Morphological and physiological characteristics of Korean wild tea populations.

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Summary

The objective of this study was to determine the relationship between Japanese tea varieties and Korean wild tea seedlings by analysis of morphological and physiological characteristics.

Seven hundred Korean wild tea seedlings growing in NIVOT's field were used as materials in this study. Seeds were collected from tea plants in 7 populations in Korea, including 6 populations in precincts of temples and 1 population in a farmer's field, in 1993. The morphological and physiological characteristics were estimated from 1998 to 2000 according to the descriptors for characterization and evaluation in plant genetic resources.

In Korean tea populations, there was a variegated leaf plant and Koro type plants could not be found out. Korean populations can be distinguished from Japanese local varieties in some morphological characteristics. The mature leaf width of Korean tea plants is small and the leaf index (leaf length / leaf width) is large compared with those of Japanese tea plants. The relative height of the pistil is longer than that of stamens in many Korean tea plants. In Korean wild tea in this study, the distribution parts of pubescence on new shoots are generally full, but in 6.8 % plants pubescence are distributed partially.

A large number of plants in the Korean populations showed strong resistance to anthracnose. There was considerable variation in degree of resistance to tea gray blight.

Key words

Camellia sinensis, Korean wild tea, morphological and physiological characters

Introduction

Tea is thought to have originated from somewhere near Yunnan Province in China and to have spread from there through China and to other South East Asian countries. Tea was first introduced to Korea by DARYUM in AD 828, and tea plants were first grown near Mt. Chiri (PARK *et al.* 2001). On the other hand, in Japan, Buddhist monks started to cultivate tea plants in temple gardens in the early part of the eighth century (UKERS 1935). It has not been clarified whether tea was introduced to Japan directly from China or through Korea. The objective of this study was to determine the relationship between Japanese tea varieties and Korean wild tea clones by analysis of morphological and physiological characteristics and established the transmission of tea from China and Japan.

Materials and Methods

Seven hundred Korean wild tea seedlings growing in NIVOT(National Research Institute of Vegetables, Ornamental Plants and Tea)'s field were used as materials in this study. Seeds were collected from tea plants in 7 populations in Korea, including 6 populations of precincts of temples and 1 population in a farmer's field, on October 21 and 22, 1993 by PARK (Table 2). They were immediately introduced to NIVOT, Japan. They were sown in a greenhouse on November 24, 1993

and were transplanted to an experimental field in the spring of 1994. The morphological and physiological characteristics of the plants were estimated from 1998 to 2000 according to the descriptors for characterization and evaluation in plant genetic resources.

Results and Discussions

In Korean tea populations, there was a variegated leaf plant, but 'Koro' type plants could not be found out. The results of analysis of variance of leaf length, leaf width and leaf index are given in Table 1. There were significant differences at the 1% level between populations. T-test was performed between any two populations in each character. The leaf length and leaf width of Hyoi Chun Myen tea plants were small and the shape of the leaf was round compared with another populations. In the Song Kwang Sa population, there were some plants with small leaves resembling 'binka' in Japan (Table 2).

Table 1. Summary of the results of analysis of variance between populations.

Source	MS[2]	F[2]
Leaf length	19.8	40.8 **
Leaf width	1.9	25.1 **
Leaf index	1.1	23.3 **

1)** Significant at the 1% level

2)MS, means square ; F, F value

3)The degrees of freedom for between populations are 6. They were tested against within population with d.f. = 690.

Table 2. Mature leaf sizes in tea plants of Korean populations.

Populations	leaf length (cm)	leaf wide (cm)	leaf index[1]
Sun Am Sa	6.4 a [2]	2.5 a	2.59 ab
Hyang Lim Sa	7.0 b	2.7 bc	2.64 acd
Song Kwang Sa	6.2 a	2.4 de	2.66 ce
Zeung Sim Sa	7.3 c	2.7 b	2.71 e
Man Yeum Sa	6.9 b	2.6 c	2.67 de
Dae Won Sa	7.1 bc	2.5 ad	2.93 f
Hyoi Chun Myen	5.5 d	2.2 e	2.49 b

1)leaf length / leaf width

2)t-test ; Any two means having a common letter are not significantly different at the 1% level of significance.

In most of Korean wild tea in this study, pubescence parts on new shoots were full, but in 6.8 % plants the pubescence were distributed partially (Table 3). In most of the plants, length and density of trichomes on leaves of new shoots were long medium or long high (Table 4). In Hyoi Chun Myen, pubescent part ons leaves of new shoots were full and length and density of trichomes on leaves of new shoot were long medium or long high.

