	European and Mediterranean Plant Protection Organisation		
	Organisation Européenne et Méditerranéenne pour la Protection des Plantes		
			06-12701 Final (rev.)
	Guidelines on Pest Risk Analysis		
	Lignes directrices pour l'analyse du risque phytosanitaire		
	Decision-support scheme for quarantine pests		
PEST RISK ANALYSIS FOR PUERARIA MONTANA VAR. LOBATA			
Pest risk analyst:			
Sarah Brunel **Gritta Schrader** **Françoise Petter**			
Draft 06 April 2006 **Final version 2007/01** **Update species name : 2015/06**			
Stage 1: Initiation			
1 What is the reason for performing the PRA?		Identification of a single pest	
2 Enter the name of the pest			*Pueraria montana* var. *lobata* (Willd.) Sanjappa & Pradeep
2A Indicate the type of the pest		plant	
2B Indicate the taxonomic position			Plantae - Fabaceae
3 Clearly define the PRA area			EPPO region
4 Does a relevant earlier PRA exist?		yes	National PRA for Germany

Stage 2A: Pest Risk Assessment - Pest categorization		
5A If you are sure that the pest clearly presents a risk, or that in any case a full Pest Risk Assessment is required, you can omit this section and proceed directly to the main Pest Risk Assessment section.	Go to main Pest Risk Assessment	
Section 2B: Pest Risk Assessment - Probability of introduction/spread and of potential economic consequences		
Note: If the most important pathway is intentional import, do not consider entry, but go directly to establishment. Spread from the intended habitat to the unintended habitat, which is an important judgement for intentionally imported organisms, is covered by questions 1.33 and 1.35.	Go to section on establishment (intentionally imported organism)	
1.2 Note down the relevant pathways, then estimate the total number of distinct pathways, by multiplying the number of relevant pathways by the number of relevant origins and the number of relevant ed uses.	Few	Intentional introduction: - for horticulture - for agriculture (for livestock fodder, erosion control, nitrogen fixing) Unintentional pathways (not further considered) - uncertainty of fragments in the soil - garden wastes (pathway for further spread to add to internal measures)
The overall probability of entry should be described and risks presented by different pathways should be identified.	Very high	The species is already established in Switzerland and Italy. The plant is also recorded as traded in the UK (Plant finder) and is also recorded by the PPP index. The risk of entry with the horticultural pathway is very high. The risk of entry for agriculture is moderately high. Intentional introduction for horticulture appears to be the most important pathway.

1.16 Specify the host plant species (for pests directly affecting plants) or suitable habitats (for non parasitic plants) present in the PRA area.		Pastures Woodland edges or woodlands without a dense canopy, Riverbanks / canalsides (dry river beds) Road and rail networks and associated land Banks of continental waters Other artificial surfaces (wastelands, Garden, Abandoned farmland) All these habitats are present in the PRA area.
1.17 How widely distributed are the host plants or suitable habitats in the PRA area? (specify)	Very widely	Pastures, Road and rail networks and associated land, Other artificial surfaces (wastelands) Woodland edges, Banks of continental water, Riverbanks / canalsides (dry river beds). These habitats are less widespread as the previous ones and are sometimes protected for their conservation value.
1.18 If an alternate host is needed to complete the life cycle, how widespread are alternate host plants in the PRA area?	/	No host needed.
1.19 Does the pest require other species for critical stages in its life cycle such as transmission, (e.g. vectors), growth (e.g. root symbionts), reproduction (e.g. pollinators) or spread (e.g. seed dispersers) ?	no	The extremely low viability of seeds has been assumed to be due to a lack of pollinators.
1.19A Specify the area where host plants (for pests directly affecting plants) or suitable habitats (for non parasitic plants) are present (cf. QQ 1.16-1.19). This is the area for which the environment is to be assessed in this section. If this area is much smaller than the PRA area, this fact will be used in defining the endangered area.	widespread	The suitable habitats are present in the whole EPPO region.

