

**Report of a Pest Risk Analysis**  
*Solanum elaeagnifolium*

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

**Pest:** *Solanum elaeagnifolium* Cavanilles  
**PRA area:** EPPO region  
**Assessors:** EPPO Secretariat, CLIMEX maps prepared by Richard Baker (CSL, UK)  
**Date:** 2006-03-07  
**Reviewed:** Panel on IAS 2006-05-16/19 (Editorial modification by EPPO Secretariat 2007/01)

**Reason for doing PRA:** *Solanum elaeagnifolium* has been declared as an invasive alien plant in many countries. It has been unintentionally introduced into Europe. It is highly invasive in Morocco, Tunisia and Syria. It is present but not widely distributed in Croatia, Greece, Spain, etc. and has just appeared in France. Several EPPO countries are still free from this plant.

**Taxonomic position of pest:** *Plantae - Solanaceae*

*Entry*

Geographical distribution: **EPPO region:** Algeria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Republic of Macedonia, Morocco, Serbia and Montenegro, Spain, Syria, Tunisia.  
**Asia:** India (Karnataka, Tamil Nadu), Israel, Taiwan.  
**Africa:** Algeria, Egypt, Lesotho, Morocco, South Africa, Tunisia, Zimbabwe.  
**North America:** Mexico, USA (Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, Nebraska, Nevada, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, South Carolina, Tennessee, Texas, Utah, Washington).  
**Central America and Caribbean:** Guatemala, Honduras, Puerto Rico.  
**South America:** Argentina, Chile, Paraguay, Uruguay.  
**Oceania:** Australia (all states).

Major host plants or habitats: Suitable habitats:  
Man-made habitats such as road sides, waste lands, gardens, orchards, canal banks, pastures and managed grassland. The plant can also colonize riverbanks.  
Most infested crops are: *Beta vulgaris var. saccharifera* (sugar beet), *Citrus spp.*, *Cucumis sativus* (cucumber), *Gossypium hirsutum* (cotton), *Hordeum vulgare* (barley), *Lycopersicon esculentum* (tomato), *Medicago sativa* (lucerne), *Olea europaea subsp. europaea* (olive), *Prunus armeniaca* (apricot), *Prunus persica* (peach), *Sesamum indicum* (sesame), *Solanum tuberosum* (potato), *Sorghum bicolor* (common sorghum), *Triticum aestivum*

(wheat), *Triticum durum* (wheat), *Zea mays* (maize).

Other infested crops: *Arachis hypogaea* (groundnut), *Asparagus officinalis* (asparagus), *Sorghum sudanense* (Sudan grass) and *Vitis vinifera* (grapevine).

Which pathway(s) is the pest likely to be introduced on:

The pathways are plants or plant products on which *S. elaeagnifolium* may be present as a contaminant, either as seeds or root fragments:

- Plants for plantings with growing media attached,
- Soil/growing medium (with organic matter) as a commodity,
- *S. elaeagnifolium* as a contaminant on used machinery and footwear,
- Seeds,
- Grain,
- Containers and packaging.

Other pathways:

- Hay: this pathway has been assessed but is considered very unlikely and is not considered further.
- Cotton

The risk presented by the different commodities of cotton needs to be further evaluated.

- Livestock and manure are pathways but are only relevant for national spread. This pathway has not been considered further in this analysis.

- the Panel considered that this plant was not likely to be imported for ornamental purposes. Intentional import has not been considered further in this analysis.

## **Establishment**

Plants at risk in the PRA area:

All suitable habitats and affected crops mentioned in the entry section are present in the PRA area.

Climatic similarity of present distribution with PRA area (or parts thereof):

The climate in the PRA area is moderately similar to the area of origin (see maps in appendix 1). The plant is thermophilic and comparable climate to the area of origin can be found in the Mediterranean region. It is also present in temperate climates. The plant appears mostly in areas of relatively low annual rainfall (250-600 mm).

Aspects of the pest's biology that would favour establishment:

*S. elaeagnifolium* mainly reproduces vegetatively, from buds on underground fragments. Regeneration can occur from fragments buried at 20 cm depth, and as small as 0.5 cm. The plant can also reproduce by seeds.

