

MARPLE DIAGNOSTICS


John Innes Centre
Unlocking Nature's Diversity



THE CHALLENGE

The wheat rusts are major fungal diseases of wheat that spread long-distance via spore dispersal on wind currents.

To protect wheat crops from attack, farmers employ good agronomic practices, alongside planting resistant varieties and (where available) applying appropriate fungicides.

However, new fungal strains frequently emerge that can overcome the resistance introduced into these crops, leading to large-scale disease outbreaks.

The key to protecting farmers' crops against rust damage is to quickly identify new strains as they emerge to better inform disease management strategies and action control measures before outbreaks spread.

**11
million
tonnes**

**OF WHEAT IS LOST
EVERY YEAR DUE
TO WHEAT RUST
DISEASES**



OUR RESEARCH

Mobile And Real-time PLant disEase (MARPLE) diagnostics is a portable, genomics-based, strain-level disease diagnostics methodology developed at the JIC in partnership with the International Maize and Wheat Improvement Center (CIMMYT). This system focuses on the wheat rust pathogens – yellow and stem rust – providing real-time, point-of-care identification of specific strains within just 2 days of field sampling, a process that previously took many, many months. MARPLE diagnostics can also be conducted directly on location, with all components needed to execute the methodology contained within a single hardcase.

HOW IT WORKS

This highly innovative approach is based on amplicon re-sequencing where a small number of genes in the pathogen genome are targeted for sequence analysis. These genes have been identified at JIC as being highly variable in sequence between different rust strains.



Focusing on these variable gene subsets reduces the amount of data needed for each sample to accurately type strains and makes it highly suited for use with the hand-held MinION nanopore sequencer, built by Oxford Nanopore Technologies.

Once data is generated, a custom, fully automated pipeline is run to type strains through comparative analysis with a collection of global strains of the wheat rust pathogens.

**SCAN FOR
MORE INFO**



FUNDING

MARPLE diagnostics is currently supported by the Bill & Melinda Gates Foundation and the Foreign, Commonwealth and Development Office (DEWAS project INV-048345), the UK Biotechnology and Biological Sciences Research Council (BBSRC) Innovator of the Year Award. It has also received support from the Feed the Future Innovation Lab for Current and Emerging Threats to Crops funded by the United States Agency for International Development (USAID) and the CGIAR Big Data Platform Inspire Challenge.



Images: MARPLE diagnostics in action in Ethiopia & In-field, real-time genotyping using the MinION sequencer (Matt Heaton & MARPLE diagnostics)



APH
ADVANCING
PLANT
HEALTH

Advancing Plant Health (APH) aims to deliver new solutions to promote beneficial interactions and disease/pest resistance in crops of both national and global significance. It integrates research expertise from the John Innes Centre and The Sainsbury Laboratory.

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