Department
for Environment,
Food & Rural Affairs

# Rapid Pest Risk Analysis (PRA) for:

## *Scaphoideus titanus*

### May 2026

# Summary and conclusions of the rapid PRA

This rapid PRA shows:

*Scaphoideus titanus*, also known as the American grapevine leafhopper, is the primary vector for flavescence dorée phytoplasma (FDp). Originating in North America, this leafhopper was first observed in Europe in 1958, where it came into contact with the phytoplasma. Grapevine flavescence dorée, the disease caused by this phytoplasma, can cause significant damage to vineyards, and from its spread by *S. titanus*, it is now found in many wine-growing regions of Europe. Due to the large impacts reported from Europe and the concern for the growing viticulture industry in the UK, *S. titanus* was made a provisional quarantine pest. This PRA has been undertaken to further investigate the likelihood of introduction of *S. titanus* and to assess the possible impacts where *S. titanus* acts as a vector for '*Candidatus* Phytoplasma vitis' (*Ca*. P. vitis) causing flavescence dorée (FD) disease in grapevine.

## Likelihood of entry

The long-distance spread of *Scaphoideus titanus* across Europe is strongly associated with the movement of *Vitis* planting material. The UK imports an average of 871 tonnes of *Vitis vinifera* planting material annually from the EU, primarily from the Netherlands, Italy, France, and Germany. This includes both grafted rootstock for vineyards and mature ornamental plants for retail, each posing different levels of phytosanitary risk. Hitchhiking via vehicles and machinery is possible, but unlikely as a pathway for entry, given current import regulations and uncertainty regarding the likelihood of the pest remaining with the vehicles over long distance. Other pathways, such as grapes or non-*Vitis* plants, are not considered significant. Overall, **the *Vitis* planting material is considered the primary pathway and is rated as moderately likely**.

## Likelihood of establishment

The UK presents suitable conditions for the establishment of *Scaphoideus titanus*, both in terms of host distribution and climate. *Vitis vinifera*, the primary host, has a wide distribution across England and Wales with over 1,000 registered vineyards covering approximately 4,200 hectares. Vineyards are often planted together and provide dense canopies, which are ideal for *S. titanus* establishment and spread. Wild or naturalised *Vitis* species also occur, which may provide additional refuges for the pest, although their exact distribution is unclear and there are no native *Vitis* species. Climatically, the UK falls within the suitable range for *S. titanus* development, as indicated by historical records from North America and modelling studies using CLIMEX. These models suggest that southern grape-growing regions of the UK are particularly favourable for establishment, although development in the UK may be slower and less optimal due to lower average temperatures. Overall, **outdoor establishment of *S. titanus* in the UK is rated as likely**. *Scaphoideus titanus* can only complete its lifecycle on *Vitis* spp., and as vineyards are not grown under protection, *S. titanus* is not considered a pest of protected cultivation. **Establishment under protection is rated as very unlikely.**

## Economic, environmental and social impact

The potential impacts from *S. titanus* alone are likely to be negligible, however its potential impacts as a vector enabling the spread of a damaging phytoplasma are significant. Impacts are, therefore, based on damage from FDp being vectored by *S. titanus*. In regions where FD is present, the economic consequences have been severe, with yield reductions of up to 92%, increased vine mortality, and significant losses in grape quality and marketability. Control measures, including mandatory insecticide applications, plant destruction, and replanting, have imposed high direct costs on growers, and disease management and compensation by some governments has reached tens of millions of euros. The potential economic impact in the UK is substantial given the rapid expansion of its viticulture sector, with over 1,000 registered vineyards and increasing domestic wine sales. Introduction of FDp could result in crop losses, costly eradication programs, and regulatory burdens, especially for nurseries and propagators. However, potential impacts in the UK would be limited by the small viticulture industry (compared to other European countries) and restricted climate suitability. Therefore, **economic impacts are rated as medium**.

While ‘*Candidatus* Phytoplasma vitis’ and *S. titanus* have a narrow host range and do not appear to directly harm biodiversity, environmental impacts may result from damage to wild *Vitis* spp. and unintended effects from the chemical control strategies used to manage the vector. Insecticides such as neonicotinoids and organophosphates can negatively affect non-target insects, contribute to environmental contamination, and increase pesticide resistance. In the UK, impact is likely to be limited as *Vitis* is not a key component to the UK ecosystem and pesticide treatments are managed carefully. These impacts are indirect and will vary with control practices. The **environmental impacts are rated as small**.

Social impacts of FDp are less documented but potentially significant, especially in wine-producing regions where viticulture contributes to employment, rural development, and cultural identity. A similar pattern could emerge in the UK, particularly in regions like Kent and Sussex, where wine tourism is growing. Outbreaks may reduce consumer confidence in UK wine, create public concern, and impact businesses linked to viticulture. As such, **social impacts are rated as medium**.

## Endangered area

The areas endangered by *S. titanus* (carrying FDp) are vineyards, which are widespread in the UK but mostly distributed across the south of England. Due to climate suitability, vineyards in the southeast of England are most at risk.

## Risk management options

*Scaphoideus titanus* is currently listed as a Provisional Quarantine Pest in GB, and statutory action is taken upon findings. FDp is a quarantine pest under both GB and EU regulations. Import of *Vitis* plants from the EU, Liechtenstein, and Switzerland is controlled, requiring certification of origin from FD free areas, active vector management, or hot water treatment, which also helps reduce *S. titanus* egg survival. However, these requirements may not always apply if FD is not officially present in the source region, creating potential gaps in protection due to wider distribution of *S. titanus*.

For containment and population suppression, close monitoring is necessary. Techniques include visual inspection of plants, beating methods, suction sampling, and sticky traps for adults. Insecticide application is most effective when timed to target third-instar nymphs, typically requiring two area-wide treatments. Pesticides previously used for control, such as organophosphates and neonicotinoids, have been phased out due to environmental concerns, but a range of conventional and organic pesticides with high efficacy are available. Cultural control, including sucker removal, pruning, debris destruction, and clearing of wild or abandoned *Vitis*, also plays an important role in management.

## Key uncertainties and topics that would benefit from further investigation

Potential dispersal capacity for natural spread: *Scaphoideus titanus* has not been recorded as a strong flier, with long-range dispersal of 300 m recorded. However, some records have been made of *S. titanus* being able to disperse relatively far. An EPPO datasheet states that a possible yearly spread of 5 to 10 km has been recorded in southwest France. Additionally, wind-assisted spread is possible, and is thought to have allowed spread from Slovenia to Austria. However, these reports are unverified, so the assessment of dispersal capacity for natural spread is uncertain and requires further investigation.

## Images of the pest

| Photo 1 *Scaphoideus titanus* adult<br> | Photo 2 Fifth instar nymph of *S. titanus*<br> |
|---|---|
| EPPO database (https://gd.eppo.int/taxon/SCAPLI ), courtesy of INRAE Bordeaux | EPPO database (https://gd.eppo.int/taxon/SCAPLI), courtesy of Ilya Mityushev |

## Is there a need for a detailed PRA or for a more detailed analysis of particular sections of the PRA? If yes, select the PRA area (UK or EPPO) and the PRA scheme (UK or EPPO) to be used.

| | | | | | |
|---|---|---|---|---|---|
| No | ✓ | | | | |
| Yes | | PRA area: UK or EPPO | | PRA scheme: UK or EPPO | |

## Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

Statutory action is considered appropriate. The introduction (entry and establishment) of this pest is rated as moderately likely. The economic impacts caused by FDp, being vectored by *S. titanus*, are considered large for individual growers and this is likely to increase as grapevine production in the UK continues to grow as an industry. While control methods are available, the effectiveness can vary and would have high potential costs.

| | | | |
|---|---|---|---|
| Yes<br>Statutory action | ✓ | No<br>Statutory action | |

# Stage 1: Initiation

## 1. What is the name of the pest?

Hemiptera: Auchenorrhyncha: Cicadellidae

*Scaphoideus titanus* Ball (1932).

Synonyms *Scaphoideus aduncus* DeLong & Knull (1971), *Scaphoideus amplus* DeLong & Mohr (1936) *Scaphoideus brevidens* DeLong & Mohr (1936), *Scaphoideus cyprius* Ball (1932), *Scaphoideus immistus titanus* Ball (1932), *Scaphoideus littoralis* Ball (1932), *Scaphoideus nigrellus* DeLong & Mohr (1936), *Scaphoideus scelestus* DeLong & Mohr (1936)

Common name: American grapevine leafhopper

## 2. What initiated this rapid PRA?

This leafhopper is a specialist of *Vitis* in Europe and the primary vector of the disease Grapevine flavescence dorée (FDp), caused by '*Candidatus* Phytoplasma vitis'. *Scaphoideus titanus* was first observed in Europe in 1958, in southern France, and is now found in a large proportion of European vineyards. Given its importance as a vector, *S. titanus* was added to the UK Plant Health Risk Register in 2017 with an overall rating of 8 for S*. titanus* being introduced alone and a rating of 40 for *S. titanus* and '*Candidatus* Phytoplasma vitis' (causal agent of Grapevine flavesence dorée) being introduced together. As a result, *S. titanus* was listed as a Provisional Quarantine Pest. This PRA is to further investigate risk and explore key uncertainties from the initial Risk Register entry and assess whether this pest meets the requirements of a Quarantine Pest.

## 3. What is the PRA area?

The PRA area is the United Kingdom of Great Britain and Northern Ireland

# Stage 2: Risk Assessment

## 4. What is the pest's status in the plant health legislation, and in the lists of EPPO[1]?

For Great Britain (GB), *Scaphoideus titanus* is currently listed in Annex 2A of Commission Implementing Regulation (EU) 2019/2072[2] as a Provisional Quarantine Pest. *Scaphoideus titanus* is not listed in the EU plant health legislation which applies to Northern Ireland[3]. EU plant health legislation does not explicitly regulate *Scaphoideus titanus* but does recognise it as a vector for flavescence dorée phytoplasma. *Scaphoideus titanus* is not recommended for regulation as a quarantine pest by EPPO, nor is it on the EPPO Alert List.

