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	8
	Master's Program	11
	Undergraduate	4
	Other	1
	Post-Doctoral fellow	1

A. Research Activities (2009.4-2010.3)

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

Books

- Okuno, T: Mechanisms of plant virus pathogenesis in "Plant Pathology" eds., S. Mayama and S. Namba. p.193-202. Buneido Syuppan, Tokyo, 2010

- Mise, K: Plant virus genomes in "Plant Pathology" eds., S. Mayama and S. Namba. p. 248-253. Buneido Syuppan, Tokyo, 2010

- Takano, Y: Analysis of genes involved in nonhost resistance in plants in "Plant Pathology" eds., S. Mayama and S. Namba. p.228-230. Buneido Syuppan, Tokyo, 2010

- Okuno, T: Three chapters for virus replication, virus movement, and molecular interactions between virus and plant in "Plant Virology" In colaboration with M, Ikegami, I, Uyeda, K, Natsuaki, and S, Namba. p. 100-140. Asakura Shoten, Tokyo, 2009

- Okuno, T: Plant defense against pathogens in "Plant Physiology" eds., T. Mimura and S. Tsurumi. p. 174-191. Kagakudojin, Kyoto, 2009

- Asakura, M. and Y. Takano: Peroxisomes and phytopathogenicity in "Emergent Funcitons of the Peroxisome". ed., S.R. Terlecky and V.I. Titorenko. p. 33-42. Research Signpost, Kerala, India, 2009

Original Papers

- Mine, A., A. Takeda, T. Taniguchi, H. Taniguchi, M. Kaido, K. Mise and T. Okuno: Identification and characterization of the 480 kDa template-specific RNA-dependent RNA polymerase complex of Red clover necrotic mosaic virus. J. Virol. 84; 6070-6081, 2010

- Asakura, M., S. Ninomiya, M. Sugimoto, M. Oku, S. Yamashita, T. Okuno, Y. Sakai and Y. Takano: Atg26-mediated pexophagy is required for host invasion by the plant pathogenic fungus Colletotrichum orbiculare. Plant Cell 21; 1291-1304, 2009

- Fujisaki, K., F. Iwahashi, M. Kaido, T. Okuno and K. Mise: Genetic analysis of a host determination mechanism of bromoviruses in Arabidopsis thaliana. Virus Res 140; 103-110, 2009

- Kaido, M., Y. Tsuno, K. Mise and T. Okuno: Endoplasmic reticulum targeting of the Red clover necrotic mosaic virus movement protein is associated with the replication of viral RNA1 but not RNA2. Virology 395; 232-242, 2009

- Narabayashi, T., F. Iwahashi, M. Kaido, T. Okuno and K. Mise: Melandrium yellow fleckbromovirus infects Arabidopsis thaliana and has genomic RNA sequence characteristics that are unique among bromoviruses. Arch. Virol. 154; 1381-1389, 2009

- Saitoh, H., S. Fujisawa, A. Ito, C. Mitsuoka, T. Berberich, Y. Tosa, M. Asakura, Y. Takano and R. Terauchi: SPM1 encoding a vacuole-localized protease is required for infection-related autophagy of the rice blast fungus Magnaporthe oryzae. FEMS Microbiol. Lett. 300; 115-121, 2009

- Sarawaneeyaruk, S., H. Iwakawa, H. Mizumoto, H. Murakami, M. Kaido, K. Mise and T. Okuno: Host-dependent roles of the viral 5'untranslated region (UTR) in RNA stabilization and cap-independent translational enhancement mediated by the 3' UTR of Red clover necrotic mosaic virus RNA1. Virology 391; 107-118, 2009

- Yoshida, K., H. Saitoh, S. Fujisawa, H. Kanzaki, H. Matsumura, K. Yoshida, Y. Tosa, I. Chuma, Y. Takano, J. Win, S. Kamoun and R. Terauchi: Association genetics reveals three novel avirulence genes from the rice blast fungal pathogen Magnaporthe oryzae. Plant Cell 21; 1573-1591, 2009

Reviews

- Yoshimoto, K., Y. Takano, and Y. Sakai: Autophagy in plants and phytopathogens. FEBS Lett. 584; 1350-1358, 2010

- Sakai, Y. and Y. Takano: Relation of autophagy with regulation of organelle number and host infecton in phytopathogens. Brain Techno news 135; 25-30, 2009

- Takano, Y., M. Asakura, and Y. Sakai: Atg26-mediated pexophagy and fungal phytopathogencity. Autophagy 5; 1041-1042, 2009

b) Conference and seminar papers presented

- The 2009 Annual meeting of the Phytopathological Society of Japan: 9 Presentations
- The 2009 Kansai meeting of the Phytopathological Society of Japan: 2 Presentations
- The 57th Annual meeting of the Japanese Society for Virology: 3 Presentations
- The 32th Annual meeting of the Molecular Biology Society of Japan: 1 Presentation

A-3.Off-campus activities

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

Membership in Science Council of Japan, etc.

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

Research grants

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

- Scientific Research (B) : Mise, Kazuyuki, D.Agric.Sci. : Molecular analysis of the regulation mechanism of systemic necrosis development in Arabidopsis thaliana upon bromovirus infection
- Scientific Research (B) : Takano, Yoshitaka, D.Agric.Sci. : Studies on plant factors required for nonhost resistance against anthracnose fungi

2.Other Research Grants

- Core Stage Backup Fund of Kyoto University : Okuno, Tetsuro, D.Agric.Sci. : Research on replication mechanisms of plant viruses
- Joint research program of Tokusima University-Institute of Enzyme Research : Okuno, Tetsuro, D.Agric.Sci. : Analysis of translation and replication mechanisms of positive-strand RNA viruses
- Core Stage Backup Fund of Kyoto University : Kaido, Masanori, D.Agric.Sci. : Investigation

of host factors involved in the cell-to-cell movement of Dianthovirus which has a unique RNAi suppression activity

A-4.International cooperation and overseas activities

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 American Association for the Advancement of Science, 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.: 28th Annual Meeting of the American Society for Virology(Canada, poster presentation), The 2009 KSPP Fall Meeting and the 1st Japan-Korea Joint Symposium (Korea, Symposium speaker), 14th International Meeting of Molecular Plant-Microbe Interections(Canada, poster presentation)
- Mise, Kazuyuki, D.Agric.Sci.: 28th Annual Meeting of the American Society for Virology(Canada, poster presentation)
- Takano, Yoshitaka, D.Agric.Sci.: 14th International Meeting of Molecular Plant-Microbe Interections(Canada, poster presentation)
- Kaido, Masanori, D.Agric.Sci.: 28th Annual Meeting of the American Society for Virology(Canada, poster presentation)

B.Educational Activities(2009.4-2010.3)

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 (Mise and Takano), 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

- Okuno, T.: Faculty of Agriculture, Ehime University (Plant Protection Theory), Faculty of Agriculture, Kochi University (Plant Virology)
- Mise, K.: School of Science and Technology, Kyoto Institute of Technology (Plant Pathology)

Open lectures, etc.

- Okuno, T.: The 52th Symposium of Japanese Scociety of Breeding, Japanese Society of Breeding, invited speaker

B-3.Overseas teaching

International students

- International students : Doctral 3 (Thailand 1, China 1, Indonesia 1) Research Students 1 (Taiwan)

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)