

Structurally Conserved Receptor-protein Complex Enables Immune Response in Plants

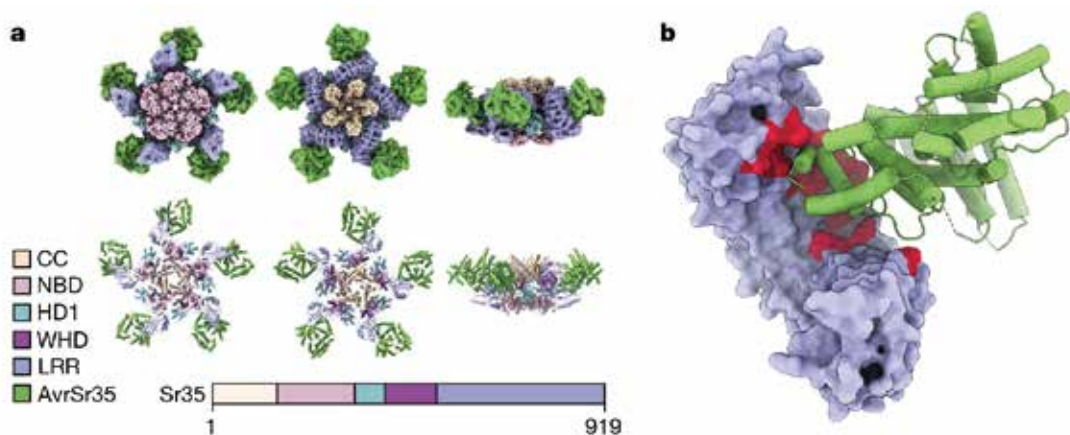
By YAN Fusheng (Staff Reporter)

Crop diseases are a critical limiting factor for agricultural production and a severe threat to global food security. Disease resistance proteins, termed nucleotide-binding leucine-rich repeat (NLR) receptors, are the most prominent family of immune receptors in plants. They are activated by molecules known as effectors that are derived from pathogenic bacteria/fungi.

How effector recognition activates receptors, and the molecular mechanisms that trigger plant immune responses and lead to disease resistance has been a major scientific question in plant research.

Previously, a collaborative study revealed that the ZAR1 resistosome, a pentameric protein complex formed between the receptors and the effectors, formed a Ca^{2+} -permeable channel for triggering plant immunity in the model plant *Arabidopsis thaliana*. However, it remains elusive whether the plant resistosomes share a common mechanism.

In the September 26 issue of *Nature*, a joint team led by Dr. CHAI Jijie from Tsinghua University/University of Cologne, Dr. Paul Schulze-Lefert from the Max Planck Institute for Plant Breeding Research, and Dr. CHEN Yuhang from the Institute of Genetics



The five-part structure of a wheat immune-receptor complex (a) and the interface (b) between Sr35 LRR domain (purple) and AvrSr35 (green), the effector of wheat stem rust pathogen *Puccinia graminis f. sp. tritici*. (Image by Förderer, A. *et al.*/Nature.)

and Developmental Biology (IGDB) under the Chinese Academy of Sciences elucidated that the NLR-based immune response system is evolutionally conserved in plants.

The researchers reveal for the first time that the wheat disease resistance receptor protein Sr35 can be recognized and activated by AvrSr35, the effector of wheat stem rust pathogen *Puccinia graminis f. sp. tritici* (Pgt), and further oligomerized to form a pentameric complex termed Sr35 resistosome. They found that the wheat Sr35 resistosome bears striking structural similarities to the ZAR1 resistosome. They also found that the wheat Sr35 resistosome assembles into a Ca²⁺-permeable pentameric cation channel, similar to the ZAR1 resistosome.

Although Sr35 and ZAR1 are classified as coiled-coil (CC) domain-containing NLRs (CNLs), wheat and

A. thaliana are two evolutionally distant species. Thus, all the evidence suggests that CNL complexes in plants are conserved during evolution.

They also demonstrated the feasibility of tweaking the receptor-effector interfaces of non-functional homologous proteins from other plants and granting them disease-resistant phenotypes.

“Our data support the evolutionary conservation of CNL resistosomes in plants and demonstrate proof of principle for structure-based engineering of NLRs for crop improvement,” said the article’s authors.

The team also plans to determine the structures of other NLR resistosomes for revealing receptor-effector interfaces and design NLRs that can recognize various effectors for durable disease resistance.

The day of rational design of disease-resistant crops is looming on the horizon.

References

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