Grapevine flavescence dorée phytoplasma is listed in GB legislation as a quarantine pest not known to occur in Great Britain (Annex 2, Part A).

Grapevine flavescence dorée phytoplasma is listed in EU plant health legislation as a quarantine pest known to occur in Union territory (Commission Implementing Regulation (EU) 2019/2072, Annex II, Part B) and measures for containment of FDp within certain demarcated areas are established in Commission Implementing Regulation (EU) 2022/1630.

## 5. What is the pest's current geographical distribution?

### North America

This pest is native to eastern North America and has been recorded in multiple US states and provinces of Canada (See table 1). The majority of records are from a catalogue of Homoptera (Metcalf, 1967) and a revision of the *Scaphoideus* genus (Barnett, 1976). These observations should be accepted with caution, as there are a number of morphologically similar *Scaphoideus* species present in North America, which may be confused with each other. The genus of *Scaphoideus* was revised in 1976, and the species *S. cyprius*, *S. littoralis*, *S. amplus*, *S. brevidens*, *S. diutius*, *S. nigrellus*, *S. scelestus,* and *S. aduncus* are now known as *S. titanus*. In North America, this leafhopper

[1] https://www.eppo.int/ACTIVITIES/quarantine_activities

[2] https://www.legislation.gov.uk/eur/2019/2072 (link to latest consolidated version)

[3] The latest consolidated version can be accessed on the left-hand side of https://eur-lex.europa.eu/eli/reg_impl/2019/2072/oj

has rarely been studied as it is not considered an economic problem, due to the absence of FDp (Chuche & Thiéry, 2014).

## Europe

*Scaphoideus titanus* was first observed in Europe in 1958, in southern France (Bonfils & Schvester, 1960). In the early 1960s, *S. titanus* individuals were found in vineyards in France and northern Italy, suggesting the leafhopper was introduced sometime before. Introduction of *S. titanus* to France was possibly from the large amounts of American rootstocks being imported after the phylloxera crisis starting from 1878, which involved more than 800,000 ha of French vineyards needing be completely replanted with more resistant American vine rootstocks. However, the introduction may have occurred earlier in the 1850s during the Powdery mildew crisis (Gonella *et al.*, 2024a).

The leafhopper is now found across Europe. A detailed record of initial findings in European viticultural areas can be found in Chuche and Thiéry (2014). There have been recent findings in Moldova (Timuş, 2015), Ukraine (Mirutenko *et al.*, 2018), Russia (Bondarenko *et al.*, 2019), and Germany (NPPO of Germany, 2024). Analysis of the population genetics suggests the majority of the European population originated from a single introduction (Papura *et al.*, 2012). It is believed that the dispersal of this leafhopper throughout Europe is from human activity, primarily from the trade of vine cuttings and rootstocks for grapevine production (Chuche & Thiéry, 2014). The spread and establishment of *S. titanus* within Europe is likely to continue and poses a risk to certain wine regions of northern Europe, due to favourable climatic conditions, evidenced by distribution across various climates in its native range of Canada and the USA.

| **Table 1 : Distribution of *Scaphoideus titanus*** | |
|---|---|
| North America: | Canada, Unites States of America (Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, New Hampshire, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Utah, Vermont, Virginia). |
| Central America: | No records, assumed absent. |
| South America: | No records, assumed absent. |
| Europe: | Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, France, Germany, Hungary, Italy, Moldova, Montenegro, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Ukraine. |

| | |
|---|---|
| Africa: | No records, assumed absent. |
| Asia: | No records, assumed absent. |
| Oceania: | No records, assumed absent. |

## 6. Is the pest established or transient, or suspected to be established/transient in the UK/PRA area?

*Scaphoideus titanus* and flavescence dorée phytoplasma are not known to occur in the UK, nor have they been intercepted in England and Wales by the Plant Health and Seed Inspectorate.

## 7. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK/PRA area?

In its native range, *S. titanus* is mainly recorded on *Vitis labrusca* and *Vitis riparia*, which are considered the preferred host plants. *Scaphoideus titanus* individuals are mostly found in woodlands and hedges, where these wild grape species are present, and are rarely found in vineyards. In Europe, *S. titanus* is mainly recorded on *Vitis vinifera*. Preference for American *Vitis* spp. over *V. vinifera* has been recorded in Europe, where these species coexist but the specific American *Vitis* species was not recorded, and results were not verified (Chuche & Thiéry, 2014). In the UK, only *V. vinifera* is present in large amounts, while other species such as *V. coignetiae*, *V. riparia*, *V. vulpina* are present but recorded at much lower numbers.

Different grapevine cultivars appear to have different effects on the fitness of *Scaphoideus titanus*. A study looking at *S. titanus* development on grapevine cultivars (*V. vinifera*) 'Barbera', 'Brachetto', and 'Moscato' measured different fitness parameters, such as nymphal developmental time, nymphal mortality, adult longevity, and female fecundity, where better performance was identified on 'Barbera' compared with the others. Differences of *S. titanus* performance on these cultivars appear to affect the plant's susceptibility to FDp, where 'Barbera' is considered highly susceptible. In comparison, *S. titanus* performance was low on the FDp-tolerant cultivar 'Moscato', possibly due to antibiosis and antixenosis defence mechanisms. Different feeding behaviour is recorded for these cultivars, where a longer duration of phloem ingestion was recorded on 'Barbera'. This suggests that cultivars preferred by *S. titanus* are more likely to acquire FDp (Ripamonti *et al.*, 2022a; Ripamonti *et al.*, 2022b). This is supported by Galetto *et al.* (2016), who reported that disease diffusion correlates more with vector acquisition efficiency than with FDp load in source grapevines. Cultivars currently recorded as being highly susceptible are 'Barbera', 'Dolcetto', and 'Arneis'. More research is required in this area to identify susceptible cultivars currently grown in the UK. While there are some tolerant cultivars, such as ‘Merlot’, there are not thought to be any resistant cultivars (Eveillard *et al.*, 2016).

Other plants that *S. titanus* has been observed feeding on include *Crataegus* spp., *Prunus persica*, *Malus* spp., *Salix* spp., *Parthenocissus quinquefolia*, *Daucus carota*, *Solidago* spp., *Juniperus virginiana*, and *Ulmus americana* (Chuche & Thiéry, 2014). Although the exact host status for the majority of these plants has not been demonstrated. *Parthenocissus quinquefolia* is an invasive plant belonging to the Vitaceae family and is considered widespread in England and south Wales (Stroh *et al.*, 2026). All life stages of *S. titanus*, except eggs, have been observed on *P. quinquefolia* and it may act as a secondary host, but this is not confirmed (Chuche & Thiéry, 2014). *Scaphoideus titanus* is considered an oligophagous species, where it completes its lifecycle on one genus (*Vitis*), but is able to feed on other food plants. While impacts on these plants are limited, they may act as reservoirs for FDp transmission, especially in areas close to vineyards.

## 8. Summary of pest biology and/or lifecycle

*Scaphoideus titanus* is univoltine, one generation a year. One report from 1987 recorded a first nymphal instar in August in southern France, 3 weeks after the last observation of newborn nymphs in mid-July. This could suggest that *S. titanus* may produce a second generation under certain conditions, with females producing non-diapausing eggs, although this has not been reported again, and it is believed to be unlikely that a second generation would have time to develop to adulthood (Chuche & Thiéry, 2014).

Adult females oviposit eggs in late summer from August to September, either individually or in groups, on grapevine stems and between bud scales. Eggs are preferentially laid underneath the peeling bark of two-year-old grapevine canes. Oviposition has also been recorded on one-year-old canes, but at much lower numbers (Schaub *et al.*, 2010). A female may lay an average of 66 eggs in a period of 47 days, with a maximum number of eggs recorded being 131 (Bocca *et al.*, 2020). Eggs overwinter in a six-to-eight-month diapause stage, and nymphs begin to hatch around mid-May. Although first instars may be found as late as the end of July or mid-August (Ripamonti *et al.*, 2022b).

For *S. titanus*, nymphal hatching is synchronised with grapevine bud break, and the hatching period remains constant (6-8 weeks) across climates. However, exposure of eggs to cold temperatures (5°C), ranging from 0 to 63 days, results in a quicker onset of hatching. Compared to eggs exposed to milder winter temperatures, where nymphal hatching can be delayed (the highest percentage of hatching occurs 20 to 30 days after the first hatching) (Chuche & Thiéry, 2009). For example, in Corsica (mean winter temperature of ~ 10°C), the hatching period is more than 3 months, while in Armagnac (west France) (mean winter temperature of ~ 6 – 7°C), this period is 1.5 months. In areas with extended hatching periods, all life stages of the leafhopper may occur simultaneously (Chuche & Thiéry, 2014). Other abiotic factors may influence the hatching period. For example, in Friuli-Venezia Giulia (Italy), in mid-May, hatching occurs a few days earlier in the lower altitude vineyards. The effect of these factors is not fully understood and requires more research. Regardless, the start of nymphal hatching is synchronised with grapevine bud break, irrespective of winter temperatures (Chuche & Thiéry, 2014).

The leafhopper has five larval instars. The development time to maturity varies with climate, where 7 – 8 weeks are recorded in France, compared to 5 – 7 weeks in Spain and Italy (Chuche & Thiéry, 2014). Other factors affect nymph growth but are currently poorly understood, for example host cultivar, population dynamics, and FDp interaction. Nymphs usually remain on the plant where they hatch, but they can easily travel from plant to plant. Young nymphs feed preferentially on suckers (new growth shoots). All instars prefer the more sheltered lower and inner leaves, but, in favourable conditions, can also be located at the apex. Instars generally don't move, unless jumping away when disturbed (Tramontini *et al.*, 2020).

