

## BGRI 2013 Technical Workshop

19–22 August, New Delhi, India



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## Barberry rust survey: Developing tools for diagnosis, analysis and data management

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Barberry (*Berberis* spp.) serves as an alternate host of many *Puccinia* species, including *Puccinia graminis* and *P. striiformis* causing stem rust and yellow rust, respectively, on cereals and grasses. A rust survey was initiated in order to study the importance of barberry in the epidemiology of *Puccinia* species in the CWANA region. The main objectives were to 1) develop a surveillance protocol, 2) develop molecular diagnostic tools for identification of *Puccinia* spp. from aecial samples, and 3) develop a data management and display system for the results as part of the Wheat Rust ToolBox (<http://wheatrust.org/international-services/service/>). Aecia-bearing leaves representing 120 barberry plants were collected in 2011 from Tajikistan and in 2012 from Iran, Azerbaijan, Uzbekistan and Georgia. Dried leaf samples were received at the Global Rust Reference Center and DNA was extracted from up to six individual aecial clusters from each plant. DNA extraction was not successful for approximately 40% of the aecial samples due to variable quality. Sequences of EF1 $\alpha$ ,  $\beta$ -tubulin or ITS were analyzed and compared to reference sequences of rust fungi that infect cereals and grasses. Sequence analyses supported the presence of *P. graminis*, *P. arrhenatheri* and *P. striiformoides* on barberry species. Geo-referenced survey and DNA sample maps with species designation are displayed in the Wheat Rust ToolBox. The future aim is to integrate barberry rust survey data based on molecular diagnostics and infection assays from research groups world-wide in order to gain insights into the role of barberry in the epidemiology of *Puccinia* spp. infecting cereals and grasses.

## Survey of barberry and associated rust pathogens in Nepal

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Wheat contributes directly to food security and the national economy in Nepal. Of the rusts of wheat, stripe rust causes the most frequent and severe yield losses. Race changes can lead to damaging epidemics. To better understand factors that influence regional diversity of the stripe rust and stem rust pathogens, we surveyed rusts on barberry in 2012 and 2013. Nepal has a high diversity of barberry (30 species) and elevational habitats that extend the seasonal distributions of wheat and barberry. The greatest diversity occurs from 2,700 m and above, and distributions range from 1,200 to 4,500 m. We surveyed locations in all regions (central, eastern, western, and far-western) of the hill zone. Barberry was common between 1,300 and 1,800 m where wheat is grown. In the far-western region, barberry was found near all the wheat fields we surveyed. Between 1,300 and 1,800 m, *Berberis asiatica* is the most common species. *B. aristata* is present at the upper end of this range. Aecial infections on barberry occurred in patchy distributions in both 2012 and 2013. Collections of aecia on barberry were made at 5 locations and are being identified by inoculation studies using a range of grass hosts. Additionally, the rust samples are being evaluated by real-time PCR assays using species-specific ITS primer/probes for detection of *Puccinia graminis* or *P. striiformis*. Preliminary results for 32 single-aecia samples from 2012 were negative for *P. graminis*; 7 were positive for the *P. striiformis* complex.