Summary of the Express Pest Risk Analysis for *Diplodia bulgarica*

PRA area: Ireland

Describe the endangered area: Irish apple cultivation

Main conclusions

The value of Irish apple sector is still comparatively small (~€6 million). However, it is expected to grow as opportunities for certain apple markets are growing (e.g. cider, juicing and dessert). The pest *D. bulgarica* has so far only been found causing an economic impact in the EU in organic orchards to date, this is similar to what has been seen for *D. seriata*. Currently, Irish organic orchard growers only account for 4% of the sector. However, as the uses of more active substances are removed with the EU driving towards decreased pesticide usage and increased organic production in agriculture and horticulture the problems associated with fungal pests such as *D. bulgarica* may become more prominent. In light of this it is recommended to raise awareness of this pest in the Irish apple sector through targeted dissemination.

Diplodia bulgarica is increasingly becoming recognised as a significant canker causing pest of apple producing regions in Europe, USA and Asia. However, its exact distribution is unknown and is likely more widespread than is currently known. The appears it is mostly associated with organic production systems, stressed or older trees (Eken et al., 2024, Hanifeh et al, 2017; Hinrich-Berger et al., 2021). While it was found to be widespread in surveys of orchards in Iran, pathogenicity trials of recovered isolates were found to be the least aggressive of 4 different canker causing fungi identified on apple orchards in that region (Nourian et al., 2021).

There are several other similar fungal canker diseases (such as *Neonectria* spp., previously known as *Nectria* spp.) present on the island of Ireland which pose a similar threat and are already effectively controlled (McCracken et al., 2003; NIAB, 2025). Therefore, at present it should be considered that properly managed apple orchards with fungicidal tools and good IPM should be able to cope with this pest. However, for organic producers the pest may be more difficult to manage. Awareness of this pathogen should be raised within the Irish apple cultivation sector, but the threat should not be overstated given the options available for control.

Phytosanitary risk for the *endangered area* *(Individual ratings for likelihood of entry and establishment, and for magnitude of spread and impact are provided in the document)*	High ☐	Moderate ☐	Low X
Level of uncertainty of assessment *(see section 17 for the justification of the rating. Individual ratings of uncertainty of entry, establishment, spread and impact are provided in the document)*	High ☐	Moderate X	Low ☐

Other recommendations:

- Submit IE PRA to EPPO
- Produce Pest factsheet for DAFM website

Express Pest Risk Analysis:

……..

Diplodia bulgarica A.J.L. Phillips, J. Lopes & S.G. Bobev

Prepared by: *Conor Francis McGee*
Date 15.05.2021. Revised 23.07.2025
Authors: Andy Bourke[a] and Conor Francis McGee[a]
Reviewers: Alberto Ramos Luz[b]
Affiliation(s): [a] Department of Agriculture, Food and the Marine, Ireland; [b] Teagasc, Oak Park Research Centre, Carlow, Ireland

Stage 1. Initiation

Reason for performing the PRA:

Hinrichs-Berger *et al.* (2021) reported the first detection of the apple pest *Diplodia bulgarica* infesting an organic apple orchard in Germany. Their paper noted the widespread damage (canker, dieback, twig blight and tree death) this pest had seemingly caused in the region since 2018. Their work also indicated that the pest may be infesting pear (*Pyrus*) in the region (though only one isolate recovered and subjected to Koch's postulates to date). Currently, little is known about *D. bulgarica* which was first characterised in 2012. However, it has since been found to be a significant pest, particularly in Iran and India where it appears to be the predominant apple canker pest (Zeynali Bari *et al*., 2021; Nabi *et al*., 2020b). The German outbreak highlighted the threat this pest may pose to apple cultivation in Europe. Therefore, a rapid PRA was initiated to gain a deeper understanding of the potential threat this species may pose for the apple sector in Ireland in 2021. This PRA was reviewed in 2025 after further reports of the disease impacting orchards in Türkiye and the US (Eken, 2022; Elfar *et al*., 2024).

PRA area: *Ireland*

Stage 2. Pest risk assessment

1. Taxonomy & Nomenclature

The genus *Diplodia* was first proposed by Montagne in 1834, with *D. mutila* considered the type species (Philips *et al*., 2012). An updated and amended description of the *Diplodia* genus was given by Philips *et al.* (2005) describing species as having "uni- or multilocular conidiomata lined with conidiogenous cells that form hyaline, aseptate, thick-walled conidia at their tips". Molecularly, there has been considerable confusion for the taxonomic placement of many *Diplodia* species, such as *D. seriata* (Trapman *et al*., 2008). In their 2012 study Philips *et al.* (2012) attempted to resolve the *Diplodia* species complex infecting apple and other Rosaceae, their study found 4 clades consisting of 16 species, among them a newly identified species from isolates collected in Bulgaria which they named *D. bulgarica* A.J.L. Phillips, J. Lopes & S.G. Bobe.

2. Pest overview

2.1 Origin

Diplodia bulgarica was first isolated from canker and fruit rot samples collected in Bulgaria (Philips *et al*., 2012). The exact origin of the species is unknown, though it appears to be very widespread and devastating in Iran. A recent Iranian study characterising *D. bulgarica* isolates molecularly indicated that there appeared to have been two separate introductions of the pest into the country from genetically divergent sources (Zeynali Bari *et al*., 2021). However, due to the lack of systematic surveys, the global distribution of *Diplodia bulgarica* remains uncertain.

2.2 Current Distribution

Within Europe, *D. bulgarica* has been recorded in Bulgaria, Germany and Serbia (Philips *et al*., 2012; Hinrichs-Berger *et al*., 2021; Vučković *et al*., 2022). In Asia, *D. bulgarica* appears widespread in Iran and has been detected in India (Jammu and Kashmir region) in 2017-2018 (Abdollahzadeh *et al*., 2015; Nabi *et al*., 2020) and was recently reported in Türkiye (Eken, 2022). The disease was most recently reported in the Xinjiang region of China (Xie *et al*., 2025). The disease was found in commercial "Golden Delicious" Orchards and wild apple (*Malus sieversii*) in Ili Kazakh Autonomous Prefecture (Xie *et al*., 2025).

