THE VARIATIONS OF JAPANESE APRICOT (*PRUNUS MUME*) CULTIVATED AROUND IN MTS. JIRI.

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ABSTRACT

Twenty-three plants of Japanese apricot (*Prunus mume*) were collected from several sites around Mountains JIRI in Korea. Japanese apricots having the different morphological features were evenly distributed in the groups made from the cluster analysis, indicating no geographic distributions but artificial vegetations in Korea. Japanese apricots were, as based on the PCR-RAPD techniques, clustered into the three groups; a group (prototype) having the five white petals with the five red sepals, a group (green type) having the five white petals with the five green sepals, and a group (hybrid type) having the more than five red petals with various colored sepals. The prototype apricots showed higher toxicities than other type apricot against bacteria and production of less compounds in TLC plates. The polypetal types of Japanes apricot were related to those of *P. armebiaca* in the characteristics of seed (the ruggedness), but also to be closed to those of *P. armebiaca* in PCR-RAPD analysis. The cluster analysis of the twenty three apricots and its related species calculated from the two primers were shown to distinguish relationships of cultivars within species, or of individual plants within cultivars, but also to display the two overlapping bands resulted from PCR-RAPD technique.

***Key Words : Prunus mume*, Japanese apricot, PCR-RAPD, phylogeny, antibacterial activity**

INTRODUCTION

Japanese apricot (*Prunus mume* Sieb et Zucc, a family Rosaceae) is native in Eastern Asia and has been cultivated for several thousands years (Tanaka, 1936; Yoshida and Kyotani, 1971; Yoshida and Yamanishi, 1988). In Korea, the apricot has been cultivated for the production of fruit as foods or medicines and also does for flowers in the southern area at 12~15℃ of average temperature (FRI, 1988). The plants of *P. mume* was divided into three *formae specialis* (or cultivars) in Korea; *alba* Rehder, *albolena* Bailey, and *alphandii* Rehdeer (Lee, 1985). The polypetals (Jones and Luchsinger, 1986) or tepals (Radford, 1986) in the flower were observed in several plants of Japanese apricot (f sp. *alphandii*).

The morphological features have been very important in the production of this plant, being related to taxonomic studies. The patterns of isozyme extracted

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from the cultivars or varieties of Japanese apricot were studied (Aoki *et al.*, 1972; Ujiie *et al.*, 1991). Recently, Polymerase Chain Reaction (PCR) and Random Amplified Polymorphic DNA (RAPD, Williams *et al.*, 1990) were developed for phylogenic grouping of cultivars or varieties of economic plants such as the cultivars of *Citrus* (Omura *et al.*, 1993), *Malus* (Harada *et al.*, 1993), and *Prunus* (Ozaki *et al.*, 1995; Shimada *et al.*, 1994). However, a little has been known about the phylogenetic relationships of the cultivars in *P. mume*, even though the plants of apricot were cultivated for horticultural or medical uses in Korea.

More than twenty kinds of Japanese apricot were represented for the different sites around Mts. JIRI and selected for this work. The morphological and genetic variations of these plants were observed for two years before this experiment. The antibacterial activity shown in the fruits of apricot was much markedly in the

Table-1. The list of the individual plants of *Prunus mume* and its related species collected for this work

Isolates	Scientific name (Type[a])	Vegetations in the collected sites
S01	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S02	*P. mume* (w)	Natural vegetation in KwiSan, ChungWon, KyoungNam
S03	*P. mume* (w)	Natural vegetation in KwiSan, ChungWon, KyoungNam
S04	*P. mume* (w)	Natural vegetation in KwiSan, ChungWon, KyoungNam
S05	*P. mume* (y)	Natural vegetation in DoSaRi, KwangYang City, JeonNam
S06	*P. mume* (p)	Natural vegetation in JinSang M, KwangYang City, JeonNam
S07	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S08	*P. mume* (w)	Natural vegetation in DaAp, KwangYang City, JeonNam
S09	*P. mume* (y)	Natural vegetation in DaAp, KwangYang City, JeonNam
S10	*P. mume* (p)	Natural vegetation in ShinKi, JinJu City, KyoungNam
S11	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S12	*P. mume* (y)	Natural vegetation in DaAp, KwangYang City, JeonNam
S13	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S14	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S15	*P. mume* (y)	Cultivated in DaAp, KwangYang City, JeonNam
S16	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S17	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S18	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S19	*P. mume* (w)	Cultivated in DaAp, KwangYang City, JeonNam
S20	*P. mume* (p)	Natural vegetation in JinSang, KwangYang City, JeonNam
S21	*P. mume* (pr)	Natural vegetation in JinSang, KwangYang City, JeonNam
S22	*P. mume* (wp)	Natural vegetation in JinSang, KwangYang City, JeonNam
S23	*P. mume* (w)	Natural vegetation in JinSang, KwangYang City, JeonNam
S24	*P. mume* (w)	Natural vegetation in KwiSan, ChungWon, KyoungNam
S25	*P. mume* (w)	Natural vegetation in KwiSan, ChungWon, KyoungNam
24	*P. persica*	Artificial vegetation in KyoungHwa, JinHae, KyoungNam
25	*P. armeniaca*	Natural vegetation in KwiSan, ChungWon, KyoungNam
26	*P. salicina*	Artificial vegetation in KwiSan, ChungWon, KyoungNam

