	European and Mediterranean Plant Protection Organisation		
	Organisation Européenne et Méditerranéenne pour la Protection des Plantes		
	Guidelines on Pest Risk Analysis		
	Lignes directrices pour l'analyse du risque phytosanitaire		
	Decision-support scheme for quarantine pests		
			07-13317 **P PM point 5.4 for information only**
PEST RISK ANALYSIS FOR IRIS YELLOW SPOT VIRUS			Includes core members comment on PRM
Pest risk analyst:			
Expert Working Group (EWG) for Iris Yellow Spot Virus Reviewed by core			Dom COLLINS (Mr) GB, Elena JACKEVICIENE (Mrs) LT, Monia MNARI-HATTAB (Mrs) TN, Ernst PFEILSTETTER (Mr) DE, Philippe REYNAUD (Mr) FR, Xavier TASSUS (Mr) FR, Jacobus (Ko) VERHOEVEN (Mr) NL, Heinrich Josef VETTEN (Mr) DE, James WOODHALL (Mr) GB,
			The EWG tried to support its judgement with references. When no references were available, the judgement was made by consensus within the EWG.
Draft 2006-09-01			
			The pest has been known of since the late 80s but was described on Iris in the 90s. Many basic epidemiological questions on IYSV remain to be addressed. In particular additional overwintering sources and hosts of IYSV are likely to be identified and other vectors may be discovered. There are many uncertainties in this PRA. **The PRA record was adjusted after the meeting by the EPPO Secretariat in consultation with the EWG members following the publication of an article of Gent *et al.* in Plant Pathology and the National Allium Research Conference (2006-12-06/08) where several presentations were made on IYSV.**
Stage 1: Initiation			
1 What is the reason for performing the PRA?			This newly characterized tospovirus came to the attention of EPPO as it has been reported in several countries on onion, leek and iris crops but only once on Iris.
2 Enter the name of the pest			*Iris yellow spot virus* [genus: Tospovirus] IYSV
2A Indicate the type of the pest			Virus

2B Indicate the taxonomic position		Bunyaviridae, Tospovirus
3 Clearly define the PRA area		The EPPO region
4 Does a relevant earlier PRA exist?	Yes	A summary Pest Risk Analysis was prepared by the Central Science Laboratory, UK in 2002, a revised draft was prepared in 2004.
5 Is the earlier PRA still entirely valid, or only partly valid (out of date, applied in different circumstances, for a similar but distinct pest, for another area with similar conditions)?	Partly valid	The earlier PRA had focussed on UK conditions and needs updating
Stage 2A: Pest Risk Assessment - Pest categorization		
6 Does the name you have given for the organism correspond to a single taxonomic entity which can be adequately distinguished from other entities of the same rank?	Yes	
7. Even if the causal agent of particular symptoms has not yet been fully identified, has it been shown to produce consistent symptoms and to be transmissible?	-	
8 Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?	Yes	
9 Does the organism have intrinsic attributes that indicate that it could cause significant harm to plants?	-	
10 Does the pest occur in the PRA area?	Yes	
11. Is the pest widely distributed in the PRA area?	No	The pest has only been reported from six countries in the EPPO region (France, Israel, Italy, the Netherlands, Slovenia, Spain) with a limited number of reported infections apart from Israel. The pathogen has also been reported in Poland and Tunisia but the EWG was unsure about the validity of these records. Further survey data is needed to clarify the "pest status of IYSV " in other EPPO countries.
12 Does at least one host-plant species (for pests directly affecting plants) or one suitable habitat (for non parasitic plants) occur in the PRA area (outdoors, in protected cultivation or both)?	Yes	
13. If a vector is the only means by which the pest can spread, is a vector present in the PRA area? (if a vector is not needed or is not the only means by which the pest can spread go to 14)	Yes	
14 Does the known area of current distribution of the pest include ecoclimatic conditions comparable with those of the PRA area or	Yes	

sufficiently similar for the pest to survive and thrive (consider also protected conditions)?		
15 Could the pest by itself, or acting as a vector, cause significant damage or loss to plants or other negative economic impacts (on the environment, on society, on export markets) ?	Yes	
16 This pest could present a risk to the PRA area.	Yes	

Section 2B: Pest Risk Assessment - Probability of introduction/spread and of potential economic consequences		
Note: If the most important pathway is intentional import, do not consider entry, but go directly to establishment. Spread from the intended habitat to the unintended habitat, which is an important judgement for intentionally imported organisms, is covered by questions 1.33 and 1.35.		
1.1 Consider all relevant pathways and list them		The list of recorded host plants is presented in Tables 1, 2 and 3. The following pathways were retained by the EWG: *Allium cepa*: seedlings (transplants) *Allium porrum*: seedlings (transplants) *Alstroemeria* species: *in vitro* plants, pot plants cut flowers *Eustoma grandiflorum*: seedlings, 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) The EWG was uncertain of the validity of some of the host records listed in Tables 2 and 3, consequently these records were not considered in the PRA. Viruliferous *Thrips tabaci* on non-host plants and on *Allium* species bulbs The expert working group considered that viruliferous thrips on non-host plants was a pathway. In addition at the National Allium Research Conference (2006-12-06/08), Nischwitz et al reported that live Thrips tabaci could be observed under scales of onions from Peru being repacked in the USA and sprouting onions with IYSV symptoms were observed in cull piles of Peruvian onions discarded in fields with close proximity to seed beds. This was consequently added as a pathway Other pathways considered but not retained • Seeds IYSV is not considered to be transmitted by seeds. • Bulbs and 'sets'** It has not been detected in the bulbs or roots of infected onion or *Hippeastrum* in Israel (Kristzman *et al.*, 2001). It has been detected in onion bulbs in la Réunion Island (Robène-Soustrade *et al*, 2006) but this is the only report on detection in bulbs and the EWG considered that bulbs was not a likely pathway. After the meeting an article on IYSV was published (Gent *et al*., 2006). This article state "that this is the only report on bulb infection by IYSV, but it suggests there is potential spread of IYSV by distribution of infected bulbs or culled bulbs as documented for TSWV in the bulbs of *Dahlia* sp". Similarly Coutts et al 2003 says that a ‘plausible explanation for its presence is planting infected bulbs’. These reports provide no experimental details and appear to be contradictory to some other reports (with experimental details), as a consequence it was concluded that the conclusions of the EWG should not be changed and that bulbs should not be considered as a possible pathway. Nevertheless this needs to be investigated further when new information is available. ** The production of onion is mainly from seeds but also from "sets", especially in the Netherlands (in Europe approx. 10 to 15 % of total onion production). Sets are small onion bulbs (approx. 1,5