The climatic zones of the regions where the pest is present are quite varied (Figure 1). Initially, the species was first characterised from isolates taken in Bulgaria, but no severe symptoms were reported there (Philips *et al*., 2012). The dominant Köppen-Geiger regions in Bulgaria (Cfa, Dfa, Dfb) range from warm-hot summers with temperate-cold winters and no dry seasons. Subsequent studies from Iran found the pest to be widespread and inducing severe symptoms in many regions, but predominantly present in the major apple growing region of west Azerbaijan, in this region the climate is characterised by cold-temperate winters and dry, warm-hot summers (Csb, Dsa). The pest has since been found in the Jammu/Kashmir region of India, a region which spans a wide range of geographical types and has an extremely varied climate which ranges from polar high-altitude tundra to arid deserts. However, the apple growing regions are likely in the southwest area of the region where the climate is characterised by temperate winters and dry hot summers (Cwa). None of these climate zones where the pest was found or inducing reported symptoms were similar to Ireland's climate which is characterised as a temperate oceanic climate (temperate winter, warm summer, no dry season (Cfb).

However, the outbreak of the pest in the western region of Germany in 2017 indicated that the pest may be well suited to the Irish climate type. The western regions of Germany are dominated by the same climate type as Ireland (Cfb) which is characterised as a temperate winter with a warm summer and no dry season. The pest has since been found in Turkey and California (USA) indicating that it is already quite widespread around the world (Eken, 2022; Elfar *et al*., 2024).

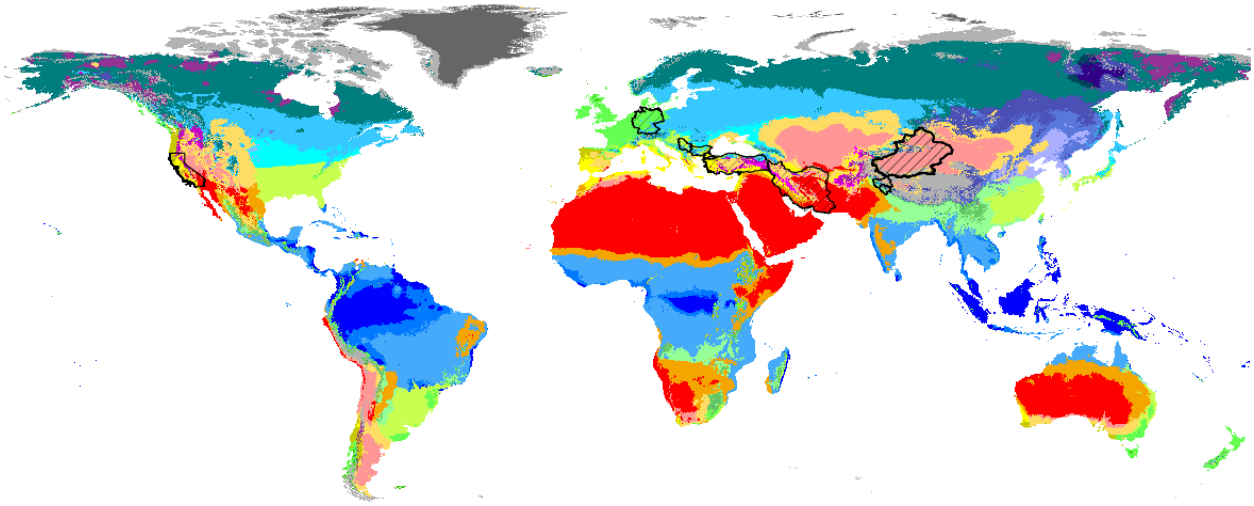

Figure 1: Distribution of *D. bulgarica* in different Koppen-Geiger climate classifications (1991-2020) in 2025.

2.3 Hosts

Diplodia bulgarica has been recorded naturally infesting *Malus* species in Bulgaria, Germany, India and Iran. In Germany, one isolate of *D. bulgarica* was recovered from a pear tree canker and shown to be capable of reinfecting *Pyrus* following Koch's postulates (Hinrichs-Berger *et al*., 2021). The disease was isolated from symptomatic material from two "Gravenstein' apple orchards in California (USA) (Elfar *et al*., 2024).

Resistance to *D. bulgarica* has been observed to differ between certain apple cultivars (Hanifeh et al., 2017). In Iran, the apple tree varieties Braeburn, Red Delicious and Red Starking and these were considered to be the most susceptible cultivars, Granny Smith and Gala showed moderate susceptibility to *D. bulgarica*, while Golden Delicious was the least susceptible variety (Hanifeh *et al*., 2017). However, in Türkiye and China the disease was recovered from symptomatic fruit and trees of the variety Golden Delicious (Eken, 2022; Xie *et al*., 2025). The disease was also found on wild apple in China (*M. sieversii*) (Xie *et al*., 2025.

In India *D. bulgarica* was isolated from canker on the apple cultivars Red Delicious, Royal Delicious and Golden Delicious in the study of Nabi *et al*. (2020b).

2.4 Lifecycle & Aetiology

The *Diplodia* genus is vast, species rich genus (Nabi *et al*., 2020b). A number of *Diplodia* species are known as serious pests of a wide range of host species such as *D. pinea* which causes crown wilt on pines and *D. corticola* which induces canker and dieback of cork and other oaks (Philips *et al*., 2012). *Diplodia* have often been described as being endophytes or opportunistic pests which manifest disease when plants are faced with stresses such as higher temperature and drought (Hanifeh *et al*., 2017).

