



CSL PEST RISK ANALYSIS FOR FLORIDA PASSION FLOWER VIRUS

Abstract/ Summary

Plants of *Passiflora caerulea* 'Constance Elliot' (passion flower) were found infected by a newly-described, unassigned virus known as Florida passion flower virus (synonym *Passiflora chlorosis virus*) at 3 UK nurseries between November 2007 and March 2008. These were the first findings of this virus in the UK although a few records of 'unknown potyvirus' have previously been diagnosed by CSL in plants of *Passiflora* spp. Only one of the outbreaks had plants that were symptomatic; foliar symptoms included chlorosis and deformity and the plants were stunted. All of the affected plants were of UK origin. The only other known location of this virus is Florida, USA where it was found on *Passiflora incense* (passion fruit) in 2004 and 2006 causing foliar chlorosis, leading to a published first record of the virus in 2007. The full distribution and host-range of the virus is not known. Because it is a potyvirus its principal mode of transmission is by aphids but it could also be mechanically transmitted or (less likely) transmitted by seed or pollen. It may already be present in the UK, but without surveillance this will not be determined. Although plants of *Passiflora* spp. are valuable this is not a major UK crop. There is no evidence that any other major crops are at risk, although this is based upon limited information. It seems likely that the industry could manage the virus, in the event of any further findings, themselves. This would be done by destruction of infected material, the production and maintenance of virus-free stock plants that are used for propagation, good hygiene practice for preparation of cuttings and grafts, and use of aphicides to control any potential vectors. The virus is not recommended for statutory control.

STAGE 1: PRA INITIATION

1. What is the name of the pest?

Florida passion flower virus (GenBank, 2006). This is an unclassified potyvirus (hence it is not italicised).

Synonyms:

Passiflora chlorosis virus (Baker & Jones, 2007).

Common names of the pest:

None.

Taxonomic position:

Virus

Family: Potyviridae



Genus: Potyvirus

Special notes on nomenclature or taxonomy:

The first record of the virus assigned a tentative name of *Passiflora chlorosis* virus (Baker & Jones, 2007). However, the sequence of the virus was deposited by the authors in GenBank (accession number DQ860147) in July 2006, where it is named as Florida passion flower potyvirus, and is described as an unclassified potyvirus (GenBank, 2006). The virus is related to the *Bean common mosaic virus* group (Baker & Jones, 2007). Enquiries to the authors of Baker & Jones (2007) regarding the correct name have not been resolved.

2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC)?

None.

3. What is the recommended quarantine status of the pest in the lists of the European and Mediterranean Plant Protection Organisation (EPPO)?

EPPO	A1 regulated	<input type="checkbox"/>	A2 regulated	<input type="checkbox"/>	Action	<input type="checkbox"/>	Alert	<input type="checkbox"/>
List:	pest list		pest list		list		list	

This virus has no EPPO quarantine status.

4. What is the reason for the PRA?

Between November 2007 and March 2008 there were three findings of the virus on *Passiflora caerulea* cv. 'Constance Elliot' on nurseries in the UK by Defra's Plant Health and Seed Inspectorate (PHSI) with statutory action being taken against them. This PRA was requested to determine whether there is a need for further statutory action to be taken against this new virus.

5. What is the PRA area?

UK ☒ EU¹ ☐ EPPO² ☐

STAGE 2: PEST RISK ASSESSMENT

6. What is the pest's present geographical distribution?

Florida passion flower virus was first found in Florida, USA in Alachua County in March 2004 and in Highlands County in February 2006 on plants of *Passiflora incense* (passion fruit). The plants had symptoms of chlorosis. These findings were reported in February 2007 (Baker & Jones, 2007) following experimental work which led to the virus being described as new,

¹ If the PRA area is the EU then it excludes locations such as the French DOMS, Spanish Canary Isles and Portuguese Azores and Madeira.

² EPPO = the whole EPPO region concentrating on the European and Mediterranean area, i.e. EPPO west of the Ural Mountains.



with a tentative name (at that time) of *Passiflora chlorosis virus*. Between November 2007 and March 2008 the virus was found on three separate nurseries in the UK on *P. caerulea* 'Constance Elliot' and was diagnosed by CSL as Florida passion flower virus from its GenBank sequence (GenBank, 2006).

