EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE
POUR LA PROTECTION DES PLANTES

08- 14022
P PM point 7.3

Report of a Pest Risk Analysis for *Aulacaspis yasumatsui*

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:	*Aulacaspis yasumatsui*
PRA area:	EPPO member countries
Assessors:	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:	2007-11-20/22

STAGE 1: INITIATION

Reason for doing 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)
Taxonomic position of pest:	Arthropoda, Insecta, Hemiptera, Sternorrhyncha, Diaspididae, Diaspidinae

STAGE 2: PEST RISK ASSESSMENT

Probability of introduction

Entry

<u>Geographical distribution:</u>

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).

<u>Major host plants or habitats:</u>

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.

<u>Which pathway(s) is the pest likely to be introduced on:</u>

Plants for planting of Cycads
Cut foliage was not considered as a pathway as the transfer to Cycad plants was considered unlikely

Establishment

<u>Plants or habitats at risk in the PRA area:</u>

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.

The following plant families are host plants:
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)

<u>Climatic similarity of present distribution with PRA area (or</u>

Conditions are not similar outdoors (see the prediction map of establishment with MAXENT appendix 1).

parts thereof):

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 outdoors. 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.

Characteristics (other than climatic) of the PRA area that would favour establishment:	None
Which part of the PRA area is the area of potential establishment:	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.

POTENTIAL ECONOMIC CONSEQUENCES

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

Describe damage to potential hosts in PRA area:	Individual plants being killed.
How much economic impact would the pest have in the PRA area:	Given that the climatic conditions are not likely to be as suitable as in the native 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 similar. (Vidal & Germain pers. com. 2007).

CONCLUSIONS OF PEST RISK ASSESSMENT

Summarize the major factors that influence the acceptability of the risk from this pest:	
Estimate the probability of entry:	Low probability of entry (it has not been detected frequently despite the fact that the plants for planting are inspected although the difficulty in detecting the pest by visual inspection increases the likelihood of entry, there are few reports of outbreaks). Nevertheless the risk is likely to increase as long as the trade continues to expand.
Estimate the probability 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.
Estimate the potential economic impact:	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.
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. 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.
OVERALL CONCLUSIONS	**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.

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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.

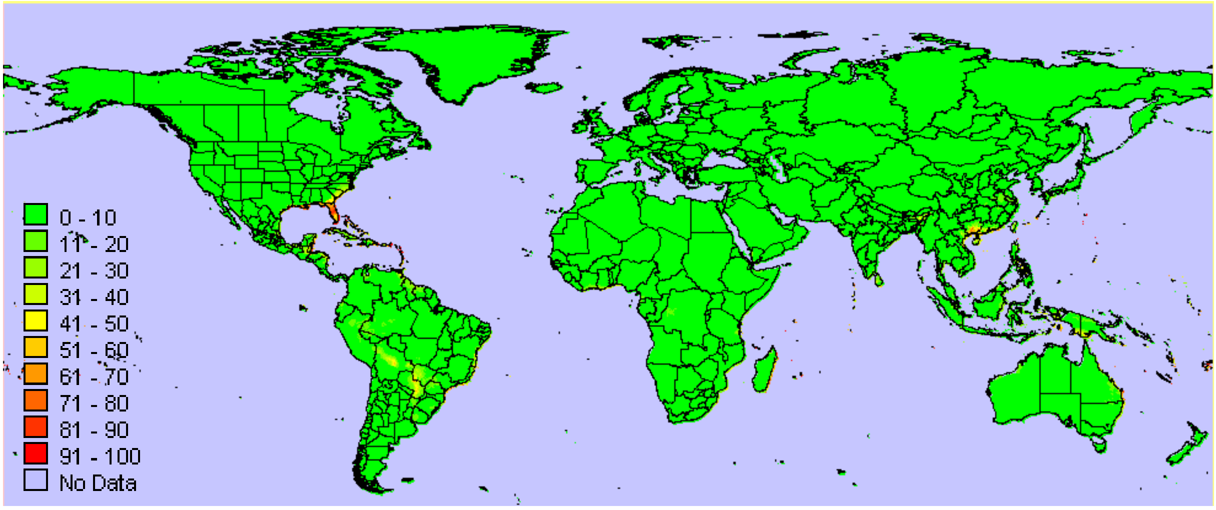

Figure 1 : Maxent 2.3 model on a global scale. The red colours indicate the best potential conditions for *Aulacaspsi yasumatsui*

