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Report of a Pest Risk Analysis for: *Ludwigia peploides*

This summary presents the main features of a pest risk analysis which has been conducted on the pest, according to EPPO Decision support scheme for quarantine pests.

Pest: ***Ludwigia peploides***
PRA area: The PRA area is the EPPO region (see map www.eppo.org).

Assessors:

A Draft PRA had been prepared by Mr Guillaume Fried, and the Expert Working Group was attended by the following experts:
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Peer review has been undertaken by Ms Schrader, Julius Kühn Institute, Germany.

Date:

Expert working group 06-2010, core member consultation 06-2011

STAGE 1: INITIATION

Reason for doing PRA:

L. peploides is widespread and invasive in the South-East and West of France and its distribution is still very limited in Belgium, Corsica, Greece, Italy, the Netherlands, Spain, Turkey, and the UK where invasions are at an early stage. The species could spread to further EPPO countries and have negative impacts on agriculture and the environment.

An EPPO Pest Risk Analysis has been performed for *Ludwigia grandiflora*. Reference will often be made to the PRA for *L. grandiflora* in the current PRA.

Taxonomic position of pest:

Kingdom: Plantae
Class: Magnoliopsida (Dicotyledons)
Subclass: Rosidae
Order: Myrtales
Family: Onagraceae

STAGE 2: PEST RISK ASSESSMENT

Probability of introduction
Entry

Geographical distribution:

Native range :

- Central America: Cuba, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti; Honduras, Jamaica, Nicaragua; Panama, Puerto Rico .

- **South America**: Argentina, Bolivia, Brazil, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela,

Note: *L. peploides* in Argentina is known to occur in Buenos Aires, Corrientes, Entre Rios, Formosa, Mendoza, Salta, Santa Fe, Tucuman.

- **North America** : United States (Alabama, Arkansas, California, Florida, Georgia, Indiana, Illinois, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, , South Carolina, Tennessee, Texas), Mexico.

Note: The EWG considered the proliferation of subspecies and varietal names in North America associated with supposed native status to be unhelpful. However, it is clear that *L. peploides* is probably native to most States where it is found in North-America.

Introduced Range :

EPPO Region: Belgium (Branquart *et al.*, 2010), France (Dutartre *et al.*, 2007) including Corsica (Jeanmonod & Schlüssel, 2007), Greece (Zotos *et al*., 2006), Italy (Celesti-Grapow *et al*., 2009), the Netherlands (Holverda *et al*. 2009), Spain (Verloove & Sánchez Gullón, 2008), Turkey (near Antalya) (Güner *et al*., 2000), the UK (BSBI, 2011).

Australasia: Australia (New South Wales, Northern Territory, Queensland, South Australia, Victoria) (Richardson *et al*., 2007; Australia's Virtual Herbarium, 2011), New Zealand (north island) (Webb *et al*., 1988; Roy *et al*., 2004).

Africa: Madagascar (GBIF Portal, 2011)

Asia: Thailand, Taiwan (GBIF Portal, 2011).

Details about the situation in EPPO countries where the species is present as well as maps are available in the PRA record (10-16828).

Major host plants or habitats:

In its native range, *L. peploides* is reported in wetlands (Rolon *et al*., 2008), in the transition zone-between aquatic and terrestrial environments (Hernandez & Rangel, 2009).

Establishment of *L. peploides* often occurs on mud in open areas of wetlands subject to fluctuating water levels (natural or managed); in disturbed marginal habitats subject to grazing, i.e. meadows (cattle, wild geese) or management. The latter can include sites where restoration for conservation or reinstatement of aquatic habitats occurs, especially where the margins have a gradual slope.

Suitable habitats include wet margins of ponds and lakes, static or slow-flowing waters, rivers, shallow ponds and lakes, canals, oxbow lakes, wetlands, ditch networks. It is also found on sediment bars on river borders and in wet meadows (Laugareil, 2002 ; Zotos *et al*., 2006), and can also colonize brackish waters (Mesleard & Perennou, 1996).

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

As for *L. grandiflora*, the plant is considered to be introduced as an ornamental aquatic plant. There is no data available on numbers of the species imported, but the species is still sold in EPPO countries, in most cases under misapplied names such as *Jussiaea* or *Ludwigia grandiflora* (Dandelot, 2004). The species is already present in Belgium, France, Greece, Italy, Spain, Turkey, the Netherlands, and theUK .

