Seeking Research/Commercialization Partner: Enhancement and backcrossing of wheat rust resistance

Overview: Wheat rust is a group of deadly, constantly changing fungal pathogens that pose a serious threat worldwide. Globally, the three wheat rusts - stem, leaf and stripe rust - are the most economically damaging diseases of wheat. All inflict heavy losses when epidemics occur, but stem and stripe rust are the most harmful, inflicting losses of 60% or more. Successful control of stem rust - mainly through resistance breeding - is estimated to have saved farmers worldwide over $1 billion annually for more than four decades. However, past wheat breeding successes cannot protect the world's wheat crop indefinitely against this changing set of pathogens. http://www.annualreviews.org/doi/full/10.1146/annurev-phyto-072910-095423

Wheat rusts, like other pathogens, can evolve into new strains that are more virulent and damaging to wheat crops. Ug99 is one such strain of stem rust, which emerged in Uganda in 1999. It has since spread beyond East Africa to Central Asia. The major concern is that the majority of the wheat varieties across East Africa, West and South Asia are susceptible to this virulent strain or its derivatives. Similarly the Yr27 virulent strain of yellow rust has caused significant losses in some countries in North Africa, Near East and Central and South Asia during the serious epidemics in 2009, 2010 and 2013.

Breeding durable disease resistance cultivars relies largely on continually introgressing new resistance genes, especially the genes with different defense mechanisms, into adapted varieties. However, genetic engineered crops continue to have a stigmatism in the market so that non-GMO derived traits are greatly preferred. To that goal, researchers at Montana State University have obtained a new resistance gene via EMS mutagenesis, a non-GMO laboratory technique well accepted in plant breeding for commercial use. This mutant, MNR220 enhances resistance to the three rusts and powdery mildew with the characteristics of delayed disease development at the seedling stage and completed resistance at the adult plant stage. MSU is seeking an industry partner to move this research into a commercial variety. As an added advantage, this mutant is salinity tolerant.

Pathogen, (Fungus), Strain repelled by MNR220	US Losses	Source	Global Losses	Source
Leaf Rust (Puccinia triticina) PRTUS6	**5-15%**	Kolmer	**50%**	Espino
Stem rust (P. Graminis f. sp .tritici) Ug99	**50-70%**	ARS	**100%**	UN FAO
Stripe rust (P. striiformis f. sp. tritici) PST78	**</= 40%**	ARS	**25%**	Global Rust
Powdery mildew (Blumeria graminis f. sp. tritici)	**</= 45%**	OSU	**35%**	Univ. Sask.

Proposed research goals: backcrossing of MNR220 into selected commercial varieties for resistance to multiple diseases; better understanding of the regulation of defense responses in wheat via high resolution mapping of the disease resistance locus.

Finding: A mutagenesis-derived broad-spectrum disease resistance locus in wheat

This discovery was made at Montana State University by Dr. Li Huang, Department of Plant Biosciences.

Technology Transfer and Development Status: This mutant gene has been published and is in the public domain. MSU maintains a leadership position in the knowledge around this gene and has extensive ability to perform introgressions into varieties of choice. Plant Variety Protection will be sought on varieties expressing this mutant gene. Paper located at:
http://link.springer.com/article/10.1007%2Fs00122-012-1841-7#page-2

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