		to 2 cm diameter) which are planted by machine. These sets are produced almost exclusively in the Netherlands on a surface of approx 1.000 ha. The trade of sets is very important and has an own tariff no (Behr, EURONION personal communication , 2007). • Natural spread Natural spread (transport of viruliferous thrips with the wind) was considered by the EWG as having very low probability • Soil: There are some reports of adult of thrips hibernating in soil (Jenser & Szenasi, 2004 cites three references) but normally, *Thrips tabaci*, the vector, overwinter 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. Gent et al (2006) also state that "the importance of overwintering of IYSV in diapausing or quiescent thrips in the soil or associated with plant debris has not been investigated, but overwintering of viruliferous thrips in soil potentially could be a source of inoculum. However, overwintering of Tomato Spotted Wilt Virus in *Frankliniella fusca* and other thrips vectors in the soil generally is minimal, and largely has been discounted as a primary means of survival of this virus". This pathway was not considered further.
1.2 Estimate the number of relevant pathways, of different commodities, from different origins, to different end uses.	Many	A trade exists for cut flowers and plants for planting coming from countries where the pest is present e.g. Israel US, Japan or other European countries where the pest is reported i.e. Slovenia, Spain, France, the Netherlands, Italy. Specific data for trade is not available for host plants of IYSV.
1.3. Select from the relevant pathways, using expert judgement, those which appear most important. If these pathways involve different origins and end uses, it is sufficient to consider only the realistic worst-case pathways. The following group of questions on pathways is then considered for each relevant pathway in turn, as appropriate, starting with the most important.		
Pathway n°: 1		Plants for planting except seeds and bulbs (e.g. seedlings, pot plants, in vitro-plants…) of *Allium* sp, *Alstroemeria* sp, *Eustoma grandiflorum.*
1.4 How likely is the pest to be associated with the pathway at origin, taking into account factors like the prevalence of the pest at origin, the life stages of the pest, the period of the year?	Likely	Some references mention that planting material may have been the source of infection (Robène Soustrade 2006, Gent *et al* 2004). Gent *et al (*2006) mention that "contaminated transplants of onions are the only source of primary inoculum identified to date in the High Plains region of the United States and may provide an important early-season source of inoculum to initiate outbreaks in neighbouring onion crops". It is likely if seedlings are produced in areas where the virus is present and *Thrips tabaci* population is high.
1.5 Is the concentration of the pest on the pathway at origin likely to be high, taking into account factors like cultivation practices, treatment of consignments	Likely	More than 50% of lots of onion transplants sampled from commercial shipments into Colorado (USA) during 2004 and 2005 exhibited symptoms of IYSV and the presence of the virus was confirmed by ELISA (Schwartz *et al*, 2004) Treatment against thrips is common in ornamental or Allium production.

1.6 How large is the volume of the movement along the pathway?	Moderate	Movement of is essentially between EPPO member countries. *Eustoma* and *Alstroemeria* are widely traded species. Specific data on trade for plants for planting of different host plants is not available (the Custom Harmonized System on which import trade data are generated does not allow to distinguish trade between species).
1.7 How frequent is the movement along the pathway?	Frequent	Plants for planting are imported all year round.
1.8 How likely is the pest to survive during transport /storage?	Very likely	A virus survives during transport or storage
1.9 How likely is the pest to multiply/increase in prevalence during transport /storage?	No judgment	Not relevant for viruses in general
1.10 How likely is the pest to survive or remain undetected during existing phytosanitary measures?	Likely	The detection of symptoms is difficult and symptoms vary between hosts. In *Eustoma* plants symptoms may be easy to detect whereas for other hosts no symptoms may be visible. In addition symptoms may not be typical for IYSV.
1.11 How widely is the commodity to be distributed throughout the PRA area?	Moderately widely	The commodities concerned are considered to be mainly distributed in western Europe (absence of precise data).
1.12 Do consignments arrive at a suitable time of year for pest establishment?	Yes	Year round import or movement
1.13 How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	Moderately likely	Many host plants of IYSV are present throughout the PRA area (e.g. *Allium* spp.). *Thrips tabaci* is present throughout the region as well but the thrips has to acquire the virus on a restricted part of the plant because IYSV infections do not appear to become systemic in onion or other host species (Gent *et al*., 2006). This make the acquisition of the virus less likely in comparison with systemically infected plants. It is unknown whether vector host preference is influenced by the presence of tospovirus. There are little data available on the efficacy of transmission of IYSV by *Thrips tabaci*. Kritzman *et al*. (2001). The EWG considered that transfer to a suitable host seems to be more likely in onions than *Alstroemeria* as the latter shows more necrotic lesions.
1.14 How likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	Very likely	Plants for planting always aid transfer to suitable hosts.
1.15 Do other pathways need to be considered?	Yes	
Pathway n°: 2		Cut flowers of *Alstroemeria* sp, *Eustoma grandiflora, Iris hollandica, Hippeastrum hybridum* or green parts of *Allium* spp.
1.4 How likely is the pest to be associated with the pathway at origin, taking into account factors like the prevalence of the pest at origin, the life stages of the pest, the period of the year?	Unlikely	There is not much information on transmission with cut flowers. It is likely if cut flowers and green part of *Allium* spp. are produced in areas where the virus is present and the *Thrips tabaci* population is high.
1.5 Is the concentration of the pest on the pathway at origin likely to be high, taking into account factors like cultivation practices, treatment of consignments	Unlikely	It is common practice that cut flowers showing symptoms will be eliminated during sorting and grading. Only mildly infected Allium spp will not be eliminated during sorting and grading.

1.6 How large is the volume of the movement along the pathway?	Major	The EWG considered that the volume was major (mainly because of the trade of cut flowers although specific data on volume of cut flowers of *Alstroemeria* sp, *Eustoma grandiflora*, *Iris hollandica*, *Hippeastrum hybridum* is lacking)
1.7 How frequent is the movement along the pathway?	Very often	Cut flowers (e.g. *Alstroemeria*) are traded in large quantities all year round.
1.8 How likely is the pest to survive during transport /storage?	Very likely	Viruses can survive during transport and storage
1.9 How likely is the pest to multiply/increase in prevalence during transport /storage?	No judgement	Not relevant
1.10 How likely is the pest to survive or remain undetected during existing phytosanitary measures?	Likely	Mildly infected plants may not be detected during inspection. Cut flowers of host species and Allium spp green parts are not inspected in many EPPO Countries.
1.11 How widely is the commodity to be distributed throughout the PRA area?	Widely	Cut flowers are distributed throughout the PRA area
1.12 Do consignments arrive at a suitable time of year for pest establishment?	Yes	Year round
1.13 How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	Unlikely (cut flowers) Very unlikely (green parts of *Allium* species)	The mode by which Thrips tabaci acquires IYSV has not been demonstrated. However, by analogy with those tospovirus-thrips vector interactions that are better understood (for example, Frankliniella occidentalis-TSWV), it is here assumed that IYSV is taken up (and can only be taken up) from infected plants by the first larval instar of Thrips tabaci and only subsequently transmitted to new host plants by the adult thrips of the same individual. It was considered unlikely that an indigenous vector will acquire the virus from infected cut flowers as first instar larvae would have to come into contact with these cut flowers. This has implications when discussing possible trade pathways. The transfer may be possible if cut flowers are already infested with immature thrips that have acquired the virus. Nevertheless it is common practice in many EPPO countries that companies producing pot plants or cut flowers will also sell purchased cut flowers and store them in close proximity to their own production sites. It is considered very unlikely for green parts of *Allium* species; it is very unlikely that these plants are in contact with host plants.
1.14 How likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	Very unlikely	The intended use of cut flowers and green *Allium* parts is "consumption"
1.15 Do other pathways need to be considered?	Yes	
Pathway n°: 3		**Viruliferous *Thrips tabaci* on non- host plants and *Allium* species bulbs (adults only)**
1.4 How likely is the pest to be associated with the pathway at origin, taking into account factors like the prevalence of the pest at origin, the life stages of the pest, the period of the year?	Very unlikely	Non-host plants would have to be grown beside infected host plants and *Thrips tabaci* would have to breed on the host plants, and then, the adults transfer to the non-host plants before they are harvested prior to movement.
1.5 Is the concentration of the pest on the	Unlikely	Treatment against thrips is common in ornamental production.

