Bio

High-throughput screening and identification of novel chemicals enhancing plant defense against pathogens/pests

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Purpose of Research

Control of pests and diseases is a critical issue in crop production, since biotic factors cause economic losses of $220 billion. Since traditional chemical pesticides have disadvantages such as the emergence of drug resistant organisms and the toxicity to beneficial symbiotic organisms and insects, i.e. possible disturbance of ecosystem, an entirely novel approach to protect crops from pathogens and pests is needed.

Plant defense activators, chemicals that boost defense/immune responses of plants, have excellent advantages as new type of low-toxicity pesticides which does not lead to emergence of drug resistant organisms. The plant immune system consists of two major pathways, involving salicylic acid (SA) and jasmonic acid (JA)/ethylene (ET). Only a few plant defense activators that activate only the SA pathway are available in the market, and these have only narrow application, mostly limited to rice pests.

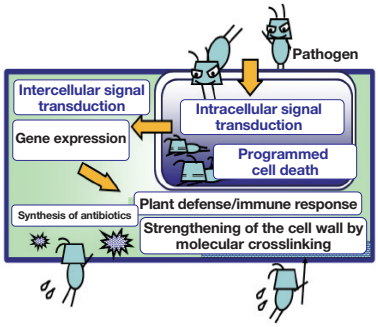
Summary of Research

Advantage of plant activator as pesticide

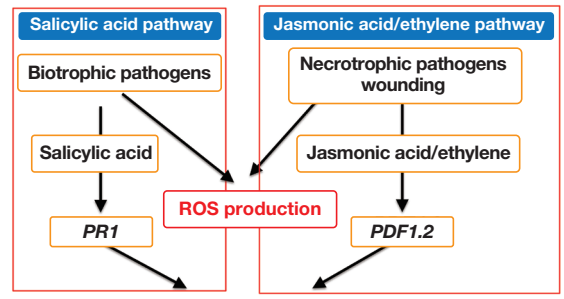
Fungicides/insecticides
Chemicals directly kill pathogens or pests

Plant defense activators
Chemicals activate plant's immune system

Plant immune responses



New plant defense activators for jasmonic acid/ethylene pathway



Target of known plant defense activators

New type of plant defense activators for this pathway

We have developed a novel high throughput screening system for plant defense activators (PCT filed), and have discovered novel putative plant defense activators that activate the JA/ET pathway or both of the above pathways, and that are expected to enhance defense responses against a wider spectrum of necrotrophic pathogens and pests.

Comparison with Conventional or Competitive Technology

Traditional chemical pesticides have disadvantages of toxicity to beneficial symbiotic microorganisms and insects, as well as disturbance of eco-system. In contrast, Plant defense activators, chemicals that boost defense/immune responses of plants, have excellent advantages as new type of low-toxicity, environment-friendly pesticides to avoid emergence of drug resistant organisms. We have developed a novel efficient high throughput screening system for plant defense activators.

Expected Applications

- Development of novel pest control methods for organic and pesticide-free farming.
- Reduction of the dose of traditional pesticides by the enhanced plant defense/immune responses.

Challenges in Implementation

- Identification/optimization of more lead compounds from a larger chemical library.
- Field test of the identified activator candidates.

What We Expect from Companies

Partnership opportunities are open to interested corporations.

Points

- **Plant defense activators are a novel type of pesticides which can preserve the ecosystem and environment in a field and avoid the emergence of drug resistant organisms**
- **We have established a high-throughput system for screening plant defense activators**
- **We have identified putative novel plant defense activators that can activate two major immune pathways in plants**

Future Developments

In vivo (whole plant) testing of the identified chemicals (secondary evaluation) is now going on.
Select high-potency activator candidates (2015).
Field test start (2016).

■ Intellectual Property: JP2013-510162 "Method for plant defense activators, plant defense activators, and method for enhancing immune responses"

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