

Guidelines on Pest Risk Analysis
Lignes directrices pour l'analyse du risque phytosanitaire

Decision-Support Scheme for an Express Pest Risk Analysis

Specific scope: This standard provides a simplified scheme for the rapid production of pest risk analyses.

Specific approval and amendment: 2012-09

Introduction

The EPPO Standards on Pest Risk Analysis (PRA) are intended to be used by National Plant Protection Organizations (NPPOs), in their capacity as bodies responsible for the establishment of phytosanitary regulations and the application of phytosanitary measures while respecting the requirements of the International Plant Protection Convention, ISPM no. 1 (*Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*) and ISPM no. 11 (*Pest Risk Analyses for Quarantine Pests including analysis of environmental risks and living modified organisms*). They are also used by the technical bodies of EPPO to formulate recommendations on phytosanitary measures to the NPPOs. In this framework EPPO has developed different Standards to be used in different circumstances. PM 5/2 was developed to provide a simplified PRA scheme to be used when an unfamiliar pest is detected in an imported consignment, in order to decide whether phytosanitary action is needed. PM 5/3 is based on ISPM no. 11 and provides detailed instructions for the following steps of PRA for quarantine pests: initiation, pest categorization, probability of introduction and spread, assessment of potential economic consequences and pest risk management.

This standard provides a simplified scheme for undertaking a rapid PRA to determine whether an organism has the characteristics of a quarantine pest, and if appropriate, to identify potential management options. Its use is particularly suitable to support recommendation of phytosanitary measures for an emerging pest. This scheme may also be used in the framework of a pathway-initiated PRA to evaluate individual pests likely to be carried by this pathway. In the case of an express PRA initiated by an outbreak, risk managers should also use the information provided to consider actions to be taken internally (such as establishing surveillance to confirm the status of the pest in the country).

An EPPO Standard on “*Generic elements for contingency plans*” (PM 9/10) describing essential elements for an emergency response for a pest outbreak or a suspected pest outbreak was adopted in 2009. In addition, a decision-support scheme for prioritizing action during outbreaks is under development to decide on measures to be applied in an outbreak area.

It is important that all steps of the Express PRA should be documented, indicating how each decision was reached and on what information it was based. The assessor may stop the assessment at any point if the evidence provided is sufficient to reach a conclusion on the pest risk.

A computerized version of this Express PRA Scheme with the CAPRA software will be prepared.

Summary¹ of the Express Pest Risk Analysis for “Strawberry mottle virus”

PRA area: Norway

Describe the endangered area: Strawberry growing regions of Norway

Main conclusions

Overall assessment of risk: (Copy your answer from Q 15).

Phytosanitary Measures: indicate whether the pest should be recommended for immediate action in the PRA area. Summarize your answer from Q 16.

Note: If the assessment shows that phytosanitary measures are not required for your country but there are indications that other EPPO countries are at higher risk, mention it.

Strawberry mottle virus (SMoV) is prevalent in Europe (Babini et al. 2001). Certified planting material is allowed to have up to 2 % virus infection (EPPO 2008). If Norway opens up for import of strawberry planting material it is very likely that over time SMoV, alone or together with other viruses, will be introduced to Norwegian strawberry fields. Although the strawberry aphid (*Chaetosiphon fragaefolii*) is not established in Norway; SMoV will probably be spread by other aphids already present in the PRA area.

To avoid the establishment of SMoV there is a need for phytosanitary measures. Since we do not know of any case of SMoV in Norway, the phytosanitary measures has to be focused to the import of strawberry planting material.

It is important to 1) avoid introducing infected plant material, and 2) avoid introducing *C. fragaefoliae* since it is the most efficient vector and is not present in Norway.

Planting material imported to Norway should come from nuclear stock material tested for SMoV and other relevant viruses. The propagation stocks should be grown in virus-free conditions where no reinfection of SMoV can occur.

In addition the planting material should be free from *C. fragaefolii*. To minimize the chance for establishment of this aphid in Norway, fields established from imported planting material should be inspected by plant inspectors from the Norwegian Food Safety Authority.

