Chair Comparative Agricultural Science

2.8.1 Laboratory: Comparative Agricultural Science

Member:	Professor	Hirai, Nobuhiro, Ph. D.
	Associate Professor	Akamatsu, Miki, Ph. D.
	Associate Professor	Ueru, Tanaka, Ph. D.
	Associate Professor	Miyake, Takeshi, Ph. D.
	Master's Program	3

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Molecular technology of a plant hormone, abscisic acid

Abscisic acid (ABA) is an important plant hormone that induces adaptative responses in plants upon water stress and low temperature. However, the effect of ABA does not last since ABA is quickly inactivated by the degradation enzyme, ABA 8'-hydroxylase. Inhibitors of the hydroxylase may delay the inactivation of ABA to increase resistance of plants to environmental stress. We have developed and improved hydroxylase inhibitors with the researchers at Shizuoka University and Chiba University. Phaseic acid is a metabolite of ABA having a moderate activity, and its reductase completely inactivates phaseic acid by conversion to dihydrophaseic acid. To develop inhibitors of the reductase, we purifyed the phaseic acid reductase and analyzed the amino acid sequence by MS. The result suggested that a known enzyme had high homology to the reductase. (Hirai)

b) Chemical ecology of ectomycorrhiza

Some ectomycorrhiza form a fairy ring which shows the circular formation of fruit body. The inside of the fairy ring of Tricholoma is a whitish mycelium-soil aggregated zone, and called “shiro”. The density of bacteria and fungi in the shiro is significantly lower than that of the outside of the shiro. The researchers of our University demonstrated in 1967 that the shiro had antimicrobial activity against bacteria. However, the antimicrobial compound(s) has been remained unclear. We identifyed an antimicrobial compound of the roots of Pinus densiflora growing at the Kamigamo research field of Kyoto University as totarol. In 2009, We have obtained ectomycorrhiza of P. densiflora growing at the Sakai research field of Kyoto Prefecture. The ectomycorrhiza contained a water-soluble antibacterial compound. The compound is heat-stable, and different from known antibitotics. Purifycation of this compoud is under progress. (Hirai)

c) Mechanism of substrate recognition by cytochrome p450s (Enzymes involved in metabolism)

Human cytochrome p450s（CYPs）are primarily membrane-associated proteins, located either in the inner membrane of mitochondria or in the endoplasmic reticulum of cells. CYPs metabolise thousands of endogenous and exogenous compounds. Most CYPs can metabolize multiple substrates, and many can catalyze multiple reactions. To clarify the substrate recognition mechanism by CYPs, using a pesticide as a model compound, we isolated, purified and identified its metabolites by CYP3A4 ad CYP2C19. The metabolite structures by both CYPs were compared. In addition, since a main

d) Mechanism of substrate recognition by P-glycoproteins (P-gp: ATP-dependent efflux pump)

P-gp is one of ABC transporters and acts as an efflux pump with broad substrate specificity. To clarify the substrate recognition mechanism by P-gp, screenig of various pesticides and derivatives as P-gp susbstrates was carried out. Then 3D-QSAR, CoMFA was performed for a pesticide and its derivatives last year. In this year, protein modeling of human P-gp was carried out for docking of ligands. (Akamatsu)

e) Analysis of pesticide residues in environment around the agricultural fields near Bangkok (Thailand) and Hue (Vietnam)

The rapid economic growth of Thailand and Vietnam resulted in a rapid increase of the demand for agricultural production leading to the great use of pesticides and chemical fertilizers. The recent increase in pesticide application might cause environmental pollution problems in both countries. After 2003, we visited Bangkok area in Thailand. The river bottom and field soils around the area were sampled and pesticide residues in the samples were analyzed. Although a small amount of a few pesticides were detected in several samples, pesticide residues in the soils of the places were kept at the safety levels until 2009. In this year, we visited agricultural fields in Hue area in Vietnam and surveyed the pesticide use in the area. In addition, we sampled several field soils and analyzed pesticide residues in the samples. (Akamatsu, Tanaka)

f) Genetic diversity and utilization of genetic resources of farm animals

Thoroughbred horses are seasonal mating animals. Foals born yearly in spring generally show a typical seasonal compensatory growth pattern, in which their growth rate declines in the first winter and increases in the next spring. A new empirical adjustment approach is proposed to adjust for this compensatory growth when growth curve equations are estimated. The new growth curve equation had a sigmoid sub-function that can adjust the compensatory growth, combined with the Richards biological parameter responsible for the maturity of animals. (Miyake)

g) Desertification and its coping strategy in the Sahel, West Africa

In the Sahel, West Africa, known as one of the frontline of desertification, field researches were conducted on development and ddissemination of the techniques to prevent desertification under the research projects on "Approaches of horizontal technology transfer in Semi-arid West Africa", and "Livelihood and adaptation strategies related to desertification in Sub-Saharan Africa". Based on the results and experiences, JICA partnership project on "Enhancement of livelihood impprovement and desertification control in the Sahel, Niger" has been inmplemented. (Tanaka)

h) Diversification of livelihood activities for vulnerable people to cope with natural disaster in Central Vietnam

