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Short Communication

Comparison of Tocopherol Contents in Adzuki Bean (*Vigna angularis*) Genotypes Traits

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Abstract

The objective of this study was to determine the tocopherols concentration of 150 adzuki bean [*Vigna angularis* (Willd.) Ohwi and Ohashi] genotypes. Adzuki beans a darker seed coat had a 4% higher total tocopherol concentration than light colored seeds, seed color also impact δ-tocopherol and γ-tocopherol concentrations. Smaller seeds had a 3% higher total tocopherol concentration than large seeds, differences among seed size groups being also observed for γ-tocopherol and α-tocopherol. Seeds from Japan and China had a 10% greater δ-tocopherol concentration, while seeds from Korea had a 7% higher γ-tocopherol concentration. Improved adzuki bean genotypes had a higher total tocopherol concentration compared to wild and landrace genotypes; differences between improvements status groups being observed for tocopherols except α-tocopherol. This study demonstrates that seed color, seed size, origin and improvement status impact adzuki bean tocopherol concentrations. © 2013 Friends Science Publishers

Keywords: *Vigna angularis*; Adzuki bean seeds; Tocopherols; Genotypes; Gas chromatography

Introduction

Adzuki bean [*Vigna angularis* (Willd.) Ohwi and Ohashi] is a leguminous crop, which use is concentrated in Asia (Yoshida *et al.*, 2008). Boiled adzuki bean juice is commonly used locally as a folk remedy to prevent health-related issues associated with aging (Maruyama *et al.*, 2008). The term 'vitamin E', which was first introduced by Evans and Bishop in 1922 as a dietary factor, is used to describe a group of naturally occurring compounds that include tocopherols and tocotrienols (Seppanen *et al.*, 2010). Tocopherols are free radical scavengers that may reduce the risk of certain cancers, cardiovascular diseases, and other neurodegenerative diseases such as Alzheimer's and Pakinson's (Kamal-Eldin and Appleqvist, 1996). Tocopherols are mostly present in vegetable oils, meats, and green parts of higher plants, while tocotrienols mainly exist in the bran fractions of certain seeds and cereals (Bauerfeind and Desai, 1977).

In this study, the tocopherols concentration in 150 adzuki bean genotypes was determined by gas chromatography (GC). Although adzuki beans are a valuable crop frequently consumed in Asia, there is limited information on their concentration of health-beneficial compounds including tocopherols.

Materials and Methods

A total of 150 adzuki bean [*Vigna angularis* (Willd.) Ohwi and Ohashi] genotypes obtained from the genebank of the RDA (Rural Development Administration, Suwon, Gyeonggi-Do, Korea) were classified into groups according to color (using the Hunter color scale; L: lightness (0 = black, 100 = white), a (-a = greenness, +a = redness), b (-b = blueness, +b = yellowness) using by a Minolta Color Difference Meter (Model CR-310, Minolta Co. Ltd, Osaka, Japan) and 100 seed weight [small (< 12 g), medium (12-18 g), and large (> 18 g)], origin (i.e., China, Japan and Korea), and improvement status (i.e., wild, landrace and improved).

Tocopherol analysis was conducted on duplicate samples from each adzuki bean genotype using a slightly modified version of the protocol of Lee and Park (2004). Data were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure in SAS (SAS Institute, 2000). Comparisons between means were made at a 0.05 probability level when ANOVA indicated model and treatment significances.

Results and Discussion

Differences in tocopherols concentrations were observed for all groups defined (i.e., color, seed size, origin and improvement status) (Table 1). Differences between seed color groups were observed for δ-tocopherol, γ-tocopherol, and total tocopherol. Seeds of color groups A (L < 30, +a, +b) and B (L < 30, +a, -b) according to Hunter's scale had a 4% greater total tocopherol concentrations than those in

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group C (L>50, +a, +b) and D (L>50, +a, -b). They also had a 13% greater concentration of δ-tocopherol than those of group D, and 11% greater γ-tocopherol concentration than those of group C. This study indicated that tocopherol concentration of adzuki beans showed higher in dark colored seeds.