Phytosanitary risk for the endangered area (Individual ratings for likelihood of entry and establishment, and for magnitude of spread and impact are provided in the document)

High

Moderate

Low

Level of uncertainty of assessment

(see Q 17 for the justification of the rating. Individual ratings of uncertainty of entry, establishment, spread and impact are provided in the document)

High

Moderate

Low

Other recommendations:

- **Inform EPPO or IPPC or EU**
- **Inform industry, other stakeholders Yes, the industry should be informed about possible threats regarding viruses in strawberry**
- **State whether a detailed PRA is needed to reduce level of uncertainty (if so, state which parts of the PRA should be focused on)**
- **Specify if surveys are recommended to confirm the pest status Yes, it is a need for a survey to get more information about pest status**
- **State what additional work/research could help making a decision.**

¹ The summary should be elaborated once the analysis is completed

Express Pest Risk Analysis:

Strawberry mottle virus

(Pest name)

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Stage 1. Initiation

Reason for performing the PRA:

The opening for import of strawberry plants to Norway gives a new situation from 2015.

PRA area: Norway

Stage 2. Pest risk assessment

1. **Taxonomy:** e.g. Genus, species/ subspecies, Authority, Family, Order, Kingdom.

Include information on strains and populations, etc. if relevant, and synonyms if appropriate.

Strawberry mottle virus, SMoV, consists of spherical particles, 28 nm in diameter, and has two RNAs, RNA1 and RNA2 (Yoshikawa N & Converse RH 1991, Thompson et al. 2002). SMoV has previously been assigned to the genus *Sadwavirus*, but is now classified as an unassigned member of the family *Secoviridae* (King et al. 2012). Strain variation is known to occur, both regarding symptom development (Mellor & Krczal 1987) and genetic sequences (Thompson & Jelkmann 2003). SMoV is transmitted in a semi-persistent manner by aphids, and is not spread by contact, seeds or pollen (Mellor & Krczal 1987).

Common name:

2. Pest overview

Summarize the life cycle (e.g. length of life cycle, location of different life stages, temperature thresholds, humidity requirements) and other relevant information (damage should be described in Q 12). If a datasheet is available, this section should only include the basic information. If available place illustrations of the pest and the symptoms caused in Appendix 1.

Host plants (for pests)/habitats (for invasive plants) (more detail should be provided in Q 7)

Symptoms

Detection and identification (note if a diagnostic protocol is available). State if and how the pest can be trapped.

The only known natural host plants is in the genus *Fragaria*, where *Fragaria ananassa* is the important commercial crop. *Potentilla spp* has been reported as experimental hosts (Mellor & Krczal 1987).

SMoV gives symptoms in sensitive varieties. Up to 30 % yields loss has been reported from sensitive cultivars, but most modern strawberry cultivars show no symptoms when infected with SMoV alone (Tzanetakis & Martin, 2013).

Severe yield losses can occur when SMOV is a part of a mixed infection with other aphid transmitted strawberry viruses, giving yield losses up to 80 % (Thompson & Jelkmann, 2003; Martin & Tzanetakis, 2006).

SMoV is regarded as one of the four most damaging aphid transmitted viruses of strawberry. The other three are *Strawberry crinkle virus*, *Strawberry mild yellow edge virus* (SMYEV) and *Strawberry vein-banding virus* (EPPO, 2008; Martin & Tzanetakis, 2006).

SMoV can be detected by testing using grafting to indicator plants (Mellor & Krczal 1987), by PCR (Thompson & Jelkmann (2003) or multiplex PCR (Thompson et al. 2003). SMOV is sap-tranmissible to test plants: *Chenopodium quinoa*, *C. amaranticolor*, *C. album*, *Cyamopsis tetragonoloba*, *Gomphrena globosa*.

3. Is the pest a vector? Yes No

If the pest is a vector, which organism(s) is (are) transmitted and does it (do they) occur in the PRA area?

4. Is a vector needed for pest entry or spread? Yes No

If a vector is needed, which organism(s) serves as a vector and does it (do they) occur in the PRA area? Consider both the pest and the vector in the assessment.

SMoV is transmitted by the strawberry aphid, *Chaetosiphon fragaefolii* (liten jordbærbladlus), as the most efficient vector. The aphid species *C. thomasi*, *C. minor* and *C. jacobi* are also known to transmit SMOV (Mellor & Krczal 1987).

Mellor & Krczal(1987) also reports that the following aphids can transmit SMOV:

- *Acyrtosiphon pelargonii rogersii* (Syn. *A. malvae rogersii*, Stor jordbærbladlus)
- *Amphorophora rubi* (stor bjørnebærbladlus)
- *Aphis gossypii* (agurkbladlus)
- *Chaetosiphon tetrahodum*
- *Myzaphis rosarum*
- *Myzus ascalonicus* (løkbladlus)
- *Myzus ornatus* («tverrstripet veksthusbladlus»)
- *Rhobium porosum*

In Poland SMOV was found to spread in strawberry field where *Aphis forbesi* as the most prevalent, but also *Amphorophora rubi* (Stor bjørnebærbladlus), *Acyrtosiphon pelargonii rogersii* (stor jordbærbladlus) and *Aulacorthum solani* (grønnflekke veksthusbladlus), were present (Cieslinska & Zawadzka 1996).

