SCPRID PhD Student: Mercy N Wamalwa

The **SCPRID** (Sustainable Crop Production Research for International Development) programme is a unique £16 million initiative, involving over 40 international research organisations, harnessing bioscience to improve food security in developing countries. It is a partnership involving the UK Biotechnology and Biological Sciences Research Council (BBSRC), UK's Department for International Development, the Bill & Melinda Gates Foundation, the Indian Council of Agricultural Research, and India's Department of Biotechnology. Each SCPRID project includes at least one partner from the UK and one from a developing nation.

Mercy Nasimiyu Wamalwa (University of Egerton) is a plant breeder/pathologist carrying out her PhD research within the BBSRC SCPRID award "Maximizing the potential for sustainable and durable resistance to the wheat yellow rust pathogen" BBSRC Grant Reference: BB/J012017/1. Her PhD project is part of a three-way collaboration between NIAB, the John Innes Centre (Norwich, UK) and the Kenya Agricultural and Livestock Research Organisation (Njoro, Kenya).

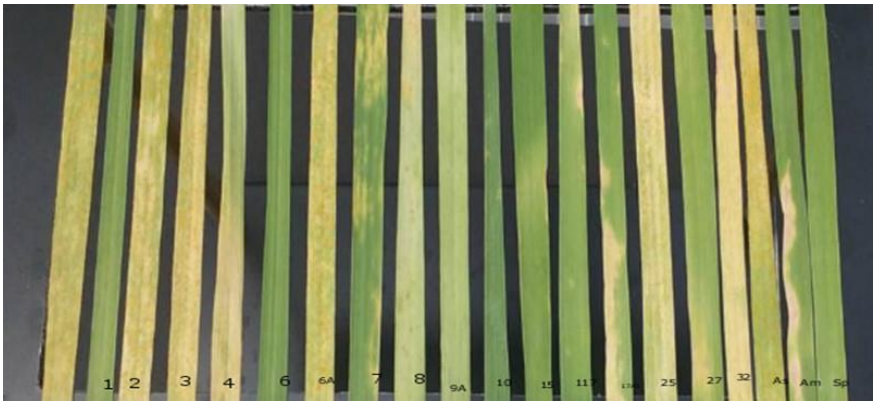
Research project

Stripe rust (also called yellow) is a wheat disease caused by *Puccinia striiformis* f.sp. *tritici* -(*Pst*), a fungal pathogen. It is an important wheat disease, limiting production worldwide by affecting yield and quality. Like other wheat rusts, the stripe rust pathogen keeps on evolving, with recurrent local emergence of new strains. However, there is a general lack of understanding about how the pathogen overcomes the resistance of newly developed varieties. Mercy's research focuses on characterization of stripe rust isolates in Kenya and mapping of stripe rust resistance genes in wheat. The ultimate goal is to incorporate the resistance genes into locally adapted varieties to reduce the impact of stripe rust and increase yields for smallholder farmers, who usually cannot afford fungicides to control the disease.

Stripe rust resistant (left) and susceptible (right) landraces growing in a field in Njoro, Kenya

Previous work

As part of the project, Mercy carried out virulence analysis of Kenyan yellow rust isolates at the Global Rust Reference Center, Aarhus University in Denmark, working with Prof. Mogens Hovmoller. The isolates included in the study were collected between 1970 and 1992, and between 2009 and 2014. Both *Pst1* and *Pst2* (which are invasive stripe rust strains possibly originating from East Africa and now widespread in America, Australia, Central Asia and Middle East) were found among the tested isolates. The results indicate an increase in virulence over the years due to evolution of the pathogen. Based on these findings, it is clear that race analysis is fundamental to breeding for stripe rust resistance in wheat.



Carrying out virulence analysis involves infecting wheat seedlings carrying genes known to confer stripe rust resistance (shown in numbers and text in the image above) with a single rust isolate and assessing their reaction.

Current work at NIAB

Thesis title: "Wheat Stripe Rust Race Analysis and Mapping of Resistant Genes in Kenya"

At NIAB, Mercy is undertaking a genetic analysis of a wheat population developed within the SCPRID project, which segregates for stripe rust resistance. The population was developed at John Innes Centre by Dr Cristobal Uauy's group. Mercy is working with Dr Sarah Holdgate in the Department of Plant Pathology at NIAB to carry out field assessment of stripe rust resistance in the wheat population, and with Dr Lesley Boyd in the Department of Genetics and Pre-Breeding where she will carry out the genetic analysis.

Collaborators

- Lesley Boyd - NIAB, Cambridge UK
- Sarah Holdgate - NIAB, Cambridge UK
- Cristobal Uauy - John Innes Centre, Norwich, UK
- Ruth Wanyera - Kenya Agricultural and Livestock Research Organisation, Njoro, Kenya.

Reference

Walter, S., Ali, S., Kemen, E., Nazari, K., Bahri, B. A., Enjalbert, J., and Vallavieille-Pope, C. (2016). Molecular markers for tracking the origin and worldwide distribution of invasive strains of *Puccinia striiformis*. *Ecology and Evolution*, 6(9), 2790-2804.