pathway at origin likely to be high, taking into account factors like cultivation practices, treatment of consignments		
1.6 How large is the volume of the movement along the pathway?	Minimal	Thrips move in trade but there is no data on how often this happens. Nevertheless it is expected that viruliferous *Thrips tabaci* on non-host plants is likely to be rare in trade.
1.7 How frequent is the movement along the pathway?	No judgment	There is no data with which to make such estimation
1.8 How likely is the pest to survive during transport /storage?	Likely	Thrips will survive transportation
1.9 How likely is the pest to multiply/increase in prevalence during transport /storage?	Not relevant	Virus could multiply in the thrips but that is not considered relevant.
1.10 How likely is the pest to survive or remain undetected during existing phytosanitary measures?	Unlikely	Import inspection procedures should detect adults (visual alone or combined with detection methods such as the Berlese method).
1.11 How widely is the commodity to be distributed throughout the PRA area?	Very widely	Ornamentals are distributed throughout the region. Onion bulbs are imported in all EPPO member countries (FAO Stats, year 2004 see Table 5)
1.12 Do consignments arrive at a suitable time of year for pest establishment?	Yes	
1.13 How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	[very] unlikely	Unlikely in case of plants for planting it might happen if the plant is planted in the vicinity of host plants. Very unlikely for non-host cut flowers and green parts of *Allium* spp.
1.14 How likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	Unlikely Very unlikely	Plants for planting present a higher risk than other commodities of non-host plants. If viruliferous thrips are present on these plants, for transmission to occur host plants would have to be in the vicinity and the thrips would have to move to these host plants. The EWG concluded that this was an unlikely scenario. Cut flowers of *Eustoma grandiflora*, *Iris hollandica*, *Hippeastrum hybridum* and green parts of *Allium* spp. present a lower risk.
1.15 Do other pathways need to be considered?	NO	
1.16 a Specify the host plant species (for pests directly affecting plants) or suitable habitats (for non parasitic plants) present in the PRA area.		*Allium* spp. *Alstroemeria* sp. *Eustoma grandiflorum* *Hippeastrum hybridum* *Iris hollandica*
1.16 b Estimate the number of host plant species or suitable habitats in the PRA area.	Few	The pest has a narrow host range. Mainly restricted to monocotyledons
1.17 How widely distributed are the host plants or suitable habitats in the PRA area?	Very widely	Onions are grown in almost all EPPO countries (FAO stats 2004). Leek is also grown in many EPPO countries (FAO stats 2004). Ornamental plants are also grown in many EPPO countries

(specify)		(species-specific data not available).
1.18 If an alternate host is needed to complete the life cycle, how widespread are alternate host plants in the PRA area?	Not relevant	
1.19. If the pest requires another species for critical stages in its life cycle such as transmission, (e.g. vectors), growth (e.g. root symbionts), reproduction (e.g. pollinators) or spread (e.g. seed dispersers), how likely is the pest to become associated with such species?	Likely	The vector *Thrips tabaci* is widely distributed in the PRA area.
Specify the area where host plants (for pests directly affecting plants) or suitable habitats (for non parasitic plants) are present (cf. QQ 1.16-1.19). This is the area for which the environment is to be assessed in this section. If this area is much smaller than the PRA area, this fact will be used in defining the endangered area.		Whole EPPO region.
1.20 How similar are the climatic conditions that would affect pest establishment, in the PRA area and in the current area of distribution?	Completely similar	*Thrips tabaci* is found throughout the region, both in glasshouse and in field conditions. In cold conditions, *Thrips tabaci* would have less generations in a year but is still able to survive.
1.21 How similar are other abiotic factors that would affect pest establishment, in the PRA area and in the current area of distribution?		No known abiotic factors
1.22 If protected cultivation is important in the PRA area, how often has the pest been recorded on crops in protected cultivation elsewhere?	Often	It has been recorded elsewhere in protected conditions Leek in the Netherlands in 1997 (Verhoeven, personal communication) Lisianthus in Japan in 2003 (Doi *et al*.,l 2003) *Alstroemeria* sp., (Okuda personal communication cited by Jones 2002) was most probably grown in glasshouse).
1.23 How likely is that establishment will not be prevented by competition from existing species in the PRA area?	Very likely	The establishment is linked to the vector which is very competitive.
1.24. How likely is that establishment will not be prevented by natural enemies already present in the PRA area?	Very likely	The establishment is linked to the vector which is very competitive.
1.25 To what extent is the managed environment in the PRA area favourable for establishment?	Moderately likely	The main host plant (onion) is not grown continuously in the EPPO region unlike in the South West of US and Australia.
1.26. How likely is it that existing control or husbandry measures will fail to prevent establishment of the pest?	Likely	Control programme against *Thrips tabaci* cannot guarantee that the pest will not establish

