

Pomological and sensory properties of 8 different fig varieties in Croatia

Abstract

The common fig (*Ficus carica* L.) is a fruit species traditionally cultivated in coastal Croatia. After some years of being of low commercial value, the interest in fig consumption and cultivation in this region seems to start following the increasing trend. One way of promoting fig consumption is to identify the varietal sensory properties, intending to match the consumer preferences. For this reason, the goal of this study was to evaluate sensory properties and pomological characteristics of fresh fruits of five dark ('Šaraguja', 'Miljska', 'Crnica', 'Piombinese', 'Nero Rosso') and three light-coloured ('Petrovača bijela', 'Tiger', 'San Martino') skin fig varieties, grown in Croatia. Figs were harvested from 5-years old trees in the fig experimental orchard located in Istria County (Croatia). Significant differences were observed for the properties of appearance, odour, flavour, and taste. Fresh fruits of varieties 'Šaraguja' and 'Tiger' reached the highest scores for the intensity of taste, fig odour, and flavour, compared to all the others. The highest values regarding fruit thickness and width were recorded from the variety 'Petrovača bijela'; length from the variety 'Šaraguja', while 'San Martino' variety had the fruits of biggest weight. The variety 'Miljska' displayed the lowest values in all the observed pomological parameters. The importance of the pomological description and observation of sensory parameters of fresh figs lies in permitting the producers to decide the potential of each variety based on consumer preferences.

Keywords: Fresh fruits; *Ficus carica* L.; sensory characteristics; pomological trait

Introduction

The common fig (*Ficus carica* L.) is a fruit species well adapted to Mediterranean climate conditions, being cultivated traditionally in coastal Croatia. However, despite its huge production potential, fig production in Croatia in the last 20 years is declining and there is a lack of organised production. In 2000 the fig production in Croatia was about 4084 t while in 2019 it was just 810 t (FAO, 2021). Reasons for this could be due to the following: the existence of old and neglected trees bearing low yield, removal of old fig trees for planting other crops, young fig trees that are not yet in the full bearing so with still low yields, climatic changes (major droughts and heavy rainfall in different periods), and statistical data processing (Prgomet and Prgomet, 2020).

However, after some years of its low commercial value, it seems that the interest in fig consumption and cultivation in this region is increasing. This might be due to a trend of a healthy lifestyle that is promoting diets based on food with high bioactive properties (such as figs) but also due to the increased interest of tourists (visiting this area in summer months) to buy local fresh figs (Prgomet et al., 2021). One way of promoting fig consumption is to identify the varietal sensory properties, intending to match the consumer preferences. More information on fresh quality products leads to greater interest in their consumption. A consumer that is being able to correctly anticipate how a certain fig variety tastes will more likely purchase more figs (King et al., 2012).

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Furthermore, the development of a set of descriptors for each fresh fig variety can bring to better communication between fig growers, retailers, and consumers (King et al., 2012).

For these reasons, the goal of this study was to evaluate sensory properties and pomological characteristics of fresh fruits of 8 fig varieties that were grown in Croatia.

Materials and methods

Fresh fig fruits were harvested at their commercial mature stage from 5-years old trees in the fig experimental orchard located in Rovinj, Istria County (Croatia) in summer 2018. The moment of the harvest was determined by monitoring the fruit softening and the occurrence of the typical varietal colour and fruity taste. Fresh fruits of five dark ('Šaraguja', 'Miljska', 'Crnica', 'Piombinese', 'Nero Rosso') and three light-coloured ('Petrovača bijela', 'Tiger', 'San Martino') skin fig varieties (Figure 1) grown in Croatia were assessed to their pomological and sensory properties. The orchard received the standard farming practices (pruning, fertilization) and was drip irrigated since planted.



Figure 1. Photographs of studied fig varieties.

Slika 1. Fotografije istraživanih sorata smokve.

