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New Pest Response Guidelines

Phytophthora species in the Environment and Nursery Settings

Karen Maguylo, PhD


UGA2110004

UGA1415156

5373364

UGA1371017

5379797

5382600

>100 species


UGA1501061

UGA1323025

UGA1400148

UGA0364080

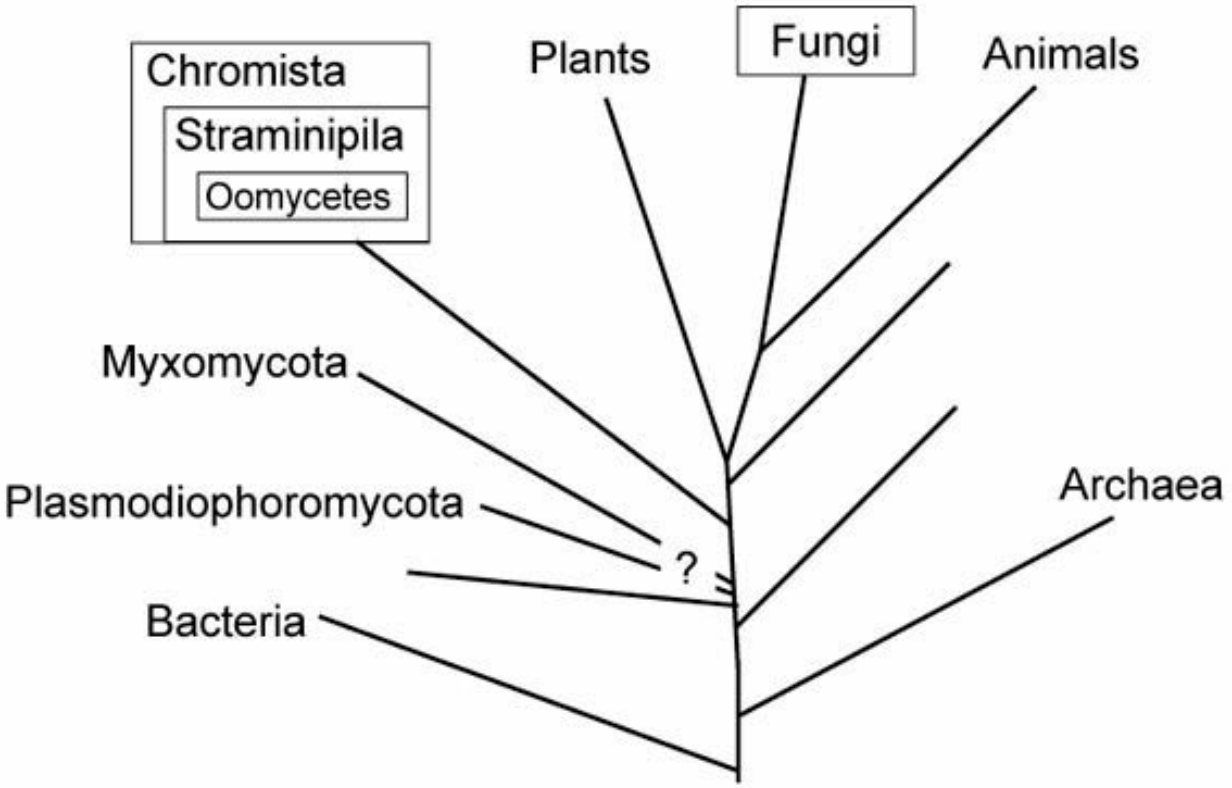
5390077

5402938

CAL OAK
786
35
992
CAL OAK
FIREWOOD
UGA1427100

What are *Phytophthora* spp.?

