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Comparison of tannin concentration in young plants of common and tartary buckwheat

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ABSTRACT

The aim of this study was to compare the tannin concentration of young common and tartary buckwheat plants. Tannins are a group of polyphenols, formed as secondary metabolites in plants. Tannins are known as antioxidants and have chemoprotective potential. They occur in many fruits and drinks, such as tea, beer, wine and juices, making them significant in human nutrition. Concentration of tannins was high in upper leaves of tartary buckwheat and in young plants of common buckwheat cv. Bosanka. There are interesting differences between tannin concentration in Bosanka young plants and tartary and Darja buckwheat young plants.

Key words: common buckwheat, tartary buckwheat, tannins, fertilization

IZVLEČEK

PRIMERJAVA KONCENTRACIJE TANINOV V MLADIH RASTLINAH NAVADNE IN TATARSKE AJDE

Namen raziskave je primerjava koncentracije tanina v rastlinah navadne in tatarske ajde. Tanini spadajo v skupino polifenolov in so sekundarni produkti metabolizma rastlin. Tanini so močni antioksidanti in delujejo zavirajoče proti nekaterim vrstam raka. Najdemo jih v sadju, čaju, vinu in sokovih, raziskava taninov je pomembna za prehrano ljudi. Koncentracija taninov je bila visoka v zgornjih listih tatarske ajde in mladih rastlinah Bosanke. Pomembne so razlike med koncentracijami taninov pri mladih rastlinah Bosanke in mladih rastlinah tatarske ajde ter Darje.

Ključne besede: navadna ajda, tatarska ajda, tanini, gnojenje

1 INTRODUCTION

Tartary buckwheat growing

Common buckwheat is grown in many countries around the world, in Asia, Europe and South Africa, in Canada, USA, Brazil and in some other places. A large variety of buckwheat foods are being traditionally produced for centuries. Dishes made from buckwheat seed are generally classified in two groups, flour dishes and groats dishes. Other products made from buckwheat are buckwheat floral honey, green buckwheat tea, buckwheat sprouts, and fresh green plant parts used as a vegetable. Buckwheat herb is especially known as a rich source of tannins and other polyphenols (Kreft et al.

2002; Kreft et al., 2006, Kalinova et al., 2006; Kalinova & Vrchotova, 2009).

In Europe buckwheat has been grown for centuries and is now, one of the important alternative crops, suitable for ecological growing, without the use of fertilizers or pesticides. It is used for flour and groats products in central and eastern Europe. For many years, cultivation of buckwheat declined, but recent interest in old, traditional foods and a re-evaluation of typical regional products has led to a resurgence in its cultivation.

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Common buckwheat is grown in all parts of Slovenia and in several regions of Bosnia-Herzegovina. Common and tartary buckwheat was grown in Bosnia-Herzegovina at least before the year 1940 but, since about 1980, this mainly ceased. In Europe, it is traditional growing of tartary buckwheat mostly spread in the cross border region Islek – which covers northern Luxemburg, the Westeifel (Germany) and the border area of the German-speaking part of Belgium. In Bosnia-Herzegovina tartary buckwheat was grown in past ten or twenty years at least in a small extent in the mountain plains south and north of Sarajevo, up to the altitude of about 1000 m (See photo on the title page of this journal in issue 93-3, 2009). This crop is in Bosnia-Herzegovina now coming back because of the interest for healthy food.

Health importance of tannins in the diet

The cellular injury caused by oxidative stress and excess of free radicals has been associated with aging and linked to clinical disorders, including cancer, heart disease, and liver damage. Plant derived polyphenols are known for their strong antioxidant potency (Bialonska et al., 2009 b). Tannins are a group of polyphenols that are formed as secondary plants metabolites. They occur in human diet, such as tea, beer, wine and juices, making them significant in human nutrition (Frazier et al., 2010).

The antimicrobial activity of tannins is associated with capability to form stable complexes with proteins, starch, and physiological metals, thereby disturbing the metabolic activity of bacterial enzymes, nutrient availability, and functionality of biological membranes (Bialonska et al., 2009 a).

The antioxidant properties of tannin are well documented, but the interactions between tannins and proteins is fundamental for their biological activities. Therefore, a better understanding of this interaction will enable clearer explanations for the biological and pharmacological activities of tannin. Frazier et al. (2010) documented that interactions with proteins were exothermic and involved multiple binding sites on the protein.

Bialonska et al. (2009 a) reported a potent antioxidant activity of tannin components from pomegranate extracts. The consumption of pomegranate products leads to a significant accumulation of ellagitannins in the large intestines, where they interact with complex gut bacteria. Results showed that pomegranate byproducts and punicalagins inhibited the growth of pathogenic clostridia and *Staphylococcus aureus*. Awika et al. (2009) reported that tannin containing sorghum extracts have strong chemoprotective potential (cancers in the gastrointestinal tract, especially esophageal cancer).

The antioxidant activity of buckwheat tannins are not studied yet, therefore the investigations of buckwheat tannins are important.

The aim of this study was to compare the tannin concentration in green parts of common and tartary buckwheat, and to evaluate their value as possible functional foods.