Although regulated in some countries, the probability of entry of intentional import as an ornamental aquatic plant for use outdoors is very likely, as the species already entered the EPPO region, and continues to enter.

The EWG considered other pathways as unlikely:
- Intentional import for non ornamental uses
- Contamination of other deliberately planted aquatic plants (e.g. water lilies)

Establishment

Plants or habitats at risk in the PRA area:

According to the CORINE Land Cover nomenclature, the habitats at risk are
- Continental waters (water courses, water bodies);
- Banks of continental water, riverbanks/canal sides (dry river beds);
- Wet meadows.

Freshwater bodies and ecosystems abound in the EPPO region, particularly static or slow-flowing waters, see CORINE Land Cover (2000) map in Appendix 1.

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

Moderately similar
Level of uncertainty: medium

The species is already present in 8 countries of the EPPO region, either in the Mediterranean, Atlantic or continental bioregions, there is therefore no doubt that the species is able to establish.
As an approximation, given the lack of accurate data on the thermal requirements of the species, it is extrapolated that the species may establish in the same places as *L. grandiflora* (see the PRA on *Ludwigia grandiflora*).

Different biogeographical regions of the EPPO region are considered to be suitable for the establishment of *L. peploides*:
The Mediterranean basin: Albania, Algeria, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Israel, Italy, Jordan, Montenegro, Morocco, Spain, Republic of Macedonia, Romania, Tunisia, Turkey, Slovenia
Atlantic Western Europe: Belgium, France, Ireland, the Netherlands, Portugal, the UK are susceptible to establishment of this species.
Continental Europe and other parts of Europe (but for which the ecoclimatic index of the species is lower): Austria, Azerbaijan, Czech Republic, Denmark, North-Western Germany, Hungary, Luxembourg, South-Western coast of Norway, Poland, Serbia, Slovakia, Sweden, North Western Switzerland, , Russia, Ukraine (Black Sea region).

The EWG considered that the CLIMEX map for *L. grandiflora* predicts quite accurately the range at high risk from this species on the basis of the current distribution of the species. This map is to be taken as an indication of the potential distribution of the species only. Indeed, there is a lack of data on cold tolerance of *L. grandiflora*, and it is possible that the species could establish in countries with more continental climates. The areas where establishment is considered unlikely may be overestimated by CLIMEX. Because of the early stage of some invasions (e.g. in Belgium, in the Netherlands), it is not possible to use the climate data for the current range to predict the entire area at risk (see the PRA for *L. grandiflora*).
Thermal ponds or waters with artificially raised temperatures may be

additional suitable habitats in countries that are not identified as having suitable overall climates.

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

Both *L. peploides* and *L. grandilfora* are tolerant to a wide range of conditions in terms of nutrient levels, types of substrate (gravel banks or sediments), pH and water quality (Matrat *et al*., 2006). They prefer full light but can tolerate shade (biomass production is reduced under shade); they are limited by flow velocity (greater than 0.25 m/s) (Dandelot, 2004) and by salinity (*L. grandiflora* tolerates up to 6g/L). *Ludwigia* spp. prefer high nutrient conditions (Hussner, 2010) and become dominant in nutrient-rich conditions (Rejamánková, 1992). Compared to *L. grandiflora*, *L. peploides* can grow in brackish waters of the Camargue, with salt concentrations of about 10 g/L (e.g., at the mouth of the Rhône) (Grillas *et al*. 1991; Mesleard & Perennou, 1996).
These abiotic factors are very common in the EPPO region and completely similar to the ones in the current range of the species, and are described below.

As for *L. grandiflora*, in favourable aquatic habitats, *Ludwigia peploides* often builds up monospecific stands and outcompetes other aquatic species (Dutartre, 2004b).

As for *L. grandiflora*, physical modification (reduction of current velocity) of waterbodies can also enhance the establishment of *L. peploides.* The main method of propagation of the 2 *Ludwigia* species is by vegetative fragmentation, so conditions that favour the creation of fragments and their dispersal within water courses will promote establishment elsewhere. Management of water bodies creates open spaces favourable for the establishment of *L. peploides*, and may also cut the plant into fragments, enhancing its spread. The EWG considered that there are no management practices that could prevent the establishment of this plant. Most water bodies that are at risk of colonization are not subject to management, and those with management plans in place would not prevent the establishment of the species.

