Recovery Plan
for
Red Leaf Blotch of Soybean
caused by
Phoma glycinicola
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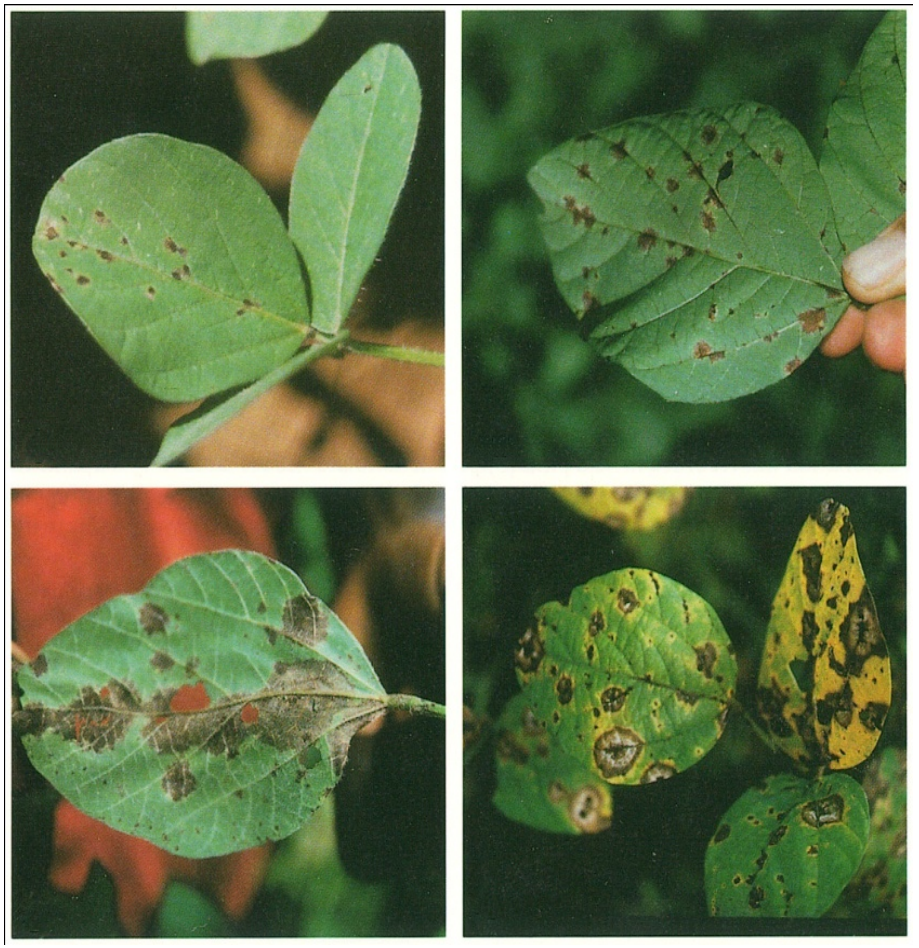
Introduction

- Red leaf blotch was first reported in Africa in 1957 (Stewart, 1957)
- Other common names include Pyrenochaeta leaf spot, Dactuliophora leaf spot and Pyrenochaeta leaf blotch
- Cameroon, Ethiopia, Malawi, Nigeria, Rwanda, Uganda, Zaire, Zambia and Zimbabwe
- RLB is a threat to production in central and southern African countries with losses of up to 50% in conducive environments

Symptoms

- Reddish lesions first appear on young soybean leaves predominantly along the veins
- Lesions expand in size and often coalesce
- Blotching occurs on older lesions where pycnidia and sclerotia are produced
- Lesions can also develop on stem, petioles and pods



The Fungus (I)

