MEETING REPORT

International Colloquium on Plant Biotechnology; Further Progress in Productive and Sustainable Agriculture

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INTRODUCTION

The “International Colloquium on Plant Biotechnology: Further progress in productive and sustainable agriculture” was held from Nov. 20–21, 2003 at Sakai City, Osaka Prefecture. This Colloquium was organized by Prof. Taiji Adachi of Osaka Prefecture University. The symposium was very successful both in the quality of presented papers and the at-home atmosphere. It was a good meeting for the young researchers and even graduate students who had an opportunity to present their results in the very international and at-home atmosphere.

The main aim of this Colloquium was to overview the recent developments in asexual transmission of genes by means of genetic recombination and somatic cell hybridization methods. However, the public acceptance of plant biotechnology is not good and the research activity itself sometimes causes social problems. Fortunately, there are some signs of increasing acceptance of new plant biotechnology in this new millennium. Thus, it is important to have this sort of symposium by researchers from not only advanced countries such as Germany and the US, but also from countries like Thailand, China, Korea, etc.

The Colloquium was held at Rihga Royal Hotel, Sakai, on 20th November, and on 21st November the venue was moved to the Academic Convention Hall of Osaka Prefecture University. Twenty-one foreign researchers and one hundred twenty Japanese researchers including graduate students gathered together. The foreign researchers were from the US, Canada, Germany, Slovenia, Ukraine, India, Thailand, Indonesia, China, and Korea.

OUTLINE OF THE COLLOQUIUM

The outline of the colloquium was as follows, Prof. T. Adachi gave the welcome greeting at first. He also explained the historical perspectives and objective of this meeting, emphasizing public criticism of genetically engineered plants and scientists' duty to produce consumer-oriented and ecologically high-quality products. This was followed by three keynote lectures. First, Prof. Franz Hoffmann from University of California, Irvine, USA overviewed the development of plant biotechnology in this quarter century. In his lecture entitled “From anthocyanin to apomixis: Genetic engineering under public disapproval”, he pointed out that we are facing a turning point in the development of genetically engineered plants. Public disapproval of GM food is not going disappear by itself. To turn the tide we have to come up with products that live up to the promise: healthier, tastier, nutritionally improved and contributing to further progress in productive and sustainable agriculture. One of the approaches that can turn the tide is achieved by improving the power of conventional breeding techniques, he stressed, such as the introduction of apomixes into non-apomictic crops. Then Prof. Horst Lörz from University of Hamburg, Germany, gave a lecture entitled, “From single cells to transgenic crops”. He gave us historical perspectives on and future trends in plant biotechnology, mainly using barely and rye, presenting some practical examples. First, the insertion and expression of the afp-gene increased the resistance of pearl millet up to 90% against infection with P. substriata in comparison to wild-type plants. Second, wheat gluten proteins (most likely gliadins), which are the basis of the rheological properties of wheat dough and its superior quality in bread making, are the cause of coeliac disease. The utilization of an RNAi-silencing approach is now under investigation to examine its potential to silence an entire gene family in hexaploid wheat. As the last speaker, Prof. Ko Shimamoto of the Nara Institute of Science and Technology, Nara, Japan, also gave us an historic view of plant biotechnology, summarizing his own experience through a lecture entitled, “Historical accounts of plant biotechnology and its future”. In his presentation, he focused on maize and rice improvement by using two
marker genes: the hygromycin resistance gene and the gus gene. Based on the success in introducing these genes into rice, he succeeded in transforming rice with an insect resistance gene and virus coat protein gene, which became the first examples of genetically engineered rice. In addition to presenting the historical view, he pointed out that Rac GTPase is an important molecular switch of defense in rice and regulates most of the key events of defense such as production of reactive oxygen species, defense-gene activation, induction of hypersensitive cell death, phytoalexin production, lignin biosynthesis and MAPK activation.