First adults appear in summer, June and July, and both sexes have relatively long average lifespans, with females living for over 60 days while males can live for over 40 days (Bocca *et al.*, 2020). Adult mating involves vibratory communication by signals transmitted via the plant. Males begin emitting signals 24 hours after emergence, although females take a minimum of 6 days to reach maturity and begin mating (Mazzoni *et al.*, 2009).

*Scaphoideus titanus* is a phloem feeder, although prolonged xylem feeding has also been observed. Nymphs prefer to feed on the small veins of the leaf blade while adults feed more readily on the larger veins or petioles (Chuche & Thiéry, 2014). In spring, phytoplasmas, already present in the plant, colonise the growing leaves via the phloem, producing a source of infection for *S. titanus*. From the first instar, phytoplasmas may be acquired during feeding. A minimum feeding period is necessary to become infective; but the exact duration has not been specified. The longer the leafhopper feeds, the more likely it is to acquire the phytoplasma. The phytoplasma is drawn from the phloem by the insect's stylet, passing through the intestinal barrier, where it joins the haemolymph. There is an incubation period of 30-45 days as the phytoplasma multiplies and colonises the body (Alma *et al.*, 2018). Once the concentration of the phytoplasma in the salivary gland reaches a sufficient level, the leafhopper becomes infectious and can transmit the phytoplasma to a healthy plant. While the leafhopper remains infectious throughout its development from subsequent instars to adult, vertical transmission (mother to offspring) of FDp is thought to be impossible as the phytoplasma has not been observed in sexual organs (Chuche & Thiéry, 2014). According to Weintraub and Beanland (2006), there are incidences of transovarial transmission of phytoplasma in *S. titanus*, although FDp is not mentioned specifically, so it is assumed that the authors are discussing a similar phytoplasma, such as one from the 16SrI group (cause of aster yellows disease).

# 9. What pathways provide opportunities for the pest to enter and transfer to a suitable host, and what is the likelihood of entering the UK/PRA area?

For the UK, we are primarily concerned with the introduction and subsequent impact of FDp with *S. titanus* acting as a vector for spread. There are multiple scenarios to consider for the entry of *S. titanus* + FDp. This may include entry of infected leafhopper nymph/adult or leafhopper eggs attached to infected planting material, which may lead to an immediate outbreak of FD. Additionally, entry of uninfected leafhoppers and FDp-infected planting material may take place separately, causing a delayed outbreak. From a historical perspective, the establishment of *S. titanus* has always preceded the establishment of FDp by a few years (Tramontini *et al.*, 2020). To avoid confusion, this section will discuss the pathways of entry for the vector *S. titanus* alone, regardless of whether the leafhopper is infected or associated with infected material.

## Planting material of *Vitis* – Canes, grafts, scions, rootstocks

Canes are the mature woody shoots of *Vitis* which contain buds that can develop into new shoots. These are often used as cuttings to propagate new vines. Scions are short parts of a grapevine shoot of the desired cultivar, which is grafted to a rootstock, producing a grafted plant. Rootstock is the root-bearing portion of a grapevine plant, often from a species that is resistant to pests or tolerant to specific soil conditions.

Several studies examining the spread of *S. titanus* across continental Europe have attributed its long-distance dispersal primarily to the movement of *Vitis* planting material. This has been suggested for multiple reasons. Firstly, the natural dispersal ability of *S. titanus* is considered limited. This leafhopper has a recorded dispersal of approximately 20 – 40 metres, with a less frequent long-range dispersal of up to 330 m. This distances were measured from July to October, which represents the window of adult presence in northwestern Italy (Lessio *et al.*, 2014). There is the possibility of wind-assisted spread, but *S. titanus* is not thought to fly high above the ground and is unlikely to come into contact with strong winds making natural spread across Europe unlikely. Wind-assisted spread has, however, been the suggested mode of spread for *S. titanus* from Slovenia to Austria (Arnaud *et al.*, 2007). Secondly, the widespread distribution of the flavescence dorée-2 strain, found in France and Italy, has a high clonality level, suggesting long-distance spread of this strain took place in a relatively short amount of time, too short for natural spread by *S. titanus* Bertin *et al.* (2007). Thirdly, in regards to *S. titanus*, randomly amplified polymorphic DNA (RAPD) data by Bertin *et al.* (2007) showed an almost complete lack of isolation by distance from France to Slovenia and Spain. This scattered pattern in the distribution of genetic diversity suggests extensive movement of *S. titanus* within Europe (from one European country to another) from the long-distance trade of planting material.

Data from PEACH and IPAFFS systems over from 2021-2024 indicate that the UK imports an annual average of 870 tonnes of *Vitis vinifera* planting material from the European

Union (trade of *Vitis* originating outside the EU, Liechtenstein and Switzerland, is prohibited (Annex 6 Part A point 10 of the assimilated Commission Implementing Regulation (EU) 2019/2072)). The largest proportion of this material originates from the Netherlands, followed by Italy, France, and Germany. Exact amounts of material originating from the Netherlands may be inflated, as it is a large trading hub and the true origins of material may be different. Trade volumes have fluctuated over recent years but imports of *Vitis* propagating material are expected to continue, reflecting the ongoing expansion of viticulture in the UK.

**Table 2. Mass of *Vitis* material imported from Europe (tonnes). Source = IPAFFS and Peach import systems**

| Year | Total annual mass (t) |
|---:|---:|
| 2021 | 1571.4 |
| 2022 | 677.9 |
| 2023 | 342.8 |
| 2024 | 893.1 |
| **Average** | **871.3** |

The figures in Table 2 encompass all *Vitis* imports, including propagating material for commercial vineyards as well as ornamental plants intended for garden centres and private use. Most import applications are submitted by plant nurseries and wholesale distributors, with a smaller proportion associated with specialist importers supplying propagating material to commercial vineyards. The wide range of imported material types may present differences in phytosanitary risk, particularly depending on the likelihood of *S. titanus* being associated with the plant type and how life stages may be concealed. As the specific age and condition of *Vitis* plants imported into the UK are often not provided from import applications, it is difficult to quantify the proportion of imports that may be suitable as a pathway for *S. titanus*.

*Scaphoideus titanus* appears to have a strong oviposition preference for older vine wood, where eggs are laid beneath the excoriated bark of *Vitis*. Bagnoli and Gargani (2011) found 0.09-0.31 larvae per $cm^2$ from the bark of ≥two-year-old wood, compared to 0.0002-0.0036 larvae per $cm^2$ from one year old wood. This suggests varying phytosanitary risk with different planting material of *Vitis*.

For material destined for viticultural use, imports typically consist of one-year-old canes or bare-rooted, grafted plants, often made from rootstock and scions. Neither of which are believed to be the preferred oviposition site for *S. titanus* and could not support the development of nymphs. Additionally, hot water treatment (HWT) is a common phytosanitary practice applied to propagating material prior to export, although not necessarily required. Studies have shown HWT to be effective in killing *S. titanus* eggs on one-year-old canes (Caudwell et al., 1997; Linder et al., 2010). However, it remains uncertain whether all imported consignments are grafted plants with one-year-old canes and undergo HWT. It is possible that untreated material may still be entering the UK and pose a significant likelihood of entry.

*Vitis* plants destined for nurseries and garden centres are often imported as mature, potted plants with woody stems and leaves. This form presents a higher phytosanitary risk due to the likely presence of bark suitable for egg deposition and foliage that could support feeding by nymphs or adults. While mobile stages such as nymphs or adults may dislodge during transport or inspection, dense packaging on trolleys may create a sheltered environment that facilitates survival. It is unknown how often mature plants undergo HWT as part of Annex 7 point 87 of the assimilated Commission Implementing Regulation (EU) 2019/2072, regardless HWT is not as effective at killing *S. titanus* eggs from ≥two-year-old wood as it is for one-year-old wood (Schaub *et al.*, 2010).

It is important to consider the potential movement of *S. titanus* from infected material to the wider environment. While the risk of entry via ornamental *Vitis* plants appears greater, the likelihood of *S. titanus* establishing a population from this pathway is uncertain. Unless planted near commercial vineyards, the chance of contact with high-density *Vitis* populations is limited. Therefore, while the likelihood of entry via ornamental *Vitis* is significant, its contribution to potential establishment remains unknown. In contrast, bare-rooted grafted plants are less likely to harbour *S. titanus* but will be planted in a vineyard, where there is likely to be multiple plots of *Vitis* for establishment and spread. While movement to the wider environment does not alter the likelihood of entry, it is important to consider in terms of introduction.

From the volume of trade, the biology of the pest, and historical patterns of spread, movement of *S. titanus* into the UK with *Vitis* material is rated as moderately likely overall. Due to the differences between propagating material (canes, scions, rootstocks) and ornamental plants (older, potted plants), the pathway scores have been separated.

***Vitis* propagating material is rated as moderately likely with medium confidence.** This material most likely contributes to a small proportion of trade volume and presence of *S. titanus* eggs is less likely compared to older plants, but provides a better opportunity for transfer to commercial vineyards.

**Ornamental plants for planting of *Vitis* is rated as moderately likely with medium confidence.** Volume of trade and likelihood of pest association is higher, however, opportunity for transfer of *S. titanus* to a vineyard is considered limited.

## Hitchhiking

From the EFSA pest survey card of flavescence dorée phytoplasma and its vector *Scaphoideus titanus*, hitchhiking in/on vehicles was identified as a potential method of long-distance dispersal. For example, in Trentino (Italy), *S. titanus* has been recorded along highways. The leafhopper has not been explicitly linked with machinery, but there is some likelihood that it may be imported to the UK with used agricultural machinery. However, if the machinery originates from outside the EU, Switzerland or Lichtenstein, importers must ensure that machinery or vehicles used for farming or in forestry are accompanied by a phytosanitary certificate and have been cleaned and are free from soil and plant debris, under Annex 7 item 3 of the assimilated Commission Implementing

Regulation (EU) 2019/2072. This should limit the likelihood of *S. titanus* being present with these commodities.

