Chair Horticultural Science

2.1.3 Laboratory : Vegetable and Ornamental Horticultur

Member :	Professor	Motoaki, Doi, Dr. Agric.Sci.
	Associate Professor	Hosokawa, Munetaka, Dr. Agric.Sci.
	Assistant Professor	Mizuta, Youichi, Dr. Agric.Sci.
	Doctor's program	1
	Master's Program	6
	Undergraduate	4

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Formation of novel capsaicinoid-like substances (CLSs) in chilli fruit
Metabolomic analysis of capsaicinoid biosynthesis in Capsicum fruit

Some chilli cultivars including ‘CH-19 Sweet’ contains CLSs such as capsinoids and capsiconinoids. These fruits have no pungency but similar physiological functions to capsaicinoids for human health. We have conducted experiments on the formation of CLSs in the fruits and the related genes.
Certain sweet pepper cultivars sometimes bear pungent fruits. A multivarietal analysis has reveal the factors affecting the occurrence of pungent fruits in 'Shishitou'. We also have analyzed the difference in capsaicinoid biosynthesis and its related metabolisms between pungent fruits and non-pungent ones by using a metabolomic technique.

b) Flower scent formation and its control

Considering the flower sent as an important quality element of ornamental plants, we are studying the formation of flower scents and how we could change it.Using rose flowers, we have been looking for some monotelpenoid synthesis genes and investigating the expression of these genes.

c) Hypersensitive physiological disorders induced by photooxydative stress

Plants which become hypersensitive state by an infection of pathogens or mechanical wounding respond severly to temperature and potooxydative stress often resulting in occurrence of physiological disorders. Using canna leaves we are studing the mechanisms of signal transduction of harvesting and subsequent potooxydative physiological disorders.

d) Various applications of leaf primordial free shoot apical meristem culture in horticulture

Leaf primordia-free shoot apical meristem culture which is originally developed by this laboratory is an effective method for viroid free plant production. In addition to this application, we are developing methods for the disease resistant plant screening in in vitro and for generating transgenic plants.

e) Unknown environmental factors for horticultural crops

Phosphorus deficiency in fertilizer or nutrient solution causes the decrease of anthocyanin biosynthesis and consequently makes red petals turn white in some petunia cultivars. We are trying to clarify the mechanism how phosphorus regulates the anthocyanin biosynthesis in petunia. And in dahlia, there are cultivars with unstable anthocyanin expression in their petals responding to high temperature. And we research about the capsicum plants which has an inflection temperature about 25℃. We are exploring unknown genetic resources in the constant temperature area in the world. At last, for determining the mutagen in in vitro culture, we would like to develop a new in vitro culture method without mutation. These four interesting environmental factors, which will concern in the genetic or epigenetic gene expressions, have not been reported.

f) Development of new plant production system

We developed new tissue culture method of the plant without using the sterility equipment by adding chlorine to the medium with sterile containers. And the enlargement method and the liquid culture method are being developed now. (2) We developed sucrose supplying technique to plant by microbe-static conditions established by phosphate elimination using aluminum hydroxide and root split. By the results obtained by this technique and the simplified tissue culture system, the method of supplying the vegetable with sugar in the open vessels was under development. (3) We facilitated the transplant and the control of the rhizosphere by making rhizosphere plane. (4) We are developing the system that consistently does the tissue culture, the raising seedling, and the harvest by combining these three methods.

g) Development of high-value added vegetables and foods materials by using metabolome analysis technique

Improve flavor, sweetens and food functions have become a general interest and have added value to vegetables Using chill peppers, tomatoes and spinaches as plant materials, we have been investigating cultivation methods and cultivars that lead to improved flavor, sweetness, storability and food functions. To achieve this purpose efficiently, we have employed a MS-MS base metabolome analysis technique in addition to target analysis of compounds related to the flavor and food functions to elucidate the correlations among metabolic pathways.

A-2.Publications and presentations

a) Publications

Original Papers(including book-reviews)

- Inamoto, K., K. Matsubara, M. Doi and H. Imanishi. 2011. Evaluation of freezing hardiness of ornamental geophytes. Acta. Hortic. 886: 105-112 (With review).

