short scientific article
received: 2005-06-07

UDC 633.852.73:582.931(497.5-Istra)

IDENTIFICATION AND CHARACTERIZATION OF AUTOCHTHONOUS OLIVE VARIETIES IN ISTRIA (CROATIA)

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ABSTRACT

With the aim of solving the confusion regarding the names of autochthonous olive varieties in Croatian Istria, their inventarization and identification was made. Morphological description of 64 olive trees was performed and samples were clustered in 6 potential variety groups with at least 14 different varieties.

Key words: olive, autochthonous varieties, morphological characteristics

IDENTIFICAZIONE E CARATTERIZZAZIONE DI VARIETÀ AUTOCTONE DI ULIVI IN ISTRIA (CROAZIA)

SINTESI

Allo scopo di dissolvere la confusione creatasi in merito ai nomi delle varietà autoctone di ulivi nell'Istria croata, gli autori hanno preparato l'inventario e l'identificazione di tali specie. L'articolo fornisce una descrizione morfologica di 64 alberi di ulivo. I campioni sono stati divisi in 6 potenziali gruppi con almeno 14 differenti varietà.

Parole chiave: ulivo, varietà autoctone, caratteristiche morfologiche

INTRODUCTION

Olive *(Olea europea* L.), the species characteristic of the Mediterranean landscape, includes a large number of varieties with significant phenotypic and genetic diverseness (Ziliotto *et al.*, 2002; Idrissi & Quazzani, 2003). In Croatia, olives are spread in all coastal regions, such as Istria, Kvarner, Dalmatia and their islands. The first historical records regarding olive growing in Istrian region date to the first century BC (Hugues, 1999). According to the latest official statistical data, about 11% of a total 2,432,653 olive trees in Croatia are cultivated in Istria (Central Croatian Bureau of Statistics, www.dsz.hr). Lately, the traditional extensive olive cultivation methods were replaced with intensive modern growing technology, making olive growing an attractive trend in agriculture. Despite a large biological variability and economic potential, there has been no systematic inventarization and description of local olive varieties in Croatian Istria. The first attempt to describe and classify local varieties following his own original system was made by Hugues in 1903 (Hugues, 1999).

Olive cultivars show a broad range of genetic variability for a large number of agronomic traits, including oil quality and content, fruit size and degrees of adaptability to environmental conditions. The ability to discriminate olive cultivars and to estimate genetic variability is an important factor for a better management of genetic resources and successful breeding programs. With this aim, we started with a few research projects focused on the most important aspects of olive growing and oil production (Peršurić *et al.*, 2004). The project named "Valorisation of autochthonous olive varieties in Istria" comprises identification, characterization, clonal selection and certificated seedlings production.

Olive trees are spread along the entire Istrian peninsula (Central Croatian Bureau of Statistics, www.dsz.hr), mostly in coastal zone around the districts of Vodnjan, Poreč, Buje, Brtonigla, Umag, Rovinj and Pula (Fig. 1). The most frequent varieties are traditionally named: *buža, rosulja, bjelica* and *crnica*.

In this paper we present the results of a three-year investigation, including morphological descriptions of 64 olive accessions and preliminary variety determination.