L. peploides possesses inherent characteristics enabling rapid vegetative spread between connected water bodies. Where present, the probability of short distance spread is very high as vegetative spread is very effective for local colonization. Human activity is principally responsible for long distance spread.

Finally, as for *L. grandiflora*, eradication of *L. peploides* is considered very difficult or even impossible in water bodies with heavy infestation. Local eradication is possible if it is started early and the water system is reasonably accessible (Grillas, 2004).

Which part of the PRA area is the endangered area:

The endangered area consists of wet margins of ponds and lakes, static or slow-flowing waters, rivers, shallow ponds and lakes, canals, oxbow lakes, wetlands, ditch networks,sediment bars on river borders, wet meadows, brackish waters where climatic conditions are suitable.
Aquatic habitats of the Mediterranean and Atlantic Western countries of the

EPPO region are considered the most at risk (excluding water bodies in the Mediterranean area that dry out during summer) and Continental Europe is also considered at risk.

POTENTIAL ECONOMIC CONSEQUENCES

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

Most data were gathered in France and it is difficult to separate the impacts of *L. peploides* or *L. grandiflora* in these situations.

While the impacts on crop yields and/or quality to cultivated plants are minor, the control costs are major.

Impacts on crops

Ludwigia grandiflora and *L. peploides* are very rarely present in rice crop and therefore do not cause a direct impact on rice production, but may indirectly be a nuisance when blocking irrigation ditches and canals. In addition, the EWG considered that as for *L. grandiflora, L. peploides* would be managed with current herbicide treatment in such crop.

Impact on pastures

By outcompeting wetland grasses, *L. peploides* as *L. grandiflora* can reduce grazing space for livestock in wet meadows (Dutartre, 2004a). This effect is increased by the low palatability of the 2 *Ludwigia* species for livestock, as cattle and horses only eat the plant when no other species is available.

Control costs

As *L. grandiflora, L. peploides* interferes with agricultural production, ecosystem services and human use of water bodies (e.g. deterioration of dams and infrastructures, loss of recreation areas, increase in flood risk, etc.).

See the PRA record for *L. grandiflora* (10-16827) for figures.

Environmental impact

The dominance of *Ludwigia* spp. leads to local loss of floral biodiversity, as well as faunal biodiversity (for macro-invertebrates and fishes) (Dandelot, 2004).

An analysis of the distribution of *Ludwigia* spp. in France shows that habitats under threat by this species include at least 12 habitats of interest for the European Commission (Habitat Directive 92/43/EEC), and 3 types of wet habitats (aquatic vegetations of the *Nymphaeion albae,* swamp vegetations with tall helophytes, prairial vegetations and flooded forests (Dutartre *et al.,* 2007)). In Greece, *L. peploides* occurs in the lake Lysimachia which constitutes one of the proposed sites of community interest included in the European Ecological network Natura 2000 of Greece (Zotos *et al*., 2006).

Ludwigia spp. cause many significant changes of ecological processes and structures in the following way :

- the high biomass production leads to the slowing of water flow (Dutartre, 1988) in channels, ditches and shallow rivers, causing increased sedimentation, which may lead to increased flood risk by reduction of channel carrying capacity, particularly in autumn. This may lead to modifications of flora and fauna communities, fish disappearing in dense beds, etc. In static open waters, the slow rate of litter decomposition can lead to shallowing of the water body and succession to swamp and marsh type vegetation.

- reduction in oxygen concentrations: in static waters, dense stands prevent the transfer of oxygen between water and the atmosphere, reduction in light availability for submerged plants reduces photosynthetic oxygen production and consumption of oxygen by *Ludwigia* spp. root respiration results in severe deoxygenation which is harmful to aquatic fauna. Concentrations of oxygen inferior to 1 mg/L have been recorded in waters where *Ludwigia* spp. are present (Dandelot *et al*., 2005a).
- decreases in pH are common due to the suppression of submerged aquatic photosynthetic processes (Dandelot *et al*., 2005b)
- change in hydrological regimes of water bodies (Dandelot, 2005b).

Social impacts

Stands of *Ludwigia* spp. can be very dense, with highly branched and very solid stems of several metres long, preventing passage for fish and users of the water (Dutartre *et al.*, 2007).

In some agricultural ditch networks in the West of France, dense stands of Flood risks may be increased by the reduction of channel carrying capacity, particularly in autumn (Dandelot, 2004).

