

Chair Horticultural Science

2.1.4 Laboratory : Pomology

Member:	Professor	Keizo, Yonemori, D. Agric. Sci.
	Associate Professor	Ryutaro, Tao, D. Agric. Sci.
	Assistant Professor	Yamane, Hisayo, D. Agric. Sci.
	Doctor's program	2
	Master's Program	6
	Undergraduate	5
	Post-Doctoral fellow	1

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Molecular markers for selecting pollination-constant and non-astringent (PCNA) type persimmon in breeding populations

The PCNA-type fruit is the most desirable persimmon for fresh consumption. The breeding program is going on to obtain new promising PCNA cultivars. However, the trait of natural loss of astringency in PCNA-type is qualitatively inherited and the PCNA-type is recessive to the other three non-PCNA types (PVNA, PVA, and PCA). Thus, F1 offspring of the PCNA x non-PCNA must be backcrossed to the PCNA type to obtain diverse PCNA offspring. This backcross yields PCNA offspring at a low rate due to the hexaploid nature of persimmon. So, we have started to find the molecular makers for selecting PCNA offspring in the breeding populations at an early seedling stage using leaf DNA in order to make greater efficiency for persimmon breeding program, and we have obtained reliable PCR-based markers. Now, we are using these markers for practical selection of PCNA-type seedlings among breeding populations derived from breeding programs.

b) Molecular basis of gametophytic self-incompatibility in Prunus

Many fruit tree species in Prunus exhibit the monofactorial gametophytic self-incompatibility. As they are unable to bear fruits parthenocarpically, fertilization is a very important factor in fruit production in self-incompatible fruit species in Prunus. We attempt to elucidate the physiological and molecular mechanisms of gametophytic self-incompatibility of four fruit tree species of Prunus: almond, Japanese apricot, Japanese plum, and sweet cherry. We have identified both the pistil determinant (S-RNase gene) and the pollen determinant (S haplotype-specific F-box protein gene) of the self-incompatibility reaction. We are now on the way to elucidate the molecular basis of the self and nonself recognition system in Prunus.

c) Studies on bud dormancy in temperate fruits

Bud dormancy in deciduous fruit tree species is a complex process necessary for plant survival in the unfavorable environment. Once formed in summer, buds enter an endodormant state and require a certain amount of cold temperatures to resume growth in a favorable environment. Recent global warming potentially causes serious problems such as irregular or loss of flowering. Recently, we have found a MADS-box transcription factor that is putatively related to endodormancy induction and endodormancy release. We are now conducting functional study to characterize the MADS-box transcription factor toward the ultimate goal to understand the internal genetic factors controlling endodormancy of deciduous fruit tree species.

A-2. Publications and presentations

a) Publications

Original Papers(including book-reviews)

- Akagi, T, A. Ikegami, and K. Yonemori (2010) DkMyb2 wound-induced transcription factor of persimmon (*Diospyros kaki* Thunb.), contributes to proanthocyanidin regulation. *Planta* 232: 1045-1059
- Akagi, T, Y. Suzuki, A. Ikegami, H. Kamitakahara, T. Takano, F. Nakatsubo, and K. Yonemori (2010) Condensed tannin composition analysis in persimmon (*Diospyros kaki* Thunb.) fruit by acid catalysis in the presence of excess phloroglucinol. *J. Japan. Soc. Hort. Sci.* 79: 275-281
- Akagi, T., Y. Takeda, K. Yonemori, A. Ikegami, A. Kono, M. Yamada, and S. Kanzaki (2010) Quantitative genotyping for the astringency locus in hexaploid persimmon cultivars using quantitative real-time PCR. *J. Amer. Soc. Hort. Sci.* 135: 59-66
- Beppu, K., K. Shogase, H. Yamane, R. Tao, and I. Kataoka (2010) Inheritance of self-compatibility conferred by the Se-haplotype of Japanese plum and development of Se-Rnase gene-specific PCR primers. *J. Hort. Sci. & Biotech.* 85: 215-218
- Esumi, T., Y. Kitamura, C. Hagihara, H. Yamane, and R. Tao (2010) Identification of a TFL1 ortholog in Japanese apricot (*Prunus mume* Sieb et Zucc.). *Scientia Hort.* 125: 608-616
- Gao, M., M. Kawabe, T. Tsukamoto, H. Hanada, and R. Tao.(2010) Somatic embryogenesis and Agrobacterium-mediated transformation of Japanese apricot (*Prunus mume*) using immature cotyledons. *Scientia Hort.* 124: 360-367.

