	European and Mediterranean Plant Protection Organization		
	Organisation Européenne et Méditerranéenne pour la Protection des Plantes		
	Guidelines on Pest Risk Analysis		
	Lignes directrices pour l'analyse du risque phytosanitaire		
	Decision-support scheme for quarantine pests Version N°3		
PEST RISK ANALYSIS FOR Aulacaspis yasumatsui			
Pest risk analyst:	EPPO Expert Working Group for PRA		EXPERT WORKING GROUP FOR PRA **Ms Bozkurt Vildan** (Ms, Central Plant Protection Research Institute,TR), **Mr Germain Jean-François** (LNPV Entomology Unit, FR) **Mr MacLeod Alan** (Central Science Laboratory GB), **Mr Malumphy Chris** (Central Science Laboratory, GB) **Mr Marler Thomas** (University of Guam, US).
	Date of the meeting	2007-11-20/22	
Stage 1: Initiation			
1 What is the reason for performing the PRA?			The pest is known as a very damaging pest of Cycads and has been intercepted in Croatia, France, Netherlands and United Kingdom. It has also been intercepted in other parts of the world (New Zealand, Florida, California)
2 Enter the name of the pest			*Aulacaspis yasumatsui* Takagi
2A Indicate the type of the pest			Scale insect

2B Indicate the taxonomic position		Arthropoda, Insecta, Hemiptera, Sternorrhyncha, Diaspididae, Diaspidinae, *Aulacaspis yasumatsui* Takagi, 1977
3 Clearly define the PRA area		EPPO member countries
4 Does a relevant earlier PRA exist?	YES	A PRA was prepared by the French National Laboratory Entomology Unit in 2002. Information provided during the meeting by the Dutch NPPO indicates that this pest was considered as a low profile pest.
5 Is the earlier PRA still entirely valid, or only partly valid (out of date, applied in different circumstances, for a similar but distinct pest, for another area with similar conditions)?	YES	Partly valid. It was a short PRA with the EU as PRA area.
Stage 2A: Pest Risk Assessment - Pest categorization		
6 Specify the host plant species (for pests directly affecting plants) or suitable habitats (for non parasitic plants) present in the PRA area.		*Aulacaspis yasumatsui* feeds exclusively on members of four primitive plant families Boweniaceae (*Bowenia* sp), Cycadaceae (*Cycas* spp.), Stangeriaceae (*Stangeria* spp.) and Zamaiceae (*Dioon*, *Encephalartos*, *Microcycas*). Collectively all plants in these families are known as cycads.
7. Specify the pest distribution		The origin of the Cycad Aulacaspis scale is from Southeast Asia. It has been introduced to Florida in 1996 and spread later in the Caribbean and in Oceania (Hawai and Guam). **Asia:** *A. yasumatsui* was originally observed in Thailand but it is probably widely distributed in South East Asia. Specific records are available from Thailand (Tagaki, 1977), Vietnam (Jansen 1995), China including Hong-Kong (Howard & Wessling, 1999), Taiwan (Sih, 2003), Singapore (Hodgson & Martin, 2001) and the Philippines, Andaman Island **Africa:** intercepted in France on branches of *Cycads* sp from Ivory-Coast (Germain & Hodges, 2007) **North America:** USA (Alabama (Muniappan, 2005), Florida (Howard *et al.* 1999),

		Georgia (Muniappan, 2005), Guam (Haynes and Marler, 2005) and Mariana Islands (Marler pers com), Hawaii (Heu *et al.*, 2003), Louisiana (Muniappan, 2005), Puerto Rico (Halbert, 2000) and Vieques Islands (Muniappan, 2005), South Carolina (Muniappan, 2005), Texas (Muniappan, 2005) and the Virgin Islands (Muniappan, 2005)) **Central America and Caribbean**: Bahamas, Barbados (Gibbs, 2003), American Virgin Islands and Cayman Islands (Howard & Weissling, 1999), Guadeloupe (Matile-Ferrero & Etienne, 2006), Martinique (Matile-Ferrero & Etienne, 2006) Puerto Rico (Halbert, 2000) and Saint Kitts and Nevis (Anon, 2006). **Oceania:** Guam (Haynes and Marler, 2005) and Mariana Islands (Marler com pers), Hawaii (Heu *et al.*, 2003) intercepted in New Zealand (Paice *et al.* 2004).
8. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	YES	*A. yasumatsui* is a single taxonomic entity. However it is morphologically close to other *Aulacaspis* species, the most significant being the pest *Aulacaspis rosae* which has been found on Cycads and is widely distributed in EPPO countries. In the field it is similar to several species developing on cycads such as *Pseudaulacaspis cockerelli, Furchadaspis zamiae* or *Poliaspis cycadis.* Microscopic examination of slide-mounted adult females is required for authoritative identification.
9. Even if the causal agent of particular symptoms has not yet been fully identified, has it been shown to produce consistent symptoms and to be transmissible?		
10. Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?	YES	*A. yasumatsui* is a very damaging pest of Cycads in Florida, the West Indies, Taiwan and Guam and is able to kill plants (Howard et al 1999). The first record of *A. yasumatsui* causing damage was in Java in the Bogor botanic garden at the end of the 1980s.
11. Does the organism have intrinsic attributes that indicate that it could cause significant harm to plants?		
12 Does the pest occur in the PRA area?	NO	The pest has not been detected in official inspections conducted in botanical gardens in the UK (Malumphy pers.com. 2007), it has never been detected in samples of scales collected on outdoor Cycads in the Southern part of France or Italy (Germain and

