characterisation of “Krupna Lubenicarka”, “Crna Lubenicarka” and “Bijela Lubenicarka” genotypes does not exist in the existing literature, the main pomological features of these genotypes were photographically documented during this research as a basis for their determination with the aim to collect and study them in the future.

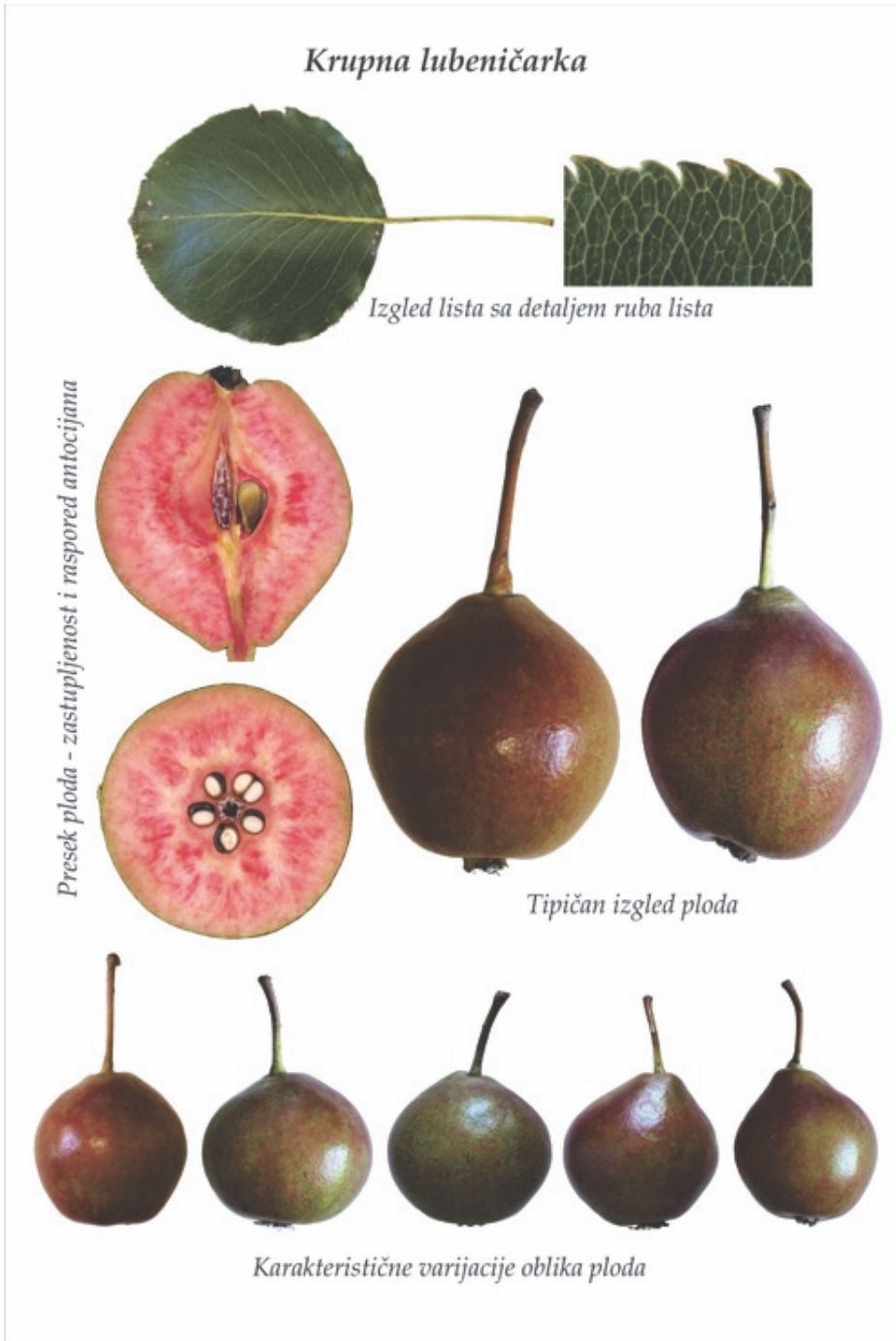


Fig. 3. “Krupna lubenicarka” variety – general appearance of the leaf and fruit  
*Sorta Krupna lubeničarka – opšti izgled lista i ploda*

