EPPO Datasheet: *Diaporthe vaccinii*

Last updated: 2024-04-16

IDENTITY

Preferred name: *Diaporthe vaccinii*
Authority: Shear
Taxonomic position: Fungi: Ascomycota: Pezizomycotina: Sordariomycetes: Diaporthomycetidae: Diaporthales: Diaporthaceae
Other scientific names: *Phomopsis vaccinii* Shear
Common names: blight of blueberry, fruit rot of blueberry, phomopsis canker and dieback of blueberry, storage rot of blueberry, twig blight of blueberry, viscid rot of blueberry
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EPPO Categorization: A2 list
view more categorizations online...
EU Categorization: RNQP ((EU) 2019/2072 Annex IV)
EPPO Code: DIAPVA

HOSTS

Principal hosts of *Diaporthe vaccinii* are cranberry (*Vaccinium macrocarpon*, *V. oxycoccos*) and blueberry (*V. corymbosum*, *V. angustifolium* and *V. virgatum*). All *Vaccinium* species tested in the past have been found to be susceptible to this pathogen (EFSA Panel, 2017). Wild *V. oxycoccos* has been found to be a host (Lombard *et al.*, 2014) and other wild *Vaccinium* species in the EPPO region could also be affected.

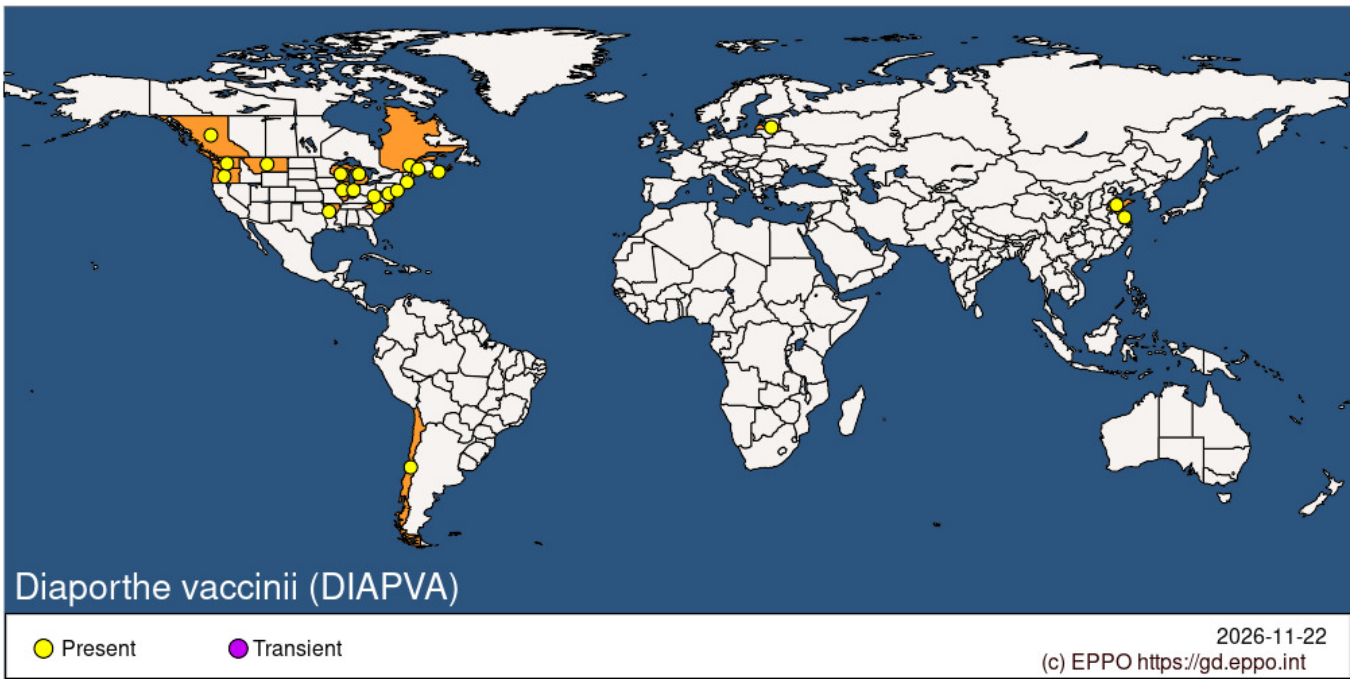
Although its host range as a pathogen is limited to *Vaccinium* species (Narouei-Khandan *et al*., 2017; Van Bruggen *et al*., 2018), *D. vaccinii* has been found as an endophyte on other plant species (Macia-Vicente *et al.*, 2007; Yue & Liang, 2013).

Host list: *Magnolia figo*, *Vaccinium angustifolium*, *Vaccinium ashei*, *Vaccinium corymbosum*, *Vaccinium macrocarpon*, *Vaccinium oxycoccos*, *Vaccinium virgatum*

GEOGRAPHICAL DISTRIBUTION

The native range of *Diaporthe vaccinii* is thought to be North America, where it is reported in all regions growing *Vaccinium* plants in the USA and Canada (Lombard *et al.*, 2014). It is currently present in Chile (spreading from North America), China and Latvia (Guerrero & Godoy, 1989; Lombard *et al.*, 2014; Yue *et al*., 2013).

