EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE
POUR LA PROTECTION DES PLANTES

09-15198 (07-13315)
WPPR point 8.4

Report of a Pest Risk Analysis *Iris yellow spot virus*

This summary presents the main features of a Pest Risk Analysis which has been conducted on *Iris yellow spot virus* according to the EPPO Decision Support Scheme.

Pest:	*Iris yellow spot virus*
PRA area:	EPPO Region
Assessors:	Expert Working Group for PRA on *IYSV :* Dom COLLINS (Mr) GB Thrips specialist, Elena JACKEVICIENE (Mrs) LT virologist, Monia MNARI-HATTAB (Mrs) TN virologist, Ernst PFEILSTETTER (Mr) DE pest risk management expert, Philippe REYNAUD (Mr) FR thrips specialist knowledge of the EPPO decision support scheme, Xavier TASSUS (Mr) FR virologist, Jacobus (Ko) VERHOEVEN (Mr) NL virologist, Heinrich Josef VETTEN (Mr) DE virologist, James WOODHALL (Mr) GB Plant pathologist/risk analyst, EPPO Secretariat
Date:	2007-01-28
Reviewed:	Reviewed by core-members 2007-01-13 **Reviewed Panel on Phytosanitary Measures 2007-02, 2008-02 and 2009-02.**

STAGE 1: INITIATION

Reason for doing PRA:	Identification of a single pest that may pose a risk to the EPPO region. This newly characterized tospovirus came to the attention of EPPO as it has been reported in several countries on *Allium* spp and cut flowers crops.
Taxonomic position of pest:	Virus Bunyaviridae, Tospovirus

STAGE 2: PEST RISK ASSESSMENT

Probability of introduction
Entry

Geographical distribution:	Outside the EPPO region the pest is present in: Australia, Brazil, Canada, Chile, Guatemala, India, Japan, New Zealand, Peru, Reunion Island, South Africa and the USA. In the EPPO region it is present in France, Germany, Israel, Italy, the Netherlands, Serbia, Slovenia and Spain. An outbreak on *Eustoma* sp in a glasshouse has been eradicated in the United Kingdom. The records not considered as valid by the EWG are Poland, Tunisia and Iran. **Recent information collected after surveys carried out in the Netherlands and France show that latent infections are much more frequent than originally thought. The pest is likely to be more widespread than reported.** The area of origin of the vector, *Thrips tabaci*, is considered to be the Near East. It is therefore assumed that the pathogen also originates from the near East. See table 1
Major host plants or habitats:	Recorded hosts are presented in tables 2 to 4. Some records have

	been considered doubtful by the Expert Working Group (EWG), consequently the major hosts studied by the EWG during the pest risk analysis are: *Allium* sp, *Alstroemeria* sp, *Eustoma* sp *Hippeastrum hybridum, Iris hollandica.* It should be noted that the EWG considered that more host plants are likely to be found. In particular natural hosts which may have an important role in IYSV epidemiology.
Which pathway(s) is the pest likely to be introduced on:	Taking the countries where the pest is present as a start of each pathway: *Allium cepa*: seedlings *Allium porrum*: seedlings *Alstroemeria* species: *in vitro* plants, pot plants and cut flowers *Eustoma grandiflorum:* seedlings and cut flowers *Hippeastrum hybridum:* cut flowers *Iris hollandica:* cut flowers Green parts of *Allium* species (considered together with cut flowers of host plants in the evaluation) Viruliferous *Thrips tabaci* on non-host plants and on *Allium* species bulbs Pathways considered but not retained Seeds are not considered to transmit IYSV. There is only a single record for the detection of the pest in bulbs and the EWG considered that bulbs (or "sets"[1] for onion) of host plants were not a likely pathway. The main pathways are seedlings. Since the EWG a record in Canada in 2007 possibly related to sets has been recorded. No further information is available so far. Some hosts mentioned in table 2 or 3 were considered as doubtful by the EWG and have not been considered in the PRA. Soil: there are some reports of adult of thrips hibernating in soil (Jenser & Szenasi, 2004 cites three references) but normally, *Thrips tabaci*, the vector, overwinters as adults in plant material (or leaf litter). Consequently, the risk from soil was considered too theoretical to be taken into account in the PRA.