Floating mats of this plant can increase mosquito populations by making the larvae inaccessible to mosquito-eating fish (Pillsbury, 2005 in DEFRA, 2006) and creating static water beneficial to mosquito development.

Describe damage to potential hosts in PRA area:

The range of habitats under threat includes threatened or vulnerable habitats in much of the PRA area.

How much economic impact would the pest have in the PRA area:

Control costs could be similar to those already spent in infested parts of the PRA area. Environmental and social impacts are supposed to be the same wherever the species grows in suitable conditions.

CONCLUSIONS OF PEST RISK ASSESSMENT

Summarize the major factors that influence the acceptability of the risk from this pest:

Estimate the probability of entry:

Although regulated in some countries, the probability of entry by intentional import as an ornamental aquatic plant for use outdoors is very likely, as the species already entered the EPPO region, and continues to enter. Uncertainty is low.

Estimate the probability of establishment:

L. peploides has already established in at least 8 countries of the EPPO region, the probability of establishment is therefore very high.

According to the climatic prediction, additional countries are at risk.

In addition, the overall probability of spread is high, uncertainty is medium.

Estimate the potential economic impact:

Economic impacts: major impacts considering the management cost, low uncertainty. Any economic benefit of the introduction of this plant as an ornamental aquatic plant is heavily outweighed by management costs.

Environmental impacts: major, low uncertainty. Invasion of slow flowing waters, loss of biodiversity degradation and modification of aquatic ecosystem including protected habitats.

Social impact: moderate, with low uncertainty. Where it occurs, it has an impact on recreational activities, it can also create favorable conditions for mosquito development, increased risk of flooding.

The part of the EPPO region which seem the most economically at risk are the Atlantic and Mediterranean areas, as well as the Black sea area.

Degree of uncertainty

The overall uncertainty of the assessment is low, owing to the very detailed information available in France.

The areas of uncertainty identified are the following:
- volume in trade ;
- natural spread by waterfowl (see PRA on *L. grandiflora*) ;
- the extent of human assisted spread via contaminated equipment or deliberate planting ;

Further areas of research to be investigated:
- the possible use of a biological control agent ;
- tolerance of anoxia (vegetative material and seed) ;
- effects of water level on potential establishment and spread ;
- critical density of competitive tall helophytes.

OVERALL CONCLUSIONS

The risk of establishment of *Ludwigia peploides* in aquatic habitats, and negative impacts on their vegetation and use, justifies measures to prevent its further spread in the EPPO region.
The pest qualifies as a quarantine pest.

STAGE 3: PEST RISK MANAGEMENT

IDENTIFICATION OF THE PATHWAYS

Pathways studied in the pest risk management

- Intentional import as an ornamental aquatic plant for use outdoors. This can also include intentional import of the species for any purpose (e.g. phytoremediation).

Other pathways identified but not studied

none

IDENTIFICATION OF POSSIBLE MEASURES

Possible measures for pathways

Intentional import as an ornamental aquatic plant for use outdoors.
Measures related to consignments:

Measures related to the crop or to places of production:
International measures
Prohibition of import and trade in the EPPO region and within the countries will effectively prevent further introduction into the EPPO region combined with accurate identification of the species.

National measures
Prohibition of the import, selling, planting, holding, movement, causing to grow in the wild of the plant may effectively prevent further establishment and spread within the EPPO region.

Integrated management plan for the control of existing infestations
It is potentially highly effective if coupled with prohibition measures. Uncertainty concerns commitment to long-term implementation.
This would require:
- Monitoring/surveillance in the countries where it is invasive or present (Belgium, France, Germany,

Ireland, the Netherlands, the United Kingdom, Italy, Spain), and surveillance in the countries at risk where it is not reported.
- Early warning consisting of exchanging information with other countries, and rapid response (as it has been implemented in the UK).
- Control of existing populations.
- Public awareness: aquatic plants producers and sellers shall be informed of the problem and work should be undertaken with them to explain the prohibition of the species, and inform consumers. Administration should also be warned that the plant shall not be used as a phytoremediation species.

Monitoring and review

Performance of these measure(s) should be monitored in countries to ensure that the aim is being achieved. This is often carried out by inspection of the commodity on arrival, noting any detection in consignments or any entries of the pest to the PRA area. Monitoring of on going eradication campaigns and management activities should also be undertaken to optimize control measures.

