

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

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EU Categorization: RNQP (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.

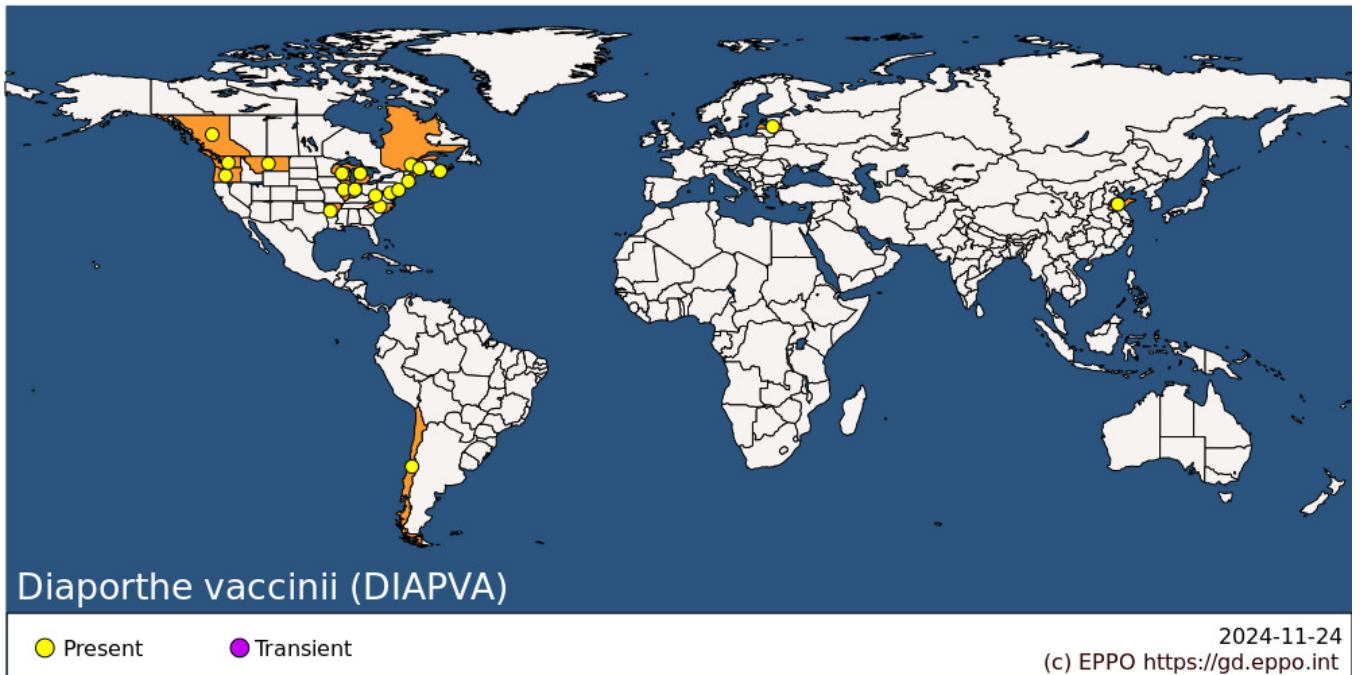
Although its host range as a pathogen is limited to *Vaccinium* species (Narouei-Khandan *et al.*, 2017; Van Bruggen *et al.*, 2018), *D. vaccinii* has been found as an endophyte on other plant species (Macia-Vicente *et al.*, 2007; Yue & Liang, 2013).

Host list: *Vaccinium angustifolium*, *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 (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 through 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 μ m x 500 μ m). Conidia are of two types, alpha conidia (6.0–10.5 \times 2.2–3.2 μ m) are hyaline, unicellular, and fusiform whilst beta conidia (15.0–24.0 \times 0.8–1.5 μ 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.