- Oomycetes
  - Fungus-like



http://www.apsnet.org

NPRG

- *Phytophthora alni* (subsp. *alni, multiformis, uniformis)*
- *P. alticola*
- *P. austrocedrae*
- *P. boehmeriae*
- *P. captiosa*
- *P. colocasiae*
- *P. fallax*
- *P.frigida*
- *P. gallica*
- *P. idaei*
- *P. iranica*
- *P. italica*
- *P. kernoviae*
- *P. melonis*
- *P. multivesiculata*
- *P. multivora*
- *P. pinifolia*
- *P. polonica*
- *P. porri*
- *P. primulae*
- *P. psychrophila*
- *P. quercina*
- *P. tentaculata*
- *P. uliginosa*

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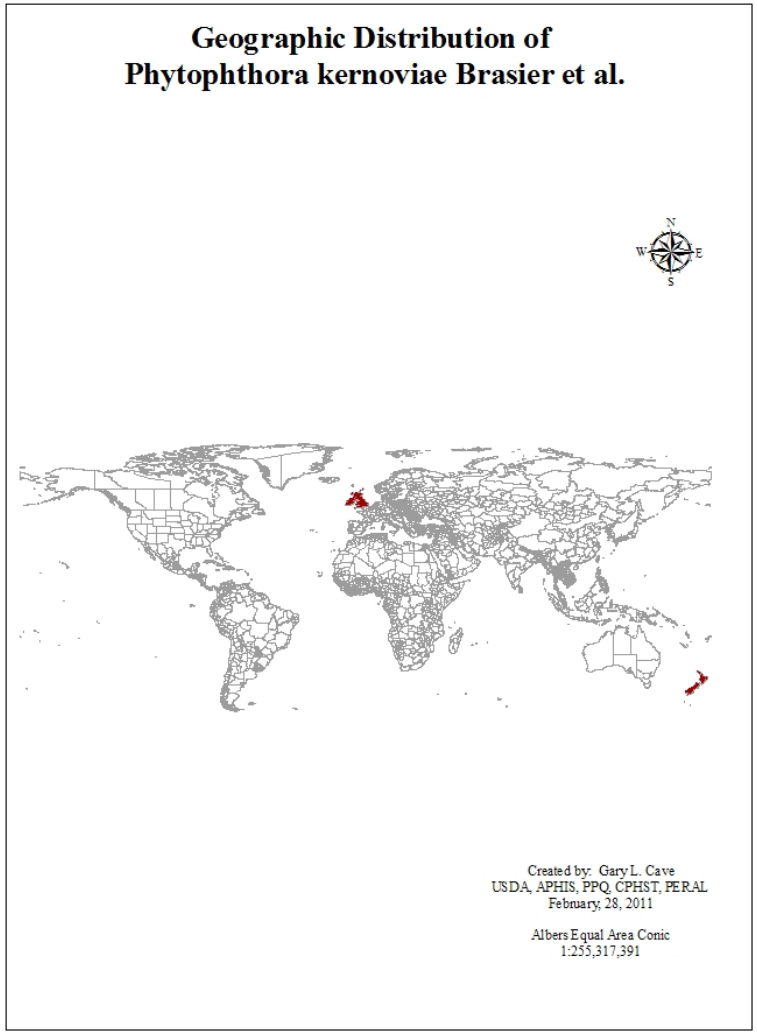
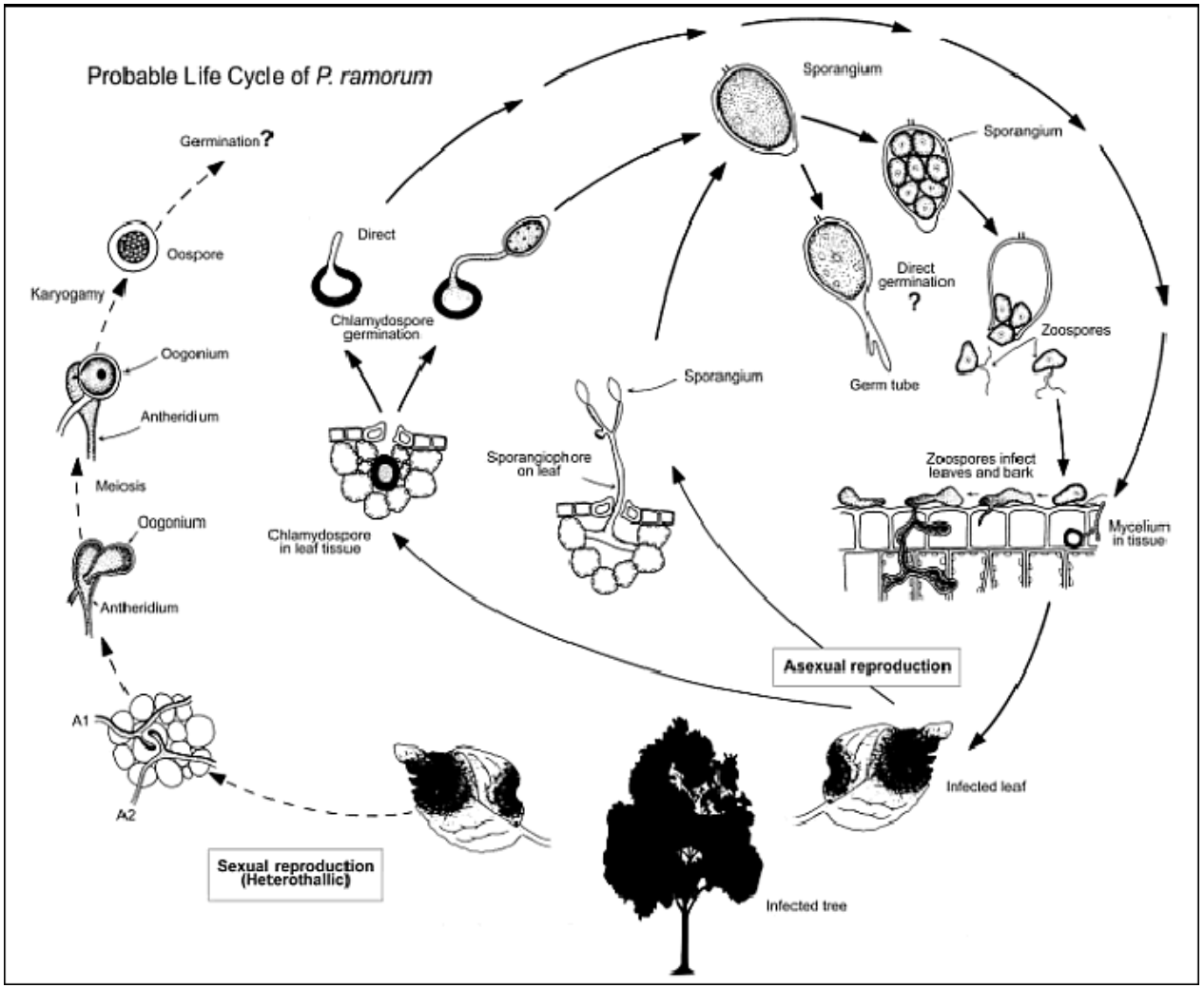
Phytophthora kernoviae - Distribution

