FORMAT FOR A PRA RECORD (version 3 of the Decision support scheme for PRA for quarantine pests)

09-15223

	European and Mediterranean Plant Protection Organisation		
	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 *Metamasius hemipterus*			
Pest risk analyst:	A preliminary draft has been prepared by Dirk Jan van der Gaag[1] and Brigitta Wessels-Berk[2]. This document has been reviewed by an Expert Working Group composed of: Francisco Javier Garcia Domínguez[3], Antonio Gonzalez Hernandez[4], Dirk Jan van der Gaag[1], Jose Maria Guitián Castrillon[3], Rosa Martin Suarez[5], Jorge Peña[6], Francesco Salomone Suarez[7], Elford Stuart Cooper Smith[8]. Comments from Robin Giblin-Davis[9] have been integrated. [1] Plant Protection Service, Plant Health Strategy & Development, P.O. Box 9102, 6700 HC Wageningen (NL) [2] Plant Protection Service, National Reference Laboratory, P.O. Box 9102, 6700 HC Wageningen (NL) [3] Tecnologias y Servicios Agrarios, S. A. - TRAGSATEC, C / Hnos. Garcia Noblejas, 37C. 2a Planta, 280037 Madrid (ES) [4] Direccion General de Agricultura, Servicio de Sanidad Vegetal, Avda. José Manuel Guimeré, 8, 38003 Santa Cruz de Tenerife (ES) [5] Sanidad Vegetal, Direccion General de Agricultura, Edificio Iberia, C/Agustin Millares Carlo, 10 Planta 3, 35071 Las Palmas de Gran Canaria, Canary Islands (ES) [6] Entomology and Nematology, Tropical Research and Education Center, 18905 SW 280th Street, FL 33031 Homestead (US) [7] Servicio de Parques y Jardines, Col N° 3521, Jefe de la Seccion de Medioambiente y Servicios Municipales, Ayutamiento de, San Cristobal de la Laguna, Tenerife, Canary Islands (ES) [8] Biosecurity and Product Integrity Division, Department of Regional Development, Primary Industry, Fisheries and Resources, GPO Box 3000, 0801 Darwin, Northern Territory (AU) [9] Fort Lauderdale Research and Education Center 3205 College Avenue Fort Lauderdale, FL 33314 - USA		
Stage 1: Initiation			

1 What is the reason for performing the PRA?		In 2006, larvae of *Metamasius hemipterus* (Coleoptera: Curculionidae) were intercepted by the Dutch NPPO on a consignment of plants for planting of *Phoenix* sp. from Costa Rica. Considering the risk that may be presented by *M. hemipterus* especially for ornamental palm species, the NPPO of the Netherlands suggested that it should be added to the EPPO Alert List. The species is currently a quarantine pest in the USA, and an A1 pest in East Africa (PQR database, visited November 2008).
2 Enter the name of the pest		*Metamasius hemipterus* L. Synonyms: *Metamasius sericeus* (Olivier) Common names (CABI, 2007a): West Indian cane weevil Weevil borer Rotten cane stalk borer Silky cane weevil Notes on taxonomy and nomenclature: *M. hemipterus* was first described by Linnaeus in 1758. Vaurie (1966) recognized three subspecies based on colour: *M. hemipterus subsp. hemipterus* (Linnaeus), *M. hemipterus subsp. sericeus* (Olivier) and *M. hemipterus subsp. carbonarius* (Chevrolat). A number of authors have given these specific statuses, although after examining over 2000 specimens, Vaurie (1966) was convinced that they were conspecific, as the secondary characters of both sexes were extremely similar and no differences existed among the forms, except for the elytral, pronotal and ventral colour patterns.
2A Indicate the type of the pest		Insect, weevil
2B Indicate the taxonomic position		Order: Coleoptera Family: Curculionidae
3 Clearly define the PRA area		EPPO region