1.27. How likely is it that the pest could survive eradication programmes in the PRA area?	Moderately likely	If the pest is found in greenhouses eradication is feasible. In field conditions it depends to what extent access to other hosts can be (temporary) prevented including unknown hosts. In addition eradication of the vector is not feasible
1.28 How likely is the reproductive strategy of the pest and the duration of its life cycle to aid establishment?	No judgment	The epidemiology of the vector-virus relationship is poorly understood. This question cannot be answered.
1.29 How likely are relatively small populations or populations of low genetic diversity to become established?	No judgment	The pest has been found around the world although pathways are not very obvious. The origin of the different infection are not known. It might be concluded from it that small populations are capable of establishment
1.30 How adaptable is the pest? Adaptability is:	Moderate	The adaptability of IYSV is closely linked to that of the vector. *T. tabaci* occurs in a wide range of climate.
1.31 How often has the pest been introduced into new areas outside its original area of distribution? (specify the instances, if possible)	Often	The original area is supposed to be in the Near East (by analogy with as for the vector) but not specific reference supports it. It has now been detected in all continents
1.32 Even if permanent establishment of the pest is unlikely, how likely are transient populations to occur in the PRA area through natural migration or entry through man's activities (including intentional release into the environment) ?	Not relevant.	Permanent establishment has occurred In the PRA area
1.33 How likely is the pest to spread rapidly in the PRA area by natural means?	Moderately likely	There is a possibility that *Thrips tabaci* populations might vary in efficacy of transmission. In the EPPO region there are differences between the situation in Israel and the Netherlands. In Israel there are clear references to transmission between crops whereas in the Netherlands spread has been limited. (Verhoeven, personal communication 2006)
1.34 How likely is the pest to spread rapidly in the PRA area by human assistance?	Moderately likely	There are outbreaks in several European countries but their number seems to be limited. In US transplants are recognized as a major source of contamination. Onions in Europe are produced mainly from seeds or by sets (see 1.1). In Southern Europe (Spain, Italy etc) there are also Onions really produced from transplants (i. e. small plants cultivated in a special seed bed and then transplanted). The importance of this production is declining. However, these transplants are usually not traded over long distances, they are produced, where they are needed (Behr, EURONION personal communication , 2007). Transplants are used in Germany for leek.
1.35. How likely is it that the spread of the pest will not be contained within the PRA area?	Very likely	The pest has not been contained in countries where it is present
The overall probability of introduction and spread should be described. The probability of introduction and spread may be expressed by comparison with PRAs on other pests.		Probability of entry is low (on average for all pathways): Plants for planting (except seeds and bulbs) present a high risk of entry Other pathways identified have been considered by the EWG to present a low to very low risk of entry. 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, therefore the risk of introduction is medium. The overall probability of spread is medium.
1.36 Based on the answers to questions 1.16 to 1.35 identify the part of the PRA area where presence of host plants or suitable habitats and ecological factors favour the establishment and spread of the pest to define the endangered area.		Whole PRA area.
2.0 In any case, providing replies for all hosts (or all habitats) and all situations may be laborious, and it is desirable to focus the assessment as much as possible. The study of a single worst-case may be sufficient. Alternatively, it may be appropriate to consider all hosts/habitats together in answering the questions once. Only in certain circumstances will it be necessary to answer the questions separately for specific hosts/habitats.		In this section Onion crops were chosen, as these are the main crop likely to be affected.
2.1 How great a negative effect does the pest have on crop yield and/or quality to cultivated plants or on control costs within its current area of distribution?	Moderate	A judgment on economic impact is very difficult to make as contradicting information is available 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 for onions for 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 that time 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 field with hardly any symptoms and no yield losses (Verhoeven, 2006 personal communication) 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. Reduction of quality has been noted on leek in France although it is difficult to know if this reduction is linked to the virus or the vector damage (Tassus personal communication, 2007). Records of economic impacts (where given) associated with outbreaks of *Iris Yellow Spot Virus* are presented in Table 4.
2.2 How great a negative effect is the pest likely to have on crop yield and/or quality in the PRA area?	Moderate	Given the contradicting information on the effect of the pest from EPPO member countries where the pest is present (see question 2.1) it is difficult to come to a conclusion on the potential economic damage in Europe. Unlike in the US, European production of onion is not mainly based on transplants (Behr, EURONION personal communication , 2007). Nevertheless it should be noted that transplants are used in Germany (for leek) and South of Europe Spain, Italy (for onion).
2.3 How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area?	Minor	In the Netherlands so far impact on production costs is very limited. The costs could be higher if contaminated plants or neighboring plants have to be destroyed. In onion crops treatment against *Thrips tabaci* is common.
2.4 How great a reduction in consumer demand is the pest likely to cause in the PRA area?	Minimal	
2.5 How important is environmental damage caused by the pest ?	Minimal	It is not reported as having an environmental impact.
2.6 How important is the environmental damage likely to be in the PRA area (see note for question 2.5)?	Minimal	No additional treatment would be needed. No information on host plant that are keystone species
2.7 How important is social damage caused by the pest within its current area of distribution?	Minimal	No records of social damage in the area where pest is present
2.8 How important is the social damage likely to be in the PRA area?	Minimal	
2.9 How likely is the presence of the pest in the PRA area to cause losses in export	Unlikely	At the moment the pest is not regulated by many countries. Problems may arise if more countries start regulating this virus in particular for other host plants (e.g. cut flowers)

markets?		
As noted in the introduction to section 2, the evaluation of the following questions may not be necessary if any of the responses to questions 2.2, 2.3, 2.4, 2.6 or 2.8 2.9 is “major or massive” or “likely or very likely”. In view of these responses, is a detailed study of impacts required?		
2.10. How easily can the pest be controlled in the PRA area?	With some difficulties	Good plant production practice *(* including *Thrips tabaci* control*)* should help to control the pest in onions (over-head irrigation has consistently been associated with a reuced incidence and severity of IYSV (Gent *et al.* 2006). But usual difficulties for thrips control will apply (resistance to plant protection products, no 100% efficacy) In the Netherlands the pest was easy to control maybe because most outbreaks were found in glasshouse conditions.
2.11. How likely is it that natural enemies, already present in the PRA area, will not suppress populations of the pest if introduced?	Very likely	*Thrips tabaci* is a very competitive organism
2.12. How likely are control measures to disrupt existing biological or integrated systems for control of other pests or to have negative effects on the environment?	Unlikely	No or hardly any additional treatment expected
2.13. How important would other costs resulting from introduction be?	Minor	If infection would occur on a large-scale research cost might increase. Production of virus-free planting material for affected hosts might be needed.
2.14. How likely is it that genetic traits can be carried to other species, modifying their genetic nature and making them more serious plant pests?	Very unlikely	Never been known to occur
2.15A Do you wish to consider the questions 2.1 to 2.15 again for further hosts/habitats?		
2.16 Referring back to the conclusion on endangered area (1.36), identify the parts of the PRA area where the pest can establish and which are economically most at risk.		Whole PRA area
Estimation of the probability of introduction of a pest and of its economic consequences involves many uncertainties. In particular, this estimation is an extrapolation from the situation where the pest occurs to the hypothetical situation in the PRA area. It is important to document the areas of uncertainty and the degree of uncertainty in the assessment, and to indicate where expert		Uncertainties affecting the evaluation: 1. Pest distribution in the EPPO region. Symptoms are not recognized in many countries no surveys for the presence of the virus. 2. Origin of the different outbreaks reported throughout the world 3. Epidemiology of the virus vector interaction is not known (by analogy to TSWV and *Thrips tabaci* it is possible that a difference exists in vector efficiency between populations from different countries where the pest has been reported)

judgement has been used. This is necessary for transparency and may also be useful for identifying and prioritizing research needs. It should be noted that the assessment of the probability and consequences of environmental hazards of pests of uncultivated plants often involves greater uncertainty than for pests of cultivated plants. This is due to the lack of information, additional complexity associated with ecosystems, and variability associated with pests, hosts or habitats.		4. Potential to cause economic damage under European conditions. Impact on yield data differs from minimal to high. In Israel and Brazil where initially severe damage where recorded damage seem to have reduced (there is no explanation to this decrease). In US more severe damages are reported since 2001. One explanation of this situation in the US may be that transplant are used for onion production in the US and that volunteer plants are commonly present in the fields which provides a host plant whole year round. Volunteer plants have been observed in the UK for onions – also wild Allium species can be hedgerow/wild species in the UK and can be perennial herbs these include *Allium ampeloprasum* (wild leek), *Allium carinatum* Keeled Garlic *Allium oleraceum* (field garlic), *Allium paradoxum* (Few-flowered Garlic), *Allium roseum* (Rosy Garlic), *Allium scorodoprasum* (sand leek), *Allium triquetrum* (Three-cornered Garlic), *Allium ursinum* (Ramsons), *Allium vineale* (Wild Onion) [From Preston et al. New Atlas of British and Irish Flora]. Many of these are also present in Europe and Mediterranean. 5. Host range: as many host plants only show or develop local infection it is suspected that a good systemically infected plant host exists which is yet to be identified. 6. Potential for bulbs to transmit the virus to the progeny 7. Volume of trade of host plants in particular for plants for planting and cut flowers of host plants. 8. Origin of the organism supposed to be from Near-East based on the assumption that it has the same origin as the centre of origin for onion).
Evaluate the probability of entry and indicate the elements which make entry most likely or those that make it least likely. Identify the pathways in order of risk and compare their importance in practice.		Probability of entry is considered low : The EWG considered all obvious pathways for IYSV. Nevertheless it considered another unknown pathway may exist. Pathways 1. Plants for planting (except seeds and bulbs) of host plants **high risk** 2. Cut flowers low risk 3. Viruliferous *Thrips tabaci* on non-host plants and bulbs of *Allium* spp. low risk 4. Green parts of *Allium* spp. Very low risk
Evaluate the probability of establishment, and indicate the elements which make establishment most likely or those that make it least likely. Specify which part of the PRA area presents the greatest risk 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

