Department for Environment Food & Rural Affairs

Rapid Pest Risk Analysis (PRA) for:

Corythucha ciliata

December 2022

Summary and conclusions of the rapid PRA

Provide: (i) a very brief introduction to the pest and the reason for undertaking the PRA, (ii) an overall summary and conclusions of the PRA and (iii) short text to summarise each section.

This rapid PRA shows:

Corythucha ciliata is a hemipteran insect, native to North America and now also present in mainland Europe. It is not known to be present in the UK. It mainly feeds on *Platanus* (plane) trees.

Risk of entry

Platanus trees are the preferred host, with very little data on movement of *Corythucha ciliata* on other tree species. Entry on the pathway plants for planting has been assessed as **moderately likely with medium confidence**. The highest risk would come with adults overwintering under loose bark of mature trees or loose-leaf litter in large pots but as most imported species of *Platanus* plants for planting would be immature, this is a lower risk.

Entry on wood and wood products with bark associated has also been assessed as **moderately likely with medium confidence.**

Hitchhiking on transport has been assessed as **likely with medium confidence** due to patterns of dispersal seen in Europe. This has been lowered from very likely to likely due

to the fact it has not yet established in the UK though it was initially found in 2006 in the UK.

Risk of establishment

The temperate climate of the UK is not thought to be a barrier to the pest establishing outdoors and so establishment outdoors has been rated **likely with medium confidence.** This has been lowered from highly likely due to populations found in the UK previously not establishing.

There are few of the host species grown under protection, so establishment indoors has been rated **unlikely with high confidence.**

Economic, environmental, and social impact

Economic impacts have been rated as **small** with **medium confidence**, as it is thought that the impact would be minimal as the pest may put trees under further stress but not be the primary cause of decline.

Environmental impacts have been rated as **small** with **medium confidence,** due to the low numbers of plane trees in wider environment and impacts in urban areas are taken into account under economic and social impacts.

Social impacts have been rated as **medium** with **medium confidence,** as the pest would possibly cause minor skin irritation due to biting and general decrease in shade provided by trees in urban areas though this is likely to only occur in very hot weather.

Endangered area

Areas of the UK where plane trees are found, particularly those in urban areas where there is an increase in plane tree density and the trees tend to be more stressed may be particularly susceptible. The most prominent example of high density of plane trees planted is London which has 1.6 million trees planted as of 2015 of which 64,000 are London plane trees (4% of total trees) (Kenton Rogers 2015).

Risk management options

One option could be to exclude *C. ciliata* and to classify it as a quarantine pest. This could possibly require plants for planting and wood of plane trees in *C. ciliata* infested regions to meet specific requirements before entering the country. Action in the event of an outbreak could be eradication by pesticides (as was conducted last time) or containment via sticky traps, or cardboard collars, which could be beneficial in both early detection and keeping populations low.

Key uncertainties and topics that would benefit from further investigation

In the UK, there was an initial finding of populations on numerous plane trees at two nurseries in Bedfordshire and a stand of plane trees 50 m away from one of the nurseries. These were treated by spraying with a pyrethroid insecticide but due to the number of *Corythucha ciliata* found at the time, was assumed to be established and no further statutory action was taken. However, no further findings have been found at these sites or elsewhere in the UK since this initial finding. Therefore, it appears that treatment was effective, and the population was unable to establish. It is unknown why *C. ciliata* has not established since then and this uncertainty is worth further discussion and research. This could perhaps be due to lack of plane trees in the immediate vicinity at the time.

Images of the pest

 Adult *Corythucha ciliata* on host tree	 Feeding damage on *Platanus* leaves
© Maja Jurc, University of Ljubljana, Bugwood.org	*© Whitney Cranshaw, Colorado State University, Bugwood.org*

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.

While there are some areas of uncertainty, there is sufficient information for a conclusion to be reached that a more detailed PRA is unnecessary.

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?

[The text below is a recommendation by the risk analyst which requires approval by PHRG]

Given evidence of impacts in similar climates to the UK in mainland Europe, it may be expected that comparable effects will occur in the UK if the pest were to be introduced. While this means that it is not expected that this pest would have a significant impact on its own, it may add to pressure on already stressed trees, especially in urban areas where there may be higher temperatures. Therefore, statutory action would be justified.

Yes Statutory action	✓	No Statutory action	

Stage 1: Initiation

1. What is the name of the pest?

Corythucha ciliata Say (Hemiptera: Tingidae)

There are two common names given to *C. ciliata.* It is often known as the sycamore lace bug in North America, as its common host is called the American sycamore tree, though it is in fact a plane species (*Platanus* sp.). Outside of North America, it is often called the plane lace bug as its main hosts are *Platanus* species.

2. What initiated this rapid PRA?

In 2006 localised outbreaks of this pest were found by the PHSI at two nurseries in Bedfordshire, alongside a stand of mature plane trees near one of the nurseries (Malumphy *et al.* 2007). London plane (*Platanus x acerifolia*) and Oriental plane *(P. orientalis*) trees imported from France and Italy, as well as mature plane trees grown on site at the nursery, were found to be infested. Some of the infested trees were 10 m tall and imported 6 years previously. The nurseries were advised to spray affected trees with insecticide which seemed effective. Due to the level of infestation and distribution on more mature trees at multiple sites, it was assumed that *C. ciliata* was already established in the UK and so statutory action against the pest was deemed inappropriate. However, 10 years later, there had been no further reported findings of *C. ciliata* in the UK and the pest was added to the UK Plant Health Risk Register, as absent from the UK. This pest is closely related to another lace bug, *Corythucha arcuata*, which some years after being introduced to Europe began causing concern. Therefore, following the RR entry for *C. ciliata*, a PRA was requested to better assess the level of risk to the UK and help decide whether statutory action against future interceptions on this pest is justified.