- England
- Scotland
- Ireland
- New Zealand



Phytophthora kernoviae - Biology



Adapted from 'The disease cycle of late blight caused by Phytophthora infestans', G.N.Agrios, (with copyright permission Academic Press)

http://rapra.csl.gov.uk/background/lifecycle.cfm

Phythophthora kernoviae - Hosts

- *Annona cherimola* (cherimoya
- *Castanea sativa* (European chestnut)
- *Drimys winteri* (winter's bark)
- *Fagus sylvatica* (beech)
- *Gevuina avellana* (Chilean hazelnut)
- *Hedera helix* (ivy)
- *Ilex aquifolium* (holly)
- *Liriodendron tulipfera* (tulip tree)
- *Lomatia myricoides* (river lomatia)
- *Magnolia* spp. (*M. amoena, brooklynensis, cylindrica, delavayi, kobus, liliflora, mollicomata, salicifolia, sargentiana, sprengeri, stellata, wilsonii*)
- *Magnolia x soulangeana*
- *Michelia doltsopa* (sweet michelia)
- *Pieris formosa* (Wakehurst pieris)
- *Pieris japonica* (Japanese pieris)
- *Podocarpus salignus* (willow podocarp)
- *Prunus laurocerasus* (cherry laurel)
- *Quercus ilex* (Holm oak)
- *Quercus rober* (English oak)
- *Rhododendron* spp.
- *Rhododendron ponticum* (pontic rhododendron)
- *Sesquiadendron giganteum* (giant sequoia)
- *Vaccinium myrtillus* (bilberry)

Symptoms – *Fagus sylvatica* - beech

Similar to *P. ramorum*

Lesions up to 12 m

Girdling

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Foliage lesions on *Magnolia* spp.