Characteristics (other than climatic) of the PRA area that would favour establishment:

*S. elaeagnifolium* is primarily associated with agricultural land, and associated man-made habitats, and is presumably favoured by the same general conditions of soil and nutrient availability as the field crops it infests.

Which part of the PRA area is the endangered area:

The Mediterranean part of the EPPO Region, northern limit probably based on winter temperature (see map in appendix 1).

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

*S. elaeagnifolium* can cause serious losses in infested crops. In Morocco, losses of up to 47% in maize and 78% in cotton have been reported. It is considered as a noxious weed in the USA.

<b>Describe damage to potential hosts in the PRA area:</b>	Damage to potential crops and habitats in the PRA area would be similar.
<b>How much economic impact would the pest have in the PRA area:</b>	The economic impact in the endangered part of the PRA area is expected to be major.
<b>Summarize the major factors that influence the acceptability of the risk from this pest:</b>	
<b>Estimate the probability of entry:</b>	<p>The probability of entry is very likely in particular for the following pathways:</p> <p>Plants for plantings accompanied by soil, Soil/growing medium (with organic matter) as a commodity, <i>S. elaeagnifolium</i> as a contaminant on used machinery, Consignments of seeds.</p> <p>It is moderately likely for <i>S. elaeagnifolium</i> as a contaminant on footwear, Grain, Containers and packaging.</p> <p>Further information needed for cotton consignments.</p>
<b>Estimate the probability of establishment:</b>	<p>Establishment is likely and is facilitated if root fragments are present in consignments. Introductions resulting from seeds of <i>S. elaeagnifolium</i> have also been reported.</p> <p>Establishment probability depends on climate, habitat and human activities. Fertilization, irrigation and ploughing facilitate the establishment of <i>S. elaeagnifolium</i>, while machinery will help spread to other suitable habitats. Some herbicides used in host crops could limit its establishment, but those used for Solanaceae crops might favour it.</p>
<b>Estimate the potential economic impact:</b>	<i>S. elaeagnifolium</i> can cause serious losses in infested crops.
<b>Degree of uncertainty</b>	<p>When performing the PRA the following uncertainties have been identified:</p> <ul style="list-style-type: none"> <li>- The distribution of the pest should be analyzed more precisely and a distinction should be made between areas where it is invasive and areas where it is present but not invasive.</li> <li>- The ability of the plant to colonize temperate climates.</li> <li>- The possibility for different Cotton commodities to act as a pathway.</li> </ul>
<b>OVERALL CONCLUSIONS</b>	A troublesome weed of field crops and disturbed land, already present locally in some Mediterranean countries, liable to spread further in infested countries and to be introduced into other countries. This justifies that management options should be identified to prevent further introduction and spread of the plant in the EPPO region.

## STAGE 3: PEST RISK MANAGEMENT

### IDENTIFICATION OF THE PATHWAYS

Pathways studied in the pest risk management (ranked by likelihood)

#### Very likely

Pathway 1: Plants for planting with growing medium attached from countries where *S. elaeagnifolium* occurs.

Pathway 2: Soil/growing medium (with organic matter) as a commodity from countries where *S. elaeagnifolium* occurs.

Pathway 3: *S. elaeagnifolium* as a contaminant on used machinery from countries where *S. elaeagnifolium* occurs.

Pathway 4: Seeds *Zea mays*, *Medicago sativa*, *Triticum aestivum*, *Sorghum bicolor*, *Gossypium spp.*, *Nicotiana tabacum* from countries where *S. elaeagnifolium* occurs.

#### Likely

#### Moderately likely

Pathway 5: *S. elaeagnifolium* as a contaminant on footwear from countries where *S. elaeagnifolium* occurs.

Pathway 6: Consignment of grain (*Zea mays*, *Triticum aestivum*, *Sorghum bicolor*) from countries where *S. elaeagnifolium* occurs.

Pathway 7: Containers and packaging.

**Other pathways identified but not studied** Commodities of cotton  
Livestock and manure

### IDENTIFICATION OF POSSIBLE MEASURES

#### **Pathway 1: Plants for planting with growing medium attached from countries where *S. elaeagnifolium* occurs**

*Measures related to consignments:*

No measures related to the consignment have been identified (The Panel considered that soil freedom was not sufficient as root fragments of *S. elaeagnifolium* may remain mixed with the plant root system).