Six *Diplodia* species are known to infest *Malus* include *D. mutila, D. bulgarica, D. intermedia, D. malorum, D. pseudoseriata* and *D. seriata*, of which *D. mutila* and *D. seriata* are the most frequent worldwide (Abdollahzadeh, 2015; Hanifeh *et al*., 2017; Philips *et al*., 2012). *Diplodia seriata* was associated with a large outbreak on organic apple orchards in 2007 that spanned Belgium, Germany (northern regions) and Netherlands (Trapman *et al*., 2008). The study outlined an infection pathway of *D. seriata* which consists of the pest infecting apple buds within 7 weeks of petal fall, followed by a latent period, after which brown rot of apples occurs as defences weaken during ripening (Trapman *et al*., 2008). The disease inflicts brown rot of fruits and "Frog eye" symptoms on leaves as well as blank canker, as shown in Figure 3 (Trapman *et al*., 2008). *Diplodia seriata* is known to over winter in apple fruit mummies on trees (dead desiccated apples remaining on the tree – Figure 1c) and in the tree bark (Trapman *et al*., 2008). Trapman *et al*. (2008) observed that apple varieties that have a strong tendency to retain fruit mummies through the winter (such as Elster and Gerlinde) were associated with higher infection rates than other varieties. The 2007 *D. seriata* outbreak was linked to the extended warm and wet periods in the summer which would have favoured fruit infection and facilitated pest spread through rain splash, which is considered the main dispersal mechanism for *D. seriata* conidia (Trapman *et al*., 2008).

The specific lifecycle of *D. bulgarica* has not been fully characterised to date. Like other *Diplodia* species the pest produces cankers on hosts which allow it to overwinter (Hinrichs-Berger *et al*., 2021). As the canker/lesion spreads it causes the wood under bark to discolour into a charcoal like appearance (Hinrichs-Berger *et al*., 2021) and on younger growth this spreading causes discoloration (Eken *et al*., 2024). The canker appears as a sunken necrotic area (Hinrichs-Berger *et al*., 2021). The canker produces pycnidia which produce the conidia (asexual spores) (Hinrichs-Berger *et al*., 2021). Conidia are likely spread by rain splash similarly to other *Diplodia* spp. A visual representation of the lifecycle is given in Figure 2.

Figure 2: *Diplodia bulgarica* is known to overwinter on trees in cankers (area of sunken dead plant tissue often called a lesion – (a & b). In the spring cankers produce structures called pycnidia (c) which produce conidia (asexual spores). Conidia (d) are dispersed by rain splash spreading the disease to new host trees. Conidia landing on bark can infest trees through the bark to prude the initial sunken cankers/lesions which causes discolouration in young branches (e), cankers (f,a) and bark cracking and peeling on older branches/trunks (b) as the infection spreads.

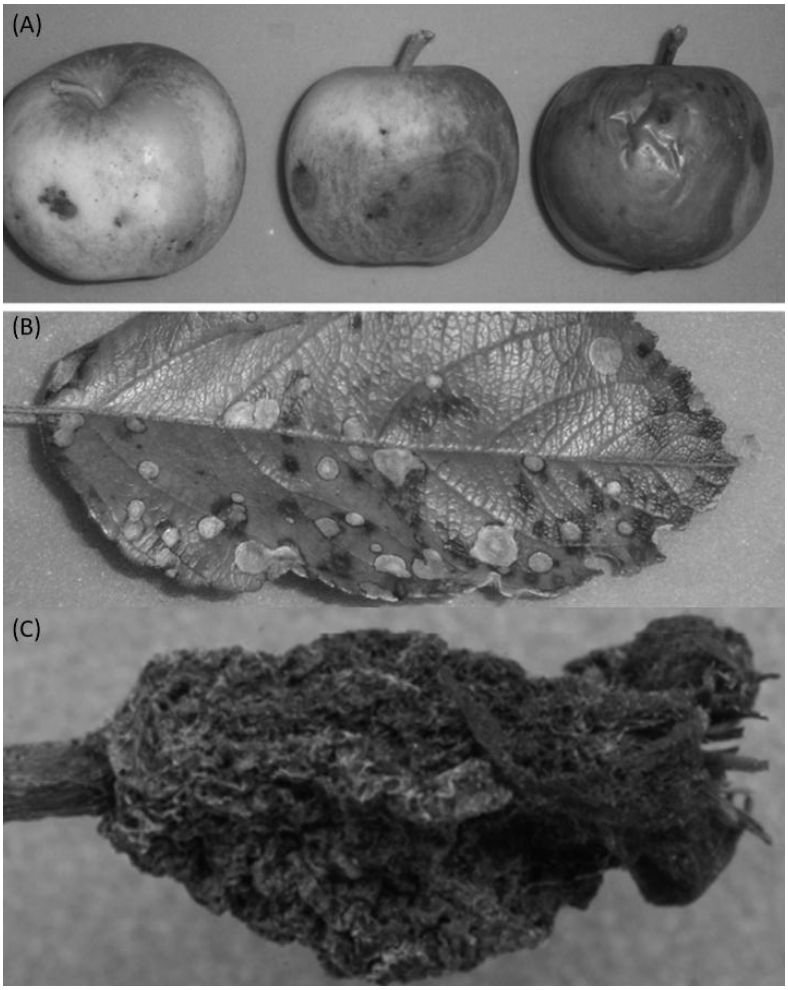

Figure 3: Symptoms of *Diplodia seriata* on apple, Brown rot (A). Frog eye on leaves (B) and overwintering habitat on dead apple mummy (C) (taken from Trapman *et al*., 2008).

In Germany *D. bulgarica* was reported as a canker on trunks and limbs of apple trees, as the infection developed the bark fell away revealing the wood beneath to be blackened like charcoal (Figures 4 a+b). In an organic apple and pear orchards in Germany brown oval sunken lesions were often observed to develop next to bark injuries (cracks, pruning wounds and sun damage), black pycnidia (Figure 5) were observed to break through bark near the canker in older infections (Hinrichs-Berger *et al*., 2021).