[a]Flowers looked like the white (w), the yellowish white (y), the pink (p) and the red (r) flower in the plants. Some plants (S21 and S22) have two kinds of flowers in the different branches.

Eastern Asia and related to the Korean herbals effective in some diseases. Thus, the possible relationship of the antibacterial activities with the morphological features was needed for further breeding materials for a medical apricot.

MATERIALS AND METHODS

Plant Materials

The plants of *Prunus mume* were selected at the various sites of southern areas in Korea (Table 1). Only one plant was selected among several plants at each individual site. The morphological features of the plants were observed once a week during the period of Feb 1998 to Apr 2000 and coded by the method of Radford (1986). The leaves and fruits were collected and the dry weights were measured after dried at 80℃ for 24 hour. The young leaves were collected from the plants in the early Spring and stored at -70℃ for extraction of genomic DNA. The plants of *P. persica*, *P. armeniaca* and *P. salicina* were also used for the comparison with these plants of apricot.

PCR-RAPD analysis

Total genomic DNA was isolated from the young leaves by the method of Brunel (1992) and Gosselin et al. (1995). The genomic DNA was amplified by PCR-RAPD using the random primers of OPA-01 (5' -CAGGCCCTTC-3' ; OPERON Technology, Alameda, CA, USA), OPA-11 (5' -CAGGCCCTTC-3'), OPA-12 (5-TCGGCGATAG-3), OPA-19 (5' -CAAACGTCGG-3'), OPO-2 (5' -ACGTAGCGTC-3') and Bioneer primer #28 (5' -CCCGCCGTTG-3' ; Bioneer Co., Chungbuk, Republic of Korea) and #36 (5' -GGGCCCGAGG-3'). The site specific primers were added to genomic DNA in the buffer/enzyme mixture (10x PCR buffer) and were amplified by the method of Lee and You (2000).

Statistical analyses

The numbers of features measured were coded into the data matrix for numerical analysis (Table 2). The

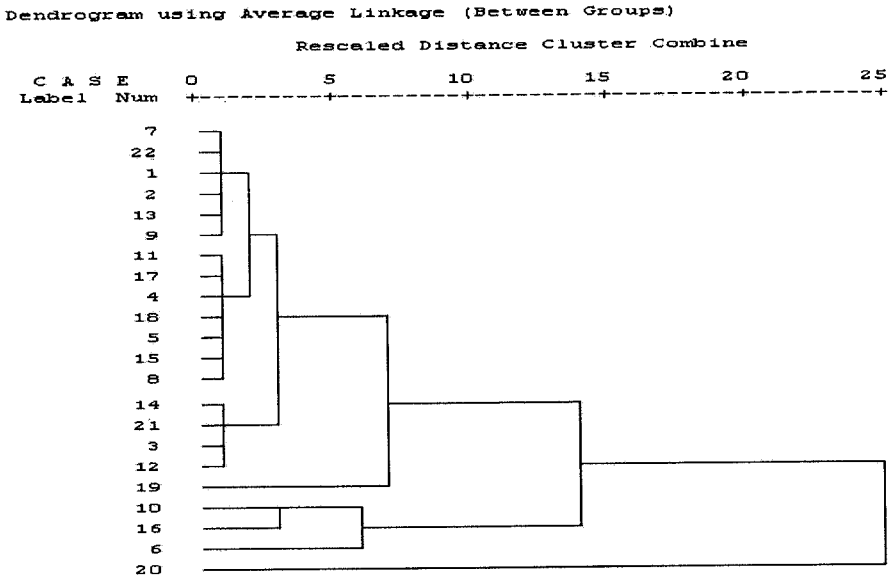

Fig.1. Cluster analysis of *Prunus mume* by the unweighted pair-group, the between group linkage, and Squared Euclidean distance method in software of SPSS-WIN (version 9), as based on the twenty three morphological features shown in Table 3; The numbers of 1 to 19 in this figure indicated the same plants marked by the S-series same; but the 20 indicated by the S22; 21 by S24 and 22 by S25, respectively.

