USDA-APHIS-PPQ, Black Stem Rust /Barberry Program Technical Meeting – Discussion Points

4700 River Road, Riverdale, MD

May 20-21st, 2009

Barberry

Survey

- L Forms from old Eradication Program in most states available for collection/analysis
  - Use in designing possible barberry surveys targeting areas of wheat production
  - BSR susceptible barberry still a potential future threat (see BSR/Ug99 Section below)

- Barberry survey may be possible through available funding for invasive species
  - Leverage of CAPS survey for rusts, not currently mandatory

- Barberry survey issues, knowledge of habitat, ecology of barberry
  - 5 or more states still have reachable L forms
  - substantial amount of work required even with information from L Forms
  - some expertise still available, but not for much longer

- Update barberry fact sheets and identification tools, education outreach important
  - Some farmers no longer aware, not an issue

- Potential conflict: susceptible native or protected barberry species in U.S.

Rust Resistance

- The CFR list needs to be updated. At least 3 cultivars listed in the CFR as *B. thunbergii* are actually *B. x ottawaensis*. Some listed varieties are no longer in trade or are duplications.

- Japanese barberry (*B. thunbergii*), which is rust resistant, is hybridizing with *B. vulgaris* to create *B. x ottawaensis.* Offspring of hybrids can segregate to produce susceptible hybrids. Feral barberry plants can originate from purple barberry landscape plants.

- Large amount of seed produced by Japanese barberry, potential indicator of weediness. Seed bank in soil: majority of seed germinates in the first year, 20% the next year, small percentage each year after.

- Mechanism of resistance in Barberry is unknown. Preliminary evidence with hybrids indicate single gene is responsible.

- Barberry bushes tested for stem rust resistance at the Cereal Disease Lab via a bioassay using *P. graminis* f. sp. *secalis* telioated Quackgrass straw. The test is repeated 10 times for each submitted barberry variety; have to have an absolute negative response 10 times before the barberry is declared resistant.

- Capacity for 20-25 assessions per year. Some years have more, some less.
  - Review of science behind testing procedure may be worthwhile

Variety Identification

- Identification of barberry plants sent to the Cereal Disease Lab for rust resistance testing relies upon the name the submitting nursery provides. Phenotype vs genotype of barberry, large information gap.

    - Names can vary greatly for the same plant, multiple submissions for same genotype.
    - Phenotypic plasticity, plants being tested for rust resistance may not match plants in production in appearance, although genetically the same.
    - Pictures and descriptions of plants to be tested should be required, being as inclusive of differences in appearance and growth habit as possible to aid in identification.
    - Genetic testing needs to be added to the process (AFLP or SSR markers) as new varieties are tested.
    - Identification the top 10 or 20 barberry varieties in trade and fingerprinted in Canada should be priority.

- Established consistency in the naming of barberry plants for inclusion in CFR.
    - Identification to include the variety, genus, epithet, and trade names.
    - It may also be useful to require the grower to submit the lineage of the plants to be tested for rust resistance as an additional source of identity (but this may be problematic with propriety issues).

- The University of Conn. found that the ideal tissue for molecular work is young actively growing shoot tips due to inhibition by polysaccharides with other tissue.
    - Sharon Talley thinks that other tissues/ protocols should be possible and more convenient

- University of Connecticut research to produce a sterile barberry is approximately 11 years out.

- Currently there is no formal certification effort or entity to certify. Establish a system to verify true to type and disease or pest resistant (Clean Plant Network, Farm Bill).

- Barberry plants imported into the U.S. are not tested genetically and rely on morphology for identification. No assurance that plants received is what is listed on associated paperwork. Some plants are shipped as dormant cuttings or plants.

<u>Black Stem Rust and Ug99</u>

- With the genomic resources at the CDL, results of a possible Ug99 isolate can be made within 24 hours.
    - More than one strain with Sr 31 virulence present in African horn, S. Africa
    - At least three strains, from genetic analysis, they look like clonal variants

- A standard set of wheat differentials must be run to identify a sample to race after it is identified as *P. graminis* f. sp. *tritici*.

    - Each set of 4 wheat varieties produces a reaction that is coded
    - Currently 5 sets, Ug99 TTKSK

- The use of SSR markers is an effective means for ensuring an isolate is not of the same genetic lineage as Ug99.
    - The CDL is developing a diagnostic Real Time PCR assay with the goal of transferring to plant diagnostic clinics, for example through CPHST, with a timeline of 6 months to a year. CPHST has the capacity and the mandate for transfer technology.
    - Next step would be to refine the assay for use on environmental samples to detect Ug99 and/or other lineages.
    - Timeline for the first step of the assay to be used on plant samples is 1 year. Timeline for environmental samples may be 2 years.

- Rust spores can adhere to clothing, a travel alert should be issued regarding travel to areas with Ug99.

- As stem rust has not been a priority for the pathologists or the breeders so far in the Pacific Northwest, preventative steps to face potential threat from Ug99 has yet to be taken in this region. Weather conditions are usually not conducive for stem rust development in the Pacific Northwest (according to Tim Murray)"

    - Stevens County, WA, source of several unknown U.S. stem rust races.
    - Survey of the Pacific Northwest should be increased due its potential as a source of unknown virulent rust strains.
    - Barberry is present and functional in the stem rust disease cycle in the Pacific Northwest. (But absolute evidence for role in appearance of new strains is not yet complete).
    - Stem rust races QFC and QCC are two examples that appear to have originated in the Pacific Northwest in the last few years.
    - Research on potential for aerial spread from isolated Rocky Mountain valleys to Midwest states is proposed

- New stem rust races do not have to necessarily form on barberry.

- Using soybean rust type models and assumptions, risk of aerial transport into the Western Hemisphere from wheat production areas in the East is not significant.

    - Open questions of wheat production in West Africa to north equator countries of South America, it is presumed low since wheat is a temperate crop (other hosts?).
    - Human mediated movement to western hemisphere is more likely.
    - Once in Western Hemisphere, there is no stopping spread. Agreements with Mexico and Canada for surveillance.
    - The BSR spores are hardier than spores of other rusts that have hitch hiked in past. Send out information to agencies to notify them of concern with Ug99 and human mediated movement.

- Current rust concern needs to be framed in a larger context than Ug99, ‘new races’ context, since there are home grown concerns that have similar potential. Sampling to characterize stem rust fields in the U.S. would indicate if a sexual population is present and if new variants may also be present.

- Sr24 virulence requires another level of surveillance. The ultimate diagnostic would be to clone resistance genes which correspond to virulence genes. Equivalent of wheat differential.

- Very little effort in recent years to sample barberries for rust. Number of rust sample submissions to the Cereal Disease Lab is less than 100 per year, greatly under the capacity of ~1000 per year. Survey for stem rust races in most likely areas for stem rust inoculum based on historic locations of barberry.

- Time of year to sample barberries for rust is not the same as when to sample wheat, this may be a practical survey problem.