European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection Des Plantes

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Pest Risk Management for *Leucinodes orbonalis*

This risk management is based on the PEPEIRA project (Werkman & Sansford, 2010). It was prepared by the EPPO Panel on Phytosanitary Measures 2011-04, 2011-11 and 2012-03.

Pathway 1: Fruits of main hosts (Solanum species, in particular S. melongena, S. aethiopicum, S. mammosum, S. aculeatissimum and S. torvum) from where the pest occurs

7.06 - Is the pathway that is being considered a commodity of plants and plant products?
yes
Fruits of *S. melongena*, *S. aethiopicum*, *S. mammosum*, *S. aculeatissimum* and *S. torvum*. The first 2 species are imported in some EU Member States, mostly in northern Europe. On the statistical data available (Europhyt), the pest has seldom been intercepted in Europe on other species other than these. *S. mammosum* is less frequently imported in Europe, but frequently found infested in the USA.

7.09 - If the pest is a plant, is it the commodity itself?
no

7.10 - Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest?
No
Level of uncertainty: medium
Solanum melongena fruit is already regulated at EU level due to *Thrips palmi* (Annex IV.A.I, point 36.2 of dir. 2000/29/EC). *L. orbonalis* was found in *Solanum* fruits in 2004 for the first time and shortly after import inspections of *Solanum melongena* had become obligatory in the EU for Thrips palmi.

In the most of the EPPO members not belonging to EU, fruits and vegetables are all listed as regulated commodities and a PC is required the exporting country for importing such commodities to, but none lists the pest as a quarantine one (see details below). The number of interceptions reported in Europhyt shows that it is possible to find the pest or its symptoms during visual inspections.
In the rest of the PRA area, the pathway seems open to some countries from some origins. As described below, fruits of eggplant are covered by general requirements for all fruits and vegetables (or solanaceous fruits and vegetables) (e.g. PC, packing, free from soil, etc.), requirements for all fruits targeting other pests, and in a few cases specific requirements for eggplant fruits (but not directly targeting *L. orbonalis*) (checked from EPPO collection of phytosanitary regulations - for non-EU countries, 1999 to 2003 depending on countries - and EU Directive):
- Albania (requirement for all fruits: import permit, PC)
- Algeria (requirements for all fruits: packed in cases, sacks or other containers, PC)
- Israel import permit, PC
- Jordan (requirement for all fruits: import permit, PC, free from soil)
- Kyrgyzstan (requirements for all fruits: import permit, PC, free from soil; place of production requirements for A1/A2 pests; fumigation or refrigeration of fruits for imports between certain dates)
- Moldova (requirement for all fruits: import permit, PC, disinfection)
- Morocco (requirements for all fruits: pest free; specific requirements for eggplant fruits: free from soil, debris, named pests; specific requirements for cleaning, grading and packing)
- Russia (requirement for all fruits: PC)
- Tunisia (requirement for all fruits: PC)
- Turkey (requirement for all fruits: PC, free from soil)
- Ukraine (requirement for all fruits: import permit, PC, free from A1/A2 quarantine pests or disinfested at point of entry)

Options at the place of production

7.13 - Can the pest be reliably detected by visual inspection at the place of production ?

yes in a Systems Approach

Level of uncertainty: low

Possible measure: visual inspection at the place of production

During the growing season, the presence of the adults can be monitored with pheromone traps. Damage may be noted on leaves and fruit for late stage larvae. However, this might not allow the detection of low populations of the pest in the country of origin.

7.14 - Can the pest be reliably detected by testing at the place of production?

no

Level of uncertainty: low

Not relevant.

7.15 - Can infestation of the commodity be reliably prevented by treatment of the crop?

yes in a Systems Approach

Level of uncertainty: low

Possible measure: specified treatment of the crop

Crops are usually treated in the countries of origin against *L. orbonalis* many times. The number of the treatments is, in general, very high, ranging from 50 to more than 100, depending on the country (Srinivasan, 2008), and not always successful. In some countries, to get better results and decrease the environmental side-effects, programs are in progress to develop IPM which involves pheromone trapping for more targeted treatments or mass trapping.

Treatments of the crop will prevent high infestations but not eliminate all individuals. The pest also has hidden life stages (larvae in fruit, pupae in soil) that would not be eliminated.