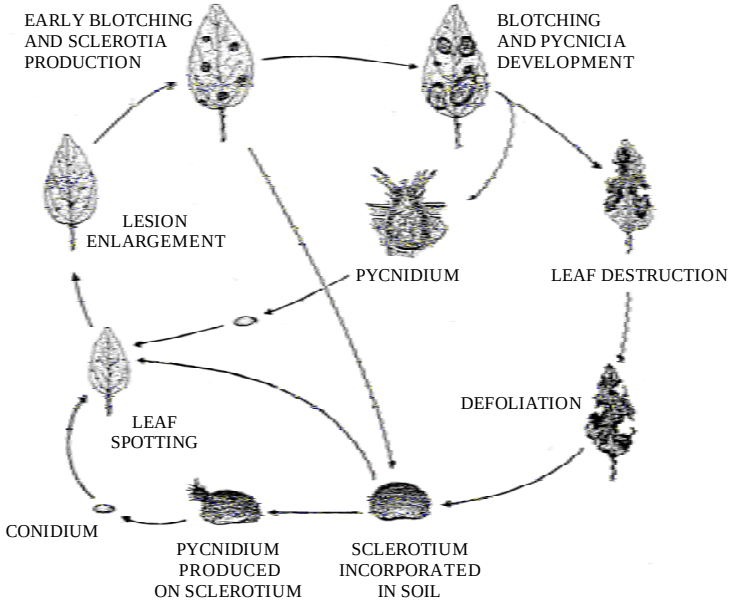
- Culturable, soilborne fungus that infects soybean and *Neonotonia wightii*, a perennial legume in woodlands and grasslands of southern Africa, and other legumes under experimental conditions
- The fungus was named *Pyrenochaeta glycines*, based on the pycnidial stage (Stewart, 1957) then *Dactuliophora glycines*, based on the sclerotial stage (Leakey, 1964)
- In 1988, both the pycnidial and sclerotial stages were observed in herbarium specimens linking the two epithets to the same fungus
- A new genus and species, *Dactuliochaeata glycines,* was established to accommodate *P. glycines* and its synnamorph, *D. glycines* (Hartman and Sinclair, 1988)

The Fungus (II)

- Since then, *D. glycines* was classified as a *Phoma* species and re-named *Phoma glycinicola* (Boerema et al., 2004)
- *P. glycinicola* produces well-defined, melonized sclerotia that on their own can be infectious, or can produce pycnidia on their surface, which then produce infectious conidia
- The fungus is unique among the *Phoma* because no other species in that group exhibits such characteristics

Disease Cycle and Spread (I)

- Sclerotia reside in the upper soil matrix released from decaying leaf litter or fallen from infected plant tissues
- Infection occurs when rain splashes soilborne sclerotia or conidia from pycnidia onto leaf surfaces
- Diseased leaves senesce prematurely releasing the sclerotia and pycnidia back to the soil
- Local spread occurs when rain showers, water splash, and/or animal or human activities transport the fungal propagules between plants and fields

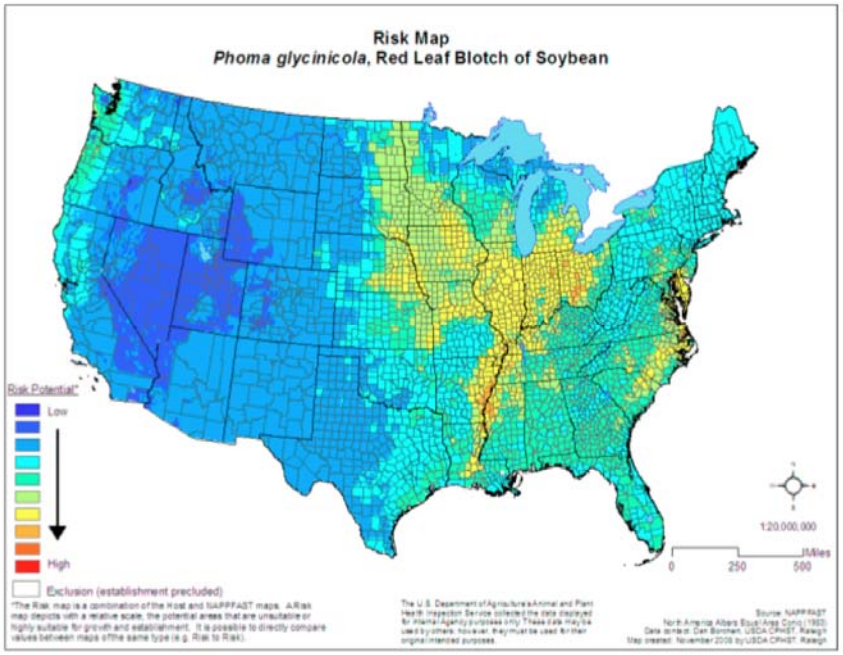


Disease Cycle and Spread (II)

- Transport of sclerotia among fields is unknown, but it is reasonable to assume they move similarly to other soil-borne pests, such as the soybean cyst nematode
- Long distance or secondary spread via conidia is unknown, but conidia are water-borne and splashed onto leaves in a similar fashion of other pycnidial fungal species
- There is no evidence that the pathogen is seedborne
- Long distance spread may occur through transport of untreated plant material, via debris accompanying seed from infected fields, or through the movement of contaminated soil

Risk Map

- The economic impact of RLB to the USA has not been determined, although a risk assessment has been completed by USDA-APHIS-PPQ-CPHST-PERAL
- The areas of the USA that have the highest risk of introduction and establishment are the Mississippi River Valley, parts of the eastern Midwest, and the Mid-Atlantic coast



