

2.4.2 Laboratory : Laboratory of Crop Evolution

Member :	Associate Professor	Kawahara, Taihachi, D. Agric. Sci.
	Assistant Professor	Yasui, Yasuo, D. Agric. Sci.
	Doctor's program	2
	Master's Program	2

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Studies on the genetic variation of wheat

Because of the huge morphological variations, the Abyssinian Highlands (Ethiopia) are thought of as the secondary center of diversity of domesticated emmer wheat (*Triticum turgidum* L.). The genetic diversity in 88 domesticated emmer wheat accessions from Ethiopia and other regions was analyzed using DNA sequences of parts of four nuclear genes, *Acc1-A*, *Pgk1-B*, *Waxy-A* and *Waxy-B*. The multilocus genotypes determined by STRUCTURE analysis enabled the 88 accessions to divide into four clusters. Each cluster included both hulled and free-threshing subspecies, and there was no clustering corresponding to specific subspecies. Both hulled and free-threshing emmer landraces in Ethiopia had several characteristic alleles, and the gene flow between them was limited. The genetic composition of Ethiopian landraces differed from that of emmer in other regions of the world. However, their nucleotide diversity was not as high as that of other emmer populations. The large morphological diversity in Ethiopian emmer landraces must have evolved from a limited genetic background.

b) Studies on the genetic variation of wild relatives of wheat

Aegilops tauschii has a wide natural species range in central Eurasia, spreading from northern Syria and Turkey to western China. The genealogical and geographical structure of variation of morphological traits was analyzed using a diverse array of 205 sample accessions that represented the entire species range. In total, 27 traits, including anther and pistil shape and internode length, were examined. Large-scale natural variation was found for all examined traits. Significant longitudinal clines were detected for anther size, internode length and spike size and shape. Anthers tended to be small in accessions from the eastern region. Internodes also tended to be short, whereas spikes tended to be long in accessions from the

eastern region. Spikelet density per spike tended to be high in the eastern habitats. In the process of west-to-east dispersal, *Ae. tauschii* underwent extensive morphological, genetic and ecological diversification that produced the variation seen among today's natural populations.

c) Studies on the self-incompatibility gene of common buckwheat

In common buckwheat, the self-incompatibility gene is closely linked with the genes controlling several morphologies related with heterostyly and they form the S supergene. So far, the linkage map and genomic library have been constructed as a first step for the cloning of the S gene by the positional cloning method. In this year, we surveyed transcriptome difference between thrum and pin styles using with a next generation sequencing machine (Solexa).

d) Screening of Au SINE retroelement in vascular plants

SINE sequence is widely found in animal genomes and many researches are already reported. However, studies on plant SINE sequence is few because of limited distribution in plants. p-SINE1 is only found in the genus *Oryza*, TS in *Nicotiana* and S1 in *Brassica*. Recently, we found novel retro element, Au SINE, in relatives of wheat. This Au SINE is found in several species belonging to Poaceae, Fabaceae and Annonaceae, and is the first plant SINE with quite wide distribution. We are now continuing to screen in other plant species and could be able to find out in genus *Gnetum* belonging to gymnosperm. Distribution both in angiosperm and gymnosperm was confirmed.

A-2.Publications and presentations

a) Publications

Original Papers

- Kawahara, T.: Molecular phylogeny among *Triticum-Aegilops* species and of the tribe Triticeae. *Breeding Science* 59: 499-504. 2009
- Matsuoka, Y., E. Nishioka, T. Kawahara and S. Takumi: Genealogical analysis of subspecies divergence and spikelet-shape diversification in central Eurasian wild wheat *Aegilops tauschii* Coss. *Plant Systematics and Evolution* 279: 233-244. 2009
- Mori, N., Y. Kondo, T. Ishii, T. Kawahara, J. Valkoun and C. Nakamura: Genetic diversity and origin of timopheevi wheat inferred by chloroplast DNA fingerprinting. *Breeding Science* 59: 571-578. 2009
- Takumi, S., E. Nishioka, H. Morihiro, T. Kawahara and Y. Matsuoka: Natural variation of morphological traits in wild wheat progenitor *Aegilops tauschii* Coss. *Breeding Science* 59: 579-588. 2009

- Tomita, M., T. Noguchi and T. Kawahara: Quantitative variation of Revolver transposon-like genes in synthetic wheat and their structural relationship with the LARD element. Breeding Science 59: 629-636. 2009

b) Conference and seminar papers presented

- 116th annual meeting of the Japanese Society of Breeding: 2 papers

A-4. International cooperation and overseas activities

International meetings(country,roles)

- Kawahara, Taihachi, D. Agric. Sci. : 6th International Triticeae Symposium (Japan, Chair of organizing committee)

B. Educational Activities(2009.4-2010.3)

B-1. On-campus teaching

a) Courses given

- Undergraduate level: Outline of Bio-production Science I(Kawahara), Origin of Cultivated Plants(Kawahara), Seminar in Plant Resource Science (Kawahara)
- Graduate level: Ethnobotany (Kawahara), Seminar in Origin of Cultivated Plants (Kawahara), Laboratory Course in Origin of Cultivated Plant (Kawahara, Yasui)

B-2. Off-campus teaching etc.

Part-time lecturer

- Kawahara, T.: Faculty of Agriculture, Kyoto Prefectural University (Genetics)