7.16 - Can infestation of the commodity be reliably prevented by growing resistant cultivars?

No but may be reconsidered in the future in a Systems Approach

Level of uncertainty: medium

Despite the attempts in India and Bangladesh which have been made to explore resistant sources as well as to develop resistant varieties of eggplants against *L. orbonalis* in the region, no commercial cultivar with appreciable levels of resistance has been developed. At the moment, only Turbo, a commercial F1 hybrid has exhibited significant resistance to *L. orbonalis* in Thailand and Taiwan (Srinivasan, 2008).

Bt transgenic varieties ('Bt brinjal') have been developed, and were considered suitable for marketing in India in 2009 (Anon., 2009), although following concerns raised by the public a moratorium on the release of eggplant hybrids was imposed.

However some cultivars are considered tolerant and are less susceptible to fruit damage (CABI datasheet): they could be used in a Systems Approach.

There is no data available on resistant cultivars for other Solanum species.

7.17 - 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, etc.)?

yes in a Systems Approach

Level of uncertainty: low

Possible measure: specified growing conditions of the crop

In many areas, *S. melongena* and similar species are grown under protected conditions. In production sites devoted to export, specific insect-proof screens and double-door (usually used against other pests such as whiteflies) will be useful to mitigate risk of introduction of *L. orbonalis*. Complementary elements should be taken into consideration to guarantee the pest freedom: the plantlets introduced in the greenhouse should be pest free and pheromone traps should be used to monitor and maintain the freedom.

It is not known if intercepted fruits were grown outdoors or under protected conditions in the country of origin.

7.18 - 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

Level of uncertainty: low

The pest might be present in the crop all year round, in suitable conditions in the field and always in glasshouse.

7.19 - 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

Level of uncertainty: low

Not relevant for fruit.

7.20 - Select the rate of spread.

Low rate of spread

Level of uncertainty: medium

Possible measure: pest-free area or pest free place of production

There a little data about the natural spread in the countries of origin (UK and NL PRAs) but it is considered that moths only fly for short distances, in darkness (FERA datasheet).

7.21 - The possible measure is: pest-free area or pest free place of production
Can this be reliably guaranteed?

yes

Level of uncertainty: medium

PFA is a possible measure as described in ISPM 4. It will in particular require the use of pheromone traps to check for absence of the pest. Pest-free seedlings should be used. There should be control on movement of eggplant (and similar species) fruit and plants, other hosts, equipment and packaging, etc. in of the area.

Pest free place of production is considered possible under protected condition, with appropriate preventive insect-proof nets (double-door and greenhouse lateral nets for protection) with use of pest-free seedlings. Pest freedom should be checked using pheromone traps.

Options after harvest, at pre-clearance or during transport

7.22 - 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 in a Systems Approach

Level of uncertainty: low

Possible measure: visual inspection of the consignment

The number of interceptions notified by EU Member States is an evidence that visual inspection of a consignment allows detection of the pest (in particular later stages), but as some *L. orbonalis* larvae are in the fruit, damage by young larvae can be easily overlooked during phytosanitary inspections, because the boring holes are very small (Dutch PRA, 2005).

Eggs are usually laid on leaves but may also rarely be laid on the pedoncule or on the fruit and are very difficult to detect during inspection. However, visual inspection at the time of export or at the point of entry may assist as part of a systems approach.

7.23 - Can the pest be reliably detected by testing of the commodity ?

No

Level of uncertainty: low

Not relevant.

7.24 - Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?

No

Level of uncertainty: low

Possible measure: specified treatment of the consignment

No chemical treatment is available to kill this internal borer in the consignment.

There is no scientific data available on the efficacy of a possible cold treatment of fruit to kill the pest. Even if such treatment would kill the pest, larvae would be still present in the fruit which will not make them suitable for marketing.

There is no scientific data available on the efficacy of a possible irradiation treatment.

7.25 - 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?

no

Level of uncertainty: low

Not applicable: the pest is inside the fruit.

7.26 - Can infestation of the consignment be reliably prevented by handling and packing methods?

yes in a Systems Approach

Level of uncertainty: low

Possible measure: specific handling/packing methods

Some visibly infested fruits will be discarded during handling and packing at origin but this will not guarantee complete freedom of the pest. Workers should be appropriately trained to perform this work. Handling and packing methods can be used as part of a systems approaches.