1.20 How similar are the climatic conditions that would affect pest establishment, in the PRA area and in the area of current distribution?	slightly similar	*P. montana* var. *lobata* is most favoured by conditions of at least 1000 mm precipitation per year, as well as high summer temperatures (over 27°C) based on its distribution in USA. The plant has broad climatic amplitude and is hardy down to -18°C (considering its establishment in Switzerland).. It is already established in Italy and in Switzerland. The pest would probably survive under broad conditions, nevertheless, invasiveness would arise under specific climatic conditions of hot and wet summer conditions
1.21 How similar are other abiotic factors that would affect pest establishment, in the PRA area and in the current area of distribution?	largely similar	It prefers deep, well-drained loamy soils but is able to establish under less favourable conditions. It is relatively indifferent to soil pH. It requires full light, and will not grow in the shade. Though it prefers moist soil, it can tolerate drought. Like most Leguminosae, *P. montana* var. *lobata* has a symbiotic relationship with nitrogen-fixing bacteria (*Rhizobium* spp.) in root nodules.
1.22 If protected cultivation is important in the PRA area, how often has the pest been recorded on crops in protected cultivation elsewhere?	/	Not relevant.
1.23 How likely is establishment to be prevented by competition from existing species in the PRA area? ***Note:*** **For pest plants, how likely is the pest plant to build up monospecific stands?**	unlikely	In Italy (Trieste), the plant was introduced in 1995-1996 and in 2003 covered almost 3000 m², forming monospecific stands.
1.24 How likely is establishment to be prevented by natural enemies already present in the PRA area?	unlikely	Several insects and fungal pathogens have been observed in USA, China and Japan. It is possible that European insects and fungus will feed on *P. montana* var. *lobata*, but it is highly improbable that they can prevent the establishment of the plant, since the plant has managed to rapidly spread once established in the Italy and Switzerland.
1.25 To what extent is the managed environment in the PRA area favourable for establishment?	Highly favourable	Road and rail networks and associated land and other artificial surfaces (wastelands) are highly favorable for the plant.

1.26 How likely are existing control or husbandry measures to prevent establishment of the pest?	unlikely	
1.27 How likely is it that the pest could be eradicated from the PRA area ?	possible	The plant hardly reproduces by seeds, but grows rapidly and produces new roots where nodes contact soil. Where the plant is present, infested areas are still restricted, eradication may be feasible.
1.28 How likely is the reproductive strategy of the pest and the duration of its life cycle to aid establishment?	likely	Fast growing (up to 30 cm per day, or 20 m per season)(http://en.wikipedia.org/wiki/Kudzu), vegetative reproduction and propagation (stems root at nodes, seed production is said to be poor in USA).
1.29 How likely are relatively small populations or populations of low genetic diversity to become established?	Very likely	Relatively little is known about the genetics of *P. montana* var. *lobata*. The species succeeded in establishing in the USA mostly by vegetative reproduction.
1.30 How adaptable is the pest? Adaptability is:	high	The species is present in a wide range of climates as it is native from both temperate and tropical zones. Three varieties exist, suggesting the plant is adaptable.
1.31 How often has the pest been introduced into new areas outside its original area of distribution? (specify the instances, if possible)	Very often	The plant is native from Eastern Asia, and has been voluntarily introduced for ornamental and agricultural purposes (and established) in North America, Central America, South America, Oceania, Africa and Europe.
1.32 Even if permanent establishment of the pest is unlikely, how likely are transient populations to occur in the PRA area through natural migration or entry through man's activities (including intentional release into the environment) ?	/	Permanent establishment is likely.
1.33 How likely is the pest to spread rapidly in the PRA area by natural means?	Moderatly likely	The plant does not reproduce efficiently by seeds, but can reproduce by vegetative fragmentation. There is an uncertainty on seeds viability and of seeds as a mean of spread.

