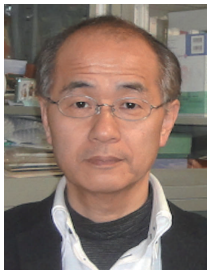
【Grant-in-Aid for Scientific Research (S)】

Broad Section F



Title of Project : Development of basic technology of chemistry and biology for reducing damage by root parasitic weeds

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Research Project Number : 18H05266 Researcher Number : 90231901
Keyword : root parasitic weeds, strigolactones, suicidal germination, inhibitor, receptor, biosynthesis

【Purpose and Background of the Research】

Strigolactones (SLs) are a plant hormone that regulates branching of plants. They also promote the germination of root parasitic plants that grow in the host plant's root, such as genus *Striga*. The root parasitic weeds infest cereals and non-cereals crops respectively, resulting 50-90% yield losses. Therefore, chemicals that regulate the functions of SLs will be very useful, so in this project we will try to develop several SL biosynthesis inhibitors, agonists and antagonists to reduce the damage by root parasitic weeds. Followings are important characters of chemicals: SL biosynthesis inhibitors must inhibit SL biosynthesis in host plants without morphological change of host plants, SL agonists must induce germination of root parasitic weeds without roots of host plants (suicidal germination) and antagonists must inhibit the perception of SLs in root parasitic weeds. To understand the mechanisms how these chemicals are perceived by their target proteins, we will also try to crystalize the complex of proteins and chemicals. As ethylene also induce suicidal germination, we will try to prepare ethylene agonists and antagonists, which will be used to facilitate the crystallization of ethylene receptors.

【Research Methods】

We have already reported a lead compound for SL biosynthesis inhibitor TIS103. In this project, we will carry out a structure-activity relationship study of TIS13 to discover more potent and specific SL biosynthesis inhibitor because TIS13 has a severe side effect at high concentrations. We will identify the target sites of the new potent inhibitors and prepare knockout mutants of the target proteins. We found that treatment of GAs also reduces the level of SLs. This means that GA can be used to protect plants from the attack of *Striga*. AC94377 and D67 are good candidates of GA agonists but their mode of binding to GA receptor is not clear. Here we will try to clarify 3D structures of complex between GA agonists and GA receptors, which will facilitate the design of new GA agonists.

To design suicidal germination inducers, we try to understand the mechanism of SL perception. At present two mechanisms, (A) and (B), are proposed as shown in Figure 1. We found receptor inhibitors that covalently bind to the catalytic site of SL receptors and inhibit the germination of *Striga* seeds induced by SLs. Among these covalent inhibitors, we found AGOL also covalently binds to catalytic site of SL receptors but shows agonistic activity. Investigation on the activation mechanism of SL signals by AGOL will make clear the mechanism of activation pathway (A). This research will facilitate the design of new suicidal germination inducers.

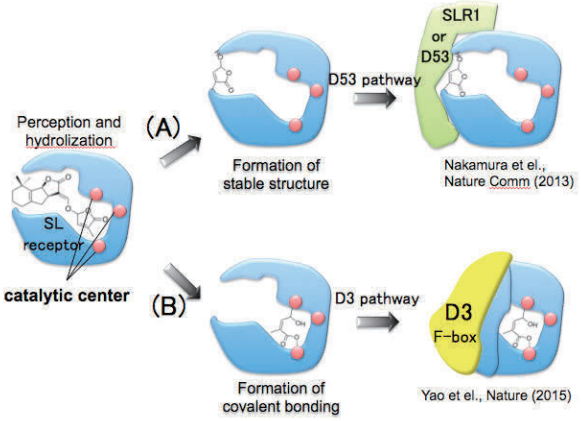

Figure 1. Perception of SL by SL receptor

【Expected Research Achievements and Scientific Significance】

- Practical use of developed chemicals in the infested fields
- Proposal of new mode of action of SLs

【Publications Relevant to the Project】

Nakamura H, et al., Molecular mechanism of strigolactone perception by DWARF14. ***Nature Comm***, 4: 2613 (2013).

Zhou F et al., D14-SCFD3-dependent degradation of D53 regulates strigolactone signaling. ***Nature***, **504**: 406-410 (2013).

【Term of Project】 FY2018-2022

【Budget Allocation】 151,600 Thousand Yen

【Homepage Address and Other Contact Information】

http://pgr.ch.a.u-tokyo.ac.jp/