List the most important potential economic impacts, and estimate how likely they are to arise in the PRA area. Specify which part of the PRA area is economically most at risk.		There is uncertainty linked to the economic impact 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).No economic losses in the Netherlands and Slovenia. Although it is reported that plants died damage has not been quantified in Spain. Reduction of quality has been noted in France on leek although it is difficult to know if this reduction is linked to the virus or the vector damage. 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 for onions for seed production (A. Gera, personal communication, 2006)
The risk assessor should give an overall conclusion on the pest risk assessment and an opinion as to whether the pest or pathway assessed is an appropriate candidate for stage 3 of the PRA: the selection of risk management options, and an estimation of the pest risk associated.		It can be an important pest of onion. Onion is an important crop for many EPPO countries. The economic impact recorded in EPPO countries where outbreaks have been reported is low except for onion bulbs production in Israel. Nevertheless severe damage has been recorded on onions in the US and Australia. **The EWG was divided on whether the pest should be considered for stage 3. It concluded that the decision should be made by the Panel on Phytosanitary Measures and that further information should be gathered from Spain Israel France Slovenia on the economic impact of the pest.** Detailed information on onion and leek crop husbandry (use of transplant and volunteers plants) should also be gathered from the EPPO members (use of transplants is recorded in Germany and Spain). **The EWG nevertheless considered that management options should be identified and provided to the Panel on Phytosanitary Measures in case this Panel would decide that the pest was an appropriate candidate for Pest Risk Management.**

This is the end of the Pest risk assessment	

Stage 3: Pest risk Management

3.1. Is the risk identified in the Pest Risk Assessment stage for all pest/pathway combination an acceptable risk?	No	Risk not acceptable for the following pathways • Plants for planting except seeds and bulbs of *Allium* spp., *Alstroemeria* sp., *Eustoma grandiflorum.* • Viruliferous *Thrips tabaci* on non-host plants and bulbs of *Allium* species • Cut flowers of *Alstroemeria* sp., *Eustoma grandiflora*, *Iris hollandica*, *Hippeastrum hybridum* No management measures are proposed for green parts of Allium species.
Pathway 1		Plants for planting (except seeds and bulbs) of *Allium* spp, *Alstroemeria* sp, *Eustoma grandiflorum.*
3.10. Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest	Yes	A phytosanitary certificate is required for all plants for planting imported into in most EPPO countries The EU plant health directive includes general requirements that the annual and bi annual plants for planting should be free from symptoms of viruses (Point 41). Such requirements only apply for consignments coming from countries outside the EU.
3.11. Can the pest be reliably detected by a visual inspection of a consignment at the time of export during transport/storage or at import?	No	Symptoms are often absent on young plants
3.12. Can the pest be reliably detected by testing (e.g. for pest plant, seeds in a consignment)?	No	As the pests produces local infection the sample size would have to be quite high to reliably detect the pest.
3.13. Can the pest be reliably detected during post-entry quarantine?	No	Not practical
3.14. Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?	No	The pest is a virus
3.15. Does the pest occur only on certain parts of the plant or plant products (e.g. bark, flowers), which can be removed without reducing the value of the consignment? (This question is not relevant for pest plants)	No	Not relevant
3.16. Can infestation of the consignment be reliably prevented by handling and packing methods?	No	Not relevant
3.17. Could consignments that may be infested be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry, and can such limitations be applied in practice?	No	

3.18. Can infestation of the commodity be reliably prevented by treatment of the crop?	Yes	Treating against the vector will reduce its population and potentially limit either the entry of the pest or its further spread. Such a measure should be combined with another measure.
3.19. Can infestation of the commodity be reliably prevented by growing resistant cultivars? (This question is not relevant for pest plants)	No	Little information on sources of resistance Limited progress has been made in breeding crops for resistance to tospoviruses, which is partly the result of the lack of suitable forms of resistance. In most cases naturally occurring resistance or tolerance is polygenic, based on complex interactions between virus, vector, and plant and as a consequence difficult to use in breeding programs. see http://www.dpw.wageningen-ur.nl/viro/research/t_1_6.html
3.20. Can infestation of the commodity be reliably prevented by growing the crop in specified conditions (e.g. protected conditions such as screened greenhouses, physical isolation, sterilized growing medium, exclusion of running water...)?	No	Thrips exclusion (and hence exclusion of the virus)is not considered practical by the EWG, particularly for field-grown crops.
3.21. Can infestation of the commodity be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages?	No	Not relevant
3.22. Can infestation of the commodity be reliably prevented by production in a certification scheme (i.e. official scheme for the production of healthy plants for planting)?	Yes	This option should be combined with treatment against *Thrips tabaci*. Nevertheless the EWG had no idea whether such scheme exist. It is a recommended option in the US (planting transplant free of IYSV, Gent *et al*, 2006). This option is not relevant for *Allium* spp *Note: Allium* spp are excluded as they are produced from seeds and not multiplied vegetatively as the other host plants
3.23. Is the pest of very low capacity for natural spread?	N/A	
3.24. Is the pest of low to medium capacity for natural spread?	Yes	The capacity for spread is linked to the vector. This capacity was determined by the EWG by analogy to TSWV and *Frankliniella occidentalis*. Experience in the Netherlands showed that infection by TSWV could be found at a distance of up to10 metres from the contaminated glasshouse, but not more (Verhoeven, personal communication-, 2006). It should be acknowledged that migratory behavior of thrips is not very well understood. Consequently possible pest management options are: Pest-free place of production for the virus (ISPM n°10) or Pest-free area (ISPM n°4)
3.25. Is the pest of medium capacity for natural spread?	N/A	
3.26. The pest is of medium to high capacity for natural spread	N/A	
3.27. Can pest freedom of the crop, place of production or an area be reliably guaranteed?	Yes	It should be guaranteed that the immediate vicinity of the place of production is free from the virus. But how can it be guaranteed? This needs some supporting recommendations.

Mis en forme : Police :Times New Roman, 11 pt, Anglais (Royaume-Uni)