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 (GB[1] and EU[2]), and in the lists of EPPO[3]?

Corythucha ciliata is not listed in the EU (which applies to Northern Ireland) or GB plant health legislation. It is not recommended for regulation as a quarantine pest by EPPO on the A1 or A2 lists, nor is it on the EPPO Alert List.

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

Corythucha ciliata is native to North America in the eastern provinces in Canada as well as a few Eastern states in the United States. *Corythucha ciliata* has now been found in Mexico in the State of Guerrero on *Annona muricata* L. (Palemón-Alberto *et al.* 2021).

There are many articles chronicling the movement of *C. ciliata* from North America to Europe and Eurasia. These stem from a finding in 1964 in Padua, Northern Italy (Servadei 1966), and subsequent reports of it being found in France in the mid-1970s (Rabasse *et al.* 1977) and Spain in 1978 (Sotres & Mansilla Vazquez 1981). By 2019, it had been recorded in every European country (excluding Bosnia and Herzegovina and Albania) west of Ukraine

The first record of *C. ciliata* in China was in 2007 (Li *et al.* 2007), and the pest was quickly found throughout many provinces either through rapid dispersal or under the radar previous establishment. There are a few articles detailing the spread but most are written in Chinese with no translation available (Dang *et al.* 2012, Gao *et al.* 2019). The pest was also found in Turkey in 2007 and it had spread 250 km by 2014 (Küçükbasmacı *et al.* 2016). A stable population was initially found in Northern Georgia in 2008 but had spread east to west by 2012 (Supatashvili *et al.* 2016) and was found in Uzbekistan in 2017 (Grebennikov & Mukhanov 2019).

There are scattered reports in other places including New South Wales, Australia, where it was first found in 2007 and has since slowly spread throughout the state (450 km over an eight year period) (Dominiak *et al.* 2019). In Africa, there are no records listed on EPPO, however there is one record of it being found distributed around Cape Town, South Africa, in 2014 as well as an unofficial finding in Rabat, Morocco, in 2015 (Malumphy, by personal correspondence 2021). In South America, *C. ciliata* has only been documented in Chile and has not been reported from neighbouring countries as of October 2022.

[1] https://www.legislation.gov.uk/uksi/2020/1527/contents/made
[2] http://data.europa.eu/eli/reg_impl/2019/2072/oj
[3] https://www.eppo.int/ACTIVITIES/quarantine_activities