Diaporthe vaccinii has also been found in Germany, Lithuania, the Netherlands, Poland, Romania, the United Kingdom, but has since been eradicated (EPPO, 2024). Past reports of this pest in European Russia and Belarus have not been confirmed by molecular methods (EFSA Panel *et al.*, 2017; Galynskaya *et al*., 2011; Narouei-Khandan *et al.* , 2017), though it was identified molecularly on cranberry seedlings imported into Russia from Belarus (Kuznetsova, 2021).



EPPO Region: Latvia
Asia: China (Jiangsu, Shandong)
North America: Canada (British Columbia, Nova Scotia, Québec), United States of America (Arkansas, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, Montana, New Jersey, North Carolina, Oregon, Washington, West Virginia, Wisconsin)
South America: Chile

BIOLOGY

The fungus grows well at an optimum pH of 5-6 and a temperature range of 4-32°C (Carlson, 1963; Weingartner & Klos, 1975). In the field, optimal temperatures for disease development have been shown to be between 8°C and 15°C, though disease can occur at average annual temperatures of between 0°C and 25°C (Narouei-Khandan *et al.*, 2017).

Diaporthe vaccinii overwinters on dead vines, the previous year's infected twigs and possibly other plant debris on the soil surface, such as leaves (Shear *et al.*, 1931; Wilcox, 1939). Overwintering at cool temperatures appears to be necessary for maturation of the sexual spores, ascospores (Shear *et al.*, 1975,1961; Wilcox, 1939). *Diaporthe vaccinii* has also been found as an endophyte in other plant species (Macia-Vicente *et al.*, 2007; Yue & Liang, 2013).

Primary inoculum (in the form of ascospores and the asexual spores, conidia) are disseminated in the crop under wet or humid conditions. Rain-dispersed conidia of *D. vaccinii* have been found to disperse throughout the growing season, the highest numbers being recorded between blossom budbreak through to bloom (Milholland, 1982; Parker & Ramsdell, 1977), though they only spread over short distances. Rain-splashed conidia are judged to infect new plants within 1-10 m of the original source of infection. Ascospores could typically spread much longer distances by wind, but have rarely been reported for *D. vaccinii* and are considered to play a negligible role in pest spread (EFSA Panel, 2017).

The fungus is believed to enter plants via the shoot tips, emerging flower buds, or though wounds caused by freezing or abrasion, resulting in systemic infection through the vascular tissue (Daykin & Milholland, 1990; Milholland, 1982; Wilcox, 1939). Pycnidia with conidia appear on stems (see further symptoms below) 2-3 weeks after infection (Wilcox, 1939; Weingartner & Klos, 1975). *Diaporthe vaccinii* also enters berries throughout the growing season at all stages of development (Milholland & Daykin, 1983).

DETECTION AND IDENTIFICATION

Symptoms

Diaporthe vaccinii is known to cause several diseases in *Vaccinium* species, including stem canker, twig blight, and fruit rot (Polashock *et al*., 2017). In certain regions, blighting of 1-year-old woody stems with flower buds is the predominant symptom in susceptible blueberry cultivars (Milholland, 1982).

Infected, current-year shoots wilt within 4 days and become covered with minute lesions. Infected leaves develop spots enlarging to 1 cm and produce pycnidia. The fungus continues to travel downward through the stem at a rate averaging 5.5 cm in 2 months, killing major branches and often entire plants (Wilcox, 1939; Daykin & Milholland, 1990). Regardless of age of stems, cankers are long and narrow, and are covered by the bark or epidermis (Weingartner & Klos, 1975). On blueberry stems over 2 years old, below wilt symptoms, *D. vaccinii* causes a brown discoloration of the stem xylem (Weingartner & Klos, 1975).

The fungus may be dormant in infected material; for example, in one study, it has been identified from 90% of stems from asymptomatic cranberry vines (Friend & Boone, 1968). Symptom development in infected plants for planting can take as long as 8 weeks, and in some cases up to 3 months, to occur (EFSA Panel, 2017) while berries may have a latent infection until maturation (Milholland & Daykin, 1983). Infection of crowns usually results in death of stems originating from the crown (Weingartner & Klos, 1975) and infected fruits turn reddish-brown, soft, often splitting and causing leakage of juice (Milholland & Daykin, 1983).

Symptoms similar to *D. vaccinii* can be associated with other fungi, such as *Godronia cassandrae* and *Botryosphaeria dothidea* (Witcher, 1961; Weingartner & Klos, 1975).

Morphology

On the host plant, the fungus develops dark and subcuticular pycnidia (roughly 200 ?m x 500 ?m). Conidia are of two types, alpha conidia (6.0–10.5 × 2.2–3.2 ?m) are hyaline, unicellular, and fusiform whilst beta conidia (15.0–24.0 × 0.8–1.5 ?m) are hyaline and filiform, though not used for identification. See EPPO (2009) for more details.