4 Does a relevant earlier PRA exist?		No
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)?		NA (not applicable)
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.		In its current area of distribution, *M. hemipterus* is a pest of sugarcane, palms, banana and other tropical plants (Weissling & Giblin-Davis, 2003; CABI, 2007a). In Florida, it attacks sugarcane, *Musa* spp. (banana and plantain) and several ornamental palms (Giblin-Davis *et al*., 1994). <u>Host list according to CABI (2007a):</u> Major hosts: *Cocos nucifera* (coconut), *Musa* spp. (banana) and *Saccharum officinarum* (sugarcane). Minor hosts: *Ananas comosus* (pineapple), *Lantana* spp., *Manihot esculenta* (cassava), *Sorghum bicolor* (sorghum), *Zea mays* (maize), *Carica papaya* (papaya), *Psidium guajava* (guava). Palm species: *Hyophorbe verschaffeltii*, *Jessenia bataua*, *Phoenix canariensis*, *Ptychosperma macarthurii*, *Roystonea regia*, *Washingtonia robusta*. <u>Notes on the host list</u> It is questionable if all plant species mentioned as minor hosts by CABI (2007a) are true host plants since the species is attracted by damaged fruits and various decaying plant material and the finding of the pest in a rotten or decaying plant (part) may not necessarily mean that the plant is a host plant. In case of cassava for example, we are only aware of a single report of the pest in roots of a single plant in Florida (Woodruff & Baranowski, 1985). Several other *Metamasius* spp. infest pineapple in the Caribbean and South America i.e. *Metamasius dimidiatipennis* (Venezuela), *M. fasciatus* (Venezuela), *M. ritchiei* (Jamaica) (Petty *et al*., 2002) and the listing of pineapple as a host plant might be a result of a misidentification. Several palm species (Arecaceae), sugar cane (*Saccharum officinarum*) and banana (*Musa* spp.) have been described by several authors to be infested by *M. hemipterus* and we assume these plant species to be certain host plants. It is uncertain if all plant species belonging to the Arecaceae (palm trees) are host plants (see

		also Q 1.1). Certain palm species seem to be more affected than others: *Phoenix canariensis* and *Ravenea rivularis* (Giblin-Davis, 2001). Palm species that have been reported as host plants are listed in Table 1. In the present PRA, we consider all palm species as potential host plants (see also Table 1).

Table 1. Palm tree species reported as host plants of *Metamasius hemipterus*

Palm species	Reference
Hyophorbe verschaffeltii	Giblin-Davis *et al*., 1994 [1)]
Phoenix canariensis	Giblin-Davis *et al*., 1994
Ptychosperma macarthurii	Giblin-Davis *et al*., 1994
Ravenea rivularis	Giblin-Davis *et al*., 1994
Roystonea regia	Giblin-Davis *et al*., 1994
Washingtonia robusta	Giblin-Davis *et al*., 1994
Bactris gasipaes	Alpizar *et al*., 2002
Jessenia bataua	Vaurie, 1966
Phoenix roebelenii	NPPO of Belgium (EPPO RS 2008/167)
Chamaedora sp.	Vaurie, 1966

[1)] Larvae were found infesting the palm species

Several palm species mentioned in Table 1 are grown in protected cultivation in the northern part of the PRA area and in the open field in nurseries and as amenity trees in the southern region. Date palm (*Phoenix dactylifera*) is an important crop in Northern African countries (Anonymous, 2003). It is however uncertain if *M. hemipterus* attacks date palm since there is no indication from the literature that date palm (*Phoenix dactylifera*) is a host plant. In fact, the pest is not present in areas where date palm is an important crop. In the US, date palms are cultivated in California where the pest is absent.