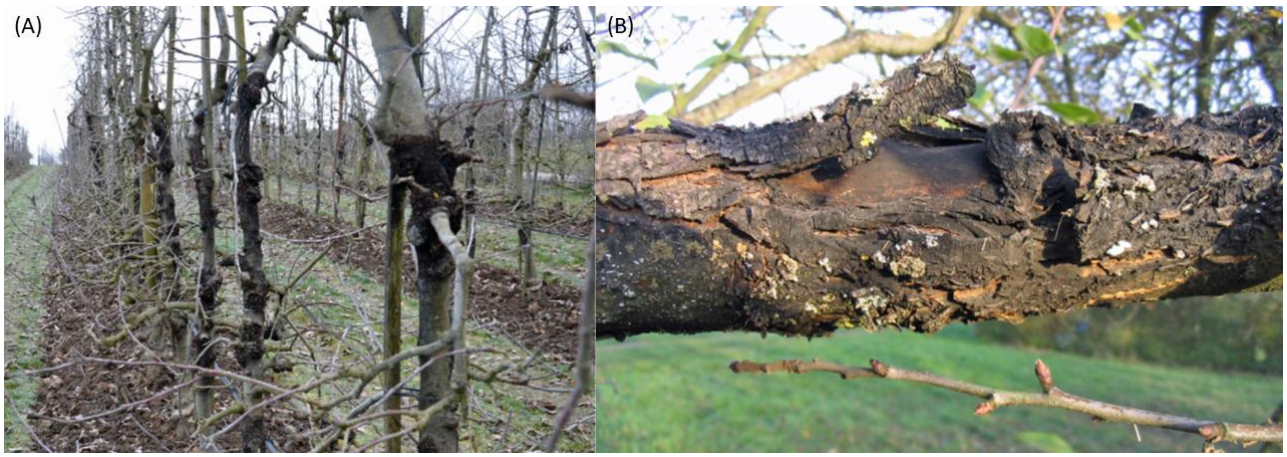

Figure 4: *Diplodia bulgarica* black canker on apple trees (A), bark peeling to revealed blackened timber beneath (B) (taken from Hinrich-Berger *et al*., 2021)

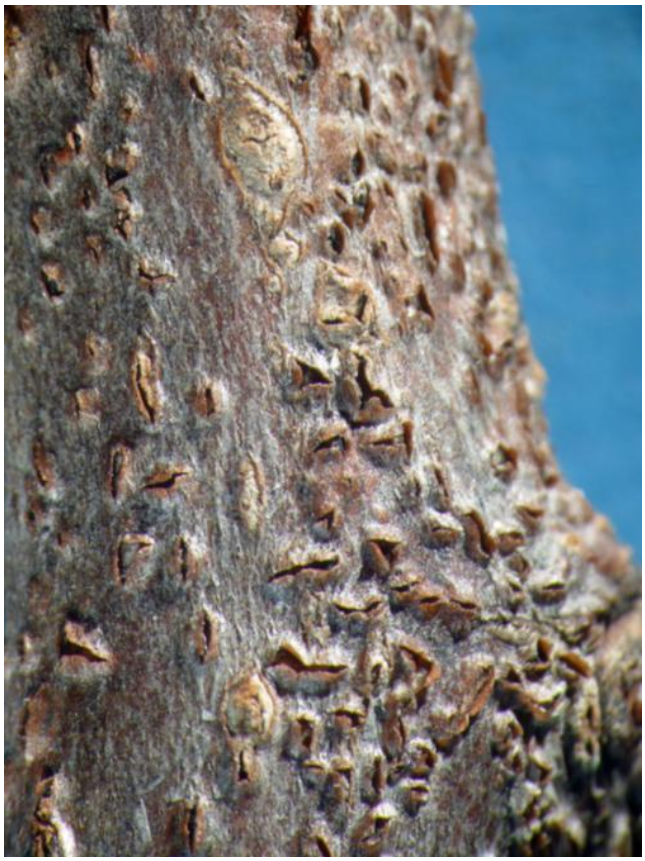
Figure 5: Black pycnidia of *Diplodia bulgarica* breaking through bark (taken from Hinrichs-Berger *et al*., 2021)

In Iran *D. bulgarica* was found to induce a range of visual symptoms on apple trees including gummosis (formation of patches of a gummy substance on the surface of plant), dieback and twig blight symptoms (Abdollahzadeh, 2015). In many outbreaks of *D. bulgarica* in Iran it was noted that the disease was more prevalent in apple trees >15 years old that were suffering from drought and nutrient deficiency (Hanifeh *et al*., 2017).

The disease has also been found to cause post-harvest rot in fruit in Türkiye on the variety Golden Delicious and in Serbia (Eken, 2022; Vučković, et al., 2022). Symptoms on fruit consisted of "sunken and light to dark brown lesions that ranged from 7 to 25 mm in diameter with defined margins" (Figure 6) (Eken, 2022). The disease was found to be highly prevalent in the Eğirdir district of Isparta province in Türkiye between 2020 to 2022 when it was found in the "majority" of 21 orchards surveyed (Eken et al., 2024). Symptoms in Turkish orchards included dieback and cankers.

In China the external symptoms were described as charcoal-like cankers with bark peeling on primary and secondary branches, internally the xylem tissue was found to be firm and brown (Xie et al., 2025).

Figure 6: Symptoms on fruit post-harvest (taken from Eken, 2022).

2.5 Management, Monitoring and Control Options

Control of *Diplodia* species in apple orchards can be managed in several ways depending on the disease management strategies of the orchard.

In organic orchards it is key to remove fruit mummies from the trees as these are known to provide a potential harbour for *Diplodia* through the winter and facilitate infection in the subsequent year (Trapman *et al*., 2008). Removal of dead wood, wood pruning as well as mummified fruit is generally key to controlling *Diplodia* apple pests such as *D. seriata* and *D. mutila* (Pacific Northwest Pest Management Handbook, 2021).

In orchards employing Integrated Pest Management (IPM) strategies, use of fungicides to control typical apple pests (e.g. *Gloeosporium* spp.) may also achieve collateral control of *Diplodia* species (Trapman *et al*., 2008).

Biological control options using endophytic bacteria have been explored and have shown some promise but are not yet widely employed to control the disease (Hagverdi *et al*., 2024).

3. Is the pest a vector? **Yes** ☐ **No** X

If the pest is a vector, which organism(s) is (are) transmitted and does it (do they) occur in the PRA area?