Trade volume of tractors from the EU is high, averaging approximately 100 million kg a year (data provided by UKtradeinfo.com), equating to tens of thousands of individual tractors each year. However, it is not possible to identify the amount that has been used and would have come into contact with *S. titanus*. Hitchhiking is a possible pathway of entry but unlikely considering that the leafhopper would need to be present on or inside a vehicle, remain for the journey and any cleaning, and then come into contact with *Vitis* plants in the UK. As the EFSA panel looking at *S. titanus* was focused on the EU territory, it is likely that this pathway is of greater concern to mainland Europe than it is the UK. While trade volume for this pathway is high, the likelihood of *S. titanus* hitchhiking on machinery and entering the UK is thought to be low; therefore, this pathway is rated as **unlikely with medium confidence**.

## Conclusion on Likelihood of Entry

Based on the provided evidence, the likelihood of *Scaphoideus titanus* entering the United Kingdom associated with imported *Vitis* planting material is considered **moderately likely**. This conclusion is supported by the substantial volume of *Vitis* imports from EU countries where the pest is present, the demonstrated role of planting material in facilitating long-distance dispersal across Europe, and the capacity of the pest to remain undetected in the egg stage on dormant canes. Although phytosanitary measures such as hot water treatment may reduce the risk, uncertainties remain regarding the consistent application and effectiveness of these practices across all consignments. Furthermore, ornamental *Vitis* imports present an additional, less predictable likelihood of entry due to their suitability for pest association and unknown proximity to commercial vineyards or wild *Vitis* spp, such as *V. vinifera*, *V. riparia*, and *V. vulpina*. Overall, the volume of trade, the biology of the pest, and historical patterns of spread collectively indicate a moderately likely risk of entry via this pathway.

The other pathway for entry assessed was hitchhiking and is currently seen as **unlikely with medium confidence**.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Vitis propagating material* | Very unlikely | ☐ | Unlikely | ☐ | Moderately likely | ✓ | Likely | ☐ | Very likely | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ✓ | Low Confidence | ☐ | | ☐ | | ☐ |
| *Ornamental Vitis plants for planting* | Very unlikely | ☐ | Unlikely | ☐ | Moderately likely | ✓ | Likely | ☐ | Very likely | ☐ |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Confidence* | High Confidence | ☐ | Medium Confidence | ☑ | Low Confidence | ☐ | | ☐ | | ☐ |
| *Hitchiking* | Very unlikely | ☐ | Unlikely | ☑ | Moderately likely | ☐ | Likely | ☐ | Very likely | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ☑ | Low Confidence | ☐ | | | | |

### Other pathways not assessed

The movement of *Vitis* plants and propagating material, and hitchhiking have been identified as the primary pathways of entry (Tramontini *et al.*, 2020). There are other pathways that could be considered, such as produce (e.g., table grapes, vine leaves), cut branches and plant parts of *Vitis*, and other plants for planting (e.g., *Ulmus*). However, these pathways are not considered significant. *Scaphoideus titanus* is not known to be associated with produce or other hosts for long periods of time, and cut branches of *Vitis* are not considered a major import. Therefore, these pathways have not been discussed in further detail or officially rated.

## 10. If the pest needs a vector, is it present in the UK/PRA area?

*Scaphoideus titanus* is a free-living organism and does not require a vector. However, parts of this PRA focus on FDp and the role of *S. titanus* as its vector. Neither of these organisms are currently present in the UK.

## 11. How likely is the pest to establish outdoors or under protection in the UK/PRA area?

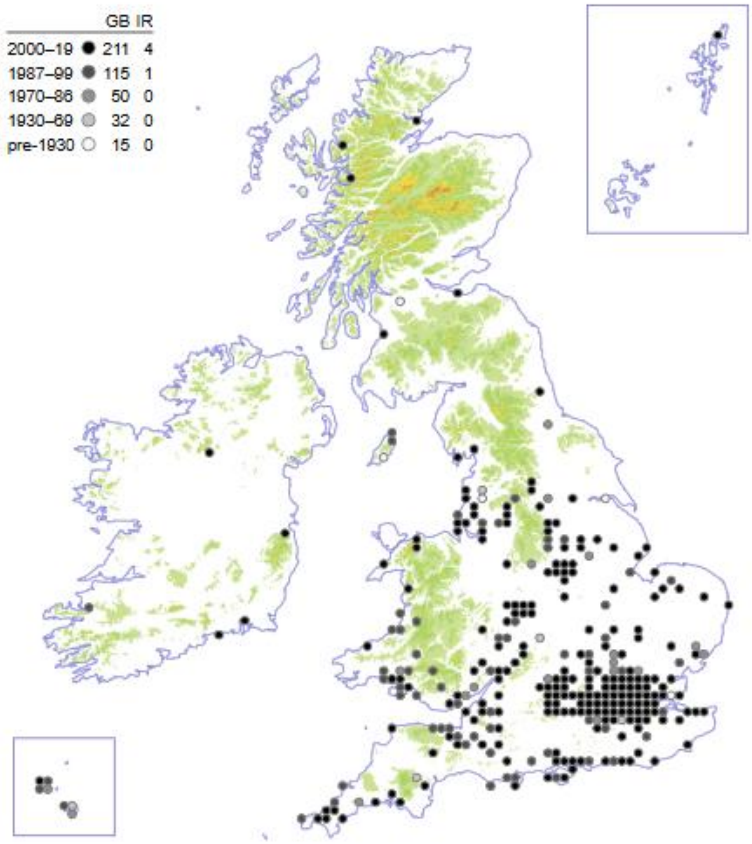
Similar to section 9, this section will consider the establishment of *S. titanus* alone and will not discuss the possible establishment of FDp at length. For this PRA, it can be assumed that areas suitable for the establishment of *S. titanus* will also allow the development and spread of FDp.

### Outdoors

### Host distribution

*Vitis vinifera* has a relatively large distribution in the UK, with large numbers being recorded in the southeast of England. Some grapevine is naturalised in the UK, growing on walls, in hedges, and along riverbanks and railways. Figure 1 shows a map of *V. vinifera* in the UK, which is assumed to be primarily wild plants (where the distribution differs slightly to registered vineyards in Figure 2). Several other introduced species of *Vitis* are found in the UK, such as *V. coignetiae*, *V. riparia*, *V. vulpina*, but these are less recorded (Stroh *et al*., 2024). Should *S. titanus* come into contact with these wild plants, there is a high risk of establishment in the wider environment, but potential spread would depend on the aggregation of *Vitis* species.

**Figure 1. Map of the UK with distribution of *Vitis vinifera*. Provided by plantatlas2020.org**




In the UK, there are 1104 registered vineyards, covering around 4,200 hectares (winegb.co.uk, 2024). Figure 2 shows the distribution of these vineyards across the UK. It should be noted that many of these vineyards are very small, with only 100 exceeding 10 ha, and more than half with an area less than 2 ha. Vineyards are likely to pose a larger risk for establishment, due to the aggregation of *Vitis* and often dense canopies, which allow leafhopper movement. Additionally, the presence of wild *Vitis* in vineyard borders or abandoned vineyards may offer an undisturbed refuge for *S. titanus*. Some cultivars are less desirable to *S. titanus*, but there are no resistant cultivars available, so all vineyards are potentially at risk. The presence of these vineyards indicates that host distribution in parts of the PRA area is suitable for the establishment of *S. titanus*.

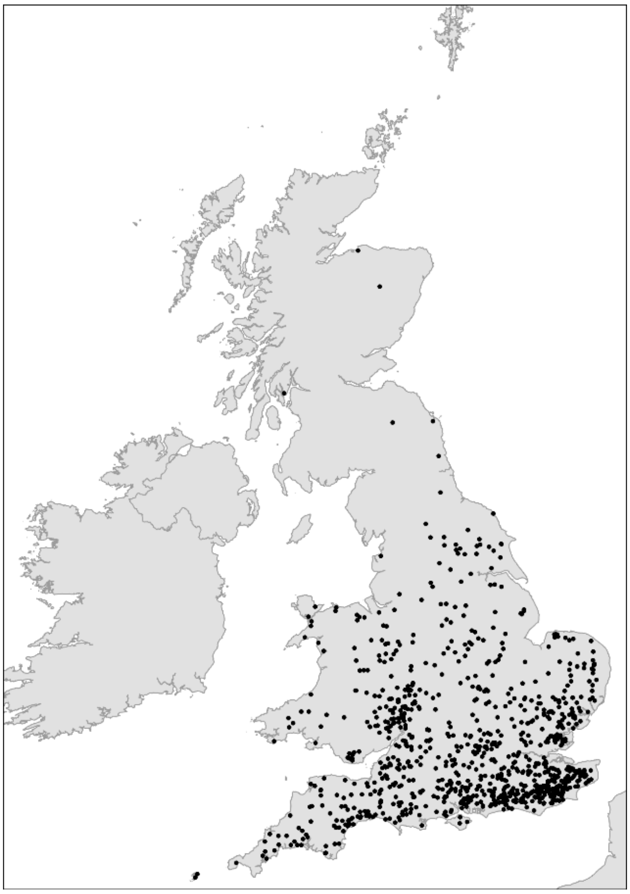


**Figure 2. Map of UK with registered vineyards, as of August 2025. One dot represents a vineyard. Data sourced from GBwines.co.uk.**

## Climate

*Scaphoideus titanus* has been recorded in North America under different climatic conditions, including the hot, humid states of Florida and Georgia, and the colder areas such as Maine (USA) and New Brunswick (Canada) (Barnett, 1976). From this, we can infer that *S. titanus* is able to develop under a wide range of climatic conditions and establishment in the UK would not be limited by climate, although, as discussed in section 5, due to taxonomic revisions and similarity with other leafhoppers, the exact distribution of *S. titanus* in North America is uncertain.