7. Specify the pest distribution		*M. hemipterus* is widely present in Central and South America and the Caribbean (Vaurie, 1966) and from there it has been introduced into West Africa and Florida (Lepesme & Paulian, 1941; Woodruff & Baranowski, 1985). <u>According to the CABI Crop Protection Compendium (CABI, 2007a), *M. hemipterus* is present in the following countries:</u> **Africa**: Cameroon, Congo, Equatorial Guinea, Gabon, Nigeria. **Asia**: Indonesia (Kalimantan) and the Philippines (restricted distribution in both countries; based on data from the Natural History Museum (London, UK) from 1904 and 1925). **North America**: Mexico, USA (Florida).

		Caribbean and Central America: Antigua and Barbuda, Barbados, Belize, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Montserrat, Nicaragua, Panama, Puerto Rico, Saint Lucia, St Kitts-Nevis, St Vincent and the Grenadines, Trinidad and Tobago, Virgin Islands (US). **South America**: Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Mexico, Paraguay, Peru, Suriname, Uruguay, Venezuela. Note: the records in Indonesia and Philippines are doubtful. Since the dates of the records (1904 and 1925) given by the Natural History Museum (London, UK) there have been no new records. This might have been a misidentification since *M. hemipterus* resembles *Rhabdoscelus obscurus* which is present in Indonesia.
8. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	Yes	
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?	NA	
10. Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?	Yes	*M. hemipterus* is considered as the species which is probably the most damaging member of the genus *Metamasius* on palm (Giblin-Davis, 2001). It is generally regarded as a secondary pest of sugarcane, bananas and palms especially attacking dead or wounded tissue. However, the pest cause serious damage in palms and sugar cane in Florida (Weissling *et al*., 2003).
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	
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	
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 protected conditions)?	Yes	Glasshouse conditions in the northern part of the EPPO region and outdoor climate in the southern part of the EPPO region will enable pest survival.
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	
18. This pest could present a risk to the PRA area.	Yes	
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		I. <u>Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp. other than seeds, seedlings and plants *in vitro* from areas where the pest occurs</u> **Palms** *M. hemipterus* attacks a wide variety of palm species. Palm plants are imported into the PRA-area from countries where the pest is present (see Q 1.6). It is unknown if all plant species belonging to the Arecaceae are host plants (see also Q 6). Giblin-Davis *et al*. (1994) observed *M. hemipterus* on several ornamental palms in Florida: *Phoenix canariensis*, *Ptychosperma macarthurii*, *Ravenea rivularis*, *Roystonia regia*, *Hyophorbe verschaffeltii* and *Washingtonia robusta.* Recently, *M. hemipterus* was intercepted on plants of *Phoenix roebelenii* in Belgium (EPPO RS 2008/167), a palm species not previously reported as a host plant. In this PRA, we therefore consider all palm species as potential host plants. Seedlings of palms may be a less relevant pathway than larger plants for several reasons. If seedlings would be infested they would die and most likely be removed before export. Larvae of another palm weevil, *Rhabdoscelus obscurus*, are known to destroy the plants and have been observed to kill seedlings in 140 mm pots (NGIA, 1998). Seedlings will probably be grown under controlled conditions and infestation may be prevented by chemical treatment. *Howea forsteriana* is imported as seedlings or germinated seeds and is one of the most popular palm for indoor use in Europe. The seedlings are imported "soil free or root washed" inside "porespan boxes" (white plastic cork). The seedlings are almost drenched in fungicide and pesticide to prevent any problem during the transport and it is not likely that they will contain any living insect (pers. comm. F Salomone Suárez, Jefe de la Sección de Medioambiente y Servicios Municipales Ayuntamiento de San Cristóbal de La Laguna, November 2008). Seedlings of *Howea forsteriana* are, as far as the EWG could judge, not imported from areas where *M. hemipterus* is present nor are we aware of any other palm species being imported as seedlings into the EPPO-region from areas where the pest is present. For this reason, palm seedlings are considered as a very unlikely pathway and we do not consider palm seedlings as a separate pathway in this PRA. **Uncertainty/lack of information:** it is unknown/uncertain whether palm species other than those mentioned above are host plants of *M. hemipterus.*