4. Is a vector needed for pest entry or spread? **Yes** ☐ **No** X

5. Regulatory status of the pest

Diplodia bulgarica is not currently known to be regulated in any legal jurisdiction.

6. Distribution

Continent	***Distribution*** *(list countries, or provide a general indication, e.g. present in West Africa)*	*Provide comments on the pest status in the different countries where it occurs e.g. widespread, native, introduced….)*	***Reference***
Europe	*Bulgaria*	Present	*Philips et al., 2012;*
	Germany	Present	*Hinrichs-Berger et al., 2021*
	Serbia	Present	*Vučković et al., 2022*
Asia	*India*	Present	*Nabi et al., 2020*
	Iran	Present	*Abdollahzadeh et al., 2015*
	Türkiye	Present	*Eken, 2022*
	China	Present	Xie *et al., 2025*
North America	*USA (California)*	Present	*Elfar et al 2024*

7. Host plants /habitats* and their distribution in the PRA area

Malus species (*M. pumila, M. sylvestris* and *M. domestica*) are widely cultivated in Ireland and native wild apple (*M. sylvestris*) can often be found in hedgerows (Figure 7). Apple trees are both commercially cultivated in the orchard sector and are also commonly cultivated in private gardens and public parks.

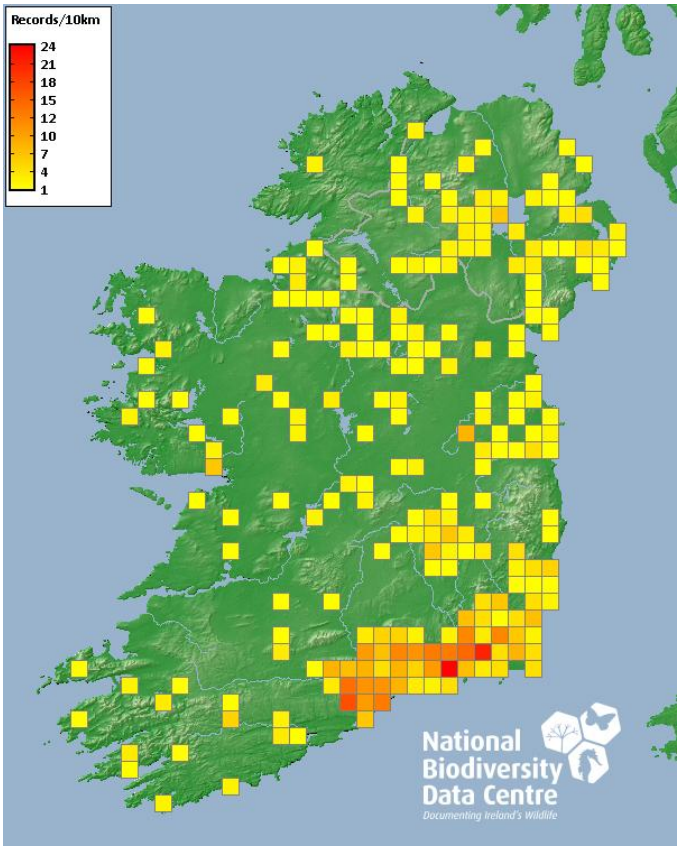

Figure 7: *Malus pumila* (recorded as M. pumila but covers the synonyms: Cultivated Apple, *Malus domestica, Malus domestica* nom. illegit., *Malus sylvestris* subsp. *mitis*) distribution in Ireland (taken from Biodiversity Ireland: https://maps.biodiversityireland.ie/Species/43124)

8. Pathways for entry

The most likely entry route for this pest into Ireland is through "Plants for Planting" of Malus trees from EU areas where the pest is currently known to be present (Bulgaria and Germany). However, the pest may be more widely distributed in Europe than in these two countries. Given the distribution of the pest through the EU is largely uncharacterised and Malus plants for planting trade flows freely within the EU there is a much uncertainty regarding the pest's likelihood for entry. Rating for entry is therefore High with moderate uncertainty. The pest could also be possibly spread in latently infected fruit given the observation of post-harvest rot in Türkiye (Eken, 2022).

Rating of the Likelihood on entry	*Low* ☐	*Moderate* ☐	*High* X
Rating of uncertainty	*Low* ☐	*Moderate* X	*High* ☐

9. Likelihood of establishment outdoors in the PRA area

The pest has not been surveyed for in Ireland to date. To our knowledge there has been little characterisation of canker in apple orchards in Ireland. In the UK the main apple canker pest is European apple canker *Neonectria ditissima* (Shuttleworth, 2021), and it is likely to be also the case for Ireland.

The pest may be controlled by fungicides in many orchards (those not following organic practices) and pass unnoticed. Therefore, the likelihood that it has already been introduced and established should be considered medium-high given it is already established in the EU but is not surveyed for and consignments of *Malus* plants for planting are not tested for latent infections. As there is a high degree of uncertainty regarding the pest's distribution (possibly under reported) the uncertainty score for likelihood of entry is high with moderate uncertainty.

The pest appears to tolerate a range of climates from the middle east to northern temperate Europe (Figure 1). *Diplodia seriata* a similar pest of apple has been shown to establish and spread in Belgium, Netherlands and

Germany. It seems likely *D. bulgarica* would be able to establish in the Irish climate. Where it is present if faces severer weather, it would likely face colder harsher winters in Bulgaria and Germany than in Ireland and likely higher summer temperatures in India and Iran what Ireland experiences. However, there is uncertainty on what are the optimum conditions (i.e. temperature) that suit the pest's infectivity and spread. A rating of high is given for ability to establish with low uncertainty.

Rating of the likelihood of establishment outdoors	*Low* ☐	*Moderate* ☐	*High* X
Rating of uncertainty	*Low* X	*Moderate* ☐	*High* ☐

10.Likelihood of establishment in protected conditions in the PRA area

Cultivation of Malus does not typically occur under protected conditions in Ireland. Not applicable.