- Kanzaki, S., T. Akagi, T. Masuko, M. Kimura, M. Yamada, A. Sato, N. Mitani, N. Utsunomiya, and K. Yonemori (2010) SCAR markers for practical application of marker-assisted selection in persimmon (*Diospyros kaki* Thunb.) breeding. *J. Japan. Soc. Hort. Sci.* 79: 150-155

- Martí, À.F., T. Hanada, J.M. Alonso, H. Yamane, R. Tao, R. (2010) The almond *Sf* haplotype shows a double expression despite its comprehensive genetic identity. *Scientia Hort.* 125:685-691.

- Tsukamoto, T., N.R. Hauck, R. Tao, N. Jiang, and A.F. Iezzoni. (2010) Molecular and genetic analyses of four nonfunctional *S* haplotype variants derived from a common ancestral *S* haplotype identified in sour cherry (*Prunus cerasus* L.). *Genetics* 184: 411-427.

- Wünsch, A., R. Tao, J.I. Hormaza. (2010) Self-compatibility in 'Cristobalina' sweet cherry is not associated with duplications or modified transcription levels of *S*-locus genes. *Plant Cell Rep.* 29:715-721.

- Yamane, H., K. Fukuta, D. Matsumoto, T. Hanada, G. Mei, T. Habu, Y. Fuyuhiko, S. Ogawa, H. Yaegaki, M. Yamaguchi, and R. Tao. (2010) Characterization of a novel self-compatible *S3'* haplotype leads to the development of a universal PCR marker for two distinctly originated self-compatible *S* haplotypes in Japanese apricot (*Prunus mume* sieb. et Zucc.). *J. Japan. Soc. Hort. Sci.* 78: 40-48.

Reviews

- Tao, R. and A.F. Iezzoni. (2010) The *S*-RNase-based gametophytic self-incompatibility system in *Prunus* exhibits distinct genetic and molecular features. *Scientia Horticulturae* 124: 423-433.

b) Conference and seminar papers presented

- The 52nd Annual meeting of the Japanese Society of Plant Physiologists: 1 Presentation
- Annual meeting of the Japanese Society for Horticultural Science: 4 Presentations
- International Horticultural Congress: 1 presentation
- Rosaceae Genome Conference: 2 presentation

A-3.Off-campus activities 2

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (B) : Yonemori, Keizo : Isolation of the gene linked to astringency-trait in persimmon and its properties for tannin accumulation
- Scientific Research (B) : Yonemori, Keizo : Exploration of the species for the origin of the cultivated *Diospyros kaki*
- Challenging Exploratory Research : Yonemori, Keizo : Study on apomixis of mangosteen fruit
- Scientific Research (A) : Tao, Ryutaro : Molecular basis of gametophytic self-incompatibility in *Prunus*
- Challenging Exploratory Research : Tao, Ryutaro : Comparative genomics of the sex expression in persimmon

2. Other Research Grants

- Joint Research Project of JSPS (Bilateral Program between Japan and USA) : Yonemori, Keizo : Isolation of the gene conferring tannin biosynthesis during fruit development and its regulatory mechanisms in the fruit
- Promotion of Basic Research Activities for Innovative Biosciences (BRAIN) : Yamane, H. : Molecular basis of bud dormancy in temperate fruits

A-4. International cooperation and overseas activities 1

Membership in academic societies

- Ryutaro Tao: International Society for Horticultural Science (Council member)

International joint research, overseas research surveys

- Yonemori, K.: Reproductive biology in tropical fruit trees (Thailand)
- Yonemori, K.: Studies on the mechanism of tannin accumulation in persimmon (USA, Italy)

- Yoenmori, K.: Studies on a PCNA cultivar of Chinese origin (China)
- Yonemori, K.: Survey on mango germplasm in Australia for mango breeding (Australia)
- Tao, Ryutaro: Transformation of fruit tree species (USA)
- Tao, Ryutaro: Self-incompatibility in Prunus (Spain, Thailand, USA)
- Yamane, Hisayo: Survey of low-chill deciduous fruit tree species adapted to subtropical regions (Thailand.)

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- Visiting Professor 1 (Australia)

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: Pomology I (Yonemori), Pomology II (Yonemori, Tao), Cell Biology (III), Seminar in Horticultural Science (Yonemori, Tao, Yamane), Laboratory Course in Bioresource Science I, II (Tao, Yamane), Fundamentals for the Laboratory Course in Bioresource Science (Tao, Yamane)
- Graduate level: Plant Propagation in Horticulture (Tao), Pomology Seminar (Yonemori, Tao, Yamane), Special Laboratory Work in Pomology (Yonemori, Tao, Yamane)

B-2.Off-campus teaching etc.

Part-time lecturer

- Yonemori, Keizo: Fukui Prefectural Univ. (Pomology for undergraduate students)