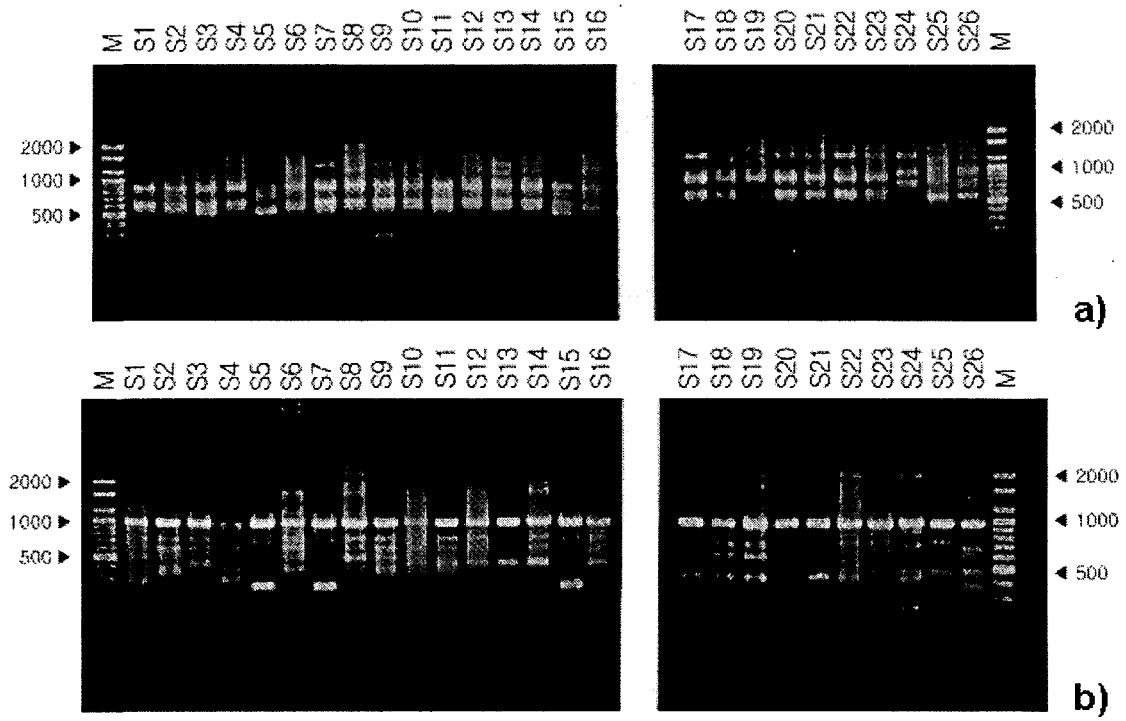

Fig.2. Random amplified polymorphic DNA analysis of the plants of *Prunus mume* using the primers OPA-01 and OPO-02; M=size marker from a 100 bp DNA ladder; The numbers of 1 to 23 in this figure indicated the same plants marked by the S-series but the lane 24 indicated by the plant of *P. persica;* the lane 25 by the plant of *P. armeniaca*; the lane 26 by the plant of *P. salicina.*

ratio of length to width of leaf or fruit collected was also coded. The relative percentage of Euclidean values, equal or less than 1 for each feature, were calculated and after then employed for cluster analysis, using SPSS-WIN. The pictures made from the PCR-RAPD bands were photographed by Kodak digital Camera (DC 120 Zoom series) and transferred into the matrix data by Imager III TM. RAPD bands separated on agarose gels were scored and transformed into a binary matrix. Cluster analysis were performed and a dendrogram was constructed using the un-weighted pair-group, the between group linkage, and squared Eucidean distance method.

Antibacterial test and TLC

The green apricots of fruit were directly collected from the plants inhabited around Mt. JIRI during the third week of July, both years of 1998 and 1999. Some fruits were not obtained from the plants located in the seven sites; S2, S9, S16, S20, S21, S22, and S23. Mainly, the green edible parts (10 to 20 g) separated from fruit were placed in the 20 mL of ethanol for several months and used for both antibacterial test and thin layer chromatography (TLC). The materials extracted were concentrated five times at the strength and used for the experiment. The paper disk of Watman # 2 sized by the 8 mm diameter were immersed in the ethanol solution containing the apricot fruit and dried by hair dryer. The paper discs were placed on the plates of LB agar pouring with *E(scherichia) coli* JM109 or KCTC 9873, and the ring formed were measured after incubation at 37 C for 24 hrs (Diffusion method, Tortora *et al.*, 2001). Also, the extracts were spotted on the pre-coated plates of silica gel and displayed by the

Table 1. Matrix of the morphological features of *Prunus mume* plant coded by the twenty-three different characterisitics mentioned above in Korea.