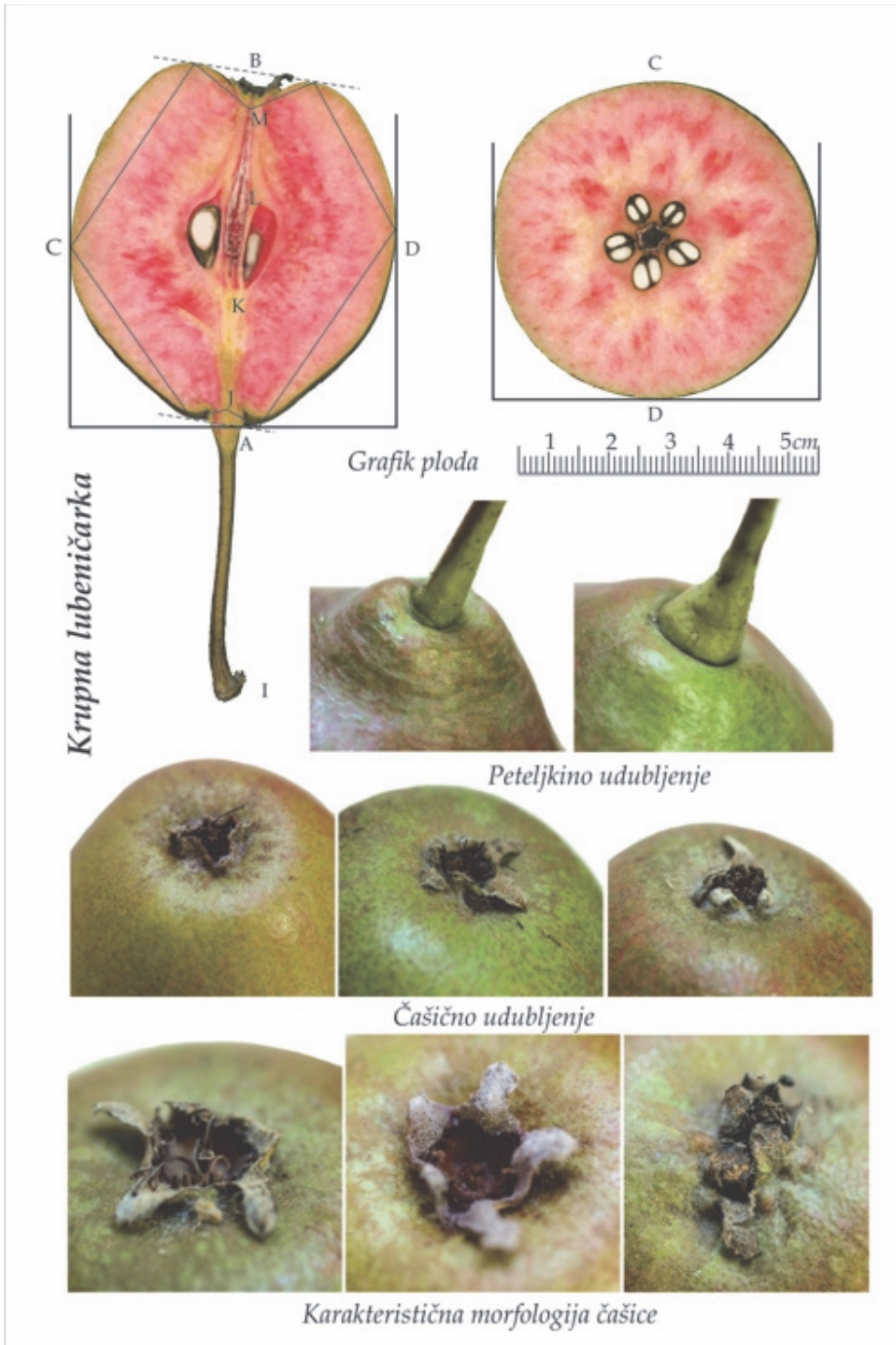


Fig. 4. “Krupna lubeničarka” variety – pomological fruit details  
 Sorta *Krupna lubeničarka* – pomološki detalji ploda