Nevertheless, early infestations (e.g. eggs, young larvae) cannot be reliably detected.

As the pest may lay eggs on peduncles, there is a theoretical risk that the consignment may become infested during packing. Packing stations should be equipped with screens on windows.

Options that can be implemented after entry of consignments

7.27 - Can the pest be reliably detected during post-entry quarantine?

no

Level of uncertainty: low

Not relevant for fruits.

7.28 - 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

Level of uncertainty: low

The Panel on Phytosanitary Measures considered that such measures should be only allowed on a case by case basis and data should be provided by the company requesting such imports.

In theory, the import of fruits intended for human consumption during the winter or also other seasons (except summer) in the northern EPPO countries represents a very low risk for these areas. Import could be allowed for fruits intended for processing with safe disposal of waste. Processing should only occur in areas other than production areas.

In practice, such measure would be difficult to implement as once the fruits enter in the EU, they could be marketed in all the Member States (including those in the endangered area) without any other additional control.

7.29 - Are there effective measures that could be taken in the importing country (surveillance, eradication, containment) to prevent establishment and/or economic or other impacts?

no

Level of uncertainty: low

Fruits are generally marketed in a short time in many different sites. It is unfeasible to check every seller. When it is known that the importer is also a producer, it might be possible to arrange a specific surveillance, but this situation is probably rare.

In the northern part of the PRA area where the pest cannot survive outdoors in winter, measures could be taken in the importing country. Importing country could consider surveillance and eradication campaign instead of import measures. It would require the separation of trade and growing flows (separate facilities for imported consignments and growing tomato) and a good surveillance system (including trapping at packing stations). Eradication is considered possible in greenhouses in that part of the PRA area. This would be possible only as long as the trade volumes are very low.

In the rest of the PRA area, although some measures may be applied they would not be sufficient. Surveillance could be put in place with traps (e.g. yellow traps or pheromone traps) at points of entry, around packing houses, in cultivation areas and in glasshouses, with regular inspections to allow early detection. However, containment and eradication would be difficult. It would suppose early detection of outbreaks.

7.30 - Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?

yes

Q.	Standalone	Systems Approach	Possible Measure	Uncertainty
7.13		X	visual inspection at the place of production	low
7.15		X	specified treatment of the crop	low
7.17		X	specified growing conditions of the crop	low

7.21	X		Pest-free place of production, pest-free area	medium
7.22		X	visual inspection of the consignment	low
7.26		X	specific handling/packing methods	low

7.31 - Does each of the individual measures identified reduce the risk to an acceptable level?

no

Level of uncertainty: low

7.32 - 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

Level of uncertainty: low

A Systems Approach could be designed in combining, growing under protected conditions, starting from healthy plantlets, monitoring the moth occurrence with traps and visual inspection at the place of production, and treating when necessary. In addition detection of infested fruits during handling and packing, and visual inspection of the consignment by the exporting country before departure of the consignment will reduce the risk of infested fruits further.

7.34 - Estimate to what extent the measures (or combination of measures) being considered interfere with international trade.

Level of uncertainty: low

The measures interfere to a certain extent with trade of fruits of eggplant, in particular for non-EU countries where no requirements currently exist for eggplants. Pest free area would be difficult to establish and maintain in many countries where *L. orbonalis* occurs, and could severely interfere with trade from these countries.

7.35 - Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.

Level of uncertainty: low

Measures would have costs linked to monitoring, establishment and maintenance of pest free areas, including the cost of pesticide application. However similar measures are applied against other pests and control is already performed against *L. orbonalis* where it occurs. Enforcement of the above mentioned measures might have initial consequences about production costs, but the development of a specific production system will be cost-effective after few years.
L. orbonalis would be difficult to eradicate if introduced in the endangered area. The possible measures have lower costs than attempting eradication or bearing the costs of the impact and likely spread of *L. orbonalis* if it established in the PRA area.

7.36 - 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

Phytosanitary measures:

<u>As stand-alone measures:</u>

- PFA
- Pest free place of production under screenhouses

<u>As part of systems approaches:</u>

Growing under protected conditions with appropriate additional requirements (use of pest-free seedlings, trapping with pheromone traps, treatments if necessary, appropriate handling and packing, inspection before export).