		Pellizzari, pers com 2007). The pest has been detected in glasshouse nurseries in France, the Netherlands and the United Kingdom. In both France and United Kingdom, chemical treatment of infested plants was recommended. In France, the plants were then sold whilst the plant in United Kingdom were held for a period of observation. *A. yasumatsui* has not been observed since then at these nurseries. In the Netherlands no specific treatment was required by the NPPO and no specific action taken.
13. Is the pest widely distributed in the PRA area?	NO	
14. Does at least one host-plant species (for pests directly affecting plants) or one suitable habitat (for non parasitic plants) occur in the PRA area (outdoors, in protected cultivation or both)?	YES	Cycads are present in the PRA area. Cycads are recorded outdoors in the Mediterranean part of the EPPO region and along the Southern Atlantic Coast (south part) and indoor in other parts of the region. It should be noted that all cycads in the EPPO region are imported from countries outside the EPPO region and not produced in the EPPO region. Small plants (mainly *Cycas revoluta*) are imported as finished plants and are sold shortly after arrival. Larger plants are imported as stems (without leaves) and are then kept in nurseries for longer periods, until they flush (leaves emerge), either in protected conditions in the northern part of the region or outdoors in the southern part.
15. If a vector is the only means by which the pest can spread, is a vector present in the PRA area? (if a vector is not needed or is not the only means by which the pest can spread go to 16)	NA	
16. Does the known area of current distribution of the pest include ecoclimatic conditions comparable with those of the PRA area or sufficiently similar for the pest to survive and thrive (consider also	YES	*A. yasumatsui* mainly occurs in the humid tropics. While this climate type does not occur as such in the EPPO region, the Azores, Canary Islands and Madeira with subtropical and fairly humid conditions, could be regarded as the most similar to that native to this organism.

protected conditions)?		In addition, this pest has been detected several times in Europe in glasshouse nurseries on plants that had been imported several months before and on which it had been able to survive and reproduce. The EWG assumed that such glasshouses were warm and less humid than in the pest native range.
17. With specific reference to the plant(s) or habitats which occur(s) in the PRA area, and the damage or loss caused by the pest in its area of current distribution, could the pest by itself, or acting as a vector, cause significant damage or loss to plants or other negative economic impacts (on the environment, on society, on export markets) through the effect on plant health in the PRA area?	YES	The pest can reduce the quality of the plant so the potential for economic impact to the horticulture Cycad trade that could result from the introduction of the pest under protected conditions needs to be assessed
18. This pest could present a risk to the PRA area.	YES	The group took a precautionary approach and considered that the pest should be further evaluated but the risk was perceived to be mainly under protected conditions. There is some uncertainty if the pest could pose a risk to the Azores, Madeira and the Canary islands.
19. The pest does not qualify as a quarantine pest for the PRA area and the assessment for this pest can stop.		

Section 2B: Pest Risk Assessment - Probability of introduction/spread and of potential economic consequences

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.1. Consider all relevant pathways and list them		Plants for planting of Cycads Cut foliage was not considered as a pathway as the transfer to Cycad plants was considered unlikely
1.2. Estimate the number of relevant pathways, of different commodities, from different origins, to different end uses.	**Few** **Low uncertainty**	Known trade in Cycads exists from China, Guatemala, Vietnam, Florida, Taiwan, Costa-Rica, Thailand. The plants are imported for a single end-use from few countries of origin
1.3. Select from the relevant pathways, using expert judgement, those which appear most important. If these pathways involve different origins and end uses, it is sufficient to consider only the realistic worst-case pathways. The following group of questions on pathways is then considered for each relevant pathway in turn, as appropriate, starting with the most important.		
Pathway n°: 1		Plants for planting of Cycads
1.4. How likely is the pest to be associated with the pathway at origin taking into account factors such as the occurrence of suitable life stages of the pest, the period of the year?	**Likely** **Low uncertainty**	The pest can be associated with plants for planting of Cycads as it has been intercepted from different origins. In Thailand, where the pest is present it is often found on the Cycad plants (Marler pers. Com., 2007).
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation	**Unlikely**	The concentration of the pest on the plants for planting in nurseries is usually low. In addition in the area of origin of the pest natural enemies maintain the population at a low level. In Florida the concentration of the pest is high (Howard *et al.*, 1999) but it

<table>
<tr><th>Question</th><th>Rating + uncertainty</th><th>Explanatory text of rating and uncertainty</th></tr>
<tr><td>practices, treatment of consignments?</td><td>Medium uncertainty</td><td>is likely that infested plants will not be exported.

Lack of specific data</td></tr>
<tr><td>1.6. How large is the volume of the movement along the pathway?</td><td>Minor

Medium uncertainty</td><td>There is no specific data on Cycad trade volume into the EPPO region from infested countries. EUROSTAT displays data for live indoor plants without distinguishing genera. The data in the table below shows increasing trade from Asia.

Trade in live indoor plants for 15 EU Countries (100 kg).

<table>
<tr><th></th><th>2000</th><th>2001</th><th>2002</th><th>2003</th><th>2004</th><th>2005</th><th>2006</th></tr>
<tr><td>China</td><td>48,174</td><td>57,732</td><td>81,133</td><td>90,071</td><td>111,812</td><td>132,113</td><td>150,833</td></tr>
<tr><td>USA</td><td>12,004</td><td>14,196</td><td>13,507</td><td>10,647</td><td>11,309</td><td>12,832</td><td>10,019</td></tr>
<tr><td>Thailand</td><td>2,285</td><td>2,263</td><td>4,378</td><td>6,055</td><td>4,409</td><td>5,129</td><td>6,826</td></tr>
<tr><td>Singapore</td><td>4,693</td><td>2,941</td><td>2,486</td><td>1,731</td><td>1,869</td><td>2,361</td><td>1,791</td></tr>
<tr><td>Vietnam</td><td>4</td><td>1,880</td><td>899</td><td>1,719</td><td>1,367</td><td>1,232</td><td>1,005</td></tr>
<tr><td>Ivory Coast</td><td>984</td><td>717</td><td>608</td><td>586</td><td>139</td><td>58</td><td>233</td></tr>
<tr><td>Guam</td><td></td><td></td><td></td><td></td><td></td><td><1</td><td></td></tr>
</table>