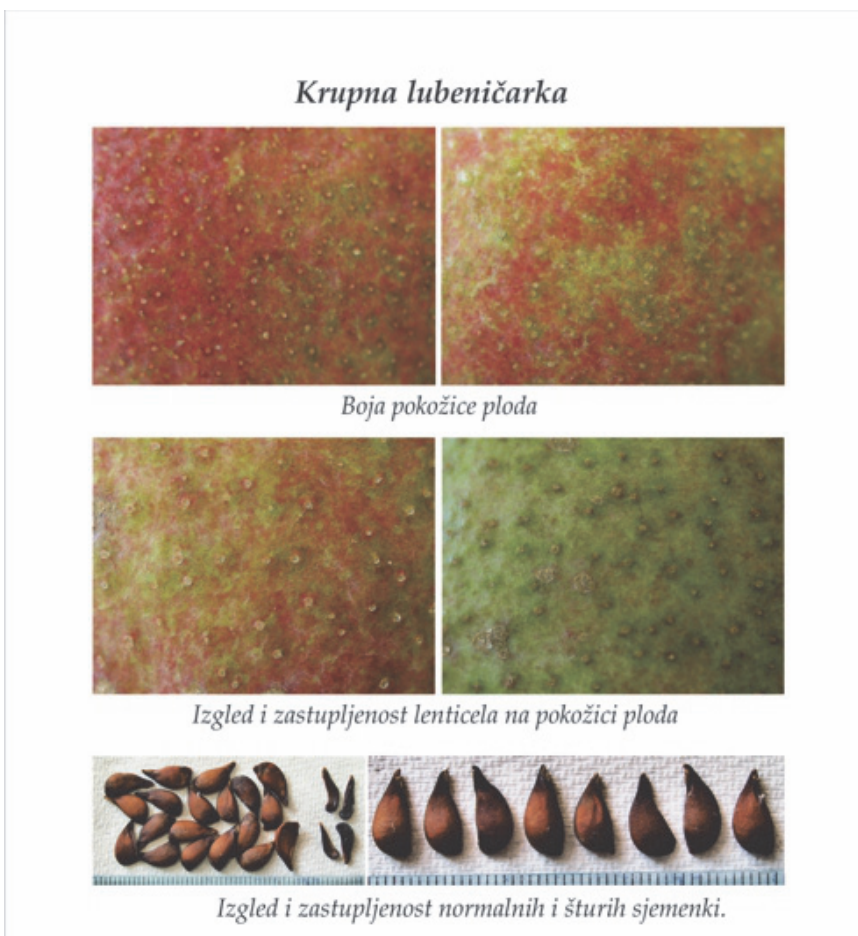


Fig. 5. “Krupna lubeničarka” variety – pomological details of the fruit skin and seeds

*Sorta Krupna lubeničarka – pomološki detalji pokožice ploda i sjemenki*

“Krupna Lubenicarka” variety has a specific fruit shape. The main colour of the fruit is dark green with brown-red and dark purple auxiliary skin colour that most often covers the whole fruit. When physiologically ripe, flesh and pergament-like chambers acquire intensive red colour that makes them very appealing. The flavour is sweet-acidic, aromatic and refreshing. Becoming completely ripe, their flesh softens, anthocyanins oxidise and acquire brown colour, whereas sugar in the flesh ferments into alcohol. “Krupna Lubenicarka” variety is a distinctive variety that needs to be protected and conserved. The only lack is a relatively rapid ripening after the period of physiological fruit ripening, therefore research is to be expected aiming at making this red fleshed fruit last longer for culinary use.