The vector *Chaetosiphon fragaefolii* is considered in a separate PRA Express from Bioforsk.

5. Regulatory status of the pest

Is the pest already regulated by any NPPO, or recommended for regulation by any RPPO? (Assessors can check this by reference to EPPO PQR, RPPO and IPPC websites in addition to normal search mechanisms).

EPPO has not listed SMOV as a quarantine virus, but SMOV is listed in the EPPO Standard PM 4 /11 (2) (EPPO 2008) regarding pathogen-tested material of strawberry.

6. Distribution

SmoV is regarded as prevalent in all strawberry production areas in the world (Mellor & Krczal1987), but up till today no case of SMOV has been found in Norway.

In a survey in Poland altogether 4,1 % of the samples were infected with SMOV, and 23,2 % of the samples in Lithuania. In Germany 1,4 % of the samples were infected with SMOV (Babini et al. 2001).

A recent study from USA (Martin & Tzanetakis 2013) documents the prevalence of SMOV in several strawberry growing regions.

There is no survey data available from Sweden, Denmark or Finland.

<i>Continent</i>	<i>Distribution (list countries, or provide a general indication , e.g. present in West Africa)</i>	<i>Provide comments on the pest status in the different countries where it occurs (e.g. widespread, native, introduced....)</i>	<i>Reference</i>
<i>Africa</i>			
<i>America</i>			
<i>Asia</i>			
<i>Europe</i>			
<i>Oceania</i>			

Information on distribution may be retrieved from PQR (<http://www.eppo.int/DATABASES/pqr/pqr.htm>), CAPRA datasets (<http://capra.eppo.org/>), CABI maps, etc.

Comments on distribution: (e.g. if known, please comment on the area of origin, how the pest has spread and on any evidence of increasing range / frequency of introductions)

7. Host plants /habitats* and their distribution in the PRA area

If the host range is large, you may group plants (e.g. deciduous trees, or at the family level, e.g. Brassicaceae, Rosaceae), and/or focus on those occurring in the PRA area. When appropriate, the difference of susceptibility between hosts should be noted. If there are many habitats, focus on those occurring in the PRA area. Reference to [FAOSTAT](#) and [EUROSTAT](#) may help assess distribution of host plants.

Host Scientific name (common name) / habitats*	Presence in PRA area (Yes/No)	Comments (e.g. total area, major/minor crop in the PRA area, major/minor habitats*)	Reference
<i>Fragaria annanassa</i>	YES	A major berry crop in Norway	
<i>Fragaria vesca</i>	YES	Growing in the wild in Norway	
<i>Fragaria viridis</i>	YES	Growing in the wild in Norway	
<i>Potentilla spp</i>	YES	Growing in the wild in Norway	

*Specify habitat for invasive plants, host plants for other pests.

8. Pathways for entry

Which pathways are possible and how important are they for the probability of entry?

Examples of pathways are:

- *Plants for planting*
 - plants for planting (except seeds, bulbs and tubers) with or without soil attached
 - bulbs or tubers
 - seeds
- *Plant parts and plant products*
 - cut flowers or branches
 - cut trees
 - fruits or vegetables
- *Wood and wood products*
 - non-squared wood
 - squared wood
 - bark
 - wood packaging material
 - chips, firewood, waste wood...
- *Natural spread*
- *Other possible pathways*
 - other packaging material

- grain
- pollen
- stored plant products

- soil/growing medium as such
- conveyance and machinery
- passengers
- hitchhiking
- plant waste
- manufactured plant products
- intentional introduction (e.g. scientific purposes)

Possible pathways (in order of importance)	Short description explaining why it is considered as a pathway	Pathway prohibited in the PRA area? Yes/No	Pest already intercepted on the pathway? Yes/No
Infected plants for planting	As SMoV may show few typical symptoms, plant material can harbor SMoV-infection without showing symptoms	At the moment YES, but probably from 2015 NOT	Yes, plants in quarantine found to be infected
Infected aphids following plant material	Aphids can easily hide in leaves of infected strawberry plants	At the moment YES, but probably from 2015 NOT	
Infected aphids blown over to Norway	Southern winds may blow infected aphids up to Norway	No	

Rating of the likelihood of entry	Low <input type="checkbox"/>	Moderate <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Rating of uncertainty	Low <input checked="" type="checkbox"/>	Moderate <input type="checkbox"/>	High <input type="checkbox"/>

In the EPPO Certification scheme for certified strawberry, up to 2% of virus infection is allowed (EPPO 2008). This makes it very likely that infected planting material will be introduced to Norway.

