Chair Science of Plant Resources

2.3.3 Laboratory: Plant Genetocs

Member:	Professor	Miyagawa, Hisashi, Ph.D.
	Assistant Professor	Nakagawa, Yoshiaki, Ph.D.
	Associate Professor	Miyashita, Masahiro, Ph.D.
	Doctor's program	1
	Master's Program	6
	Undergraduate	5
	Post-Doctoral fellow	1

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Chemistry of ecdysone agonists

The molting process is regulated by a molting hormone, 20-hydroxyecdysone (20E), in most invertebrates. To date 4 compounds which mimic the action of 20E are in the market as insecticide. The base structure of these compounds is dibenzoylhydrazine (DBH). DBHs are very toxic to Lepidoptera, but they are either very weak or inactive against other insect order. Previously, we found three novel compounds which specifically bind to ecdysone receptors by in silico screening. In this study we modified one of the structure and measured the binding activity, which was three times more potent than the original compound.

b) Chemistry of bioactive peptides in plants

Plants induce various defense responses when they are attacked by pathogens. These defense responses are triggered by a variety of molecules (elicitors). We previously discovered a novel small peptide PIP-1, which can activate defense reactions in tobacco cells, from random hexapeptide libraries. PIP-1 induces H2O2 generation as an early defense response and phytoalexin biosynthesis as a late defense response, but induction of the latter requires a 100-fold higher concentration than that of the former. In this study, to elucidate factors that cause this difference, degradation of PIP-1 by plant cells was investigated. As a consequence, PIP-1 was degraded from its C-terminus, and activity seems to be lost several hours after treatment. This suggests that continuous activation of plant defense system by PIP-1 is required for induction of phytoalexin synthesis.

c) Chemistry of scorpion toxins

We previously isolated an insecticidal toxin LaIT1, from the venom of the Japanese scorpion Liocheles australasiae. In this study, to investigate the structure-activity relationship of LaIT1, we synthesized several analogs ofLaIT1, in which C- or N-terminal regions are truncated, and examined its effects on insect toxicity. When these analogs were synthesized, peptides with non-native disulfide bridge patterns were mainly generated. This indicates that these regions are important for stabilization of folding of native LaIT1. Deletion of C- or N-terminal regions resulted in a marked reduction of the activity, indicating that these regions are also essential for the interaction with the receptor.

A-2.Publications and presentations

a) Publications

Books

- Nakagawa, Y: Structures and functions of ecdysteroid receptors. In " Biology of Molting and Metamorphosis: Mechanism of Hormonal Regulation in Insects and Crustaceans (Eds. Sonobe, H. and Nagasawa, H.)", Tokai University Press, pp. 99-121, 2011.

- Nakagawa, Y: Overview of insect growth regulators. In " Biology of Molting and Metamorphosis: Mechanism of Hormonal Regulation in Insects and Crustaceans (Eds. Sonobe, H. and Nagasawa, H.)", Tokai University Press, pp. 147-166, 2011.

Original Papers(including book-reviews)

- Seino, Y., T. Ogura, T. Tsubota, M. Shimomura, T. Nakakura, A. Tan, K. Mita, T. Shinoda, Y. Nakagawa , T. Shiotsuki: Characterization of juvenile hormone epoxide hydrolase and its telated genes in larval development of silkworm, Bombyx mori. Biosci Biotech Biochem 74; 1421-1429, 2010

- Ishihara A, T. Nakao, M. Yuko, M. Murai, N. Ichimaru, C. Tanaka, H. Nakajima, K. Wakasa, H. Miyagawa: Probing the role of tryptophan-derived secondary metabolism in defense responses against Bipolaris oryzae infection in rice leaves by a suicide substrate of tryptophan decarboxylase. Phytochemistry 72; 7-13, 2011

- Harada T., Y. Nakagawa, T. Ogura, Y. Yamada, T. Ohe, H. Miyagawa: Virtual screening for ligands of the insect molting hormone receptor. J Chem Inf Model 51; 296-305, 2011

- Miyashita, M., Y. Hanai, H. Awane, T. Yoshikawa, H. Miyagawa: Improving peptide fragmentation by N-terminal derivatization with high proton affinity. Rapid Commun Mass Spectrom 25;1130-40, 2011

Reviews

- Nakagawa, Y.: Molecular mechanism of molting and the structure-activity relationship of the molting inhibitors. Nihonnouyakugakkaishi 36, 300-303., 2001

Reports,others

- Endo, T. R.: National Bioresource Project Wheat: Overview. Wheat Information Service, 2007

b) Conference and seminar papers presented

- The 12th IUPAC International Congress of pesticide Chemistry (4)

- Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry 2010: 2 reports

- Annual Meeting of the Pesticide Science Society of Japan : 4 reports

- Japan Society for Bioscience, Biotechnology, and Agrochemistry (Kansai Branch Meeting): 1 report

A-3.Off-campus activities 1

Membership in academic societies

- iyagawa, Hisashi : Japan Society for Pesticide Science (councilor, editorial member), Japan Society for Bioscience, Biotechnology, and Agrochemistry (councilor of Kansai branch)

- Nakagawa, Yoshiaki : The Division of Structure-Activity Studies, The Pharmaceutical Society of Japan (board member), Japan Society for Pesticide Science (editorial board member, councilor), Japan Society for Bioscience, Biotechnology, and Agrochemistry-Kansai Branch (councilor), Japan Society for Pesticide Science: Design of Agrochemicals (member)

A-3.Off-campus activities 2

Research grants

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

- Monbukagakusho Research Grant: (C) : Hisashi Miyagawa :

- Monbukagakusho Research Grant: Encouragement of Young Scientists (B) : Miyashita, Masahiro : Screening for plant defense activating peptides from combinatorial peptide Libraries

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Nakagawa, Yoshiaki: IUPAC Chemistry and The Environmental Division (VI): Plant Protection (member)

International meetings(country,roles)

- Endo, Takashi：6th Inetenational Triticeae Symposium (Japan, Chair of organizing committee)

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- Adjunct associate professor　1（Sweden）

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Bioorganic Chemistry I (Miyagawa, Nakagawa), Organic Reaction Mechanism II (Nakagawa), Laboratory Course in Bioorganic Chemistry (Miyagawa, Nakagawa, Miyashita), Structure Analysis of Organic Compounds (Miyagawa), Food Safety II (Miyagawa), Experimental Course in Division of Applied Life Sciences (Nakagawa, Miyashita); Novel Strategy for Agricultural Science (Miyagawa, Nakagawa), Applied Life Sciences (Miyagawa)

- Graduate level : Bioregulation Chemistry Seminar (Miyagawa, Nakagawa, Miyashita), Experimental Course in Bioregulation Chemistry (Miyagawa, Nakagawa, Miyashita). Bioregulation Chemistry (Miyagawa, Nakagawa, Miyashita)

B-2.Off-campus teaching etc.

Part-time lecturer

- Miyagawa, H.: School of Life and Environmental Sciences, Osaka Prefecture University (Molecular design), , Faculty of Biotechnology, Fukui Prefectural University (Pesticide Chemistry)

- Nakagawa, Y.: Faculty of Life and Environmental Sciences, Kyoto Prefectural University (Industrial organic chemistry), Faculty of Science and Engineering, Konan University (Special BiologyI)

B-3.Overseas teaching 1

International students

- International students : Research Students 1 (USA)

Special notes：

Pesticide Science Society of Japan Award for the Encouragement of Young Scientists (Miyashita, M.)

12th IUPAC International Congress of Pesticide Chemistry (Program Chair)