



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Pest categorization

Exobasidium maculosum M. T. Brewer

Exobasidium leaf and fruit spot



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Background

The purpose of this categorization is to determine whether *Exobasidium maculosum* (Exobasidium leaf and fruit spot) has the potential to satisfy the criteria in the definition for a quarantine pest for the United Kingdom (UK). The method used by the CFIA to initiate and conduct this categorization is consistent with international guidelines set by the International Plant Protection Convention (IPPC). Definitions follow those listed in the IPPC's *Glossary of phytosanitary terms*.

Initiation point(s): This categorization was identified via a Commodity Risk Assessment on blueberry plants from Canada to the UK for the Jens-Georg Unger Plant Health Fellowship project, funded by the European and Mediterranean Plant Protection Organisation (EPPO). This project was led by a visiting scientist from the UK Department for the Environment, Food and Rural Affairs, utilising the tools and templates of the Canadian Food Inspection Agency and coordinating with experienced Canadian risk assessors.

Identification of the PRA area: The PRA area is all of the UK.

Current regulatory status: *Exobasidium maculosum* is not currently regulated as a pest in the UK or by any member country of EPPO (EPPO 2022).

Identity of organism

Name: *Exobasidium maculosum* M.T. Brewer (Exobasidiaceae)

Synonyms: N/A

English common names: Exobasidium leaf and fruit spot

French common names: N/A

1. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?

Yes

If no

Go to 2

Go to 11

This pathogen is distinguished from other *Exobasidium* species by its morphology and its genetic sequence of the large subunit of the ribosomal DNA (Brewer *et al.* 2014). The fungus produces cylindrical basidia and musiform/fusiform basidiospores that are slightly curved and hyaline with a conspicuous hilar appendage (Polashock *et al.* 2017).

The fungus was initially confused with *Exobasidium vaccinii* (Cline 1998; Smith 2012), a pathogen that causes a red leaf disease with symptoms that include galls, leaf spots and defoliation (Booth 1983). Symptoms of *E. maculosum* include the development of unsightly green spots on fruit and the upper side of leaves, often resulting in fruit and leaf drop. The affected fruit tissue when harvested is tough, chewy and unattractive, preventing the sale of the fruit. Spots are white on the underside of infected leaves, and pale green when viewed from above, and become necrotic over time (Cline 1998; Ingram *et al.* 2017; Smith 2012). Girdling and blighting could also occur on emerging shoots (Ingram *et al.* 2017).

Presence in the PRA area

2. Does the organism occur in the PRA area?

If yes

Go to 3

No

Go to 5

Exobasidium maculosum is not known to be present in the PRA area.

3. Is the organism widely distributed in the PRA area?

If yes

Go to 11

If no

Go to 4

Regulatory status

4. Is the organism under official control in the PRA area or is it a potential candidate for official control?

Yes

Go to 5

If no

Go to 11

Potential for establishment and spread in the PRA area

5. Does the PRA area have climatic conditions suitable for establishment and spread of the organism?

Yes

Go to 6

If no

Go to 11

6. Does the PRA area have ecological conditions suitable for establishment and spread of the organism?

Yes

Go to 7

If no

Go to 11

Exobasidium maculosum was recently identified in 2014 on rabbiteye blueberry (*V. virgatum*), highbush blueberry (*V. corymbosum*) and southern highbush blueberry (hybrids of *Vaccinium* species) (Brewer *et al.* 2014; Cline 1998). It was later found on lowbush blueberry (*V. angustifolium*) (Stewart *et al.* 2015). These *Vaccinium* species are present in urban areas (e.g. gardens) in the UK and/or in cultivated areas such as fields, nurseries, and garden centres, that could enable the establishment and spread of this fungus (GBIF 2022; RHS 2022a; RHS 2022b).

The fungus has been identified to the species level in parts of Canada (Nova Scotia) and the U.S. (Georgia, Maine, North Carolina) (Brewer *et al.* 2014). *Exobasidium* leaf and fruit spot symptoms have also been recently reported in Mississippi, Quebec and New Brunswick (PMC 2020; Smith 2012). Before ten or so years ago, these symptoms rarely occurred and when they did, there was no significant impact. For example, similar symptoms were recorded in the 1930s in Quebec and Ontario but without any mention of an impact on yield (Nickerson and Vander Kloet 1997). This suggests that the fungus is native to North America and probably only emerged recently as a significant blueberry disease due to an increasing host population or environmental change (Stewart *et al.* 2015). However, the full native range of *Exobasidium maculosum* remains uncertain, given its recent emergence as a pest and the past confusion with this fungus and *E. vaccinii*. As *E. vaccinii* has been recorded in Great Britain (Booth 1983), it is possible that *E. maculosum* is present in Great Britain instead.