Code de champ modifié

3.28. Are there effective measures that could be taken in the importing country (surveillance, eradication) to prevent establishment and/or economic or other impacts?	Yes	Eradication measures could be envisaged in particular for outbreaks under protected conditions. Eradication feasibility also depends on crop practices (eradication might be difficult to achieve when continuous cropping of onions is common practice) What would the measures be? Crop destruction/ Thrips treatments?
3.29. Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?	Yes	Pest-free area Pest-free place of production Treatment of the crop for thrips control Certification scheme (except for *Allium* spp.)
3.30. Taking each of the measures identified individually , does any measure on its own reduce the risk to an acceptable level?	No	Treatment for the vector as such is not sufficient Certification scheme without efficient thrips management is not sufficient
3.31. For those measures that do not reduce the risk to an acceptable level, can two or more measures be combined to reduce the risk to an acceptable level?	Yes	Certification schemes + treatment against thrips could reduce the risk. It provides a lower level of protection than pest-free place of production or pest-free area.
3.32. If the only measures available reduce the risk but not down to an acceptable level, such measures may still be applied, as they may at least delay the introduction or spread of the pest. In this case, a combination of phytosanitary measures at or before export and internal measures (see question 3.29) should be considered.	N/A	
3.33. Estimate to what extent the measures (or combination of measures) being considered interfere with trade.		There are no specific measures for the moment on IYSV host plants. Pest-free area or pest-free place of production are reasonable phytosanitary measures
3.34. Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.		As the pest is present in the EPPO region additional cost are expected for the countries where the pest is present (phytosanitary certification, official control measures, establishment and maintenance of pest-free areas and places of production).
3.35.Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences?	Yes	Pest-free area for IYSV. Pest-free place of production for IYSV Certification Scheme + treatment against the vector is considered by the EWG as providing a lower level of protection (except for *Allium* sp)
3.36. Envisage prohibiting the pathway		
3.37. Have all major pathways been analyzed (for a pest-initiated analysis)?	No	
Pathway 2		**Viruliferous *Thrips tabaci* on non-host plants and on bulbs of *Allium* sp**
3.10. Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest	Yes	A phytosanitary certificate is required for all plants for planting in most EPPO countries The EU plant health directive includes general requirements that the annual and bi annual plants for planting should be free from symptoms of insects (Point 41). Such a requirement only applies for consignments coming from countries outside the EU.

3.11. Can the pest be reliably detected by a visual inspection of a consignment at the time of export during transport/storage or at import?	Yes	Visual inspection for adult thrips, although it should be noted that detecting thrips under the scales of onions might not be easy.
3.12. Can the pest be reliably detected by testing (e.g. for pest plant, seeds in a consignment)?	No	
3.13. Can the pest be reliably detected during post-entry quarantine?	No	Not practical
3.14. Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?	Yes	Treatment of the consignment with what?
3.15. Does the pest occur only on certain parts of the plant or plant products (e.g. bark, flowers), which can be removed without reducing the value of the consignment? (This question is not relevant for pest plants)	No	Not relevant
3.16. Can infestation of the consignment be reliably prevented by handling and packing methods?	No	Not relevant
3.17. Could consignments that may be infested be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry, and can such limitations be applied in practice?	No	
3.18. Can infestation of the commodity be reliably prevented by treatment of the crop?	Yes	Treating against the vector will reduce its population and potentially limit either the entry of the pest or its further spread and such a measure should be combined with another measure.
3.19. Can infestation of the commodity be reliably prevented by growing resistant cultivars? (This question is not relevant for pest plants)		Not relevant
3.20. Can infestation of the commodity be reliably prevented by growing the crop in specified conditions (e.g. protected conditions such as screened greenhouses, physical isolation, sterilized growing medium, exclusion of running water...)?	No	Thrips exclusion (and hence exclusion of the virus) is not considered practical by the EWG, particularly for field-grown crops.
3.21. Can infestation of the commodity be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages?	No	Not relevant
3.22. Can infestation of the commodity be reliably prevented by production in a certification scheme (i.e. official scheme for the production of healthy plants for planting)?	No	Not relevant for thrips
3.23. Is the pest of very low capacity for natural spread?		

3.24. Is the pest of low to medium capacity for natural spread?	Yes	The capacity for spread is linked to the vector. This capacity was determined by the EWG by analogy to TSWV and *Frankliniella occidentalis*. Experience in the Netherlands showed that infection by TSWV could be found at a distance of up to10 metres from the contaminated glasshouse, but not more (Verhoeven, personal communication, 2006). It should be acknowledged that migratory behavior of thrips is not very well understood. The EWG considered that the consignments should originate from a place of production free from IYSV or a Pest-free area (this means that they should either be no host plants in the place of production and immediate vicinity or these host plants should be free from the virus, or the area should be free from the virus). Such option would ensure that *Thrips tabaci* would be non viruliferous. It should be noted that as *T. tabaci* is widely distributed in the EPPO region, it cannot be regulated. It is not possible to require absence of *T. tabaci* except when the consignment comes from an area where the virus is present. Consequently possible pest management options are: Pest-free place of production for the virus (ISPM n°10) or Pest-free area (ISPM n°4)
3.25. Is the pest of medium capacity for natural spread?		
3.26. The pest is of medium to high capacity for natural spread		
3.27. Can pest freedom of the crop, place of production or an area be reliably guaranteed?	Yes	It should be guaranteed that the immediate vicinity of the place of production is free from the virus But can it be guaranteed and how?
3.28. Are there effective measures that could be taken in the importing country (surveillance, eradication) to prevent establishment and/or economic or other impacts?	Yes	The EWG considered that eradication measures could be envisaged in particular for outbreaks under protected conditions. Eradication feasibility also depends on crop practices (eradication might be difficult to achieve when continuous cropping of onions is common practice). No specific recommendations were made. Treatments for thrips?
3.29. Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?		Pest-free area for IYSV Pest-free place of production for IYSV Consignment of plants for planting of non host plants should be free from adults of *Thrips tabaci* Or The consignment has been treated against *Thrips tabaci* to eliminate it
3.30. Taking each of the measures identified individually, does any measure on its own reduce the risk to an acceptable level?	Yes	-

3.31. For those measures that do not reduce the risk to an acceptable level, can two or more measures be combined to reduce the risk to an acceptable level?	NA	
3.32. If the only measures available reduce the risk but not down to an acceptable level, such measures may still be applied, as they may at least delay the introduction or spread of the pest. In this case, a combination of phytosanitary measures at or before export and internal measures (see question 3.29) should be considered.	NA	
3.33. Estimate to what extent the measures (or combination of measures) being considered interfere with trade.		There are no specific measures for the moment on thrips. *Thrips tabaci* is common in the EPPO region. Such measures would interfere with trade in particular considering trade coming from Israel where all plants for planting (except seeds and bulbs) and bulbs of *Allium* spp would be subjected to thrips freedom requirements.
3.34. Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.		As the pest is present in the EPPO region additional cost are expected for the countries where the pest is present (phytosanitary certification, official control measures, establishment and maintenance of pest-free areas and places of production).
3.35. Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences?		For consignments of plants for planting of non-host plant and bulbs of *Allium* spp coming from a country where IYSV occurs. Pest-free area for IYSV Or Pest-free place of production for IYSV Or Consignment of plants for planting of non host plants should be free from adults of *Thrips tabaci* Or been treated against *Thrips tabaci* to eliminate it
3.36. Envisage prohibiting the pathway		
3.37. Have all major pathways been analyzed (for a pest-initiated analysis)?	No	
Pathway 3		Cut flowers of *Alstroemeria* sp, *Eustoma grandiflora, Iris hollandica, Hippeastrum hybridum*
3.2. Is the pathway that is being considered a commodity of plants and plant products?	Yes	

