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Black Stem Rust / Barberry Program Update

APHIS-PPQ
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National Plant Board 86th Annual Meeting
Mystic, CT, July 22-26, 2012



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- **Historical Objectives: Eradication Program**
- Role in maintaining the durability of resistance in small grain crops (wheat, barley, oats, rye) after series of epidemics
- Reducing the chances of new rust races developing on alternate host barberry
- 1917: Barberry Eradication Program initiated, >600 million (98%) plants eradicated
- 1919 : Federal Quarantine established, 17 States are listed as "Protected States"
- 1981 : USDA eradication program officially ends


Protected States


Salting

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Routine Activities:– Regulation 7CFR 301.38


- Rust resistant varieties approved for propagation and commercilaization
- Screening for rust resistance at USDA-ARS, Cereal Disease Laboratory (CDL), St. Paul, MN (~ 1 year time line)
- Statistics; +300 varieties/species tested - ~25 popular varieties in the market.
- Inspections of nurseries in the protected states under Compliance Agreements
- Program managed through "Cooperative Arrangement" SPHDs/SPROs/State Agricultural Dept.

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Screening of Barberry cultivars in the Greenhouse at USDA-ARS, Cereal Disease Laboratory, St. Paul, MN (David Long, Yue Jin) - APHIS-PPQ Funding ($45,000)


Rust Infected wheat straws are the source of pathogen spores

Test plants


Wire mesh


Humid Chamber (3-4 days, 80% humidity)

Common barberry, *Berberis vulgaris* is used as susceptible control plants

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BSR Program

Berberis thunbergii

- Out of 35-40 varieties in the market majority are *B. thunbergii* species or their hybrids
- Plants are locally bred, shipped interstate, new varieties imported, exported to Canada ($?)
- Current morphological identification of 40+ varieties not practical
- CFIA, Canada introduced molecular (AFLP) typing as "quality control" in 2008
- One instance of rejection of shipment from MI to Canada based on molecular typing

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BSR program highlights (2010 – 2012)

- Through the Direct Final Rule process PPQ added 21 new varieties of rust resistant *Berberis* and 2 varieties of rust resistant *Mahonia* to the regulated list. 3 more will be added to the list in 2012.
- Working with the Field Operations folks on resolving issue on "Annual Report" requirements. PPQ is flexible on the nature of the report. States should work with the SPHDs.
- Recent USDA-ARS research (Yue Jin et al, 2011) has indicated that *B. koreana* and their hybrids with *B. thunbergii* (Bailsel and Tara) are susceptible to stripe rust (*P. striiformis f. sp. tritici*). PPQ does not regulate stripe rust.
- Issue of rust symptoms on *B. koreana* hybrids shipped to Canada resolved with CFIA – thanks to prompt action of USDA-ARS (Yue Jin, Les Szabo).
- Request to Industry stakeholders to fund USDA-ARS for resistant testing of barberry would assist in the sustainability of this important program.

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BSR Program Highlights

- Funding from USDA-FAS – Technical Assistance for Specialty Crops – TASC : $150,000 for 3 years for University of Connecticut, Storrs. Fingerprinting / database development of ornamental barberry varieties.
- Farm Bill funding 10201 for BSR proposals:
  - Michigan Department of Agriculture for surveying barberry varieties in nursery trade
  - GIS – Archiving historical data for survey on re-emergence of barberry
- Renewed interest in the BSR program and its role in potential threat from strain Ug99 – PPQ participation in USDA-ARS Recovery Plan
- Successful in leveraging resources and supporting collaborations

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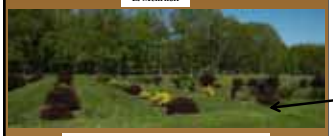
Current Program Status: Barberry / Ornamentals : Mark Brand, University of Connecticut (Funding: NIFA, University Grants, USDA-FAS)



Barberry Nursery at Storrs, CT (M. Brand)

- Research on ecology and invasiveness of barberry using molecular tools
- Hybridization in nature between ornamentals and common barberry
- Mislabeling of ornamental varieties surveyed
- Well characterized barberry germplasm collection at Storrs

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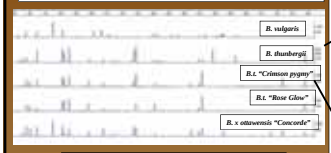
University of Connecticut, Storrs – Mark Brand



- Molecular techniques (AFLP) can determine "trueness" and avoid duplication of names
- "Quality Control" expertise at Univ. of Conn. will reduce trade issues
- MSU, MI- Univ. of Conn. Farm Bill project: All 151 plants in nursery trade tested, were true to type.
- Clonal variation noticed in 14 samples, mainly in "Crimson Pygmy".
- Eliminate hybrids of common barberry (*B. vulgaris)* from trade?
- Univ. of Conn. Breeding for "triploid" low fruiting capacity varieties - avoid dispersal

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Farm Bill Funding: Washington State University, Pullman and CPHST, Ft. Collins

- Re-emphasize the importance of barberry in rust epidemics to wheat and barley growers
- Avoid emergence of new races of BSR pathogen
- Re-survey for barberry re-growth in MN, IA, WI, MT, OR, WA, ID
- Barberry historical survey records – "L forms" digitized in collaboration with CPHST, Ft. Collins (Lisa Kennaway)
- P. Peterson, Y. Jin, E. Dabaan (MN), S. Foster, T. Murray, X. Chen, D. Roberts (WA), Idaho (M. Cooper), A. Barta (IA), D. Long (WI)