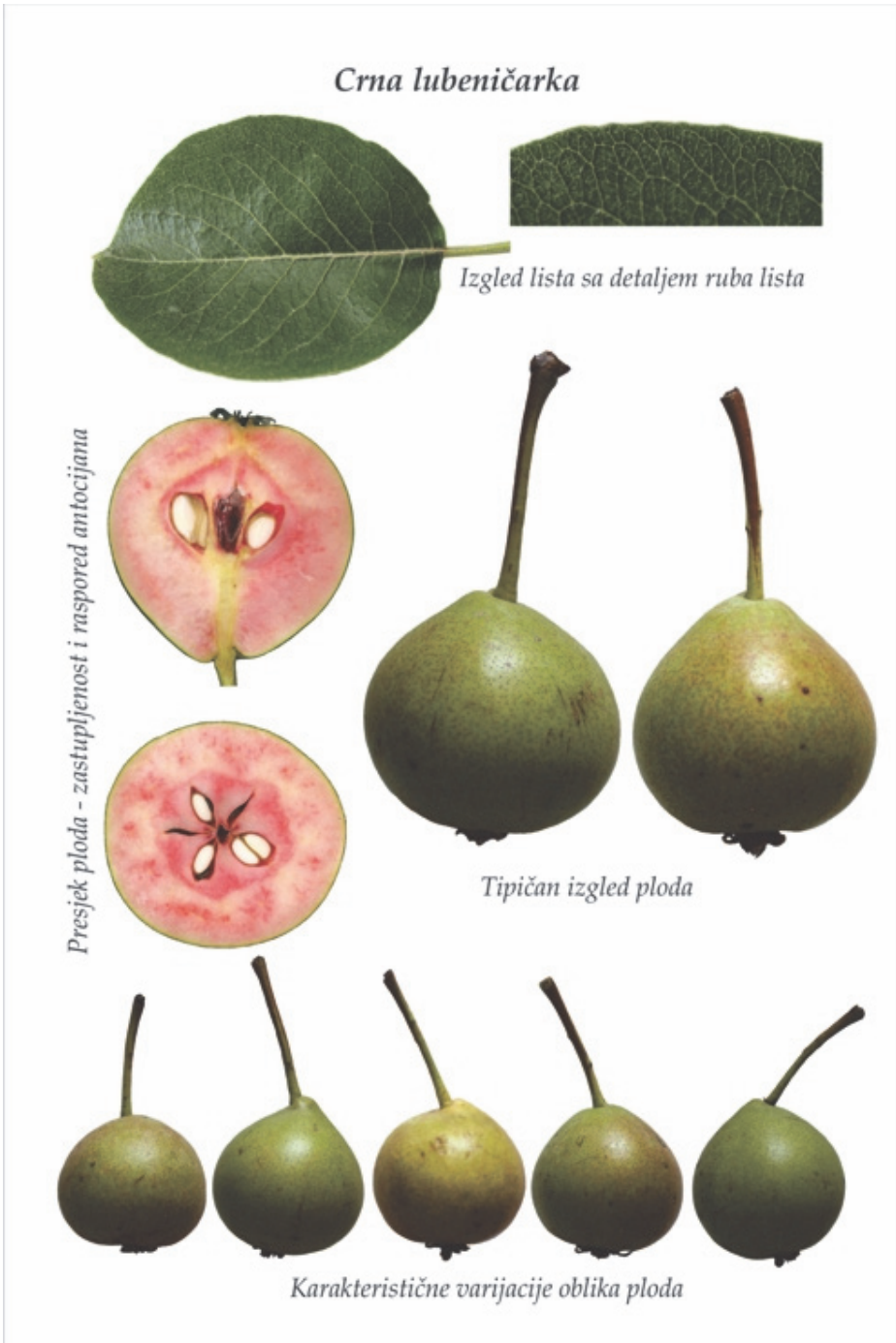


Fig. 6. “Crna lubeničarka” variety– general appearance of the leaf and fruit  
*Sorta Crna lubeničarka – pomološki detalji ploda*