1.34 How likely is the pest to spread rapidly in the PRA area by human assistance?	Very likely	In North America, the plant has been widely planted and is very invasive. Human activities are the major factor of spread.
1.35 How likely is it that the spread of the pest could be contained within the PRA area?	unlikely	Containment appears to be uncertain. It is difficult to contain vigorous climbers.
The overall probability of introduction and spread should be described. The probability of introduction and spread may be expressed by comparison with PRAs on other pests.	Very high	The species is already established in the PRA area (Switzerland and Italy) and is sold as an ornamental plant. The probability of spread is high, even more if assisted by humans.
1.36 Based on the answers to questions 1.16 to 1.35 identify the part of the PRA where presence of host plants or suitable habitats and ecological factors favour the establishment and spread of the pest to define the endangered area.		The endangered area is very difficult to delimit. It consists in areas from the Southern parts of the EPPO regions where there are high temperatures and high rainfalls. These locations occur in the valleys of mountains at low altitudes (Pyrenees, Alps, Mountains of Georgia) and in conditions not too cold (lakes).
2.0 For the following questions, will you be considering all hosts/habitats together or specific case(s)?	All hosts/habitats together	
2.1 How great a negative effect does the pest have on crop yield and/or quality to cultivated plants or on control costs within its current area of distribution?	moderate	According to Dr. Coleman Dangerfield (University of Georgia, forest economist). "Losses vary with the potential use of the land in an uninfested state. Where productive forest land has been overtaken, lost productivity is estimated at $48 per acre per year. The present net value of an average stand of pines grown on cutover land for 25 years in the southeast is approximately $650 per acre. *P. montana* var. *lobata* control costs exceed $200 per acre per year for five years." (Britton *et* al., 2002). As in the US, a spreading rate of 48,000 hectare per year is estimated, productivity will continue to decrease in proportion. Costs for chemical control amount to 80 US Dollars per hectare per year (Miller, 2002).
2.2 How great a negative effect is the pest likely to have on crop yield and/or quality in the PRA area?	moderate	Though *P. montana* var. *lobata* is not likely to be a problem on agricultural land, it would probably invade forest land after cutting as in North America, with indirect effects on wood production.

2.3 How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area?	moderate	Forest management could be impacted, as in the USA.
2.4 How great a reduction in consumer demand is the pest likely to cause in the PRA area?	/	Not relevant.
2.5 How important is environmental damage caused by the pest within its current area of distribution?	major	In Japan, the native range of the plant, it is present everywhere in man-made environments (pers. com. M. Smith) but there are no damage recorded. In its introduced range, the species is very invasive in USA where it has been widely planted, even colonizing natural areas in National Parks. Elsewhere it has been less planted and is less invasive but can strongly affect riverbanks and riparian ecosystems. The plant has a fast development and rapidly covers the soil, affecting indigenous plants and completely modifying the structure of the ecosystem (Clabassi *et al.*, 2003).
2.6 How important is the environmental damage likely to be in the PRA area (see note for question 2.5)?	major	There is obvious potential for damage because few plants can survive once smothered by *P. montana* var. *lobata* and small ecosystems could be radically altered as the plant forms monospecific stands. Riparian ecosystems are very vulnerable in Europe and are already susceptible to many invasive plants and other causes of destruction.
2.7 How important is social damage caused by the pest within its current area of distribution?	minor	Recreational facilities are overgrown, the weight of the *P. montana* var. *lobata* vines on power and phone lines could cause serious problems for these utilities (Durso, 2000).
2.8 How important is the social damage likely to be in the PRA area?	minor	Same social impacts could be observed in the PRA area.
2.9 How likely is the presence of the pest in the PRA area to cause losses in export markets?	minimal	Loss of export markets as an ornamental plant.
2.9A As noted in the introduction to section 2, the evaluation of the following questions may not be necessary if any of the responses to questions 2.2, 2.3, 2.4, 2.6 or 2.8 is "major or massive" or "likely or very likely". In view of these responses, is a detailed study of impacts required?	no	

2.15A Do you wish to consider the questions 2.1 to 2.15 again for further hosts/habitats?	No	
2.16 Referring back to the conclusion on endangered area (1.36), identify the parts of the PRA area where the pest can establish and which are economically most at risk.		See previous answer. Suitable habitats are pastures, mixed forests, conifer forests, broad-leaved forests, riverbanks / canalsides (dry river beds), road and rail networks and associated land, other artificial surfaces (wastelands)
2.16A Estimation of the probability of introduction of a pest and of its economic consequences involves many uncertainties. In particular, this estimation is an extrapolation from the situation where the pest occurs to the hypothetical situation in the PRA area. It is important to document the areas of uncertainty and the degree of uncertainty in the assessment, and to indicate where expert judgement has been used. This is necessary for transparency and may also be useful for identifying and prioritizing research needs. It should be noted that the assessment of the probability and consequences of environmental hazards of pests of uncultivated plants often involves greater uncertainty than for pests of cultivated plants. This is due to the lack of information, additional complexity associated with ecosystems, and variability associated with pests, hosts or habitats.		- Reproduction by seeds, viability of seeds and pollinators - Natural spread - Ability to establish in the EPPO region and the role of hot wet summers and cold winters. - Precise amount of trade for ornamental use. - The natural habitats potentially invaded (other than riparian habitats). - Uncertainty of fragments in the soil as a pathway