Exobasidium maculosum has recently been identified in South Africa and Poland. Curiously in both reports, *E. maculosum* was identified on species outside of the *Vaccinium* genus; on dead wood of Scots pine (*Pinus sylvestris*) from a forest in Poland and on orchid roots in South Africa (Behnke-Borowczyk *et al.* 2021; GBIF 2022). In each case, it is not known how or when it became established. South Africa and Poland are both major producers of North American blueberry varieties (Villata and Council 2012), so *E. maculosum* may have spread to these countries on imported blueberry plants for planting from the United States (U.S.) or Canada.

The production of basidiospores from leaf and fruit spots is believed to enable long-distance dispersal of this fungus. Germination of these basidiospores produce yeast-like conidia that oversummer and overwinter on the surface of blueberry plants and then serve as the primary inoculum. Infection of *Exobasidium maculosum* is boosted by rainfall. It may also be limited by high temperatures, as is common for members of *Exobasidium* species (Ingram *et al.* 2017; Ingram *et al.* 2019). It has also recently been suggested that a vector may influence the transmission and infection of this pathogen (Abrahams 2021). Therefore, it is possible that the conditions for infection could be met in the UK, especially given the high possibility of rainfall, though the presence of a potential vector remains uncertain.

Potential for economic and environmental consequences in the PRA area

7. Is the organism a known pest in its area of current distribution?

Yes **Go to 9**
If no Go to 8

8. Does the organism have intrinsic attributes that indicate that it could cause significant harm to plants?

If yes Go to 9
If no Go to 11

9. With specific reference to the plants or habitats which occur in the PRA area, could the organism by itself, or acting as a vector, cause significant damage or loss to plants leading to negative economic, environmental, societal or export market impacts?

Yes **Go to 10**
If no Go to 11

In the past, this disease has had a very minor impact on the crop and only occurred rarely. Unfortunately, in recent years, significant economic losses have been reported in the U.S. from the pest's impact on fruit quality and overall yield. Crop losses have not been officially estimated, though there have been reports of 25-60% losses of yield in particular varieties or fields in the U.S. (Cline 1998; Cline *et al.* 2014). It has also been reported that at least one U.S. farm has been abandoned as a result of this disease (Smith 2012). The impact of this fungus on Canadian blueberry production has not been quantified, though its occurrence has been noted frequently in some parts of Canada (PMC 2020). Interestingly, no records could be found of this fungus on blueberries in South Africa or Poland despite its detection on other unrelated plant species. The reasons for this are unknown.

Blueberry species, such as *Vaccinium angustifolium*, are cultivated in the UK and are at risk of this pathogen, if it is not already present (see page 6). The value of the GB blueberry-growing economy is currently valued at £32 million ex-farm (Jack Evans, British Summer Fruits, pers. comm., Jun. 10, 2022). Blueberry plants are also grown as ornamental plants in gardens (RHS 2022a). Finally, native *Vaccinium* species, such as *V. vitis-idaea* and *V. myrtillus* in the wild, could also be affected by this fungus though their host status is unknown. These native species are already under pressure from pathogens like *Phytophthora ramorum*.

Conclusion

10. This organism has the potential to satisfy the definition of a quarantine pest.

11. This organism does not fulfill all of the criteria for a quarantine pest.

Exobasidium maculosum is currently believed to be absent from the UK. Based on our current knowledge of this pathogen, it appears that it could establish in UK blueberry plantations and could cause damage to the UK. However, its recorded presence in South Africa and Poland does not seem to have impacted blueberry production.

It therefore has the potential to satisfy the definition of a quarantine pest. However, it is possible that this pathogen is already present in the UK, previously being misidentified as *Exobasidium vaccinii*. Therefore, a survey is recommended before a Pest Risk Analysis is conducted. In addition, there are significant gaps in our understanding of the epidemiology of this disease, including its lifecycle, the infection process and the potential role of a vector, all of which could impact the amount and type of uncertainty within a formal UK-specific estimate of disease impact (PMC 2020) and/or a full pest risk assessment.

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