

New insights in rust resistance in wheat

December 6 2018



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For more than 20 years, a large international group of researchers, including from Aarhus University, has worked purposefully to investigate a gene that protects wheat against yellow rust. Yellow rust is a widespread and serious fungal disease that causes many losses in wheat globally. The researchers' new knowledge is an important piece in the

jigsaw regarding the development of new cultivars of wheat that are resistant to yellow rust. The results were recently published in *Nature Communications*.

Wheat is one of the world's most important crops. On a global scale, 244 million hectares are grown annually, which is more area than any other crop. The yield is more than 750 million tons per year. Wheat is widely used for both food and feed so it is therefore important to protect it against [fungal diseases](#).

Yellow rust threatens wheat

One of the diseases that can infect wheat is the fungal disease yellow rust. Approximately 88 percent of wheat production is susceptible to yellow rust, and a conservative estimate says that the disease ruins at least 5 million tons of the global annual wheat harvest.

The pathogenic fungus evolves quickly to produce new, virulent strains, so there is a constant arms race between plant breeders to develop disease-resistant varieties of wheat and the rust fungus. With a better understanding of the mechanisms that the wheat plant uses for self-defence, plant breeders will be more well-equipped for the task. This is precisely the area in which the research group can contribute significant new results.

Defence mechanism investigated

The researchers zoomed in on the gene sequence of the Yr15 resistance gene in wheat. Yr15 is known for being one of the most effective resistance genes against [yellow rust](#). The researchers found that Yr15 has a unique mode of action. Some of the members of the international group of researchers mapped the gene sequence of Yr15, while the

researchers from Aarhus University investigated how the resistance gene prevents fungal growth inside the infected wheat plant.

"Yr15 is an old acquaintance and plant breeders already have it on hand. The new and exciting finding is that we have discovered that Yr15 works differently than other resistance genes. It produces defence responses early in the infection process, and we have found only one single case where the fungus could bypass this defence," says Professor Mogens Støvring Hovmøller from the Department of Agroecology at Aarhus University and one of the researchers in the international group.

Breed disease-resistant crops requires access to resistance genes that represent the whole array of modes of action. In this way, if the fungus overcomes one defence mechanism, other resistance [genes](#) may prevent the fungus from causing [disease](#) in the plant.

With the aid of advanced microscopy, the researchers at Aarhus University observed the actual defence responses associated with Yr15 [resistance](#) in wheat. The researchers used a wide array of fungal isolates hosted by the Global Rust Center at AU Flakkebjerg, where fungal isolates from all over the world are stored for the purpose of research in [wheat rust](#).

More information: Valentina Klymiuk et al, Cloning of the wheat Yr15 resistance gene sheds light on the plant tandem kinase-pseudokinase family, *Nature Communications* (2018). [DOI: 10.1038/s41467-018-06138-9](https://doi.org/10.1038/s41467-018-06138-9)

Provided by Aarhus University

Citation: New insights in rust resistance in wheat (2018, December 6) retrieved 23 April 2024

from <https://phys.org/news/2018-12-insights-rust-resistance-wheat.html>

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