



# The Food & Environment Research Agency

## Rapid pest risk analysis for *Plantago asiatica mosaic virus*

*This document provides a rapid assessment of the risks posed by the pest to the UK in order to assist Risk Managers decide on a response to a new or revised pest threat. It does not constitute a detailed Pest Risk Analysis (PRA) but includes advice on whether it would be helpful to develop such a PRA and, if so, whether the PRA area should be the UK or the EU and whether to use the UK or the EPPO PRA scheme.*

### **STAGE 1: INITIATION**

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

*Plantago asiatica mosaic virus* (PIAMV).

Genus Potexvirus, Family Flexiviridae.

*Nandina mosaic virus* (NaMV) is a synonym of PIAMV (Hughes *et al.*, 2005).

It is a close phylogenetic relative of *Tulip virus X* (Komatsu *et al.* 2008).

#### **2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC<sup>1</sup>) and in the lists of EPPO<sup>2</sup>?**

This pest is not listed in the EC Plant Health Directive and is not recommended for regulation as a quarantine pest by EPPO, nor is it on the EPPO Alert List.

#### **3. What is the reason for the rapid assessment?**

In July 2010 the Netherlands reported a first finding of *Plantago asiatica mosaic virus* (PIAMV). The virus was detected on *Lilium* spp., at first in protected lily flower production, and then in outdoor lily flower bulb production fields. In affected glasshouses up to 80% losses were reported, whereas outdoors no severe damage or crop loss was observed. No official phytosanitary measures were taken, but the lily production industry initiated measures to eradicate the virus from breeding and propagation systems (Plant Protection Service of the Netherlands, 2010; EPPO, 2011). In early 2012 reports were received of suspected findings in Spain on a sister crop to one being grown in the UK (PHSI pers. comm.). In July 2012, it was confirmed in stems in the UK, reported to be of Spanish origin (Fera diagnosis data). A rapid assessment was initiated to help inform policy decisions on the risk posed by this pest.

### **STAGE 2: RISK ASSESSMENT**

#### **4. What is the pest's present geographical distribution?**

No detailed data are available. The following reports were obtained:

Russian Federation: First described in the Russian Far East on *Plantago asiatica* L. (Kostin & Volkov, 1976; Solovyev *et al.*, 1994).

Japan (Komatsu *et al.* 2008),

USA (Moreno *et al.* 1976; Hughes *et al.*, 2002).

<sup>1</sup> [http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en\\_2000L0029\\_do\\_001.pdf](http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en_2000L0029_do_001.pdf)

<sup>2</sup> <http://www.eppo.org/QUARANTINE/quarantine.htm>

The Netherlands (Plant Protection Service of the Netherlands, 2010)

The Plant Protection Service of the Netherlands (2010) also states that is probably present in Chile, New Zealand and South Korea.

The confirmation of this virus in stems reported to originate from Spain suggest it is also present in this country (Fera diagnosis data).

## **5. Is the pest established or transient, or suspected to be established/transient in the UK?**

PIAMV was reported affecting lily crops in the Netherlands in 2010 (Plant Protection Service of the Netherlands, 2010). In 2012 it was confirmed in stems in the UK, reported to be of Spanish origin (Fera diagnosis data).

The first finding from the Netherlands was in protected flower crops, with subsequent findings in field production. The origin of the virus is not clear, but it may have been introduced by the import of infected bulbs from outside the EU. Dutch breeders are known to have imported nuclear stock of Oriental Lily species from Asia and Chile and the virus could have been introduced into breeding programmes without being noticed (Plant Protection Service of the Netherlands, 2010). During the growing seasons in 2010, 2011 and 2012 specific official surveys were carried out with the following findings:

2010 – 2 positive samples in 44 tested

2011 – 3 positive samples in 30 tested

2012 – 3 positive samples in 30 tested.

There appear to be higher levels of infection for Oriental lily species than Longiflorum lily species, but no further details on the crops surveyed are available (Plant Protection Service of the Netherlands, 2012).