Pomological characteristics of 25 fig fruits per variety included fruit weight, thickness, width, and length. The fresh fruit weight was measured with a precision balance (0.1 g sensitivity), while the fruit thickness, width and length were determined with a digital calliper (0.01 mm sensitivity). Sensory properties were evaluated based on appearance, odour, flavour, taste, and texture, according to King et al. (2012) with some modifications. A scale from 1 to 5 points was used for the sensory assessment and the samples were coded and presented randomly to each panellist ($n=22$) on white plastic plates. The age of panellists ranged between 24 and 62, and the ratio of male/female was 48%/52%.

The data were analyzed with a one-way analysis of variance (ANOVA). All analyses were done using the Statgraphics 5.1 plus statistical program (Statgraphics Plus for Windows 5.1, 2005; Statistical Graphics Corporation, Rockville, Maryland, USA). Differences between the means were compared using an LSD test at $p<0.05$.

Results and discussion

As expected, the studied varieties varied in appearance and sensory profiles. The significantly highest values regarding the fruit length were recorded for the varieties 'Šaraguja', 'Nero Rosso', 'San Martino' and 'Crnica' (5.26 cm, 5.12 cm, 5.11 cm and 5.09 cm, respectively). Fruits of 'Petrovača bijela' displayed the highest values regarding thickness and width (4.94 cm and 5.17 cm, respectively), followed by 'San Martino' (4.88 cm and 5.09 cm, respectively) and 'Crnica' (4.88 cm and 5.05 cm, respectively) (Figure 2). The highest values regarding the fruit weight was recorded for the 'San Martino' fruits (79.0 g), 'Crnica' (76.1 g) and 'Petrovača bijela' (71.9 g), while the variety 'Miljska' displayed the lowest values in all the observed pomological parameters (fruit length 3.10 cm, thickness 3.80 cm, width 4.02 cm and weight 40.5 g) (Figures 2 and 3).

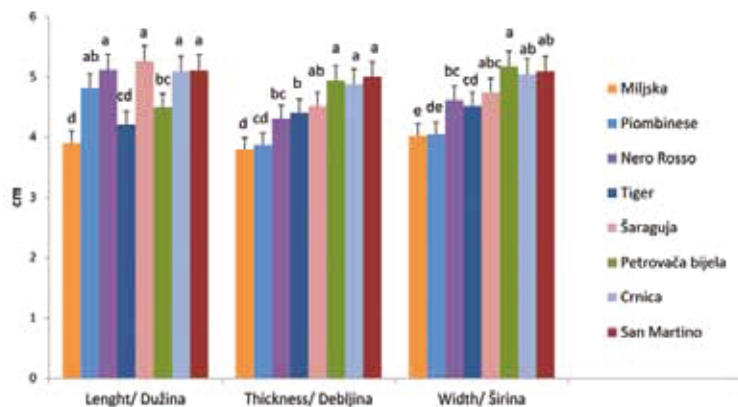


Figure 2. Pomological properties (length, thickness and width) of fresh fig fruits of 8 fig varieties. Results are expressed as mean±SD. Different letters indicate significant differences ($p < 0.05$) among varieties by LSD test.

Slika 2. Pomološke karakteristike (dužina, debljina, širina) svježih plodova 8 sorti smokve. Rezultati su izraženi kao srednja vrijednost±SD. Različita slova označavaju značajnu razliku ($p < 0.05$) među sortama prema LSD testu.