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Symptoms - *Rhododendron* spp.

www.invasive.org

shoot dieback

www.forestry.gov.uk

necrosis

www.invasive.org

Survey

03. Survey *Phytophthora* spp.

Phytophthora species	Hosts	Symptoms	Survey Specifics	Baits used	Media used for culturing	Key Reference(s)
Phytophthora kernoviae	*Annona cherimola* (cherimoya), *Castanea sativa* (European chestnut), *Drimys winteri* (winter's bark), *Fagus sylvatica* (beech), *Gevuina avellana* (Chilean hazelnut), *Hedera helix* (ivy), *Ilex aquifolium* (variegated holly), *Liriodendron tulipfera* (tulip tree), *Lomatia myricoides* (river lomatia), *Magnolia* spp. (magnolia) *Michelia doltsopa* (sweet michelia), *Pieris* spp. (pieris), *Podocarpus salignus* (willow podocarp), *Prunus laurocerasus* (cherry laurel), *Quercus* spp.(oak), *Rhododendron* spp.,(rhododendron), *Sesquiadendron gigantеum* (giant sequoia), and *Vaccinium myrtillus* (bilberry).	**Leaves:** Leaf blights (blackening of leaf petiole, leaf tip, leaf base), necrotic lesions, dieback, wilting. Rhododendron leaves often fall within a few weeks of infection. **Stem:** Bleeding bark cankers, can girdle/kill trees, dieback. Bleeding cankers may be sunken or demarcated by black lines.	Direct plating of symptomatic tissue (necrotic inner bark or leaf lesions). Brown and Brasier (2007) recommend attempting to isolate from the xylem if discoloration is present.	Rhododendron 'Cunningham's White leaf disks (Benson *et al.*, 2008)	SMA + MRP (Elliot *et al.*, 1966), PARPH	Brasier *et al.* (2005) Beales *et al.* (2006)

Common Symptoms associated with *Phytophthora* spp.

- Leaf blight
- Stem canker
- Root rot
- Leaf spots
- Twig blight or dieback
- Lesions
- Internal discoloration
- External discoloration
- Defoliation
- Production of abnormal exudates
- Chlorosis
- Abnormal leaf discoloration
- Plant death

- Visual inspection
- Soil Sampling

lesions of foliage of magnolia

necrosis of rhododendron leaves

bleeding lesion on tru of European beech

Wilting of rhododendron

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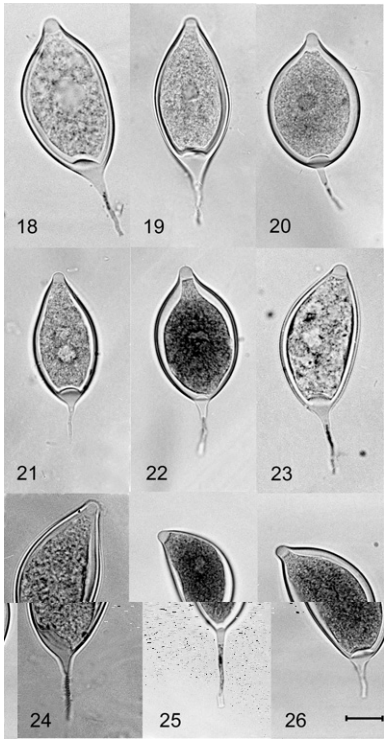
Diagnostics and Identification

