



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Pest categorization

Operophtera bruceata (Hulst) (Lepidoptera:
Geometridae)

Bruce spanworm



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Background

The purpose of this categorization is to determine whether *Operophtera bruceata* (the bruce spanworm) has the potential to satisfy the criteria in the definition for a quarantine pest. 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: 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: *Operophtera bruceata* is not regulated in the UK, however it is regulated as a quarantine pest in Chile (EPPO 2022).

Identity of organism

Name: *Operophtera bruceata* (Hulst) (Lepidoptera: Geometridae)

Synonyms: *Cheimatobia bruceata* (Hulst), *Rachela bruceata* Hulst

English common names: Bruce measuring worm, bruce spanworm

French common names: Arpenteuse de Bruce

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

Yes

Go to 2

If no

Go to 11

Operophtera bruceata can be difficult to distinguish from the closely related species *O. brumata* (and to further complicate matters, these two species are capable of hybridizing with each other). However, adults of *O. bruceata* are identified from other *Operophtera* species by having a disc-like dot on the upper surface of its backwing, a grey-brown or light brown front wing with a golden brown leading edge, and a golden brown to brown abdomen (Troubridge and Fitzpatrick 1993). Larvae of *O. bruceata* can be identified by having larger heads (0.30-0.36mm), typically dark anal plate, and progressing through four phases between molting instead of five like *O. bruceata*. Pupae of *O. bruceata* have longer spines than the stalk of the cremaster (a hook on the chrysalis for attaching the pupae to the plant) (Eidt and Embree 1968).

Presence in the PRA area

2. Does the organism occur in the PRA area?

If yes

Go to 3

No

Go to 5

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?

If 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

The Bruce spanworm occurs across Canada, from Newfoundland to British Columbia, and the United States (see Figure 1) (Brown 1962). An unconfirmed report of this species has also been made from Denmark (iNaturalist 2022). It has also been identified beyond its native region, in Greenland (Downes 1966; GBIF 2022; Koponen 1978; Wolff 1964). It is not known whether this pest arrived in Greenland via human-assisted pathways such as trade, though it is speculated that these moths may have arrived on wood from Labrador with the Vikings (Downes 1966). It is also possible that *Operophtera bruceata* spread naturally. Despite the adult females being wingless, the *O. bruceata* larvae can disperse by

spinning down threads of silk from their host plant. These threads, if broken, can then be carried long distances by wind (Brown 1962). The potential distance via this method of travel has not been calculated.

It is perhaps unsurprising that this pest was able to establish in Greenland given its wide host range (see below) and its ability to tolerate cold temperatures. *Operophtera bruceata* is adapted for winter survival and is able to withstand temperatures of lower than -36°C (Elkinton *et al.* 2010). It is highly likely therefore that this pest could establish and spread in the UK climate.