Table 1: Distribution of Florida passion flower virus

North America:	Florida, USA
Central America:	No record
South America:	No record
Caribbean:	No record
Europe:	Three UK outbreaks (see 4.)
Africa:	No record
Asia:	No record
Oceania:	No record

References:

7. Is the pest established or transient³ in the PRA area? (Include information on interceptions and outbreaks here).

Unknown. There have been three findings of the virus on UK nurseries on plants of *P. caerulea* 'Constance Elliot'. All of the plants involved are of UK origin and were raised from cuttings. In the first finding (November 2007) 700 plants were symptomatic and all of the plants were destroyed. In the second finding (January 2008) one stock plant which was asymptomatic, but found to be infected with the virus, was destroyed. In the third finding (March 2008) 1050 asymptomatic plants are currently being held as a result of virus testing at CSL proving positive for Florida passion flower virus.

8. Is there any reason to suspect that the pest is already established in the PRA area?

Possibly. Prior to, and just after the scientific description of this new virus in February 2007 (Baker & Jones, 2007) CSL have diagnosed 'unknown' potyviruses on *Passiflora* spp. of UK origin (CSL, 2008). These are listed in Table 2.

Table 2: CSL diagnosis of 'unknown potyviruses' on *Passiflora* spp.

Year	Month	Host	Plant material	Origin
1999	April	<i>Passiflora</i> sp.	Leaves	-
2005	October	<i>Passiflora</i> sp.	Leaves	UK
2007	July	<i>Passiflora caerulea</i>	Leaves	UK

Date = date sample received by CSL

In addition to the newly-described Florida passion flower virus there are at least 6 other potyviruses that affect *Passiflora* including *Passionfruit crinkle virus*, *Passionfruit mottle virus* and *Passionfruit woodiness virus* (Baker &

³ Transience: presence of a pest that is not expected to lead to establishment (ISPM No., FAO, Rome)



Jones, 2007) as well as those additionally listed by Brunt *et al.*, (1996); i.e. *Passiflora ringspot potyvirus*, *Passiflora South African potyvirus*, and *Passionfruit Sri Lankan mottle potyvirus*. These viruses have also been described under various synonyms.

Because there are now at least seven potyviruses affecting *Passiflora* spp. (including Florida passion flower virus) it is not possible to say whether other CSL 'unknown potyvirus' diagnoses were any of these, and thus whether in fact the new virus is already present in the UK.

The plant material found affected by Florida passionflower virus is of UK origin so it is not possible to determine where the virus has come from.

9. What are the pest's host plants? List natural and experimental hosts.

The natural hosts of Florida passion flower virus that are known to date are *Passiflora incense* (passion fruit) (Baker & Jones, 2007) and *Passiflora caerulea* cv. 'Constance Elliot' (passion flower) (UK PHSI samples/CSL diagnoses).

Host-range studies (Baker & Jones, 2007) showed that Florida passion flower virus caused systemic chlorosis in *Chenopodium quinoa* (quinoa) but not on any other host tested (unspecified list) including eight species of legumes and *Nicotiana benthamiana* (tobacco plant).

Other than *Passiflora* spp., the potential host-range of this newly-described virus is not known.

10. Which hosts are of economic and/or environmental importance in the PRA area?

Passiflora species are currently the only known hosts. These are grown as ornamentals in the UK under protection (glasshouses, conservatories, as pot plants for indoor use), as cut flowers, as summer patio plants, and as half-hardy plants which can be grown outdoors. Although there are 465 species of *Passiflora* worldwide - most of them from South America - few are hardy enough to overwinter outside in the UK (Clayton, 2003). Nevertheless, some cultivars are bred to be half-hardy and so can be suitable for planting in sheltered areas outdoors.

P. caerulea is the only species of *Passiflora* affected in the UK to date. It is also the species of *Passiflora* which has the most suppliers (50) listed in the RHS Plant Finder (RHS, 2008). The cultivars of this species include 'Constance Elliot' (36 suppliers), 'Clear Sky' (3 suppliers) and *P. caerulea rubra* (3 suppliers). (RHS, 2008).

