Project: Expanding Host Plant Resistance for Integrated Pest Management of Wheat Stem Sawfly

Brief Description: Montana State University requests support to improve economic and environmental sustainability of Northern Great Plains wheat production by developing new host plant resistance mechanisms for use as components in integrated pest management (IPM) of wheat stem sawfly (WSS). Resistance mechanisms to be developed are host plant induced mortality of immature WSS, in addition to producing varieties that are less suitable choices for WSS and utilizing the capacity of some varieties to compensate for yield losses due to WSS feeding.

Executive Summary: WSS is the most destructive insect pest of wheat in Montana, with annual crop losses exceeding $75 million in each of the past two years. Outbreak populations are expanding and causing heavy losses in winter, spring and durum wheat grown throughout the State. Larval feeding in stems reduces grain weight by an average of 20%. Infested stems lodge, causing additional losses and increased costs at harvest. Stem lodging decreases snow retention and germination of lodged seed further depletes soil moisture. Agricultural inputs must be increased to control resulting volunteer wheat plants and crop disease. Existing insecticides and cultural management practices are ineffective.

Project Description: Lodging-resistant varieties with solid, pith-filled stems have been continually used as a stand-alone management strategy for decades. These varieties cause limited mortality of larval WSS, but there is evidence that other sources of innate cereal crop produced toxins can cause even greater mortality in all three wheat classes. Trap cropping, based on varieties that attract and retain WSS paired with unattractive varieties, has shown promise against heavy infestations by exploiting the ability to kill larvae in the attractive variety. Recently, tolerance to feeding WSS has also been elucidated. The determination of the genetic, biochemical, and molecular basis for resistance mechanisms is required for sustained development of varieties to be used in an IPM strategy. Exploration of candidate compounds linked to resistance mechanisms is being explored biochemically and metabolically so that the genes controlling expression may be incorporated into targeted wheat lines using classical and marker assisted plant breeding. Expanded host plant resistance is the basis for sustainable strategies that are being developed for WSS in Montana. New forms of host plant resistance can be utilized in ongoing efforts to enhance and conserve innate beneficial biocontrol agents.

Congressional Action Needed: An appropriation of $500,000 is requested.

I**mportance to Montana:** Montana and surrounding WSS impacted areas are leaders in the U.S. wheat industry, with annual economic yields greater than $2 billion being threatened by this pest. Wheat is also a key resource in critical new efforts at value-added crop production in the Northern Great Plains, so WSS IPM research is needed to sustain the development of these markets. Education and training of Montana producers and students will be strengthened by the enhancement of innovative wheat breeding and IPM research programs that graduate leaders in agriculture and biotechnology. Montana and Northern Great Plains wheat varieties must remain competitive with those developed in Canada, and innovative IPM hinges on developing varieties that ensure that our producers maintain their advantage. Overall, this appropriation will provide an innovative, sustainable, and deliverable IPM approach for WSS. In turn, this will enhance our ability to remain among nation's leaders in wheat production.

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