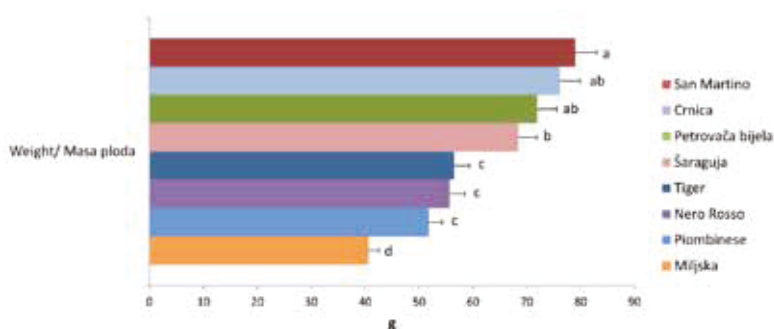


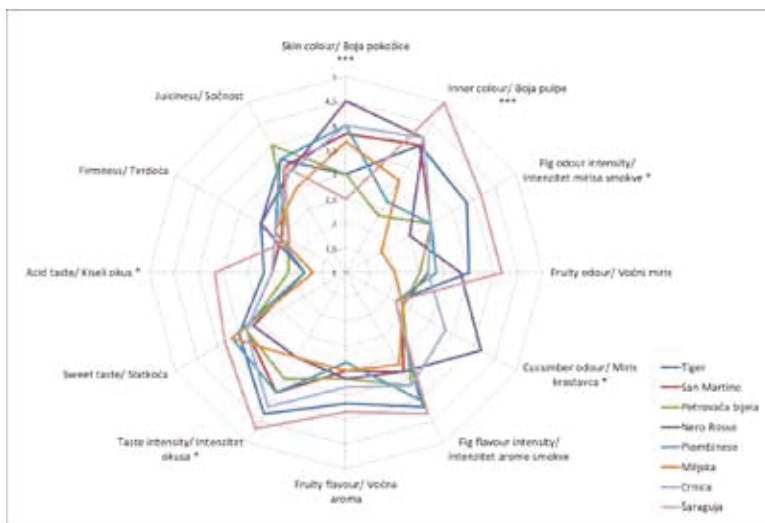
Figure 3. Pomological attribute (weight) of fresh fig fruits of 8 fig varieties. Results are expressed as mean±SD. Different letters indicate significant differences ($p < 0.05$) among varieties by LSD test.

Slika 3. Pomološka karakteristika (masa) svježih plodova 8 sorti smokve. Rezultati su izraženi kao srednja vrijednost±SD. Različita slova označavaju značajnu razliku ($p < 0.05$) među sortama prema LSD testu.

The fruit weights in several similar studies on figs varied from 35.6 to 55.6 g (Crisosto et al., 2010), 22.2 to 52.5 g (Çalışkan and Polat, 2008), and from 29.8 to 59.9 g (Mahmoudi et al., 2018). However, the fruit size differs according to the genotype, tree age, agronomical practices, weather conditions, place of cultivation, etc. (Crisosto et al., 2010; Trad et al., 2013). In the conditions of Istria, the fruit weight of studied varieties ranged from 40.6 to 79.0 g.

In the recent complementary study, where the fruits were harvested from the same trees and on the same year as the ones here mentioned, the variety 'Miljska' contained the highest levels of phenolics and fructose, and displayed the strongest total antioxidant activity, both for FRAP and DPPH (Prgomet et al., 2021). The fruit's appearance does not always mean the fruit is of the best quality, as it may be a poor indicator of fruit internal quality (Morales et al., 2020).

In the present study, several sensory descriptors (Graph 1) showed significant differences among most of the studied fig varieties. The fig skin colour is an attribute that has a direct effect on consumer acceptance (Sortino et al., 2017). Significantly the highest score for skin colour was obtained in 'Nero Rosso' (4.50), whereas for the inner colour descriptor the highest score was reached by 'Šaraguja' samples (with the maximum score of 5.00).



Graph 1. Spider plot of sensory profile of 8 fig varieties. Statistical differences were set at $p < 0.05$ (*), $p < 0.01$ (**) and $p < 0.001$ (***). Absence of superscript indicates no significant differences.

Grafikon 1. „Spider plot“ senzornog profila 8 sorata smokve. Statističke razlike postavljene su na $p < 0,05$ (*), $p < 0,01$ (**) i $p < 0,001$ (***). Odsutnost oznake ukazuje na nepostojanje značajne razlike.