2 MATERIALS AND METHODS

Material: Plants were grown at the experimental field of Faculty of Agriculture and Food Science, University of Sarajevo, in Sarajevo in 2008. Domestic cv. Bosanka, from Bosnia, Slovenian buckwheat cv. Darja and tartary buckwheat from Luxemburg were used in a study, performed in Sarajevo in 2008. Plants were grown without fertilization, or with a standard NPK fertilization; namely granulated mineral fertilizer, N:P:K in relation 4 : 12 : 20, amount 50g/m². Samples for analyses were collected from young plants (two proper leaves) and at the beginning of flowering separately for

lower and upper leaves of the plant. **Determination of tannin:** Total tannin contents were determined spectrophotometrically using vanillin-HCl reagent, as previously reported (Kreft et al., 2002). Each sample was analyzed in triplicate.

The data were evaluated by multifactor ANOVA (Statgraphics Version 4) and significance accepted at $P < 0.05$.

3 RESULTS AND DISCUSSION

Results presented in Fig. 1 show that concentration of tannins was high in upper leaves of tartary buckwheat and low in young plants of Darja. This probably depends on higher impact of sunshine radiation on

young plants and on higher positioned leaves of flowering plants.

Results in Bosanka are different. Here the tannins concentration are high in young plants and not in upper leaves as we observed in tartary buckwheat and Darja

buckwheat. The concentration of tannins in Darja was lower in comparison to Bosanka and tartary buckwheat.

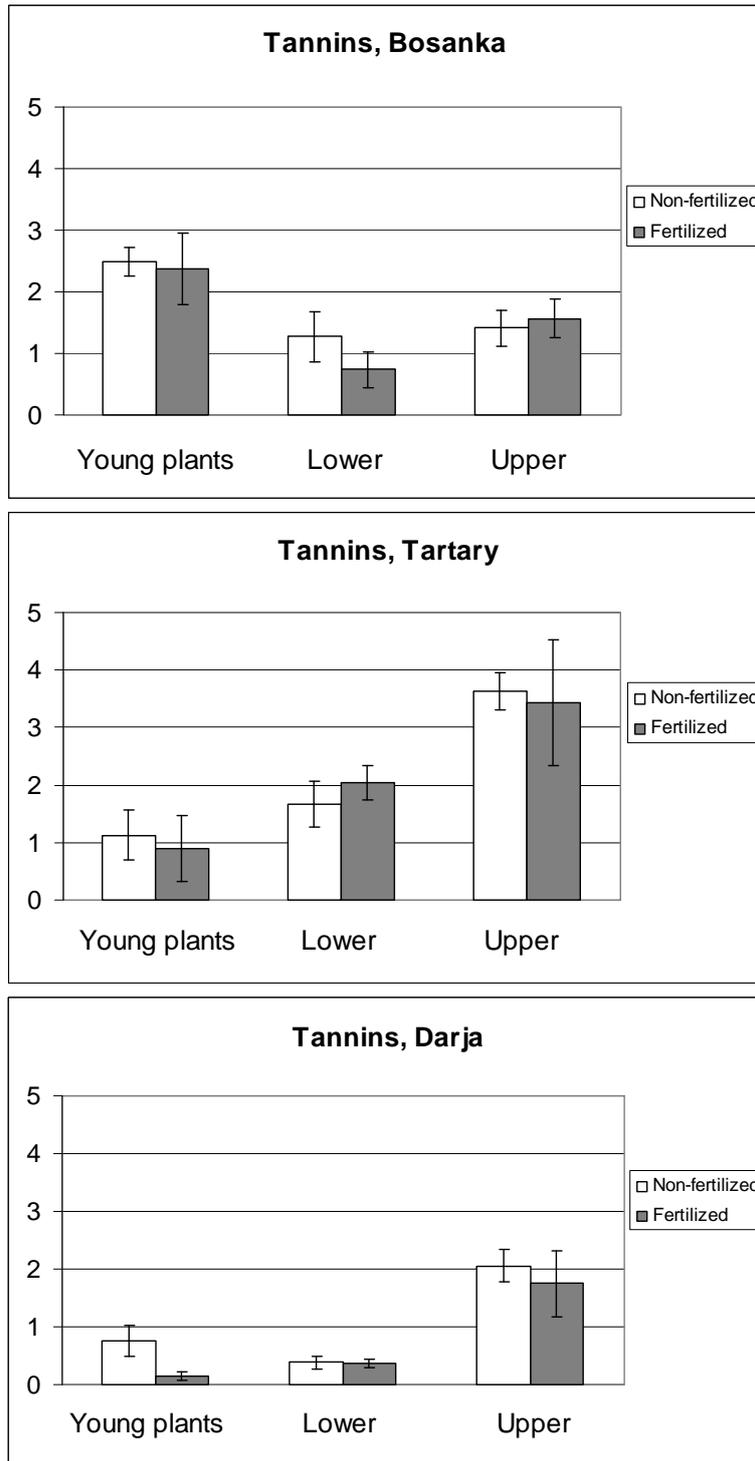


Fig. 1. Tannins in young plants (two leaves), lower and upper leaves in flowering Bosanka - Bosnia domestic common buckwheat variety, tartary buckwheat and common buckwheat Darja; without and with NPK fertilization, respectively (g in 100 g of dry matter).

Fertilisation had no effect on the concentration of studied substances.

We may conclude that fertilization with standard NPK fertilization had no clear impact on the concentration of tannins in buckwheat samples. Studied tartary buckwheat in the upper, light exposed leaves had higher concentration of tannins in comparison to

common buckwheat. Except in common buckwheat cv. Bosanka, young plants had lower concentration of tannins in comparison to the upper leaves of flowering plants. In any way, different varieties of buckwheat react differently on environmental factors, influencing the concentration of tannins in green parts of buckwheat plants.

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