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		This pathway exists as shown by interceptions/findings in imported host plants including vegetative propagation material: USA: • in stems of *Chamaedorea* sp. in Texas (Vaurie, 1966) The Netherlands: • on *Phoenix* palms imported from Costa Rica in 2006 and 2 times in 2008 (source: NPPO of the Netherlands). The 2006-interception was plants infested by larvae. The 2008-interceptions were single adults (one adult on each consignment) and it was unknown if the plants were infested or if the pest was present as a hitchhiker). Belgium • on *Phoenix roebelenii* imported from Costa Rica in 2008 (EPPO RS 2008/167) ***Musa spp.*** *M. hemipterus* attacks *Musa* spp. (banana and plantain). There are currently very few imports of *Musa* spp. (plants and/or stems) into the PRA-area from countries where the pest is present, but this may change in the future. Import data of *Musa* spp. were received from the following EPPO countries: Algeria, Croatia, Czech Republic, France, Germany, Hungary, Malta, the Netherlands and Turkey. The import data were from 2005 to 2007. Among the countries listed above, the Netherlands was the only country that imported *Musa* spp. from countries outside the EPPO region (see Q 1.6). The plants imported by the Netherlands are (usually) small plants (20 to 40 cm) grown in potting soil and probably grown in protected conditions (NPPO of the Netherlands, pers. comm., 2008). The EWG considered the probability of these small plants to be infested as very low. However, companies may import larger plants in the future. Known interceptions/findings in imported host plants including vegetative propagation material are relatively old and were probably not on banana seedlings but large plants or plant parts: Australia: • on banana plants imported from Jamaica in 1920 (Tryon, 1920). USA:

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		• on banana stems from Panama or Costa Rica in 1924 and 1925 (CABI, 2007a) • on material (not specified, may have been banana stems or fruits) from the Antilles in 1921 and 1922 (Lepesme & Paulian, 1941). II. Commercial import of fruits from areas where the pest occurs *M. hemipterus* may be present as a hitchhiker on imported fruits from host plants. The presence of larvae in commercial imports of fruits is unlikely. So far, the only records of oviposition of *Metamasius* species on fruits are for *M. ritchiei* Marshall which attacks pineapples (Sherwood, 2004). In the USA, *M. hemipterus* was intercepted on imported banana and pineapple fruits in 1920 and 1940 (CABI, 2007a). In the UK the pest was intercepted on banana fruits or as ship “stowaways” in the UK (Whitehead, 1991). Large amounts of fruits are imported but only one interception is known in the EPPO region (on bananas in the UK, Whitehead, 1991), but on the other hand, bananas are not inspected. The finding on pineapple fruits may be a misidentification because other *Metamasius* spp. infest pineapple in the Caribbean and South America, i.e. *M. dimidiatipennis* (Venezuela), *M. fasciatus* (Venezuela), *M. ritchiei* (Jamaica) (see Petty *et al*., 2002). The pineapple is considered very unlikely as a pathway and is therefore not considered further. Whitehead (1991) had listed insects that had been found in the UK, mostly introduced on bananas or as sip “stowaways”, and *M. hemipterus* was one of them. From this report, it is unclear whether *M. hemipterus* was actually found on banana. The method of banana import at the time of the records (1920 and 1940) was very different from nowadays. At that time, whole bunches were imported, while nowadays, bananas come as boxes in hands, and are treated in a bath and then covered, and spend some time in a maturation chamber. This pathway is considered very unlikely and is not considered further. III. Movement of host plants (palms and *Musa* spp.) with passengers Individuals can import whole or parts of host plants including fruits from areas where the pest is present. Caton & Griffin (2006) have made a qualitative assessment of the pest risk associated with fruits and vegetables in passengers baggage in the USA. *M. hemipterus* was not in the top 20 intercepted insect plant pests at U.S. airports. The situation for EPPO-countries may, however, be different since passengers may not import plants into the USA while they are allowed to do so (in

