

Black stem rust of wheat: a re-awakening nightmare?

Back in eighteenth century Europe, a man called Tozzetti noted that black stem rust disease of wheat was worse in fields where barberry was used to restrain cattle. Later, pathologists found that this was because barberry is the 'alternate host' for *Puccinia graminis* f.sp. *tritici*, the fungus that causes the awful disease. This fungus has a two-stage life cycle, including asexual reproduction on wheat with massive dispersal of spores from crop to crop. The 'alternate' stage is sexual reproduction on the barberry, which is crucial for rapid development of new forms of the pathogen which may infect resistant wheat varieties.

This discovery led to a remarkable example of human involvement in plant disease control. Early in the twentieth century, a human chain was formed across the wheat belt in the American prairies, whose purpose was to remove every single barberry bush. This had a direct impact on disease spread. More importantly, it ensured success for plant breeders who introduced resistance genes into their wheat varieties over the next decades. By the 1950's, the disease was well in retreat and effectively disappeared for half a century.

One country that benefited was the UK where stem rust had also been common. This was found to be due to common wind patterns which brought the stem rust spores initially from North Africa, across the Iberian peninsula, over France and then to the UK. In some years, the pathogen reached as far as Norway. All of this stopped with the introduction of resistant varieties, particularly in North Africa and Spain.

Not surprisingly, this meant that stem rust resistance declined in priority in breeding programmes. Then, suddenly, in 1999 in Uganda and Kenya, a new race of the fungal pathogen, Ug99, was found which is able to overcome more or less all of the resistance genes in use around the world. Ug99 is now spreading rapidly – my guess is that it could be back in the UK in less than five years. And our current mild winters and hot dry summers will favour epidemic development and winter survival of the pathogen.

What can we do? This really is a global problem and depends on global solutions. Fortunately, the Global Rust Initiative has been actively checking through varieties and resistances for use as parental material for breeding into current modern varieties, which UK breeders can also use. For our part at The Organic Research Centre, we're looking at the possibility of introducing resistant material into our wheat populations (see 'Populations performing' *Bulletin* 84) – which could be a rapid way of developing resistant stocks for field use, while demonstrating further the exciting potential for wheat populations.

Prof. Martin Wolfe