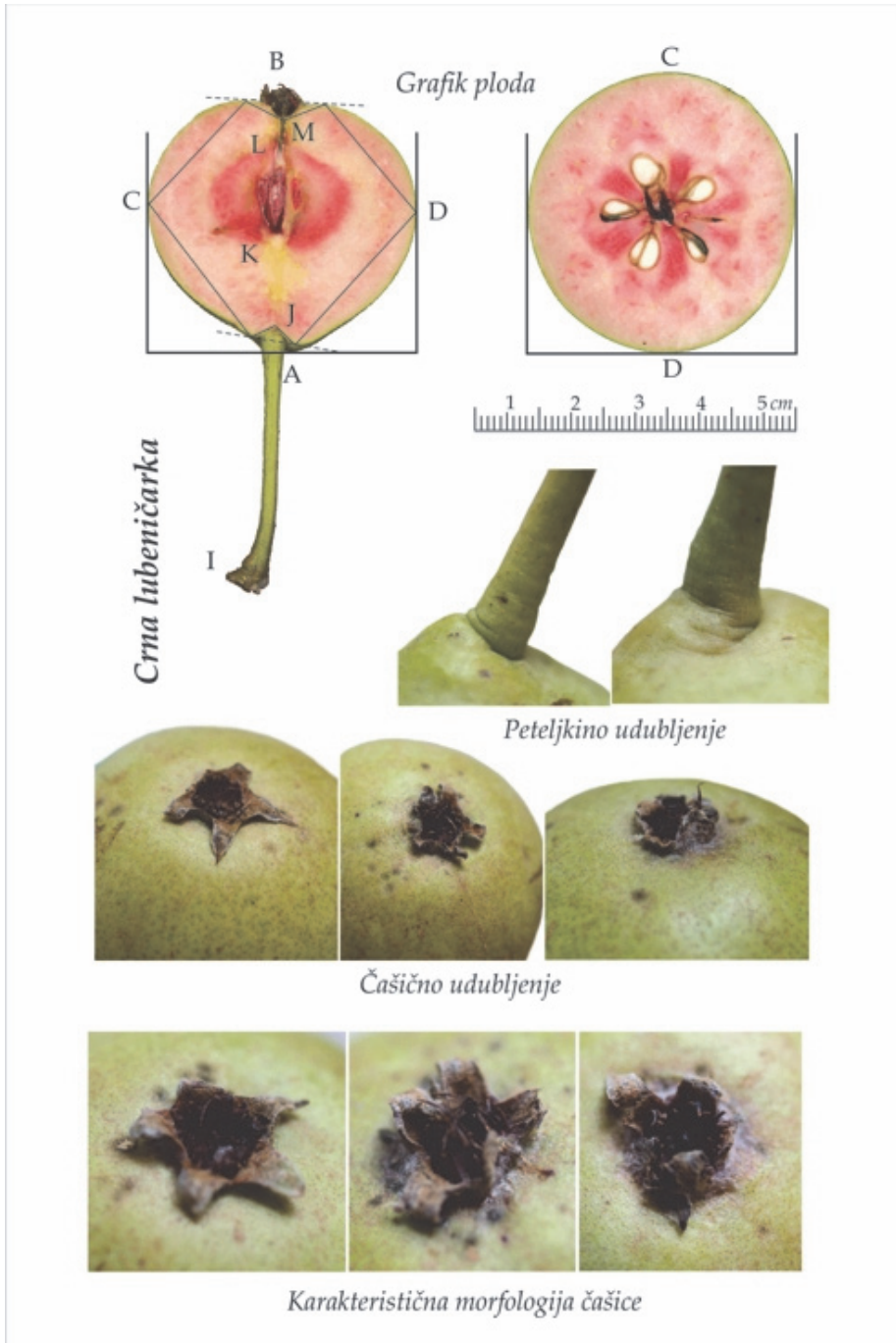
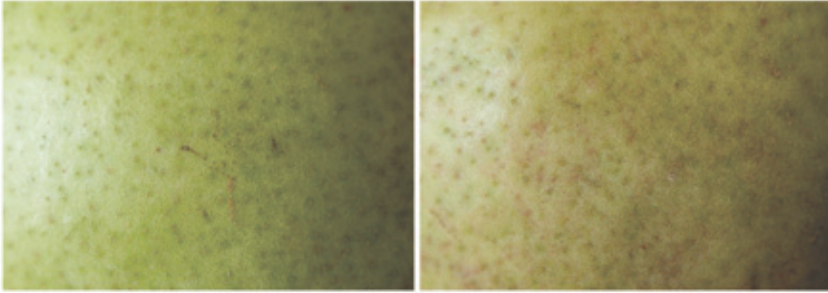
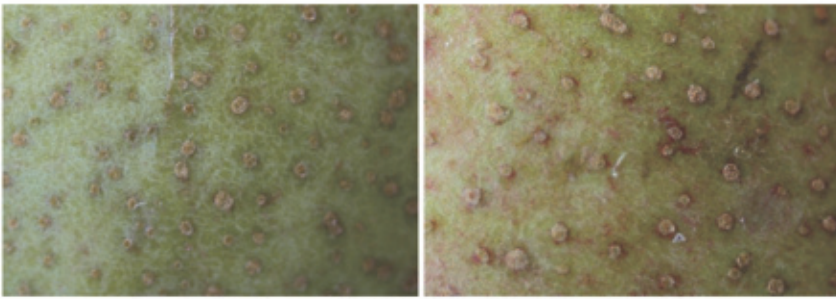


Fig. 7. "Crna lubenicarka" variety – pomological fruit details  
*Sorta Crna lubenicarka – pomološki detalji ploda*

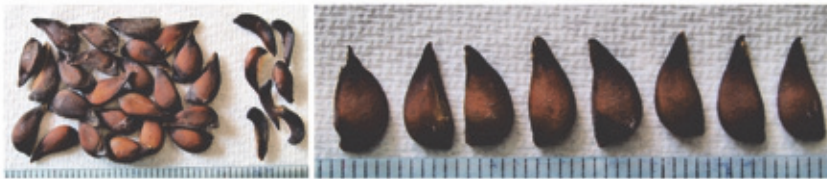
### *Crna lubeničarka*



*Boja pokožice ploda*



*Lenticele na pokožici ploda - izgled i zastupljenost*



*Izgled i zastupljenost normalnih i šturih sjemenki.*

Fig. 8. “Crna lubenicarka” variety – pomological details of the fruit skin and seeds  
*Sorta Crna lubeničarka – pomološki detalji pokožice ploda i sjemenki*

