Chair Science of Plant Protection

2.4.3 Laboratory : Plant Pathology

Member :	Professor	Okuno, Tetsuro, D.Agric.Sci
	Associate Professor	Mise, Kazuyuki, D.Agric.Sci
	Associate Professor	Takano, Yoshitaka, D.Agric.Sci
	Assistant Professor	Kaido, Masanori, D.Agric.Sci
	Doctor's program	7
	Master's Program	11
	Undergraduate	3
	Other	1
	Post-Doctoral fellow	1

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Studies on plant RNA virus infection

Plant viruses cause serious diseases in many important plant species, but few effective antiviral strategies have been developed. This is likely due to our inadequate understanding of the basic biology of plant viruses. We are studying the mechanisms of infection and replication of plant viruses and their interaction with host plants. Viruses used for the studies are dianthoviruses and bromoviruses. Plants used for the studies are Arabidopsis, barley, cowpea, tobacco and others. We have been analyzing the molecular structures and the functions of viral RNAs and proteins in the infection process of viruses in both plant and protoplast systems. Researches include investigations on the early events of infection to the late maturation stage such as protein synthesis, RNA replication, the cell-to-cell movement of virus, and packaging of viral RNAs into virions and analyses of molecular mechanisms of symptom expression caused by plant virus infection.

b) Identification of host factors involved in plant virus infection

Viruses utilize host proteins to establish infection in plants. Plant virus genomes and their encoded proteins are proposed to have physical interactions with putative host-derived factors. Surveys for plant genes involved in RNA virus infections have been progressing by using proteomics approach including affinity chromatography purification and mass spectrometry and genetic approach using Arabidopsis mutants.

c) Studies on infection mechanism of phytopathogenic fungi

Plant pathogenic fungi cause serious diseases on a wide range of crops and ornamental plants. For development of novel strategies for protecting plants from fungal infection, it is necessary to understand both of fungal infection and plant resistant mechanisms at molecular level. Researchers are studying infection mechanism of a plant pathogenic fungus Colletotrichum orbiculare, the causal agent of cucumber anthracnose. Molecular genetic analysis has identified many genes involved in pathogenicity of C. orbiculare. Based on information about identified pathogenicity-related genes, we are especially focusing on relations of peroxisomal metabolic function, autophagy, and RNA regulation with fungal infection mechanism. Using Arabidopsis thaliana and several Colletotrichum species that have different host ranges, we are studying nonhost plant resistance and suppression of plant defense responses by adapted pathogens.

A-2.Publications and presentations

a) Publications

Original Papers(including book-reviews)

- An, M., H-O. Iwakawa, A. Mine, M. M. Kaido, K. Mise, and T. Okuno, A Y-shaped RNA structure in the 3'untranslated region together with the trans-activator and core promoter of Red clover necrotic mosaic virus RNA2 is required for its negative-strand RNA synthesis. Virology 405: 100-109, 2010

- Hiruma, K., M. Onozawa-Komori, F. Takahashi, M. Asakura, P. Bednarek, T. Okuno, P. Schulze-Lefert, and Y. Takano, Entry mode-dependent function of an indole glucosinolate pathway in Arabidopsis for nonhost resistance against anthracnose pathogens. Plant Cell 22:2429-2443, 2010

- Mine, A., K. Hyodo, A. Takeda, M. Kaido, K. Mise and T. Okuno, Interactions between p27 and p88 replicase proteins of Red clover necrotic mosaic virus play an essential role in viral RNA replication and suppression of RNA silencing via the 480-kDa viral replicase complex assembly. Virology 407:213-224, 2010

- Iwakawa, H-O., A. Mine, K. Hyod., M. An, M. Kaido, K. Mise and T. Okuno, Template recognition mechanisms by replicase proteins differ between bipartite positive-strand genomic RNAs of a plant virus. Journal of Virology 85:497-509, 2011

- Kaido, M., N. Funatsu, Y. Tsuno, K. Mise and T. Okuno, Viral cell-to-cell movement requires formation of cortical punctate structures containing Red clover necrotic mosaic virus movement protein. Virology 413:205-215, 2011

- Hyodo, K., A. Mine, H-O. Iwakawa, M. Kaido, K. Mise and T. Okuno, Identification of amino acids in auxiliary replicase protein p27 critical for its RNA-binding activity and the assembly of the replicase complex in Red clover necrotic mosaic virus. Virology 413:300-309, 2011

Reviews

- Takano, Y. Infection strategy of plant pathgenic fungi (in Japanese). Seibutsu no Kagaku Iden 64 (5): 20-25, 2011

- Yoshimoto, K., Y. Takano and Y. Sakai, 2011 Autopahgy in plants and phytopathogens. FEBS Letters 584:1350-1358.

b) Conference and seminar papers presented

- The 2010 Annual meeting of the Phytopathological Society of Japan: 8 Presentations

- The 2010 Kansai meeting of the Phytopathological Society of Japan: 1 Presentation
- The 2011 Annual meeting of the Phytopathological Society of Japan: 8 Presentations
- The 58th Annual meeting of the Japanese Society for Virology: 2 Presentations
- The 33rd Annual meeting of the Molecular Biology Society of Japan: 3 Presentations
- American Society for Virology. 29th Annual Meeting: 3 Presentations
- 21st International Conference on Arabidopsis Research: 1Presentation
- The 9th International Mycological Congress: The biology of Fungi: 2Presentations