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

Degree of uncertainty Low

CONCLUSION:

Recommendation for possible measures:
PC= Phytosanitary certificate, RC=Phytosanitary certificate of re-export

Pathway 1:	Prohibition

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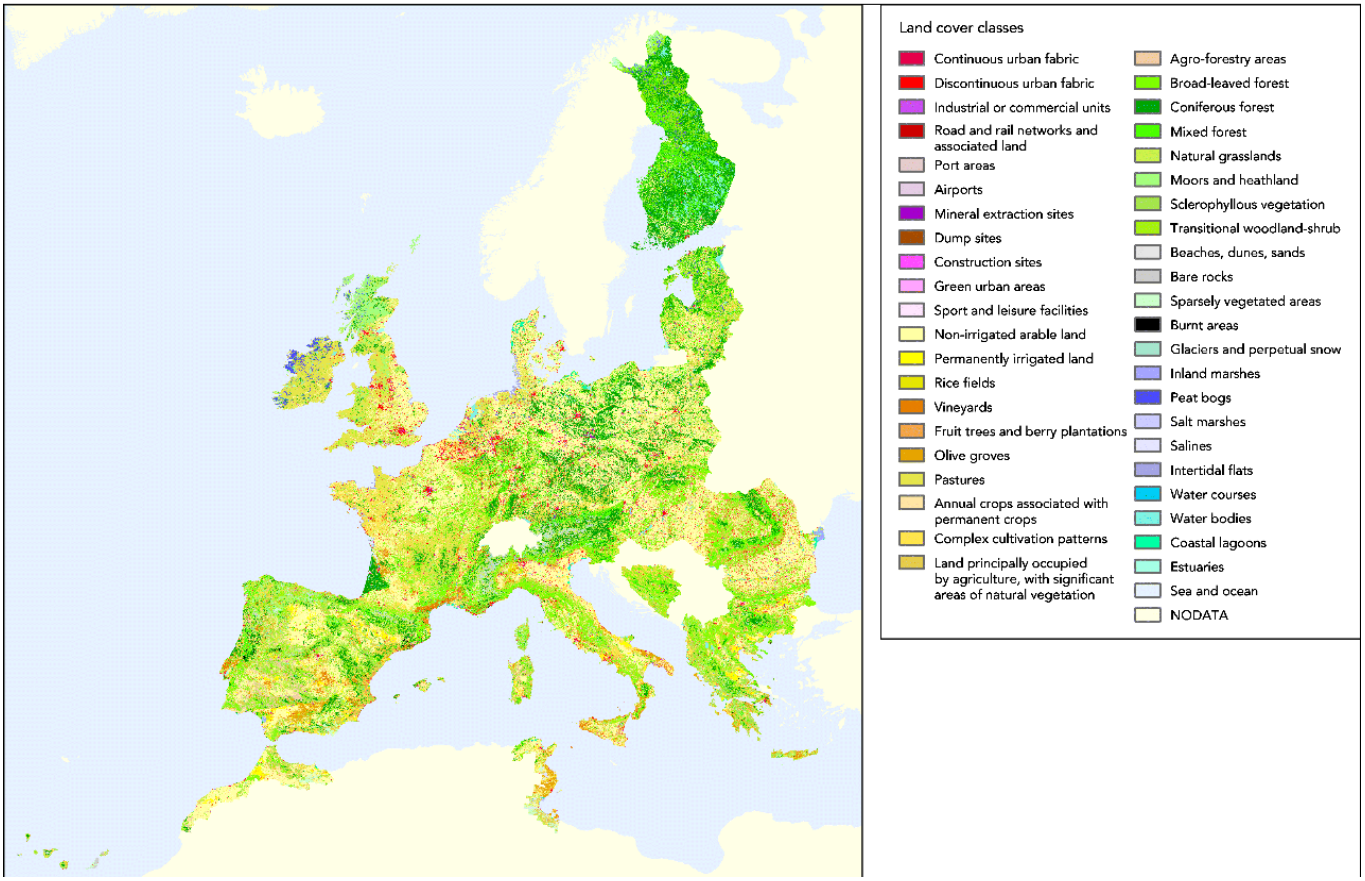
Appendix 1

CORINE Land Cover classification

Available at:
http://www.eea.europa.eu/data-and-maps/figures/corine-land-cover-2000-geographic-view-1



Corine land cover 2000 geographic view, European Environment Agency