Rating of the likelihood of establishment in protected conditions	*Low* ☐	*Moderate* ☐	*High* ☐
Rating of uncertainty	*Low* ☐	*Moderate* ☐	*High* ☐

11. Spread in the PRA area

For *D. seriata* rain splash is considered the main dispersal mechanism for conidia, the 2007 outbreaks associated with this pest were related to the warm wet periods during that summer (Trapman *et al*., 2008). Certainly, in Ireland many summers can be characterised to considerable levels of rainfall. If *D. bulgarica* conidia spread in a similar manner to other *Diplodia* species (as is likely) suitable conditions for spread in Ireland are likely. Spread is characterised as moderate with low-medium uncertainty.

Rating of the magnitude of spread	*Low* ☐	*Moderate* X	*High* ☐
Rating of uncertainty	*Low* X	*Moderate* X	*High* ☐

12. Impact in the current area of distribution

12.1 Economic Impact

Diplodia bulgarica has only been recently characterised, however, the impact it has on apple cultivation is becoming apparent, particularly in Iran and India.

Apple cultivation is widespread in Iran and figures from 2014 indicate that with 3.4 million metric tons produced it was the country's most important fruit crop. *Diplodia bulgarica* is considered the most important disease in the main apple producing region in Iran (west Azerbaijan province), which produces ~26% of apple cultivation (Alijani *et al*., 2016; Hanifeh *et al*., 2017). However, a study by Nourian *et al*. (2021) indicated that of the 4 main fungal canker causing pests in the main apple production hubs in Iran, *D. bulgarica* was the least widespread and least aggressive.

In India, *D. bulgarica* appears to be the predominant canker causing *Diplodia* species in the Jammu and Kashmir provinces which were surveyed in a study by Nabi *et al*. (2020b). Canker in apple orchards had been observed to be increasing in the Indian regions prior to 2017-2018, the study found two apple pests *D. bulgarica* and *D. seriata* inflicting smoky canker symptoms on the three cultivars sampled (Red Delicious, Royal Delicious and Golden Delicious) (Nabi *et al*., 2020b).

In Baden-Wuerttemberg Germany, canker was observed causing widespread damage in an organic apple orchard in 2018. Characterisation revealed that 38/57 *Diplodia* isolates were 99% similar to *D. bulgarica* (Hinrich-Berger *et al*., 2021). In their survey over two thirds of *Diplodia* species isolated from apple and pear trees showing canker, dieback and twig blight symptoms were identified as *D. bulgarica*. In certain cases, the

canker girdled the tree and caused tree death. This marked the first economic impact associated with the pest in Europe. There are no reports of the effects of the pest in Bulgaria where isolates were first obtained.

In 2007, an outbreak of a similar apple pest, *D. seriata*, led to up to 25% loss of the harvest in some organic apple orchards in Europe (Trapman *et al*., 2008).

Diplodia bulgarica was reported from Türkiye in 2022 when it was also shown to be capable of causing post-harvest rot in apples (Eken, 2022). The level of prevalence and economic damaged caused in Türkiye has not been reported beyond symptoms reported in one grown area (Eğirdir district of Isparta province) from 2020-2022 (Eken et al., 2023).

In 2024 the disease was reported in California (Elfar *et al.,* 2024). The disease was isolated from two orchards where symptoms were widespread: 10-30% of trees displayed typical signs of cankers on branches.

As more information on the pest has come to light over the years it appears it is mostly associated with organic production systems, stressed or older trees (Eken *et al.*, 2024, Hanifeh *et al.*, 2017; Hinrich-Berger *et al*., 2021). While it was found to be widespread in surveys of orchards in Iran, pathogenicity trials of recovered isolates were found to be the least aggressive of 4 different canker causing fungi identified on apple orchards in that region (Nourian *et al.,* 2021).

In China the disease symptoms were observed to range between 30-40% of trees in affected commercial orchards (Xie *et al*., 2025).

Impact is considered low with low uncertainty.

Rating of the magnitude of impact	*Low* X	*Moderate* ☐	*High* ☐
Rating of uncertainty	*Low* X	*Moderate* ☐	*High* ☐

Management, Monitoring and Control Options

Control of *Diplodia* species in apple orchards can be managed in several ways depending on the disease management strategies of the orchard.

In organic orchards it is key to remove fruit mummies from the trees as these are known to provide a potential harbour for *Diplodia* through the winter and facilitate infection in the subsequent year (Trapman *et al*., 2008). Removal of dead wood, wood pruning as well as mummified fruit is generally key to controlling *Diplodia* apple pests such as *D. seriata* and *D. mutila* (Pacific Northwest Pest Management Handbook, 2021).

In orchards employing Integrated Pest Management (IPM) strategies, use of fungicides to control typical apple pests (e.g. *Gloeosporium* spp.) may also achieve collateral control of *Diplodia* species (Trapman *et al*., 2008).

12.2 Ecological Impact

Malus sylvestris is considered a native tree and is found in the wild and in hedgerows, this tree is likely susceptible to *Diplodia* canker. Wild apple trees may be affected if the pest is introduced. Score is rated as low with low uncertainty.

Rating of the magnitude of impact in the current area of distribution	*Low* X	*Moderate* ☐	*High* ☐
Rating of uncertainty	*Low* X	*Moderate* ☐	*High* ☐

12.3 Sociological Impact

Apple trees are widely traded to members of the public from nurseries. Should the disease arrive, it would possibly pose a problem for members of the public who may lack the relevant plant protection products to control the disease. The impact of the disease may be recognised quite quickly by members of the public. The social score was therefore considered low with low uncertainty.

Rating of the magnitude of impact in the current area of distribution	*Low* X	*Moderate* ☐	*High* ☐
Rating of uncertainty	*Low* X	*Moderate* ☐	*High* ☐

13. Potential impact in the PRA area

The National Apple Orchard Census (Bord Bia, 2017) revealed that there were 50 apple producers in Ireland cultivating 713 hectares of apple orchard. This indicated the sector had grown 16% since the previous census in 2012 (625 hectares). The value of harvested Irish apples was €5.94 million in 2016, a 22% increase since 2012 (€4.88 million). The increase was partly explained by the increasing opportunities in the dessert, juicing and cider markets.