M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
S01	44	82	12.5	1	1	1	2	12.5	10.5	1	5	0	5	3.0	3.1	11.2	0	0	0	0	1.3	2.0	0.8
S02	31	60	10.0	1	1	1	2	11.0	10.5	1	5	0	5	3.0	2.7	10.2	1	0	0	1	1.2	1.5	0.5
S03	31	60	6.0	1	1	1	2	11.5	11.0	1	5	0	5	3.0	2.9	13.8	0	0	1	2	1.5	1.9	1.2
S04	50	79	12.0	1	1	1	2	11.0	11.5	1	5	0	5	3.0	3.0	14.0	0	0	0	2	1.5	2.0	1.2
S05	36	59	10.0	2	0	1	2	11.5	11.0	2	5	1	5	3.1	3.1	13.5	0	0	0	2	1.5	1.9	1.2
S06	52	95	19.0	1	1	0	2	15.0	15.0	3	5	0	5	3.8	3.8	30.6	1	0	0	2	2.2	2.6	3.1
S07	37	75	13.5	1	1	1	2	13.5	13.0	1	5	0	5	2.7	3.0	11.3	0	1	0	2	1.5	1.9	0.9
S08	39	84	12.0	1	1	1	2	13.0	13.0	1	8	0	5	2.9	3.3	13.4	0	0	0	2	1.5	2.4	1.3
S09	42	61	11.0	1	1	1	2	11.5	12.5	2	5	1	5	2.7	2.8	9.2	0	0	0	2	1.3	2.0	0.8
S10	56	90	18.0	1	1	0	4	14.0	10.0	4	5	2	5	3.9	3.9	24.2	1	0	1	2	2.0	2.3	2.1
S11	50	81	15.0	1	1	1	2	13.3	12.5	1	5	0	5	3.0	3.3	13.8	0	0	0	2	1.5	2.4	1.3
S12	34	69	7.0	1	0	1	2	12.0	10.0	2	5	1	5	2.8	2.9	14.4	0	0	0	2	1.4	1.9	1.2
S13	33	74	9.0	1	1	1	2	13.8	13.7	1	5	0	5	3.0	2.8	11.3	1	0	1	2	1.4	1.7	0.7
S14	35	80	9.0	1	0	1	2	10.0	9.5	1	5	0	5	3.3	3.3	17.0	0	1	0	2	1.7	2.0	1.8
S15	40	81	12.0	1	0	1	2	12.8	12.5	2	5	1	5	3.0	3.2	16.0	0	0	0	2	1.5	2.1	1.3
S16	50	88	15.5	1	1	1	2	12.8	12.0	1	5	0	5	3.3	3.4	20.0	0	1	0	0	1.4	2.2	1.2
S17	39	73	14.0	1	1	1	2	13.5	13.0	1	5	0	5	3.0	3.2	15.3	0	0	1	0	1.5	2.2	1.7
S18	40	66	12.0	1	1	1	1	13.0	13.0	1	5	0	5	3.0	3.2	12.9	0	0	0	2	1.6	2.2	1.3
S19	32	52	10.0	2	1	1	4	8.1	8.0	1	5	0	5	1.8	2.0	3.1	0	0	1	0	1.0	1.5	0.3
S22	43	78	12.0	2	1	1	2	8.0	7.5	6	25	0	5	2.9	3.2	13.2	1	0	0	2	1.4	2.1	1.1
S24	35	66	9.0	1	1	1	1	12.3	10.5	1	5	0	5	3.2	3.2	17.2	0	0	1	2	1.5	1.6	1.2
S25	46	87	13.0	1	1	1	2	10.7	10.7	1	5	0	5	2.8	3.0	11.1	0	1	0	2	1.6	2.3	1.4

solvent of diethyl ether and chloroform (1:1) in TLC (HP-TLC pre-coated plates of Silica Gel 60, Merck). The compounds separated on the plates of TLC were colored at 80 (C in the dry oven for 5 to 10 min and confirmed under UV light.