Evaluate the probability of entry and indicate the elements which make entry most likely or those that make it least likely. Identify the pathways in order of risk and compare their importance in practice.		The plant has already entered and is sold for ornamental purposes. The volume of entry is correlated with consumer demand, which is actually almost inexistent.
Evaluate the probability of establishment, and indicate the elements which make establishment most likely or those that make it least likely. Specify which part of the PRA area presents the greatest risk of establishment.		The plant is already naturalized in Italy. The probability of establishment in the rest of the Mediterranean EPPO region is high considering its climate and abiotic factors.
List the most important potential economic impacts, and estimate how likely they are to arise in the PRA area. Specify which part of the PRA area is economically most at risk.		*P. montana* var. *lobata* could significantly reduce biodiversity, especially in riparian habitats which are fragile ecosystems. Important impacts are: reduction of endangered species; significant reduction, displacement or elimination of other species; indirect effects on plant communities (species richness, biodiversity); ... (Clabassi *et al.* 2003) Cost of control in man-made sites is high.
The risk assessor should give an overall conclusion on the pest risk assessment and an opinion as to whether the pest or pathway assessed is an appropriate candidate for stage 3 of the PRA: the selection of risk management options, and an estimation of the pest risk associated.		**This plant represents a risk.**

Pathway 1		Trade of the plant for ornamental purposes
3.28. Are there effective measures that could be taken in the importing country (surveillance, eradication) to prevent establishment and/or economic or other impacts?	yes	Possible measures/requirements: • increase public awareness of the risk posed by this plant. • declaration that *P. montana* var. *lobata* is a quickly spreading alien invasive plant, • prohibition of import • prohibition of sale • prohibition of holding • prohibition of planting • restrictions on / conditions for planting • prohibition on movement • obligations to report findings • monitoring/surveillance • emergency plan o establishment of an action plan for local eradication when the plant is found Eradication and monitoring/surveillance should be organized where the plant is known to be present but not widespread (France, Belgium; Germany). • proposal of alternative species for planting see also EPPO standard PM 3/ XX Guidelines for intentional import of invasive alien plants or potentially invasive alien plants (in preparation)
3.29. Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?	yes	Monitoring, surveillance and eradication. Internal measure (see 3.28)
3.30. Taking each of the measures identified individually, does any measure on its own reduce the risk to an acceptable level?	yes	Prohibition of import and trade of the plant in the EPPO countries is the most efficient measure. However, where the plant is established, there is a need to manage it.
3.31. For those measures that do not reduce the risk to an acceptable level, can two or more measures be combined to reduce the risk to an acceptable level?	no	The plant could not be managed if constant new individual plants are re-introduced.

3.33. Estimate to what extent the measures (or combination of measures) being considered interfere with trade.		Precise information on the trade of this plant is lacking. However, it does not seem to be traded in huge quantities.
3.34. Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.		The marginal trade of this plant would not justify nor balance management costs.
3.35. Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with trade, are cost-effective and have no undesirable social or environmental consequences?	yes	Eradication and monitoring/surveillance in the countries where it is present but nor very widespread. Management, monitoring/surveillance, publicity, obligation of reporting findings in the countries where it is invasive and widespread.
3.36. Envisage prohibiting the pathway	yes	Prohibition of import, trade and movement of the plant. Trade within the EPPO countries should also be prohibited.
3.37. Have all major pathways been analyzed (for a pest-initiated analysis)?	yes	
3.40. Indicate the relative importance of pathways		Trade of the plant for ornamental purposes: very high
3.41. All the measures identified as being appropriate for each pathway or for the commodity can be considered for inclusion in phytosanitary regulations in order to offer a choice of different measures to trading partners.		
3.42. In addition to the measure(s) selected to be applied by the exporting country, a phytosanitary certificate (PC) may be required for certain commodities. The PC is an attestation by the exporting country that the requirements of the importing country have been fulfilled. In certain circumstances, an additional declaration on the PC may be needed (see EPPO Standard PM 1/1(2): Use of phytosanitary certificates)		
Conclusion of Pest Risk Management. **Summarize the conclusions of the Pest Risk Management stage. List all potential management options and indicate their effectiveness. Uncertainties should be identified.**		Intentional introduction as an ornamental plant Prohibited (see also recommendations for internal measures)

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Annexe 1

Potential Geographical Distribution of *P. montana* var. *lobata*

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 *P. montana* var. *lobata* in the EPPO region if no measure is taken to limit its spread.
The CLIMEX "match climate" function: knowing where the species is present, CLIMEX compare a location where the species is known to be present and extrapolate it to the area of study. This method was used in the present document.