A-3.Off-campus activities 1

Membership in academic societies

- Okuno, Tetsuro, D.Agric.Sci : The Phytopathological Society of Japan (Editor-in-Chief of PSJ Journal, Councilor), The Japanese Society for Virology (Councilor), The Molecular Biology Society of Japan, The RNA Society of Japan

- Mise, Kazuyuki, D.Agric.Sci : The Phytopathological Society of Japan (Managing Editor of PSJ Journal), The Japanese Society for Virology, The Molecular Biology Society of Japan

- Takano, Yoshitaka, D.Agric.Sci : The Phytopathological Society of Japan (Editorial Manager of PSJ Journal), The Molecular Biology Society of Japan, The Japanese Society of Plant Physiologists

- Kaido, Masanori, D.Agric.Sci : The Phytopathological Society of Japan (Editorial Manager of PSJ Journal)

A-3.Off-campus activities 2

Research grants

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

- Grant-in-Aid for Scientific Research (A) : Okuno, Tetsuro, D.Agric.Sci : Molecular mechanisms underlying circumvention and utilization of plant defense systems by virus

- Grant-in-Aid for Scientific Research (B) : Mise, Kazuyuki, D.Agric.Sci. : Mechanisms of host specificity in rice-bromovirus interactions

- Grant-in-Aid for Scientific Research (B) : Takano, Yoshitaka, D.Agric.Sci. : Studies on plant factors required for nonhost resistance against anthracnose fungi

- Grant-in-Aid for Scientific Research (C) : Kaido. Masanori, D.Agric.Sci. : Studies on the association of Dianthovirus cell-to-cell movement with viral genome replication

- Grant-in-Aid for Scientific Research (B) : Hosokawa. Munetaka, D.Agric.Sci. : Determination of functional sequences available for horticulture in viroid nucleotide

- Grant-in-Aid for Scientific Research (Young Researcher) : Hiruma, Kei, Doctor Course Student : Functional molecular analysis of EDR1-dependent immune pathway required for nonhost plant resistance

2.Other Research Grants

- CREST (Core Research of Evolutional Science & Technology) : Sakai, Yasuyoshi, D. Agric. Sci. : Metabolism-based regulation of organelle homeostasis and cell function (eukaryotic microorganisms)

- Promotion of Basic Research Activities for Innovative Biosciences : Takano, Yoshitaka, D.Agric.Sci. : Comprehensive search on effectors of anthracnose pathogens and the development of effector inhibitors

- Inamori Foundation Research Grants : Takano, Yoshitaka, D.Agric.Sci. : Molecular analysis of a protein kinase EDR1 involved in induction of nonhost plant defense

- Institute for Fermentation Research Grants : Takano, Yoshitaka, D.Agric.Sci. : Molecular analysis of organelle function required for pathogenesis expression of plant pathogens and an applied approach for drug development

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Okuno, Tetsuro, D.Agric.Sci.: The RNA Society, The American Society for Virology, American Society for Microbiology

- Mise, Kazuyuki, D.Agric.Sci.: The American Phytopathological Society, The American Society for Virology, The Society for General Microbiology

- Takano, Yoshitaka, D.Agric.Sci.: The International Society of Molecular Plant-Microbe Interactions

International meetings(country,roles)

- Okuno, Tetsuro, D.Agric.Sci. : 29th Annual Meeting of the American Society for Virology(USA, poster presentation)

- Mise, Kazuyuki, D.Agric.Sci. : 29th Annual Meeting of the American Society for Virology(USA, poster presentation)

- Takano, Yoshitaka, D.Agric.Sci. : 21st International Conference on Arabidopsis Research (Japan, poster presentation), The 9th International Mycological Congress: The biology of Fungi (Scotland, oral presentation)

- Kaido, Masanori, D.Agric.Sci. : 29th Annual Meeting of the American Society for Virology(USA, poster presentation)

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Plant Pathology I (Okuno), Plant Pathology II (Mise and Takano), Seminar in Plant Protection (Okuno), Biotechnology-Novel Strategies for Agriculture (Okuno), Microbiology (Okuno), Cell Biology III (Mise), Outline of Bioresource Science IV (Mise and Takano), Laboratory Course in Bioresource Science I, II (Okuno, Mise, Takano and Kaido)

- Graduate level : Plant Pathology (Advanced Course) II (Okuno), Seminar in Plant Pathology (Okuno, Mise, Takano and Kaido), Research in Plant Pathology (Okuno, Mise, Takano and Kaido)

B-2.Off-campus teaching etc.

Part-time lecturer

- Mise, K.: Faculty of Agriculture, Kochi University (Plant Virology), School of Science and

B-3.Overseas teaching 1

International students

- International students : Master 1 (Taiwan) Doctral 4 (Thailand 1, China 2, Indonesia 1)

C.Other Remarks

- Okuno, Tetsuro, D.Agric.Sci.: Bio-oriented Technology Research Advancement Institution, National Agriculture and Food Research Organization (Selection and evaluation committee member), Japan Science and Technology Agency (Basic Research Program Adviser)

- Mise, Kazuyuki, D.Agric.Sci.: Committee of the Grant-in-Aid for Scientific Research, Japan Society for the Promotion of Science (committee member)