A review of significant trade in Cycads shows a growing trend in the last 20 years (CITES, 2003)
Compared with other plants for planting, the volume of movement on this pathway was considered to be minor.</td></tr>
<tr><td>1.7. How frequent is the movement along the pathway?</td><td>Often

Low uncertainty</td><td>It happens all year round. This is supported by the fact that the Dutch interception records from 2004 to 2007 are spread over the year (Loomans pers comm. 2007).</td></tr>
</table>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.8. How likely is the pest to survive during transport /storage?	**Very likely** **Low uncertainty**	The pest can shelter in the bark and on the roots. Specimens found in Europe during import inspection were alive.
1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?	**Likely** **Medium uncertainty**	The transportation time to Europe is approximately 4 to 5 weeks for consignments coming from Asia. There is not always temperature control in containers. If the temperature reaches 25°C in the container this could allow the pest to multiply. This is more likely to happen in the summer period. There is no record of temperature conditions during transportation of plants.
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	**Very likely** **Low uncertainty**	If plants are imported with leaves the scale may be detected on the leaves but Cycads are often imported without leaves. The pest is difficult to detect because it is hidden in the crown, in the bark and also on the roots.
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	**Very widely** **Low uncertainty**	Cycads are becoming common ornamental plants in Europe.
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	**Yes**	Plants arrive all year round. They will be imported in nurseries or sold for indoor use. Consequently the time of the year has no importance for establishment.
1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	**Very likely** **Low uncertainty**	In this case the pest is already on a suitable host. Plants imported without foliage are likely to be kept in protected conditions until they flush. Infested plants for planting may be grouped close to other suitable hosts to which *A. yasumatsui* could transfer.
1.14. In the case of a commodity pathway, how likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) to aid transfer to a suitable host or habitat?	**Very likely** **Low uncertainty**	The intended use is planting. This aids transfer (see answer to Q1.13)

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.15. Do other pathways need to be considered?	**NO**	No other pathway has been identified.
Conclusion on the probability of entry. Risks presented by different pathways.		Low probability of entry (it has not been detected frequently despite the fact that the plants for planting are inspected, few reports of outbreaks). Nevertheless the risk is likely to increase as long as the trade continues to expand.
1.16. Estimate the number of host plant species or suitable habitats in the PRA area (see question 6).	**Moderate number** **Low uncertainty**	Cycadaceae about 90 species; Stangeriaceae 1 species; Boweniaceae 2 species, Zamiaceae about 180 species. The most frequent Cycads in the EPPO region are: *Cycas media*, *Cycas pectinata*, *Cycas revoluta*, *Cycas rumphii*, *Cycas siamensis*, *Cycas thouarsii*, *Dioon edule* and *Encephalartos ferox*. The EWG had no information on the rare species present in collections in botanical gardens. Species labelled as *Cycas circinalis* are often other Cycas species which have been misidentified most commonly *Cycas rumphii*. *Cycas revoluta* is a popular pot plant and is also an important amenity plant (e.g. in Turkey)
1.17. How widely distributed are the host plants or suitable habitats in the PRA area? (specify)		As pot plants Cycads can be widely distributed indoors in the EPPO region. Cycads are also present outdoors in the southern part of the EPPO region (Mediterranean coast)
1.18. If an alternate host or another species is needed to complete the life cycle or for a critical stage of the life cycle such as transmission (e.g. vectors), growth (e.g. root symbionts), reproduction (e.g. pollinators) or spread (e.g. seed dispersers), how likely is the pest to come in contact with such species?		
1.19. How similar are the climatic conditions that would affect pest establishment, in the PRA area and in the	**Outdoors:** **Not similar** **Low uncertainty**	Conditions are not similar outdoors (see the prediction map of establishment with MAXENT appendix 1).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
current area of distribution?	**Protected conditions Moderately similar Medium uncertainty** **high uncertainty with regard to Canary Islands, Azores and Madeira**	Conditions are only similar in wet tropical glasshouses but there are very few such glasshouses apart from botanical gardens or recreational parks. Nevertheless populations have been detected in heated glasshouses in the United Kingdom, a few months after plants were imported which suggests that they have been capable of reproducing under such conditions. In addition infested plants were detected in 2006 in a French nursery on plants coming from the Netherlands. These plants were declared to have been imported from Costa Rica in 2004. This also supports the fact that the pest can establish in heated glasshouses. There is uncertainty regarding the similarity of climatic conditions: The fact that the pest has been found in protected conditions with hot but not very humid conditions was discussed by the EWG. It was mentioned that some areas of the EPPO region such as the Canary islands have very specific climatic conditions where establishment outdoors could be possible, although the climatic prediction study does not show these as suitable for establishment. There is experience with tropical and subtropical pest which have established in the southern part of the region but such an assumption would have a high uncertainty.
1.20. How similar are other abiotic factors that would affect pest establishment, in the PRA area and in the current area of distribution?	**N/A**	No known abiotic factor.
1.21. If protected cultivation is important in the PRA area, how often has the pest been recorded on crops in protected cultivation elsewhere?	**Never** **Low uncertainty**	There is no evidence that the pest has been found under protected cultivation elsewhere than in Europe.
1.22. How likely is it that establishment will occur despite competition from existing species in the PRA area?	**Likely** **Low uncertainty**	Several species feed on Cycads in the EPPO region both indoors and outdoors but they are very rare.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.23. How likely is it that establishment will occur despite natural enemies already present in the PRA area?	**Very likely** **Low uncertainty**	*Rhyzobius lophanthae* a potential natural enemy is present in the Mediterranean part of the region (FAUNA EUROPEA 2004). It is an efficient natural enemy in Guam and Hawaii (Heu *et al.* 2003). It is difficult to extrapolate these data as these natural enemies are less likely to be found under protected conditions. The EWG concluded that it is not likely to prevent establishment
1.24. To what extent is the managed environment in the PRA area favourable for establishment?	**Moderately favourable** **Low uncertainty**	Protected conditions are favourable in particular when glasshouses provide a hot and humid atmosphere but this is not the case for the majority of glasshouses.
1.25 How likely is it that existing pest management practice will fail to prevent establishment of the pest?	**Very likely** **Medium uncertainty**	In the EU, there is a reduction in the active substance available to control for scales. Especially in the botanical gardens which are open to the public.
1.26. Based on its biological characteristics, how likely is it that the pest could survive eradication programmes in the PRA area?	**Outdoors:** **Very likely** **Low uncertainty** **Protected conditions:** **Moderately likely** **Low uncertainty**	*A yasumatsui* is difficult to detect (small size pest mostly hidden in the plants). Eradication is best achieved by destroying the plants. Where it has been introduced there is no report of successful eradication outdoors. By the time the scale is found it is often too impractical to carry out an eradication programme. In United Kingdom, one outbreak was detected under protected conditions. Treatments of infested plants were required and subsequent monitoring of the nursery was conducted. The pest has not been found again since (Malumphy pers com 2007). Nevertheless aldicarbe which was used for eradication is no longer authorised. There is no information on the treatment which was recommended in France.
1.27. How likely is the reproductive strategy of the pest and the duration of its life cycle to aid establishment?	**Very likely** **Low uncertainty**	The scale breeds continuously and has a very short life cycle.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.28 How likely are relatively small populations to become established?	**Very likely** **Low uncertainty**	One fecund female is enough to begin a population (100 eggs per female on average).
1.29. How adaptable is the pest?	**Low adaptability** **Low uncertainty**	It is specialized on Cycads and has a narrow range. It has not spread to temperate areas outdoors so it does not appear to have a wide temperature adaptability.
1.30. How often has the pest been introduced into new areas outside its original area of distribution? (specify the instances, if possible)	**Occasionally** **Medium uncertainty**	It has been introduced in several states in the USA and also countries in Central America and the Caribbean (see question 7)
1.31. If establishment of the pest is very 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) ?		Establishment is likely in protected conditions and has already occurred.
Conclusion on the probability of establishment		Conditions outdoors are not favourable for establishment in the EPPO region (uncertainty for Azores, Madeira and Canary Islands). There is a possibility for the pest to establish under protected cultivation and scale insects are usually difficult to control. Low probability of establishment outdoors Medium probability of establishment in protected conditions.
1.32. How likely is the pest to spread rapidly in the PRA area by natural means?	**Unlikely** **Low uncertainty**	The first instar larvae can be spread by wind but the chances of landing on a Cycad are very low. First instars can only crawl for one meter. Male cycad sacle emerge form their scale shortly before death and fly to search of female for mating and die.
1.33. How likely is the pest to spread rapidly in the PRA area by human assistance?	**Likely** **Medium uncertainty**	Movement with trade is thought to be the main means of long distance spread (plants are assumed to be moved around a lot). Locally the pest can be spread by workers (on equipment or clothes).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.34. Based on biological characteristics, how likely is it that the pest will <u>not be</u> contained within the PRA area?	**Unlikely** **Low uncertainty**	In protected conditions if the pest is detected early it can be contained by preventing movement of host plants during the period when measures are implemented.
Conclusion on the probability of spread		The pest has a medium probability of spread.
Conclusion on the probability of introduction and spread **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.**		The probability of entry is low (it has not been detected frequently despite the fact that the plants for planting are inspected, few reports of outbreaks). Nevertheless the risk is likely to increase as long as the trade continues to expand. Conditions outdoors are not favourable for establishment in the EPPO region. There is a possibility for the pest to establish under protected cultivation and scale insects are usually difficult to control. Low probability of establishment outdoors Medium probability of establishment in protected conditions. The probability of establishment is low to medium. The pest has a medium probability of spread. It has an overall probability of establishment or spread low to medium