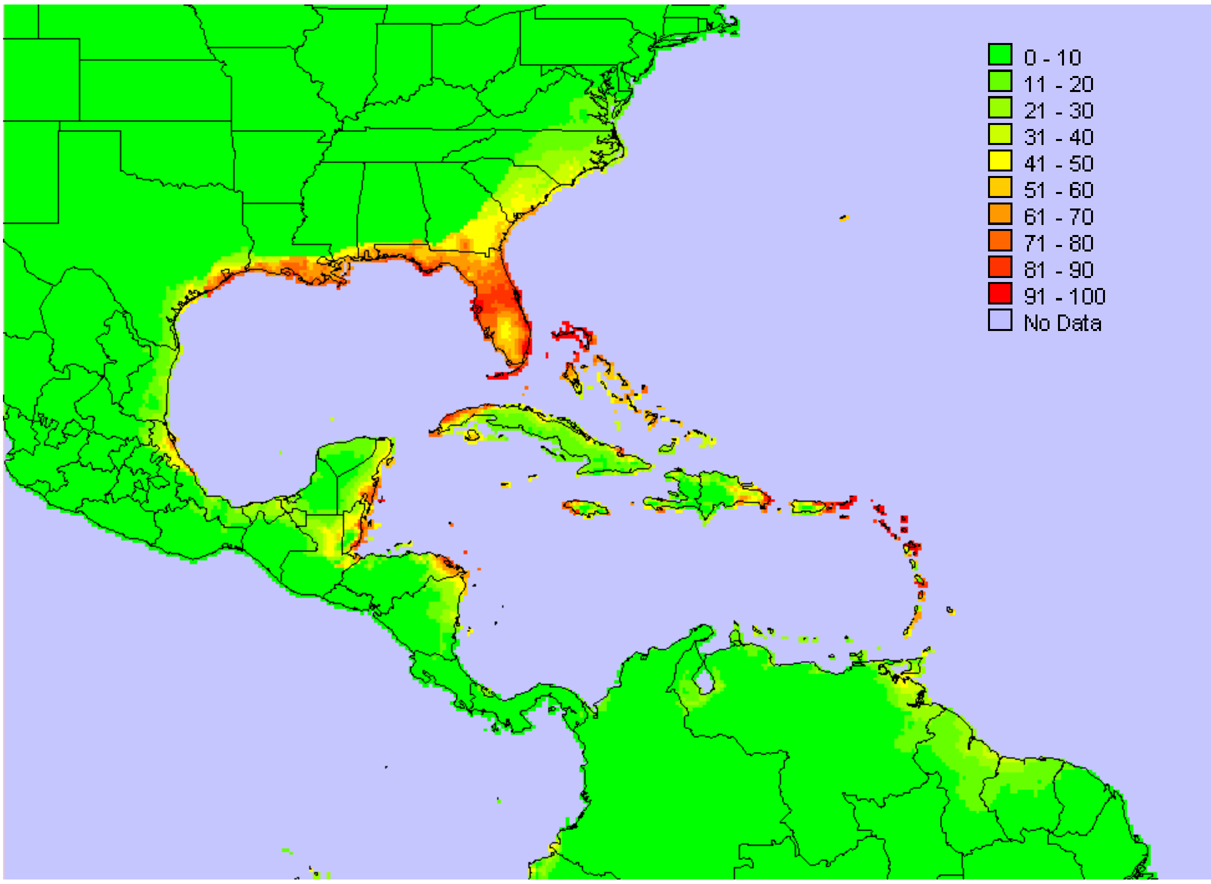

Figure 2: Caribbean zone. The red colours indicate the best potential conditions for *Aulacaspsi yasumatsui*