Further evidence to support the suitability of the UK climate for *S. titanus* is the ecoclimatic models produced by ACRP (2013) and Jeger *et al.* (2016). As a part of risk assessments for FDp, CLIMEX modelling studies have been used to model the establishment potential of *S. titanus* in Europe. Risk of establishment is represented by an ecoclimatic index (EI), where an EI value of >20 indicates suitability to climatic conditions, according to the authors of Jeger *et al.* (2016). The models produced by both projects strongly suggest that *S. titanus* is likely to be able to establish over most of the EU territory and, in particular, in all northern and central European grapevine-growing areas, including the southern parts of the UK. While the EI for the UK is on the lower boundary of suitability (~20), this number has also been estimated for parts of France where the vector has already established. It is important to note this data has low resolution so is unlikely to identify warmer and cooler areas. Vineyards in the UK are often situated in areas with a warmer microclimate, for example south facing valleys, these areas would be suitable for establishment but unlikely to be seen in these climate models. There are some differences between the models proposed by ACRP (2013) and Jeger *et al.* (2016), but this is most likely due to the use of different climate data. ACRP (2013) states the use of 'current climate data' but exact figures are not presented, but it could be the default CLIMEX data from 1961-1990, whilst the EFSA paper (Jeger *et al.*, 2016) states they used climate data from 1999-2010. For this PRA, the EFSA model will be used for scoring. From this model, we can rate the likelihood of *S. titanus* establishment in the UK as likely (Figure 3).

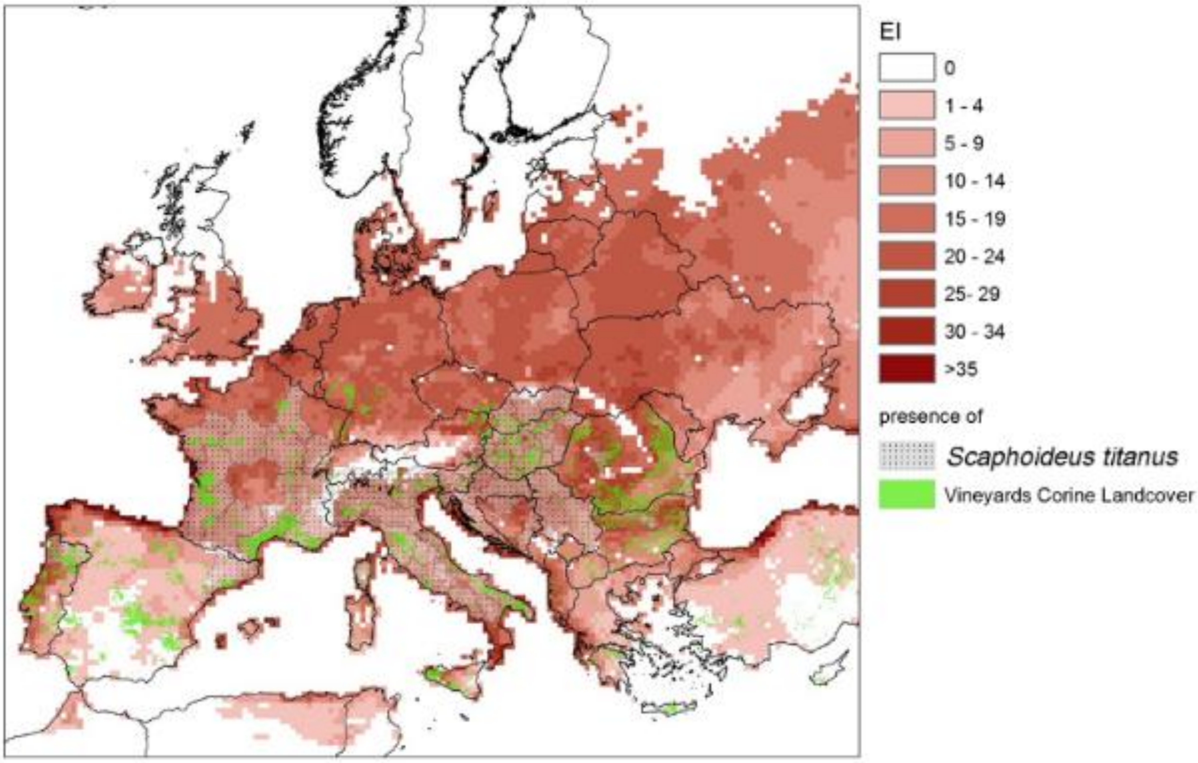



**Figure 3. Predicted suitability for establishment of *Scaphoideus titanus* in Europe based on climate data 1999-2010 modelled with the CLIMEX software combined with vine-growing areas in Europe (Jeger *et al.*, 2016). Reproduced under Creative Commons Attribution-NoDerivs License.**

For *S. titanus* development, ACRP (2013) identified the optimum temperature at 24°C.This suggests that in the UK, development of *S. titanus*, while possible, would not be optimal, and the UK could experience smaller or less fit populations. In areas with sub-optimal temperatures, there may be increased mortality, limiting the next year's populations (Falzoi *et al.*, 2014). This does not limit the likelihood of establishment but may influence potential impacts.

Current climatic suitability in the UK can be shown by using the CLIMEX model indices of *S. titanus*, specifically the Degree Day (DD) threshold calculated from populations in Austria. With the use of current climate data from the MET Office, we can provide a more detailed map of suitable areas in the UK (Figure 4). These results support the previous mentioned models which identified large parts of England and Wales as being able to support the development of *S. titanus*. The dates provided indicate the estimated emergence dates of adults. Emergence in August highlights that UK temperatures may not be optimal, as emergence usually occurs from June to July, but this timeframe is expected to allow establishment. This is further examined in Figure 5, where development temperature thresholds are compared to previous years in the UK. In the 1990s, there was generally insufficient accumulated warmth for nymphs to develop to adults, but in recent years, temperatures have been high enough to allow complete development and oviposition. Where years are colder, for example 2019, oviposition would likely not be possible and could lead to population reduction and possibly prevent another generation. Based on this analysis, the climate in the southeast of England is becoming more favourable for *S. titanus*. However, a cool year could mean that adults do not develop, and females fail to lay eggs, possibly limiting long-term establishment of *S. titanus* in the UK.

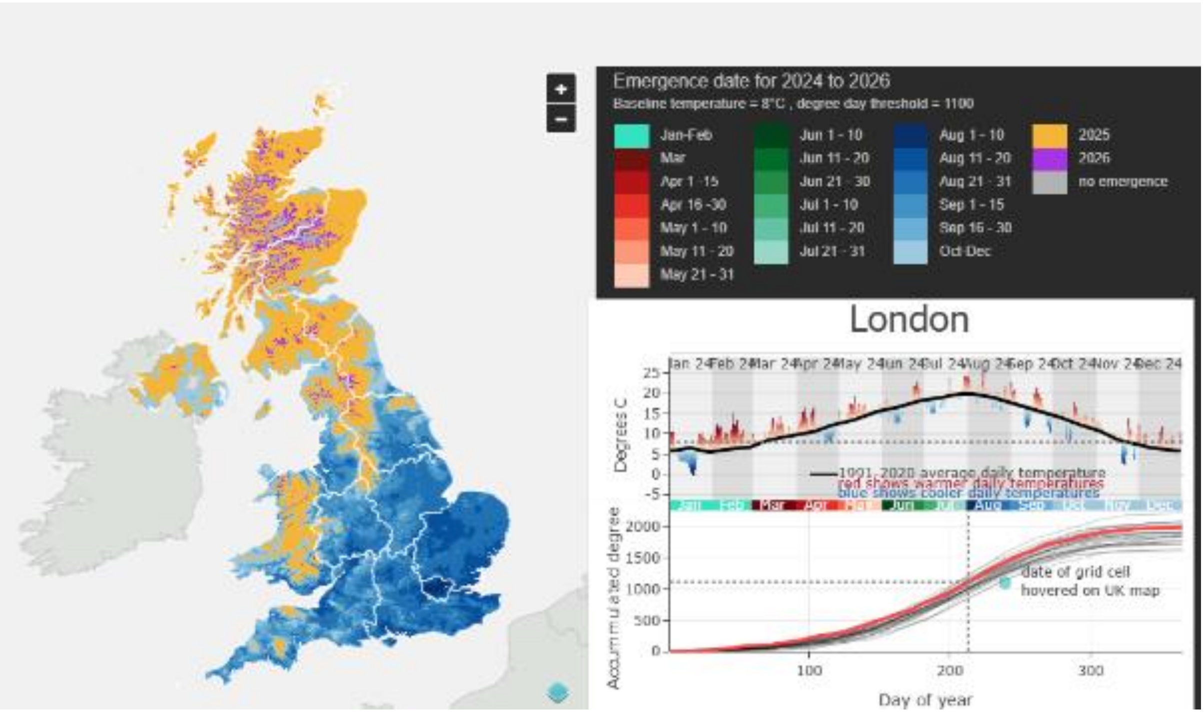



**Figure 4. Map and chart displaying the approximate emergence dates of *Scaphoideus titanus* adults. Model based on data provided by (ACRP, 2013) (base temperature = 8°C, Degree Day threshold = 1100 DD). Model produced using the Met Office UK Climate-Pest Risk Web Tool.**