Establishment

Plants at risk in the PRA area:	*Allium* sp *Alstroemeria* sp *Eustoma grandiflorum* *Hippeastrum hybridum* *Iris hollandica* Onion and leek (main host plants) are grown in many countries in the EPPO region.
Climatic similarity of present distribution with PRA area (or parts thereof):	The pest is vectored by *Thrips tabaci* which is present throughout the EPPO region, both in field and protected conditions. In cold conditions, *Thrips tabaci* would have fewer generations per year but would still be able to survive. The EWG considered that the climatic conditions were completely similar
Aspects of the pest's biology that would favour establishment:	IYSV is vectored by *Thrips tabaci* which is a very common thrips in the EPPO region. It should be noted that the pest epidemiology is not well understood, it is possible that a host plant playing a key role in the epidemiology of the pathogen remains to be discovered.

[1] Sets are small onion bulbs (approx. 1,5 to 2 cm diameter) which are planted by machine.

Characteristics (other than climatic) of the PRA area that would favour establishment: The host plants are widely distributed in the PRA area. Symptoms can vary between hosts and the detection of symptoms can be difficult. In *Eustoma* plants, symptoms can be easy to detect whereas for other hosts, symptoms may not be as visible or typical for IYSV.
Eradication of the vector of the pest is not feasible.

Which part of the PRA area is the endangered area: As the pest is found under protected conditions as well as in fields, the EWG considered that all the wholeEPPO region is at risk.

POTENTIAL ECONOMIC CONSEQUENCES

How much economic impact does the pest have in its present distribution:

This section focuses on Onion crops, as these are the main crop likely to be affected.

Information presented below is the result of the EWG updated by information gathered by the EPPO Secretariat after the meeting and during the Panel on Phytosanitary measures.

Economic impact is very variable between countries:

In **Brazil** severe impacts were recorded in 1999 " the incidence of this disease called "sapeca" by the growers often reached levels of 100% resulting in a total loss of bulb and seed production" (Pozzer et al, 1999). In 2006 no economic damage is reported anymore (Renato de Resende, personal communication).

In the **US** economic impact is reported on onion crops, and is considered there as a severe pest of onion (Gent 2004, Mohan & Moya 2004, Crowe & Pappu, 2005). Reduction of the size of the bulbs is noted. The epidemic of IYSV in Colorado (USA) in 2003 was estimated to have cost growers $2.5 to $5 million in farm receipt alone, based on a conservative 5 to 10% loss of a $ 50 million annual revenue (Schwartz & Gent cited by Gent *et al.*,2006). **It should be noted that in the US, the production of onion is mainly based on transplants and many outbreaks could be associated with the use of contaminated transplants.**

In **Israel**, severe losses were reported in 1997: "a high incidence of the disease was observed in the surrounding fields and in other onion-growing areas in Israel, associated with large populations of *Thrips tabaci*" (Gera *et al.* 1998 cited in Gera *et al.* 2000). In recent years crop losses are mainly recorded in onions seed production (A. Gera, personal communication, 2006)

In 1999 in **Slovenia**, leeks showing necrotic spots were collected and IYSV was detected. The incidence of the disease was over 90% but no obvious effect on yield was observed (Mavrik & Ravnikar 2002). Since then, no specific data has been gathered and *Allium* spp. are not important crops in Slovenia (Ravnikar personal communication, 2007)

In the **Netherlands**, infection was found in few plants with hardly any symptoms and no yield losses (Verhoeven, 2006 personal communication).After surveys conducted in 2008 in the Netherlands in onion crops it was concluded that latent infections are much more frequent than originally thought and outbreaks appear mainly where thrips populations are high. Damage is limited.

In **Germany**, in summer 2007 infected onion plants often showed white to straw-coloured oval, necrotic lesions on the leaves. At a later stage of the disease, the number of lesions increased and led to decay of the leaves. While at the beginning of the vegetation period, only isolated plants or small groups of plants appeared to be infected, onion plots were evenly infected at a later stage. So far, yield reductions have not been observed in onion crops (dry bulb production).

In **Spain**, symptoms sometimes with necrotic lesions, curled leaves and bulbs of reduced size were observed in September 2003, in one onion field in Albacete region. Severely affected plants eventually died (Cordoba-Selles *et al.*, 2005). Nevertheless, in this area damages have not been quantified and this is the only region in Spain where it has been detected, further studies should be initiated in 2007 (Jorda-Gutierrez, personal communication, 2006). In Spain, onions are produced both from seeds and transplants.

In **France**, surveys were carried out in 2006 and 2007 essentially on *Allium* crops (see also RS 2006/141). more than 70% of the positive samples were showing feeding damage caused by *Thrips tabaci* but IYSV symptoms (e.g. diamond-shaped lesions) were not consistently observed on IYSV-infected samples. Apart from the presence of *Thrips tabaci* which can cause direct damage, no economic losses could be attributed to the occurrence of IYSV in the infected crops.