Symptomatic stems reported to be from a Spanish *Lilium* crop were submitted to Fera by a UK grower in March 2012 and PIAMV was confirmed in July 2012. The UK grower submitting the stems was also growing bulbs originating from the same stock as the Spanish-grown infected stems. These bulbs had been planted later (under glass) and the bulbs showed no symptoms. A personal communication from the PHSI suggests the UK crop may have shown symptoms later, but no UK sample was submitted for testing so this cannot be confirmed.

EU findings have thus far been in *Lilium* spp.. There have been limited surveys in the Netherlands, but there is no evidence of how widely the virus may be distributed in the EU, or whether it is affecting other genera, such as *Primula* or *Nandina*. It's presence in the UK has been suspected, but not confirmed.

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

There is very little in the literature on this virus. It has been reported as infecting a wide range of plant species (Solovyev *et al.*, 1994; Ozeki *et al.*, 2006), however, the original reference for this work (Kostin & Volkov, 1976) is unavailable. The following have all been recorded as hosts:

*Plantago asiatica* (Kostin & Volkov, 1976)

*Lilium* spp. (Komatsu *et al.*, 2008)

*Primula* spp (Komatsu *et al.*, 2008)

*Nandina domestica* (Hughes, 2002)

The virus has also shown symptoms on several test plant species such as: *Chenopodium quinoa*, *C. amaranticolor*, *Gomphrena globosa*, *Nicotiana benthamiana* and *N. occidentalis* (Plant Protection Service of the Netherlands, 2010; Moreno *et al.*, 1976; Ozeki *et al.*, 2006).

The range of host types from which PIAMV has been detected i.e. woody (*Nandina*); dicotyledon (*Primula*); monocotyledon (*Lilium*) is an indication of its capacity to adapt to a wide range of hosts, although the precise range is as yet unidentified.

The genus *Primula* and *Lilium* contain popular garden and house plants in the UK and they are widely sold at garden centres as well as specialist stockists. *Lilium* bulbs are also grown commercially in the south west and Lincolnshire and it was concern from this industry that initially triggered this risk assessment. Species of *Lilium*, *Primula* and *Chenopodium* also grow in the wild, with *Primula veris* (cowslip), *Primula vulgaris* (primrose) and *Chenopodium album* (fat hen) being particularly widespread (BSBI Tetrad Maps).

## 7. If the pest needs a vector, is it present in the UK?

The pathogen is transmissible through mechanical inoculation. There are no other recognised vectors.

## 8. What are the pathways on which the pest is likely to move and how likely is the pest to enter the UK?

### Pathway: Plants and bulbs for planting

As there are no recorded vectors of this virus, the only possible pathway for the pathogen to enter the UK is through the movement into the area of infected plants for planting from an infected region. The major trade routes for all the recognised hosts involve the movement of rooted cuttings, plug plants or bulbs rather than through transport of seed. In each case the virus could survive through movement in trade.

Although the true distribution of this pest is unclear, as a major source of these ornamental species into the UK will be through trade of propagation material from the Netherlands (EUROSTAT, 2013), it is anticipated that the presence of the virus within Dutch production provides a potential source of virus infected host plants into the UK. It is not known what proportion of this imported material is for onward sale (e.g. in garden centres) or is planted by UK commercial cut flower growers or propagators, although the latter is thought to be extremely small.

Since there is a lack of published data on symptom development in infected rooted cuttings/plugs or bulbs, the likelihood of detecting the presence of virus infected plants by visual inspection cannot be properly assessed, though it is likely that a low incidence of virus infected plantlets or bulbs with limited symptom development would not be intercepted. Dry bulbs for movement within the EU are not routinely required to be inspected on arrival in another MS and, of course, would not show virus symptoms at this stage.

The introduction of standard testing as part of certification schemes for propagation material was reported to be being considered by the Netherlands in 2010 (Plant Protection Service of the Netherlands, 2010). It is now included in the Netherlands' lily certification scheme. The bulbs intended for further propagation are tested and the level of PIAMV should be below 1%. Both breeders and growers are working together to control PIAMV in lily production (Peter Reed, Fera *pers comm.*). As the UK does not have a lily bulb propagation industry and the Netherlands are the major supplier of ornamental bulbs in the EU and the UK, this should reduce the risk of entry to the UK to a low level.