Pathway 2: Plants for planting of main hosts (S. melongena, S. aethiopicum, S. mammosum, S. aculeatissimum and S. torvum) from where the pest occurs

7.06 - Is the pathway that is being considered a commodity of plants and plant products?
yes

7.09 - If the pest is a plant, is it the commodity itself?
no

7.10 - Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest?
Yes but not for all EPPO countries
Level of uncertainty: medium
Measures are in place in some countries of the PRA area that would prevent introduction of the pest on this pathway to these countries:
- In the EU, Croatia, Norway, Serbia, and Switzerland, import of plants for planting of *Solanaceae* is prohibited (except from European countries and countries in the Mediterranean region) (EU Directive 2000/29/EC).
- In Israel, the import of the plants could be authorised only after a specific PRA is conducted for the exporting country.
In Jordan, Morocco, Russia, Turkey and Ukraine no prohibition are in force, while in Tunisia plants coming from Asia, America and Australia are prohibited (EPPO website).

Options at the place of production
7.13 - Can the pest be reliably detected by visual inspection at the place of production ?
yes in a Systems Approach
Level of uncertainty: low
Possible measure: visual inspection at the place of production
During the growing season, the presence of the adults can be monitored with pheromone traps.
Larvae entering the plant shoots may cause plant wilting. However, non-hatched eggs or very early infestations are unlikely to be detected.

7.14 - Can the pest be reliably detected by testing at the place of production?
no
Level of uncertainty: low
Not relevant.

7.15 - Can infestation of the commodity be reliably prevented by treatment of the crop?
yes in a Systems Approach
Level of uncertainty: low
Possible measure: specified treatment of the crop
A targeted treatment schedule could prevent or reduce infestations during the vegetation cycle but not eliminate all individuals.

7.16 - Can infestation of the commodity be reliably prevented by growing resistant cultivars?
no but may be reconsidered in the future in a Systems Approach
Level of uncertainty: medium
Despite the attempts in India and Bangladesh which have been made to explore resistant sources as well as to develop resistant varieties of eggplants against *L. orbonalis* in the region, no commercial cultivar with appreciable levels of resistance has been developed. At the moment, only Turbo, a commercial F1 hybrid has exhibited significant resistance to *L. orbonalis* in Thailand and Taiwan (Srinivasan, 2008).
Bt transgenic varieties ('Bt brinjal') have been developed, and were considered suitable for marketing in India in 2009 (Anon., 2009), although following concerns raised by the public a moratorium on the release of eggplant hybrids was imposed.
However some cultivars are considered tolerant and are less susceptible to fruit damage (CABI datasheet): they could be used in a Systems Approach.
There is no data available on resistant cultivars for other Solanum species.

7.17 - 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, etc.)?

yes in a Systems Approach

Level of uncertainty: low

Possible measure: specified growing conditions of the crop

Plantlets are usually grown under protected conditions. In production sites devoted to export, specific insect-proof screens and double-door (usually used against other pests such as whiteflies) will be useful to mitigate the risk of introduction of *L. orbonalis*. Only pest-free plantlets may be introduced in the greenhouses. Complementary elements should be taken into consideration to guarantee the pest freedom: pheromone traps should be used to monitor and maintain the freedom.

7.18 - 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

Level of uncertainty: low

The pest might be present in the crop all year round, in suitable conditions in the field and always in glasshouse.

7.19 - 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

Level of uncertainty: low

Certification schemes are usually established to address viruses/pathogens that are transmitted by the mother plant. They do not address insect pests specifically, but general inspections required in this framework may allow the pest to be detected. This approach is considered under the option of "pest-free place of production" (see answer to question 7.21).

7.20 - Select the rate of spread.

Low rate of spread

Level of uncertainty: medium

Possible measure: pest-free area or pest free place of production

The moths only fly for short distances, in darkness, and typically rest on the underside of foliage with their abdomens curled upwards (FERA datasheet).

7.21 - The possible measure is: pest-free area or pest free place of production. Can this be reliably guaranteed?

yes

Level of uncertainty: medium

PFA is a possible measure as described in ISPM 4. It will in particular require the use of pheromone traps to check for absence of the pest. Pest-free seedlings should be used. There should be control on movement of eggplant fruit and plants, other hosts, equipment and packaging, etc. in of the area.