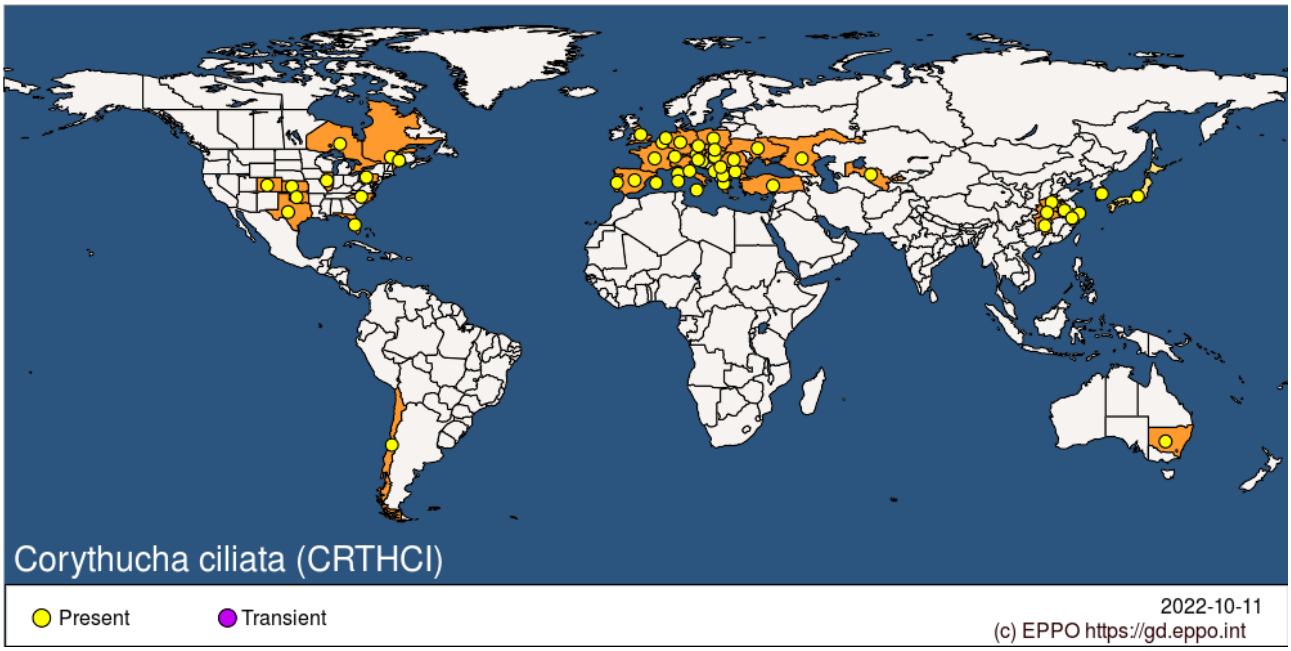

Figure 1. Map of *Corythucha ciliata* global distribution

Table 1: Distribution of *Corythucha ciliata*	
North America:	Eastern Canada- Ontario, Quebec; Eastern United States- Colorado, Florida, Illinois, Kansas, Maine, North Carolina, Oklahoma, Pennsylvania, and Texas (Halbert SE 1998); Mexico (Palemón-Alberto *et al.* 2021)
Central America:	No reports
South America:	Argentina (Carpintero *et al.* 2022), Chile (Ernesto 1990)
Europe:	Austria (Hopoltseder 1984), Belgium (Aukema *et al.* 2007), Bulgaria (Ĭosifov 1990), Croatia (Maceljski & Balarin 1972), Czechia (Stehlík 1997), France including Corsica (d'Aguilar *et al.* 1977), Germany (Hopp 1984), Greece (Tzanakakis 1988), Hungary (Kükedi 2000), Italy (including Sardinia and Sicily (Servadei 1966), Montenegro (Rabitsch 2008), Netherlands (NPPO of the Netherlands, 2009), North Macedonia (Cvetkovska-Gjorgievska *et al.* 2019), Poland (Lis 2009), Portugal (Hoffmann 1996), Romania (Kis 1990), Russia (European and Southern) (Voigt 2001), Serbia (Tomic D 1974), Slovakia (Kollár 2007), Slovenia (Maceljski & Balarin 1972), Spain (including the Baleariac Islands) (Ribes 1980), Switzerland (Barbey 1996), Turkey (Mutun 2009)

Africa:	Capetown, South Africa (Picker & Griffiths 2015)
Asia:	People's Republic of China (Eastern provinces of Anhui, Henan, Hubei, Hunan, Shanghai, Shejiang) (Li *et al.* 2007), Georgia (Supatashvili *et al.* 2016) Republic of Korea (Chung *et al.* 1996), Japan (Tokihiro *et al.* 2002), Uzbekistan (Grebennikov & Mukhanov 2019)
Oceania:	Australia (established in New South Wales) (Dominiak *et al.* 2019)

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

In the United Kingdom there were findings of *Corythucha ciliata* at two sites in 2006 by the Plant Health and Seeds Inspectorate (PHSI) in Bedfordshire on both imported and nearby mature *Platanus* species. The extent of the findings suggested that these were established populations, however in the intervening years, there have been no further reports of *C. ciliata* in the United Kingdom. Unfortunately, the sites were not closely monitored as it was believed that there were established populations in the area. A summer survey of sticky traps in 2021 in the area found no sign of *C. ciliata* and a further visual survey in September 2022 found no sign of *C. ciliata* in the original two sites. Two inspectors inspected 10% of ~1000 *Platanus* trees across the sites in the original outbreak area. *Corythucha ciliata* is a very distinctive (though small) species and it seems likely that if it were present in the UK, it would have been recorded by amateurs in the intervening 16 years. Therefore C. ciliata is considered to be absent from the UK for the remainder of this PRA.

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?

Major Hosts (as listed by EPPO)

Platanus (plane)
Platanus occidentalis
Platanus orientalis
Platanus racemosa
Platanus wrightii
Platanus × *hispanica*

Other hosts (as listed by EPPO)

Broussonetia papyrifera (mulberry)
Carya ovata (hickory)
Chamaedaphne (Cassandra)
Fraxinus (ash)
Liquidambar styraciflua (American sweetgum)
Quercus laurifolia (laurel oak)

Hosts listed by other sources

A few fact sheets in the USA also mention that this insect may be found on *Cotoneaster* and hawthorn [assumed to be *Crataegus*] (Anon 2012) and a new find in Mexico of breeding populations on *Annona muricata* L. (soursop) (Palemón-Alberto *et al.* 2021).

Though there are reports of *Corythucha ciliata* being found on non-plane hosts (Halbert & Meeker 2004), it is not known if there is feeding damage done to these secondary host plants, if full life cycles can be completed or if it is merely happenstance that *C. ciliata* is found on them (Kment 2007).

Platanus species are important to the UK as an urban planting tree as they are hardy, pollution tolerant and historically planted in city areas.

8. Summary of pest biology and/or lifecycle

Plane lace bug (*Corythucha ciliata)* is a pest on one main host Genus (*Platanus*) and gets its name from the common name for *Platanus* trees (called sycamore in North America). Both nymphs and adults feed on the underside of leaves, initially near the veins and then outwards, affecting the whole leaf (Halbert & Meeker 2004). This causes chlorotic stippling on the upper surface of the leaf which then may drop prematurely (Ju *et al.* 2011). Adult females lay several hundred eggs along leaf veins in the warmer months and 1-3 generations can occur in a year. The optimum development temperature for a full life cycle is between 19°C and 33°C though adults have been known to survive winter temperatures as low as -24°C (Ju *et al.* 2011) overwintering in loose bark on the trunk (Wade 1917). The closely related *Corythucha arcuata* (oak lace bug) has been known to overwinter under raised bark, bark crevices, and branch forks covered by leaf litter etc (Paulin *et al.* 2021) so it is likely that *C. ciliata* does the same.

Corythucha ciliata can be found on all *Platanus* species and there is no clear consensus to a preferred *Platanus* host with some studies saying *Platanus occidentalis* (Tzanakakis 1988) is preferred and others saying London plane tree (*Platanus* × *hispanica,* synonym *Platanus* × *acerifolia*) (Ju *et al.* 2011, Thiéry *et al.* 1999) is the preferred host. A few studies state that Oriental plane tree (*P. orientalis)* is only a minor host (Rojht *et al.* 2009) while others find *P. orientalis* is the most common tree infested (Mutun 2009).

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?