P. caerulea 'Constance Elliot' is half-hardy in the UK (BBC, 2008). As a species, *P. caerulea* is described as hardy to about -15°C, if plants are 'cut



down' to the ground by frost they can regenerate from the base (Anon., undated). Thus it can be grown outdoors.

P. incense is the name of the host from which this new virus was first described (Baker & Jones, 2007). The host also appears to be known as *P. incense* (in various web-based articles) and as such it has 3 suppliers listed in RHS (2008). It is grown as an ornamental in the UK. This cultivar was originally bred in Florida in 1973, for fruit production. It will tolerate -8°C but the top growth dies down below 0°C so it is less suited to UK conditions than *P. caerulea*. It is described as suffering from virus problems with a more recent cultivar 'New Incense' being virus-free. (Clayton, 2003).

Passiflora plants are expensive to buy (ca. £10 each at current prices) but they are not a major UK crop.

There are no fruit crops of *Passiflora* in the UK. The major production areas for passion fruit include Brazil, Kenya, Australia and Hawaii. (Kew, undated).

11. If the pest needs a vector, is it present in the PRA area?

Potviruses are principally transmitted by aphids (in a non-persistent manner) as well as by mechanical inoculation, grafting and, in some cases, by seed and (rarely) by pollen (Brunt *et al.*, 1996). The aphid responsible for transmission of Florida passion flower virus is not known. However, because of the possible range of transmission routes described for potviruses, it is assumed that a vector is not a pre-requisite for this new virus to be spread to other plants.

12. Describe the pathway(s) considered by this PRA⁴.

Because Florida passion flower virus is newly-described its full distribution and host list is not known. Thus, the only potential pathway for entry from outside of the UK at present is on plants or cuttings of *Passiflora* spp. from the USA where the virus has only been reported in Florida, once in 2004 and once in 2006 (Baker & Jones, 2007) infecting plants of *P. incense*.

Whether the virus could enter on fruit is not known as there are no descriptions of fruit infection. If it did, fruit would still have to be brought into close proximity with plants of *Passiflora* spp. for any risk of transmission to UK plants to be possible. Similarly, whether or not it could enter on seed is not known as there are no studies available.

The virus may enter the UK from other countries but without surveillance data it is not possible to say where else it may enter from.

13. How likely is the pest to enter the PRA area⁵?

⁴ A pathway description typically identifies a geographic origin, a host plant or plants and the intended use of the host. Other pathways including entry on other commodities or by natural means should be considered.

⁵ Pest entry includes an assessment of the likelihood of transfer to a suitable host (ISPM No. 11, FAO, Rome)



Very unlikely ☐ Unlikely ☐ Moderately likely ☒ Likely ☐ Very likely ☐

The only pathway of entry that can be considered at present is on plants or cuttings of *Passiflora* spp. imported from the USA and this is moderately likely.

Data on import inspections of *Passiflora* spp. have been provided by Defra's Plant Health and Seed Inspectorate (PHSI) dating back to 2000 (L. Bennett, PHSI, 2008, *personal communication*). This may not be a complete record of all *Passiflora* material imported into the UK.

Imports of grown plants of *Passiflora* spp. that have been inspected by the PHSI have originated in Belgium, Italy and the Netherlands; cuttings and 'other propagation material' have come from Kenya, and seed has come from Australia and Canada.

Thus, there are no recent records of PHSI inspections of imports of planting material from the USA.

Imports of produce (passion fruit) that have been inspected by the PHSI have come from Aruba, Columbia, Ghana, India, Israel, Jamaica, Kenya, Uganda, Thailand, South Africa, Zambia and Zimbabwe. Thus there are no recent records of PHSI inspections of imports of produce from the USA.

Planting material from the USA is still a potential pathway of entry nevertheless, as it is not prohibited, but the risk of entry is moderate as the only location of the virus to date has been in Florida.

The risk of entry from other countries is not known.

14. How likely is the pest to establish outdoors in the PRA area?

Very unlikely ☐ Unlikely ☐ Moderately likely ☒ Likely ☐ Very likely ☐

Plants of *Passiflora* spp. can be grown outdoors in the UK. (See 10.).