Plants &  
bulbs for  
planting:

Very  
unlikely

☐

Unlikely

☒

Moderately  
likely

☐

Likely

☐

Very  
likely

☐

## 9. How likely is the pest to establish outdoors or under protection in the UK?

Due to the biology of viruses, whose survival and replication is intrinsically linked to living host tissue, if viable infected plant material enters the PRA area and is planted, the virus has the potential to establish.

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

## 10. How quickly could the pest spread in the UK?

PIAMV is classified in the Flexiviridae as a *Potexvirus*. This group contains viruses such as the type member *Potato virus X* and *Pepino mosaic virus*. These viruses are readily transmissible through plant handling and sap transfer on contaminated cutting tools, and by analogy it is assumed that a similar mode of transmission will apply to this virus. The only specific evidence for spread of this virus comes from Moreno *et al.* (1976), who state that: "The virus was readily transmitted from infected nandina plants to ..... The virus was not transmitted from *Nandina* by *Myzus persicae* or through seed." and this would seem to support this assumption. As the main hosts are produced either for the ornamental plants trade or for use as cut flowers, all hosts will be subjected to physical handling and cutting throughout the production cycle.

The rate of spread through trade will be determined by the level of infection in the propagation material. While the Netherlands is one of the biggest exporters of this material, reports of symptomatic stems in Spain suggests that it may be already be more widely distributed than currently reported.

Natural spread:	Very slowly	<input type="checkbox"/>	Slowly	<input checked="" type="checkbox"/>	Moderate pace	<input type="checkbox"/>	Quickly	<input type="checkbox"/>	Very quickly	<input type="checkbox"/>
In trade:	Very slowly	<input type="checkbox"/>	Slowly	<input type="checkbox"/>	Moderate pace	<input checked="" type="checkbox"/>	Quickly	<input type="checkbox"/>	Very quickly	<input type="checkbox"/>

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

As the Netherlands is a major source of propagation material for ornamentals in the EU the presence of this virus in *Lilium* bulb stock suggests that the UK lily cut-flower industries are most at risk from this virus. Also of concern would be amateur growers buying in uncertified infected plant material, though most of the material sold in retailers is from the Netherlands. Wild grown host species growing close to infected cultivated plants may possibly also be at risk and, if the virus was to get into wild growing plants, could provide a reservoir for reinfection of garden and commercial plants. However, because potexviruses are mostly mechanically transmitted this risk would probably be very low.

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

There appear to be no specific data regarding the impact of this virus from outside the EU.

When first found in the Netherlands, plants grown in greenhouses in the winter showed severe necrotic symptoms on the leaves. Symptom development of an infection starts at the end of the vegetative growth stage with rust-coloured veins on the bottom side of the leaf, which become necrotic in a few days. In latter stages symptoms appear on the top side of leaves. The necrosis causes a reduction in the value of cut-flowers, with losses of up to 80%

reported in 2010. In outdoor *Lilium* bulb production, although the virus has been found, no severe damage or crop loss has been reported (Plant Protection Service of the Netherlands, 2010 & 2012).

PIAMV has now been included in the Netherlands' lily certification scheme. The bulbs intended for further propagation are tested and the level of PIAMV should be below 1%.

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

### 13. What is the pest's potential to cause economic, environmental or social impacts in the UK?

Lack of data makes this difficult to judge, but the main impact is likely to be to a loss in value to cut-flowers and ornamentals such as *Lilium* and *Primula*. The cut-flower and bulb industry is likely to be affected due to the potential loss of bulb stock as well as reduction in value from the flowers. A personal communication from the PHSI suggests that a UK bulb crop under glass may have shown symptoms in 2012, but no UK sample was ever submitted for testing and no problems arising from this potential case have ever been reported.

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

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

Not applicable.

### **STAGE 3: PEST RISK MANAGEMENT**

#### **15. What are the risk management options for the UK? (Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors).**

The only pathway considered as a possible route for entry into the UK is plants for planting, in particular bulbs.

The situation in the Netherlands, as reported in November 2012, is that no phytosanitary measures are being considered and the phytosanitary export certification of the Netherlands has been amended to take into account requirements of third countries (Plant Protection Service of the Netherlands, 2012). PIAMV is now included in the Netherlands' lily certification scheme. The bulbs intended for further propagation are tested and the level of PIAMV should be below 1%. Both breeders and growers are working together to control PIAMV in lily production (Peter Reed, *Fera pers comm.*). This reduces the risk of entry to the UK. Even if bulbs were produced in another country but not during a certification scheme, the EU Marketing Directives for propagation of ornamental plants requires all propagation material to be "substantially free" of injurious pests so this requirement would apply to the production system, though not to bulbs sold for final retail sale.