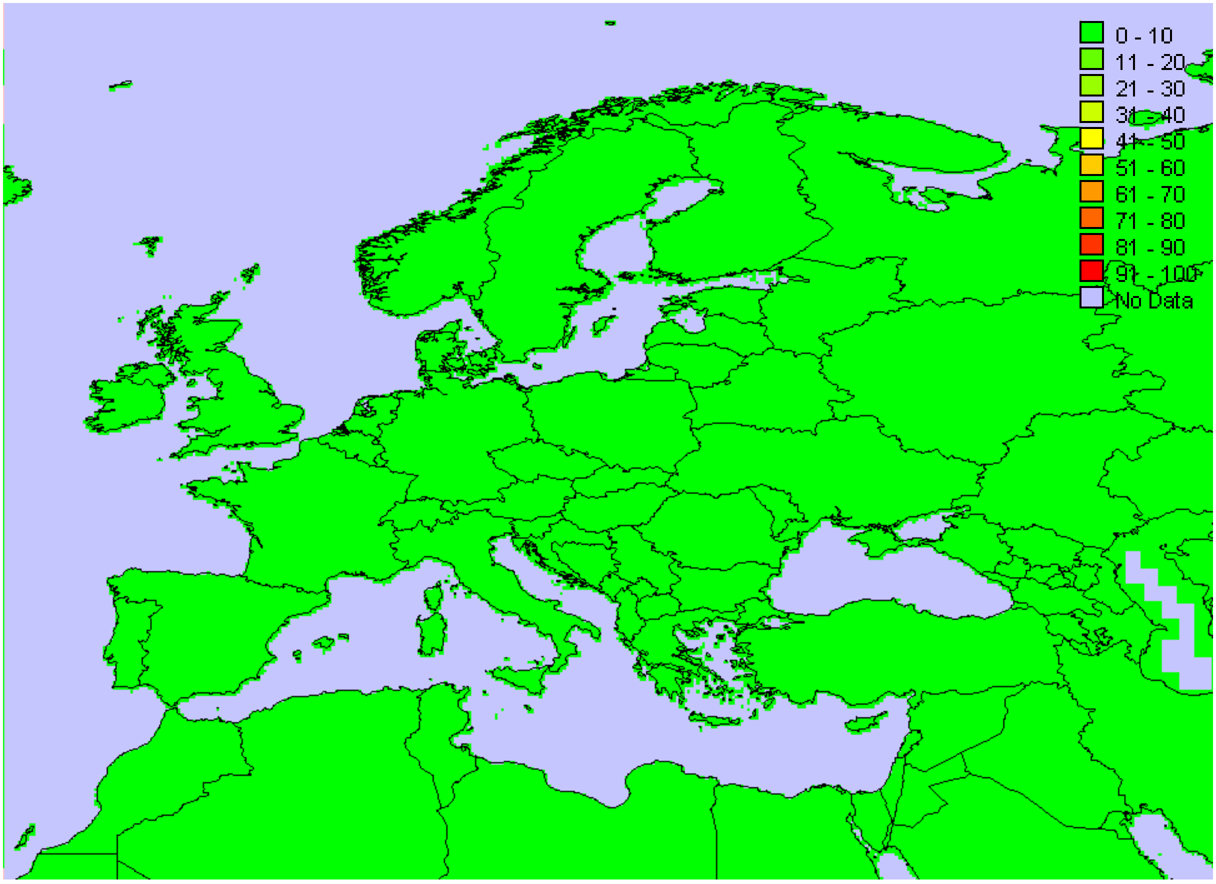

Figure 3: European representation with MAXENT 2.3 for *Aulacaspis yasumatsui*.

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.