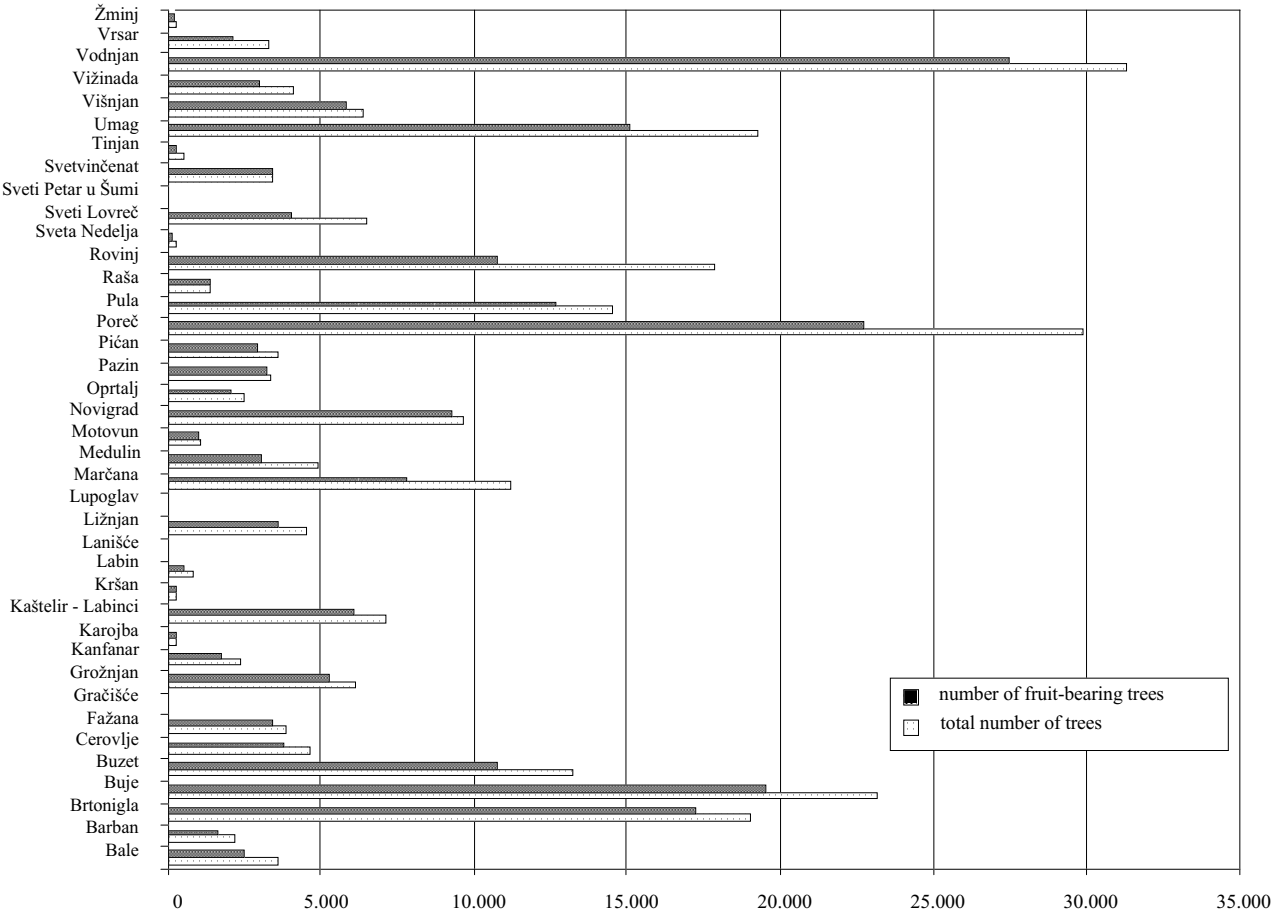

Fig. 1: Olive trees distribution in Istrian County.
Sl. 1: Razširjenost oljk v Istri.

Tab. 1: List of analysed morphological characteristics according to International Olive Oil Council (COI).
Tab. 1: Seznam analiziranih morfoloških značilnosti po priporočilih Mednarodnega sveta za olivno olje (COI).