Plants for planting

The first finding of *C. ciliata* in Europe was in Padua, Italy in 1964 (Servadei 1966), and was possibly introduced by an unknown commodity on ships from North America (Hufnagel *et al.* 2006) and spread throughout the neighbouring countries within a few decades (d'Aguilar *et al.* 1977, Mutun 2009). *Corythucha ciliata* appears to be easily dispersed along human transport routes as especially seen in Turkey (Mutun 2009). Dormant young trees with less fissured bark may be less of an export risk as the adults spend winter under loose bark more commonly characteristic of mature trees (Ju *et al.* 2011). In general, most trees imported into the UK are imported whilst dormant (leaf-less) and as mentioned above, loose bark isn't the only pathway, but it seems likely that immature trees will be easier to inspect.

However, most trees imported into the UK are likely to be young, with fewer bark crevices and therefore a lower risk of association with overwintering hidden plane lace bugs. If larger tree products are moved, they would pose a greater risk as it would be difficult to determine if they were entirely pest free.

According to GB legislation at the time of writing, plants for planting of *Platanus* L. from most countries including Albania, Armenia, EU Member States, Switzerland, Turkey, USA, China and any third country where the following pests are known to occur: *Anoplophora chinensis*, *Ceratocystis platani*, or *Anoplophora glabripennis* (The Plant Health (Phytosanitary Conditions) (Amendment) (EU Exit) Regulations 2020- Schedule 7) must have an inspection of plants for planting due to the presence of these pests. In addition, *Platanus* plants for planting from Albania, Armenia, EU Member States, Switzerland, Turkey and the USA must be accompanied by an official statement that the plants must have been grown throughout their life in an area established by the national plant protection organisation in accordance with ISPM4 as an area that is free from *Ceratocystis platani*. This means that where the distribution of *C. platani* coincides with that of *C. ciliata,* planting material is not permitted to be imported into GB, however *C. ciliata* is more widely distributed than *C. platani* and therefore this may not provide effective mitigation. Many other secondary hosts of *Corythucha ciliata*, including *Fraxinus*, are also required to have an inspection prior to importation due to other pests or diseases (especially *Phytophthora ramorum* Werres, De Cock & Man in 't Veld, *Anoplophora glabripennis* (Motschulsky), or *Agrilus planipennis* (Fairmaire). *Quercus* and *Fraxinus* are both also currently prohibited from non-EU third countries, pending risk assessment under the provision of a list of high-risk plants (Annex 6- part B of The Plant Health (Phytosanitary Conditions) (Amendment) (EU Exit) Regulations 2020).

Similar regulations on the movement of host material apply in Northern Ireland, mainly under Commission Implementing Regulation (EU) 2019/2072. However, the C*. platani*

measures on *Platanus* planting material do differ slightly in Northern Ireland. Commission Implementing Regulation (EU) 2018/2019 (Annex I) covers the temporary host prohibitions pending PRA.

The following table illustrates the number of *Platanus* plants imported into the UK (from PHSI data) from Jan 2016-Nov 2019 from the EU. This number includes all sizes of trees, from immature saplings to more mature specimens. The data only includes *Platanus* plants for planting that were pre-notified, and it is unknown how many trees are imported without pre-notification.

Table 2. Total number of *Platanus* imports pre-notified to UK from Jan 2016-Nov 2019

European country of origin	**Total *Platanus* imports pre-notified to UK** Jan 2016-Nov 2019
Netherlands	6599
France	1860
Belgium	629
Germany	402
Denmark	300
Italy	151
Spain	29
Irish Republic	25
Hungary	2
Total	**9,997**

A similar North American lace bug is found on oak trees, *Corythucha arcuata* (Hemiptera, Tingidae), and a number of countries have taken measures against its spread. *Corythucha arcuata* was first observed in Europe in 2001 and has rapidly spread throughout the continent (EPPO 2021). GB has measures on *Quercus* plants for planting, which are currently prohibited from non-EU third countries, but there are no specific measures on *Corythucha arcuata.*

Wood and wood products

Platanus species are the main host plants of *C. ciliata*, though there are several other plant species that could be potential hosts. Movement of wood of any species could be considered a pathway for overwintering *C. ciliata* adults. The long distance dispersal and rapid spread of this pest has been attributed to the transport of plants and logs with bark attached (Ju *et al.* 2009, Wu & Liu 2016).

There are a few special requirements that must be met on wood and wood products imported into GB at present. Wood of *Platanus* L. from Albania, Armenia, EU Member States, Switzerland, Turkey, and the USA, other than wood packaging material, must be from a plane canker stain free (*Ceratocystis platani*) area or have undergone kiln-drying to below 20% moisture (The Plant Health (Phytosanitary Conditions) (Amendment) (EU Exit) Regulations 2020- Schedule 7, Part A). Wood obtained in whole or in part from *Platanus* spp. from EU Member States where *Anoplophora glabripennis* is known to occur must

have special requirements met including kiln-drying or processed into small 2.5 cm chips. Similar requirements apply for the import of *Platanus* wood into Northern Ireland, under Commission Implementing Regulation (EU) 2019/2072 and any relevant emergency measures (e.g., for *A. glabripennis*).

However, pest free areas of *Anoplophora glabripennis* and *Ceratocystis platani* could be a pathway into the UK, as only a few European countries have *A. glabripennis* or *C. platani* populations (either transient or restricted distribution) (EPPO, 2021) whilst the majority of Europe have populations of *Corythucha ciliata*.