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		most) EPPO-countries. Passengers may import small quantities (up to 12 articles) of soil-free plant material that is not subject to prohibition or special restrictions (US Department of Agriculture, Circular PPQ Q37-1, 3/2006). Additionally, US Federal Regulation, Agriculture, PART 319—FOREIGN QUARANTINE NOTICES lists banned species, some of them being palms (e.g. *Phoenix, Trachycarpus*, *Livistona*). From 1990 to 2004, *Metamasius* sp. was intercepted 753 times in passenger's baggage at land borders in the US. Probably, most of these interceptions were made at the Mexico – USA border since the pest is present in Mexico and not in Canada (CABI, 2007a). These interceptions show that passenger's luggage is a pathway for *M. hemipterus* at land borders. This pathway will be less relevant for the EPPO region than commercial import because of the much lower volume of plants and other consignments brought in by passengers than by commercial trade The high number of interceptions at land borders in the USA is probably due to the presence of the pest in Mexico and the high numbers of persons travelling from Mexico to the USA. No countries/regions where the pest is present border the PRA area, and, therefore this pathway is considered less relevant for the EPPO-region than for the USA. This pathway is further considered, but its probability is assessed to be very low to low. IV. <u>Commercial import of sugar cane from countries where the pest occurs</u> *M. hemipterus* attacks sugar cane. According to FAOSTAT, the following volumes of sugar cane were imported in the EPPO region (Table 2): Table 2. Tonnes of sugarcane imported into the EPPO region in 2003, 2004, and 2005 (source: FAOSTAT), with exporting countries listed for 2005:

Country	2003	2004	2005
Belgium	3	5	11 (From Cameroon, France and Syria)
Czech Republic	0	0	8 (node tails available)
France	35	84	61 (from Costa Rica 3, Germany, Belgium, Brazil, the Netherlands)
Ireland	3	1	1 (from Germany)
Italy	96	76	30 (from Egypt, China, France, Pakistan, the Netherlands).
Netherlands	391	75	79 (Costa Rica 24, USA 36, China 5, Columbia 7, Ecuador 1, Ghana 2, Kenya

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<tr><td></td><td></td><td></td><td>3, Suriname 1)</td></tr>
<tr><td>Portugal</td><td>6</td><td>7</td><td>8 (from Brazil, Venezuela, the Netherlands)</td></tr>
<tr><td>Spain</td><td>8</td><td>109</td><td>10 (importing from the Netherlands)</td></tr>
<tr><td>United Kingdom</td><td>139</td><td>150</td><td>154 (Nigeria, France, Colombia, Sweden, Ireland, Costa Rica, China).</td></tr>
</table>
It is to be noted that imports coming from EU countries (Belgium, France, Germany, the Netherlands, Sweden, etc.) were imported from tropical countries and then re-exported within the EU.

Sugar cane should be transformed as soon as harvested so that concentration of raw sugar is not lost (CNUCED website). It is most probable that sugar cane is transformed directly where it is produced, and that sugar cane imported into Europe is for other purposes.
Sugar cane is imported to metropolitan France from overseas departments for consumption (to eat, in cocktails, in decoration) (see http://www.webrankinfo.com/annuaire/site-25091.htm). The purpose of import of sugar cane in other EPPO countries is considered to be the same.
No additional information from official sources could be gathered.
If sugar cane was to be introduced into other countries from areas where the pest occurs, it is very unlikely that the pest contained in sugar cane could escape.
It is unknown whether sugar cane is imported for ornamental purposes, but it is considered unlikely.
Additionally, the probability that M. hemipterus could escape during transport is considered very low and this pathway is, therefore, not considered any further in the present PRA.