Analysed morphological characteristics	Category
LEAF (2 characteristics)	
Form	1. elliptic
	2. elliptic-lanceolate
	3. lanceolate
Curvature	1. hyponastic
	2. flat
	3. epinastic
	4. helicoidal
INFLORESCENCE (2 characteristics)	
Length	1. short
	2. medium
	3. long
Number of flowers	1. scarce
	2. medium
	3. high
FRUIT (9 characteristics)	
Shape	1. spherical
	2. oval
	3. elongated
Symmetry	1. symmetrical
	2. weakly asymmetric
	3. asymmetrical
Position of maximum transversal diameter	1. towards base
	2. central
	3. towards apex
Shape of apex	1. pointed
	2. rounded
Shape of base	1. truncated
	2. rounded
Mamelon	1. absent
	2. weakly present
	3. evident
Presence of lenticels	1. sparse
	2. numerous
Dimension of lenticels	1. small
	2. large
Ripeness start	1. from base
	2. uniform
	3. from apex
ENDOCARP (10 characteristics)	
Shape	1. spherical
	2. oval
	3. elliptic
	4. elongated
Symmetry (position A)	1. symmetrical
	2. weakly asymmetric
	3. asymmetrical
Symmetry (position B)	1. symmetrical
	2. weakly asymmetrical
Position of maximum transversal diameter	1. towards base
	2. central
	3. towards apex
Apex	1. pointed
	2. rounded
Base	1. truncated
	2. pointed
	3. rounded
Surface	1. smooth
	2. rugose
	3. scabrous
Number of fibrovascular grooves	1. reduced
	2. medium
	3. elevated
Distribution of fibrovascular grooves	1. uniform
	2. grouped around suture
Bill of apex	1. without mucro
	2. with mucro

MATERIALS AND METHODS

Plant material was collected in the entire Istrian area, after accurate field observations and study of distribution density on the territory. Chosen accessions represent the old and most valuable cultivars, traditionally named *buža, crnica, karbonaca, karbonera, črnica, rosulja, rosinjola, rošola, istarska bjelica, belica, bilica, bjankera, domaća, plominka* and others. Morphological description was performed on 64 olive trees according to International Olive Oil Council standards (COI, 1997). Altogether, 23 characteristics of leaf (2), inflorescence (2), fruit (9) and stones (10) were measured during three years (Tab. 1). Some characters like inflorescence length and flower number can vary due to exogenous factors (environment, cultivation technology, etc). In case of uncertainty in category defining, measuring was repeated on the larger sample and prevailing category was taken under consideration.

The data have been analysed using the STATISTICA 5.0 program. Accessions were grouped by cluster analysis using the Unweighted pair-group method (UPGMA) with the Squared Euclid distance.

RESULTS AND DISCUSSION

Results obtained by morphological description enabled us to partially clarify the actual confusion as to the naming of various varieties. Accessions were grouped in 6 main clusters with different potential varieties (Fig. 2, Tab. 2). The first cluster contained the largest number of samples described as istarska bjelica, bjelica, buža, črna, črnica and plominka. Samples belonging to bilica, črna and črnica were grouped in the second cluster, karbonaca and drobna in the third, belica, karbonera, bilica, črnica and rosinjola in the fourth cluster. One sample was set apart and considered as separate variety named moražo. In the sixth cluster, a few potential varieties, all named duga were grouped.

So far, the analyses assumed 14 potential varieties, but considering that there are significant differences even between accessions, it can be expected that the number of varieties could be higher. Appropriate names and main variety characteristics are given in Table 3. Numerous synonyms indicating local varieties that caused present confusion in their naming are not only the consequence of a millennium long olive presence in Istria but also of phenotypic variability between genetically similar individuals, due to environmental conditions.

During data processing, problems with similar variety names, homonyms and synonyms have emerged. Despite some very similar local variety names, such as istarska bjelica, bilica, bjelica and belica, they showed different morphologic profiles and were clustered in distinctive groups, supporting our assumption about differ-

Tab. 2: List of investigated accessions with potential variety classification.
Tab. 2: Seznam preučevanih oljk s klasifikacijo potencialnih sort.

Accession numbers	Potential variety
1-5	Istarska bjelica
6	Non defined
7-10	Bilica
11-12	Duga
13-15	Belica
16-17	Bjelica
18-21	Buža
22-27	Črna
28-31	Duga
32-33	Buža
34-35	Črnica
36	Buža
37-44	Črnica
45	Karbonera
46-49	Karbonaca
50-52	Črnica
53-54	Drobna
55	Moražo
56	Karbonaca
57-60	Plominka
61-64	Rosinjola

ent varieties. The same situation was observed with respect to črnica, crnica, karbonera and karbonaca. Aimed at solving homonym problems with different accessions named buža we left the traditional name only for accessions from the south areas of Istrian County (Vodnjan, Bale), where they are grown mostly in old plantations, and chose new names for homonyms at other localities. On the other hand, some differently named accessions seemed to be synonyms, and were classified under the same name.