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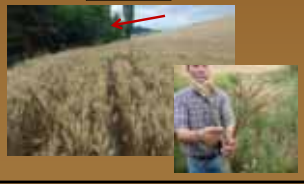
Barberry Program: Washington State

Potlach, ID



- WA Program initiated in 1944 due to severe rust epidemics in 1941- 43 and ended in 1978
- Only 21 Eastern Washington Counties are protected
- Re-emergence of common barberry in a small number of sites in both WA and ID
- Foster surveyed 100 properties and discovered re-emergence in 9 properties
- Murray and Chen detected barberry in 20 locations in Whitman, Stevens and Latah Counties

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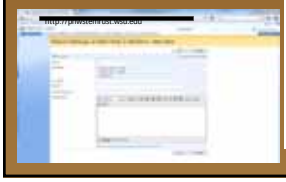
Pacific North West – Barberry Working Group



- Follow-up reports from stakeholders
- Encourage destruction of barberry when found
- Reporting suspected stem rust & barberry to @ http://PNWstemrust.wsu.edu
- Build an archive of PNW barberry eradication materials and data
- Resurvey select locations for barberry, monitor BSR development and race composition

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How to Recognize Common Barberry

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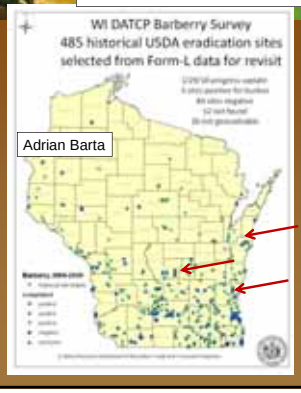
Archiving and Digitizing Barberry Eradication Records for re-emergence survey

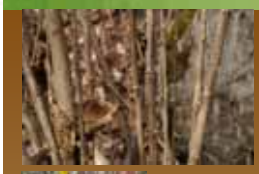
1944-1956

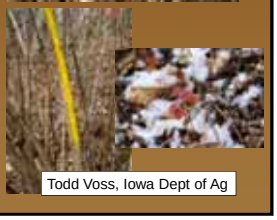
Lisa Kennaway, CPHST and Tim Murray, WSU

Surveys in Wisconsin



Adrian Barta





Todd Voss, Iowa Dept of Ag

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Disease Management & Epidemiology: BSR

Rust on barberry leaves

- Race typing studies at USDA-ARS, Cereal Disease Laboratory reveal a number of new races that can overcome resistance in currently used wheat lines
- It is now recognized that if unchecked, yields in wheat fields adjacent to common barberry or thousands of miles away can be impacted.
- Modeling work to predict movement of new races of rust from Pacific Northwest to other wheat growing regions of the US is on-going at Penn State (Scott Isard).

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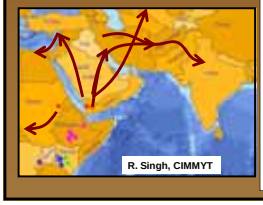
BSR and Incursions of Ug99 Cooperative efforts : USDA

Shoes or clothing

Rust spores



R. Singh, CIMMYT

- USDA-ARS, Cereal Disease Laboratory, St. Paul
  - Research on early detection tools (L. Szabo)
  - Race typing of BSR pathogen (Yue Jin)
  - Breeding for resistance
- USDA-APHIS-PPQ / CPHST roles – facilitation, permits, and validation
- S. Isard, Penn State (USDA-NIFA, Bio-security grant) **Modeling current risks of Ug99** movement into W. Hemisphere
  - Air-borne from East Africa – **Not Significant**
  - Human-mediated – **Sig.**
  - Air borne (**future**) from S. America – **Sig.**
- **Need for awareness to prevent accidental introduction (shoes, clothing, military vehicles, etc) – Fact Sheets**

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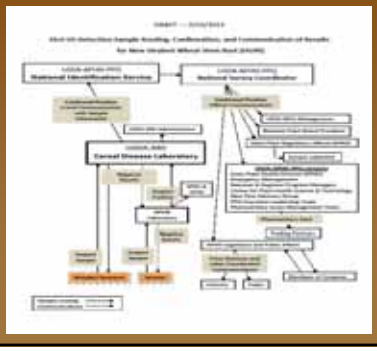
Flow chart for reporting Ug99 detections



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Recommendations for Improving BSR program Ad-Hoc Working Group, Riverdale, May 2009

Participants: USDA-ARS, CSREES, APHIS, ANLA, NPB, Universities - Penn State, Washington State University, SD State University, University of Connecticut.
(http://www.aphis.usda.gov/plant_health/plant_pest_info/barberry/technical-mtg.shtml)

Barberry:

- Improve "Scientific " or "Technical" aspects – Fingerprinting/Nursery Surveys
- Improve information flow to stake holders (Nursery industry) and regulators
- Harmonize BSR activities with CFIA (Canada) – trade in barberry, Ug99 related information

Black Stem Rust /Ug99:

- Need to link with Wheat/small grains industry on barberry eradication
- Be part of the Global Efforts on Ug99
- Leverage Resources with other federal agencies, Grain and nursery industry and improve coordination and communication.

Goal: Meet objectives of the NAPPO Executive Committee declaration (August 11th, 2008), USDA "Action Plan", Plant Board Resolutions, BSR program needs.

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Seedless *B. vulgaris* species in Iran

Acknowledgements:
National Plant Board, State Plant Health Directors, State Plant Regulatory Officers WSU, USDA-ARS, NIFA, Penn State University, PPQ-CPHST, Nursery Industry

THANK YOU