V. <u>Commercial import of Phoenix fronds</u>
Large volumes of Phoenix fronds (leaves) are imported from Costa Rica into the EPPO region by the florist trade (source database NPPO of the Netherlands). M. hemipterus is more common in the trunk, but can also be found on the fronds. If disturbed when the fronds are removed and packed they will most likely fly away (J. Peña, pers. comm., 2008). M. hemipterus have never been observed infesting green fronds. The probability that M. hemipterus will be associated with imported fronds is, therefore, considered very low.

VI. <u>Hitchhiker on import of plants or plant parts other than palm trees, Musa spp sugar cane, and banana fruits.</u>
M. hemipterus has been intercepted as a hitchhiker on several commodities:
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Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		- one interception of a single adult is known from the USA on candelabra cactus (*Euphorbia trigona*) from the Dominican Republic in 1979 (Woodruff & Baranowski, 1985). - one beetle in *Dracaena* propagation material from Costa Rica in 2007 (NPPO of the Netherlands) - one beetle on *Heliconia* from Ecuador in 2006 ((NPPO of the Netherlands) - *M. hemipterus* is considered to be associated with *Dracaena fragrans* as it was intercepted in the US. It is not mentioned whether *M. hemipterus* infested the plant or was found as a hitchhiker (Colpetzer, 2005). Interceptions on various consignments indicate that the pest can enter with the import of various plant material. VII. <u>Commercial import of palms and *Musa* spp. as tissue culture plantlets</u> Tissue culture plantlets are grown *in vitro* under laboratory conditions and, therefore, cannot become infested or contaminated by the pest. The pathway, "import of palms and *Musa* spp. as tissue culture plantlets" is, therefore, not considered further in this PRA
1.2. Estimate the number of relevant pathways, of different commodities, from different origins, to different end uses.	**Not relevant**	
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.		I. <u>Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp. other than seeds, seedlings and plants *in vitro* from areas where the pest occurs</u> This pathway is probably the most important one since movement of infested plant material is probably the main way by which the pest is spread over large distances as the pest can often go undetected (Weissling & Giblin-Davis, 2003). The probability that seedlings might be contaminated is considered to be very low since seedlings are very controlled. II. <u>Movement of palm trees (Arecaceae) and *Musa* spp. with passengers.</u> III. <u>Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp sugar cane, and banana fruits. No detailed study of the entry potential as a hitchhiker has been conducted in this PRA because of the lack of data on import volumes and the difficulty to assess the probability that the pest is associated with the various plant materials. Recent interceptions indicate, however, that the pest can enter with various</u>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		plant species and based on these interceptions the probability of entry is assessed to be low to moderate.
Pathway n°: I **This pathway analysis should be conducted for all relevant pathways**		**Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp. other than seeds, seedlings and plants *in vitro* from areas where the pest occurs**
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** **Uncertainty: high**	Minimal information is available on the abundance of the pest on palms and *Musa* spp. grown in nurseries in which plants are grown for export to the EPPO region. The pest has been found/intercepted at least 3 times in Europe on *Phoenix* palms originating from Costa Rica. In Florida, at least 5 nurseries have reported problems related to the pest, but more nurseries could be infected (J. Peña, pers. comm. 2008). It is, however, unknown if the pest occurs at high prevalence in palm or *Musa* spp. nurseries in other countries where the pest is present.
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation practices, treatment of consignments?	**Moderately likely** **Uncertainty: high**	See also Q 1.4: minimal information is available and we do not know if the pest is present in palm or nurseries or on *Musa* spp. (at high prevalence). If the pest is present in areas where the palms and *Musa* spp. are grown it is difficult to grow palms completely free of the pest because of hidden life stages and difficulties to control these life stages (see also Q 2.4). Generally, importers are willing to ship high quality trees so that the consignment is not blocked in customs (e.g. palms without dead fronds). Nevertheless, the pest cannot always be seen, and some traders might not be aware if trees are infested with the pest. An infested palm tree can harbour hundreds of specimens of *M. hemipterus* (e.g. Giblin-Davis *et al*, 1996b). The 2006 interception in the Netherlands concerned plants infested with larvae. The 2008 interceptions in the Netherlands were single adult insects (one insect on each consignment) and it is unknown if the plants were infested or whether the pest was present as a hitchhiker (NPPO of the Netherlands, pers. comm., 2008).
1.6. How large is the volume of the movement along the pathway?	**Massive** **Uncertainty: low**	Import data from the following EPPO countries were received: Algeria, Croatia, Czech Republic, France, Germany, Hungary, Malta, the Netherlands and Turkey. The import data were from 2005 to 2007. In total, these countries imported about 8 million palm trees per year from countries outside the EPPO-region. More than 90% of these palm trees are imported by or via the Netherlands. From countries where *M. hemipterus* were present about 3 million palm trees are imported per year of

