NAME OF SPECIES: *Sirococcus clavigignenti-juglandacearum* Butternut Canker pathogen

Synonyms:

Common Name: Butternut Canker pathogen

A. CURRENT STATUS AND DISTRIBUTION

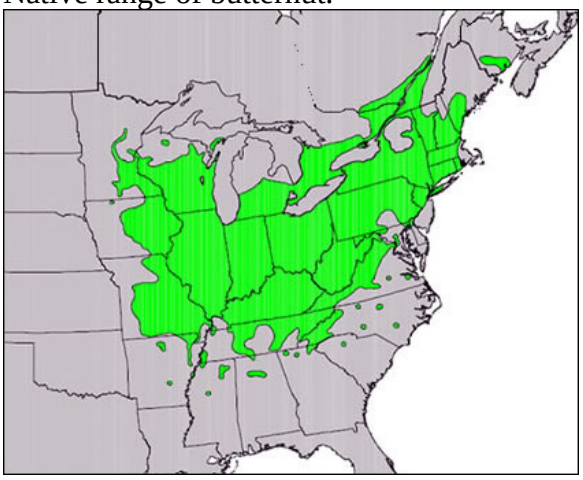
I. In Wisconsin?

1. YES X NO

2. Abundance:
The presence of *S. clavigignenti-juglandacearum* has been confirmed in 45 counties in Wisconsin. Reports of the presence of this disease have come from all counties in Wisconsin where butternut is present. A 1992 survey revealed that 91% of the 1,394 trees surveyed were infected.

3. Geographic Range:
The presence of *S. clavigignenti-juglandacearum* has been confirmed in 45 counties in Wisconsin. Reports of the presence of this disease have come from all counties in Wisconsin where butternut is present.

Native range of butternut.



4. Habitat Invaded:
All habitats where butternut grows, which include the southern WI oak-hickory and elm, ash, cottonwood forests and northern forests including maple, beech, birch and aspen, birch types.

5. Historical Status and Rate of Spread in Wisconsin:
Data comparing disease incidence in 1976 and 1992 show percent of tree infected changed from 30 to 91 over this 16 year period.

6. Proportion of potential range occupied:
100%

II. Invasive in Similar Climate Zones

YES X NO X
United States and Canada: Present throughout the natural range of butternut in US; in Canada, present in Ontario, Quebec and NewBrunswick (see map to left).

III. Invasive in Similar Habitat Types

YES X NO

IV. Habitat Affected

All habitats where butternut grows, which include the southern WI oak-hickory and elm, ash, cottonwood forests and northern forests including maple, beech, birch and aspen, birch types.

2. Conservation significance of threatened habitats:
Butternut is a minor component of all forest types it inhabits. Loss of this species will reduce mast available to wildlife. The diversity of tree species will be reduced as butternut is eliminated; it will be replaced by cohorts.

V. Native Habitat

1. Countries:
Unknown origin. Genetic diversity studies have shown little genetic variability in the pathogen, which supports the hypothesis that this pathogen was introduced into the United States.

2. Hosts: Butternut, *Juglans cinerea*. Black walnut and heartnut can be infected yet are not as susceptible.

VI. Legal Classification	1. Quarantined species? YES NO X in United States
	2. By what states, countries?
B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS	
I. Life History	1. Type of organism: Fungus; anamorphic Ascomycota
	2. Life cycle: Trees are infected through buds, lenticels, cracks in the bark and leaf scars. After infection occurs, bark cell walls are degraded, resulting in a dark brown sticky residue and brown exudates. Hyphae penetrate phloem parenchyma and progress into bark and wood tissue. Throughout the growing season, conidia develop beneath infected bark in sticky masses. Stromatal pegs lift and rupture the bark; conidia are extruded in cirri from pycnidia present among the hyphal pegs.
	3. Methods of Spread: Condia are dispersed by rain splash and wind (in water droplets), in run-off water from infected branches and stems.
II. Climate	1. Climate restrictions: Spores require 16 hours of dew at 20 degrees C to germinate on the bark on butternut.
	2. Effects of potential climate change: Unknown
III. Dispersal Potential	1. Invasion pathways: Before this disease was detected, it is likely that infected nursery stock and seed were widely distributed. Naturally, spores can be distributed by insects and in wind-blown water droplets.
	2. Distinguishing characteristics that aid in its survival and/or inhibit its control: The fungus is able to sporulate on dead butternuts for 20 months or more. Conidia can survive outside of the host for at least 8 hours in cool weather. The pathogen is also seed-borne. Infected host material is widespread throughout Wisconsin, providing inoculum throughout the host range.
IV. Ability to go Undetected	HIGH MEDIUM LOW X
	Signs and symptoms: The canker caused by this fungus has a characteristic form. Isolation of the fungus requires basic laboratory skills. The pathogen can often be observed under the microscope by picking conidia from under peeling bark on the canker margin.
C. DAMAGE POTENTIAL	
I. Competitive Ability	1. Presence of Natural Enemies: None are known
	2. Presence of Competitors: None are known
	3. Rate of Spread: Percent infection of butternut in Wisconsin changed from 30 to 91 in 16 years. Infected trees may take up to 10 years to die. Larger trees take longer.
II. Environmental Effects	1. Alteration of ecosystem/community composition? YES X NO Notes: Effects of loss of butternut have not been well

	documented. If butternut occurs in small groupings, loss of the tree from a forest produces a small canopy gap, which may allow understory brush and pioneer tree species to fill in.
	2. Alteration of ecosystem/community structure? YES X NO Notes: Community structure would be altered but effects would depend on species that replace butternut. In addition, the opening of the canopy from death of individual trees increases the amount of available light, nutrients, and moisture on the forest floor, and thereby increases the populations of both herb and shrub species.
	3. Alteration of ecosystem/community functions and processes? YES X NO Notes: Butternuts produce mast for wildlife. Loss of overstory could increase runoff – affecting area streams and increase loss of soil from the site.
III. Socio-economic	1. Effects of Restricting Entry: Restricting the movement of nursery stock could have an effect on the nursery industry; butternut is not a species that is commonly offered by nurseries.
	2. Effects on Human Health: None known
D. PREVENTION AND CONTROL	
I. Detection Capability:	Notes: The butternut canker pathogen is easily detected.
II. Costs of Prevention :	Notes: Unknown.
III. Responsiveness to prevention efforts:	Notes: Unknow. The cat, so to speak, is out of the bag.
IV. Control tactics:	1. Cultural: Creating small canopy openings around seed-producing butternuts and controlling competition from the top to encourage regeneration are known to be productive ways to encourage butternut regeneration. 2. Biological: None known 3. Chemical: None known 4. Regulatory: This disease is widespread through the range of butternut in the U.S. Inoculum is also widespread; regulatory efforts would not impact the movement of this disease as it is spreading on its own.
V. Minimum Effort:	Notes: Encourage butternut regeneration and preservation of potentially disease-resistant material.
VI. Most Effective Control:	Notes: Encourage butternut regeneration and preservation of potentially disease-resistant material. Breeding to develop disease-resistant material.
VII. Cost of prevention or control vs. Cost of allowing invasion to occur:	Notes: Unknown
VIII. Non-Target Effects of Control:	Notes: None known.
IX. Efficacy of monitoring:	Notes: High. Butternut canker is relatively easy to monitor.

X. Legal and landowner issues:	Notes: Landowners can make a significant difference in encouraging regeneration of butternut. Most butternut grows on private property, thus, cooperation from private landowners is critical to maintaining butternut as part of Wisconsin's forest resource.

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