The apple market is broken down into Culinary (49%), dessert (26%) and cider (25%). The Irish apple sector employed 69 full time and 313 part-time in 2016. The main regions for apple cultivation were largely in Leinster (Dublin, Tipperary, Waterford, Kilkenny and Kildare).

Organic apple production appears to be particularly susceptible to *Diplodia* pests. In 2017 there were four organic producers accounting for an area of 15.3 hectares. It is not known how many organic producers there are present (2025), but information from trade journals (Irish Farmers Journal) in the public domain indicates that they were successful and looking to expand in the future (Leahy, 2021).

In the overall scheme apple production is relatively low value comparatively to major crops such as mushrooms, and the tillage sector. However, with the domestic apple dessert market valued at €131 million, there is substantial scope for this sector to grow in the future (Bord Bia, 2020). As organic apple production represents only a small portion of the sector the economic impacts are considered to be low with low-medium uncertainty, however, the continuing trend for policy to favour organic production methods of cultivation mean this sector may grow in the future.

There are several other similar fungal diseases (*Neonectria* spp., previously known as *Nectria* spp.) present on the island of Ireland which pose a similar threat and are already effectively controlled (McCracken et al., 2003; NIAB, 2025). The pest seems to be more prevalent in much warmer and drier environments than Ireland (e.g. Iran, Turkey, California), particularly on older stressed or unmanaged trees (Hanifeh *et al.*, 2017. So far impacts have only been reported on organic production in Germany which has the most similar climate to Ireland compared to the other regions where it is reported.

ating of the magnitude of impact in the current area of stribution	*Low* X	*Moderate* ☐	*High* ☐
ating of uncertainty	*Low* ☐	*Moderate* X	*High* ☐

14. Identification of the endangered area

Irish apple production

15. Overall assessment of risk

The value of Irish apple sector is still comparatively small (~€6 million). However, it is expected to grow as opportunities for certain apple markets are growing (e.g. cider, juicing and dessert). The pest *D. bulgarica* has so far only been found causing an economic impact in the EU in organic orchards to date, this is similar to what has been seen for *D. seriata*. However, as the uses of more active substances are removed with the EU driving towards decreased pesticide usage and increased organic production in agriculture and horticulture the problems associated with fungal pests such as *D. bulgarica* may become more prominent. In light of this it is recommended to raise awareness of this pest in the Irish apple sector through targeted dissemination.

Diplodia bulgarica is increasingly becoming recognised as a significant canker causing pest of apple producing regions in Europe, USA and Asia. However, its exact distribution is unknown and is likely more widespread than is currently known. The appears it is mostly associated with organic production systems, stressed or older trees (Eken et al., 2024, Hanifeh et al, 2017; Hinrich-Berger et al., 2021). While it is was found to be

widespread in surveys of orchards in Iran, pathogenicity trials of recovered isolates were found to be the least aggressive of 4 different canker causing fungi identified on apple orchards in that region (Nourian et al., 2021).

There are several other similar fungal diseases (*Neonectria* spp., previously known as *Nectria* spp.) present on the island of Ireland which pose a similar threat and are already effectively controlled (McCracken et al., 2003; NIAB, 2025; NIAB, 2025b). Therefore, at present it should be considered that properly managed apple orchards with fungicidal tools and good IPM should be able to cope with this pest. However, for organic producers the pest may be more difficult to manage. Awareness of this pathogen should be raised within the Irish apple cultivation sector, but the threat should not be overstated given the options available for control.

Stage 3. Pest risk management

16. Phytosanitary measures

Trade *Malus* imports are regulated under Reg 2019/2072:

(1) *Malus* imports are regulated under Reg 2019/2072. *Malus* imports other than dormant plants free from leaves, flowers and fruits are prohibited from entry into the EU from third countries (EU 2019/2072 Annex VI point 8) Third countries other than Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom.

(2) Malus Plants for planting imports other than seeds (Annex VI point 9) are prohibited from third countries other than: Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, New Zealand, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo- Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine, the United Kingdom (1) and United States other than Hawaii.

Certain third countries which are allowed to trade Malus plants with the EU have some stipulations to be free of certain pests (such as *Grapholita packardi, Saperda candida* and *Phyllosticta solitaria*), however no *Diplodia* species are currently regulated.

Movement of *Malus* trees within the EU is allowed and therefore any *Malus* trees imported into Ireland from Bulgaria and Germany could potentially introduce the pest. Trade in trees is also allowed with some non-EU countries which may transport the disease in latently infected dormant trees.

Therefore, there are multiple potential pathways to introduce the pest, if it is not already present. The pest is already reported from 3 continents (Asia, Europe and North America) and is likely more widespread throughout the world. No further measures are proposed at present given it is already widespread in Europe and the fact it likely poses a low risk to the Irish orchard sector with current control methods. There are several other similar fungal diseases (*Neonectria* spp., previously known as *Nectria* spp.) present on the island of Ireland which pose a similar threat and are already effectively controlled (McCracken et al., 2003; NIAB, 2025).

A survey of Irish orchard diseases could determine if the pest is already present and to what extent. If Ireland was found to be pest free, then further consideration could be given to the pest if its impact in other areas was found not to be greater than anticipated.

17. Uncertainty

- What is its true world distribution and is it already present in Ireland
- What are the optimum climatic conditions for its infectivity

18. Remarks

- A summary factsheet will be prepared.

19. REFERENCES

Abdollahzadeh, J., 2015. *Diplodia bulgarica*, as a new pathogen and potential threat to the apple industry in Iran. Phytopathologia Mediterranea, 54(1), pp.128-132.

Alijani, N., Manafi Shabestari, M. and Ghosta, Y., 2016, August. Biocontrol effects of endophytic fungi isolated from apple trees against *Diplodia bulgarica* the causal agent of apple canker disease. In 22th Iranian Plant Protection Congress (p. 339).

Hanifeh, S. and MJ, Z.D.S., 2017. Reaction of some apple cultivars to *Diplodia bulgarica* in Iran. Mycosphere, 8(2), pp.1253-1260.