Hitchhiking

Hitchhiking on several modes of transport (vehicles, ships, trains etc) have been mentioned by different countries as a likely means of rapid spread within states/provinces/countries and neighbouring countries (Chung *et al.* 1996, d'Aguilar *et al.* 1977, Ernesto 1990, Hopoltseder 1984, Kment 2007, Li *et al.* 2007, Mutun 2009, Servadei 1966, Soria *et al.* 1991, Tomic D 1974, Tzanakakis 1988, Yang *et al.* 2017). This method of spread by transport is obvious when looking at local studies in Greece (EPPO 2021, Tzanakakis 1988), Turkey (Mutun 2009), and Australia (Dominiak *et al.* 2019). This movement along railways or highways, has also been seen in the similar species *Corythucha arcuata* in Slovenia (Jurc & Jurc 2017), Bulgaria (Simov *et al.* 2018) and other countries (Csóka *et al.* 2020, Tomescu *et al.* 2018, Zubrik *et al.* 2019). At present this pathway is high risk for the UK, due to direct train routes from Brussels and Paris - which have high levels of *C. ciliata*, to London - which has a high number of *Platanus* species as well as the required climate. Due to the number of vehicles, both business and personal, as well as trains that move into the UK daily from European countries with *C. ciliata,* it seems likely that this will be a pathway.

Plants for planting	Very unlikely	☐	Unlikely	☐	Moderately likely	☑	Likely	☐	Very likely ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

Wood products	Very unlikely	☐	Unlikely	☐	Moderately likely	☑	Likely	☐	Very likely ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

Hitchhiking	Very unlikely	☐	Unlikely	☐	Moderately likely	☐	Likely	☑	Very likely ☐

Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				

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

This is a free-living organism which does not require a vector.

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

Outdoors

Although *Corythucha ciliata* has not established in the UK, it is found throughout most of Europe, including in countries with very similar climates to the UK. The UK has many plane trees planted in urban centres as well as areas with secondary hosts of *C. ciliata* which suggests that *C. ciliata* would have no problem establishing in the UK (see Figure 2 from BSBI). It is likely that two generations per year are possible throughout much of southern England but three generations are not, according to degree day information from a 2011 paper (Ju *et al.* 2011).

According to the world map of Köppen-Geiger climate classification, large parts of Europe including France, Belgium, Netherlands, Germany, Austria, Switzerland are the same climate classification as the UK. Considering that all these countries are affected by *C. ciliata* it therefore seems highly likely that the pest would establish if introduced. However, this has been lowered to likely as it did not establish in 2006 and hasn't been found since. It is also only with medium confidence as the population that was found in the UK did not establish and the reasons are unknown, although it is possible that those findings were a small population and treatment applied at the time was effective.

Under Protection

Platanus species that are large enough to be host to *C. ciliata* are unlikely to be planted under protection in the UK and therefore would not contribute to establishment.

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	☐

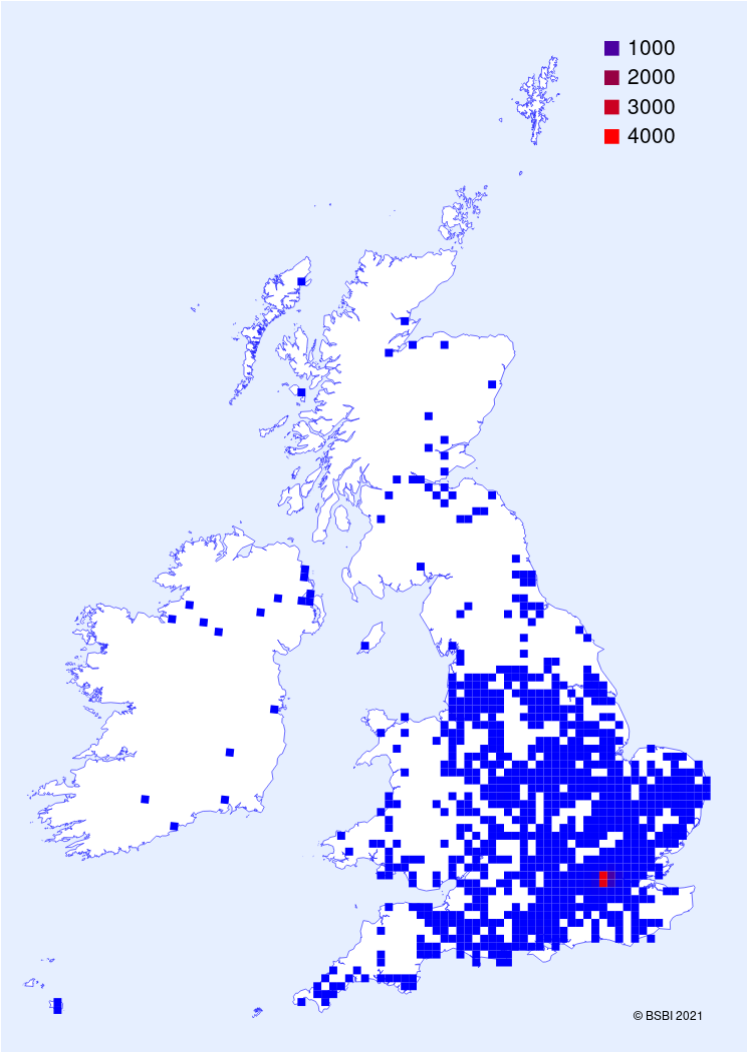

Figure 2. Map of United Kingdom showing number of recorded *Platanus* species planted (including *Platanus orientalis, P. occidentalis* and all other *Platanus species)* © BSBI 2021

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

Natural spread

Nymphs of *C. ciliata* rarely travel very far but adults can travel at least 20 m/day though it is assumed that their fast spread is helped along by hitchhiking along transport routes (Wu & Liu 2016), and it may be difficult to differentiate between truly natural spread and “human assisted”. In New South Wales, Australia it spread 450 km over 8 year period (Dominiak *et al.* 2019), and in Spain 70 km per year (Soria *et al.* 1991) though it is likely to naturally spread slower in the UK’s cooler climate.

