Santos, A. F. dos. 2016. *Phytophthora boehmeriae*. Forest Phytophthoras 6(1). doi: 10.5399/osu/fp.6.1.3851

Phytophthora boehmeriae

Overview

Phytophthora boehmeriae Sawada is a species that has been recorded on only a few hosts (Erwin and Ribeiro 1996) since its first description in leaves of *Boehmeria nivea* (L.) Gaud-Beau in Taiwan (1927). It has also been reported in China, Australia, Greece (Erwin and Ribeiro 1996) and South Africa (Roux and Wingfield 1997). In South America, it was reported only in Argentina on citrus (Frezzi 1950), and in Brazil on black wattle (Santos et al. 2006). Erwin and Ribeiro (1996) report some additional trees as hosts: Deodar cedar (*Cedrus deodora* (G. Don) D. Don), eucalyptus (*Eucalyptus pilularis* Sm.) and Mexican yellow pine (*Pinus patula* Schiede ex Schlectendahl et Chamisso). In black wattle (*Acacia mearnsii* De Wild.), *P. boehmeriae* has been reported in South Africa (Roux and Wingfield 1997) and Brazil (Santos et al. 2006), thus becoming one of the causal agents of the disease known as gummosis, along with *P. nicotianae* (Santos et al. 2005), *P. frigida* (Alves et al. 2016) and *P. meadii* McRae (Roux and Wingfield 1997). Gummosis is the main disease of black wattle in Brazil (Santos et al., 2005) and South Africa (Roux and Wingfield 1997). It is characterized by necrotic lesions on the trunk, from the collar to the upper portions, with or without gum exudation (Santos and Luz 2007).

Morphology

Sporangia of *P. boehmeriae* are ovoid to spherical, papillate and caducous, measuring 35 µm × 30 µm, with a length:width ratio of 1.16:1, mean depth of papillae of 4.83 µm, and exit pore of 4.69 µm (Fig. 1). *P. boehmeriae* is homothallic, forming plerotic oospores with smooth walls and amphigynous antheridia. Cultures produce oospores abundantly (Fig. 2). Chlamydospores are terminal or intercalary (Fig. 3) (Santos et al. 2006).

Figure 1. Sporangia showing ovoid and ovoid to spherical shape and papillate condition (reproduced with permission Summa Phytopathologica, courtesy A. F. dos Santos).

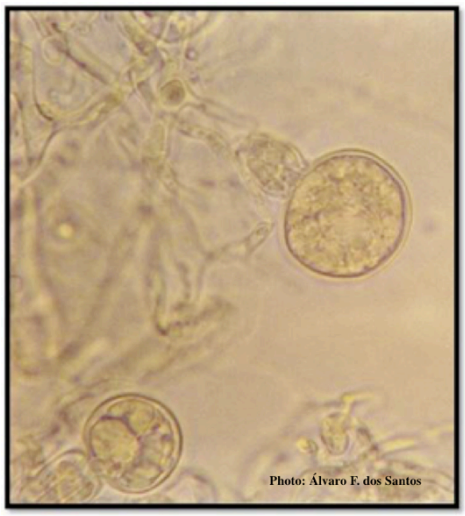

Figure 2. Oogonia and oospores with amphigynous antheridia. (reproduced with permission Summa Phytopathologica, courtesy A. F. dos Santos).

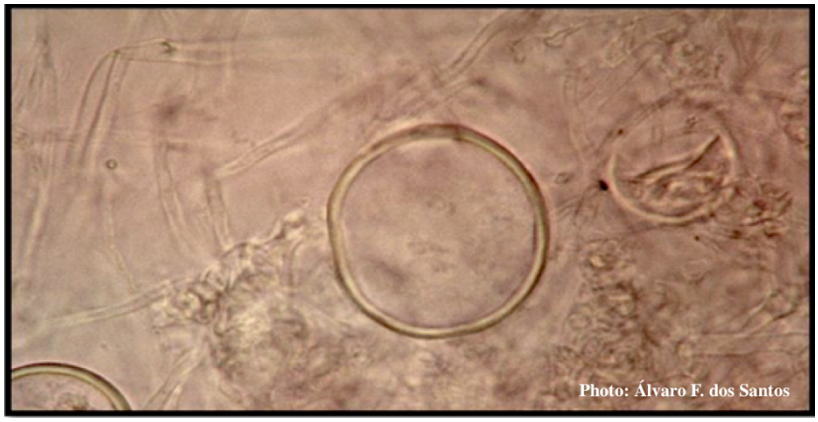

Figure 3. Globose chlamydospore. (reproduced with permission Summa Phytopathologica, courtesy A. F. dos Santos).