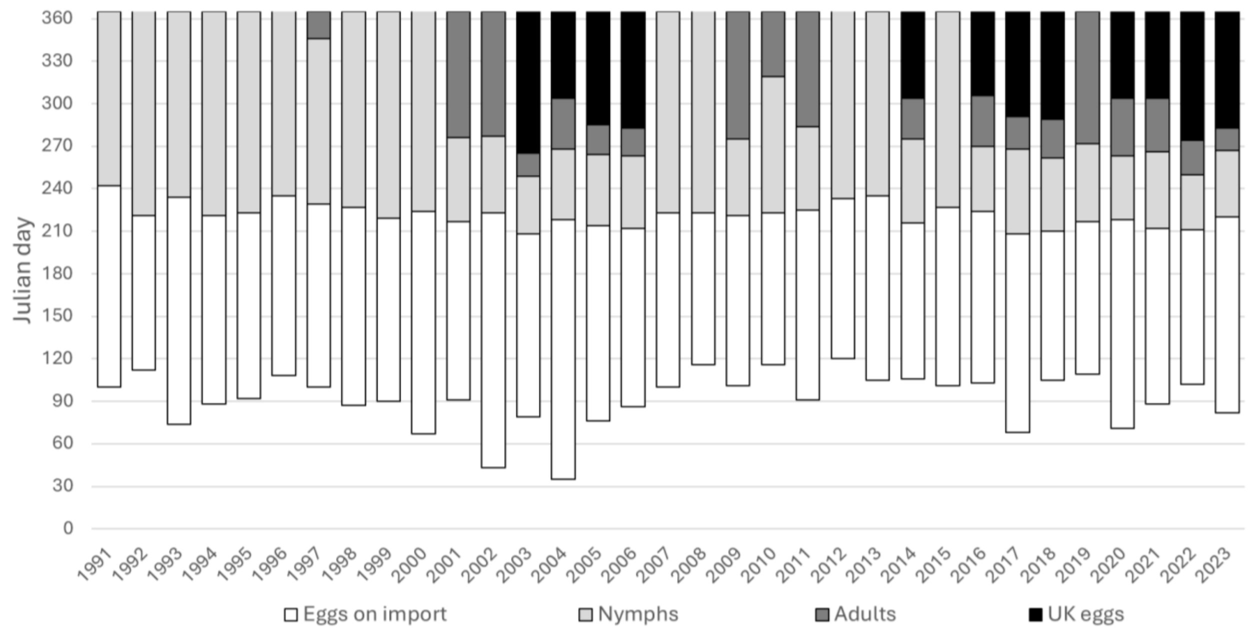



**Figure 5. Chart displaying hypothetical developmental timings of *Scaphoideus titanus* in southeast England from 1991 to 2022. This chart was produced by comparing temperature threshold data from Falzoi *et al.* (2014) and the daily temperature data from SE England from the Met Office UK Climate-Pest Risk Web Tool.**

**Outdoor establishment is rated as likely with medium confidence.**

## Under protection

Leafhoppers are a common pest issue for protected cultivation and can be vectors of a variety of plant diseases that may impact plant health and growth. However, *S. titanus* can only complete its lifecycle on *Vitis*, and as vines are not grown under protection commercially, *S. titanus* is not considered a pest of protected cultivation.

*Vitis* plants may also be grown in conservatories or glasshouses by hobbyists or in polytunnels by small domestic growers. For smaller scale grapevine production, rooted cuttings or grafted vines may be grown in a controlled environment to support root development and shoot production. It would be difficult to estimate the amount of *Vitis* plants currently being grown under these conditions. However, these *Vitis* populations are likely to be small and isolated. Any *S. titanus* populations that become established would also be isolated and possibly transient, where populations are likely to die out or be killed by pest management. Where populations under protection could establish, the ability of this pest to move from these areas to vineyards is unknown.

While some exceptions exist, grapevine production does not often occur under protection, therefore, **establishment under protection is rated as very unlikely with medium confidence.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Outdoors* | Very unlikely | ☐ | Unlikely | ☐ | Moderately likely | ☐ | Likely | ✓ | Very likely | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ✓ | Low Confidence | ☐ | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Under Protection* | Very unlikely | ✓ | Unlikely | ☐ | Moderately likely | ☐ | Likely | ☐ | Very likely | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ✓ | Low Confidence | ☐ | | | | |

# 12. How quickly could the pest spread in the UK/PRA area?

## Natural spread

The natural spread of *Scaphoideus titanus* is generally considered slow and spatially limited, largely influenced by the proximity of vineyards and the presence of wild *Vitis* species in the landscape. This leafhopper is not a strong flier, with typical dispersal distances of approximately 20 to 40 meters, although occasional long-range dispersal events up to 330 meters have been recorded (Lessio *et al.*, 2014). In an EPPO (2025) datasheet, a yearly spread of 5 to 10 km is reported in southwest France, although no further reference is provided, so this remains uncertain and possibly linked to human-assisted spread. Natural spread may also be affected by wind-assisted dispersal; however, *S. titanus* generally flies at low heights and is unlikely to be carried by strong winds. Nonetheless, wind is hypothesized to have facilitated spread between Slovenia and Austria (Steffek *et al.*, 2007).

The vector's flight activity is primarily crepuscular or nocturnal, peaking between late afternoon and early morning, and is strongly dependent on photoperiod and temperature. Flight activity increases with daily minimum temperatures, with maximum adult captures observed above 22°C, though the precise minimum temperature for flight initiation remains unclear (Chuche & Thiéry, 2014). This may suggest that the spread of *S. titanus* in the UK would be limited, especially where adult emergence is estimated for mid to late August.

Within vineyards, *S. titanus* movement tends to be restricted to the canopy, primarily along vine rows rather than across, and is influenced by vine density and canopy structure. Additionally, *S. titanus* exhibits an aggregated spatial distribution, where higher population densities are observed in the central areas rather than the borders. It was found that under normal wind conditions, *S. titanus* did not spread significantly outside the vineyard within a 24 m radius. Therefore, it appears unlikely that a vineyard would become colonised when no other vineyards are nearby (Lessio & Alma, 2004). However, it is suggested that the leafhopper may use ecological corridors and wild *Vitis* spp. to spread to other vineyards (Lessio *et al.*, 2014).

Due to the leafhopper's limited flight capacity, preference for central areas of the vineyard, and lower UK temperatures, **natural spread capability is rated as slowly with medium confidence**.

## With trade/hitchhiking

As discussed in section 9, human-mediated spread is thought to be the driving force behind the spread of *S. titanus* throughout mainland Europe. This is thought to be primarily through *Vitis* propagating material. It is not known whether similar spread would be observed in the UK. Due to the unfavourable climate, rootstocks and canes are seldom produced in the UK, and most propagating material is imported. Should *S. titanus* become established in the UK there are some potential pathways of trade that would allow spread. Some commercial vineyards in the UK may supply imported propagating material to other vineyards, but it is considered unlikely that this material would be placed in proximity to an established vineyard and allow exposure to plants pests. Additionally, sometimes a grower may sell their own established vines to other vineyards, especially when selling up or pursuing a different business, but it is unknown how often this happens. Propagating material and plants being traded in the UK must be certified with a plant passport and inspected for pests prior to movement, but this measure may not be sufficient to detect overwintering eggs laid underneath the bark of the plants.

Hitchhiking on vehicles and machinery may allow faster spread of *S. titanus* in the UK. This pathway was identified in the EFSA pest survey card, although no evidence is provided to suggest this pathway is significant. Spread of *S. titanus* along highways has been reported from Tretino, Italy (Steffek *et al.*, 2007), but direct experimental proof for spread via cars, trains, or farm machinery has not been published. There is research that supports the dispersal of invasive insect species via hitchhiking, such as the paper by Elsensohn *et al.* (2024) concerning the Spotted lanternfly (*Lycorma delicatula*), but the risk for *S. titanus* specifically is unknown.

**Spread with trade is rated as slowly with medium confidence.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Natural Spread* | Very slowly | ☐ | Slowly | ✓ | Moderate pace | ☐ | Quickly | ☐ | Very quickly | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ✓ | Low Confidence | ☐ | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *With trade/hitchhiking* | Very slowly | ☐ | Slowly | ✓ | Moderate pace | ☐ | Quickly | ☐ | Very quickly | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ✓ | Low Confidence | ☐ | | | | |

## 13. What is the pest's economic, environmental and social impact within its existing distribution?

The impacts caused by *S. titanus* populations in the absence of FDp are negligible, as seen from the North American populations. Therefore, this section and section 14 will discuss the impacts of FDp, with *S. titanus* acting as the vector and allowing efficient spread.

### Reduced yield, vine loss, and quality reduction

FDp may cause a variety of symptoms that are detrimental to the grapevine plants, including a reduced root system, stunted shoots, reduced leaf size, premature leaf drop, absence of grape bunches, dieback, and death of the plant. Depending on the cultivar, plant vigour, presence of other pathogens, and intensity of infection, yield may decrease dramatically (Tramontini *et al.*, 2020) with a decrease between 51% to 92% compared to healthy plants reported in some cases, resulting in a lower number of bunches and decreased bunch weight (Oliveira *et al.*, 2019). After infection, plants either die or recover. Productivity of recovered vine remains lower than that of healthy, uninfected vines, but are still more productive than symptomatic vines (Morone *et al.*, 2007).

Furthermore, grapes may show delayed or uneven ripening, lower sugar content, and higher acidity. This affects the taste and quality of the grapes, reducing value and marketability. It is believed that this impact to wine and table grapes quality is a minor impact compared to the direct quantitative impact on production (Tramontini *et al.*, 2020).

### Increased management costs

When FDp is uncontrolled and allowed to spread, there can be 'catastrophic' consequences. When no control of *S. titanus* is undertaken, the number of infected vines may increase steadily by 10-fold every year and reach an 80-100% infection rate within a few years (Steffek *et al.*, 2007). For example, from 1949 to 1954 in Armagnac and Chalosse (France), all Baco 22A grapevines became infected, leading to a reduction in productivity and yield (EPPO, 2025). Therefore, the control of FDp and its vector, *S. titanus*, is important.

The cost of control can be significant. Primarily, the application of insecticides can be expensive, especially where multiple applications are necessary. In Switzerland, FDp was reported in Ticino, and the two mandatory buprofezin treatments cost €250,000 alone (Chuche & Thiéry, 2014). Exact details of this outbreak treatment are unverified but is possibly from the control completed in 2007, which included spraying over a total surface of 600 ha of vineyards, averaging a cost of €460 per ha (EPPO, 2007).

There is an obvious economic loss when a large portion of a vineyard is already infected with FDp, and the only option available is destruction. This was seen in Serbia, where vineyard destruction in response to FDp led to a loss of approximately €3.2 million in 2005

(Steffek *et al.*, 2007). Additionally, the replacement of vineyards can be expensive. In northeast Italy, the average annual cost of replacement was estimated at €6.50 per plant for a 5-year-old productive vineyard planted with the cultivar “Perera” at 1,500 plants $ha^{-1}$ with a 13 t $ha^{-1}$ yield (Pavan *et al.*, 2012). This cost can vary with cultivar, vineyard management, yield, and age of the vineyard.

