

Fighting a global rust threat

CSIRO Plant Industry



Ug99 is a strain of the wheat fungus black stem rust – is considered by some to be the biggest threat to wheat production worldwide. CSIRO Plant Industry has been subcontracted by Cornell University, USA, with funding from the Bill & Melinda Gates Foundation Global Development Program, to help find solutions to this potential threat to world food supplies.

Ug99

Ug99 (a strain of *Puccinia graminis f. sp. tritici*) first came to the world's attention in 1999 when it was discovered in Uganda, hence its name.

When severe, Ug99 can cause whole crop failures, not just reduce yields or reduce quality.

Wheat varieties worldwide, including those in Australia, rely on only a few rust-resistance genes to protect them from different strains of rust, but a significant proportion of these resistance genes provide no protection against Ug99 and derived strains.

These two factors make Ug99 a formidable threat.

Global reach

Since 1999, Ug99 has been detected in other parts of Africa, including Kenya and Ethiopia.

From previous fungal invasions, scientists expected the prevailing winds to carry Ug99 spores to Egypt, Turkey and Syria, and then east to Iran, a major wheat-grower, buying them some time. But by 2007 Ug99 had already reached Yemen and, in early 2008, Iran.

Most crops in Asia's major wheat growing areas are vulnerable to Ug99, so if it gets to these areas food shortages and famine could result.

Ug99 could also pose a bio-security threat to Australia.



CSIRO scientists Dr Evans Lagudah (left) and Dr Mick Ayliffe (right) are leading the CSIRO Plant Industry effort to help find solutions to the wheat stem rust Ug99 that could pose a bio-security threat to Australia.

CSIRO research to help

CSIRO's leading rust research team, including Dr Evans Lagudah and Dr Mick Ayliffe in Canberra, is contributing to the fight against Ug99 through its partnership with Cornell University under the Durable Rust Resistance in Wheat project, part of the Borlaug Global Rust Initiative.

Dr Lagudah's research will focus on rust resistance genes that are effective against Ug99, previously sourced from ancestral wheat species, to identify DNA markers for these genes. DNA markers help wheat breeders incorporate desirable genes into new varieties quickly.

Dr Ayliffe will expand his research into why rice is immune to rust, to determine what protects it against rust and if this mechanism can be transferred to wheat to protect it against Ug99.

CSIRO believes that participation in a co-ordinated international consortium is the best way to find solutions to the potential global threat that Ug99 poses.

This research adds to the current CSIRO – Grains Research and Development Corporation (GRDC) partnership and CSIRO's broader aim to tackle pests and diseases in Australian grain crops and provide better food security for the future. The Australian Centre for International Agricultural Research (ACIAR) is also supporting CSIRO and the University of Sydney's research into Ug99.

Elsewhere in Australia

Other Australian institutions involved in the Durable Rust Resistance in Wheat project include the University of Sydney's Plant Breeding Institute and the University of Adelaide's School of Agriculture, Food and Wine.

Along with the International Centre for Wheat and Maize Improvement (CIMMYT), The University of Sydney's Plant Breeding Institute has coordinated the evaluation of Australian wheat varieties and breeding material against Ug99 in Kenya, to identify resistant and vulnerable varieties. In tests conducted in 2005, the Australian wheat material performed better than material from any other country.

The Borlaug Global Rust Initiative

Given the gravity of Ug99 as a problem, a large international research effort is underway to try and find solutions to stop its spread and negative effects on wheat production.

The Borlaug Global Rust Initiative aims to systematically reduce the world's vulnerability to all three wheat rusts. Under this initiative, Cornell University in the United States of America, has established the Durable Rust Resistance in Wheat project which will bring together 15 leading research agencies from across the world including CSIRO in Australia.

The project is funded by the Bill & Melinda Gates Foundation's Global Development Program through a grant to Cornell University. CSIRO will be a sub-contractor to Cornell University to collaborate on this research.

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