In Central Vietnam, field researches were conducted on diversification of livelihood activities for vulnerable people to cope with natural disaster under the research project on "Chronic hazards surrounding socio-ecologically vulnerable people and resilience of communiy in Indochina region". Based on the results and experiences, JICA partnership project on "Integrated support for vulnerable people and communities in disaster-prone Central Vietnam" has been inmplemented. (Tanaka)

A-2.Publications and presentations

a) Publications

Books

- Hirai, N. Abscisic acid. In Comprehensive Natural Products Chemistry II. Vol. 4: Chemical Ecology, ed. by Mori, K., Elsevier, 2010, pp. 53-67.

- Ho, T.T., Le, V. A. and Tanaka, U. (eds) : Community-based rural development approaches. [in Vietnamese with English abstract], Ngon Nghiep Press, Hanoi, 2010, pp. 180

Original Papers(including book-reviews)

- Todoroki, Y., Naiki, K., Aoyama, H., Shirakura, M., Ueno, K., Mizutani, M. and Hirai, N.: Selectivity improvement of an azole inhibitor of CYP707A by replacing the monosubstituted azole with a disubstituted azole. Bioorg. Med. Chem. Lett., 20, 5506-5509 (2010).

- Ogawa, Y., Akamatsu, M., Hotta, Y., Hosoda, A., Tamura, H.: Effect of essential oils, such as raspberry ketone and its derivatives, on antiandrogenic activity based on in vitro reporter gene assay. Bioorg. Med. Chem. Lett., 20, 2111-2114 (2010).

- Tozaki, T., Hirota, K., Sugita, S., Ishida, N., Miyake, T., Oki, H., Hasegawa, T.: A genome-wide scan for tying-up syndrome in Japanese Thoroughbreds. Anim. Genet., 41 Suppl 2:80-86 (2010).

- Tozaki, T., Miyake, T., Kakoi, H., Gawahara, H., Sugita, S., Hasegawa, T., Ishida, N., Hirota, K., Nakano, Y.: A genome-wide association study for racing performances in Thoroughbreds clarifies a candidate region near the MSTN gene. Anim. Genet., 41, Suppl 2:28-35 (2010).

- Sukegawa, S., Miyake, T., Takahagi, Y., Murakami, H., Morimatsu, F., Yamada, T., Sasaki, Y.: Replicated association of the single nucleotide polymorphism in EDG1 with marbling in three general populations of Japanese Black beef cattle. BMC Res. Notes, 3, 66 (2010).

- Ikazaki, K.,Shinjo, H., Tanaka, U., Tobita, S., Funakawa, S. and Kosaki, T. : Performance of Aeolian Materials Sampler for the determination of amount of coarse organic matter transported during wind erosion events in Sahel, West Africa. Pedologist, 53(3), 126–134 (2010).

- Rwezimula, F., Tanaka, U. and Ikeno, J. : Agro-ecological characteristics and inherent roles of indigenous farming systems in the eastern slopes of northern Uluguru Mountains, Tanzania. Journal of Agricultural Development Studies, 20(3), 65-71 (2010).

Reports,others

- Ueru TANAKA: Techniques to cope with desertification in the Sahel, West Africa. Gendai-Nogyo (Sept. 2010), 322-327 (2010)

b) Conference and seminar papers presented

- The 2010 Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry: 2 presentations

- The 5th Annual Meeting of The Chemical Biology: 1 presentation

- The 45th Annual Meeting of The Japanse Society for Chemical Regulation of Plants (Kobe): 5 presentation

- The 2010 International Conference on Plant Growth Substances (Taragona): 1 presentation

- The 38th Symposium on Structure-Activity Relationships: 2 presentations

- The 35th Annual Meeting of Pesticide Science Society of Japan: 1 presentation

- The 36th Annual Meeting of Pesticide Science Society of Japan: 2 presentations

- 18th EuroQSAR, Discovery Informatics & Drug Design : 2 presentations

- The 23th Annual Meeting of The Japanese Society of Equine Science: 1 presentation

- The 2010 Spring Meeting of Japanese Scoiety of Agricultural Systems: 1 presentation

- The 2010 Autum Meeting of Japanese Scoiety of Agricultural Systems: 2 presentation

- The 2010 Annual Meeting of Japanese Society of Soil Science and Plant Nutrition: 2 presentations

- JIRCAS/ICRISAT Workshop on Fertility Improvement of Sandy Soils in the Sahel (Niamey), 23 June 2010: 3 presentations