RESULTS

Morphological features

The flower was bloomed early spring before the leaves come out in the plants. The color of petal and sepal were observed as an important characteristic of flower in the plant; white and pink petals and red and green sepals. The color of petal was often interfered by the color of sepal. The variety with blue fruits were observed to have the white petal and the green sepal (i.e. S05, S09, S12 and S15), whereas the other variety which are cultivated for their flowers to have the white petal and red sepal (S01, S02, S03, S4, S6 and so on). The numbers of petal were generally five but 15 to 25 in some plant (S21, S22 and S23). The plant of S08 has the eight petals in the flowers.

The 40 to 50 stamens were arranged around a pistil in most plants, but two pistils were observed in the flowers of S21, S22 and S23 (two layers of petal arranged flowers in most plants). The green fruits were generally harvested for medical usages before they were ripen during the last week of June or first week of July. The ripen fruits were observed on the top of plants because it was very difficult to be observed. The color

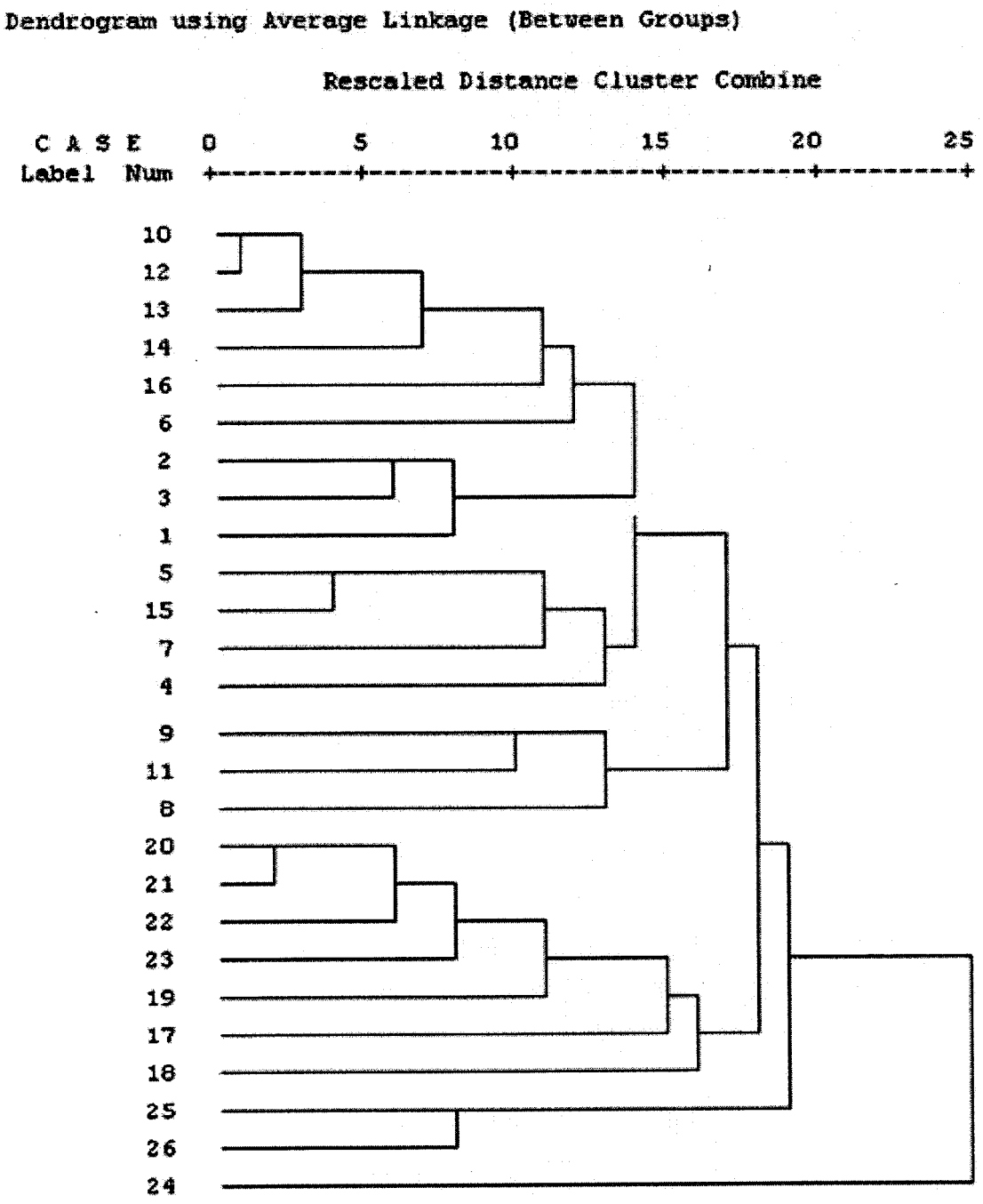

Fig.3. The cluster analysis of the genomic DNA' s *Prunus mume* and related species calculated by the unweighted pair-group, the between group linkage, and Squared Euclidean distance method in software of SPSS-WIN (version 9), as based on the PCR reactions with the different primers; The numbers of 1 to 23 in this figure indicated the same plants marked by the S-series same; but the lane 24 indicated by the plant of *P. persica*; the lane 25 by the plant of *P. armeniaca*; the lane 26 by the plant of *P. salicina*.

