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High-throughput screening and identification of novel chemicals enhancing plant defense against pathogens/pests

Department of Applied Biological Science, Faculty of Science and Technology

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-Molecular dissection of signal transduction in response to pathogen attack and environmental stresses in plants.
-Molecular mechanisms for plant immunity.
-Regulation and physiological significance of autophagy and programmed cell death in plants.
-Regulation of defense responses and growth in plants.
-Involvement of reactive oxygen species in plant signaling.

Biography

1990 PhD in plant biology, University of Tokyo
1990-1999 Staff Scientist at National Institute of Agrobiological Sciences, Tsukuba, Japan
1995-1997 Visiting Scientist, University of California, San Diego, U.S.A.
1999- Professor, Tokyo University of Science
2000 Young Investigator Award, Bioimaging Society of Japan
2001 Young Investigator Award, Japanese Society of Plant Physiologist
2007-2009 Scientific Research Senior Specialist, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan
2007-2011 Editor, Journal of Plant Research
2013- Associate Director, Imaging Frontier Research Division, Research Institute of Science & Technology, Tokyo University of Science

Selected Publications

Kaya *et al.* (2014) Ca^{2+}-activated ROS production by Arabidopsis RbohH and RbohJ is essential for proper pollen tube tip growth. ***Plant Cell*** 26: 1069-1080
Kurusu *et al.* (2014) OsATG7 is required for autophagy-dependent lipid metabolism in rice post-meiotic anther development. ***Autophagy*** 10: 860-870.
Kurusu *et al.* (2013) An S-type anion channel SLAC1 is involved in cryptogein-induced ion fluxes and modulates hypersensitive responses in tobacco BY-2 cells. ***PLOS ONE*** 8:e70623.
Kurusu *et al.* (2013) Plant mechanosensing and Ca^{2+} transport. ***Trends in Plant Science*** 18: 227-233.
Hamada *et al.* (2012) Regulation of a proteinaceous elicitor-induced Ca^{2+} influx and production of phytoalexins by a putative voltage-gated cation channel, OsTPC1, in cultured rice cells. ***J Biol. Chem***. 287: 9931–9939.
Kurusu *et al.* (2010) Regulation of microbe-associated molecular pattern-induced hypersensitive cell death, phytoalexin production and defense gene expression by calcineurin B-like protein-interacting protein kinases, OsCIPK14/15, in rice cultured cells. ***Plant Physiol.*** 153: 678-692
Ogasawara *et al.* (2008) Synergistic Activation of Arabidopsis NADPH Oxidase AtrbohD by Ca^{2+} and Phosphorylation. ***J. Biol. Chem.*** 283: 8885-8892.
Takeda *et al.* (2008) Local Positive Feedback Regulation Determines Cell Shape in Root Hair Cells. ***Science*** 319: 1241-1244.

Description of the research

Control of pests and diseases is a critical issue in crop production since estimated loss by biotic factors cause economic loss of $220 billion. Traditional chemical pesticides which have still major counter measure against crop loss have disadvantages of toxicity to beneficial symbiotic microorganisms and insects, as well as disturbance of eco-system.

Plant defense activators, chemicals that boost defense/immune responses of plants, have excellent advantages as new type of pesticides to avoid emergence of drug resistant organisms.

The plant immune system consists of two major pathways involving salicylic acid (SA) and jasmonic acid (JA)/ethylene (ET). Only a few plant defense activators that activate only SA pathway with narrow application mostly limited to rice pests are available in market.

We have developed a novel high throughput screening system for plant defense activators (PCT filed), and have discovered novel putative plant defense activators that activate the JA/ET pathway or both of the two pathways, which are expected to enhance defense responses against necrotrophic pathogens and pests.