There are no scientific studies that show whether the virus would survive outdoors if infected plant material were planted; or how the virus could transfer from infected plant material to uninfected plant material (which is possible by a number of transmission routes including aphid transmission, mechanical transmission or seed – see 11).

It is presumed that establishment is possible.

15. How likely is the pest to establish in protected environments in the PRA area?



Very unlikely ☐ Unlikely ☐ Moderately likely ☐ Likely ☒ Very likely ☐

The three UK outbreaks of Florida passion flower virus were all on plants grown under protection. The plants were of UK origin. It is therefore assumed that establishment is possible in *Passiflora* spp. grown under protection in the UK.

16. How quickly could the pest spread⁶ within the PRA area?

Very slowly ☐ Slowly ☐ Moderate pace ☐ Quickly ☐ Very Quickly ☐

The rate of spread in *Passiflora* spp. in the UK is not known. There are no data on spread (including the mode of spread) in Florida where it was first reported in 2007. In the absence of any further information from here or from the UK no answer is possible.

17. Which part of the PRA area is the endangered area?

The endangered area includes (at least) the places of production where *Passiflora* spp. are grown commercially in the UK plus (potentially) private gardens, households etc where *Passiflora* spp. are grown.

18. What is the pest's economic, environmental or social impact within its existing distribution?

Very small ☒ Small ☐ Medium ☐ Large ☐ Very large ☐

The first record of the virus (Baker & Jones, 2007) describes plants with chlorosis being submitted for diagnosis to a laboratory in Florida in March 2004 and February 2006, but with no further details. It is assumed that the virus has caused no significant impact in the USA in the absence of any published reports of damage.

19. What is the pest's potential to cause economic, environmental or social impacts in the PRA area?

Very small ☐ Small ☒ Medium ☐ Large ☐ Very large ☐

The symptoms of infection in the first UK outbreak were chlorosis and deformities of the leaves and stunting of the plants. A total of 700 plants were symptomatic to a greater or lesser extent. These plants were unsaleable. The subsequent 2 outbreaks were a) on an asymptomatic stock plant and b) on samples taken from ca. 1000 asymptomatic plants. (S. Matthews-Berry, CSL,

⁶ ISPM No 5. defines spread as the expansion of the geographic distribution of a pest within an area. Note that just because an organism can move or be transported quickly, does not mean that it will spread quickly, i.e. it also has to establish.



2008, *personal communication*). Whilst plants of *Passiflora* spp. are individually valuable they are not a major UK crop. Because of this and the asymptomatic nature of 2 of the 3 findings it is presumed that the potential damage in the UK will be small.

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

This is a virus and therefore it is not a vector of plant pathogens, but a pathogen itself.

STAGE 3: PEST RISK MANAGEMENT

21. How likely is the pest to continue to be excluded from the PRA area?

<u>Under protection:</u>	Very likely <input type="checkbox"/>	Likely <input type="checkbox"/>	Moderately likely <input type="checkbox"/>	Unlikely <input checked="" type="checkbox"/>	Very unlikely <input type="checkbox"/>
<u>Outdoors:</u>	Very likely <input type="checkbox"/>	Likely <input type="checkbox"/>	Moderately likely <input type="checkbox"/>	Unlikely <input checked="" type="checkbox"/>	Very unlikely <input type="checkbox"/>

It seems unlikely that the virus could be excluded from plants of *Passiflora* spp. grown under protection or outdoors.

Because the global distribution of the virus is unknown with the exception of Florida, USA, the further entry of the virus may not be excluded in imported plant material.

The virus has already been shown to be present in the UK as all 3 of the UK outbreaks were of UK origin, in plants grown under protection. Whether it is widespread in *Passiflora* spp. in the UK is not known as two of the three findings were asymptomatic, the virus was only recently-described, and prior to this there have been 'unknown' potyviruses diagnosed by CSL in the UK on *Passiflora* spp.

The *Passiflora* cultivar that was infected in all 3 outbreaks *P. caerulea* 'Constance Elliot' is sufficiently hardy to be grown outdoors.

Passiflora spp. have the potential to become infected outdoors although it is not known whether the virus could overwinter in the UK.