In **New Zealand** infected *Allium* crops showed a significant amount of thrips damage, but most plants had no IYSV symptoms. Two of the ornamental *Allium* species (*A. senescens* and *A. murrayanum*), tested positive for IYSV by ELISA but were symptomless. The economic impact of IYSV in onion and shallot still needs to be determined in New Zealand.

In **Italy**, no loss of yield had been seen in a field where many plants showed symptoms.

Other crops

In the **United Kingdom,** (June 2007) affected leaves of lisianthus (*Eustoma grandiflorum*) collected from a glasshouse showed pale necrotic lesions. It was reported that in the worst affected block within the glasshouse, up to 20% of the plants were showing similar symptoms. The infected crop has been removed and measures taken to eradicate the infection.

Describe damage to potential hosts in the PRA area:	Plants infected with IYSV usually show necrotic spots. Damages are described below for different host plants (extracted form the draft Datasheet on IYSV) *Iris hollandica* In the Netherlands, infected iris showed yellow and sometimes necrotic spots on leaves. Symptoms were later reported to consist of chlorotic spots that developed into yellow and necrotic spots. *Allium porrum* Symptoms on leek in the Netherlands have been described as elongated, oval chlorotic rings that turn yellow and eventually become necrotic. Rings could occasionally be observed overlapping each other. In Slovenia, symptoms were said to be chlorotic spots that later became necrotic. *Allium cepa* Onion with IYSV in Israel had straw-coloured ringspots on leaves and flower stalks. In Brazil, symptoms were described as necrotic eye-like spots on leaves and flower stalks. In the USA onions had straw-coloured, dry, necrotic spindle- or diamond-shaped lesions on flower stalks. Some lesions had distinct green centres with chlorotic and necrotic borders. Other lesions appeared as concentric rings of alternating green and chlorotic/necrotic tissue *Hippeastrum hybridum (*Amaryllis) *Hippeastrum hybridum* cv 'Orange Souvereign' infected with IYSV in Israel had chlorotic spots and rings. *Eustoma grandiflorum* Lisianthus (*Eustoma grandiflorum* 'Eko White') systemically infected with IYSV was stunted, had necrotic spots and rings on leaves and stems, and developed tip necrosis and flower distortion. Necrotic spots and rings were also a symptom in Japan (Doi *et al.*, 2003). Systemic symptoms on a range of artificially inoculated lisianthus cultivars included necrotic spots, necrotic ringspots, colour breaking in petals, necrosis, and streaks (Doi *et al.*, 2003). *Alstroemeria* Necrotic spots on leaves were noticed on infected plants.
How much economic impact would the pest have in the PRA area:	In 2006, the EWG was not able to make a judgement on the potential economic damage for the PRA area because of the differences in reports of damage caused by the pest between European and USA/Australian outbreaks. In addition, there are differences in agronomy practices (e. g. onions are mainly planted from seeds or sets in Europe, transplants seems to be only used in the southern part of the region and this is a declining practice). The Panel on phytosanitary measures reviewed the situation of the pest and considered that the potential for damage was limited.

CONCLUSIONS OF PEST RISK ASSESSMENT

Summarize the major factors that influence the acceptability of the risk from this pest:	• Outbreaks have already been reported in the EPPO region but given that latent infection are . • It is very likely that the pest will survive or remain undetected during existing phytosanitary measures.

- The pest can establish in the PRA area and its vector is widely distributed in the PRA area.
- The potential for economic damage is low based on the experience in EPPO countries where the pest has been reported (except for the UK outbreak and seed production in Israel).

Estimate the probability of entry:

The EWG considered the probability of entry for all obvious pathways for IYSV. It was considered that the probability of entry is low but that another unknown pathway may exist.

For each individual pathway the probability of entry was rated as follows:
Plants for planting (except seeds and bulbs) of host plants: high risk
Cut flowers of *Alstroemeria, Eustoma grandiflorum, Iris hollandica* and *Hippeastrum hybridum*: low risk
Viruliferous thrips on non host plants and bulbs of *Allium* spp: low risk
Green parts of *Allium* spp: very low risk

Estimate the probability of establishment:

Probability of establishment is high
The climatic conditions in the PRA area are suitable for the pest to establish and its vector *Thrips tabaci* is widely distributed throughout the PRA area.
The pest has already been introduced in several EPPO and non EPPO Countries the risk of introduction seems moderately high.

