

# Prof. Kiwamu Minamisawa

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**Biography:** Dr. Kiwamu Minamisawa is Professor of Environmental Plant Microbiology, Graduate School of Life Sciences, Tohoku University, and Past President of Japanese Society of Microbial Ecology (JSME; 2012-2016). His research focuses on the diversity and functions of plant-associated bacteria including soybean bradyrhizobia and microbial communities associated with rice and soybean plants in agricultural settings. In particular, he has been bridging microbial genomics/metagenomics and microbial processes in the environments with respect to nitrogen cycling and greenhouse gas emission on the earth. He is serving as Senior Editor of The ISME Journal (2011-2016) and Editor-in-Chief of Microbes & Environments (M&E; 2007-2010), and as editorial board member for Applied and Environmental Microbiology, Molecular Plant-Microbe Interactions and Plant Cell Physiology.



## Plant-associated bacteria mitigate greenhouse gas emission

Biogeochemical processes and microbial functions in rice paddies have been the focus of a large number of studies. Methane-nitrogen cycle interaction is a key unresolved issue in research on rice paddies. A rice symbiotic gene, relevant to rhizobial nodulation and mycorrhization in plants, likely accommodates diazotrophic methanotrophs or the associated bacterial community in root tissues under low-N fertilizer management, which may permit rice plants to acquire N via  $N_2$  fixation.  $CH_4$  oxidation by methanotrophs is a driving force in shaping bacterial communities in rice roots grown in  $CH_4$ -rich environments. A hypothesis was proposed for the interplay between rice plants, root microbiomes, and their biogeochemical functions. Our group has also revealed active N transformation in soybean rhizosphere.  $^{15}N$  tracer experiment indicated that the  $N_2O$  was derived from N fixed in the nodules. As for nitrification, the addition of nitrification inhibitors significantly reduced  $N_2O$  flux.  $^{15}N$  experiment and fungal isolation indicated that nitrite-utilizing fungi including *Fusarium* species substantially mediate  $N_2O$  emission in soybean rhizosphere. Inoculation experiments showed that soybean bradyrhizobia contribute to both production and consumption of  $N_2O$  via bacterial denitrification. Soybean nodulation is controlled by several host genes referred to as *Rj* genes. A dominant allele *Rj2* restricts nodulation by specific rhizobial strains. Bradyrhizobial type III secretion system (T3SS) and plant resistance (R) protein has been identified as the causal factors for inducing the symbiotic incompatibility. We have isolated spontaneous mutants that were able to nodulate on *Rj2*-soybeans, and identified the causal effector protein. I want to discuss the implications of our findings in terms of symbiotic evolution.