- An, SJ., D. Pandeya, SW. Park, J. Li, JK. Kwon, S. Koeda, M. Hosokawa, NC. Peak, D. Choi and BC. Kang. 2011. Characterization and genetic analysis of a low-temperature-sensitive mutant, sy-2, in Capsicum chinense.
Theor. Appl. Genet. 122: 459-470 (With review).

- Koeda, S., M. Hosokawa, BC. Kang, C. Tanaka, D. Choi, S. Sano, T. Shiina, M. Doi and S. Yazawa. 2011. Defense response of a pepper cultivar cv. Sy-2 is induced at temperatures below 24°C. J. Plant Res. in press (With review)

- Ito, H., T. Hayashi, M. Hashimoto, K. Miyagawa, S. Nakamura, Y. Mizuta and S. Yazawa. 2010. A protocol for preparing preserved flowers with natural color and texture.
Hort Technol. 20: 445-448. (With review).

- Tanaka, Y., M. Hosokawa, T. Miwa, T. Watanabe and S. Yazawa. 2010. Novel loss-of-function putative aminotransferase alleles cause biosynthesis of capsinoids, nonpungent capsaicinoid analogues, in mildly pungent chili peppers (Capsicum chinense). J. Agric. Food Chem. 58: 11762-11767 (With review).

- Tanaka, Y., M. Hosokawa, T. Miwa, T. Watanabe and S. Yazawa. 2010. Newly mutated putative-aminotransferase in nonpungent pepper (Capsicum annuum) results in biosynthesis of capsinoids, capsaicinoid analogues.
J. Agric. Food Chem. 58: 1761-1767 (With review).

- Itou, H., K. Nishikawa, T. Awano, M. Hosokawa and S. Yazawa. 2010. Secondary Cell Walls at a Scarious Floral Leaf in Several Plant Species Including Helichrysum bracteatum. Hortic. Res. 9: 19-23 (in Japansese with English abstract) (With review).

b) Conference and seminar papers presented

- 2010 28th International Horticultural Congress 2010 Lisboa (5 presentation)

- 2010 Autumn Meeting of the Japanese Society for Horticultural Science (4 presentations)

- 2011 Spring Meeting of the Japanese Society for Horticultural Science (4 presentations)

A-3.Off-campus activities 1

Membership in academic societies

- Motoaki Doi : The Japanese Society for Horticultural Science(Councilor, Selection Committee Member of Horticultural Society Prize, Chair of Promotion Committee of Horticultural Society Activities), The Japaneses Society of Agricultural, Biological and Environmental Engineers and Scientists , Hydroponic Society of Japan

- Munetaka Hosokawa : The Japanese Society for Horticultural Science

- Youichi Mizuta : The Japanese Society for Horticultural Science

A-3.Off-campus activities 2

Research grants

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

- Scientific Research (B) : M.Doi : Molecular basis of scent emission through a non-mevalonate pathway in fragrant flowers.

- Scientific Research (B) : M.Hosokawa : Screening of functional sequences in viroid

- Grant-in-Aid for Exploratory Research : M.Hosokawa : Screening of antimutagen suppressing the somatic mutation occurence

- Scientific Research (B) : M.Hosokawa : 25℃ Genetic switch: Search for Solanaceae plants at the tropical region using tiny temperature fluctuations for their growth and development

2.Other Research Grants

- Strategic plan for research and development :Wakayama prefecture : Daisuke Ogawa : Effective production for statice micropagation

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Motoaki Doi: J. Fruit Ornam. Plant Res. (Editoral board)

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Outline of Bioresource Science I (Doi), Ornamental Horticulture (Doi and Hosokawa), Vegetable Science (Doi), Seminar in Horticultural Science (Doi, Hosokawa and Mizuta), Laboratory in Bioresource Science I, II (Hosokawa and Mizuta)

- Graduate level : Special Lecture of Plant Production Science (Doi), Vegetable and Ornamental Horticulture (Advanced course) (Doi), Vegetable and Ornamental Horticulture-Seminar (Doi, Hosokawa and Mizuta), Special Laboratory Work in Vegetable and Ornamental Horticulture (Doi, Hosokawa and Mizuta), Environmental Control for Horticulture (Hosokoawa)

B-2.Off-campus teaching etc.

Part-time lecturer

- M. Doi: Takii Horticulture College

C.Other Remarks

- M. Doi : A Member of the Selection Committee of Kounosuke Matsushita Foundation of EXPO '90 Awards, A Trustee of Japan Flower Promotion Center