

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

Biological Sciences (Biology)



Title of Project : Endomembrane-Mediated Organ Straightening and Defense in Plants

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Research Project Number : 15H05776 Researcher Number : 00241232

Research Area : Biology, Basic Biology, Plant Cell Biology

Keyword : Environmental responses, Organelle, Plant-microbe interaction, Plant molecular biology

【Purpose and Background of the Research】

After bending in response to gravity or light, plant organs have the ability to stop bending and resume straight growth. Remarkably, nothing is known about the fundamental molecular mechanisms responsible for this response. Our recent studies indicate that straightening is driven by an actin-myosin XI cytoskeleton in a specific type of cell having a long actin cables. The first aim of this project is to disclose the molecular mechanism of straightening of plant organs. Our previous findings suggest a model whereby dynamic interactions between endoplasmic reticulum (ER) and actin-myosin XI cytoskeleton determine the architecture and movement patterns of the ER strands. We also found an ER-derived organelle and designated it as ER body. ER bodies develop in epidermal cells in seedlings and accumulate a large amount of β -glucosidases, which can produce substances that potentially protect against invading pests. The second aim of this project is to unveil an ER-body function as a novel defense system in Brassicaceae plants.

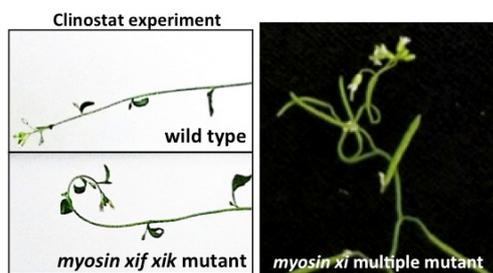


Figure 1. Actin-myosin XI cytoskeleton responsible for organ straightening and plant posture

【Research Methods】

Specific aims are: (1) to genetically identify factors responsible for straightening, to analyze actin dynamics, and finally to show that long actin filaments act as a bending sensor to trigger the straightening system and (2) to address how the ER bodies support the innate immunity against herbivores.

【Expected Research Achievements and Scientific Significance】

Evidence from this research will provide an idea that plants have evolved the endomembrane-mediated strategies against biotic and abiotic stresses. This will give a valuable insight into the fields of plant tropism and defense.

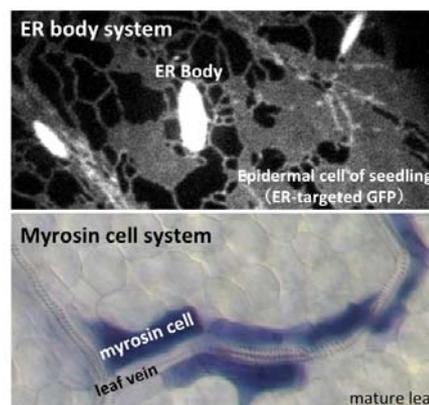


Figure 2. Two mustard-oil bomb systems in Brassicaceae plants

【Publications Relevant to the Project】

- Okamoto, K, Ueda, H, Shimada, T, Tamura, K, Kato, T., Tasaka, M., Morita, M.T., & Hara-Nishimura, I (2015) Regulation of organ straightening and plant posture by an actin–myosin XI cytoskeleton. *Nature Plants* 1: 15031: DOI: 10.1038.
- Ueda H, Yokota E, Kutsuna N, Shimada T, Tamura K, Shimmen T, Hasezawa S, Dolja VV, Hara-Nishimura I. (2010) Myosin-dependent endoplasmic reticulum motility and F-actin organization in plant cells. *Proc Natl Acad Sci U S A*. 107:6894-9.

【Term of Project】 FY2015-2019

【Budget Allocation】 153,800 Thousand Yen

【Homepage Address and Other Contact Information】

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