“Crna Lubenicarka” has small fruits. The main colour of the fruit is dark green with brown-reddish auxiliary skin colour that rarely appears on individual fruits. When physiologically ripe, flesh and pergament-like chambers, especially in the seed case tissue, acquire red colour that makes them very appealing. The flavour is sweet-acidic with specific aroma. Becoming completely ripe, their flesh softens, anthocyanins oxidise and acquire brown colour, whereas sugar in the flesh ferments into alcohol. According to the claims of Beširević (2010), “Crna Lubenicarka” variety shows particular resistance towards pathogens and should be conserved as a potential donor of these properties.

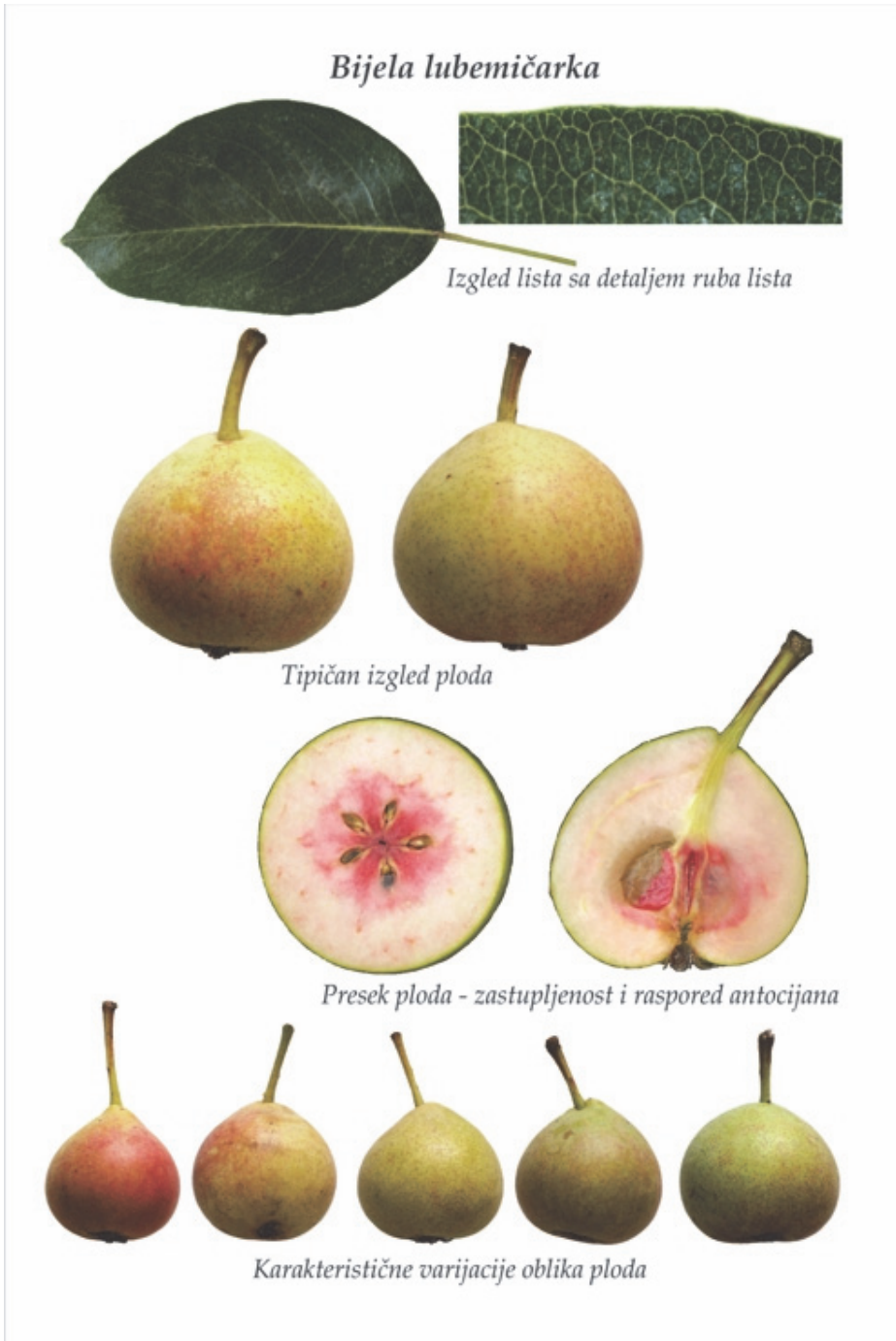


Fig. 9. “Bijela lubeničarka” variety– general appearance of the leaf and fruit  
*Sorta Bijela lubeničarka – opšti izgled lista i ploda*