9. Likelihood of establishment outdoors in the PRA area

Consider in particular the presence of host plants/habitats and climatic suitability and describe the area where establishment is most likely (area of potential establishment). Reference to maps such as Köppen-Geiger climate zones, day degrees and hardiness zones may help assess the likelihood of establishment (see e.g. http://capra.eppo.org/files/links/Rating_Guidance_for_climatic_suitability.pdf).

Rating of the likelihood of establishment outdoors	Low <input type="checkbox"/>	Moderate <input type="checkbox"/>	High <input checked="" type="checkbox"/>
Rating of uncertainty	Low <input checked="" type="checkbox"/>	Moderate <input type="checkbox"/>	High <input type="checkbox"/>

10. Likelihood of establishment in protected conditions in the PRA area

Consider the presence of host plants within protected cultivation (e.g. glasshouses, shade houses) and describe the area of potential establishment. For invasive plants consider if protected conditions are a suitable habitat.

Rating of the likelihood of establishment in protected	Low <input type="checkbox"/>	Moderate <input type="checkbox"/>	High <input checked="" type="checkbox"/>
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conditions			
Rating of uncertainty	Low X	Moderate <input type="checkbox"/>	High <input type="checkbox"/>

11. Spread in the PRA area

- Natural spread
- Human assisted spread

Briefly describe each mode of spread (e.g. natural flight of invertebrate pests, wind dispersal, carried within plants or plant products, carried with traded commodities), and indicate the rate or distance of spread.

If possible consider how long it would take for the pest to spread widely within the area of potential establishment if no phytosanitary measures are taken. If no specific data are available, compare with similar organisms.

Rating of the magnitude of spread	Low <input type="checkbox"/>	Moderate X	High <input type="checkbox"/>
Rating of uncertainty	Low <input type="checkbox"/>	Moderate X	High <input type="checkbox"/>

Poland is not known to have *C. fragaefolii*, However SMoV is still spread by other aphid species (Cieslinska & Zawadzka 1996). A similar situation can occur in Norway, where other aphid species will be able to cause a natural spread of this virus, both in the open and under protected cultivation (plastic tunnels).

12. Impact in the current area of distribution

Briefly describe the economic, ecological/environmental and social impacts in the current area of distribution.

Briefly describe the existing control measures applied against the pest.

Rating of the magnitude of impact in the current area of distribution	Low <input type="checkbox"/>	Moderate X	High <input type="checkbox"/>
Rating of uncertainty	Low <input type="checkbox"/>	Moderate <input type="checkbox"/>	High X

The rating chosen should be based on the highest type of impact.

SMoV has recently been causing serious damage in strawberry crops in North America (Demschak 2013). It seems that in this case most damaged plants were double infected with SMoV and SMYEV. This case underpins the potential for crop loss due to SMoV.

13. Potential impact in the PRA area

Consider whether impacts in the area of potential establishment will be similar to that in areas already infested, taking into account availability of plant protection products, natural enemies, cultural practices, etc. in the area of potential establishment. Consider other consequences (e.g. export loss) if applicable.

Will impacts be largely the same as in the current area of distribution? Yes /No

The impact of SMoV in Norway will probably be:

- Loss of yield
- In Norway most strawberry crops are usually kept for two to three winters. If SMoV is established in Norway it could probably give reduced winter hardiness and consequently less surviving plants.
- Double infection with aphid transmitted viruses is known to make the symptoms and yield loss worse. As aphid-transmitted viruses in strawberry do not occur in Norway, the introduction of SMoV-infected planting material, and possibly the strawberry aphid, could possibly make the crop more vulnerable to double infection with SMoV and other aphid-transmitted viruses.

If No

<i>Rating of the magnitude of impact in the area of potential establishment</i>	Low <input type="checkbox"/>	Moderate <input type="checkbox"/>	High <input type="checkbox"/>
<i>Rating of uncertainty</i>	Low <input type="checkbox"/>	Moderate <input type="checkbox"/>	High <input type="checkbox"/>

14. Identification of the endangered area

Define the endangered area (see definition in ISPM 5): describe in which part of the area of potential establishment significant impact is expected.