Spread with trade

As seen very clearly in the previous section on hitchhiking, and the original introduction via shipping routes from North America to Europe (Hufnagel *et al.* 2006), the rate of spread can be increased by human activity and transport mediums.

C Bloomfield of Agricultural Scientific Collections, Australia (cited in (Williams *et al.* 2021) explains it quite succinctly when she says that:

‘The host species (plane trees) of *C. ciliata* are commonly planted as ornamental street trees, [and] as such they line roadways, parking areas and areas of high traffic. *C. ciliata* can be transferred from the tree canopy onto vehicles parked underneath the trees or blown from the canopy by passing vehicles. They can then be transported long distances (or shorter distances within the same town/city) on the vehicles and be blown, brushed (or fly) onto plane trees in the new locality. It is also possible for *C. ciliata* to fly, be blown or brushed onto human pedestrians and moved about in similar ways. *C. ciliata*, being

difficult to see when in small numbers, can remain unnoticed until founder populations have increased to the extent that damage to foliage becomes apparent by which time the insects may already have been spread to new areas.'

This is very applicable to the UK as well, as there is a large proportion of *Platanus* species planted in urban areas (e.g., London) (see map) and traffic from these cities may spread *C. ciliata* throughout the country as hitchhikers.

There are also a few reports of *C. ciliata* being found on non-plane hosts, (listed in the host section). This information shows that *C. ciliata* could slightly increase its spread when *Platanus* species are less common as other tree species could be used as stop-gap hosts.

Natural Spread	Very slowly	☐	Slowly	☑	Moderate pace	☐	Quickly	☐	Very quickly	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				

With trade	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?

In general, *C. ciliata* causes economic, environmental, and social impact by causing chlorosis of leaves on *Platanus* trees resulting in defoliation and weakening of the tree. This happens as *C. ciliata* feed on the underside of the leaves, causing small chlorotic stippling on the upper leaf surface as well as producing excrement on the underside, reducing the respiratory ability of the host tree (Wade 1917). This causes aesthetic issues as the leaves bronze and drop prematurely.

Economic and Environmental Impacts

Weakened/stressed trees are more likely to be susceptible to *C. ciliata* attacks (Tzanakakis 1988). In Italy it is known to cause death and decline of trees in combination with two fungi, *Ceratocystis fimbriata* Ellis & Halsted f.sp. *platani* Walter (Ascomycetes: Ceratocystidaceae), and *Apiognomonia veneta (*Sacc. & Spege.) Hohn. (Ascomycetes: Valsaceae) (Anselmi *et al.* 1994). *Ceratocystis fimbriata,* also known as plane wilt, is not present in the UK while *Apiognomonia veneta* is widespread in the UK. It is suspected that *C. ciliata* may act as a vector for these fungi though it is still a tenuous link (Maceljski 1986).

Another impact worth noting was found by Savvidis *et al.* (2009) in Greece. They found that rainbow trout farms along the Louros River in Greece, in a number of years,

experienced sudden trout death after heavy downpours if there were *C. ciliata* infested plane trees located along the river. After conducting basic trials, they concluded it was *C. ciliata* and not the *Platanus* species that were causing this reaction. It is unknown if warm temperatures exacerbated the issue or whether it was the adults, nymphs, or their frass that caused such quick deaths. However, there is only one report of these issues so it seems a rare phenomenon.

Social Impacts

There are also social (health) impacts with reports of *C. ciliata* biting people and causing mild reactions in Italy, Romania, and France (Dutto & Bertero 2013, Grozea *et al.* 2020, Izri *et al.* 2015). The bites cause lesions and mild itching and seem to be most common in areas around or below very heavily infested trees and seem to be from the insects dropping onto people rather than swarming or crawling up (Dutto & Bertero 2013).

Another impact in cities has been found of isolated reports in Milan, Italy that high levels of excrement dropping from trees above parked vehicles damages the paint of cars (Voigt 2001).

Economic Impacts	Very small	☐	Small	☑	Medium	☐	Large	☐	Very large	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				
Environmental 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	☐				

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

The potential impacts in the UK are likely to be similar to the effects already seen in similar European climates. Using Belgium, Germany, Netherlands, and France as comparable countries, *Corythucha ciliata* in urban areas can withstand the winters and breed during the summer.

Economic and Environmental Impacts

Comparing countries with the most similar climates to the UK, impacts in the UK are likely to be minor at low levels but could include loss of leaves, weakening of trees, and an increase in the susceptibility to disease at high population levels. The most prominent example of high density planted plane trees is London, which had 1.6 million trees planted as of 2015, of which 64,000 are London plane trees (4% of total trees) (Kenton Rogers 2015). Due to the urban heat island effect and high pollution, these trees are particularly susceptible.

After many consecutive years of feeding at high levels, trees are weakened and may be vulnerable to opportunistic fungi and disease (Malumphy *et al.* 2007). This is likely to lead to economic impacts of replacement, and localised environmental impacts. Many years of severe damage caused by *C. ciliata* combined with other environmental influences (drought stress is a large factor) may kill the tree (Barnard & Dixon 1983). However, unless feeding is combined with other factors, most years the only noticeable effect will be bronzed foliage and early leaf drop (Halbert SE 1998). There are potential increased impacts due to climate change in the future, looking at countries with slightly warmer climates (Italy etc) may allow us to predict the effects of *C. ciliata* in the UK in future changing environments.