REFERENCES

- Anco DJ & Ellis MA (2011) Phomopsis twig blight of blueberry. *Ohio State University Extension*. Retrieved from <https://ohioline.osu.edu/factsheet/plpath-fru-45> [Accessed 20 March 2024].
- Bergman HF & Wilcox MS (1936) The distribution, cause, and relative importance of cranberry fruit rots in Massachusetts in 1932 and 1933, and their control by spraying. *Phytopathology* **26**, 656-664.
- Cardinaals J, Wenneker M, Voogd J & Van Leeuwen G (2018) Pathogenicity of *Diaporthe* spp. on two blueberry cultivars (*Vaccinium corymbosum*). *EPPO Bulletin* **48**, 128-134.
- Carlson LW (1963) Physiology, pathogenicity, and control of fungi causing cranberry diseases [Abstract]. *Dissertation Abstracts* **24**, 1331.
- Cline B (2014) Twig blight of blueberry. *Fruit Disease Information*. Retrieved from <https://content.ces.ncsu.edu/twig-blight-of-blueberry> [Accessed 20 March 2024]
- Daykin ME & Milholland RD (1990) Histopathology of blueberry twig blight caused by *Phomopsis vaccinii*. *Phytopathology* **80**, 736-740.
- Dharmaraj K, Michalecka M, Alexander BJ & Toomey-Heller M (2022) New real-time PCR assay for detecting the blueberry and cranberry twig blight pathogen. *Journal of Phytopathology* **170**, 683-692.
- EPPO (2009) EPPO Standards Diagnostics PM 7/86 (1) *Diaporthe vaccinii*. *EPPO Bulletin* **39**, 18–24.
- EPPO (2024) *Diaporthe vaccinii*. *EPPO Global Database*. Retrieved from <https://gd.eppo.int/taxon/DIAPVA/distribution> [Accessed 2 March 2024].
- Farr DF, Castlebury LA & Rossman AY (2002). Morphological and molecular characterization of *Phomopsis vaccinii* and additional isolates of *Phomopsis* from blueberry and cranberry in the eastern United States. *Mycologia* **94**, 494-504.
- Friend RJ & Boone DM (1968) *Diaporthe vaccinii* associated with dieback of cranberry in Wisconsin. *Plant Disease Reporter* **52**, 341-344.
- Galynskaya NA, Yarmolovich VA, Morozov OV & Gordey DV (2011) [A complex of pathogenic fungi in young plantings of *Vaccinium angustifolium* Ait. in the Belarusian Lake District.] *Proceedings of BSTU*, **No. 1**, Forestry, 224-228 (in Russian).
- Guerrero CJ & Godoy A (1989) Detection of *Phomopsis vaccinii* (Shear, Stevens and Bein) in highbush blueberry (*Vaccinium corymbosum* L.) [Abstract] *Agricultura Técnica (Santiago)* **49**, 220-223.
- Kuznetsova AA, Tsvetkova YV, Kamchenkov AV (2021) Culture morphological features of the pathogen *Diaporthe vaccinii* in regulated products – cranberry plants. *Plant Health and Quarantine* **2**, 27-36.
- Lombard L, Van Leeuwen G, Guarnaccia V, Polizzi G, Van Rijswijk P, Rosendahl K, Gabler J & Crous P (2014) *Diaporthe* species associated with *Vaccinium*, with specific reference to Europe. *Phytopathologia Mediterranea* **53**, 287-299.
- Macia-Vicente JG, Jansson HB, Abdullah SK, Descals E, Salinas J & Lopez-Llorca LV (2007) Fungal root endophytes from natural vegetation in Mediterranean environments with special reference to *Fusarium* spp. *FEMS Microbiology Ecology* **64**, 90-105.
- Michalecka M, Bryk H & Seliga P (2017) Identification and characterization of *Diaporthe vaccinii* Shear causing upright dieback and viscid rot of cranberry in Poland. *European Journal of Plant Pathology* **148**, 595-605.
- Milholland RD & Daykin ME (1983) Blueberry fruit rot caused by *Phomopsis vaccinii*. *Plant Disease* **67**, 325-326.
- Milholland RD (1982) Blueberry twig blight caused by *Phomopsis vaccinii*. *Plant Disease* **66**, 1034-1036.