Table 3. Pubescent part on leaves of new shoots in Korean tea populations

	Classification						
Populations	0	1	2	3	5	7	9
Sun Am Sa	0	0	0	0	4	15	139
Hyang Lim Sa	0	0	0	0	1	6	178
Song Kwang Sa	0	0	0	0	1	3	82
Zeung Sim Sa	0	0	1	0	3	10	89
Man Yeum Sa	0	0	0	0	1	2	80
Dae Won Sa	0	0	0	0	1	0	65
Hyoi Chun Myen	0	0	0	0	0	0	12

0:Absent, 1:Midrib, 2:Midrib and nearby, 3:1/3 of leaf, 5:1/2 of leaf , 7:2/3 of leaf, 9:Full

Table 4. Length and density of trichomes on leaves of new shoots in Korean tea populations.

Length of trichomes		Short			Intermediate			Long		
Density of trichomes	Absent	Low	Medium	High	Low	Medium	High	Low	Medium	High
Sun Am Sa	0	1	4	1	4	15	7	1	52	73
Hyang Lim Sa	0	0	3	0	0	15	8	1	59	99
Song Kwang Sa	0	1	1	0	0	3	0	3	32	46
Zeung Sim Sa	0	0	3	0	8	12	5	0	42	33
Man Yeum Sa	0	0	4	0	4	9	6	2	26	32
Dae Won Sa	0	0	2	1	2	1	2	1	22	35
Hyoi Chun Myen	0	0	0	0	0	0	0	0	2	10

Flower structures were investigated only 394 plants and could not clarify the difference between populations. Relative pistil height was longer than that of stamens in many Korean plants (Table 5). Levels of style branching point were mostly intermediate or shallow, and there were only a few plants for which the point was deep (Table 6). About two thirds of the plants had some or all constricted styles (Table 7).

Table 5. Relative pistil height in Korean tea populations.

Relative pistil height	Number of plants
S	1
M	112
L	281

S: pistil height was shorter than that of stamens, M:pistil and stamens are the same height, L:pistil height was longer than that of stamens

Table 6 Level of style branching point in Korean tea populations.

Level of style branching point	Number of plants
Deep	6
Intermediate	170
Shallow	218

Table 7 Number of constricted styles in Korean tea populations

Number of constricted styles	Number of Plants
Absent	259
Some	50
All	85

The resistance to anthracnose was resistance in many Korean tea plants. There was considerable variation in degree of resistance to tea gray blight (Table 8)

Table 8 Resistance to anthracnose and tea gray blight in Korean tea populations

	Number of plants						
	Very low	Low	Slightly low	Intermediate	Slightly high	High	Very high
Anthracnose	0	0	3	20	160	153	1
Tea gray blight	19	17	88	187	141	169	61

Korean populations can be distinguished from Japanese local varieties in some morphological and physiological characteristics. 'Koro' plants, whose trait is controlled by a single recessive gene, were sparsely distributed among Japanese populations (Toyao 1966,1979). In this study, there was no 'Koro' type as the same result by Yamaguchi *et al.* (1994). Toyao *et al.* (1996) reported that the leaf length, leaf width and leaf index of Japanese populations varied in the range of 4.80 to 7.41, 1.84 to 3.35, and 2.15 to 2.39, respectively. The mature leaf width of Korean tea plants was small and leaf shape was round compared with Japanese one. In Japanese populations, the relative height of the pistil is generally lower than that of stamens (Toyao *et al.* 1996). But the relative height of

pistil was found to be longer than that of stamens in many of the tea plants in the Korean populations. In variation of pubescent patterns, China tea clones belonging to var. *sinensis* showed narrower variation than Assam tea clones belonging var. *assamica*. Especially in Japanese local populations, almost all clones had a whole surface distribution except 1 clone in 1241 clones were investigated (TAKEDA 1993). As the result of this study, the variation of pubescence patterns in Korean populations were large compared with Japanese populations.

Anthracnose and tea gray blight are major diseases in Japanese tea cultivation. The Korean plants were partially in sensible to anthracnose. A large number of plants in the Korean populations showed strong resistance towards both diseases and were particular importance to breeding disease resistance of Japanese and Korean tea cultivars.

The leaf and flower characteristics of plants in the Hyoid Chun Myen population were similar to those of Japanese tea plants. It may be a clue that the tea relationship between two countries will be clear. There are so many hypotheses, which should be needed for comparing a lot of data between two countries. The results of this investigation were not insufficient to establish the transmission of tea from China and Japan. But the local tea populations on Tsushima Island were distinguishable from other Japanese local populations and were similar to Korean population in floral structures (IKEDA *et al*. 2001). Tsushima is an island located between the Korean Peninsula and Kyushu island of Japan. It is considered to be one proof that recognizes the existence of the tea transmission route through Korea.

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