Environmental impacts are likely to be small as *Platanus* trees are not planted often in the wider environment, but are more commonly found in parks, public gardens and lining of town and city streets. For this reason, economic and environmental impacts are rated as small with medium confidence, as it would take several factors to have a large effect and then only in towns and cities. It is not possible to accurately predict what impacts may be under future climate change, but the impacts in other warmer parts of Europe are being monitored and evidence to suggest a need for significant re-evaluation of these conclusions will lead to a revisit of this PRA.

Social Impacts

Social impacts due to biting and loss of shade trees could also be a potential issue. Biting has only been recorded in Paris, France (Izri *et al.* 2015), Piedmont, Italy (Dutto & Bertero 2013), and Bucharest, Romania (Grozea, 2020) which all have similar climates to the UK according to fairly broad classifications used in Köppen-Geiger mapping. Paris is in the same climatic range whereas Piedmont and Bucharest are the same main climate and precipitation level but have hot summers. The biting only occurs in areas where populations have built up, there is a high density of adults on host trees and it is in very hot weather as in the summer.

Corythucha ciliata feeding results in loss of foliation and in urban environments where plane trees are often planted to provide shade in the summer, this loss could lead to social impacts. Loss of trees in an urban environment can exacerbate high temperatures, Georgi and Zafiriadis (2006) found that there was an average decrease of 2°C in temperature under shade planted trees in cities which created a cooler microclimate. For these

reasons, social impacts are rated as medium with medium confidence as these issues are most likely as there are many large plane trees in urban areas but impacts are likely to only occur in very hot weather.

Economic Impacts	Very small	☐	Small	☑	Medium	☐	Large	☐	Very large ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
Environmental 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?

Corythucha ciliata has been occasionally recorded in combination with two fungi *Ceratocystis platani* (Ascomycetes: Ceratocystidaceae) and *Apiognomonia veneta* (Sacc. & Speg.) Höhn. (Ascomycetes: Valsaceae) (Anselmi *et al.* 1994, Malumphy *et al.* 2007) in Italy and it is suspected it acts as a vector for these, but has not been proven.

16. What is the area endangered by the pest?

Platanus trees are commonly planted in urban areas of the UK, especially along roads and in parks since Victorian times (Woodland Trust, 2021). London plane (possibly a hybrid of Oriental plane and American sycamore) is especially common in London and other cities in southern Britain, as they are pollution tolerant, have large leaves to create shade and can tolerate extensive pruning (Tubby & Pérez-Sierra 2015). Looking at Figure 2 in section 12 you can see that *Platanus* species are more prevalent in the south and are particularly dense around urban areas. Figure 3 shows the mix of mature and young plane trees recorded in the UK today, with large amounts recently planted (2010-2019) in the East and West Midlands and a large proportion of trees from the 1950s located in the London area. From the data on the BSBI website, 90% of *Platanus* trees in the UK have been planted since 2000, however this is likely grossly skewed due to better tracking information in the last twenty years. It is worth noting that the planting of plane trees has roughly trebled every decade between 1987-2020 (from 1017 planted between 1987-1999 to 9110 planted between 2010-2019) (BSBI)

