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

Title of Project : Higher-Order Functions of Stomatal Guard Cells in Plant Environmental Adaptation

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Research Project Number : 26221103 Researcher Number : 10192501
Research Area : Plant Physiology
Keyword : stomatal responses to the environment

【Purpose and Background of the Research】

Stomata in the epidermis, formed by pairs of guard cells, serve as major gateways for gas exchange between plants and their environment, in particular the uptake of CO_2 and evaporation of water – processes vital to plant life. Guard cells integrate external environmental and intrinsic developmental signals and appropriately adjust the stomatal pore apertures to optimize growth performance.

Leaf temperature provides a convenient indicator of transpiration, and can be used to detect mutants with altered stomatal control. To identify genes that function in physiological responses in guard cells, we isolated CO_2-insensitive mutants from *Arabidopsis* through high-throughput leaf thermal imaging (**Fig. 1**). In the present study, the stoma is treated as the main organ of higher-order information processing in plants, and searches will be made for factors carrying and processing information about the external environment and internal conditions, and for factors involved in communication with other organs.

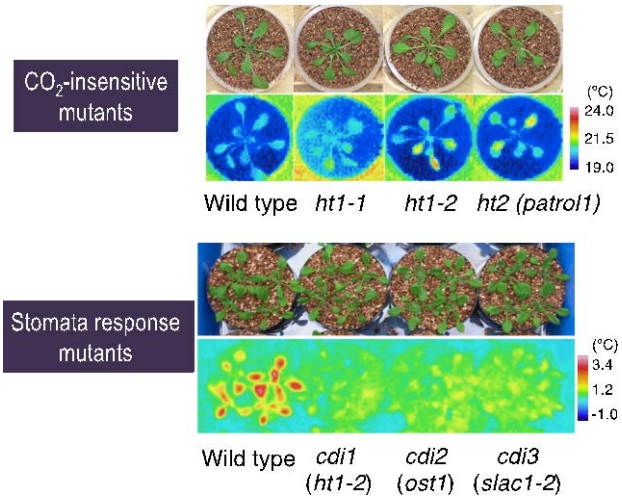

Fig. 1 Isolation of stomatal response mutants using a high-throughput thermal imaging technique.

【Research Methods】

(1) Guard cell chloroplasts are hypothesized to carry some of the higher-order functions of stomatal guard cells. We will analyze the role of guard cell chloroplasts in stomatal higher-order information processing using *gles1* mutants with non-chlorophyllous stomata.
(2) A Dof transcription factor, SCAP1, is essential for the development of functional stomata. We will analyze the formation of functional stomata by identifying factors regulating the expression of the *SCAP1* gene and of the direct target genes of SCAP1.

【Expected Research Achievements and Scientific Significance】

Stomatal higher-order information processing plays a pivotal role in the adaption and survival of plants in diverse environments, but many aspects of the underlying molecular mechanism remain unknown. Through the present study, we expect to develop a paradigm for the general characteristics of information processing in plants by demonstrating the mechanisms of the compilation and integration of higher-order information in stomata.

【Publications Relevant to the Project】

・ Hashimoto-Sugimoto, M., Higaki, T., Negi, J., Hasezawa, S. and Iba, K. (2013) A Munc13-like protein in *Arabidopsis* mediates H^+-ATPase translocation that is essential for stomatal responses. ***Nature Commun.*** 4:2215 doi: 10.1038/ncomms3215.
・ Negi, J., Hashimoto, M. and Iba, K. (2008) CO_2 regulator SLAC1 and its homologues are essential for anion homeostasis in plant cells. ***Nature*** 452: 483-486.

【Term of Project】 FY2014-2018

【Budget Allocation】 150,100 Thousand Yen

【Homepage Address and Other Contact Information】

http://plant.biology.kyushu-u.ac.jp