*Measures related to the crop or to places of production:*

Infestation can be prevented if the plants are grown in a growing medium free from the pest.

The pest is considered to have a low to medium mobility, pest-free place of production<sup>1</sup> and pest-free area for *S. elaeagnifolium* are recommended measures.

*Other possible measures*

Surveillance and/or eradication campaign would not be sufficient to prevent establishment.

#### **Pathway 2: Soil/growing medium (with organic matter) as a commodity from countries where *S. elaeagnifolium* occurs**

*Measures related to consignments:*

Heat treatment or sterilisation of the soil is a recommended measure.

*Measures related to the crop or to places of production:*

As the pest is considered to have a low medium mobility, pest-free place of production for *S. elaeagnifolium* or pest-free area for *S. elaeagnifolium* are recommended measures. This means that the soil or growing medium has to be collected in a pest-free place of production or a pest-free area.

*Other possible measures*

No internal measures such as surveillance and/or eradication campaign have been identified.

#### **Pathway 3: *S. elaeagnifolium* as a contaminant on machinery from countries where *S. elaeagnifolium* occurs**

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<sup>1</sup> According to ISPM 10 "Requirements for the establishment of pest-free places of production and pest-free production sites"

Cleaning or disinfection of imported machinery or vehicles is recommended.

**Pathway 4: Seeds of *Gossypium spp.*, *Hordeum indicum*, *Medicago sativa*, *Nicotiana tabacum*, *Sesamum indicum*, *Sorghum bicolor*, *Triticum spp.*, *Zea mays* from countries where *S. elaeagnifolium* occurs**

*Measures related to consignments:*

Cleaning of seeds has been identified as a possible measure reducing the risk to a sufficient level.

*Measures related to the crop or to places of production:*

Crop freedom was considered as an appropriate management option for this plant. Treatment of the crop was not considered a sufficient measure to ensure crop freedom and an inspection of the field before harvest should be required.

Pest-free place of production and pest-free area were also identified as appropriate measures.

*Other possible measures*

Surveillance and/or eradication campaign would not be sufficient to prevent establishment.

**Pathway 5: *S. elaeagnifolium* as contaminant on footwear where it occurs**

Publicity to enhance public awareness on pest risks is a recommended measure.

**Pathway 6: Consignment of grain (*Hordeum spp.*, *Sesamum indicum*, *Sorghum bicolor*, *Triticum spp.*, *Zea mays*) from countries where *S. elaeagnifolium* occurs**

*Measures related to consignments:*

Cleaning of grain has been identified as a possible measure reducing the risk to a sufficient level.

*Measures related to the crop or to places of production:*

Crop freedom was considered as an appropriate management option for this plant. Treatment of the crop was not considered as a sufficient measure to ensure crop freedom and an inspection of the field before harvest should therefore be required.

Pest-free place of production and Pest-free area were also identified as appropriate measures.

*Other possible measures*

No internal measures such as surveillance and/or eradication campaign have been identified.

**Pathway 7: Containers and packaging**

Use of clean containers and packaging material is recommended.

**EVALUATION OF THE MEASURES IDENTIFIED IN RELATION TO THE RISKS PRESENTED BY THE PATHWAYS**

The likelihood of Pathways has been ranked from very likely to moderately likely (see pathway section).

Measures are recommended for the different pathways. General measures are recommended for used machineries and travellers, containers and packaging material.

