Chair Science of Plant Resources

2.4.2 Laboratory : Crop Evolution

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

A. Research Activities (2010.4-2011.3)

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 emmer wheat accessions from Ethiopia and other regions was analyzed using DNA sequences of parts of four nuclear genes. 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 cluster 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 so 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 geographical structure of variation of morphological traits was compared to variation of nucleotide genes using 122 accessions that represented the entire species range. Longitudinal clines in several morphological traits was caused by preexisting genetic diversity among populations before the process of west-to-east dispersal after the last glaciation. Further, variation in flowering time was examined using 50 accessions from Central Asia and Western China. It was confirmed that eastern accessions of Ae. tauschii have a high level of flowering time variation as well as western accessions.

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), and identified a candidate gene for self-incompatibility.

d) Studies of Au SINE letroelement in vascular plants

SINE sequence is widely found in animal genomes but 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 a 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 Ephedra belonging to gymnosperm. Distribution both in angiosperm and gymnosperm was confirmed.

A-2.Publications and presentations

a) Publications

Books

- Kawahara, T.: What is "Mugi" in "Natural History of "Mugi"" eds., Y Sato and K. Kato. Hokkasido University Press, Sapporo, p. 15-26, 2010

- Kawahara, T.: Diversity and genetic resources of Wheat in "Natural History of "Mugi"" eds., Y Sato and K. Kato. Hokkasido University Press, Sapporo, p. 313-337, 2010

Original Papers(including book-reviews)

- Takenaka, S. N. Mori and T. Kawahara: Genetic variation in domesticated emmer wheat (Triticum turgidum L.) in and around Abyssinian Highlands. Breeding Science 60: 212-227. 2010

b) Conference and seminar papers presented

- 118th annual meeting of the Japanese Society of Breeding: 2 papers

A-3.Off-campus activities 2

Research grants

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

- Exploratory Research (B) : Kawahara, Taihachi : Studies on adaptive genes using core collection of a plant species distributing widely over Eurasia.

- Exploratory Research (C) : Yasui, Yasuo : Studies on genetic base of self-incompatibility in common Buckwheat

A-4.International cooperation and overseas activities 1

International meetings(country,roles)

- Kawahara, Taihachi : International Triticeae Symposium (Member of International Organizing Committee)

International joint research, overseas research surveys

- Kawahara, T.: Joint Research Project, Japan-Russia Cooperative Program, JSPS. "Evolutional analysis of cereal related species in former Soviet countries on the silk-road to Japan"

- Kawahara, T. Grant-in Aid for Scientific Research (KAKENHI), Overseas research (Leader, Sato, Y.) Botanical archeology of Small River Cemetry in Xinjiang, China

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

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

- Graduate level : Plant Genetic Resources (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, Taihachi: Faculty of Agriculture, Kyoto Prefectural University (Genetics)