Pseudopezicula tracheiphila

Scientific Name
Pseudopezicula tracheiphila, Müller – Thurgau 1913 (Korf et. al, 1986)

Synonyms:
Pseudopeziza tracheiphila, Phialophora tracheiphila (anamorph)

Common Name(s)
Rotbrenner, red fire

Type of Pest
Fungal pathogen

Taxonomic Position
Phylum: Ascomycota, **Class:** Ascomycetes, **Order:** Helotiales, **Family:** Helotiaceae

Reason for Inclusion in Manual
CAPS target: AHP Prioritized Pest List - 2014

Background
Pseudopezicula tracheiphila is an Ascomycete fungus. The primary morphological character that distinguishes members of the Ascomycota is the ascus (plural asci), a sac-like cell containing the ascospores cleaved from within by free cell formation after karyogamy and meiosis. Eight ascospores typically are formed within the ascus but this number may vary from one to over a thousand according to the species. Asci are typically formed in an ascocarp (*i.e.,* a perithecium, pseudothecium, apothecium, or cleistothecium). Ascomycetes may have two distinct reproductive phases, one sexual (teleomorph) involving the formation of the

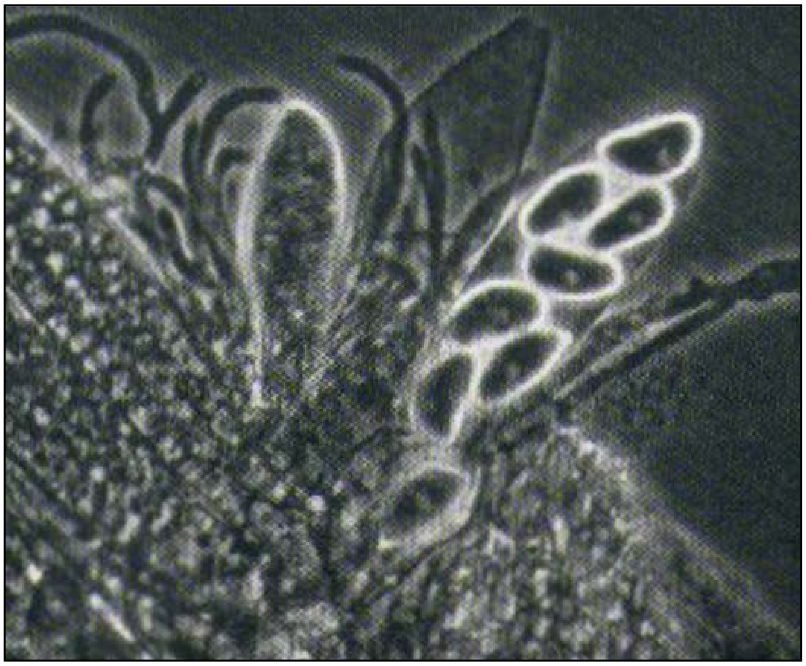

Figure 1. Eight-spored asci and branch paraphyses of *Pseudopezicula tracheiphila.* Photo courtesy W. Gärtel; Reprinted, by permission, from Pearson, R.C., and Goheen, A.C. 1988. Compendium of Grape Diseases. American Phytopathological Society, St. Paul, MN.

asci and ascospores, and the other asexual (anamorph), with spore/conidia production occurring at different times on the same mycelium.

Pest Description

Teleomorph (sexual stage): *Pseudopezicula tracheiphila*
Anamorph (asexual stage): *Phialophora tracheiphila*

Pseudopezicula tracheiphila:

The fungus produces apothecia (an open, cuplike or saucerlike, ascus-bearing fungal fruiting body (ascocarp), often supported on a stalk) as the perfect/sexual stage. Apothecia are erumpent from the leaf tissue and are often associated with the veins. They are minute, up to 0.6 mm in diameter, sessile, gelatinous, whitish to faintly colored and gregarious. Apothecia contain inoperculate, broadly clavate, eight-spored asci (115 to 145 x 18 to 28 µm) (Fig. 1.), which show a blue pore in iodine after treatment with aqueous potassium hydroxide. Ascospores are hyaline, ellipsoid (19 to 27 x 9 to 14 µm) and are flattened on one side. During germination, ascospores produce a spore-like vesicle on one side, which is characteristic of the fungus. Paraphyses are branched and curved or slightly deformed at the apex, filiform, septate and hyaline (Plant Health Australia, 2004).