All parts of the EPPO region are at risk

Estimate the potential economic impact:

The economic impact recorded in EPPO countries where outbreaks have been reported is low except for onion seed production in Israel and the outbreak on Lisianthus in UK.

Degree of uncertainty

The following areas have varying degrees of uncertainty:

- Pest distribution in the EPPO region: symptoms are not easily recognized or plants are symptomless and in many countries there are no surveys to detect the presence of the virus.
- Origin of the different outbreaks reported throughout the world is not clear
- Epidemiology of the virus and the virus-vector interaction are not known (by analogy to TSWV and *Thrips tabaci* it is possible that a difference exists in vector efficiency between vector's populations from different countries where the pest has been reported)
- Potential to cause economic damage under European conditions: impact on yields data differ from minimal to high. In Israel and Brazil, where initially severe damage was recorded, the levels of damage seem to have reduced (Renato de Resende, personal communication). In the USA, more severe damage has been are reported since 2001. One explanation to this situation may be that transplants are used for onion production in the USA and that volunteer plants are commonly present in the fields which provides a host plant whole year round. Volunteers plants are present in Europe as well, but the use of transplants in onion production is not a common practice in Europe.
- Host range: as many host plants only develop local infection it is suspected that a good systemically infected

plant host may exist which has not been identified.
- The potential for bulbs to transmit the virus.
- Volume of the trade of host plants, in particular for plants for planting and cut flowers of host plants.
- Origin of IYSV.

OVERALL CONCLUSIONS

The pest is already present in 7 countries of the EPPO region and surveys in the Netherlands and France have showed that infection is very often latent. So there is uncertainty in the current distribution of the pest.
Onion is an important crop for many EPPO countries but the economic impact recorded in EPPO Countries where outbreaks have been reported is low, except for onion seed production in Israel. Detailed information on onion crop husbandry has also been gathered which indicate that transplants are not commonly used in Onion production.

The Panel on phytosanitary measures concluded in 2009-02 that the pest should not be recommended for regulation

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Table 1. Year of the first record of *Iris Yellow Spot Virus* for each country

Continent	Country	Year of first country record
North America	USA	1989
	Canada	2007
Central America	Guatemala	Not known
South America	Brazil*	1994
	Peru	2003
	Chile	2004
Europe	Netherlands	1992
	Slovenia	1999
	Italy	1999-2001
	Spain	2003
	France	2005
	Germany	2007
	Serbia	2007
Asia	India	1990s
	Israel	1998
	Japan	Not known
Africa	Réunion Island†	2004
Oceania	Australia	2002

* May have been present in Brazil since 1981 but the disease was then attributed to *Tomato Spotted Wilt Virus.*
† Réunion Island is an overseas department of France.

Table 2. *Allium* species reported as natural hosts of *Iris Yellow Spot Virus*

Host	**Location**	**Year of first outbreak**	**Reference**
Allium altaicum (wild onion)	Washington, USA	2005	Pappu *et al*., 2006
Allium cepa (onion)	Idaho, USA	1989	Hall *et al*., 1993
	Oregon, USA	1989	Hall *et al*., 1993
	Brazil	1994[a]	Pozzer *et al*., 1999
	Israel	1998	Gera *et al*., 1998a
	Slovenia	1999	Mavrič & Ravnikar, 2000
	Italy[b]	1999-2001	Cosmi *et al*., 2003
	Colorado, USA	2001	Schwartz *et al*., 2002
	Arizona, USA	2002	Gent *et al*., 2006
	California, USA	2003	Poole *et al*., 2006
	Utah, USA	2002	Abad *et al*., 2003
	Australia[c]	2002	Coutts *et al*., 2003
	New Mexico, USA	2002	Creamer *et al*., 2004
	Washington, USA[d]	2003	du Toit *et al*., 2004
	Spain	2003	Córdoba-Sellés *et al*., 2005
	Réunion Island	2003	Robène-Soustrade *et al*., 2006
	Peru	2003	Mullis *et al*., 2006
	Georgia, USA	2004	Mullis *et al*., 2004
	Chile	2004	Rosales *et al*., 2005
	France	2005	Huchette *et al*., 2006
	Texas, USA	2005	Miller *et al*. 2006
	Netherlands	2005	Verhoeven, Pers. Comm.
	New York, USA	2006	Hoepting *et al*., 2006
	Japan	Not known	Zen *et al*., 2005
	India	Not known	Kumar & Rawal, 1999
	Guatemala	Not known	Nischwitz *et al*., 2006
Allium cepa var. *ascalonicum* (shallot)	Rèunion Island	2004	Robène-Soustrade *et al*., 2006
	Washington, USA	2004	Pappu *et al*., 2006
	New York, USA	2006	Hoepting *et al*., 2006
Allium fistulosum (Welsh onion)	New York, USA	2006	Hoepting *et al*., 2006
Allium porrum (leek)	Idaho, USA	1992	Gent *et al*., 2006
	Netherlands	1997	Verhoeven, Pers. Comm.
	Slovenia	1999	Mavrič & Ravnikar, 2000
	Australia	2002	Coutts *et al*., 2003
	Rèunion Island	2004	Robène-Soustrade *et al*., 2006
	France	2006	Anon., 2006
	New York, USA	2006	Hoepting *et al*., 2006
	Colorado, USA	2006	Schwartz *et al*., 2007
Allium sativum (garlic)	Réunion Island	2004	Robène-Soustrade *et al*., 2006
Allium pskemense *(wild onion)*	Washington, USA	2005	Pappu *et al*., 2006
Allium schoenoprasum (chives)	Idaho, USA	1992	Gent *et al*., 2006
Allium vavilovii (wild onion)	Washington, USA	2005	Pappu *et al*., 2006