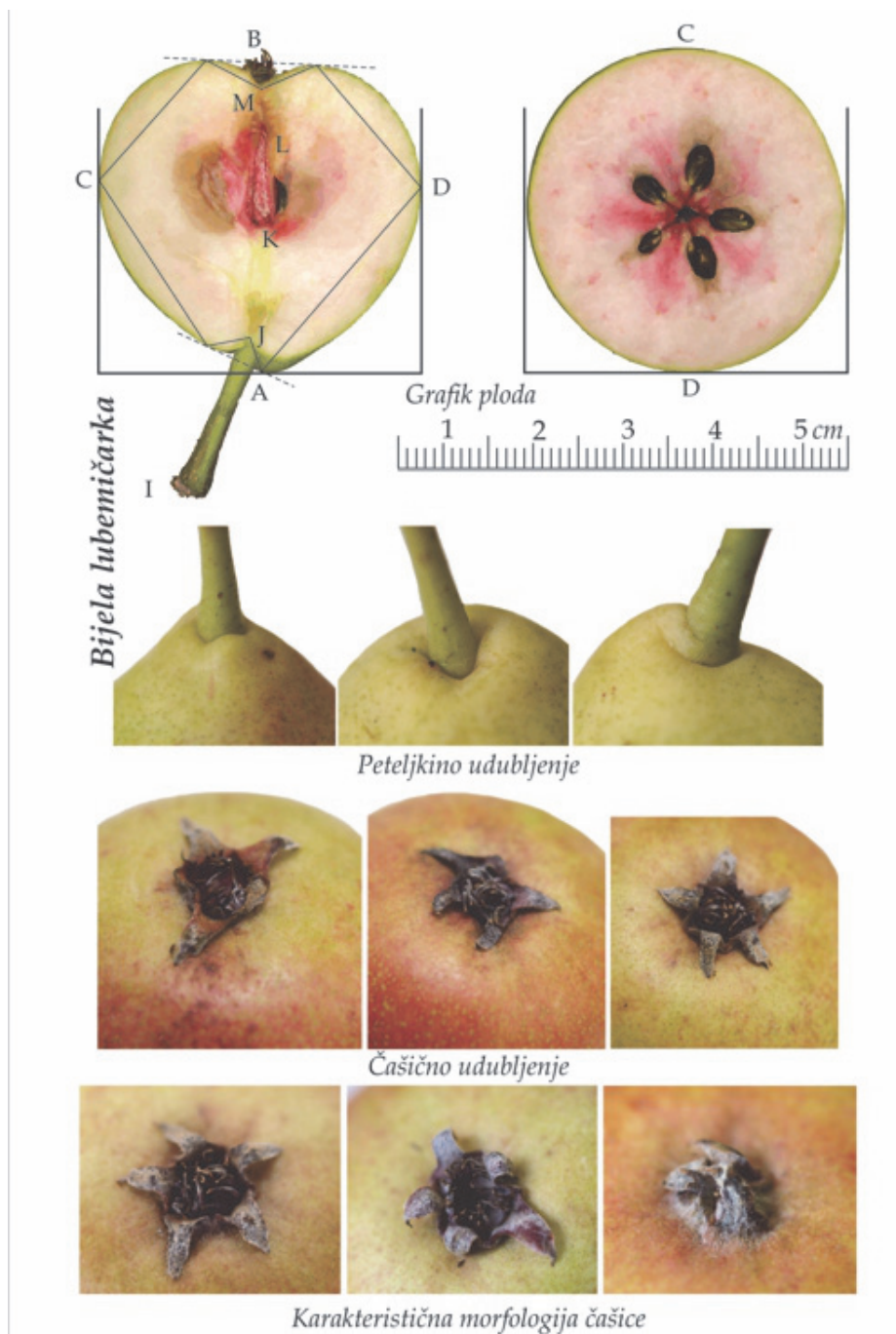


Fig. 10. "Bijela lubenicarka" variety – pomological fruit details  
 Sorta *Bijela lubenicarka* – pomološki detalji ploda



Fig. 11. “Bijela lubenicarka” variety – pomological details of the fruit skin and seeds

*Sorta Bijela lubenicarka – pomološki detalji pokožice ploda i sjemenki*

“Bijela Lubenicarka” has small fruits. The main colour of the fruit is light green with auxiliary skin colour ranging from orange to red hues that completely cover the sunny side of the fruit. When physiologically ripe, the flesh acquires light reddish colour whereas the seed case becomes reddish and red. The fruit flavour is sweet-acidic with specific aroma. Becoming completely ripe, their flesh quickly softens, anthocyanins oxidise and acquire brown colour, whereas sugar in the flesh ferments into alcohol. According to Beširević (2010), “Bijela Lubenicarka” variety

shows particular resistance towards pathogens and should be conserved as a potential donor of these properties.

