Rainwater monitoring of rust spores

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Atmospheric transport and deposition is a major mechanism for dispersal of certain rust fungi. Trap nurseries, currently used to follow seasonal movements of rusts, are labor intensive and reflective of past events.   *Puccinia graminis* was used as a model rust system to test whether real-time PCR can detect rust spores in rain, with the goal of developing an early warning system for rust diseases. Weekly rain samples from 19 National Atmospheric Deposition Program (NADP) sites in the Puccinia Pathway were used. The assay utilized rust specific primers and a *P. graminis* specific TaqMan probe nested within a general primer-pair within the ITS1 region of the rDNA. Lower limits of the assay were roughly 1-10 spores per sample based on spiking experiments. *P. graminis* spores were detected by June 1st 2004 throughout the Great Plains, and found consistently in rain samples three weeks prior to the first field observations as the season progressed. In 2005 and 2006, a modified version of the above assay was used to detect *Phakopsora pachyrhizi* (causal agent of Asian soybean rust) spores in rain. To date, *Ph. pachyrhizi* spores have been detected throughout the eastern and central US, but with higher frequently at NADP sites near the Gulf and Atlantic coasts and along the Ohio River Valley westward to Kansas. There was a greater than three-fold increase in the number of samples testing positive for *P. pachyrhizi* in 2006 than 2005, with the most significant increase in August. There was also an increase in the average spore load per sample in 2006 compared to 2005. The data is consistent with the hypothesis of the disease becoming established in the southern US and Central America.