Table 3. Diameters (mm) of clear zones appeared from the antibacterial activity tests on Nutrient agar cultured with two different stains of *E. coli*.

Isolates	Strains of *E. coli*		Isolates	Strains of *E. coli*	
	JM 109	KCTC 9873		JM 109	KCTC 9873
Control	0	0	S12	24.1	17.4
S01	21.0	20.4	S13	17.5	16.6
S03	9.5	7.4	S14	14.0	17.6
S04	9.0	7.7	S15	12.5	17.6
S05	7.5	6.6	S17	8.4	8.7
S06	8.5	8.6	S18	12.5	12.0
S07	18.4	17.4	S19	13.4	14.4
S08	8.1	8.7	S24	8.0	7.1
S10	19.5	16.5	S25	17.0	17.4
S11	19.4	18.9			

of fruit were green in the immature fruits and turned to yellow in the ripen fruit. However, the red spots were observed at the ripen fruit in some plants. The drupe which was a fleshy, indehiscent fruit with a stony endocarp surrounding a usually single seed, was different at glance, after removing the exocarp and mesocarp. The drupe was rugged in the surface of apricot, but smooth in the surface of *P. armebiaca*. Then, the middle type of drupe was observed in the fruits of S17, S18 and S19. The size of leaf was related to those of flower or those of fruit.

Twenty three morphological characteristics were employed for cluster analysis : 1. length of leaf (cm), 2. width of leaf (cm), 3. length of petiole (mm), 4. color of leaf (1: yellowish green, 2: green), 5. color of petiole (0: yellow, 1: green), 6. trichome on the leaf (0: absent, 1: present), 7. blooming date (1; March 7, 2: March 14, 4 March 28), 8. length of flower (mm), 9. width of flower (mm), 10. color of petal (1: white, 2: yellowish white, 3; white pink, 4: pink, 6, two kinds of color) 11. number of petal 12. color of sepal (0: greenish red, 1; white green, 2: Red) 13. number of sepal 14. length of fruits(cm) 15. width of fruits (cm) 16. weight of fruits (mg) 17. color of fruits (0; white yellow, 1 white green in unripe state) 18. color of fruits (0: greenish yellow, 1: yellow in ripen fruits) 19. red spot on the fruits (0: absent, 1; present), 20. shape of fruits (0: round, 1: unregular, 2: ellipsoid) 21. length of seed (mm) 22. width of seed (mm) 23. weight of seed (mg).

The plants having the bigger sizes of flower or fruit were grouped and separated from those having the smaller sizes of flower. The rates of length to width of leaf, fruit and flower (i.e. feature 1 and 2 of leaf) were calculated and constricted to the dendrogram (Fig.1). The four groups were basically divided as based on the cluster analysis of morphological features; 1) the plants of group (S07, S22, S01, S02, S13 and S09) having the five white petals and red sepals, 2) the plants of group (S11, S17, S04, S18, S05, S15 and S08) having the five white petals and red or green sepals but bigger size of flower than the other group (over 10 cm diameter in flower), 3) the plants of group S14, S21, S01, S03, and S12) having the five white petals and red or green sepals but smaller size of flower than the other group (less than 10 cm diameter in flower) and 4) the plants of group (S19, S16, and S06) having various petals and green or red sepals but smooth drupe in the fruits). The plants (S02, S04 and S03) inhabiting at Kwisang in