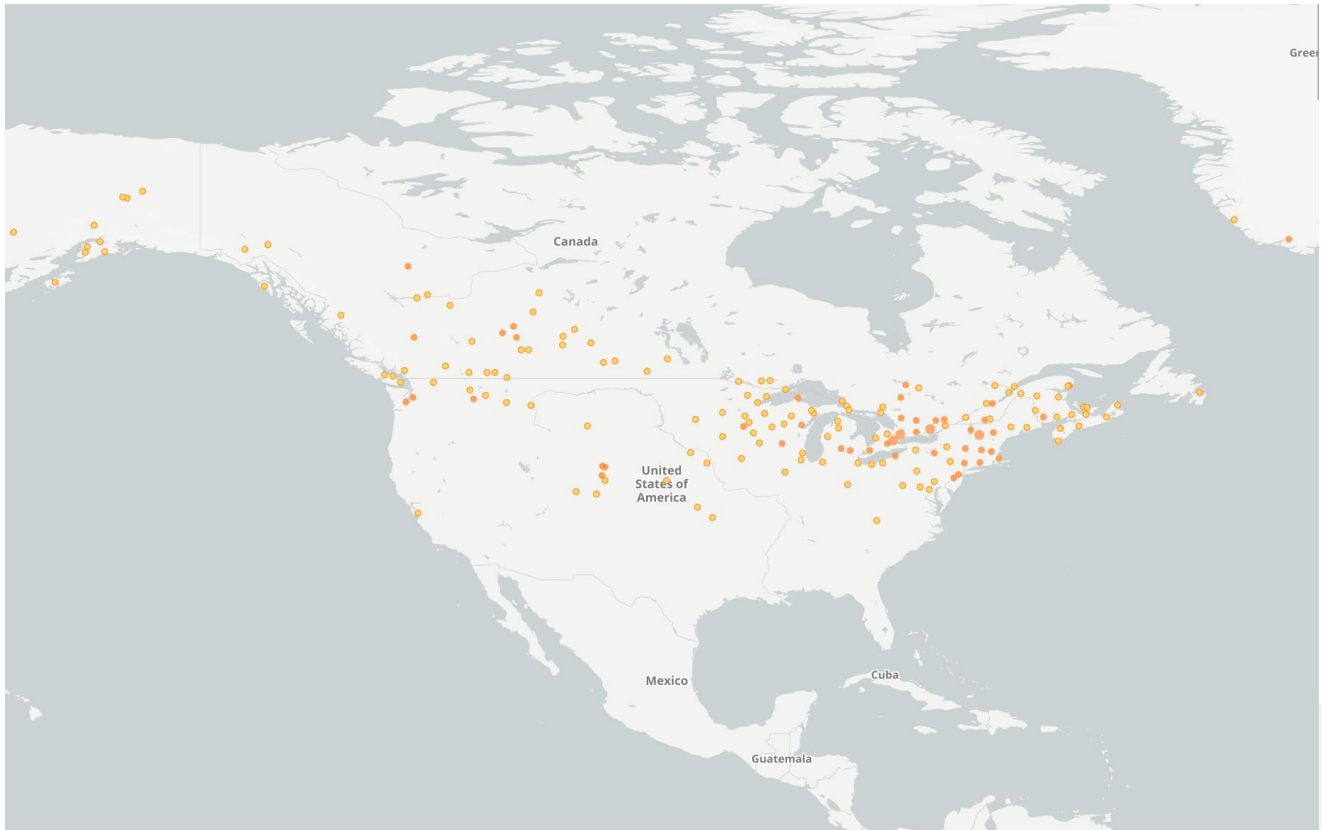


Figure 1: Distribution of *Operophtera bruceata* (GBIF 2022)

The known host range of *Operophtera bruceata* (Brandt 1995; Brown 1962; Gillespie and Beirne 1982; McMullen 1973):

- *Acer glabrum* var. *douglasii* (Douglas maple)
- *Acer negundo* var. *interius* (Manitoba maple)
- *Acer saccharum* (sugar maple)¹
- *Alnus* spp. (alder)

¹ The preferred host plants

- *Amelanchier alnifolia* (saskatoon)
- *Betula* spp. (birch)
- *Fagus grandifolia* (beech)¹
- *Holodiscus discolor* (ocean-spray)
- *Lonicera* spp. (honeysuckle)
- *Malus* spp. (such as apple)
- *Populus tremuloides* (trembling aspen)¹
- *Prunus* spp. (such as cherry)
- *Prunus virginiana* var. *demissa* (chokecherry)
- *Ribes* spp. (currant)
- *Rosa* spp. (rose)
- *Rubus* spp. (raspberry)
- *Salix* spp. (willow)¹
- *Ulmus americana* (white elm)
- *Vaccinium corymbosum* (highbush blueberry)

A number of these species are present in the UK, namely *Alnus* spp, *Betula* spp., *Holodiscus discolor*, *Lonicera* spp., *Salix* spp., as well as commercially grown *Malus* spp., *Prunus* spp., *Ribes* spp., *Rosa* spp., *Rubus* spp., and *Vaccinium corymbosum* (Kew 2022). In addition, beech, birch, willow and alder are all principal broadleaf trees in the woodlands of Great Britain (ForestResearch 2021). These species could also enable the establishment and spread of the Bruce spanworm.