There are also indirect losses from FDp infection. In Piedmont (Italy), from 1999 to 2003, an estimated €1.5 million per year was spent in disease control programs. In addition, in 2005, the Italian government and European Union compensated affected growers with €34 million for yield losses and replanting (Belli *et al.*, 2010). Even when controlled, the estimated yield loss of FDp under current management practices is estimated at 0.5-1% of the EU wine and grape production (Jeger *et al.*, 2016).

## Regulatory compliance costs and trade impacts

In the EU, due to the status of FDp as a quarantine organism included in the Commission Implementing Regulation (EU) 2019/2072, Annex II, Part B, if FDp is found in a vineyard or place of production such as a nursery, statutory action must be taken. Vineyards in an affected area must comply with strict phytosanitary regulations, including monitoring and control of the vector, *S. titanus*. Import restrictions and additional regulations can also be imposed on a country level, possibly leading to fines or restrictions on grape sales if compliance is not met. Additionally, the movement of plant material is restricted due to the loss of authorisation for plant passports, causing issues for nurseries and propagating businesses (Tramontini *et al.*, 2020). The presence of FDp in wine-producing regions may also lead to a loss of reputation and a loss of revenue.

## Environmental impacts

There are no environmental impacts reported for *S. titanus* or FDp, mostly due to their narrow host range. They may infect a few other hosts, for example, *S. titanus* may feed on *Crataegus* spp., *Prunus* spp., *Ulmus* spp., etc. (Chuche & Thiéry, 2014), and FDp has been found to naturally infect *Alnus* spp., *Clematis* spp., *Salix* spp., etc. (EPPO, 2025). However, damage to these hosts has not been reported and appears unlikely, meaning there are no suggested impacts to biodiversity. In parts of Europe, such as Germany, there is the concern that control strategies, such as the removal of wild *Vitis* spp., that may act as FDp reservoirs, could result in the loss of rare, ancestral wild *Vitis vinifera* subsp. *sylvestris* populations.

The use of insecticides to control *S. titanus* may have a detrimental impact on non-target insect populations. As well as persistence in soil, contamination of the environment, appearance of resistant pathogenic strains, and potential negative impacts on human health (Oliveira, 2021). Currently, this has not been recorded specifically in relation to *S. titanus* treatments.

## Social impacts

Social impacts are often underreported in papers, so estimation of the current impacts of FDp is difficult. Regardless, it is certain that FDp is endangering viticulture in some regions where wine production is very important. High incidence rate of FDp can lead to complete or partial destruction/closure of vineyards (Steffek *et al.*, 2007). While not specifically reported, the loss of vineyards may have an impact on employment, either directly for vineyard roles (pruning, harvesting, cellar work) or indirectly to related services in the wine industry, such as guides, hospitality, and local producers. Additionally, the loss of vineyards and/or a loss of grape quality can result in a loss of reputation for some wine-producing regions, and a subsequent reduction in tourism. These are important, not only to the grape and wine producers but also to the local community.

Impacts from flavescence dorée phytoplasma, vectored by *Scaphoideus titanus*, in its current range are **rated as large with high confidence**.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Impacts* | Very small | ☐ | Small | ☐ | Medium | ☐ | Large | ☑ | Very large | ☐ |
| *Confidence* | High Confidence | ☑ | Medium Confidence | ☐ | Low Confidence | ☐ | | | | |

# 14. What is the pest’s potential to cause economic, environmental and social impacts in the UK/PRA area?

## Economic

Viticulture is a fast-growing industry in the UK. In 2024, the Food Standards Agency Wine Team registered 1,030 commercial vineyards, around 4,209 hectares, belonging to 221 wineries. In 2023, 87 new vineyards were registered, highlighting the rapid growth of wine growing in the UK. Additionally, WineGB reported sales of UK wines have increased consistently since 2018, with a 10% sales increase from 2023 to 2024 (winegb.co.uk, 2024). A market research report estimated the UK wine industry generated £422.4 million in revenue in the 2024-25 fiscal year (Atere, 2025). Domestic wine production most likely attributes to a small portion, but this is expected to increase in the future.

Damages to the UK viticulture industry could be similar to those recorded in Europe. Primarily, the introduction of FDp leading to yield reduction and crop destruction, either from direct pathogen damage or as a result of statutory action in response to an outbreak. This may lead to increased production costs from the replacement of infected plants and the increased management of the leafhopper vector. Additionally, outbreaks may lead to monitoring, containment, and eradication programs led by the Government, resulting in increased public spending, as seen in Piedmont, Italy (Belli *et al.*, 2010). There is also the concern of wine quality being affected, reducing market value.

The introduction of *S. titanus* and FDp may also have indirect impacts on the viticulture industry. As wine production increases in the UK, there is also an increase in wine tourism, especially for regions such as Kent, Sussex, and Cornwall. In addition to direct loss of customers for wineries, losses in this area can impact related industries such as bottling, distribution, retail, and hospitality.

However, impacts for the UK are likely to be lower than impacts reported from the pest's existing distribution. Primarily, the viticulture industry in the UK is still considered small, especially compared to many European countries such as France, Italy and Germany. Damages for individual growers could be high but economic impacts for the whole of the UK would be limited. Additionally, the UK climate is deemed suitable for pest establishment, especially in the southeast of England, but UK temperatures are considered suboptimal. This could limit population levels, reducing the opportunity for transmission of FDp, and limiting natural spread.

**Potential economic impacts are rated as medium with medium confidence.**

## Environmental

The possible environmental impacts of *S. titanus* and FDp are expected to be limited in the UK. Wild *Vitis* is not a key component to the UK environment and has little significance to the UK's ecosystem. Any environmental impact is likely to originate from the use of chemical control for the leafhopper vector. An increased use of pesticides could negatively impact non-target organisms, and potential runoff could lead to soil degradation and water pollution. Additionally, increased pesticide use may lead to higher chemical resistance in pest populations, which is becoming a serious agronomic issue. However, potential impacts would be limited with the use of an Integrated Pest Management strategy and proper regulation of chemical controls.

**Potential environmental impacts are rated as small with medium confidence.**

## Social

Social impacts are likely to be most significant for rural communities with strong ties to local wineries which provide employment opportunities and revenue, as well as cultural identity in some areas. Introduction of FDp and subsequent damage to the viticulture industry may result in loss of employment, economic decline, and reduced attendance to wine festivals and vineyard tours, causing agritourism to suffer. Introduction of FDp may also alter the public perception of UK viticulture, where reporting of outbreaks could decrease consumer confidence in the safety and/or quality of UK-produced wine. As well as public opposition to increasing chemical control in response to outbreaks and the disapproval of biosecurity failures.

**Potential social impacts are rated as medium with low confidence.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Economic Impacts* | Very small | ☐ | Small | ☐ | Medium | ☑ | Large | ☐ | Very large | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ☑ | Low Confidence | ☐ | | | | |
| *Environ - mental Impacts* | Very small | ☐ | Small | ☑ | Medium | ☐ | Large | ☐ | Very large | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ☑ | Low Confidence | ☐ | | | | |
| *Social Impacts* | Very small | ☐ | Small | ☐ | Medium | ☑ | Large | ☐ | Very large | ☐ |
| *Confidence* | High Confidence | ☐ | Medium Confidence | ☐ | Low Confidence | ☑ | | | | |

## 15. What is the pest's potential as a vector of plant pathogens?

*Scaphoideus titanus* is considered a vector of plant pathogens, specifically flavescence dorée phytoplasma. *Scaphoideus titanus* is a phloem feeder, nymphs prefer to feed on the small veins of the leaf blade while adults feed more readily on the larger veins or petioles (Chuche & Thiéry, 2014). In spring, phytoplasmas already present in the plant colonise the growing leaves via the phloem, producing a source of infection for *S. titanus*. The phytoplasma is drawn from the phloem by the insect's stylet, passing through the intestinal barrier, where it joins the hemolymph. There is an incubation period of 30-45 days as the phytoplasma multiplies and colonises the body (Alma *et al.*, 2018). Once the concentration of the phytoplasma in the salivary gland reaches a sufficient level, the leafhopper becomes infectious and is capable of transmitting the phytoplasma to a healthy plant. The leafhopper remains infectious for life.

Due to its narrow host range of *Vitis* spp., *S. titanus* is considered the most efficient vector of FDp, where it is more likely to have continuous contact with infected and healthy plants, increasing likelihood of transmission.

Other Auchenorryncha species have been observed transferring FDp, but their importance is either unknown or believed to be very limited. These include:

- *Dictyophara europaea*: Has demonstrated ability to transmit FDp from *Clematis vitalba* to grapes in natural conditions (Filippin *et al.*, 2009), although *Vitis* is not among its preferred hosts (Lessio & Alma, 2008). This leafhopper is not known to occur in the UK.
- *Orientus ishidae*: Ability to vector FDp confirmed in laboratory experiments (Lessio *et al.*, 2016), although with limited efficiency compared with *S. titanus*. This leafhopper does not move frequently into vineyards and is therefore considered only a very occasional vector of FDp (Lessio *et al.*, 2019). This leafhopper is

believed to be present in the UK but with a restricted distribution. It was first recorded in London in 2011, with a few findings every year on inaturalist.org.

- *Phlogotettix cyclops*: Transmission trials have shown the ability to acquire FDp from *Clematis vitalba* and transmit FDp to *Vitis* spp. However, further studies are needed to verify whether this species serves as a vector of FDp between *Vitis* plants in the field (Strauss & Reisenzein, 2024). It is not known to occur in the UK.

## 16. What is the area endangered by the pest?

The areas endangered by *S. titanus* (infected with flavescence dorée phytoplasma) are vineyards, which are widespread in the UK but mostly distributed across the south of England (Figure 2). A higher density of vineyards in an area may allow faster spread of *S. titanus*, compared to relatively isolated vineyards. Additionally, the climate in the southeast of England is suitable for establishment and conditions are likely to become more favourable with climate change. The climate in much of Wales, Scotland and Northern Ireland is considered too cool for establishment (highlighted in Figure 4). Therefore, vineyards in the south of England, and especially the southeast, are most at risk.