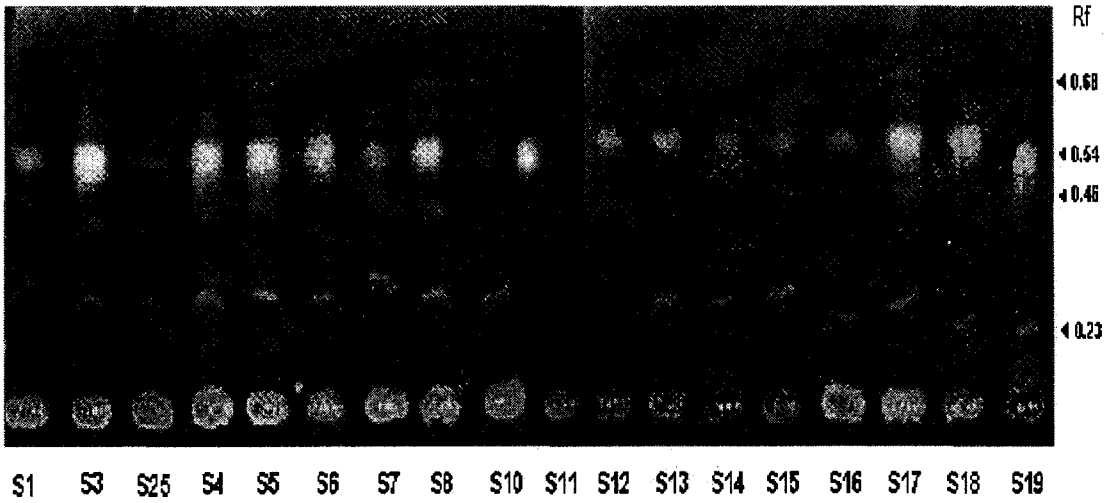

Fig.4. HP-Thin Layer Chromatography of the fruit extracted solutions using the developing solvent (Chloroform : Diethyether 1:1 v/v) and stained with Sulfuric acid and heating. The extractions of the fruit obtained from various plants showed the various compounds (red, the green white)

Eastern areas of Mts.JIRI) were evenly grouped into the cluster groups of those (S07, S11 and S14) inhabiting at Daap in Western areas of Mts. JiRi).

Relationship of 23 plants

The twenty-three plants of S01 to S23 were employed with the three species of *Prunus* closed to *P. mume*, as an out-group plant. The genomic DNA' s extracted were reacted with more than seven various primers supplied by OPA-series, OPO-series, and Bioneer-28 and 36. The polymorphic bands synthesized from various primers were obtained by the digital Camera and coded into the computer. The basic information obtained above were processed with a cluster analysis by a program of SPSS-WIN and calculated to the dendrogram shown in Fig.3 (but not shown here). The matrix data obtained from PCR-RAPD reactions with the primer or its combinations of primers were iteratively calculated in routine and constructed to the dendrogram of cluster analysis. The dendrogram obtained from the cluster analyses were compared with the natural phylogenetic separations; *P. mume* plants (S01 to S23), *P. persica* (24), *P. armeniaca* (25), and *P. salicina* (26) as the four different grouping shown in Fig.3 (OTU 18 rescaled distances cut and assuming for a species of Prunus). Cluster analyses of RAPD data showed that *P. mume* plants (S01 to S23), *P. persica* (24), *P. armeniaca* (25), and *P. salicina* (26) were separated into different groups. The polymorphic patterns of RAPD bands synthesized by the two primers, OPA-01 and OPO-02, were selected and used for this study (Fig.2) with the two primers. The ten or thirteen polymorphic bands were synthesized with the primer OPA-01 or OPO-02 (Fig.2). The bands between the 900 and 1000 bps synthesized by OPO-2 ('A band' marked) and around 600 bps by OPA-01 ('B band') were confirmed to be a common bands shown in all plants used in this work. The A and B bands of DNA were synthesized from the genomic DNA' s extracted from all species of *Prunus* employed here. The plants in the group I and II (S10 to S06 and S02 to S01 in Fig.3, respectively) were those

having the white flowers and similar to the descriptions by Lee (1985). The plants of the group III (S05 to S04 in Fig.3) were the plants having the white flowers and green sepal, showing the yellow flowers in the morphological features. The plants belonged to the group V (S20 to S18 in Fig.3) were observed to be the plant having double layers of petals (mostly more than five petals in flower) and having pink color in the petals. Particularly, the seeds of the plants in the group V were observed to be resemble *P. armeniaca* in ruggedness of seed surface.

Antibacterial activity and TLC pattern

Several green fruits of apricot were not obtained during the experimental period because the collection time for them was missed or the fruits collected were badly treated for sampling. The fruits collected from the plants of S1 and S12 showed bigger activities than others on both cells of *E. coli* (Table 2). The fruits were, in all plants, observed to have some compounds inhibiting the growth of *E. coli* cells, but to show the different responses, especially for the *E. coli* cells (Table 2). The various color-spots and the fluorescent compounds showed under the ultraviolet were displayed on Fig.4. The fruits showing the red spots (S3, S4, S8, and S17 in Fig.4) were not observed to have less antibacterial activities than those not showing like S1 and S12. More than ten compounds were extracted from ethanol and displayed in TLC-silica gels. The fluorescent spots at the Rf (=0.54) in TLC plate were acted with the cells of *E. coli*.

