【Grant-in-Aid for Transformative Research Areas（A）】

Section Ⅲ

Title of Project： Multi-layered regulatory system of plant resilience under fluctuating environment

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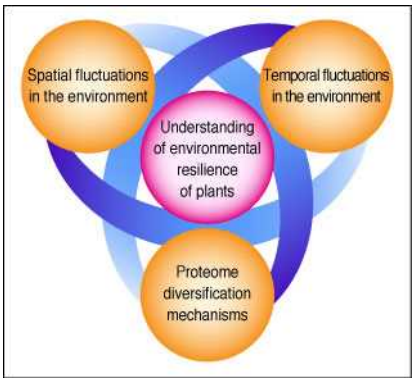
Number of Research Area：20A302　Researcher Number：20464399

【Purpose of the Research Project】

Plants are exposed to constantly fluctuating environments where they sprout. Attributes of their environment, such as soil nutrients and leaf-filtered sunlight, display mosaic-type spatial fluctuations, and are accompanied by irregular fluctuations across time, such as in degree of dryness. Moreover, it is not unusual for attributes of a real natural environment to fluctuate in a compound manner. To survive in such environments, plants are equipped with characteristic resilience mechanisms that enable them to adapt robustly and flexibly to environmental changes across a wide dynamic range. However, research to date has been limited to analysis of single-environment response under uniform conditions, and has not elucidated multi-layered adaptive mechanisms in intrinsically fluctuating, compound environments. In particular, most phenomena and molecular mechanisms whose actions can be observed only under fluctuating environmental conditions remain to be elucidated. By focusing on molecular mechanisms that regulate fluctuating temporal and spatial environmental information, and the proteome diversification mechanisms supporting them, this research project will seek to elucidate the nature of plant environmental resilience, and revolutionize research into biological adaptation to the environment.

【Content of the Research Project】

This transformative research project will seek to understand the robust as well as the characteristically flexible dynamic adaptive capacity that plants demonstrate under fluctuating environmental conditions—that is, their environmental resilience mechanisms—by going a step beyond research to date into plant environmental response under uniform conditions, to effect a revolution in research methods and concepts relating to plant environmental response, by introducing three original perspectives actually seen in natural environments: 1) spatial fluctuations; 2) irregular fluctuations over time; and furthermore, 3) multi-layered proteome diversification mechanisms, including changes in transcription start sites, as a molecular basis supporting adaptive capacity in fluctuating temporal and spatial environments. In addition, plant environments in the natural world are thought to consist of multiple, overlapping and fluctuating environmental layers, and an understanding of plant responses to complex natural environments such as this has so far been almost entirely lacking. In this research project, specialists engaged in different types of environmental stimulus response research will collaborate to elucidate response mechanisms in compound environments of various configurations.



Three original perspectives in this project

【Expected Research Achievements and Scientific Significance】

Elucidation of the molecular mechanisms supporting plant environmental resilience should establish concepts that give rise to new research currents. Moreover, this research project will promote the development of young researchers who can play active international roles. In addition, it should generate results that will contribute to structuring basic technologies for solving food supply and energy problems in the future. These researches could also facilitate understanding of biological systems for regulating a wide range of environmental information.

【Key Words】

Resilience: Commonly signifies dynamic adaptive capacity incorporating flexibility and robustness with respect to a continuously changing environment. This can truly be said to exemplify the survival strategy of plants, which have chosen a strategy of immobility, in contrast to animals, which move about seeking environments optimized for survival.

【Term of Project】 FY2020-2024

【Budget Allocation】 1,204,200 Thousand Yen

【Homepage Address and Other Contact Information】

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