【Grant-in-Aid for Scientific Research (S)】

Biological Sciences (Agricultural Sciences)

# Title of Project : Molecular Mechanism and Evolution of Self-Incompatibility in Plants

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Research Project Number : 16H06380 Researcher Number : 70273836
Research Area : Agricultural Chemistry, Applied Biochemistry
Keyword : Plant Biochemistry, Reproduction, Self-incompatibility

## 【Purpose and Background of the Research】

Flowering plants have self-incompatibility (SI) systems to avoid inbreeding and to maintain genetic diversity. The self/nonself discrimination in SI is achieved by the interaction between the set of male and female *S*-determinants encoded at the *S*-locus. We have thus far revealed that completely different modes of self/nonself discrimination have been adopted in two plant families, Brassicaceae and Solanaceae (Figure 1).

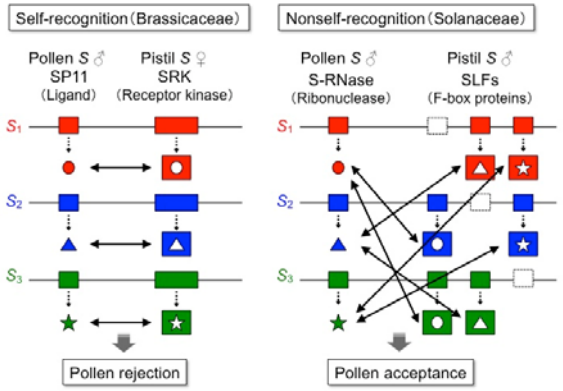


Figure 1. Self- and nonself-recognition in plant self-incompatibility

In the Brassicaceae family, direct and specific interaction between the pollen-localized small ligand protein SP11 and the pistil surface receptor kinase SRK represents the 'self'-recognition, which then induces further downstream events required for self-pollen-rejection.

On the contrary, in the Solanaceae family, a ribonuclease named S-RNase exhibits a specific cytotoxicity against self-pollen, because in the 'nonself'-pollen the S-RNase is detoxified by the pollen F-box proteins (SLFs).

In this research project, we aim to clarify: 1) protein structural basis of the specific self/nonself recognitions; 2) molecular mechanisms of the self-rejection and nonself-acceptance responses caused via the self/nonself discrimination; 3) evolutionary dynamics which lead to the diversification of self/nonself discrimination mechanisms in SI.

## 【Research Methods】

1) Heterologous protein expression system of SRK, S-RNase and SLFs will be intensively optimized in this project; 2) In the Brassicaceae SI system, revealing the calcium-signaling dynamics in the pistil cells; and in the Solanaceae SI system, fate of S-RNase in the elongating pollen tubes will be investigated in depth; 3) Comparative analysis of the genomic structures will be employed to reveal the evolutionary processes.

## 【Expected Research Achievements and Scientific Significance】

This research project is expected to advance our understanding of the mechanism of self/non-self discrimination, one of the basic principles of life. The study contributes to revealing diverse physiological processes, as the F-box and receptor-like kinases are the two largest protein families in plants. Studying the evolutionary diversity of SI in plants leads to understand the surviving tactics of plants in fluctuating environments. Scientific advances from this study contribute to establishing new agricultural technologies relevant to $F_1$ hybrid seed production.

## 【Publications Relevant to the Project】

・Iwano M, Ito K, Fujii S, *et al.* Calcium signalling mediates self-incompatibility response in the Brassicaceae. **Nature Plants** 1, 15128, 2015.
・Kubo K, Paape T, *et al.* Gene duplication and genetic exchange drive the evolution of S-RNase-based self-incompatibility in *Petunia*. **Nature Plants** 1, 14005, 2015.

## 【Term of Project】 FY2016-2020

## 【Budget Allocation】 140,800 Thousand Yen

## 【Homepage Address and Other Contact Information】

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