DISCUSSIONS

Since this plants have been cultivated for horticultural or medical usages for long times (more than 2000 years). It was very difficult to find the natural vegetations of Japanese apricot in Korea. For this experiment, the sites were randomly selected before two year' s basic surveys, but most of them were considered not to be native (Fig.1). The cultivation or natural vegetation of apricot plants was considered to be conserved with the greater Mountains and under the different cultural situations. However, any genetic conservation of Japanese apricot was not found in these areas, but all apricot plants employed would be considered artificially planted. Also, the random distributions of the apricot plants as showed in both Fig.1 (as based on the morphological features) and Fig.3 (as based on the PCR-RAPD techniques) were consistent with those resulted from the artificial vegetations. The geographic distributions of apricot plant were found in the sites randomly collected in this works. The twenty-three sites selected were considered to be replications rather than the geographic variation. In spite of this regarding, the genetic variations for Japanese apricot could be important in breeding of apricot for the medical and horticultural usages and should be investigated for further information.

The morphological features were various, but were difficult to find relatedness of the 23 kinds of Japanese apricot, taking exceptions of few features; the colors of petals, polypetal (tepal), colors of sepal and ruggedness of seeds in this study. The color of petal and numbers of tepal were reported to be related to the varieties or cultivars of apricots. (Tanaka, 1936; Yoshida and Kyotani, 1971; Yoshida and Yamanishi, 1988) The green apricots for horticultural usage were observed to be a plant having the white petals and green sepals. The white apricot for the medical usage were considered to be a plant having the white petals and red sepal (Fig.4 and Table 2). This type plants are generally having the rugged seed-coats. The tepal (or polypetal) apricot (more than five petals and sepals becoming the petals) for horticultural usage were observed to be generally a plant having many tepal and the plain seed-coats in the drupe, resembling those of seed in *P. armeniacea*. The pink color of petal and ruggedness of drupe in the

apricot plants were reported to be originated from the hybrids of *P.mume* with *P. armeniaca*. (Judd *et al.*, 1999)

Three *formae specialis* of *P. mume* has been reported; (Lee, 1985) *alba* Rehder, *alboplena* Bailey, and *alphandii* Rehder. However, it is considered that the term of 'formae specialis' is not suitable for these varieties of apricot, and also not matched with the varieties of our surveys made in this work (Table 2). The concept of ecotype or subspecies is not appropriate for these varieties because the geographic variations were not found among the individuals or geographically isolated apricots in this work. The terms of 'varieties' or 'cultivar' could be more suitable than those of 'formae specialis' for these variations of apricot plants in Southern areas in Korea:

Proto type (Group I and II): white petals and red sepals; longer petals than sepals; petals and sepals are alternates; 5 petals and sepals; drupes and ruggedness on the fruits; redish-black branches;

Green type (Group III and IV): white yellow petals and olive green sepals, longer petals than sepals; alternate sepals and petals; 5 petals and sepals; drupes and ruggedness on fruits; olive green color branches;

Hybrid type (Group V): pink petals and brown sepals; alternate sepals and petals; drupes fruits; few ruggedness on fruits; polypetals; 15-25 petals; red brown color of branches;

Divisions of the plants collected from the twenty-three different sites were made from the morphological features and the PCR-RAPD using the two primers. Particularly, the grouping the apricot plants was distinguished from the other species of *Prunus*; *P. persica*, *P. armeniaca*, and *P. salicina*. The twenty-three individual plants of apricot were grouped to a branch of *P. mume* and to the different branch of other species. The groups I and II of *P. mume* were distinguished from the other groups of *P. mume* in the antibacterial test (Table 3) and TLC (Fig.4). In other studies, a branch of several varieties of apricot and out-group of other species of Prunus were considered to be a proper phylogenetic tree of this plant. (Shimada *et al.*, 1994; Ujiie et al., 1991) The common bands of RAPD (around 1000 bps) were synthesized with the primer OPO-2, and were considered to be applicable for distinguishing the genus of *Prunus*, as based on this work. (Williams *et al.*, 1990) Many bands synthesized with the two primers were scattered in the different patterns due to the individual plant of apricot collected. From this result, it was considered that the two primers are suitable for distinguishing the relationship of species with varieties or of varieties with individuals of plant and for further genetic work of *Prunus*.

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