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
Conclusion regarding endangered areas **1.35. Based on the answers to questions 1.16 to 1.34 identify the part of the PRA area where presence of host plants or suitable habitats and ecological factors favour the establishment and spread of the pest to define the endangered area.**		Cycads in protected conditions. Question mark for the Canary Islands, Azores and Madeira which are more sub-tropical. To a lesser extent the pest may also establish in the Mediterranean part of the EPPO region.
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?	**Major in areas where it has been introduced** **Low uncertainty**	In the area of origin of the pest, it is not a major problem due to the presence of natural enemies. In areas where it has been introduced (Florida, the West Indies, Taiwan and Guam), it can kill Cycads (Howard et al 1999). In Guam in certain areas 90% of Cycads in the forest are killed. In urban environments without treatment mortality can be as high as 100%. In Taiwan on *C. taitungensis* such mortality is not observed in the wild although the infestion is more recent than in Guam (90% of plants infested in one reserve but only 3% mortally), nevertheless losses were noted in nurseries on seedlings and adults of various ages (Chao pers. com. to Haynes, 2005). In Florida, the Cycad scale has caused significant economic losses to the Cycad industry, and threatens the large concentration of nurseries in Southern Florida which grow and ship Cycads throughout the USA and overseas (Global Invasive Species Database).
2.2. How great a negative effect is the pest likely to have on crop yield and/or quality in the PRA area without any control measures?	**Minor** **Low uncertainty**	Given that the climatic conditions are not likely to be as suitable as in the native and introduced range, the effect is considered to be minor. In the few findings in the region they were only few plants detected. The first interception dates back to 1995 and the pest is regularly intercepted in the Netherlands, no specific action has been taken and no impact has been recorded (Lomans pers. com.). The situation in France is the same. (Vidal & Germain pers. com. 2007).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.3. How easily can the pest be controlled in the PRA area without phytosanitary measures?	**Easily** **Low uncertainty**	High value Cycads are usually not sold if they are of poor quality. The industry will take action if required as would apply to botanical garden. Small plants that are intended to be sold to end consumers present a very low risk to the industry.
2.4. How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area?	**Minimal** **Low uncertainty**	Control costs will only be incurred in cases where treatment is required.
2.5. How great a reduction in consumer demand is the pest likely to cause in the PRA area?	**Minimal** **Low uncertainty**	Only a small proportion of Cycads are likely to be infested enough to result in reduction in consumer demand. Heavily infested plants will not be sold.
2.6. How important is environmental damage caused by the pest within its current area of distribution?	**Major** **Low uncertainty**	Outside of the native area within the tropical range, endemic species are endangered (Marler *et al*, 2006).
2.7. How important is the environmental damage likely to be in the PRA area (see note for question 2.6)?	**Minimal** **Low uncertainty**	There is no Cycad native species in the EPPO region (see map in appendix)

