Chemical composition of the first crop of "white leaf tea" plants in Japan

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Summary

In Japanese four ‘white leaf tea’ plants, “Hoshinomidori, Kiraka, Yamabuki and Morokozawa”, values of leaf color and contents of free amino acids, catechins, and inorganic components in first flush were measured. Leaf color values of these ‘white leaf teas’ were greatly lower than that of normal green tea cultivar “Yabukita”. Contents of total free amino acids (TFA) of ‘white leaf teas’ were around two times higher than that of “Yabukita.” The contents of total catechins were lower in ‘white leaf teas’. In mineral contents, it was not observed a large difference between ‘green leaf tea’ and ‘white leaf teas’, such as in TFA. In addition, the leaf color of “Morokozawa” was changed from white yellow to green with keeping high TFA content, when the first flush were covered with a black cheesecloth (85% shading rate) during the growing period.

Introduction

It was reported that, first flushes of‘ white leaf tea’ cultivars, “Xiaoxueya and White leaf No.1”, their leaf color showed white yellow, and their contents of catechins were lesser but contents of free amino acid, especially theanine, were greatly higher than that of normal green tea cultivar (Du et al. 2006). In Japan, “Hoshinomidori and Kiraka” were well known as ‘white leaf tea’ cultivar, registered in 1981 and 2006, respectively. Also, there are two “white leaf tea” strains “Morokozawa and Yamabuki” in Shizuoka. These two cultivars and two strains are cultivated on a small scale. It was speculated that these Japanese ‘white leaf teas’ contained free amino acids at high level as Chinese ones, because the taste of these infusions were so good. But it has not been reported about these Japanese white leaf teas. In this present study, we compared the value of leaf color and contents of free amino acids, catechins, caffeine and inorganic components in Japanese ‘white leaf teas’, “Hoshinomidori, Kiraka, Morokozawa and Yamabuki”, to those of Japanese normal green tea cultivar “Yabukita”. Next, effect of shading on the leaf color and the chemical composition of “Morokozawa” were also examined.

Materials and methods

First flushes of “Hoshinomidori, Morokozawa and Yabukita” were harvested from Shizuoka Tea Research Center (Kikugawa city) at the optimum plucking time in 2009, and these flushes were manufactured by 2 kg-type machines according to standard ‘sencha’ processes. First crops of “Kiraka and Yamabuki” in 2009 were purchased from tea store in Shizuoka. These tea samples were ground into a fine powder. According to conventional methods, contents of TFA, catechins and caffeine were measured by HPLC (LC-10AT, Shimadzu). The contents of organic acids and inorganic cations were analyzed by ion chromatography (ICS2000, Dionex) and inductively coupled plasma atomic emission spectroscopy (SPS7800, Seiko), respectively.

For measurement of leaf color, first flushes of “Yabukita, Hoshinomidori and Morokozawa” in Shizuoka Tea Research Center, “Kiraka” in Fukuroi city and “Yamabuki” in Shimizu-ku, Shizuoka city were harvested and immediately their second leaf was used for the measurement by chlorophyll meter (SPAD-502, Konica Minolta).

Additionally, the leaf color and chemical composition of these tea plants were measured as mentioned above “Morokozawa and Yabukita” were covered a single layer of black cheesecloth (85% of shading rate) for growing period of first flushes.

Results and discussion

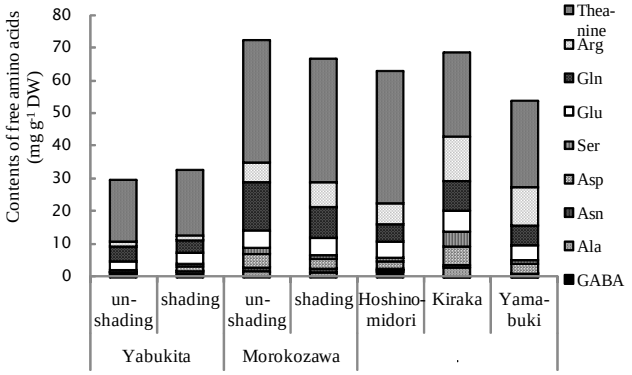
The leaf color of first flushes of Japanese 'white leaf teas' indicated white yellow (Table 1). Values of leaf color of them were around 3.5 to 9.5, extremely lower than that of green tea cultivar 'Yabukita'.

Table 1 Values of leaf color and contents of catechins and caffeine of first flushes

Plant type	Cultiver and strain name	treatment	value of leaf color*	catecins** (mg g^{-1} DW)					Caffeine** (mg g^{-1} DW)
				EC	ECg	EGC	EGCg	Total	
Green leaf tea	Yabukita	unshading	48.2±1.9	17±1.1	19.1±3.3	34.1±2.3	75.2±11.1	145.4±12.9	33.4±5.9
		shading	52.7±3.3	10.7±1.1	10.7±2.6	18.7±5.6	56.3±3.7	96.4±2.4	36.5±1.9
White leaf tea	Morokozawa	unshading	9.5±3.1	15.2±0.6	12.7±1.1	27.0±0.0	51±12.7	105.9±9.2	40.1±1.9
		shading	36.7±5.2	6.5±0.8	2.1±1.9	21.7±2.2	8.4±2.9	38.7±1.5	39.0±2.2
	Hoshinomidori	unshading	8.0±3.7	6.1±0.7	29.3±2	9.1±0.0	64±9.2	108.6±9.5	35.6±1.7
	Kiraka	unshading	3.5±2.0	10.4±1.5	16.9±4.3	17.2±1.8	62.1±8.4	106.5±15.1	31.6±1.3
	Yamabuki	unshading	8.0±3.5	13.5±0.4	24.9±6.4	24.7±1.4	78.5±8.8	141.6±17	34.3±0.3

*The data represents mean±SD (n = 10). **The data represents mean±SD (n = 3).

Contents of theanine, Arg, Gln, Glu, Asp, Ser, GABA of 'white leaf teas' were higher than those of 'Yabukita', resulting that these contents of TFA of 'white leaf teas' were around 2 times higher than that of 'Yabukita' (Fig. 1). Comparing to 'Yabukita', the rate of Arg of 'white leaf teas' was particularly increased, rather than that of theanine. Four catechins, epicatechin (EC), epicatechin gallate (ECg), epigallocatechin (EGC) and epigallocatechin gallate (EGCg) were measured, and the sum of them was shown as total catechins content (Table 1). Comparing to "Yabukita", contents of total catechins were lower in "Morokozawa, Hoshinomidori and Kiraka", but similar in "Yamabuki". Caffeine content was higher in "Morokozawa" but not in other three 'white leaf teas'. In potassium, calcium, magnesium, aluminum and manganese, amounts of former four elements were higher in 'white leaf teas' (data not shown). In addition, the effect of shading on first flushes of "Morokozawa" was examined. The leaf color values of "Morokozawa and Yabukita" were increased, but the degree of increment was larger in "Morokozawa", showing its color greenish (Table 1). This suggested that discolor of leaves of "Morokozawa" might caused by strong lighting. The shading didn't affected the content of TFA of "Morokozwa", while increased that of "Yabukita". Amount of catechins was decrease in both tea plants. It was suggested that the shading was a useful method for changing leaf color of "Morokozawa" to green with keeping contents of TFA at the same level.



These showed the characteristics in chemical composition of Japanese 'white leaf teas', that is, high free amino acid content. Additionally, it was suggested that discoloration of first flush of "Morokozawa" might be caused by strong lighting.

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References

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