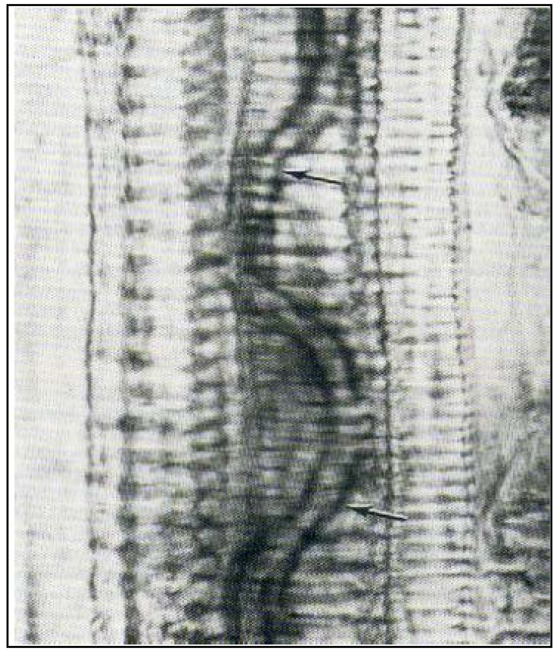

Figure 2. Hyphae of *Phialophora tracheiphila* growing in a sine-wave pattern inside a vessel element of a leaf. Photo courtesy of H. Schüepp; Reprinted, by permission, from Pearson, R.C., and Goheen, A.C. 1988. Compendium of Grape Diseases. American Phytopathological Society, St. Paul, MN.

The formal/technical description is available in Korf et al. (1986).

Phialophora tracheiphila:

The fungus produces short, hyaline and septate conidiophores that carry unicellular, ellipsoid, aseptate, and hyaline conidia (2 to 3 x 1.5 to 2 µm) (Konig et al., 2009). Generally the conidiophores are coarser than the vegetative hyphae (Plant Health Australia, 2004).

Cultural characteristics: The diagnostic feature of the fungus is the presence of sine-wave pattern (Fig. 2) of hyphae observed in the xylem vessel elements when affected plant tissues are cleared by boiling in 2% aqueous potassium hydroxide for 2 to 3 minutes (Plant Health Australia, 2004).

Biology and Ecology

P. tracheiphila is an erumpent discomycete forming tiny, densely aggregated apothecia, 95 to 125 apothecia per cm^2, mostly on the lower surface of leaves. On the upper surface, less than 1 to 20 apothecia per cm^2 are typically observed (Korf et. al, 1986). The fungus overwinters in infected vine leaves on the ground. In Germany, *P. tracheiphila* usually occurs after frequent rains in April and May and affects the shoots and leaves. Conditions required for the fungus to invade the vascular system are not well understood; however, soil conditions and water supply that place the vine under temporary stress appear to be important factors (Konig et. al, 2009).

The source of inoculum of the disease is ascospores, which are formed sexually in asci within apothecia. *P. tracheiphila* is composed of two different mating types and exhibits a bipolar heterothallic mating system. Apothecia are formed primarily on fallen leaves in the spring. Apothecia may also develop on current-season infected leaves in late summer or fall. Apothecia development requires sufficient wetness on fallen leaves. Depending on weather conditions, apothecia with mature ascospores may be present throughout the season. Under wet and warm conditions, ascospores are released before bud burst. Disease incidence and severity depend on the abundance of apothecia on fallen leaves on the ground of the vineyard and on the number of released ascospores and leaf wetness (Konig et. al, 2009). Heavy rainfall and prolonged leaf wetness favor infection and lead to severe disease. The fungus has an incubation period of two-to-four weeks from infection to symptom development (Konig et al., 2009).