22. If the pest enters or has entered the PRA area how likely are outbreaks to be eradicated?

Very likely <input type="checkbox"/>	Likely <input checked="" type="checkbox"/>	Moderately likely <input type="checkbox"/>	Unlikely <input type="checkbox"/>	Very unlikely <input type="checkbox"/>
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Eradication is possible (but costly) by destruction of infected plant material.

Other measures that should be applied in the event of an outbreak are for the 'cleaning-up' of infected stocks and the subsequent production and



maintenance of virus-free stock plants that are used for propagation, good hygiene practice for preparation of cuttings and grafts, and aphicides to control any potential vectors.

23. If eradication is not possible, what management options are available for containment and/or non-statutory control?

The measures described above (22) could be deployed by the horticultural industry for non-statutory control.

24. Conclusion and recommendations.

The first findings of Florida passion flower virus (synonym *Passiflora chlorosis* virus) in the UK occurred at 3 nurseries between November 2007 and March 2008 on plants of *Passiflora caerulea* 'Constance Elliot'. This virus was first described in 2007 (2004 and 2006 records) from Florida, USA and is not subject to statutory control anywhere in the world. Although the first UK outbreak was symptomatic, with 700 plants showing foliar symptoms, the next two findings were not. The full distribution and host-range of the virus is not known but it may already be present in the UK as the plants were of UK origin and CSL have previously diagnosed unknown potyviruses on *Passiflora* spp. on UK material. Because it is a potyvirus its principal mode of transmission is by aphids but it could also be mechanically transmitted or (less likely) transmitted by seed or pollen. Although plants of *Passiflora* spp. are valuable this is not a major UK crop and it seems likely that the industry could manage the virus, in the event of any further findings, themselves. In the longer-term, the *Passiflora* production industry should be able to produce and maintain virus-free stock material as has happened with similar cases of new viruses in ornamentals.

It is recommended that Florida passion flower virus should not be subject to statutory control and that advice be given to the horticultural industry regarding measures that can be taken to prevent or respond to new findings. For propagators, advice should include destruction of infected material, maintenance of virus-free stock plants that are used for propagation, good hygiene practice for preparation of cuttings and grafts, and aphicides to control any potential aphid vectors.

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Further work that would reduce uncertainties

Area of PRA	Uncertainties	Further work that may reduce uncertainty
Taxonomy	The virus is currently unassigned and is named Florida passion flower virus in GenBank (2006) and <i>Passiflora chlorosis</i> virus in the first formal record (Baker & Jones, 2007).	Clarification of its name. Enquiries have been made but are as yet unresolved.
Distribution	As it is a newly-described virus the first published record was from Florida in 2007, 3 years after it was first found there. The UK records are on UK material. Its distribution in the UK as well as in other countries is not known.	Surveillance and testing of <i>Passiflora</i> spp.
Hosts	Current hosts are <i>Passiflora incense</i> and <i>Passiflora caerulea</i> . Experimental host range testing was done by Baker & Jones (2007) but their findings are not fully reported and they did not report any major hosts from the 8 unspecified legumes that they tested.	Host-range testing.
Pathways	The only potential pathway of entry that is currently known is on plants of <i>Passiflora</i> spp. from the USA.	Information on distribution and host range as well as potential for entry on seed and fruit of <i>Passiflora</i> spp.
Establishment	Establishment on <i>Passiflora</i> spp. grown outdoors is possible but depends upon the ability of the virus to survive UK winters.	Over wintering experiments.
Spread	It is presumed that the virus is spread by aphids and possibly by mechanical transmission, and less likely by seed and pollen.	Transmission experiments.
Impact	Current hosts are species of <i>Passiflora</i> on which foliar symptoms and stunting have only been reported in 1 of the 3 UK outbreaks.	Testing of <i>Passiflora</i> species to determine the probability of plants being symptomatic following virus transmission and the age of plants in which this occurs. Wider host-range testing.
Management	The principal route of transmission is likely to be via aphids, but mechanical transmission and transmission via seed and pollen is also possible but not proven. The aphid species involved in transmission is uncertain. Control includes prevention of spread.	Investigation of the mode of transmission in plants of <i>Passiflora</i> spp, as well as whether fruit can be implicated. Identification of aphid vectors.



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