Pest free place of production is considered possible under protected condition, with appropriate preventive insect-proof nets (double–door and greenhouse lateral nets for protection). The use of pheromone traps is appropriate to monitor and an appropriate control system should be adopted to maintain the freedom.

Options after harvest, at pre-clearance or during transport

7.22 - 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

Level of uncertainty: low

Possible measure: visual inspection of the consignment

Larvae entering the plant shoots may cause plant wilting. Such symptoms can be observed during a visual inspection, but not initial ones or non-hatched eggs. In addition as plants for planting are likely to be very young, symptoms are unlikely to be detected.

7.23 - Can the pest be reliably detected by testing of the commodity ?

no

Level of uncertainty: low

Not relevant.

7.24 - Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?

no

Level of uncertainty: low

Possible measure: specified treatment of the consignment

The pest is an internal borer, so only systemic insecticides may be used to destroy the pest. In addition specific active substances to kill eggs would have to be used. There is no scientific data available to support the efficacy of such treatments.

Other kinds of treatments (irradiation, heat treatment) cannot be applied on young herbaceous plants as they would kill them or at least affect their viability.

7.25 - 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?

no

Level of uncertainty: low

Not applicable.

7.26 - Can infestation of the consignment be reliably prevented by handling and packing methods?

no

Level of uncertainty: low

Possible measure: specific handling/packing methods

An appropriate selection in the nursery, eliminating all the visually infested plantlets, can reduce the risk but will not guarantee complete pest freedom. The presence of eggs can hardly be detected during the handling operations.

Options that can be implemented after entry of consignments

7.27 - Can the pest be reliably detected during post-entry quarantine?

no

Level of uncertainty: low

This is not practical for seedlings. The imported plantlets are likely sold to the producers for transplanting in a short time.

A post-entry quarantine could be possible only if the plantlets are in a very early stage and they are kept for sometime in the importing nurseries.

7.28 - 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

Level of uncertainty: low

Planting is the only end-use. At origin, the pest may occur on plants at any time of the year.

7.29 - Are there effective measures that could be taken in the importing country (surveillance, eradication, containment) to prevent establishment and/or economic or other impacts?

no

Level of uncertainty: low

Although some measures may be applied they would not be sufficient. Surveillance could be put in place with traps (e.g. yellow traps or pheromone traps) at points of entry, in cultivation areas and in glasshouses, with regular inspections to allow early detection. However, containment and eradication would be difficult. It would suppose early detection of outbreaks. Plantlets might be traded to different producers, in different areas, and it is not practical for the NPPO to monitor them.

7.30 - Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?

yes

Q.	Standalone	Systems Approach	Possible Measure	Uncertainty
7.13		X	visual inspection at the place of production	Low
7.15		X	specified treatment of the crop	Low
7.17		X	specified growing conditions of the crop	Low
7.21	X		Pest-free place of production, pest-free area	Medium

7.31 - Does each of the individual measures identified reduce the risk to an acceptable level?

no

Level of uncertainty: low

7.32 - 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

Level of uncertainty: low

A Systems Approach could be designed in combining growing under protected conditions, monitoring the moth occurrence with traps and visual inspection at the place of production, and treating with insecticides when necessary.

7.34 - Estimate to what extent the measures (or combination of measures) being considered interfere with international trade.

Level of uncertainty: low

The trade is thought to be very limited and disturbance would be minimal. The pathway is also already regulated to a certain extent in most countries of the PRA area. The development and the establishment of an appropriate control scheme for plantlets production cannot be considered interfering with the international trade.

7.35 - Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.

Level of uncertainty: low

Initially the development and the establishment of an appropriate control scheme for plantlets production can cause a cost increase, but its implementation does not have undesirable social or environmental consequences. *L. orbonalis* would be difficult to eradicate if introduced in the endangered area. The possible measures have lower costs than attempting eradication or bearing the costs of the impact and likely spread of *L. orbonalis* if it established in the PRA area.

7.36 - 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

Phytosanitary measures:

<u>As stand-alone measures:</u>

- PFA
- Pest free place of production

<u>As part of systems approaches:</u>

Growing under protected conditions with appropriate additional requirements (trapping with pheromone traps, inspection during production, treatments if necessary).

References

See references in the Dutch and English PRAs.

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