Figure 3. Rotbrenner on grape leaves. Photos courtesy of Dr. Michael Maxiner, Julius Kühn Institute (JKI), Federal Research Centre for Cultivated Plants Institute for Plant Protection in Fruit Crops and Viticulture

The fungus is primarily spread by water and airborne spores (Plant Health Australia, 2009). Unlike other members of Peziculoideae that attack woody stems and branches, these species occur on leaves, mostly in association with the vascular elements.

Symptoms/Signs

Lesions on leaves (Fig. 3, 4) are initially yellow on white cultivars and bright red to reddish brown on red cultivars. A reddish brown necrosis develops in the center of the lesion (Fig. 4), leaving only a thin margin of yellow or red tissue between the necrotic and green areas of the leaf. The lesions are typically confined to the major veins and the edge of the leaf and are several cm wide. Early infections occur on the first to the sixth leaf position of young shoots, resulting in minor losses. Later infections attack leaves up to the 10th or 12th position on the shoot, which results in severe defoliation. The fungus also attacks the inflorescences and berries causing them to rot, dry out and fall.

Figure 4. Closeup of rotbrenner on grape leaves. Photo courtesy of Dr. Michael Maxiner, Julius Kühn Institute (JKI), Federal Research Centre for Cultivated Plants Institute for Plant Protection in Fruit Crops and Viticulture

Young leaves are susceptible after they reach a width of about 5 cm but the probability of infections increases from the 6-leaf stage. After an incubation period of two to four weeks, the fungus invades the vascular elements of infected leaves, causing symptom development (Konig et. al, 2009).

Pest Importance

Rotbrenner, caused by *Pseudopezicula tracheiphila,* is an important grape disease in the cool viticulture regions of Europe (*e.g.,* Austria, France, Germany, Hungary, and Switzerland) (Pearson et al., 1991). Rotbrenner causes economic yield loss in all common European cultivars of *Vitis vinifera* (grape), especially on cultivars Elbling, Müller-Thurgau, and the red cv. Domina, where it causes strong early leaf fall and depression of the quality of wine by a lower sugar content of the must.

Attack of flower clusters results in a depression of yield from approximately 25 to 100% (Holz, 2000). Early infections generally result in less loss than late infections. Inflorescences can be attacked before or during flowering, causing them to rot and dry out. High levels of infection during flowering can lead to severe yield losses of up to 90%.

Pseudopezicula tracheiphila is on the harmful organism list for Brazil, Chile, and China. This pest could have trade implications with these countries if the pest was found in the United States.

Known Hosts

Major Hosts:

Parthenocissus quinquefolia (Virginia creeper), *Parthenocissus tricuspidata* (Boston ivy),*Vitis labrusca* (fox grape),*Vitis riparia* (riverbank grape), and *Vitis vinifera* (grapevine) (Korf et al., 1986).

Known Vectors (or associated insects)

Pseudopezicula tracheiphila is not vectored by any insect and is not known to be a vector.

Known Distribution

Asia: Jordan, Turkey. **Europe:** Austria, France, Germany, Hungary, Switzerland, Romania, Montenegro (former Yugoslavia), Serbia, Moldova, Ukraine, and Russia. **Africa:** Tunisia. **South America:** Brazil (Korf et al., 1986; USDA ARS, 2013).

The North American report from New York is now known to be a related species *Pseudopezicula tetraspora* (Korf et al., 1986; Pearson et al., 1986; Pearson et al., 1988). The South America isolate may also be *P. tetraspora*, a related North American species (USDA ARS, 2013).