In culture, mycelium has a radiate growth pattern and is white, after 3 weeks sometimes greyish white in some strains (EPPO, 2009). It has been recently reported that the features of *D. vaccinii* in culture (including the colour or structure of surface mycelium, reverse pigmentation, appearance, location, number or size of pycnidia) vary between isolates and/or different studies (Farr *et al.*, 2002; Polashock *et al.*, 2017; Vilka & Volkova, 2015). Given this morphological variation, *D. vaccinii* could be confused with related species (Vilka & Volkova, 2015). This emphasises the importance of using additional identification methods.

Detection and inspection methods

Detection and identification of *D. vaccinii* have been thoroughly described in EPPO (2009). If symptoms of *Diaporthe* species are observed on *Vaccinium* plants, a preliminary diagnosis should occur via the removal of spores which are placed under a microscope for examination. In the absence of any fruiting bodies, the infected material should be incubated in damp chambers to induce the production of pycnidia. In both cases, after examination, spores should be transferred to agar for isolation in pure culture.

EPPO (2009) acknowledges the overlap of *D. vaccinii* morphological features with other species and recommends that species identification should be confirmed by internal transcribed space (ITS) amplicon sequencing (EPPO, 2009). Other DNA-based tests have been developed for identifying *D. vaccinii* (Lombard *et al.*, 2014; Michalecka *et al.*, 2017). Given the tendency for *D. vaccinii* to be asymptomatic or mis-diagnosed, it has recently been suggested that diagnosticians purely rely on molecular tests, such as real-time PCR, that can process a large number of samples quickly and reliably (Dharmaraj *et al.*, 2022).

PATHWAYS FOR MOVEMENT

The export of infected blueberry and cranberry plants for planting from North America to other countries has been the main source of infection at new sites (Wilcox & Falconer, 1961; Guerrero & Godoy, 1989). Dormant or minimal signs of infection would reduce the likelihood of plants being intercepted. This pathway remains a significant risk from countries where *D. vaccinii* is present, though the use of propagation via tissue culture has reduced this risk in recent years. The high volumes of exported blueberry and cranberry fruit from affected countries is another significant pathway for pest movement (EFSA Panel, 2017).

Natural spread of the pest is much less likely. Spore dispersal of *D. vaccinii* only occurs over short distances, typically within 1-10 m by rain-splashed conidia. Ascospores have rarely been reported and are considered to play a negligible role in pest spread. Finally, although birds can transfer various fungal pathogens over large distances, it is highly uncertain whether this is a pathway for the movement of *D. vaccinii* (EFSA Panel, 2017).

PEST SIGNIFICANCE

Economic impact

The disease is commonly established in the USA on cranberries and blueberries (Friend & Boone, 1968; Weingartner & Klos, 1975) and was considered in the late 1940s to be of minor importance (Wilcox, 1939) though it was occasionally responsible for serious losses, such as a reduction of 18-35% of the cranberry crop (Bergman & Wilcox, 1936). From the 1970s onwards, *D. vaccinii* started to be a major threat to blueberry production in the USA under favourable conditions (Weingartner & Klos, 1975). Twig blight of susceptible blueberry cultivars has been estimated to cause fruit loss of 20-24 blueberries per stem in parts of the USA (Milholland, 1982), or a 25-37% yield loss overall (EFSA Panel, 2017).

More recently, in Canada, 24% of a cranberry harvest were lost due to fruit rot after 3 weeks of storage. *Diaporthe vaccinii* was identified as the fourth most prevalent pathogen causing this fruit rot (Sabaratnam, Wood, & Nabetani, 2016). There is limited information of the current impact of this pest in the USA (EFSA Panel, 2014).

Control

All *Vaccinium* species tested in the past have been found to be susceptible to this pathogen (EFSA Panel, 2017), although resistance appears to vary between cultivars (Polashock & Kramer, 2006). Recommended cultural controls include pruning out infected canes to reduce inoculum, planting resistant cultivars, and limiting overhead irrigation (Anco & Ellis, 2011; Cline, 2014; Sabaratnam, 2018). Chemical controls are also an option, applied at 2-week intervals from bud break through to bloom. Additional sprays through berry development act against fruit rot (Polashock *et al.*, 2017).

Phytosanitary risk

Diaporthe vaccinii has the potential to establish in the EPPO region (Narouei-Khandan, 2017). However, it has been reported in multiple European countries in the past and then been eradicated without causing noticeable damage. The fungus has not apparently persisted in most European locations or spread onto commercial crops and the symptoms caused by *D. vaccinii* in Europe appeared to be mild (Cardinaals *et al.*, 2018; EFSA Panel, 2014). It has therefore been suggested that this fungus is not a major threat to blueberry production in Europe (Cardinaals *et al.*, 2018).

PHYTOSANITARY MEASURES

The EFSA Pest Risk Assessment for *D. vaccinii* (2017) identified several risk management measures against this fungus, such as requiring that imported *Vaccinium* plants for planting originate from a pest free area, a pest free place of production or be produced and exported as tissue culture or plug plants directly derive from tissue culture.

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe', and revised in 2024. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

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