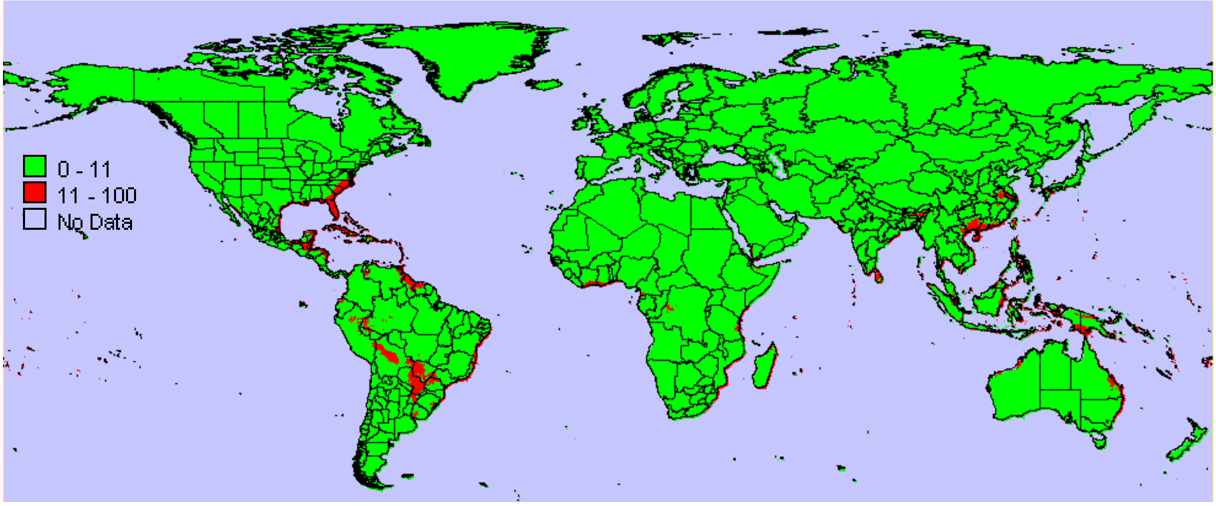

Figure 4: Global distribution of *Aulacaspis yasumatsui* following MAXENT 2.3. Red zones are favourable for the pest with a threshold of 10,865

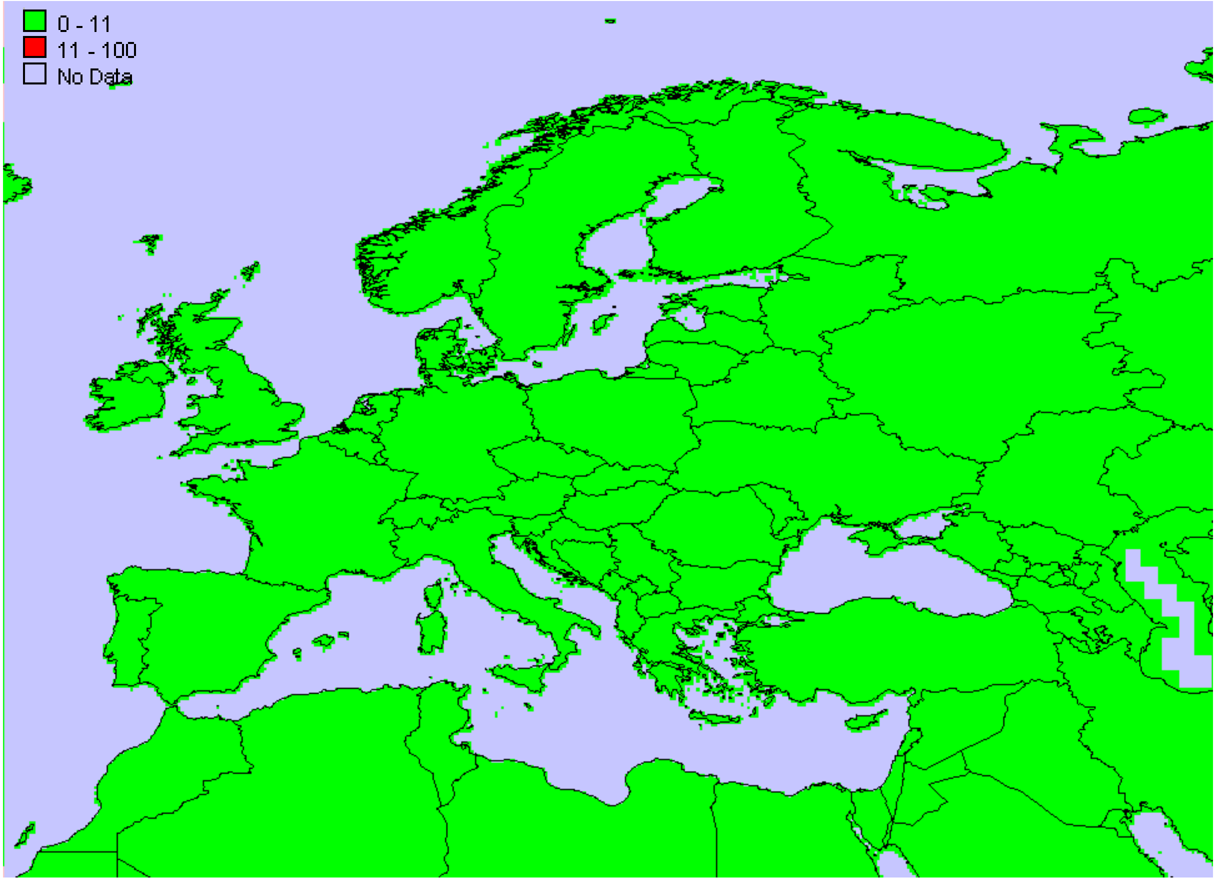

Figure 5: European representation with MAXENT 2.3 for *Aulacaspis yasumatsui*.

1 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).