Genetics:

Phytophthora boehmeriae is placed in Clade 10 (Kroon et al., 2012) (see also Fig. 4).

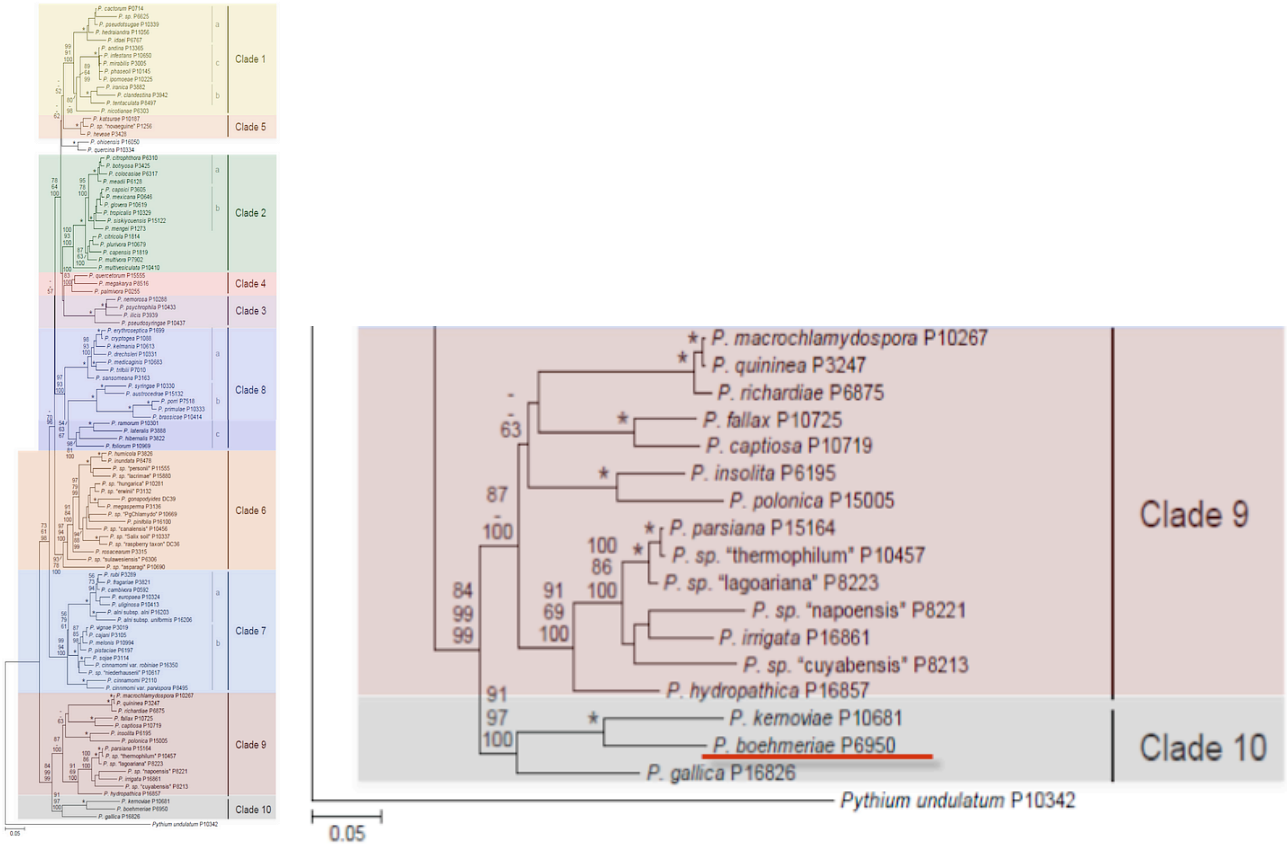

Figure 4. Genus-wide phylogeny for *Phytophthora* using four mitochondrial loci (cox2, nad9, rps10 and secY; 2,373 nucleotides). (Martin, Blair and Coffey, unpublished).