This inventarization and preliminary classification provided us a base for further research. Subsequent morphological investigations and DNA analyses will additionally clarify the so far reached considerations.

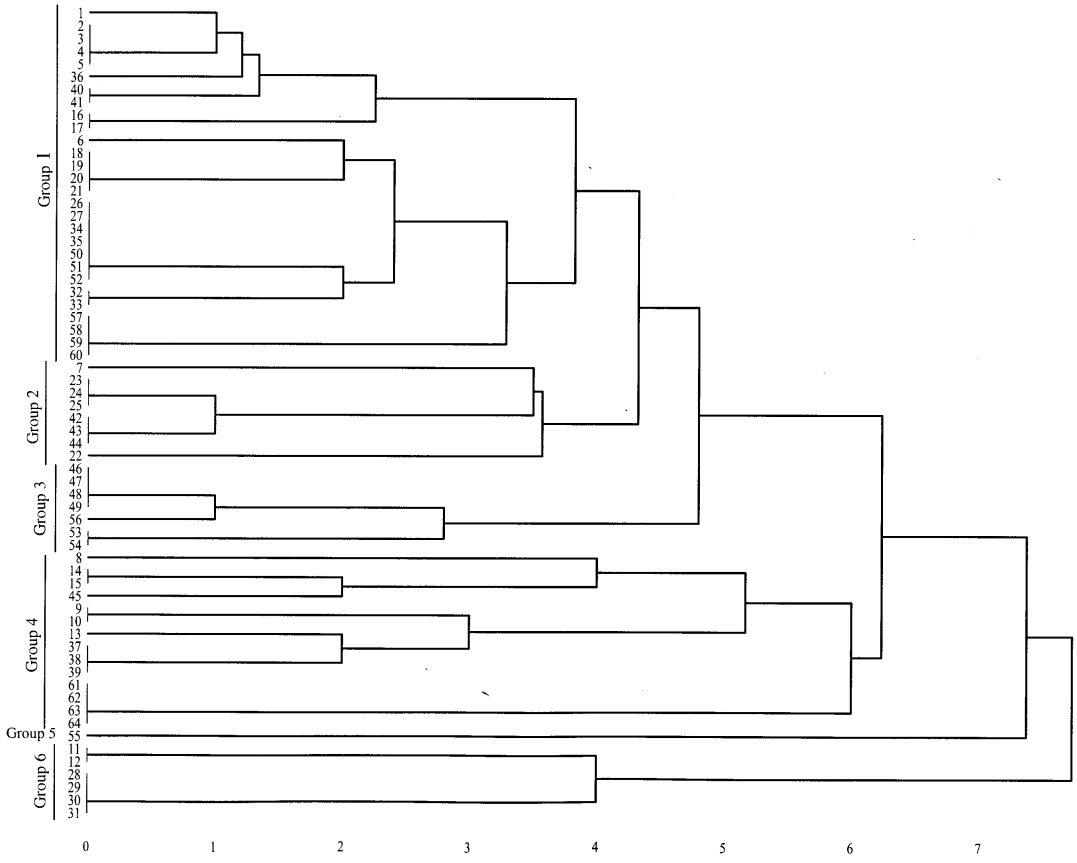

Fig. 2: Dendrogram obtained from the selected 23 morphological parameters, UPGMA method with Squared Euclidean distance. Accessions are indicated with numbers from 1 to 64.
Sl. 2: Dendrogram, napravljen na osnovi 23 izbranih morfoloških parametrov in metode UPGMA s kvadrirano Evklidovo distanco. Oljke so označene s številkami od 1 do 64.

Tab. 3: Morphological description of main olive varieties.
Tab. 3: Morfološki opis glavnih oljčnih sort.