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.8. How important is social damage caused by the pest within its current area of distribution?	**Minimal** **Low uncertainty**	No specific social damage recorded
2.9. How important is the social damage likely to be in the PRA area?	**Minimal** **Low uncertainty**	
2.10. How likely is the presence of the pest in the PRA area to cause losses in export markets?	**Minimal** **Low uncertainty**	The EPPO countries are not Cycad producers. Cycads are imported and re-exported from the major importing countries in the EPPO region (Germany, Netherlands) http://www.iucn.org/themes/ssc/news/cycadsap.htm.
2.11. How likely is it that natural enemies, already present in the PRA area, will not reduce populations of the pest below the economic threshold?	**Very likely** **Medium uncertainty**	There is at least one natural enemy (*Rhyzobius lophanthae*) present in the Mediterranean part of the EPPO region. It is an efficient natural enemy in Guam and Hawaii (Heu *et al.* 2003). It is difficult to extrapolate these data as these natural enemies are less likely to be found under protected conditions.
2.12. How likely are control measures to disrupt existing biological or integrated systems for control of other pests or to have negative effects on the environment?	**Unlikely** **Low uncertainty**	No existing biological or integrated systems are known for Cycads.
2.13. How important would other costs resulting from introduction be?	**Minimal** **Low uncertainty**	This is not an important production for which research cost would be incurred. It could be important that information is made available to Cycad specialist growers or botanical gardens.
2.14. How likely is it that genetic traits can be carried to other species, modifying their genetic nature and making them more serious plant pests?	**Impossible**	

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.15. How likely is the pest to cause a significant increase in the economic impact of other pests by acting as a vector or host for these pests?	**Impossible**	
2.16. Referring back to the conclusion on endangered area (1.35), identify the parts of the PRA area where the pest can establish and which are economically most at risk.		None of the EPPO region is considered to be economically at risk. However, there is still a question mark for the Canary Islands, Azores and Madeira if the pest could become established outdoors
Degree of uncertainty		There are some question marks on whether the pest has reached the northern and southern limit of its potential distribution because of its recent spread to Florida, the Carribean and Oceania since less than 10 years. This could have consequences on the determination of the area for potential establishment in particular for areas such as the Canary Islands, Azores and Madeira.
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 probability of entry is low as only one pathway has been identified: plants for planting of Cycads. Nevertheless, the difficulty in detecting the pest by visual inspection increases the likelihood of entry.
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.		Conditions outdoors are not favourable for establishment in the EPPO region. There is a possibility for the pest to establish under protected cultivation and scale insects are usually difficult to control. Low probability of establishment outdoors Medium probability of establishment in protected conditions.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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.		Individual plants being killed. Unlikely to kill a plant under European conditions. Instances where the pest was found no damage was recorded although it was detected several times and no specific action was taken.
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 associated pest risk.		The EWG considered that the pest was not an appropriate candidate for stage 3. Recommendation could be made to NPPOs to inform the Cycad industry and botanical gardens about the potential risk for tropical glasshouses.

This is the end of the Pest risk assessment	

Stage 3: Pest risk Management

Question	Y/N	Explanatory text
3.1. Is the risk identified in the Pest Risk Assessment stage for all pest/pathway combinations an acceptable risk?	**Yes**	**See above**

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Potential distribution of *Aulacaspis yasumatsui* (Hemiptera : Diaspididae) as predicted with MAXENT 2.3

P. Reynaud (LNPV, FR) – 31/10/07

MAXENT 2.3 has been used to determine the most likely distribution for *Aulacaspis yasumatsui*. MAXENT estimates species'distribution by finding the distribution of maximum entropy (i.e. closest to uniform) subject to the constraint that the expected value of each environmental variable (or its transform and/or interaction) under this estimated distribution matches its empirical average.

MAXENT uses the known geographic distribution to predict the most probable potential distribution. 33 records of presence have been used :

Country	Place	Latitude	Longitude
Thailand	Bangkok	13° 43' 52" N	100° 31' 16" E
Singapore	Singapore	01° 18' 01" N	103° 49' 31" E
China	Hong-Kong	22° 16' 43" N	114° 10' 28" E
Taiwan	Taipei	25° 21' 10" N	121° 29' 57" E
Taiwan	Taitung	22° 45' 38" N	121° 08' 53" E
Taiwan	Taichung	24° 08' 49" N	120° 40' 13" E
Hawaii	Honolulu	21° 18' 26" N	157° 51' 31" O
Guam	Guam	13° 28' 03" N	144° 44' 47" E
USA	Tallahassee	30° 26' 18" N	84° 16' 52" O
USA	Quincy	30° 35' 13" N	84° 16' 52" O
USA	St- Augustine	29° 53' 40" N	81° 18' 53" O
USA	Jacksonville	30° 19' 55" N	81° 39' 23" O
USA	Ft. Pierce	27° 26' 50" N	80° 19' 33" O
USA	Naples	26° 08' 30" N	81° 47' 43" O
USA	Tampa	27° 56' 56" N	82° 27' 33" O
USA	Brooksville	28° 33' 18" N	82° 23' 17" O
USA	Saint Petersburg	27° 46' 14" N	82° 40' 46" O
USA	Orlando	28° 32' 17" N	81° 22' 46" O
USA	Winter Haven	28° 01' 19" N	81° 43' 59" O
USA	Gainesville	29° 39' 06" N	82° 19' 30" O
USA	Lake City	30° 11' 22" N	82° 38' 22" O
USA	Miami	25° 46' 32" N	80° 11' 39" O
USA	Ft Lauderdale	26° 07' 19" N	80° 08' 38" O
USA	The Keys	24° 33' 15" N	81° 47' 31" O
USA	Mobile	30° 41' 39" N	88° 02' 35" O
USA	Brownsville	25° 54' 06" N	97° 29' 50" O
Porto-Rico	Vieques Island	18° 07' 37" N	65° 25' 26" O
Martinique	Rivière-Salée	14° 31' 45" N	60° 58' 49" O
Guadeloupe	Pointe-à-Pitre	16° 14' 14" N	61° 31' 49" O
Guadeloupe	Capesterre	16° 02' 49" N	61° 33' 57" O
Guadeloupe	Sainte-Anne	16° 14' 08" N	61° 23' 08" O
Guadeloupe	Saint-François	16° 15' 02" N	61° 16' 20" O
Guadeloupe	Sainte-Rose	16° 19' 49" N	61° 41' 53" O

