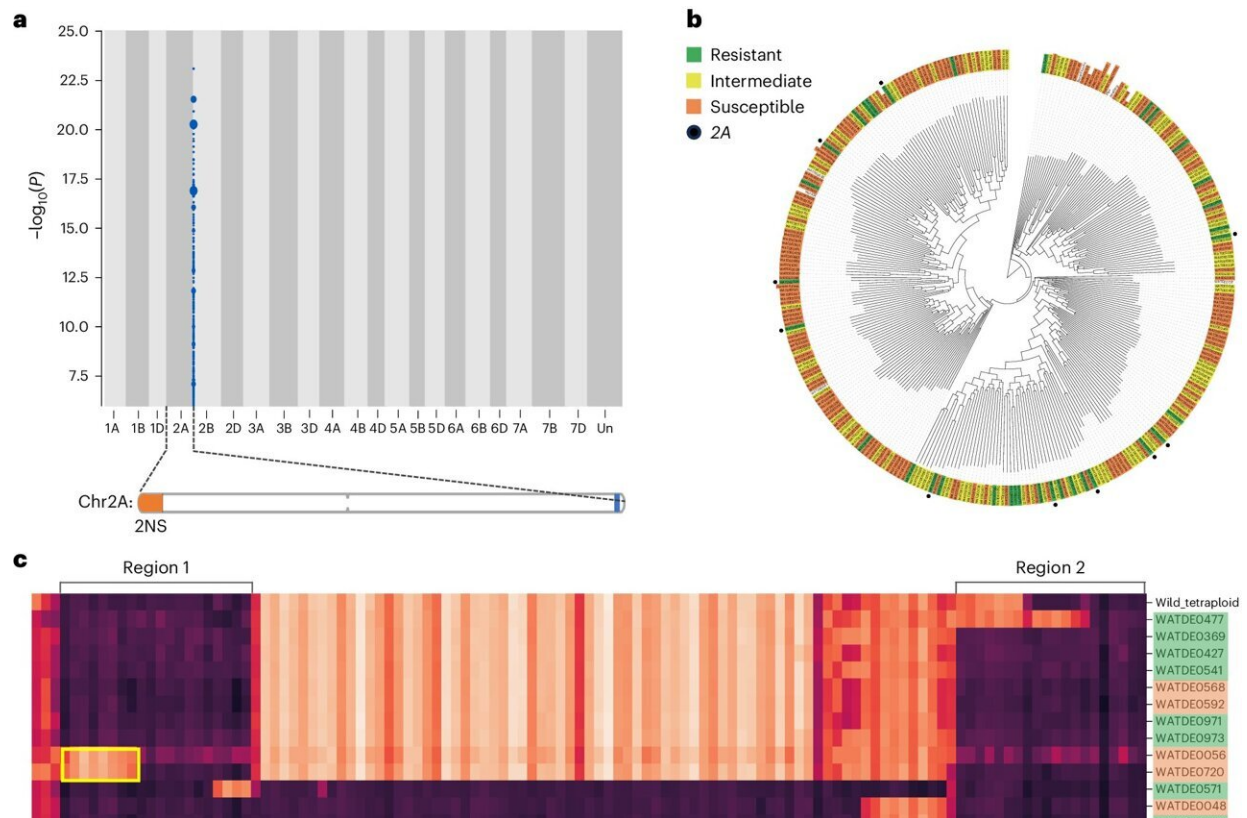


Hope from an unexpected source in the global race to stop wheat blast

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Genetic identification and validation of resistance to the wheat blast fungus effector AVR-Rmg8 by k-mer-based association mapping and haplotype analysis. Credit: *Nature Plants* (2024). DOI: 10.1038/s41477-024-01718-8

An important breakthrough in efforts to halt the advance of wheat blast, an emerging threat to international food security, has come from a

surprising source.

New research unexpectedly reveals that wheat varieties with [resistance](#) to another pathogen, [powdery mildew](#), also confer protection against [wheat blast](#). The study is [published](#) in the journal *Nature Plants*.

When seeking resistance to diseases, it is common to search among varieties or old landraces from regions where the disease originated. As wheat blast is a disease of humid sub-tropical regions, efforts to control the disease have focused on finding resistance genes among wheat varieties adapted to warmer climates.

A [research collaboration](#) led by the John Innes Centre, and including the University of Zürich, challenges this approach, suggesting that researchers should not ignore resistance in wheat varieties that have been bred to withstand other diseases including those of colder climes, like powdery mildew.

Using gene discovery methods developed at the John Innes Centre, they have identified the first gene that protects wheat plants against the strains of the blast fungus that contain the protein effector AVR-Rmg8.

Surprisingly, the gene—located on chromosome 2A of the wheat genome—is Pm4, a gene that gives wheat resistance to powdery mildew, a disease of the cooler, wetter climates of the northern hemisphere.

European plant breeders have been selecting wheat with Pm4 for many years for resistance to powdery mildew; now those in the [southern hemisphere](#) will be urged to do the same to protect against wheat blast.

"These findings were completely unexpected, and they suggest that if you want to find resistance to wheat blast you should also look in varieties that come from non-tropical regions, where they already have

resistance to mildew," said Professor Paul Nicholson, a group leader at the John Innes Centre and coordinator of the study, which also includes contributions from Mexico-based CIMMYT and Saudi Arabia-based KAUST.

"We need to be open to the idea of looking in unusual places because blast is a disease of high-temperature, high-humidity environments while mildew is a disease of low-temperature, high-humidity environments, so no one would have thought of looking in European varieties previously because one is looking for commonalities."

The research team made the discovery by screening over 300 varieties of wheat in the Watkins Collection, a diversity panel gathered from around the globe in the 1930s. Of this population, just 3% showed resistance to wheat blast pathogen strains that produce AVR-Rmg8.

Worryingly, all the varieties that were highly resistant to blast carried the Pm4 gene, indicating that only a single resistance was present among this highly diverse population. This emphasizes the need to identify additional resistances to ensure robust, durable resistance against this new threat.

The team will now use the same gene discovery methods to search among European-bred [wheat varieties](#) for further resistance [genes](#) to blast, increasing the genetic armory which can be deployed against this destructive disease.

Dr. Tom O'Hara, lead author of the study, said, "This is the first cloned blast resistance gene—unlike previous resistances to blast, we have gotten down to the exact gene—even identifying minute variations of the gene that render it nonfunctional. This means our findings can be of great immediate benefit for breeders.

"Our aim from the start was to find resistance that was deployable in Bangladesh and potentially other countries where blast has spread to. The added satisfaction is that our study has taken an unexpected twist."

More information: Tom O'Hara et al, The wheat powdery mildew resistance gene Pm4 also confers resistance to wheat blast, *Nature Plants* (2024). [DOI: 10.1038/s41477-024-01718-8](https://doi.org/10.1038/s41477-024-01718-8)

Provided by John Innes Centre

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