Potential variety	Main morphological characteristics			
	Leaf	**Inflorescence**	**Fruit**	**Stone**
Bjelica	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: uniform	Shape: elliptic Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: rugose
Buža	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: spherical and symmetrical Max diameter: central Ripeness start: uniform	Shape: oval Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: scabrous
Duga (buža)	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and weakly asymmetrical Max diameter: central Ripeness start: from apex	Shape: oval Max diameter: central Shape at apex: pointed Shape of base: rounded Surface: rugose
Črna (buža, karbonera, domaća, morgaca)	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: uniform	Shape: oval Max diameter: central Shape at apex: rounded Shape of base: pointed Surface: rugose
Črnica	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: from base	Shape: oval Max diameter: towards apex Shape at apex: rounded Shape of base: rounded Surface: scabrous
Karbonera (crnica)	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: uniform	Shape: oval Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: rugose
Drobna	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: spherical and symmetrical Max diameter: central Ripeness start: from apex	Shape: spherical Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: scabrous
Karbonaca	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: from apex	Shape: oval Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: scabrous
Moražo	Shape: elliptic Curvature: flat	Number of flowers: scarce	Shape: spherical and symmetrical Max diameter: central Ripeness start: uniform	Shape: spherical Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: rugose
Bilica	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: from base	Shape: elliptic Max diameter: towards apex Shape at apex: rounded Shape of base: rounded Surface: scabrous
Belica	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: from base	Shape: oval Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: rugose
Rosinjola	Shape: elliptic Curvature: flat	Number of flowers: scarce	Shape: oval and symmetrical Max diameter: central Ripeness start: uniform	Shape: elliptic Max diameter: towards apex Shape at apex: rounded Shape of base: pointed Surface: scabrous
Plominka	Shape: elliptic-lanceolate Curvature: flat	Number of flowers: scarce	Shape: spherical and symmetrical Max diameter: central Ripeness start: from apex	Shape: oval Max diameter: central Shape at apex: rounded Shape of base: pointed Surface: rugose
Istarska bjelica (bjankera)	Shape: elliptic-lanceolate Curvature: flat and helicoidal	Number of flowers: scarce	Shape: spherical and symmetrical Max diameter: central Ripeness start: uniform	Shape: elliptic Max diameter: central Shape at apex: rounded Shape of base: rounded Surface: rugose

CONCLUSIONS

The carried out research revealed significant biological diversity of olive varieties in Istrian County. The obtained results indicate their large biological and economic potential. Our classification and description constitute the basic elements for the preservation of old olive varieties as important national biological heritage. Further morphological description, confirmed by molecular investigations and additional chemical analyses of oil, will contribute to a better management of genetic resources as well as to registration of founded varieties in national and international databases.

ACKNOWLEDGEMENTS

The present paper was prepared within the framework of the project "Valorisation of autochthonous olive varieties in Istria", financed by the Croatian Ministry of Science, Education and Sports. Thanks to the great team performing endless measurements: Boris Žigante, Živka Kovačić, Dario Lindi, Almir Mešić and Robert Tercolo.

IDENTIFIKACIJA IN OZNAČBA AVTOHTONIH SORT OLJK V HRVAŠKI ISTRI

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POVZETEK

Na Istrskem polotoku gojijo različne sorte oljk. Z namenom, da se odpravi zmeda pri imenovanju olj̆nih sort v hrvaški Istri, je bila opravljena temeljita inventarizacija in identifikacija teh sort, in sicer v okviru dolgoročnega raziskovalnega projekta, ki se osredotoča na ohranjanje in valorizacijo avtohtonih sort oljk. Avtorji so v zadnjih treh letih napravili morfološki opis 64 oljk in zbrane podatke uporabili v postopku grozdičaste analize. Vzorce so zbrali v 6 potencialnih sortnih skupinah z najmanj 14 različnimi sortami. Nadaljnje raziskave, vključno z morfološkimi in genetskimi analizami, bodo poglobile vpogled v biološko bogastvo oljk, ki doslej še ni bilo raziskano.

Ključne besede: oljka, avtohtone sorte, morfološke značilnosti

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