The endangered areas are the strawberry growing regions of Norway.

SMoV would have an impact on the important strawberry production areas in Norway, which are the counties of: Agder, Telemark, Akershus, Østfold, Vestfold, Buskerud, Hedmark, Oppland, Rogaland, Møre- og Romsdal and Sør-Trøndelag.

15. Overall assessment of risk

Summarize the likelihood of entry, establishment, spread and possible impact without phytosanitary measure. An overall rating should be given in the summary part which is placed at the beginning of the Express PRA.

Then consider whether phytosanitary measures are necessary.

If the assessment shows that phytosanitary measures are not required for your country but there are indications that other EPPO countries are at higher risk, mention it.

Strawberry mottle virus (SMoV) is prevalent in Europe (Babini et al. 2001). Certified planting material is allowed to have up to 2 % virus infection (EPPO 2008). If Norway opens up for import of strawberry planting material it is very likely that over time SMoV, alone or together other viruses, will be introduced to Norwegian strawberry fields. Even without the strawberry aphid (*Chaetosiphon fragaefolii*) established in Norway, SMoV will probably be spread by other aphids already present in the PRA area.

To avoid the establishment of SMoV there is a need for phytosanitary measures.

Stage 3. Pest risk management

16. Phytosanitary measures

Describe potential measures for relevant pathways and their expected effectiveness on preventing introduction (entry & establishment) and / or spread. If possible, specify prospects of eradication or containment in case of an outbreak. Indicate effectiveness and feasibility of the measures

As described in PM 5/3 possible options for phytosanitary measures include

Options at the place of production

Detection of the pest at the place of production by inspection or testing

Prevention of infestation of the commodity at the place of production (treatment, resistant cultivars, growing the crop in specified conditions, harvest at certain times of the year or growth stages, production in a certification scheme)

Establishment and maintenance of pest freedom of a crop, place of production or area

Options after harvest, at pre-clearance or during transport

Detection of the pest in consignments by inspection or testing

Removal of the pest from the consignment by treatment or other phytosanitary procedures (remove certain parts of the plant or plant product, handling and packing methods, specific conditions or treatments during transport)

Options that can be implemented after entry of consignments

Detection during post-entry quarantine

Consider whether 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

Prohibition

Surveillance, eradication, containment

As we do not know of any case of SMoV in Norway, the phytosanitary measures have to be focused on the import of strawberry planting material.

It is important to 1) avoid introducing infected plant material, and 2) avoid introducing *C. fragaefoliae* as a possibly more efficient vector.

Planting material imported to Norway should come from nuclear stock material tested for SMOV and other relevant viruses. The propagation stocks should be grown in virus-free conditions where no reinfection of SMOV can occur.

In addition, the planting material should be free from strawberry aphids in the genus *C. fragaefolii*. To minimize the chance for establishment of this aphid in Norway, fields established from imported planting material should be inspected by plant inspectors from the Norwegian Food Safety Authority.

17. Uncertainty

List and describe the main sources of uncertainty within the risk assessment and risk management. State whether a detailed PRA is needed to reduce key aspects of uncertainty (if so state which parts of the PRA should be focused on). Comment on what work would be needed to address uncertainties (e.g. for distribution the need for surveys, produce epidemiological data...)

There are no records of SMOV from Norway. But as there has been no survey for aphid-transmitted viruses in Norway it is a possibility that some cases of SMOV might have been overlooked.

18. Remarks

Add any other relevant information or recommendations. For example when phytosanitary measures are not considered appropriate, recommendations for the development of other control strategies can be made (e.g. Integrated Pest Management, certification schemes).

Testing for SMOV is included in the Norwegian certification schemes for strawberry. All nuclear stock of strawberry is regularly tested for SMOV by indicator plants and PCR. Testing for SMOV by the same methods is also a part of the present quarantine practise in Norway. If SMOV, a virus not regarded as a quarantine virus in other countries, is introduced to Norway it will be a completely new situation regarding aphid transmitted viruses in strawberry, possibly making this crop more vulnerable to virus diseases and winter damage.

Once the analysis has been completed, a summary should be prepared (see the summary box at the beginning of the Express PRA)

19. REFERENCES

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Appendix 1. Relevant illustrative pictures (for information)

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