3.10. Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest	No	Within the EU Plant Health Directive a phytosanitary certificate is only required for *Lisianthus* which is nowadays renamed as *Eustoma*
3.11. Can the pest be reliably detected by a visual inspection of a consignment at the time of export during transport/storage or at import?	No	Symptoms can be seen at the place of production but may be more difficult to detect in a consignment before export as it might have been sorted.
3.12. Can the pest be reliably detected by testing (e.g. for pest plant, seeds in a consignment)?	No	Not practical for cut flowers
3.13. Can the pest be reliably detected during post-entry quarantine?	No	Not practical
3.14. Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?	No	The pest is a virus
3.15. Does the pest occur only on certain parts of the plant or plant products (e.g. bark, flowers), which can be removed without reducing the value of the consignment? (This question is not relevant for pest plants)	No	Not relevant
3.16. Can infestation of the consignment be reliably prevented by handling and packing methods?	No	Not relevant
3.17. Could consignments that may be infested be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry, and can such limitations be applied in practice?	Yes	Cut flowers free from *Thrips tabaci* can be accepted even if they are contaminated with the virus. In order for the thrips to transmit the virus to other host plants, it would have to breed on the contaminated flowers and first instar larvae should acquire the virus, this was considered as a very unrealistic scenario
3.18. Can infestation of the commodity be reliably prevented by treatment of the crop?	Yes	Treating against the vector will reduce its population and such measure should be combined with another measure such as?
3.19. Can infestation of the commodity be reliably prevented by growing resistant cultivars? (This question is not relevant for pest plants)	No	Not relevant
3.20. Can infestation of the commodity be reliably prevented by growing the crop in specified conditions (e.g. protected conditions such as screened greenhouses, physical isolation, sterilized growing medium, exclusion of running water...)?	No	Thrips exclusion is not considered practical by the EWG.
3.21. Can infestation of the commodity be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages?	No	Not relevant
3.22. Can infestation of the commodity be reliably prevented by production in a certification scheme (i.e. official scheme for the production of healthy plants for planting)?	No	Not relevant
3.23. Is the pest of very low capacity for natural spread?	N/A	
3.24. Is the pest of low to medium capacity for natural spread?	Yes	Pest-free place of production for the virus (ISPM n°10) or Pest-free area (ISPM n°4)
3.25. Is the pest of medium capacity for natural spread?	N/A	

3.26. The pest is of medium to high capacity for natural spread	N/A	
3.27. Can pest freedom of the crop, place of production or an area be reliably guaranteed?	Yes	It should be guaranteed that the immediate vicinity of the place of production is free from the virus HOW?
3.28. Are there effective measures that could be taken in the importing country (surveillance, eradication) to prevent establishment and/or economic or other impacts?	Yes	The EWG considered that eradication measures could be envisaged in particular for outbreaks under protected conditions. Eradication feasibility also depends on crop practices (eradication might be difficult to achieve when continuous cropping of onions is common practice). No specific recommendations were made. Thrips treatments and destruction of affected cut flowers?
3.29. Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?		Pest-free area Pest free place of production Treatment of the crop Cut flowers free from *Thrips tabaci*
3.30. Taking each of the measures identified individually , does any measure on its own reduce the risk to an acceptable level?	No	Treatment for the vector as such may not be sufficient because it may not eradicate it
3.31. For those measures that do not reduce the risk to an acceptable level, can two or more measures be combined to reduce the risk to an acceptable level?	Yes	Treatment against thrips could reduce the risk. It provides a lower level of protection than pest-free place of production. Combination is not considered as pest-free place of production provides an adequate level of protection.
3.33. Estimate to what extent the measures (or combination of measures) being considered interfere with trade.		There are no specific measures for the moment on IYSV host plants (cut flowers). Pest-free area and pest-free place of production are reasonable phytosanitary measures
3.34. Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.		As the pest is present in the EPPO region additional cost are expected for the countries where the pest is present (phytosanitary certification, official control measures, establishment and maintenance of pest-free areas and places of production).
3.35. Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences?	Yes	For consignments of cut flowers of *Alstroemeria* sp. *Eustoma grandiflora, Iris hollandica, Hippeastrum hybridum* of non-host plant coming from a country where IYSV occurs. Pest-free area or pest-free place of production Cut flowers free from thrips Treatment of the consignment (this provides a lower level of protection)
3.36. Envisage prohibiting the pathway		
3.37. Have all major pathways been analyzed (for a pest-initiated analysis)?	Yes	

3.40. Consider the relative importance of the pathways identified in the conclusion to the entry section of the pest risk assessment		All obvious pathways for IYSV have been considered. Nevertheless it is possible that another unknown pathway may exist. Pathways 1. Plants for planting (except seeds and bulbs) of host plants high risk 2. Cut flowers low risk 3. Viruliferous Thrips tabaci on non-host plants and bulbs of Allium spp. low risk 4. Green parts of Allium spp. Very low risk

Conclusion of Pest Risk Management. **Summarize the conclusions of the Pest Risk Management stage. List all potential management options and indicate their effectiveness. Uncertainties should be identified.**		Measures have been identified for the pathways Options identified for • Plants for planting (except seeds and bulbs) of *Allium* sp, *Alstroemeria* sp, *Eustoma grandiflorum* originating from countries where IYSV occurs ▪ Pest-free area for IYSV or ▪ Pest-free place of production for IYSV or ▪ Certification Scheme + treatment against the vector is considered by the EWG as providing a lower level of protection • Viruliferous *Thrips tabaci* on non-host plants and bulbs of *Allium* species For consignments of plants for planting of non-host plant originating from countries where IYSV occurs. ▪ Pest-free area for IYSV or ▪ Pest-free place of production for IYSV or ▪ Consignment of Plants for planting of non host plants should be free from adults of *Thrips tabaci* or ▪ the consignment been treated against *Thrips tabaci* to eliminate it • Cut flowers of *Alstroemeria* sp, *Eustoma grandiflora*, *Iris hollandica*, *Hippeastrum hybridum* originating from countries where IYSV occurs. ▪ Pest-free area or pest-free place of production or ▪ Cut flowers free from *Thrips tabaci* or ▪ Treatment of the consignment (this provides a lower level of protection) Uncertainties: Host range especially knowledge of true systemic host. Capacity of natural spread Possibility of bulb transmission

Table 1. *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)	Rèunion 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 2. Species other than *Allium* reported as natural host of *Iris Yellow Spot Virus*[a,b]

Host	Location	Year of first outbreak	Reference
Alstroemeria sp.	Japan Netherlands	Not known 2004	Okuda & Hanada, 2001 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
Bessera elegans	Japan	Not known	Jones, 2005
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
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
Taraxacum sp. (Dandelion)	New York, USA	2006	Hopeting *et al*., 2006
Vicia sativa (Common vetch)	Georgia, USA	2004	Gent *et al*., 2006

[a] Hoepting *et al*. (2006) also reported IYSV in New York State on 'pigweed' in 2006. However, pigweed is the common name for several different plant species. Consequently, this record is not listed in Table 2. [b] From Ben Moussa *et al*. (2005) it is unclear whether the virus is present in Tunisia or whether they report potato, tomato and pepper as natural or experimental hosts of the virus. Therefore, these Tunisian records are not listed in Tables 1 and 2.