4/ Results

The modelling approach that is use here aims to define the environmental conditions within which a species can persist by associating known distributional information with suites of environmental

variables. Geographical regions presenting similar environments to where the species has been observed can thus be identified. This model should be interpreted as identifying regions that have similar environmental conditions to where the species is known to occur, and not as predicting actual limits to the range of a species. Maxent assigns a probability of occurrence to each cell in the study area. by default the software presents the probability distribution in a form that is easy to use and interpret, namely a "cumulative" representation. The probability is multiplied by 100 to give a percentage. So, each cell value lies between 0 and 100.

First approach (Figure 1, 2 and 3) : for each cell of the grid, a predicted value is calculated without definition of a threshold. The image uses colors to show prediction strength, with red indicating strong prediction of suitable conditions for the species, yellow indicating weak prediction of suitable conditions, and green indicating very unsuitable conditions.

Second approach (Figure 4 and 5) : we chose the lowest predicted value associated with any one of the observed presence records. We term this the "lowest presence threshold". This approach can be interpreted ecologically as identifying pixels predicted as being at least as suitable as those where a species' presence has been recorded. The image use only two colors: red to indicate the predicted suitable areas and green for non suitable areas.

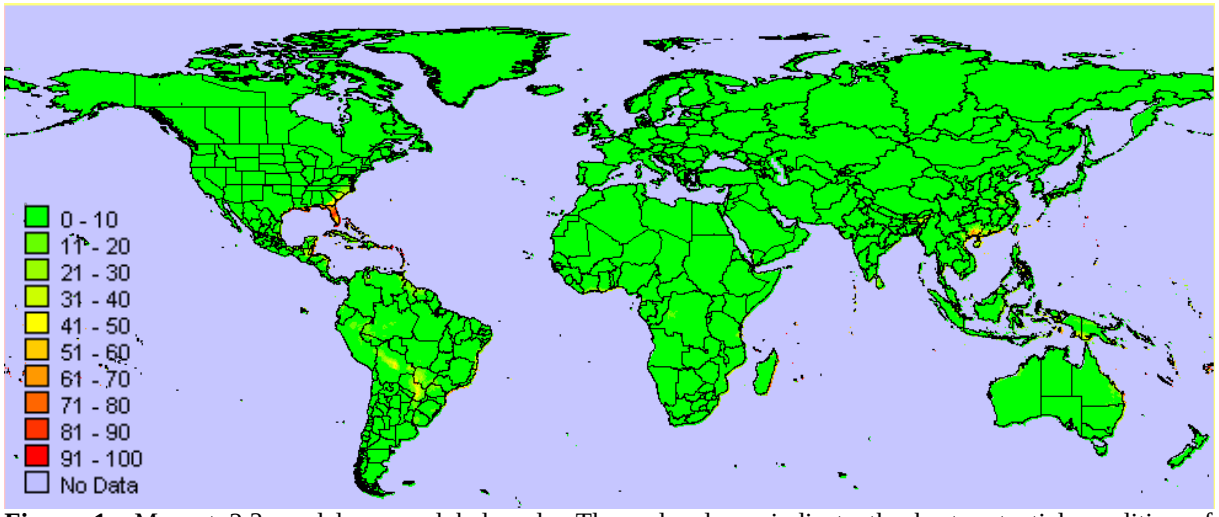

Figure 1 : Maxent 2.3 model on a global scale. The red colours indicate the best potential conditions for *Aulacaspsi yasumatsui*