# Stage 3: Pest Risk Management

## 17. What are the risk management options for the UK/PRA area?

### Regulation

*Scaphoideus titanus* is currently listed as a Provisional Quarantine pest for GB, where statutory action is taken against any findings. Flavescence dorée phytoplasma is a quarantine pest for all parts of the UK; therefore, plants for planting of *Vitis* from EU member states, Liechtenstein, and Switzerland are subject to special requirements. These include: (a) originating from an area known to be free of FDp; (b) originate from a site of production where no symptoms have been observed, monitoring and control of FDp vectors have been carried out, and no symptoms have been observed from abandoned *Vitis* in the vicinity; or (c) have undergone hot water treatment.

As *S. titanus* is the primary vector of FDp, direct monitoring and control of this leafhopper is required for the import of *Vitis* plants for planting in areas where FDp is present. Additionally, the use of hot water treatment for the eradication of FDp for plants and rootstocks has also been shown to be effective at killing *S. titanus* eggs. The submersion of wood, scions, and rootstocks in 50°C water for 45 minutes is very effective for the treatment of FDp and is effective in killing *S. titanus* eggs on 1-year-old material. Eggs on 2-year-old material may not be fully controlled (Schaub *et al.*, 2010). However, these requirements do not apply if FDp is not known to occur in the area where the plants originate. The distribution of *S. titanus* is currently believed to be larger than FDp; in certain areas, pre-export requirements may not be seen as necessary, allowing a higher risk of vector association with material. On the other hand, *Vitis* propagating material is often imported from ‘trusted’ growers that will routinely inspect material and conduct hot water treatment, even when FDp is not known to occur. Nevertheless, specific measures concerning *S. titanus* would reduce the risk of importing this pest from areas where it is known to occur and FDp is not known to occur.

## Eradication

The control of *S. titanus* with insecticide applications and removal of infected vines remain the best control options for managing FDp in mainland Europe. However, *Scaphoideus titanus* has never been fully eradicated from any region where it has become established. Complete eradication remains difficult for a few reasons. The detection of *S. titanus* can take multiple years, depending on monitoring and surveillance intensity, allowing the leafhopper to spread at low density until the surrounding area is completely infested. Leafhoppers are capable of dispersing between vineyards and surrounding vegetation, which can act as reservoirs for leafhopper populations. Therefore, eradication would require large-scale control of multiple vineyards and the surrounding vegetation, which is often not practical.

## Control

### Monitoring

There are multiple techniques for monitoring populations of *S. titanus*. These primarily involve counting the number of nymphs on the underside of leaves, after beating, or using a suction apparatus, as well as the use of sticky traps, although the last two techniques are used preferentially for adults, and may not be effective at monitoring nymphal instars, which are the target for insecticide treatment. Often, accurate morphological identification of leafhoppers requires examination of genitalia. However, reports from inspectors in Italy state that the distinctive colouring and size of *S. titanus* allows easy identification and separation from other leafhoppers. There are good identification keys to the species found in central Europe, but *S. titanus* is unlikely to be included in British Hemiptera keys (Chris Malumphy, personal communication).

### Treatment

When *S. titanus* is suspected or identified, area-wide monitoring of all life stages is necessary to estimate population size and identify the proper timing of insecticide application. The most common strategy is two insecticide sprays, when there is a large population of *S. titanus* and/or a high number of symptomatic grapevines occur in the vineyard. The first spraying is applied when third instar nymphs are dominant in the population, and the second spraying about two weeks later to suppress newly hatched nymphs (Gonella *et al.*, 2024b). Third instars are targeted for insecticide treatment as this stage is near the end of the latency period, after which they become infective. More than one insecticidal spray is needed due to the prolonged egg-hatching period, which lasts for over 45 days (Tacoli *et al.*, 2017). Although, in areas with warm winters, the egg-hatching period is prolonged further (up to 3 months), therefore these areas would require multiple sprays to target all stages. When low levels of *S. titanus* are present, one application before adult emergence may be sufficient. An additional insecticide treatment of the vineyard borders, e.g., natural vegetation and abandoned vineyards, in late summer is recommended (Bocca *et al.*, 2020). Insecticide applications should be area-wide, rather than multiple applications, as this leads to a greater reduction in *S. titanus* populations (Gonella *et al.*, 2024b).

There are predictive models that can be used to predict the occurrence of the third nymphal instar (Rigamonti *et al.*, 2011), although it is important to note that application of these models to a new area such as the UK may be problematic. Several factors would need to be considered for an accurate model in a new area, such as vector adaptability to new temperature regimes, multiannual infestation patterns, and the potential effects of climate change (Gonella *et al.*, 2024b).

Previously, organophosphates such as chlorpyrifos-ethyl and chlorpyrifos-methyl, and neonicotinoids such as thiamethoxam, were used for control of *S. titanus*, due to their high contact ability and persistence, allowing 90% efficacy. However, in 2018, these active ingredients were withdrawn from the European market due to concerns of toxicology and ecotoxicology issues (Gonella *et al.*, 2024b). Control is now based on pyrethroids (e.g., etofenprox, deltamethrin, taufluvalinate), butelonides (e.g., flupyradifurone), or other neonicotinoids (e.g., acetamiprid). In a 2023 study of conventional and organic pesticides, etofenprox and deltamethrin were identified as the most effective conventional pesticides and pyrethrins in terms of organic insecticides (Prazaru *et al.*, 2023). However, due to changing regulations on insecticides, advice should be sought from Health and Safety Executive on the current appropriate insecticides to use.

## Cultural control

Managing the crop

Cultural control can also be used to reduce populations of *S. titanus;* these include destruction of branches from winter pruning, as they may host leafhopper eggs (Bagnoli & Gargani, 2011), and removal of suckers, the preferred feeding site of nymphs (Chuche & Thiéry, 2014). Growers should also remove the leaves from fruiting parts of the plant (Bunch leaf zone removal) as this may improve insecticide coverage and remove the favourable effects of a dense canopy. Additionally, the removal of wild *Vitis* plants in the area surrounding a vineyard and the removal of abandoned vineyards can reduce leafhopper populations and remove potential FDp reservoirs (Pavan *et al.*, 2012; Lessio *et al.*, 2014).

Tolerant varieties

There are currently no known cultivars of grapevine that are thought to be resistant or immune to either FDp or feeding damage from *S. titanus*. However, some cultivars have shown tolerance to FDP, such as Brachetto, Merlot (Eveillard *et al.*, 2016), and Tocai Friulano (Angelini *et al.*, 2024). This tolerance is thought to be the result of varying effectiveness of passive and active defence responses, and the possible ability to compartmentalise the phytoplasma and prevent spread to the rest of the plant (Casarin *et al.*, 2023; Angelini *et al.*, 2024). It is important to note that these cultivars, while experiencing fewer symptoms, may still act as a source of FDp inoculum for susceptible cultivars if grown nearby (Eveillard et al., 2016). Additionally, there are some cultivars that are less attractive to *S. titanus*. This may be due to chemical processes such as antibiosis and antixenosis defence mechanisms (Ripamonti *et al.*, 2022a). Projects such as BIORES (Natural and BIOtechnological genetic RESistances against flavescence dorée for vineyard sustainability) are looking to better understand the genetic basis of FDp tolerance in the hopes of producing resistant or more tolerant grapevine cultivars. Currently, while the use of tolerant cultivars may help to limit the risk of yield losses, the control of *S. titanus* with insecticide applications and removal of infected vines remain the best control options.

Biological controls

An alternative control strategy currently being explored is the use of biocontrol agents. Several natural enemies associated with *S. titanus* have been identified, found both in the native and introduced areas. But they have shown limited effectiveness with parasitism/predation rates below 1% (Gonella *et al.*, 2024b). However, there are new species being discovered with potential as biocontrol. For example, the cuckoo wasp (*Elampus bidens*), a parasitoid that uses *S. titanus* as a host for its immature stages until the leafhopper is consumed by a zoophagous insect, which acts as the final host for *E. bidens*. The final host species has not been identified, but the higher parasitism rates (up to 25%) suggest a possible control strategy to reduce *S. titanus* populations where other control strategies cannot be pursued (Bocca *et al.*, 2023). This biocontrol agent is still at the theoretical stage, so even if it were proved effective and selective enough, authorisation would be many years off.

Mating disruption

Vibrational mating disruption is a current alternative pest control strategy being explored. This aims to reduce *S. titanus* populations by interfering with its intraspecific communication to prevent mating. Vibrational mating disruption works through transmission of synthesised disturbance signals to grapevines in the same frequency range (150-200 Hz), masking the natural mating signals produced by courting leafhoppers (Thiery *et al.*, 2023). The strategy has shown effectiveness in disrupting mating and reducing the population of *S. titanus* nymphs in subsequent years. From 2017 to 2022, a field experiment was conducted in a commercial organic vineyard of 1.5 ha (‘Cabernet franc’ cv., Guyot system) at Fondazione Edmund Mach, San Michele all’Adige (Italy). A significant reduction of nymphs (up to -50%) was recorded, especially in the first 3 years after application (2018-2020), followed by a loss of effectiveness in the last two years

(2021-2022). This was attributed to a reduction in device performance leading to a smaller working distance (Nieri *et al.*, 2023).

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This PRA has been undertaken following IPPC International Standards for Phytosanitary Measures (ISPMs 2 and 11) and it provides technical evidence relating to the risk assessment and risk management of this pest.

This PRA has been undertaken taking into account the environmental principles laid out in the Environment Act 2021. Of particular relevance are:

**The prevention principle**, which means that any policy on action taken, or not taken should aim to prevent environmental harm.

**The precautionary principle**, which assists the decision-making process where there is a lack of scientific certainty.

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