Risk map for *Phoma glycinicola* introduction and establishment was produced by Engle and Magarey 2009, by permission

Monitoring and Detection

- There are no surveys monitoring for RLB in the USA
- Methods need to be published to confirm positive molecular identification of the fungus
- Molecular detection methods can be developed at Fort Detrick containment facility or
- An international cooperative partnership to identify samples and extract DNA would provide the necessary DNA samples to complete the molecular detection methods for the fungus

Response

- If an introduction occurs and the results of the delimiting survey are known, options for control will likely include fungicide applications
- If the disease is isolated, there is a good possibility the pathogen can be eradicated by destroying all infected plants prior to production and deposition of sclerotia
- If the detection is late, fields will need to be removed from production indefinitely
- Research on sclerotial/pycnidial longevity is needed to address how long a field or location needs to remain in quarantine or under surveillance

Mitigation and Disease Management (I)

- Any disease mitigation strategy must be coordinated among Federal, State and local regulatory officials
- Prevention/Exclusion. Since the pathogen has a relatively low risk of being introduced into the USA (little, if any, import of soybean seed and associated debris from infested areas in Africa), thus, phytosanitary regulations are not needed
- If the pathogen were found in the USA, it has low potential for rapid spread; it may be controlled, but not eradicated, by fungicides
- Continued exclusion of this disease through port activities is an essential initial step in the mitigation and disease management strategy

Mitigation and Disease Management (II)

- Germplasm. In 1982-1984, all USA-grown commercial cultivars were susceptible in field tests in Zambia and Zimbabwe and in trials conducted before 1992 based on "Hartwig's" southern USA soybean germplasm collection – approx. 5000 lines tested in Zimbabwe
- Biological and Cultural Control. Both of these are unknown
- Fungicide Control. The fungicide fentin actetate was effective for control of red leaf blotch in Africa, but no information is available on current USA soybean-registered fungicides
- Eradication. Early detection and the destruction of infected material may make eradication possible if there is a single entry point with limited spread

Infrastructure and Experts

- A research project concerning RLB is active at the USDA/ARS Bio-Safety Level 3 Plant Pathogen Containment facilities in Ft. Detrick, MD
- The focus of this project, implemented by Paul Tooley, is to culture and maintain the fungus, develop inoculation techniques, and devaluate host resistance
- The following scientists have experience working with RLB or *P. glycinicola* and can be contacted: **Glen Hartman**, USDA-ARS, Urbana, IL; **Clive Levy**, Commercial Farmers Union of Zimbabwe, Harare, Zimbabwe; **Ranajit Bandyopadhyay**, IITA, Ibadan, Nigeria; **Paul Tooley**, USDA-ARS, Ft. Detrick, MD; **Lawrence Datnoff**, Louisiana State University, Baton Rouge, LA

Research Priorities (I)

- Determine the overwintering potential in USA through simulated conditions (high priority; short term)
- Evaluate efficacy and application methods of fungicides currently registered for use on soybean (high priority; short term)
- Develop effective molecular diagnostic techniques to identify *P. glycinicola* from other common foliar soybean pathogens (high priority; short term)

Research Priorities (II)

- Determine effective measures to control, confine or destroy the pathogen in the field with scientists in RLB countries (high priority; long term)
- Discover sources of resistance and develop resistant commercial varieties (low priority; long term)
- Develop better prediction models of potential spread of *P*. *glycinicola* that includes other potential hosts(low priority; long term)
- Evaluate the efficacy of various biocontrol agents that are commercialized for use on other soybean diseases like Sclerotinia stem rot for the control of RLB (low priority; long term)

Extension Priorities

- Provide outreach materials for clinicians, soybean growers, crop advisors, and the industry on RLB diagnosis and disease management (high priority; short term)
- Disseminate information gained through research to other researchers at meetings, workshops, and other venues (high priority; short term)
- Establish a field monitoring system compatible with current programs like the IPM PIPE (high priority; long term)
- Distribute fungicide guidelines (low priority; long term)

Education Priorities

- Develop training materials on detection, monitoring and management of RLB (high priority; short term)
- Host a diagnostician workshop in Beltsville for provisional diagnostic standard operating procedure development and training (cultural characteristics, digital diagnostic refresher, PCR) (high priority; short term)
- Develop training materials for port of entry Safeguarding Specialists (USDA) and Department of Homeland Security personnel (high priority; short term)
- Conduct first detector training – laboratory (NPDN) and field (PIPE) (high priority; short term)

References

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