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		which more than 2/3 belong to the genera *Dipsys* and *Phoenix* (Table 3). The pest may also be present in parts of Indonesia and the Philippines but this is uncertain (see Q 7). The average number of palm trees imported per year from Indonesia was about 37 000 from 2005 – 2007. No import was recorded from the Philippines. Table 3. Average number of palm trees per year (period 2005 – 2007) imported into the EPPO region from countries where *M. hemipterus* is present.

Origin	Avg. no. of palm trees per year
Costa Rica	1,234,592
Honduras	1,145,663
El Salvador	371,449
Dominican Republic	135,422
Guatemala	87,329
Argentina	10,500
Dominica	3,733
Brazil	1,961
Cuba	428
Paraguay	331
Guadeloupe	6
Panama	1
Total	2,991,418

Note: the total number of palm trees imported into the EPPO-region from countries where *M. hemipterus* is present is probably more than 3 million per year since data were only received from a limited number of EPPO countries. Nevertheless, Appendix 1 shows that the Netherlands is the main importer of ornamental plants: in 2008, they imported 70% of the ornamental plants in quantity in the EU, and 62% in value.
However,, an import volume of 3 millions of palms per year or more is considered massive, which is the highest rating, and the uncertainty on this figure is consequently low.

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<tr><th>Question</th><th>Rating + uncertainty</th><th>Explanatory text of rating and uncertainty</th></tr>
<tr><td></td><td></td><td>Among the countries listed above, the Netherlands was the only country that imported Musa sp from countries outside the EPPO region. Relatively low numbers of Musa plants were imported from countries where the pest is present (Table 4). Table 4: Number of plants of Musa sp. imported from countries where M. hemipterus is present
<table>
<tr><th>Country</th><th>2005</th><th>2006</th><th>2007</th></tr>
<tr><td>COSTA RICA</td><td>1</td><td>1500</td><td>0</td></tr>
<tr><td>USA*</td><td>743</td><td>0</td><td>72</td></tr>
<tr><td>GUATEMALA</td><td>0</td><td>0</td><td>14</td></tr>
<tr><td>BRAZIL</td><td>0</td><td>0</td><td>84</td></tr>
</table>
* present in Florida; it is unknown from which part of the USA Musa sp. were imported.</td></tr>
<tr><td>1.7. How frequent is the movement along the pathway?</td><td>Very often

Uncertainty low</td><td>Plant material from palms and Musa spp. is imported on a daily basis throughout the whole year in sea containers.</td></tr>
<tr><td>1.8. How likely is the pest to survive during transport/storage?</td><td>Very likely

Uncertainty: low</td><td>Eggs, larvae and pupae are found inside the stem of the plants and protected from adverse conditions. Adults may remain in the stem until conditions are favourable (Weissling & Giblin-Davis, 2003). It is, therefore, very likely that the pest will survive transport and storage conditions of living palm trees. Recent interceptions in Phoenix palm trees from Costa Rica show that the pest is able to survive during transport (see also Q 1.3).</td></tr>
<tr><td>1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?</td><td>Unlikely