Narouei-Khandan H, Harmon C, Harmon J P, Olmstead J, Zelenev VV, Van der Werf W, Worner SP, Senay SD & Van Bruggen AHC (2017) Potential global and regional geographic distribution of *Phomopsis vaccinii* on *Vaccinium* species projected by two species distribution models. *European Journal of Plant Pathology* **148**, 919-930.

Parker PE & Ramsdell DC (1977) Epidemiology and chemical control of *Phomopsis* canker of highbush blueberry. *Phytopathology* **67**, 1481-1484.

Polashock JJ & Kramer M (2006) Resistance of blueberry cultivars to *Botryosphaeria* stem blight and *Phomopsis* twig blight. *HortScience* **41**, 1457-1461.

Polashock JJ, Caruso FL, Averill AL & Schilder AC (2017) *Compendium of blueberry, cranberry, and lingonberry diseases and pests (2nd edition)*. The American Phytopathological Society.

Sabaratham S (2018) *Phomopsis* diseases of blueberry. Retrieved from <https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/animal-and-crops/plant-health/phomopsis-blueberry.pdf> [Accessed 20 March 2024].

Sabaratham S, Wood B & Nabetani K (2016) Fruit rot pathogens and their impact on cranberry production in British Columbia [2014 study]. *Abbotsford Agriculture Centre, Ministry of Agriculture, Abbotsford, BC, Canada*.

Shear CL, Stevens NE & Bain HF (1931) Fungus diseases of the cultivated cranberry. *Technical Bulletin*, United States Department of Agriculture No. **258**, 7-8.

Van Bruggen A, West J, Van der Werf W, Potting R, Gardi C, Koufakis I, Zelenev VV., Narouei-Khandan H, Schilder A & Harmon P (2018) Input data needed for a risk model for the entry, establishment and spread of a pathogen (*Phomopsis vaccinii*) of blueberries and cranberries in the EU. *Annals of Applied Biology* **172**, 126-147.

Vilka L & Volkova J (2015) Morphological diversity of isolates from cranberry (*Ait.*) in Latvia. *Rural Sustainability Research* **33**, 8-18.

Weingartner DP & Klos EJ (1975) Etiology and symptomatology of canker and dieback diseases on highbush blueberries caused by *Godronia (Fusicoccum) cassandrae* and *Diaporthe (Phomopsis) vaccinii*. *Phytopathology* **65**, 105-110.

Wilcox HJ & Falconer MA (1961) New or uncommon plant pests. *Plant Pathology* **10**, 123-124.

Wilcox MS (1939) *Phomopsis* twig blight of blueberry. *Phytopathology* **29**, 136-142.

Witcher W (1961) Blueberry stem blight caused by *Botryosphaeria dothidea*. *Dissertation Abstracts* **22**, 23.

Yue Q & Liang C (2013) *Phomopsis vaccinii* isolate 110027 18S ribosomal RNA gene, partial sequence; internal transcribed spacer 1, 5.8S ribosomal RNA gene, and internal transcribed spacer 2, complete sequence; and 28S ribosomal RNA gene, partial sequence. *Genbank*. Retrieved from <https://www.ncbi.nlm.nih.gov/nuccore/KC488259.1> [Accessed 3 March 2024].

Yue Q, Zhao H, Liang C & Li X (2013). The pathogen causing *Phomopsis* twig blight of blueberry [Abstract]. *Mycosystema* **32**, 959-966.

CABI and EFSA resources used when preparing this datasheet

CABI Datasheet on [Phomopsis vaccinii \(Phomopsis twig blight of blueberry\)](#)

EFSA Panel on Plant Health (PLH) Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gilioli G, Grégoire JC, Jaques Miret JA & MacLeod A (2017) Pest risk assessment of *Diaporthe vaccinii* for the EU territory. *EFSA Journal* **15**, e04924.

EFSA Panel (2014). Scientific Opinion on the pest categorisation of *Diaporthe vaccinii* Shear. *EFSA Journal*, **12**, 3774.

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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.

CABI/EPPO (1997) *Quarantine Pests for Europe* (2nd edition). CABI, Wallingford (GB).



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