Operophtera bruceata has a number of biological controls in its native range. This pest is preyed upon by birds, spiders, lacewing larvae, ladybird beetles, small rodents and ground beetles such as *Calosoma frigidum*. It is also infected by a viral pathogen nucleopolyhedrovirus (NPV) and attacked by a long list of parasites such as *Agrypon provancheri*, *Buathra dorsicarinata*, *Cratichneumon* sp., *Cyzenis albicans*, *Cyzenis pullula*, *Horogenes* sp., *Pimpla hesperus*, *Telenomus* sp., and *Triclistus crassus* (Barron 1989; Gillespie and Finlayson 1981; Humble 1985; Ives and Cunningham 1980; O'Hara and Cooper 1992; Polashock *et al.* 2017; Woods 1960). Some of these biological controls are present in the UK and could potentially contribute to controlling Bruce spanworm numbers (GBIF 2022; UKSI 2022). Nevertheless, it is believed that the aforementioned parasites only control *O. bruceata* numbers adequately between outbreaks (Volney 1995). The virus NPV, present naturally in certain Bruce spanworm populations, has been credited for collapsing outbreaks (Ives 1984; Ives and Cunningham 1980).

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?

If yes Go to 10
No **Go to 11**

The larvae of *Operophtera bruceata* web the host leaves together with silk to feed, or feed openly on leaf tissue, fruit and flower clusters. Severe defoliation can occur and hosts can be heavily covered in silk (Brown 1962). Infestations can range from a few hectares to thousands of kilometers (for example, an outbreak in 1958 covered 130,000 km²) (Rose and Lindquist 1982; Volney 1995).

This pest could cause damage to the hosts present in the UK. *Malus* spp., *Prunus* spp., *Ribes* spp., *Rosa* spp., *Rubus* spp., and *Vaccinium corymbosum* are all commercially produced in the UK and have significant economic value. For example, 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). Plants such as honeysuckle and rose are also sold as ornamental plants for gardens. Finally, beech, birch, willow and alder are significant components of the GB forestry industry (ForestResearch 2021; RHS 2022). Notably, beech and willow are among the preferred hosts of *Operophtera bruceata* (Brown 1962).

The GB forestry industry appears to be the most at-risk from this pest. *Operophtera bruceata* is mainly reported in woodland areas in its native and introduced ranges (Brown 1962; Downes 1966). For example, in Greenland, this pest has been reported occurring in large numbers and feeding on willow and birch trees, causing defoliation (Koponen 1978; Wolff 1964). Fortunately, outbreaks of this pest are rare and only last 2-3 years before collapsing without any permanent damage to the host plants

and little or no impact on host mortality (Brandt 1995; Ives 1984; Martineau and Monnier 1966; Roland and Embree 1995; Rose and Lindquist 1982). However, there will be a reduction in host radial growth during an outbreak (Ives and Wong 1988). In one outbreak, growth was impeded by 14.3% in aspen trees defoliated by *O. bruceata*, though some compensatory growth after a defoliation event may also occur (Brandt 1995; Cortini and Comeau 2020). Finally, the resulting silk from dispersing larvae also have a social impact by being an annoyance in recreational areas and camping grounds (Hiratsuka *et al.* 2004).

Damage from this pest on other hosts appears to be fairly minor. Losses are expected to be under 2.5-7% in blueberry production (Gillespie 1985). Surface injury may occur on host fruit though it is often not reported (McMullen 1973; Treherne 1921). Significant damage to crops such as apple, pear and cherry orchards has not been reported, despite some bloom reduction and defoliation. This was attributed to the application of insecticides intended to control other pests (McMullen 1973). Organic farming techniques have also effectively suppressed this pest (Madsen and Carty 1979). Once again though, the pest was noted to be sporadic (McMullen 1973). No recent reports of this pest incurring damage have been identified.

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.

This moth is absent in the UK although it does appear capable of establishing and spreading to other countries, as shown in Greenland, and attacking host plants. Given that this pest attacks sporadically in its native range before being quickly suppressed, without incurring host mortality or major damage to yields, it is believed that this pattern would occur similarly in the UK. Some non-specific natural enemies of *Operophtera bruceata* occur in the UK which may help to limit their numbers between outbreaks. The virus NPV, responsible for collapsing outbreak populations, is present naturally in certain Bruce spanworm populations so may also be transferred with *O. bruceata*. To conclude, this organism does not fulfill all of the criteria for a quarantine pest.

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