Potential Distribution within the United States

Rotbrenner is most likely to occur in the cool viticulture regions of the United States. Based on interception and commodity destination data, the most likely places for the introduction of this pest would be in California, New York, New Jersey, Illinois, Kansas, and Georgia.

Pathway

Vitis sp. are regulated via 7CFR319.37–5(b)(1) for *Pseudopezicula tracheiphila. Vitis* spp. (all propagules except seeds) are prohibited from all countries except for Canada when meeting the required import conditions (Plants for Planting Manual, 2012). This fungal pathogen is not known to be seedborne in grape.

Parthenocissus propagative material, however, doesn’t appear to be subject to regulations and there appears to be an open pathway for *Parthenocissus* PM. Although shipments appear to be mostly seed, there were 16 shipments of *Parthenocissus* sp. PM since 2001 from countries where this pest is known to occur. There were an additional 46 shipments of *Vitis* sp. PM from countries where this pest is known to occur. These shipments also appear to be mostly seed.

There have been one hundred interceptions of host material that could harbor *P. tracheiphila* from countries known to have the disease. Many (~90) of these interceptions were destined for propagation.

Survey

CAPS-Approved Method*: The CAPS-approved survey method is to collect symptomatic plant tissue by visual survey.

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at https://caps.ceris.purdue.edu/approved-methods.

Literature-Based Methods:

Apothecia production from leaf material: Apothecia have been produced under laboratory conditions from outdoor overwintered symptomatic leaves. The leaf residues were thoroughly washed in distilled water and soaked for one hour. The smoothed leaf tissue pieces were placed, partly upper side up; partly lower side up, into Petri dishes, on a two-fold moistened filter paper. The leaf tissue pieces and the filter paper layer were saturated and kept at room temperature (18 to 20°C; 64.4 to 68°F) under scattered light. On slight magnification, development of apothecia was visible on the leaf residue after three or four days. After six to eight days, the apothecia obtained full development (Lehoczky, 1966).

Apothecia production on agar media: Apothecia form on some agar media (malt agar, Vitis-stem extract medium) but not on other media (potato dextrose agar) (Korf et al., 1986). Apothecia can also be produced by placed surface sterilized symptomatic grapevine leaves overlaid on malt extract agar (Plant Health Australia, 2004).

Spore trapping: In Europe, monitoring of the ascospore release by means of spore traps enables disease forecast and timed fungicide application (Pearson et al., 1991; Konig et al., 2009).

Key Diagnostics/Identification

CAPS-Approved Method*: Morphological. The diagnostic feature of the fungus is the presence of sine-wave pattern of hyphae observed in the xylem vessel elements when affected plant tissues are cleared by boiling in 2% aqueous potassium hydroxide for 2-3 min (Plant Health Australia, 2004) and the production of eight ascospores within asci/apothecia.

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at https://caps.ceris.purdue.edu/approved-methods.

Literature-Based Methods:

Culture: The anamorph of the fungus can be grown plating surface sterilized plant material on 2.5% malt extract agar (Plant Health Australia, 2004).

Easily Confused Pests

Pseudopezicula tetraspora, a four-spored American species, causing angular leaf scorch has similar symptoms to *P. tracheiphila* (Pearson et al., 1988). Diagnostic features for these two fungi are similar, but *P. tetraspora* only produces four ascospores in contrast to *P. tracheiphila* that produces eight. Unlike other members of Peziculoideae, which attack woody stems and branches, these two species occur on leaves, mostly in association with the vascular elements.

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This datasheet was developed by USDA-APHIS-PPQ-CPHST staff. Cite this document as:

Costanzo, T. and Sullivan, M. 2013. CPHST Pest Datasheet for *Pseudopezicula tracheiphila.* USDA-APHIS-PPQ-CPHST.

Reviewer(s): Michael Maixner, Julius Kühn Institute, Siebeldingen, Germany.

Update History:

August, 2013: Original datasheet prepared

November, 2014: Updated approved method links in document.