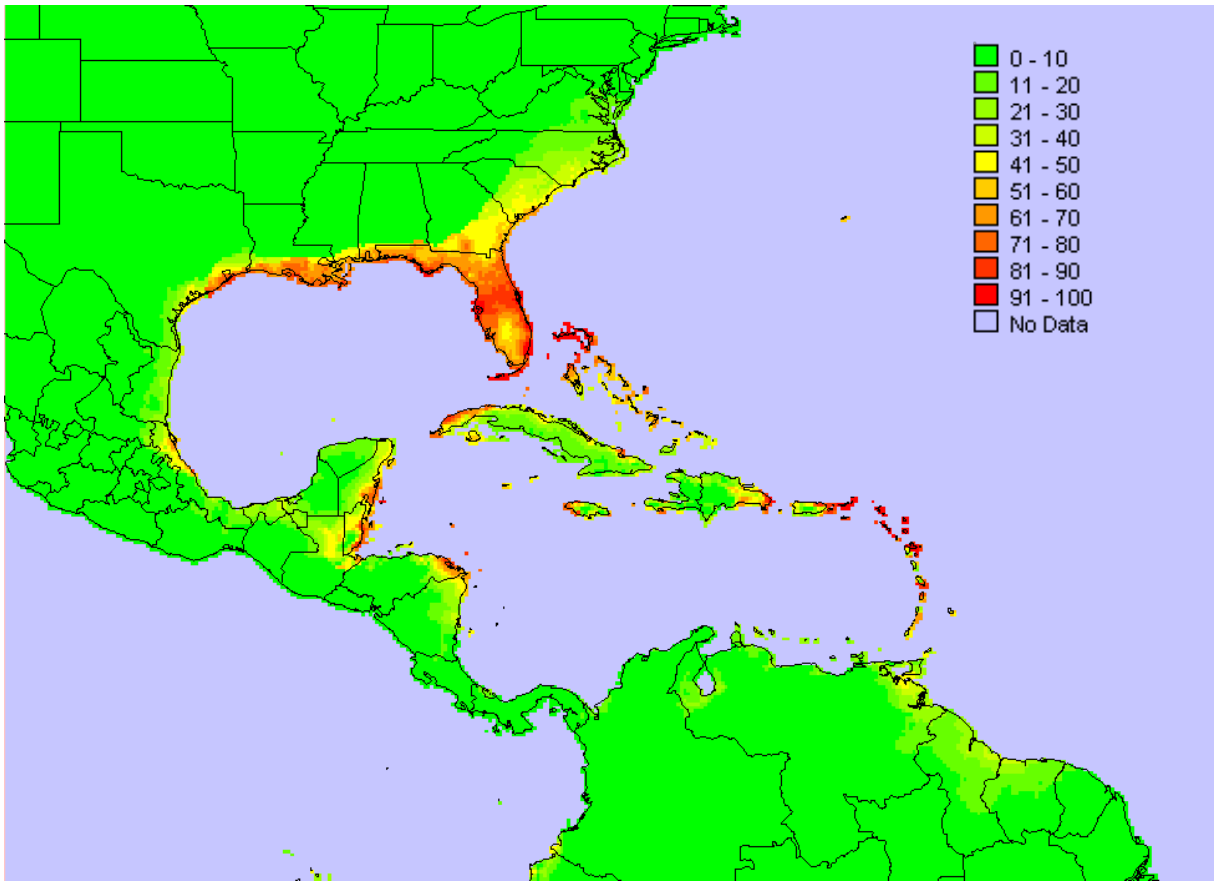

Figure 2: Caribbean zone. The red colours indicate the best potential conditions for *Aulacaspsi yasumatsui*

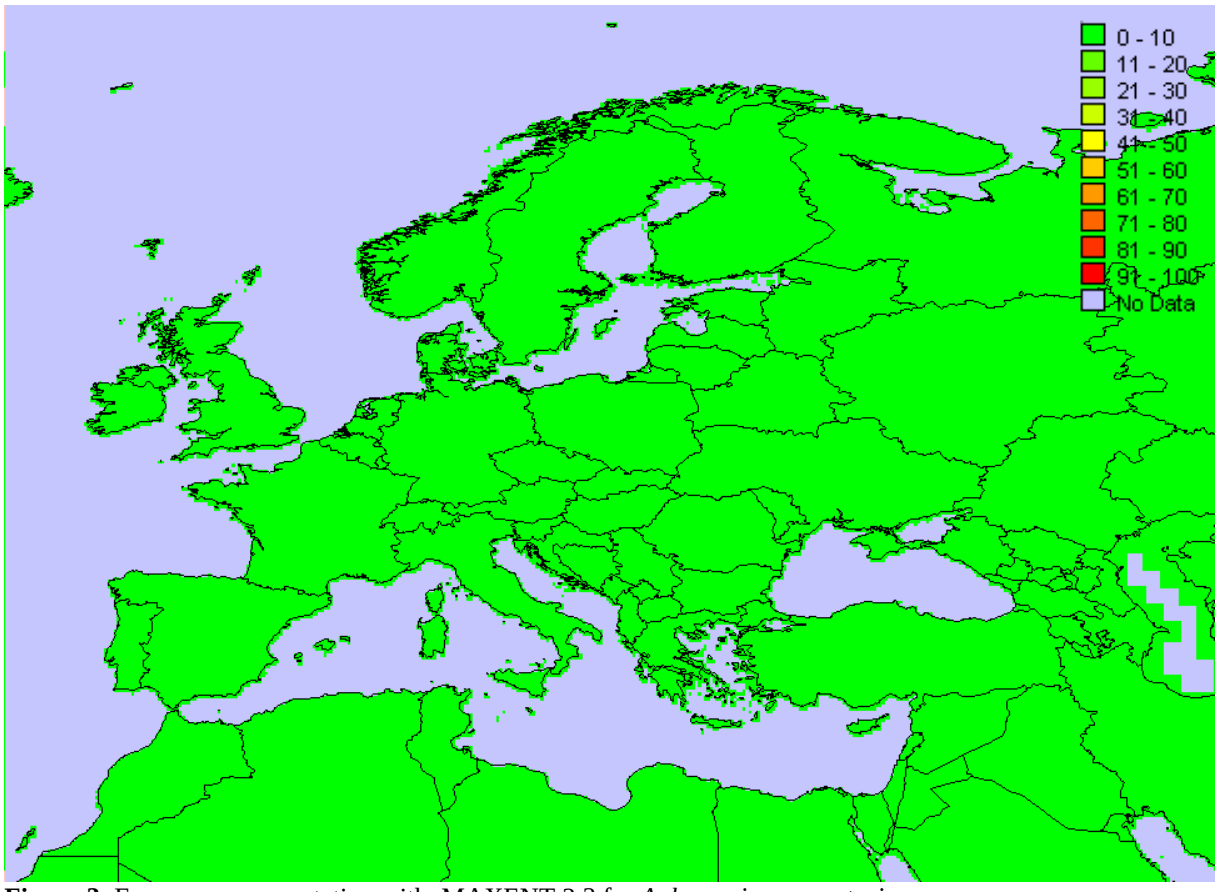

Figure 3: European representation with MAXENT 2.3 for *Aulacaspis yasumatsui*.

In a second step a theoretical threshold was determined in which the minimum threshold was 10,865. The corresponding maps are shown in figures 4 and 5.