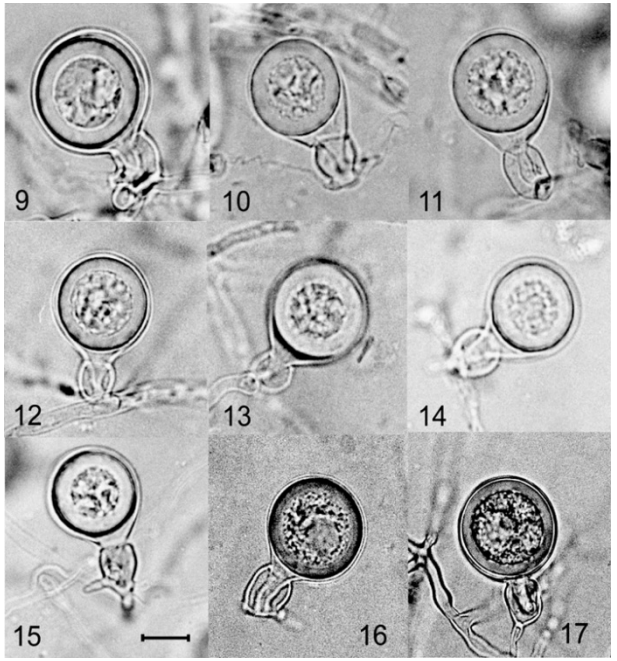
04. Pest Diagnostics & Identification *Phytophthora* spp.

***Phytophthora* spp.**	**Main hyphae**	**Sporangia**	**Chlamydospores**	**Heterothallic vs. Homothallic**	**Oogonia**	**Oospores**	**Antheridia**	**Growth Characteristics ***
Phytophthora kernoviae	Hyphae sometimes denticulate or tuberculate.	Sporangia occasional on CA, common on plugs immersed in soil water or soil leachate; sympodial sporangiophores. Sporangia papillate, caduceus, from regular ovoid or limoniform to distinctly asymmetrical or 'mouse-shaped' with one rounded and one flatter side. Most have a conspicuous vacuole. Sporangia length x width range of means 38.5-45.5 x 22.5-27 µm. Length-breath ration: average 1.5 µm. Sporangial pedicels range of means 8.6-14.1 µm.	No chlamydospores observed.	Homothallic	Oogonia, diameter range of means 23.5-25.5 µm; often with tapered stalks.	Plerotic, diameter range of means 21.1-22.5 µm; wall thickness averages about 3.5 µm.	Amphigynous. Length/width range of means 11.5-12.5 x 10-10.8 µm.	On CA-largely submerged in darkness. On exposure to light, small central patchy aerial mycelium. Diurnal light, alternating rings of aerial mycelium. Maximum growth temperature 26 °C, optimum at 18 °C.

Diagnostics and Identification

- Serological
  - Can not differentiate from *P. ramorum*
- Morphological
  - Symptoms are not characteristic
- Molecular
  - 2 diagnostic procedures developed





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Phythophthora - Control

- Exclusion
- Eradication
- IPM
  - Biological control has not been investigated
- Chemical
  - none for *P. kernoviae*
  - Fungicides?
- Cultural
  - for kernoviae, burning, or other plant destruction

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Phythophthora - Pathways

- Introduced in 3 ways:
  - Movement of infected plant material
  - Natural environmental movement of spores
  - Transmission of non-plant pathways to plant material

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Research Needs

- Little information available for most of the phytophthora:
  - Life cycle
  - Biology
  - Economic Importance
  - Ecological Importance
  - What is necessary to develop targeted surveys
- *P. kernoviae*
  - Host range
  - Biology and epidemiology
- Determination of the susceptibility of North American alder to *P. alni*
- Determination of ecology and ecological importance of *P. alni* in North America
- Elucidation of the biology and life cycle of *P. alni* under field conditions, including the role of the oospore in the biology and survival of *P. alni*
- Determination of the importance of *P. alticola* and *P. frigida* as tree pathogens in the Phytophthora complex association with collar rot of cold-tolerant Eucalyptus species
- Clarification of the economic importance and the ecological importance of *P. boehmeriae* on hosts other than cotton

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THANKS