Table 3. Experimental hosts of *Iris Yellow Spot Virus*

Host	Symptom	References
Chenopodium amaranticolor (Tree spinach)	Local necrotic lesions	Doi *et al*., 2003; Gera *et al*., 2002; Pozzer *et al*., 1999
Chenopodium murale (Nettleleaf goosefoot)	Local necrotic lesions	Mavrič & Ravnikar, 2000
Chenopodium quinoa (Quinoa)	Local necrotic lesions	Doi *et al*., 2003; Gera *et al*., 2002
Datura stramonium (Thorn apple)	Occasional local necrotic lesions	Gera *et al*., 2002; Pozzer *et al*., 1999
Emilia sonchifolia (Cupid's shaving brush)	Occasional local necrotic lesions	Gera *et al*., 2002
Gomphrena globosa (Globe amaranth)	Local necrotic lesions	Doi *et al*., 2003; Gera *et al*., 2002
Impatiens sultani (Busy lizzie)	Necrotic spots on leaves	Doi *et al*., 2003
Lactuca sativa (Lettuce)	Necrotic spots on leaves and leaf mosaic symptoms	Doi *et al*., 2003
Nicotiana benthamiana	Chlorotic spots or vein lesions on inoculated leaves followed by systemic leaf deformation, leaf mosaic symptoms also observed	Doi *et al*., 2003; Gera *et al*., 2002; Ghotbi *et al*., 2005; Pozzer *et al*., 1999
Nicotiana glutinosa	Leaf mosaic symptoms	Doi *et al*., 2003
Nicotiana rustica	Lesions on the veins of inoculated leaves followed by systemic leaf deformation	Doi *et al*., 2003; Pozzer *et al*., 1999
Petunia x *hybrida* (Petunia)	Occasional local necrotic lesions	Doi *et al*., 2003; Ghotbi *et al*., 2005; Gera *et al*., 2002
Spinacia oleracea (Spinach)	Necrotic spots and leaf mosaic symptoms	Doi *et al*., 2003
Vica faba (Broad bean)	Occasional local necrotic lesions	Doi *et al*., 2003
Vigna unguiculata (Cowpea)	Systemic mild necrotic lesions and necrotic leaf spots	Ghotbi *et al*., 2005

Table 4. Economic impacts (where given) associated with outbreaks of *Iris Yellow Spot Virus*

Location and date	**Crop**	**Impact**	**Reference**
Australia, 2002	Onion	Widespread symptoms sometimes causing complete crop abandonment	Coutts *et al*., 2003
Brazil, 1994	Onion	Disease incidence often reached levels of 100%, resulting in a total loss of bulb and seed production	Pozzer *et al*., 1999
Chile, 2004	Onion	50% of the crop showed symptoms in fields that were sampled	Rosales *et al*., 2005
Colorado, 2001-2003	Onion	5% incidence, general reduction in bulb size. Survey work 2 years later found 73% incidence. Conservative estimates of 5-10% losses	Swhartz *et al*., 2002; Gent *et al*., 2004; Gent *et al*., 2006
Idaho and Oregon, 1989	Onion	Up to 90% loss of seed yield in some instances	Mohan & Moyer, 2004
India, 1999	Onion	'Potential to cause complete crop loss'	Kumar & Rawal, 1999
Israel, 1998	Onion	Disease incidences of up to 60% resulting in heavy losses in onion bulb production	Kritzman *et al*., 2001
New Mexico, 2002-2003	Onion	ELISA showed 24 to 59% infection with a 0.5 to 30% incidence of diseases symptoms	Creamer *et al*., 2004
Oregon, 2002	Onion	Up to 100% incidence of symptoms at one site, leading to 95% lodging and near total crop failure. Less severe at other sites	Crowe & Pappu, 2005
Rèunion Island, 2005	Onion	Survey of 10 onion fields found 75% of leaves with symptoms and 27% of bulbs ELISA positive. Present in 15% of 45 day old seedlings at one nursery	Robène-Soustrade *et al*., 2006
Slovenia, 1999	Onion	Over 90% level of disease incidence in one field but no obvious effect on yield	Mavrič & Ravnikar, 2000
Spain, 2003	Onion	Severely infected plants eventually died, 'potentially devastating'	Córdoba-Sellés *et al*., 2005
Texas, 2006	Onion	Disease incidence approached 100% in some fields with associated yield loss and quality problems	Miller *et al*., 2006
Washington, 2003	Onion	Symptomatic plants observed in five seed crops at incidences ranging from <1% to approximately 20%	du Toit *et al*., 2004
Netherlands, 1992 onwards.	Onion, leek, Alstroemeria	"With exception of the first infection in Iris, there was only limited or even very little	Verhoeven, Pers. Comm.

		damage by the virus, so its economic impact is low.”	
Netherlands, 1992	Iris	50-90% incidence of infected plants	Mavrič & Ravnikar, 2000
Australia, 2002	Leek	10% of infected leeks had pale bands along mid-rib	Coutts *et al*., 2003
Colorado, 2006	Leek	Incidence of plants with foliar lesions on multiple leaves (25-30%) and stunting of 5% of infected plants in both leek cultivars affected suggests that IYSV could seriously reduce leek stem development and marketability	Schwartz *et al*., 2007

In addition to the losses reported from the outbreaks in Table 5, a field experiment was undertaken in Washington State, USA. Out of 46 onion cultivars tested all but three had signs of severe infection and a ‘significant negative impact on total yield and bulb size’ was observed for all the cultivars tested (du Toit & Pelter, 2005).

References mentioned in the PRA record for Iris Yellow spot virus

Córdoba-Sellés C, Martínez-Priego L, Muńoz-Gómez R and Jordá-Gutiérrez C (2005). *Iris yellow spot virus* : A new onion disease in Spain. *Plant Disease*. **89**:1243.

Coutts BA, McMichael LA, Tesoriero L, Rodoni BC, Wilson CR, Wilson AJ, Persley DM and Jones RAC (2003). *Iris yellow spot virus* found infecting onions in three Australian states. Australas. *Plant Pathology*. **32**:555-557.

Doi M, Zen S, Okuda M, Nakamura H, Kato K and Hanada K (2003). Leaf necrosis disease of lisianthus (*Eustoma grandiflorum*) caused by *Iris yellow spot virus*. *Japanese Journal of Phytopathology* **69**:181-188.

Gent DH, Schwartz HF and Khosla R (2004). Distribution and incidence of *Iris yellow spot virus* in Colorado and its relation to onion plant population and yield. *Plant Disease*. **88**:446-452.

Gent DH, Schwartz HF and Khosla R (2004). Managing *Iris yellow spot virus* of onion with cultural practices, host genotype and novel chemical treatments. (Abstr.) *Phytopathology* **94**:S34

Jenser and Szenasi, 2004, Review of the biology and vector capability of Thrips tabaci Lindeman (Thysanoptera: Thripidae). *Acta Phytopathologica et Entomolologica Hungarica* **39** (1-3): 133-155.

Jones D (2002). PPP 9369: Summary Pest Risk Analysis for *Iris yellow spot virus*, CSL, York, UK

Kritzman A, Lampel M, Raccah B and Gera A (2001). Distribution and transmission of *Iris yellow spot virus*. Plant Disease **85**:838-842.

Pozzer L, Bezerra IC, Kormelink R, Prins M, Peters D, Resende R de O and de Avila AC (1999). Characterization of a tospovirus iolate of *Iris yellow spot virus* associated wit a disease in onion fields in Brazil. *Plant Disease* **83**:345-350.

Robène-Soustrade I, Hostachy B, Roux-Cuvelier M, Minatchy J, Hédont M, Pallas R, Couteau A, Cassam N, and Wuster G (2006). First report of *Iris yellow spot virus* in onion bulb- and seed-production fields in Réunion Island. *Plant Pathology* **55**:288.

Schwartz HF, Gent DH, Fichtner S, Hammon RW and Khosla R (2004). Integrated management of *Iris yellow spot virus* in onion. Pages 207-212 in: Proc. 2004 *National Allium Research Conference*, Grand Junction, CO. Colorado State University, Fort Collins.