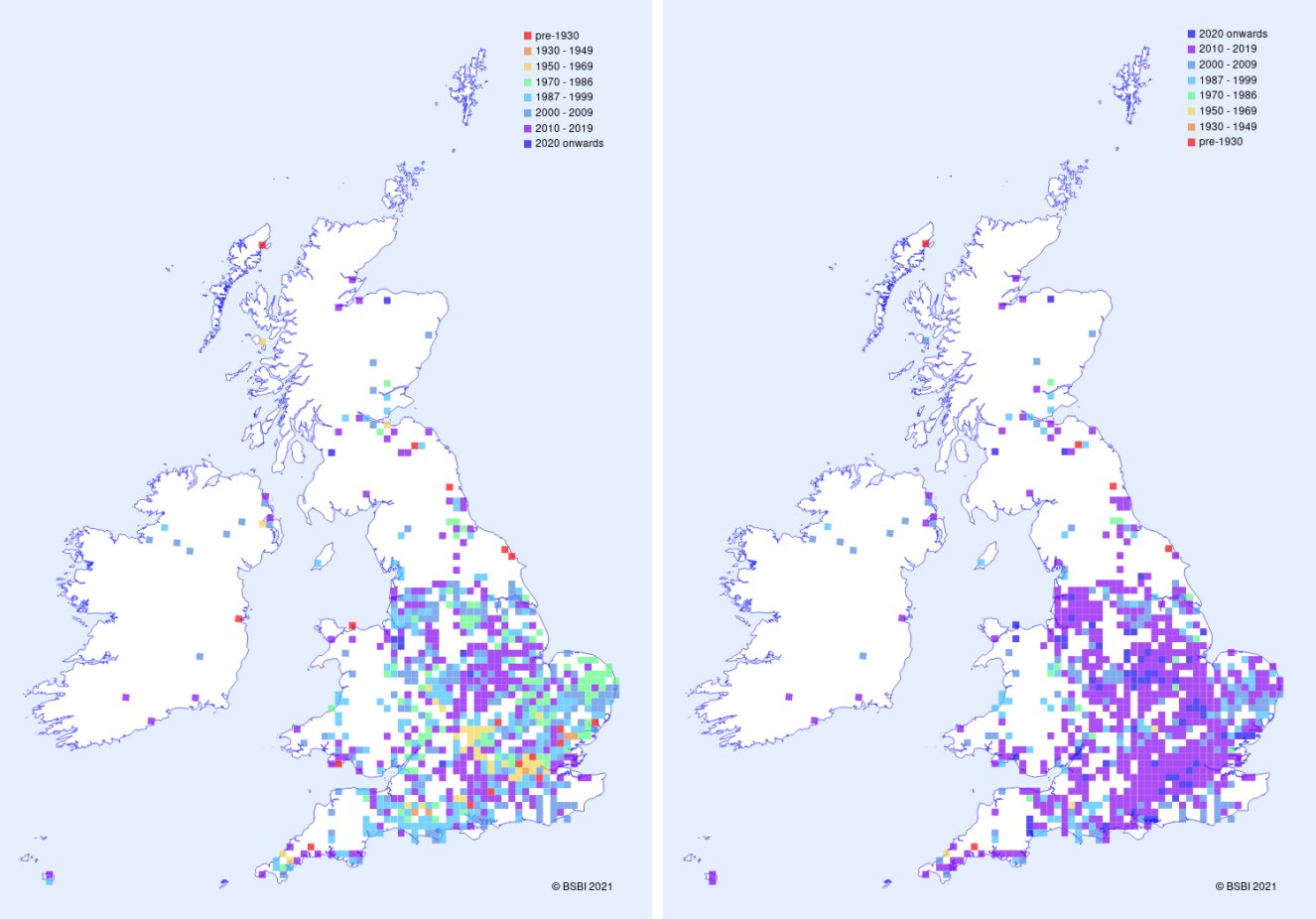

Figure 3: Maps of United Kingdom showing year that plane trees were planted. Map on left shows earliest planted trees layered on top of data points showing more recently planted. Map on the right shows the more recently planted *Platanus* trees layered on top. Data from © BSBI

Stage 3: Pest Risk Management

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

Exclusion

An option to exclude *C. ciliata* is to classify it as a quarantine pest. This could possibly require plants for planting and wood of plane trees in *C. ciliata* infested regions to meet special requirements before entering the country. Basing requirements off current restricted products these could include:

Plants of *Platanus*, intended for planting, other than fruits and seeds

a) the plants have been grown throughout their life in places of production in countries where *Corythucha ciliata* is not known to occur, or
b) the plants have been grown throughout their life in an area free from *Corythucha ciliata* established by the national plant protection organisation in accordance with relevant International Standards for Phytosanitary Measures, or
c) the plants have been produced in nurseries which, including their vicinity, have been found free from *Corythucha ciliata* on the basis of official inspections and official surveys carried out at appropriate times, or
d) the plants have been grown throughout their life in a site with complete physical protection against the introduction of *Corythucha ciliata* and have been inspected at appropriate times and found to be free from *Corythucha ciliata.*

Wood of *Platanus* other than in the form of chips, sawdust, or wood packaging material

a) an official statement that it is squared so as to remove entirely the rounded surface,
b) an official statement that it is bark-free and the water content is less than 20% expressed as a percentage of the dry matter,
c) an official statement that it is bark-free and has been disinfected by an appropriate hot air or hot water treatment, or
d) in the case of sawn wood, with or without residual bark attached, an official statement that it has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule.

It is unknown if kiln drying is an effective treatment as *C. ciliata* is quite hardy and have heat hardening abilities. According to (Ju *et al.* 2011) the temperature that causes 50% mortality (LD50) after 30 minutes is 44.3°C and as kiln drying is often required to reach 50°C it is possible that small populations of *C. ciliata* may survive the process.

Eradication/Containment

The effectiveness of eradication or containment is likely to depend where and how quickly the outbreak is found. In October 2006, as previously stated, *Corythucha ciliata* was found in Bedfordshire by the PHSI in two nurseries and in surrounding mature plane trees. The pesticide bifenthrin (withdrawn from UK use in 2011) was applied to the imported stock as well as mature trees. It was, however, assumed that this was unlikely to be effective and that the pest was likely to have already spread in the vicinities. After 16 years, *C. ciliata* has not been found again so it is assumed that it was truly a localised population that was possibly eradicated by the pesticide treatment. The disappearance could also be due to founder effects (small population with too little genetic diversity to persist), or to chance unfavourable climatic conditions (a wet, cold winter could possibly have decreased over winter survival). Due to the urban location of plane trees, it is assumed that amateur enthusiasts, and tree workers in cities would spot these insects relatively quickly if they established a sizeable population.

There are a few countries that have conducted surveys using trapping to look for the spread of a similar lace bug *Corythucha arcuata* as well as the presence of *C. ciliata.* There have been cardboard collars, yellow sticky traps, visual inspections, net sweeping, and suction traps used to name but a few. Using cardboard collars to create an artificial habitat for overwintering adults was found to be highly effective as seen in a study in Croatia with the average number of adults collected per cm^2 of cardboard increasing year on year (from 1.5 adults found in 2019-14.3 adults in 2021) to clearly show build-up of population (Williams *et al.* 2021).

Non-statutory controls

Raising awareness among the public is vital to discover *C. ciliata* at low levels before there is a major population increase. In the USA, natural predators such as lacewings provide some control and insecticides are also used. Routine use of insecticides on mature plane trees is likely to be impractical in the UK due to the cost and difficulty of making pesticide applications and the non-target impacts of treatments. However, approved insecticides could be used at nurseries. There are various methods which could be used to control or eradicate *C. ciliata* in small numbers and which provide some control in the United States. The use of insecticides, home remedies (soap, hosing off etc), and biocontrol (assassin bugs, lacewings, spiders and predatory mites) (Carroll 2021, Winski 2015) can be used to lower populations if necessary.

Some of the measures listed in eradication/containment may also be suitable for routine pest management in the event that statutory action is considered inappropriate.

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This publication is available via the UK Plant Health Information portal https://planthealthportal.defra.gov.uk/

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.

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