Overall, it is considered that this virus can be managed without the need for EU regulation via the testing of propagating material within certification schemes and application of the marketing directives

##### **Exclusion**

It should be possible to exclude this pathogen without the need for regulation via the use of bulbs which have been produced under a certification scheme with a nil tolerance for this virus. This would be the best means of non statutory control. Control via a certification scheme would mean that growers would have the option to buy material which had been derived within a certification scheme and which was free from PIAMV, or non-certified material meeting the requirements of the marketing directive.

Exclusion by regulation could be attempted through the listing of PIAMV in Council Directive 2000/29/EC either in Annex IIAII with requirements for the whole EU or in Annex IB or IIB with requirements just for protected zones. Measures required under 2000/29/EC could include the following:

- Plants for planting including bulbs have been produced on a place of production which is free from PIAMV, this could either be by visual inspection or testing could be required or
- Individual lots could have been tested and found free from the virus.

##### **Eradication**

It may be possible to eradicate PIAMV by the removal of the infected lot along with stringent hygiene measures, i.e. thorough cleaning of any tools or machinery used on the infected crop to prevent spread to subsequent crops. It should be noted that if the regulation of PIAMV was proposed there would be a requirements for any outbreaks of PIAMV in the UK to be eradicated, this may involve the destruction of infected flowering crops or propagation material.

##### **Containment**

It may be possible to contain PIAMV through the implementation of stringent hygiene measures, i.e. thorough cleaning of any tools or machinery used on the infected crop to prevent spread to neighbouring crops. If PIAMV was to be regulated these kind of measures would be required under a Plant Health Notice. However such measures could also be implemented as matter of good routine hygiene by growers without the need for regulation.

## 16. Summary and conclusion of rapid assessment.

This rapid assessment shows:

*Risk of entry:* Unlikely. It is unclear how widespread this virus may be in the EU, but its presence in the Netherlands in the past suggests a low risk of entry through plants for planting, especially bulbs not produced via a certification scheme. PIAMV is now included in the Netherlands' lily certification scheme.

*Risk of establishment:* Very likely. Should viable infected plant material enter the PRA area and be planted the virus has the potential to establish.

*Economic impact:* Small, although lack of data makes this difficult to judge. The cut-flower and bulb industry is likely to be affected due to the potential loss of bulb stock as well as reduction in the value of the flowers.

*Endangered area:* UK lily cut-flower industries are most at risk from this virus. Also of concern would be amateur growers buying in uncertified infected plant material, though most of the material sold in retailers is from the Netherlands.

*Risk management:* It is considered that this virus can be managed without the need for EU regulation via the testing of propagating material within certification schemes and the application of the marketing directives.

**17. Is there a need for a detailed PRA? If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used.** (for PH Risk Management Work stream to decide) ✓ (put tick in box)

Based on the likely level of impact of this pest and potential for it to be managed by industry a more detailed PRA is not considered necessary.

No	X
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Yes		PRA area: UK or EU		PRA scheme: UK or EPPO	
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### 18. IMAGES OF PEST

<i>Photo 1 (pest)</i>	<i>Photo 2 (e.g. symptoms?)</i>
<i>Source/ copyright owner</i>	<i>Source/ copyright owner</i>

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

Official phytosanitary action against this pest is not being considered in the Netherlands because this virus can be managed by testing the mother stock and certification procedures to reduce to a minimum the virus in *Lilium* breeding and propagation systems. Even if bulbs were not produced under a certification scheme, the EU Marketing directives would require all propagating material to be substantially free of the virus. Based on this and the potential for the same management to be utilised in the UK, statutory action is not considered appropriate, although growers should be advised not to propagate from any affected stock.

Yes  
Statutory action ☐

No  
Statutory action ☒



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**Author (s):** Helen Anderson, Adrian Fox, Sharon Matthews-Berry, Peter Reed, Anna Skelton.