“Wheat Blast: an emerging threat to wheat production worldwide”

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Wheat (Triticum aestivum L.) is one of the most widely consumed cereal as a source of protein. The crop is grown in about 222.34 million hectares producing nearly 753.1 million tons globally in various climatic conditions, including tropical, sub-tropical and temperate regions (USDA 2017). Wheat blast, caused by Magnaporthe oryzae Triticum pathotype (MoT) (synonym Pyricularia oryzae), is one of the emerging threats to wheat production worldwide (USDA 2015; CABI 2017; Cruz and Valent 2017). The MoT is a haploid, filamentous ascomycetous fungus infecting above ground plant parts, especially wheat heads, and drastically affecting seed production. Under favorable conditions, the disease can severely reduce crop yield and affect grain quality (Goulart et al. 2007). The disease was first reported in 1985 on wheat in Paraná State, Brazil. Since then, it has spread to other wheat-producing countries in South America, such as Bolivia, Argentina and Paraguay (Kohli et al. 2011). Outside South America, the wheat blast fungus was first observed in 2011 in a single wheat head in Kentucky, USA (Farman et al. 2017). In 2016, a wheat blast outbreak was reported in Bangladesh, where the disease affected nearly 15% of total wheat acreage and caused devastating crop losses to wheat farmers (Callaway 2016; Malaker et al. 2016; Islam et al. 2016). In addition to Bangladesh, the fungus caused devastating yield losses in 2017 to wheat production in India (Das 2017), the second largest producer of wheat worldwide. The finding of wheat blast outside of South America highlights its potential to cause disease outbreaks in hot and humid conditions of Bangladesh and India, where wheat is largely grown by subsistence farmers, rising serious concerns of wheat blast becoming a pandemic disease in wheat-growing regions of South Asia and beyond (CIMMYT 2017). In phylogenomics analyses, the Bangladeshi MoT isolate was shown to be closely related to the highly aggressive wheat-infecting South American MoT strain, suggesting that the wheat blast fungus was most likely introduced from South America (Islam et al. 2016). In contrast, the Kentucky isolate was reported to be closely related to US strains found on ryegrass and tall fescue and genetically distinct from the South American MoT, indicating that wheat infection in Kentucky likely occurred via ‘species jump’ from forage grasses to wheat (Farman et al. 2017). Recent studies have shown that mutations in the "avirulence" gene \textit{PWT3} of the fungus and extensive cultivation of wheat cultivars lacking \textit{Rwt3} “resistance” gene in the early 1980s have contributed to the emergence of virulent strains pathogenic to wheat cultivars carrying \textit{Rwt3} gene (Inoue et al. 2017). Since MoT is seed-borne, strict quarantine practices are essential for preventing spread of the pathogen through seed exchange and distribution systems across nations. Although chemical controls are currently being used for minimizing the spread of MoT, development of new blast-resistant varieties are vigorously pursued through international collaborations across the globe. The recent release of BARI Gom 33, developed by the Wheat Research Center in Bangladesh in collaboration with the International Maize and Wheat Improvement Center in Mexico (Braun et al. 2017), is helping farmers to cultivate wheat in blast-prone areas. The introduction of blast-resistant cultivars and deployment of effective and integrated control strategies combined with implementation of strict quarantine practices are expected to help wheat farmers in Bangladesh recover from the wheat blast epidemics.
References


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