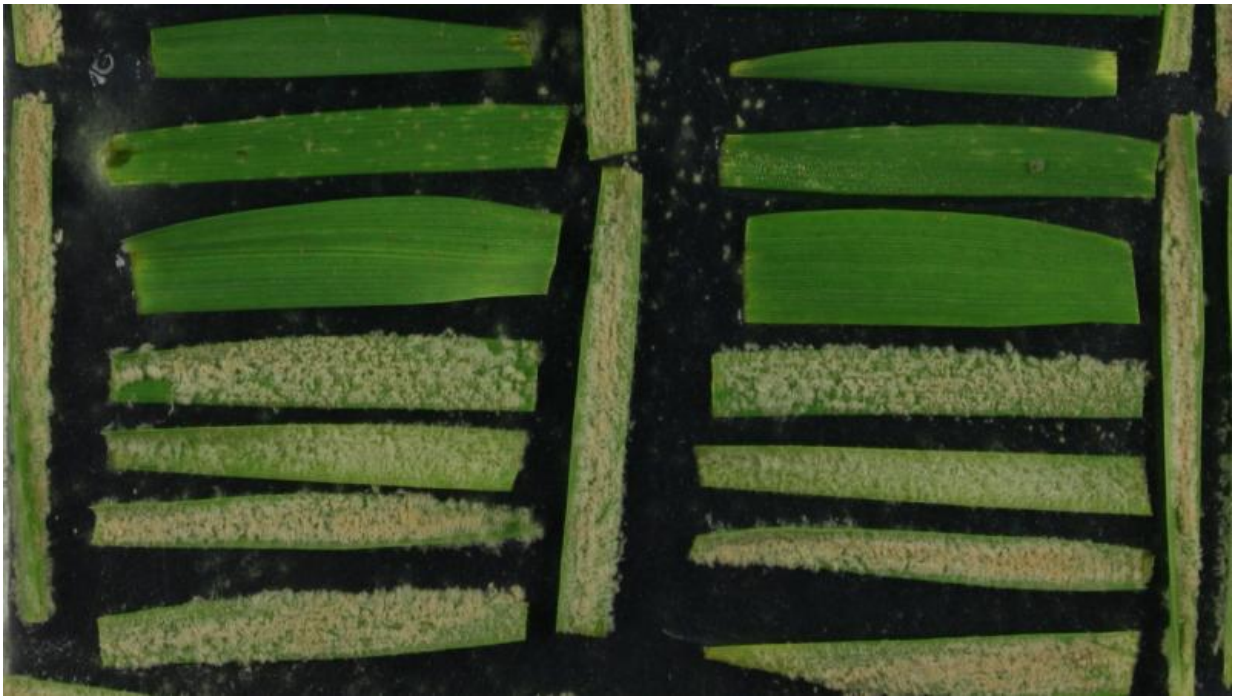
Fungus attacks new type of grain thanks to an evolutionary trick

January 12 2016



Researchers collected samples from infected grain fields all over Europe. Credit: UZH

For the past few years, mildew has been able to infect triticale grain, which up to then had been resistant to this fungal disease. So how was the pathogen able to spread to a different host plant? Researchers from the University of Zurich have shown that the new pathogen is a genetic mix of existing mildew forms.

Triticale is an artificial grain type stemming from a cross between wheat and rye. Since the 1960s, triticale has been cultivated in many places as a feed grain and had proved very resistant to mildew attack. This fungal pathogen causes huge losses in cereal production. In the case of wheat, for example, the fungus can reduce the harvest by up to 45%. But triticale fields were infected for the first time in 2001, and mildew is now being reported in many triticale growing regions in Europe.

Comparison of the mildew genome confirms: The new form is a hybrid

Researchers from the University of Zurich have now examined how the mildew managed to spread to triticale. To do this, they collected samples from infected grain fields all over Europe and examined the genetic information of different forms of mildew. The genetic material (genome) of the pathogens that attack triticale, rye and wheat were then compared using bioinformatics. The comparisons showed that the new triticale fungus is a hybrid of the variants specialized in wheat and rye: 12.5% of the genome is identical to DNA sequences from the form specialized in rye, while 87.5% stems from the form specialized in wheat.

Evolution of the pathogen reflects the development of the host plant

This means that a hybrid from two mildew variants specialized in two different host plants can infect the cross between those two host plants. The study thus shows the manner in which mildew adapts to new host plants in a co-evolutionary way and can break down their resistance. The study also reveals that this recent evolutionary event was not a one-off occurrence. Around 10,000 years ago, mildew overcame the resistance of bread wheat, which was relatively new at the time, in the same way.

"These results are of major significance for treating and preventing plant diseases. The more we know about the evolutionary mechanisms of mildew, the better we can keep new cultivated plants resistant to the pathogens", explains Thomas Wicker from the Institute of Plant Biology at the University of Zurich.

More information: Fabrizio Menardo et al. Hybridization of powdery mildew strains gives rise to pathogens on novel agricultural crop species, *Nature Genetics* (2016). DOI: 10.1038/ng.3485

Provided by University of Zurich