## Conclusion

All inventoried trees of “Krupna Lubenicarka” across the regions of Podrinje and Potkozarje have identical pomological features by which this genotype has been verified as a variety, that is, vegetative progeny of the source seedling of unknown origin.

Within the vegetative progeny of pears that have been identified in the field and that expand under the common term “Lubenicarka”, two genotypes were identified in this paper – “Crna Lubenicarka” and “Bijela Lubenicarka”, although the issue concerning their final status, either as two separate varieties of unknown origin or different clones in numerous vegetative progeny under the common term “Lubenicarka”, still remains unresolved.

## References

1. *Beširević, V.* (2009): Autohtone jabuke i kruške sa prostora Bosne i Hercegovine. Harfo-graf, d.o.o. Tuzla, str. 233.
2. *Bubić, Š.* (1952): Specijalno voćarstvo. Veselin Masleša, Sarajevo, str. 383.
3. *Kanlić, K.* (2010): Autohtone sorte voćaka istočne Bosne. Štamparija Fojnica, Fojnica.
4. *Lolić, M.*, (1934): Sorte krušaka. Referat na II Zemaljskom voćarskom kongresu. Izdavač "Srpsko poljoprivredno društvo", Beograd. str: 236 – 243.
5. *Lukman, F.*, (1937): Sorte jabuka i krušaka koje treba gajiti. Izdavač: "Seljački bukvar", Beograd. str: 1 – 63.
6. *Mičić, N., Đurić Gordana*, (2008): Anatomija, morfologija i opis plodova voćaka. Naučno voćarsko društvo Republike Srpske. Banja Luka.
7. *Mratinić Evica* (2000): Kruška. Veselin Masleša, Beograd. str: 437.
8. *Todorović, B.* (1899): Voćke i voće. Srpska književna zadruga 57. Beograd – Zagreb. str: 452.
9. *Vitolović, V.* (1949): Specijalno voćarstvo – Pomologija. Poljoprivredno izdavačko preduzeće – Beograd. str: 252.

# Pomološka karakterizacija sorti krušaka iz grupe lubeničarki

Nikola Mičić<sup>1,2</sup>, Gordana Đurić<sup>2,1</sup>, Besim Salkić<sup>3</sup>

<sup>1</sup> Poljoprivredni fakultet Univerziteta u Banjaluci  
<sup>2</sup> Institut za genetičke resurse Univerziteta u Banjaluci  
<sup>3</sup> Rasadnik Srebrenik – Špionica

## Sažetak

Pomološka karakterizacija krušaka iz grupe lubeničarki izvršena je na tri genotipa identifikovana u brojnom vegetativnom potomstvu kao deo autohtonog sortimenta Bosne i Hercegovine. Sorta Krupna lubeničarka preporučivana je za širenje u proizvodnji početkom XX veka, a pratila su je i još dva genotipa (Crna lubeničarka i Bijela lubeničarka) pod zajedničkim nazivom Lubeničarka. Rezultati istraživanja pokazuju da sorta Krupna lubeničarka ima vegetativno potomstvo stabilnih pomoloških karakteristika koje su jasna i pouzdana odrednica ove sorte. Genotipovi Crna i Bijela lubeničarka imaju određene pomološke različitosti koje ih jasno diferenciraju, ali i određene sličnosti čija varijabilnost otvara pitanje njihove pouzdane pomološke i genetičke karakterizacije. Morfometrijske analize ploda i lista sorte Krupna lubeničarka i genotipova Crna i Bijela lubeničarka predstavljaju njihovu prvu pomološku karakterizaciju koja se može usvojiti kao pouzdana osnova za njihovo kolekcionisanje, dalja pomološka proučavanja i genetičku karakterizaciju.

*Ključne reči:* Krupna lubeničarka, Crna lubeničarka i Bijela lubeničarka

Gordana Đurić  
*E-mail Address:*  
*gordanadju@gmail.com*