Molecular Characterization and Enhanced Efficacy in the Development of a Novel Host-Specific Bioherbicide Candidate for Cyperus rotundus

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Cyperus esculentus and C. rotundus, or yellow and purple nutsedge, are widespread throughout many areas of the United States and have been classified as two of the world's most invasive weeds. In this experiment, rust fungi collected from yellow and purple nutsedges were tested as potential biological control agents of these invasive weeds. The fungi were identified, stored, and activity improved by increasing germination rates through the use of volatiles (nonanol, coumarin, indoleacetic acid-IAA). The rust was confirmed as Puccinia canaliculata on yellow nutsedge and as P. conclusa on purple nutsedge. The infection of purple nutsedge by P. conclusa is a completely new host-pathogen interaction as well as an effective and specific biological control. In terms of volatile application, coumarin resulted in the highest level of disease severity in comparison to all other volatiles and untreated controls. Coumarin's effectiveness was likely due to the fact that it increased rust spore germination but did not increase parasite germination as nonanol did. As predicted, inoculated plants exposed to volatile solutions exhibited significantly higher disease severity and spore germination rates than untreated controls. This indicates that volatiles were effective in increasing germination rates in live plant assays and also support the strong biological control potential of Puccinia conclusa. Because P. conclusa represents a novel strain infecting C. rotundus, it could be developed as an effective bioherbicide candidate for this invasive species. Additionally, the successful increase of germination rates through the utilization of volatiles would be extremely beneficial to the agricultural industry of the United States and around the world.

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