[a] Possibly present in Brazil from as early as 1981 but was then attributed to *Tomato Spotted Wilt Virus* (Gent *et al*., 2006). [b] Gent *et al*. (2006) lists IYSV as present on onion in Italy but the abstract of Cosmi *et al.* (2003) only states it as on *Portaluca* species. [c] Subsequent to this finding Coutts *et al*. (2003) found IYSV in archived onion samples from 1998. [d] Suspect symptoms were observed as early as 1999 (Pappu *et al*., 2006).

Table 3. Species other than *Allium* reported as natural host of *Iris Yellow Spot Virus*

Host	**Location**	**Year of first outbreak**	**Reference**
Alstroemeria sp.	Japan	Not known	Okuda & Hanada, 2001
	Netherlands	2004	Verhoeven, Pers. Comm.
Amaranthus retroflexus	Colorado, USA	2004	Gent *et al*., 2006
Ambrosia sp. (Ragweed)	New York, USA	2006	Hopeting *et al*., 2006
Arctium sp. (Burdock)	New York, USA	2006	Hopeting *et al*., 2006
Atriplex micrantha	Utah, USA	2008	Evans *et al.* 2009
Bessera elegans	Japan	Not known	Jones, 2005
Chenopodium album	Idaho and Washington, USA	2006	Sampangi *et al.* 2007
Chrysanthemum sp.	Poland	2001	Balukiewics & Kryczynski, 2005
Clivia minata	Japan	Not known	Jones, 2005
Cycas sp.	Iran	2000-2002	Ghotbi *et al*., 2005
Eustoma grandiflorum (Lisianthus)	Japan	2003	Doi *et al*., 2003
Eustoma russellianum	Israel	1999	Kritzman *et al*., 2000
Geranium carolinianum (Carolina cranesbill)	Georgia, USA	2004	Gent *et al*., 2006
Hippeastrum *x* hybridum (Amaryllis)	Israel	1998	Gera *et al*., 1998b
Iris hollandica (Dutch iris)	Netherlands	1992	Derks & Lemmers, 1996
Kochia scoparia (Bassia scoparia)	Idaho and Washington, USA	2006	Sampangi *et al.* 2007
Lactuca serriola	Idaho and Washington, USA	2006	Sampangi *et al.* 2007
Linaria canadensis (Blue toadflax)	Georgia, USA	2004	Gent *et al*., 2006
Pelargonium hortorum (Geranium)	Iran	2000-2002	Ghotbi *et al*., 2005
Portulaca oleracea (Common purslane)	Colorado, USA	2004	Gent *et al*., 2006
Portulaca sp. (Purslane)	Italy	1999-2001	Cosmi *et al*., 2003
Rosa sp.	Iran	2000-2002	Ghotbi *et al*., 2005
Rubus sp. (Bramble)	New York, USA	2006	Hopeting *et al*., 2006
Scindapsus sp.	Iran	2000-2002	Ghotbi *et al*., 2005
Sonchus asper	Georgia, USA	2006 or 2007	Nischwitz *et al.* 2007
Taraxacum sp. (Dandelion)	New York, USA	2006	Hopeting *et al*., 2006
Tribulus terrestris	Idaho and Washington, USA	2006	Sampangi *et al.* 2007
Vicia sativa (Common vetch)	Georgia, USA	2004	Gent *et al*., 2006