A-3.Off-campus activities 1

Membership in academic societies

- Hirai, Nobuhiro : Japan Society for Bioscience, Biotechnology, and Agrochemistry (councilor of the Kansai Branchl), Japanese Society for Chemical Regulation of Plants (head of general secretary)

- Akamatsu, Miki : Pesticide Science Society of Japan (Board member), Division of Structure-Activity Studies, the Pharmaceutical Society of Japan (Board member), Japan Society for Bioscience, Biotechnology, and Agrochemistry (councilor)

- Miyake, Takeshi : Society of Beef Cattle Science (Secretary), Japanese Society of Animal Breeding and Gentics (Board member)

- Tanaka, Ueru : Japanese Society of International Rural Development (member of editorial board)

A-3.Off-campus activities 2

Research grants

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

- Scientific Research (B) : Kondo, Satoru : Development of a method increasing water-stress resistance in fruit trees by regulation of abscisic acid hydroxylase (Hirai)

- Scientific Research (B) : Akamatsu, Miki : Survey and analyses of toxic or generic pesticides in Indochina area and potent risk evaluation

- Scientific Research (C) : Akamatsu, Miki : Mechanism of substrate recognition by cytochrome p450s and metabolism prediction system of drug candidates

- Scientific Research (B) : Tanaka, Ueru : Approaches of horizontal technology transfer in Semi-arid West Africa

- Scientific Research (B) : Kobayashi, Masami : Chronic hazards surrounding socio-ecologically vulnerable people and resilience of communiy in Indochina region (Tanaka)

2.Other Research Grants

- Feasibility study for Research Institute for Humanity and Nature：Tanaka, Ueru：Livelihood and adaptation strategies related to desertification in Sub-Saharan Africa

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Hirai, Nobuhiro: International Plant Growth Substances Association, International Allelopathy Society

- Akamatsu, Miki : American Chemical Society

International meetings(country,roles)

- Akamatsu, Miki：18th EuroQSAR, Discovery Informatics & Drug Design (Greece, Scientific Committee member)

International joint research, overseas research surveys

- Pesticide residue analysis in environment around the suburban agricultural fields of Bangkok, Akamatsu, Miki, (Thailand)

- Pesticide residue analysis in environment around the suburban agricultural fields of Hue, Akamatsu, Miki, (Vietnam)

- Desertification and its coping strategy in West Africa and Southern Africa, Tanaka Ueru (Burkina Faso, Niger, Namibia)

- Diversification of livelihood activities for vulnerable people to cope with natural disaster in Central Vietnam, Tanaka Ueru (Vietnam)

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- Kyoto University Guest Professor 1（Canada）

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Science English in Agriculture (Akamatsu), Discovery and Development of New Drugs (Department of Pharmaceutical Sciences (share, Akamatsu), Information Processing Basics in Agriclture (Miyake), Livelihood, Environment and Peace - a case in Vietnam - I & II (shared, Tanaka), Nature and Culture (shared, Tanaka), Environmental Agriculture (shared, Tanaka)

- Graduate level : Comparative Agricultural Science (Hirai, Tanaka), Comparative Study of Resources and Environment (Akamatsu, Miyake), Agriculture and Environment in Japan (Hirai, Akamatsu, Tanaka, Miyake), Techniqies fo Agricultural Environment (English, GSGES, Tanaka), Terrestrial Ecosystems Management (GSGES, Tanaka), Environmental Management Leaders A (English, shared, GSGES, Tanaka)

B-2.Off-campus teaching etc.

Part-time lecturer

- Akamatsu, Miki : Doshisha Women's U College of Liberal Arts (Life Sciences)

Open lectures, etc.

- Tanaka, Ueru: Learning from Wind, Soil and People - Living with Desertification - (Hirosaki University)

- Tanaka, Ueru: Learning from Wind, Soil and People - Living with Desertification - (Obihiro Chikusan University)

B-3.Overseas teaching 1

International students

- International students : Master 1 (China)

C.Other Remarks

- Hirai, Nobuhiro, : Japan Society for the Promotion of Science, member of Committee on Grants-in-Aid for Scientific Research, Shimadzu Corporation, member of Committee on Bioethics

- Akamatsu, Miki : The Ministry of Agriculture, Forestry, and Fisheries of Japan, tentative member of Councils of agricultural materials, pesticide division, The Ministry of Economy, Trade and Industry, tentative member of Councils of Chemicals, National Institute of Technology and Evaluation, member of Structure-Activity Relationship Committee

- Tanaka, Ueru : Global Human Environment Forum, "Committee for technical extenstion to desertification", advisor, JICA partnership project on "Integrated support for vulnerable people and communities in disaster-prone Central Vietnam", manager