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 *P. montana* var. *lobata* 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 *P. montana* var. *lobata*

Figure 1: Euro-Med map of the CLIMEX Match Index based on Croglio, Switzerland (45.9ºN, 8.8ºW
Figure 2: Euro-Med map of the CLIMEX Match Index based on Trieste, Italy (45.6ºN, 13.8ºW)

Conclusion

The endangered area is very difficult to delimit. It consists in areas from the Southern parts of the EPPO regions where there are high temperatures and high rainfalls. These locations occur in the valleys of mountains at low altitudes (Pyrenees, Alps, Mountains of Georgia) and in conditions not too cold (lakes).

References

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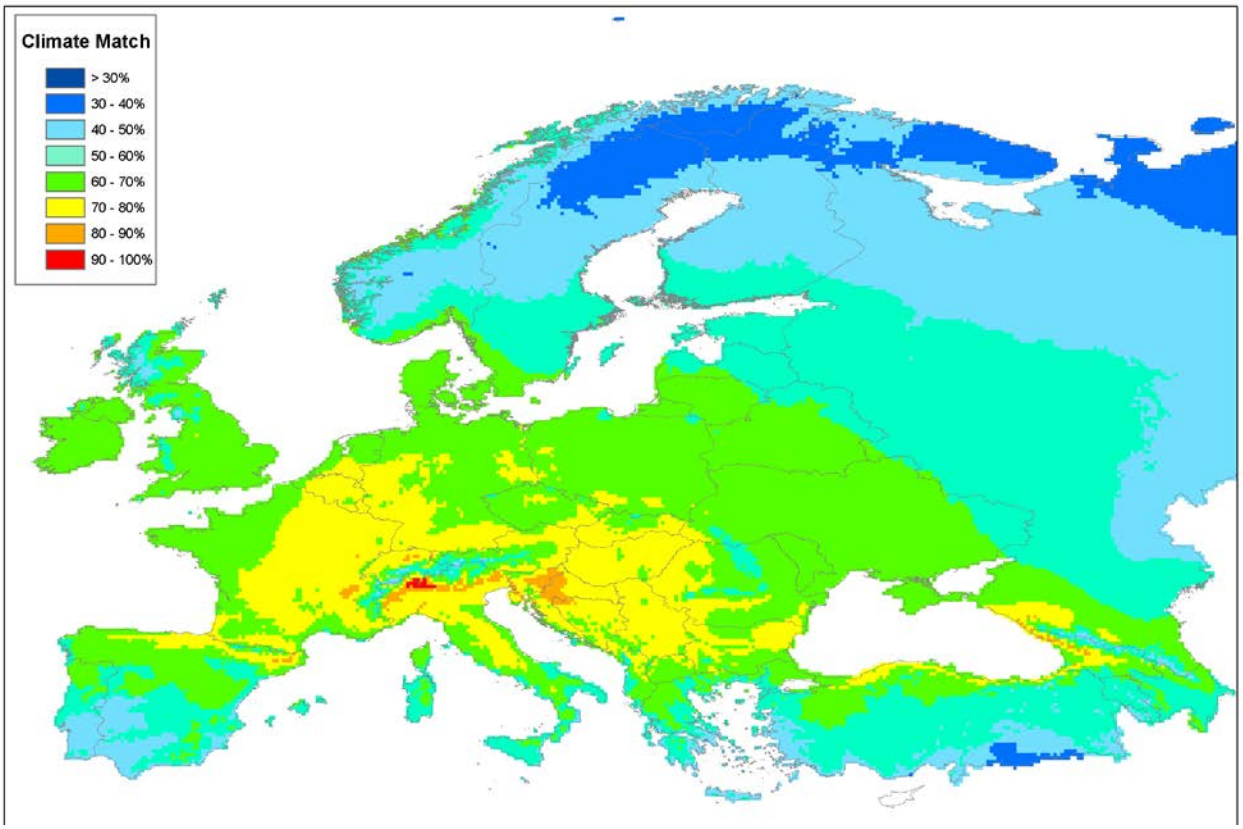
Prepared by Richard Baker, Central Science Laboratory, York UK, 31.5.2006

CLIMEX MATCH INDEX, Based on Croglio, Switzerland (45.9ºN, 8.8ºW)



CLIMEX MATCH INDEX, Based on Trieste, Italy (45.6ºN, 13.8ºW)