Bord Bia, 2017. National Apple Orchard Census 2017. Available at: https://www.bordbia.ie/globalassets/bordbia.ie/industry/irish-sector-profiles/horticulture-censuses/national-apple-orchard-census-2017.pdf (Accessed on 17.09.21).

Bord Bia, 2020. Website available at: https://www.bordbia.ie/globalassets/bordbia2020/industry/insights/new-publications/assessing-growth-opportunities-for-irish-horticulture-.pdf (Accessed on the 17.09.21).

Eken, C., 2022. Diplodia bulgarica, cause of postharvest rot on apples in Turkey. Australasian Plant Disease Notes, 17(1), p.15.

Eken, C., Demir, D. and Çağlayan, K., 2024. Diplodia bulgarica, the cause of canker disease in apple (Malus× domestica) in Türkiye. Archives of Phytopathology and Plant Protection, 57(9), pp.676-690.

Elfar, K., Carachure, C., Bustamante, M.I., Andrews, E. and Eskalen, A., 2024. First report of Diplodia bulgarica causing black canker on apple in California. Plant Disease, 108(2), p.531.

Hagverdi, S., Khakvar, R., Arzanlou, M. and Aliasgharzad, N., 2024. Inhibitory Effect of Endophytic Bacteria with Auxin Production Ability on *Diplodia bulgarica*, the Causative Agent of Apple Canker in East Azerbaijan Province.

Hanifeh, S., Zafari, D. and Soleimani, M.J., 2017. Reaction of some apple cultivars to Diplodia bulgarica in Iran. Mycosphere, 8(2), pp.1253-1260.

Hinrichs-Berger, J., Zegermacher, K. and Zgraja, G., 2021. First report of *Diplodia bulgarica* causing black canker on apple (*Malus domestica*) and pear (*Pyrus communis*) in Germany. New Disease Reports, 43(1), p.e12004.

Leahy, C., 2021. Simply Better advertorial: organic packs a punch of flavour. Website available at: https://www.farmersjournal.ie/simply-better-advertorial-organic-packs-a-punch-of-flavour-625019 (Accessed on 16.09.2021).

McCracken, A.R., Berrie, A., Barbara, D.J., Locke, T., Cooke, L.R., Phelps, K., Swinburne, T.R., Brown, A.E., Ellerker, B. and Langrell, S.R.H., 2003. Relative significance of nursery infections and orchard inoculum in the development and spread of apple canker (Nectria galligena) in young orchards. Plant Pathology, 52(5), pp.553-566.

Nabi, S.U., Raja, W.H., Mir, J.I., Sharma, O.C., Singh, D.B., Sheikh, M.A., Yousuf, N. and Kamil, D., 2020. First report of *Diplodia bulgarica* a new species causing canker disease of apple (*Malus domestica* Borkh) in India. Journal of Plant Pathology, 102(2), pp.555-556.

Nabi, S.U., Sheikh, M.A., Raja, W.H., Mir, J.I., Sharma, O.C., Singh, D.B., Yousuf, N., Shafi, M., Khan, K.A., Yadav, M.K. and Kamil, D., 2020b. Morphological and molecular characterization of *Diplodia* spp. associated with apple canker disease in India. Crop Protection, 137, p.105238.

NIAB, 2025. Disease cycle and epidemiology (Apple canker). Website avilable at: https://www.niab.com/disease-cycle-and-epidemiology-apple-canker. Last accessed on 03.03.2025.

NIAB, 2025b. Symptoms and recognition (Apple canker). Website available at: https://www.niab.com/symptoms-and-recognition-apple-canker#:~:text=Neonectria%20rots%20appear%20in%20cold,colour%20with%20very%20little%20sporulation. Last cccessed on 07.03.2025.

Nourian, A., Salehi, M., Safaie, N., Khelghatibana, F. and Abdollahzadeh, J., 2021. Fungal canker agents in apple production hubs of Iran. Scientific reports, 11(1), p.22646.

Pacific Northwest Pest Management Handbook, 2021. Apple (Malus spp.)-Diplodia Canker. Website available at: https://pnwhandbooks.org/plantdisease/host-disease/apple-malus-spp-diplodia-canker (Accessed on 16.09.2021).

Phillips, A., Alves, A., Correia, A. and Luque, J., 2005. Two new species of *Botryosphaeria* with brown, 1-septate ascospores and *Dothiorella anamorphs*. Mycologia, 97(2), pp.513-529.

Phillips, A.J.L., Lopes, J., Abdollahzadeh, J., Bobev, S. and Alves, A., 2012. Resolving the *Diplodia* complex on apple and other Rosaceae hosts. Persoonia: Molecular Phylogeny and Evolution of Fungi, 29, p.29.

Shuttleworth, L.A., 2021. Alternative disease management strategies for organic apple production in the United Kingdom. CABI Agriculture and Bioscience, 2(1), pp.1-15.

Trapman, M., Maxin, P. and Weber, R.W., 2008. *Diplodia seriata*, cause of black fruit rot in organically grown apples in Holland, Belgium and Northern Germany. In Ecofruit-13th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing: Proceedings to the Conference from 18thFebruary to 20th February 2008 at Weinsberg/Germany (pp. 177-181).

Vučković, N., Vico, I., Duduk, B. and Duduk, N., 2022. Diversity of Botryosphaeriaceae and Diaporthe species associated with postharvest apple fruit decay in Serbia. Phytopathology®, 112(4), pp.929-943.

USDA, 2021. Canker and Rust Diseases. Website available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd563464.pdf (Accessed on 16.09.2021).

Xie, S., Wu, H., Wang, Y., Chen, C., Gong, F., Guo, Y., Li, H. and Zhang, M., 2025. First Report of *Diplodia bulgarica* Causing Black Rot Canker on Apple in China. Plant Disease, (ja).

Zeynali Bari, R., Abrinbana, M. and Ghosta, Y., 2021. Genetic variation, vegetative compatibility, and aggressiveness diversity of Diplodia bulgarica isolates from apple orchards in West Azarbaijan province of Iran. Plant Pathology.