The title of the first session was "Genetic manipulation and tissue culture", chaired by Dr. S. Bhojwani (India) and Dr. B. Bohanec (Slovenia). Drs. Y. Gleba (Germany), S. Kawasaki (Japan), Y. Kishima (Japan), B. Javornik (Slovenia), K-Z. Riu (Korea), M. Yokoyama (Japan) and V. S. Jaiswal (India) reported recent advances in transgenic methods in plants and their practical applications in hop, rice, and citrus. Dr. Yokoyama found α-ketol linolenic acid (KODA), a stress-induced factor, in Lemna paucicos-tata. KODA reacts with catecholamines to generate many products that strongly induce flowering in L. paucicos-tata, although KODA itself is inactive. He then analyzed two major products of the reaction between KODA and norepinephrine, named FN1 and FN2. FN1 was identified as a tricycle α-ketol fatty acid and showed strong flower-inducing activity, but FN2 was inactive.

The second session was "Overcoming breeding barriers through plant biotechnology", chaired by Dr. Y. Gleba and Dr. K. Yoshida (Japan). This session was financially supported by a grant for scientific research from MEXT, Japan. In this session, future perspectives on regulation of plant reproduction were mainly reported and discussed in different kinds of crops by Drs. P. Ozias-Akins (US), L. Chen (Japan), W. Marubashi (Japan), M. Ebina (Japan), R. Akashi (Japan) and Y-Y. Chung (Korea). Among the reports, the establishment of a reproducible particle bombardment transformation protocol for bahaigraass reported by Dr. Akashi was noteworthy. This improved culture system allowed high production of embryogenic calli and also regenerative tissues. The medium conditions are 2.0 mg/L 2,4-D, 0.1mg/L BAP and 50 μm copper sulfate at 31 +/- 1 C under dim light conditions. As a result, transgenes were stably transmitted to T1 progeny.

The third session was entitled “Micro- and nano-techniques in plant genetic engineering”, chaired by Dr. H. Lörz and Dr. P. Ozias-Akins. The 5 speakers in this session were Drs. K. Fukui (Japan), S. Apisitwanch (Thailand), Y. Hosokawa (Japan), B. Bohanec (Slovenia), and S. S. Bhojwani. A variety of new approaches to plant biotechnology were reported, for example, application of laser optics for manipulation of plant cells, and a novel transgenic method using bio-active beads. The bio-active beads were Ca-alkaline micro-beads, and various-sized genetic materials from plasmid DNAs to nuclei could be trapped by the beads. Bio-active beads containing plasmid DNAs or YAC DNAs containing the GFP gene were used to transform tobacco cells. The transient expression of the GFP gene was clearly observed in cultured tobacco cells, demonstrating that transformation of even YAC-sized DNAs was successfully mediated by bio-active beads. Nondestructive manipulation of single living plant cells using a femtosecond laser was described by Dr. Hosokawa.

The last session was organized as a joint meeting with the “Center for Research and Development of Bio-Resources” and the "Innovation Center for Cooperative Research and Development”, Osaka Prefecture University. The title of the session was “Molecular Plant Physiology” and the session was chaired by Dr. T. Adachi and Dr. S. Tokutomi (Japan). Drs. P-S. Song (Korea), S. Tokutomi, P. Pauls (Canada), and H. Uchimiya (Japan) reported recent advances in plant physiology in relation to light, and practical applications of these advances to agricultural productivity. Dr. Tokutomi reported the utilization of light by plants as signals to fine-tune photosynthetic activities. He discussed the photo-regulation mechanism in relation to kinase activity of photropin and concluded that an N-terminal chromophoric domain, LOV2 (Light, Oxygen and Voltage) of photropin behaves like a light-regulated molecular switch of kinase activity.

Presentations at the poster session were mainly conducted by junior scientists and students. Enthusiastic discussions were held everywhere in the poster session. One of the highlights of the poster session was selection of the Journal of Plant Physiology Awards posters. Three best posters were selected, and the award will be a good encouragement for the winners.

We believe that the lectures by researchers who were involved in developing plant biotechnology from the very beginning of this field gave deep and positive stimulation to junior scientists and students as they talked about the past, present and future of plant biotechnology in their own words, based on their own experience. It is anticipated that this colloquium will contribute to building new and strengthening existing bridges of international collaboration, and furthering friendships among scientists across borders in an era of public disapproval of GMO.