Furthermore, 'Šaraguja' and 'Tiger' varieties reached the best scores for the parameters "intensity of taste", "fig odour" and "fruity flavour". One of the most commonly produced varieties in Croatia, 'Petrovača bijela', has scored the highest score for "juiciness" (4.10), although no significant differences were found for this parameter (Graph 1).

The consumer decision is mostly based on general fruit appearance and their previous experience with that specific product (Fernández-Serrano et al., 2021). In general, the information on different fruit properties (what can help in decision to purchase it) can be found to a greater or lesser extent on fruit packages and/or fruit information tables on the market.

However, the information on fruit sensory properties is often lacking on the products, in Croatia being rarely used. The information on each fruit species and in particular on each varieties' sensory characteristics could be an important factor in the consumer's decision on purchasing it. In a study done by Fernández-Serrano et al. (2021) on 394 consumers the "sensory characteristics", among others like "production method", "harvest date", "percentage of the price received by the farmer", was identified as one of the major information gaps due to the unavailability of these labels for a high percentage of consumers. Irrespective of fruit type, according to consumers, sensory labels should include information on "sweetness" and "flavour intensity" (Fernández-Serrano et al., 2021).

Herein obtained results might be useful for creating specific sensory terminology regarding varieties grown in Croatia that can lead to better communication between producers, retailers, and consumers.

Conclusions

There was a notable difference among studied varieties based on sensory and pomological properties in the present study. Fresh fruits of varieties 'Šaraguja' and 'Tiger' reached the highest scores for the intensity of taste, fig odour, and flavour, and, also, for the fruity odour and flavour, compared to all the others. The highest values regarding fruit thickness and width were recorded from the variety 'Petrovača bijela', length from the variety 'Šaraguja', while 'San Martino' variety had the fruits of the biggest weight. The variety 'Miljska' displayed the lowest values in all the observed pomological parameters.

The importance of the pomological description and observation of sensory parameters of fresh figs lies in permitting the producers to decide the potential of each variety based on consumer preferences and acceptability.

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Izvorni znanstveni rad

Pomološka i senzorna svojstva osam različitih sorata smokve u Hrvatskoj

Sažetak

Smokva (*Ficus carica* L.) je voćna vrsta koja se tradicionalno uzgaja u primorskoj Hrvatskoj. Nakon nekoliko godina niske komercijalne vrijednosti ove kulture, čini se da interes za potrošnjom i uzgojem smokava u ovoj regiji počinje rasti. Jedan od načina promicanja konzumacije smokava je prepoznavanje sortnih senzornih svojstava, sa ciljem usklađivanja sklonosti potrošača. Iz tog razloga cilj ovog istraživanja bio je procijeniti senzorna i pomološka svojstva svježih plodova pet crnih ('Šaraguja', 'Miljska', 'Crnica', 'Piombinese', 'Nero Rosso') i tri bijele ('Petrovača bijela', 'Tiger', 'San Martino') sorte smokve uzgojene u Hrvatskoj. Smokve su ubrane s pet godina starih stabala u pokusnom smokviku u Istarskoj županiji (Hrvatska). Uočene su značajne razlike u svojstvima izgleda, mirisa, arome i okusa. Svježi plodovi smokve sorti 'Šaraguja' i 'Tiger' postigli su najviše ocjene za intenzitet okusa, mirisa i arome smokve u odnosu na sve ostale sorte. Najviše vrijednosti debljine i širine ploda utvrđene su za sortu 'Petrovača bijela', širine za sortu 'Šaraguja', dok je sorta 'San Martino' imala plodove najveće mase. Sorta 'Miljska' imala je najmanje vrijednosti za sva istraživana pomološka svojstva. Važnost pomološkog opisa i istraživanja senzornih svojstava svježih smokava leži u omogućavanju proizvođačima da odluče o potencijalu svake sorte na temelju preferencija potrošača.

Ključne riječi: Svježi plodovi; *Ficus carica* L.; senzorne karakteristike; pomološka svojstva



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