Growth in culture:

In carrot-agar cultures, *P. boehmeriae* has a petaloid appearance with maximum mycelial growth at 24°C, and no growth at 32°C (Santos et al. 2006).

Distinguishing characteristics for identification

Phytophthora boehmeriae is distinguished from the other species that cause gummosis (*P. nicotianae* and *P. frigida*) especially by being homothallic and producing caducous sporangia with short pedicels (<5 µm), and showing no growth at 32°C (Santos et al. 2006). The species *P. meadii* does not occur in Brazil, and differs from *P. boehmeriae* in the production of caducous sporangia on medium-length pedicels (18 µm) and being heterothallic (Gallegly and Hong 2008).

Disease History

Gummosis has occurred in black wattle plantations in Brazil for more than 40 years (Santos and Luz 2007). The etiology was resolved only recently, with the causal agents identified as *Phytophthora nicotianae* (Santos et al. 2005), *P. boehmeriae* (Santos et al. 2006) and *P. frigida* (Alves et al. 2016). In South Africa, this disease has been reported in black wattle by Zeiljemaker (1971) associated with *P. nicotianae* and by Roux and Wingfield (1997) associated with *P. boehmeriae* and *P. meadii*.

Impacts in the forest

Gummosis by *P. boehmeriae* has a limited geographical distribution in black wattle production areas of the state of Rio Grande do Sul, in southern Brazil (Santos and Luz 2007) and South Africa.

Forest and Wildland Hosts and Symptoms:

Gummosis caused by *P. boehmeriae* occurs in outbreaks in rainy years associated with strong and constant winds (Santos and Luz 2007). Black wattle plantations of Brazilian trees with gummosis caused by *P. boehmeriae* can be distinguished from those caused by *P. frigida* and *P. nicotianae* (Santos 2001, Santos and Luz 2007, Alves et al. 2016). Gummosis associated with *P. frigida* and *P. nicotianae* has lesions in the basal region of the trunk and does not exceed 1.5 m in height, while gummosis associated with *P. boehmeriae* produces lesions over the entire trunk reaching up to 10 m (Fig. 5).

Fig. 5. Symptoms of gummosis on black wattle (reproduced with permission Summa Phytopathologica and Tropical Plant Pathology, courtesy A. F. dos Santos).

Table 1. *Phytophthora boehmeriae* main hosts, symptoms, and locations.

Host Latin name	Host common name	Symptoms	Habitat	Region
Acacia mearnsii	black wattle	gummosis, canker	plantations	South Africa, Brazil
Boehmeria nivea	Chinese grass; white ramie	leaf blight	agriculture	Taiwan, Japan, China, Australia, Greece, South Africa
Broussonetia papyrifera	paper mulberry	leaf blight		China
Cedrus deodara	deodar cedar			China
Citrus spp.	citrus	brown rot (fruit)	agriculture	Argentina, Australia, China
Eucalyptus pilularis	blackbutt	root rot		Australia
Gossypium hirsutum	cotton	leaf blight, root rot	agriculture	China, Greece
Pinus patula	Mexican yellow pine	root rot	plantations	Australia

Management and education resources

Forest Phytophthoras – a hidden threat to take a serious note of:
http://www.fabinet.up.ac.za/newsitem/240-forest_Phytophthoras.pdf

Gomose de *Phytophthora* da acácia-negra:
http://forestphytophthoras.org/sites/default/files/educational_materials/com_tec101.pdf

O complexo gomose da acácia-negra:
http://forestphytophthoras.org/sites/default/files/educational_materials/circ-tec44.pdf

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