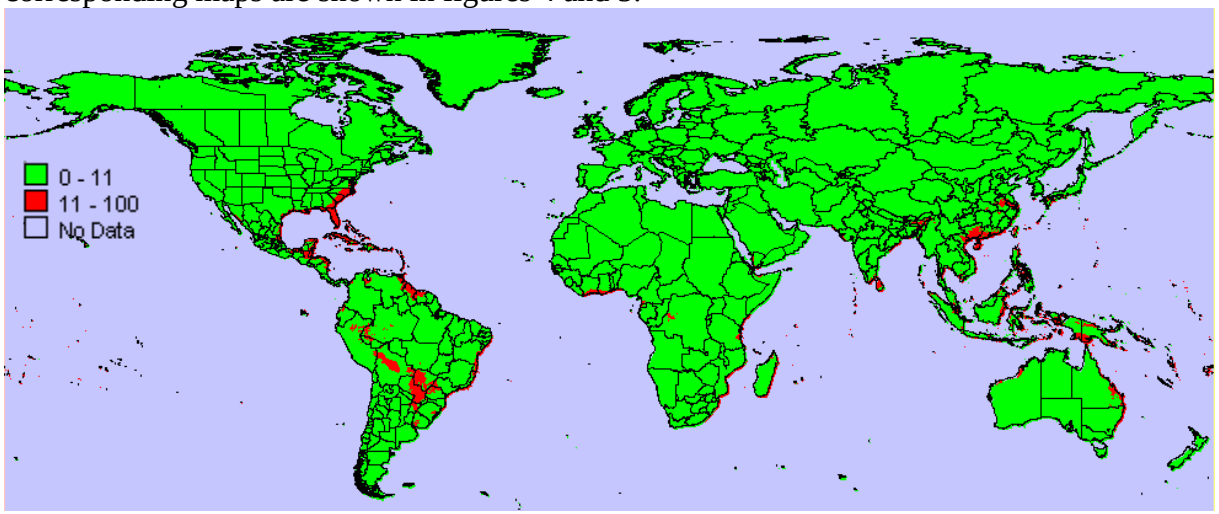

Figure 4: Global distribution of *Aulacaspis yasumatsui* following MAXENT 2.3. Red zones are favourable for the pest with a threshold of 10,865

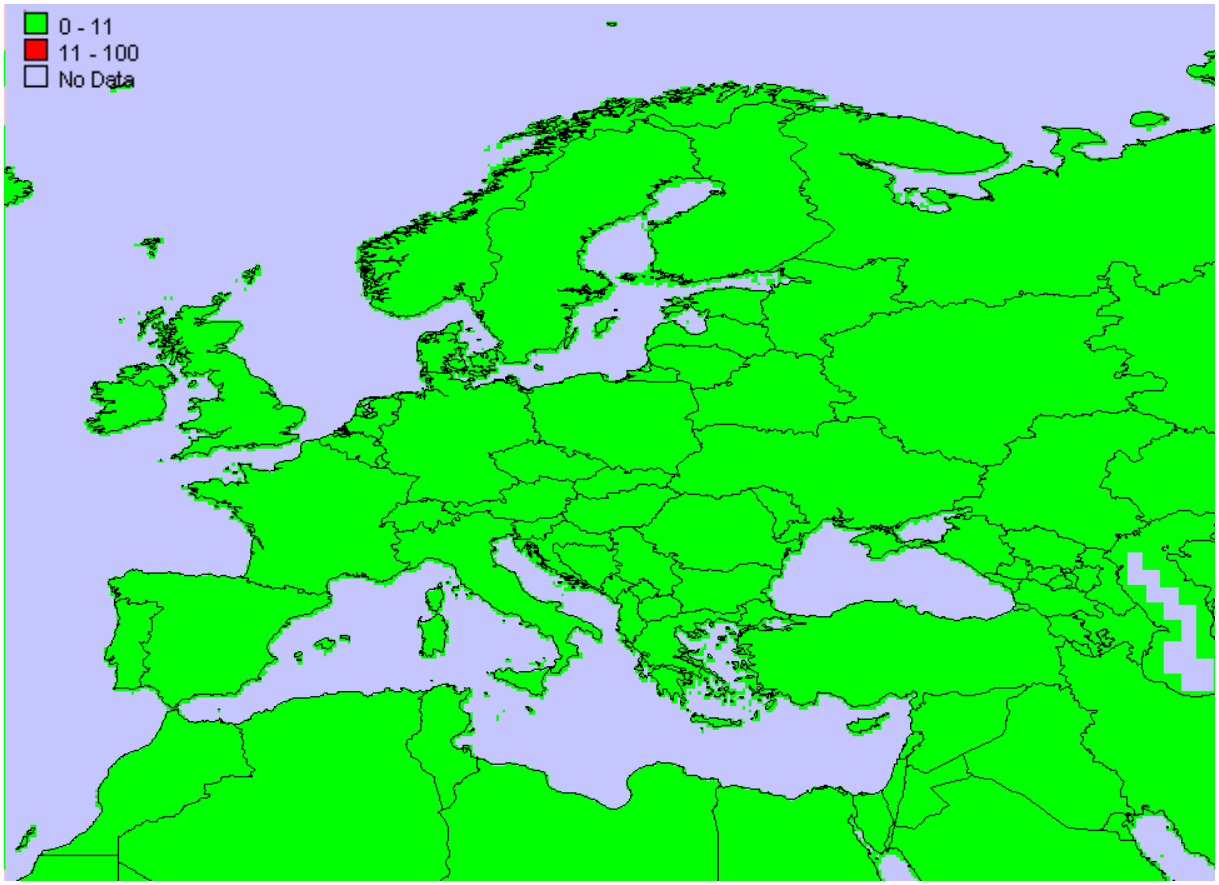

Figure 5: European representation with MAXENT 2.3 for *Aulacaspis yasumatsui*.

Potential geographical distribution of the scale

The areas most favourable for the scale (Figures 1 and 2) include humid and sub humid tropical zones. MaxEnt does not predict areas at risk in the EPPO region. (Figures 3 and 5).