Differences among seed size groups were observed for γ-tocopherol, α-tocopherol, and total tocopherol. Small adzuki bean seeds had a 3% greater total tocopherol concentration than medium-sized seeds. Smaller seeds also had 14 and 2% greater concentrations of γ-tocopherol and α-tocopherol, respectively than large-and medium-sized seeds.

Differences among genotypes of different origins (i.e., Korea, Japan and China) were observed for γ-tocopherol and α-tocopherol. Adzuki bean genotypes from Korea had a 10% higher δ-tocopherol concentration than those from Japan. Genotypes from Korea also had a 2% higher γ-tocopherol concentration than those from Japan and China.

Improvement status also had an impact on all tocopherols except α-tocopherol. Wild and Improved genotypes had a 4% greater total tocopherol concentration compared to landrace genotypes. Improved genotypes had higher concentrations of both δ-tocopherol and β-tocopherol, differences with wild and landrace genotypes being as large as 11%. Finally, wild genotypes had a 16% greater γ-tocopherol concentration than other groups.

Tocopherol concentrations we observed in adzuki beans contrast with results from previous studies. Indeed the few studies, which have reported on the tocopherol concentration in adzuki beans all reported negligible concentrations of α-tocopherol and β-tocopherol (Yoshida *et al.*, 2008). Differences could be attributed to differences in growing conditions, seed storage, or extraction methods, which all have been reported to affect tocopherol concentration and proportions in other legume species (Ching and Mohammed, 2001; Seguin *et al.*, 2009). Differences in tocopherol concentrations we observed among groups differing in seed coat color, seed size, origin, and improvement status were also reported for tocopherols and other health-beneficial compounds in soybean (Lee *et al.*, 2008). Overall, α-tocopherol concentrations we observed are in accordance with those previously reported in *V. sinensis* seeds (Ching and Mohammed, 2001).

Results from this study demonstrate that tocopherol concentrations of adzuki bean seeds are affected by seed color, seed size, origin and improvement status. Our results suggest that there is significant variation in tocopherol concentrations among adzuki beans genotypes, which implies that there is potential for genetic selection of specific tocopherols in this species.

Table 1: Tocopherol concentrations (μg g^{-1}) of adzuki bean genotypes differing in seed coat color, seed size, origin and improvement status

Trait	δ-tocopherol	β-tocopherol	γ-tocopherol	α-tocopherol	Total
Color					
A (108)	78.4 a	29.8	50.6 a	39.3	198.0 a
B (52)	76.3 b	29.7	49.0 a	39.3	194.3 a
C (102)	75.3 b	29.7	44.3 b	39.3	188.7 b
D (36)	68.6 c	29.7	49.1 a	39.7	187.1 b
Size					
Small (220)	75.8	29.7	49.5 a	39.5 a	194.4 a
Medium (60)	75.5	29.8	44.3 b	39.0 b	188.6 b
Large (20)	77.4	29.8	43.2 b	38.8 b	189.2 ab
Origin					
Korea (112)	72.0	29.8	51.4 a	39.8 a	193.0
Japan (122)	79.1	29.7	46.9 b	39.1 b	194.9
China (8)	79.0	29.9	49.3 ab	39.2 b	197.3
Improvement					
Wild (94)	74.8 b	29.7 b	53.7 a	39.5	197.7 a
Landrace (132)	76.1 b	29.7 b	46.1 b	39.5	191.3 b
Improved (10)	83.8 a	30.0 a	46.1 b	39.3	199.1 a

Number of genotypes evaluated is provided parentheses

Color groups defined using Hunter's scale (L, Lightness; a, Redness; b, Yellowness; A, L<30, +a, +b; B, L<30, +a, -b; C, L>50, +a, +b; D, L>50, +a, -b)

Size groups are defined based on the 100-seed weight (Small, <12 g; Medium, 12 to 18 g; Large, >18 g)

Means in a column followed by different letters are significantly different (P<0.05)

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