**Degree of uncertainty**

The degree of uncertainty is considered to be low

**CONCLUSION:**

**Recommendation for possible measures for the endangered area:**

Plants for planting with growing medium attached from countries where <i>S. elaeagnifolium</i> occurs	PC and, if appropriate, RC Area freedom for <i>Solanum elaeagnifolium</i> <u>or</u> Pest-free place of production for <i>Solanum elaeagnifolium</i> <u>Or</u> The plants have been grown in a growing medium free from the pest
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Soil and growing medium (with organic matter) originating in countries where <i>Solanum elaeagnifolium</i> occurs	PC and, if appropriate, RC Heat treatment or soil sterilisation <u>or</u> Area freedom for <i>Solanum elaeagnifolium</i> <u>or</u> Place of production freedom for <i>Solanum elaeagnifolium</i> *
Used machinery originating in countries where <i>Solanum elaeagnifolium</i> occurs	Cleaning or disinfection of imported machinery or vehicles
Seeds of <i>Gossypium spp.</i> , <i>Hordeum indicum</i> , <i>Medicago sativa</i> , <i>Nicotiana tabacum</i> , <i>Sesamum indicum</i> , <i>Sorghum bicolor</i> , <i>Triticum spp.</i> , <i>Zea mays</i> from countries where <i>S. elaeagnifolium</i> occurs	PC and, if appropriate, RC Area freedom for <i>Solanum elaeagnifolium</i> <u>or</u> Place of production freedom for <i>Solanum elaeagnifolium</i> <u>Or</u> Crop freedom for <i>S. elaeagnifolium</i> <u>Or</u> Cleaning of seeds to eliminate <i>S. elaeagnifolium</i> seeds
Footwear from countries where <i>Solanum elaeagnifolium</i> occurs	Publicity to enhance public awareness on pest risks
Consignment of grain ( <i>Hordeum spp.</i> , <i>Sesamum indicum</i> , <i>Sorghum bicolor</i> , <i>Triticum spp.</i> , <i>Zea mays</i> ) from countries where <i>S. elaeagnifolium</i> occurs	PC and, if appropriate, RC Area freedom for <i>Solanum elaeagnifolium</i> Or Place of production freedom for <i>Solanum elaeagnifolium</i> * Or Crop freedom for <i>Solanum elaeagnifolium</i> Or Cleaning of grain to eliminate <i>S. elaeagnifolium</i> seeds
Containers and packaging	Cleaned containers and packaging

PC= Phytosanitary Certificate, RC= Phytosanitary Certificate for Re-Export

\*: the soil or growing medium should be collected in a pest-free place of production or a pest-free area.

## Potential Geographical Distribution of *Solanum elaeagnifolium*, with emphasis on the EPPO region

The CLIMEX model is a computer programme aiming at predicting the potential geographical distribution of an organism considering its climatic requirements. It is based on the hypothesis that climate is an essential factor for the establishment of a species in a country.

This documents aims at predicting the potential geographical distribution of *S. elaeagnifolium* in the EPPO region if no measure is taken to limit its spread.

The “match climates” function in CLIMEX, a computer programme that compares climate in different locations and predicts potential distribution based on current distribution and climate, was used to provide a basic comparison of the climates at these locations with those in the rest of the world and in the Euro-Med area. Climate is represented by the 1961-90 30 minute latitude/longitude resolution world climatology (New *et al.*, 1999). Outputs from CLIMEX were imported into a geographical information system (ArcView) and mapped.

It is important to stress that the CLIMEX Match Index maps should be used with great care in predicting the potential distribution of *S. elaeagnifolium* because:

- Distribution depends on many other factors apart from climate,
- The composite Match Index algorithm used by CLIMEX is based on differences in maximum, minimum and mean temperatures, annual rainfall, rainfall pattern, relative humidity and soil moisture. These factors, the relationship between them and the algorithm employed by CLIMEX may not necessarily be relevant for *S. elaeagnifolium*.

### Euro-Med map of the CLIMEX Match Index based on Kairouan, Tunisia (35.8°N, 9.8°E)

Chalghaf *et al.* (2006, unpublished) highlight Kairouan in Tunisia as a location where *S. elaeagnifolium* flourishes.

### References

Chalghaf, E., Aissa, M., Mallassi, H. & Mekki, M. (2006) Maitrise de la propagation de la morelle jaune (*Solanum elaeagnifolium* Cav.) dans le gouvernat de Kairouan. *EPPO Workshop on Invasive Alien Species, May 2006*. Unpublished.

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New M, Hulme M, Jones PD (1999) Representing twentieth century space-time climate variability. Part 1: Development of a 1961-90 mean monthly terrestrial climatology. *Journal of Climate*, **12**: 829-856.

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**CLIMEX MATCH INDEX**  
Based on Kairouan  
Tunisia, 35.8N, 9.8W

