



# Diversity among Croatian common bean (*Phaseolus vulgaris* L.) landraces



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## Abstract

Common bean (*Phaseolus vulgaris* L.), once known as the poor’s man meat, has recently gained attention as functional food being a valuable source of high-quality protein. In Croatia common bean is traditional, but unfortunately, neglected crop. It is cultivated in low input production systems. The landraces are adapted to local environments and growing conditions, showing a great variability in morphological and agronomic traits. In order to assess morphological diversity and protein content we analysed 300 Croatian common bean landraces. The accessions grouped into seven clearly defined clusters representing distinct morphotypes commonly known by their traditional names: *Trešnjevac*, *Zelenčec*, *Biser*, *Dan noć*, *Puter*, *Tetovac* and *Kukuruzar*. The protein content in raw seeds ranged from 16.69 to 27.88%. The results will allow the identification of most promising landraces to be used for breeding purposes.

Keywords: common bean, landrace, protein content, morphological diversity

## Introduction

Common bean (*Phaseolus vulgaris* L.) is an important grain legume for human consumption worldwide. Because of its high quality protein content, common bean is often use as meat substitutes especially for people in developing countries (Romero-Arenas et al., 2013). On the other hand in developed countries, common bean gained attention as functional food because of its high protein, fibre, vitamins, minerals and carbohydrates composition (Câmara et al., 2013).

In Croatia common bean is traditional, but unfortunately, neglected crop. The long traditional of common bean cultivation in Croatia has enabled the development of many landraces adapted to local environments and growing conditions. They are cultivated in low input production systems almost exclusively by small farmers. The landraces usually have local names and show a great variability in morphological (Fig. 1) and agronomic traits. The aim of this study was to analyze the morphological diversity of 300 accessions of Croatian common bean landraces as well as to determine crude protein content in raw seeds.

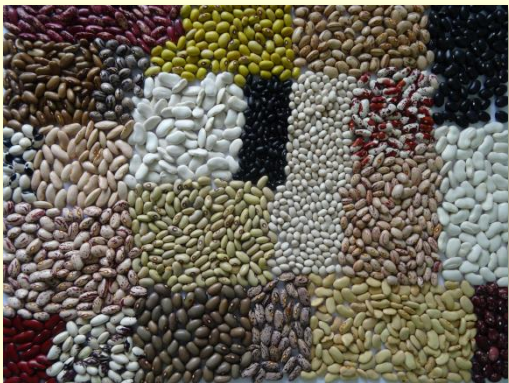


Fig. 1. Morphological variability of Croatian common bean landraces



Fig. 3. Field trial

## Materials and methods

The research material included 300 accessions of common bean landraces collected from all the parts of Croatia (Fig. 2). A field experiment was set up at the University of Zagreb, Faculty of Agriculture, Department of Seed Science and Technology in 2014 (Fig. 3).

Morphological analysis was carried out using the descriptors list for common bean (Phaseolus Database; available at <http://www.genbank.at/en/ecpgr-phaseolus.html>)

A total nitrogen content was determined using Kjeldahl method. Crude protein content was obtained by formula: nitrogen content in seed x 6.25.

The univariate analyses of variance using PROC GLM in SAS (SAS Institute Inc., 2011) with a post hoc Tukey's multiple comparison test was used to compare mean nitrogen and protein content among seven traditional cultivars.

## Results and Discussion

Based on morphological traits, out of 300 accessions 278 were assigned to seven clusters representing distinct morphotypes indicated by their traditional names: *Trešnjevac*, *Zelenčec*, *Biser*, *Dan noć*, *Puter*, *Tetovac* and *Kukuruzar*. The rest of accessions represent different morphotypes with a limited number of accessions, and were omitted from further analysis.

The total nitrogen content of the raw seeds ranged from 2.67 to 4.46 % while protein content ranged from 16.69 to 27.88 %. The mean of the nitrogen content was 3.44 % ± 0.02 and of crude protein content 21.52 % ± 0.13.

The results presented in Table 1 show that Croatian common bean accessions representing traditional cultivars *Dan noć* (3.71 % ± 0.14) and *Kukuruzar* (3.70 % ± 0.04) had the highest total nitrogen content, while *Dan noć* (23.20 % ± 0.85), *Kukuruzar* (23.14 % ± 0.26) and *Tetovac* (22.31 % ± 0.34) had the highest total protein content. The values of crude protein content of the 278 Croatian common bean traditional cultivars are in agreement with values reported in other published studies. Aliu et al. (2014) reported that the protein content in seeds of Kosovo common bean landraces ranged from 20.43 to 23.83 %. Analyzing common bean cultivars grown in Mexico and Brazil Mojica and Gonzalez de Mejía (2015) found that the protein content ranged from 19.0 to 27.2 % seeds, while in the study of Vidigal Filho et al. (2011), the protein content in Brazilian common bean landraces ranged from 11.5 to 36 % depending on the environmental factors, geographical location and growing season.

Croatian common bean landraces differ substantially in nitrogen and crude protein content and thereby represent an important source of diversity to be used in future association mapping study aimed at elucidating the genetic bases of bioactive nutrient content in common bean.



Fig. 2. Locations of sampled accessions of common bean on the map of Croatia

Table 1. Nitrogen (%N) and crude protein content (%Proteins) of seven Croatian traditional cultivars							
No	Cultivar	n	%N		%Proteins		
1	<i>Dan noć</i>	8	3.71 ± 0.14	A*	23.20 ± 0.85	A	
2	<i>Kukuruzar</i>	43	3.70 ± 0.04	A	23.14 ± 0.26	A	
3	<i>Tetovac</i>	27	3.57 ± 0.05	AB	22.31 ± 0.34	A	
4	<i>Puter</i>	17	3.43 ± 0.07	ABC	21.41 ± 0.45	AB	
5	<i>Trešnjevac</i>	128	3.40 ± 0.03	ABC	21.25 ± 0.22	AB	
6	<i>Biser</i>	18	3.27 ± 0.06	BC	20.43 ± 0.38	B	
7	<i>Zelenčec</i>	37	3.14 ± 0.03	C	19.64 ± 0.21	B	

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## Acknowledgements

This work has been fully supported by Croatian Science Foundation under the project UIP-11-2013-3290.