Uncertainty: low</td><td>The lifecycle is about 2 – 3 months (Weissling et al, 2003; Brito et al, 2005) and transport takes about 12 –14 days from Honduras or Costa Rica (information obtained from a Dutch importer, November 2008). Thus, the pest cannot complete its life cycle during transport but development of different life stages that are present is possible (e.g. hatching of eggs, development of larvae). Female adults lay eggs about 27 days after pairing (Weissling et al., 2003) and, therefore, the probability that adults will mate and females will subsequently lay eggs during transport is very unlikely to occur. If females are present that have already mated, they might lay eggs during transport leading to an increase in population size.</td></tr>
</table>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	**Very likely** **Uncertainty: low**	**Palms** In the EU, there is a current regulation for *Rhyncophorus ferrugineus*, but the area of origin of this pest is different from that of *M. hemipterus*. In the 27 member countries of the EU, inspection of palms for planting are made, according to part B of Annex V of Directive 2000/29/EC. However, it is difficult to detect the pest since the eggs and larvae are found inside the stem and infestation can often go undetected in trees such as *Phoenix canariensis* (Weissling & Giblin-Davis, 2003). Other countries might have specific measures on palms (e.g. Canary Islands and Israel). For instance, in the Canary Islands, import of palms is restricted to seeds and trees with a trunk diameter of less than 5 cm at the base (BOE n°24 de 28/1/2006). **Musa spp.** In the EU, there is a current regulation on *Ralstonia solanacearum* (Bacteria: Burkholderiaceae), *Radopholus similis* and *R. citrophilus* (Nematoda: Pratylenchidae), but the requirements for these organisms are totally different than the one needed for *M. hemipterus*.
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	**Very Widely** **Uncertainty: low**	From the data received by the EPPO Secretariat, Algeria, Croatia, Czech Republic, France, Germany, Hungary, Malta, the Netherlands and Turkey are importing palms from countries outside and/or within the EPPO region. Other EPPO-countries may also import palms. Countries, such as the Netherlands and France import palms from outside the EPPO region to re-export to other EPPO countries. Italy, Spain, Portugal import and re-export palms to other EPPO countries (Francesco Salomone, pers comm. 2008). From the data received, the Netherlands were the only country importing *Musa* spp. The Netherlands probably re-export *Musa* spp. to other EPPO countries.
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	**Yes** **Uncertainty: low**	Eggs and larvae are found inside the stem of the plants and protected from adverse conditions. Adults may remain in the stem until conditions are favourable (Weissling & Giblin-Davis, 2003). Palm trees and *Musa* spp. are imported almost on a daily basis and throughout the year (NPPO of the Netherlands).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	**Very likely** **Uncertainty: low**	Plants for planting are imported by nurseries or may be directly sold to end-consumers. In both cases, palms are likely to be placed near other host plants which can be infested by adults emerging from the imported plants, at least in southern countries. In all cases, at least one mated female or one female and one male beetle will need to be present to start a breeding population. An infested palm tree can harbour hundreds of specimens of *M. hemipterus* (e.g. Giblin-Davis *et al*, 1996b) and in case one or more infested trees are imported, it is very likely that at least one male and female beetle (or larvae) are present.
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** **Uncertainty: low**	See above When palms and *Musa* spp. are planted outdoors or located in nurseries, *M. hemipterus* could fly and colonize other host plants.
Pathway n°: II **This pathway analysis should be conducted for all relevant pathways**		**Movement of palms and *Musa* spp. plants with passengers from areas where the pest occurs**
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?	**Moderately likely** **Uncertainty: high**	The general public (passengers) could bring palms or *Musa* spp. bought in markets or taken from the wild. These plants are, therefore, less subject to controls than commercially imported plants. Passengers are not trained to recognize pests on palms and may overlook the pest. Small palms and *Musa* spp. are more likely to be carried by passengers than large ones, but may still contain the pest. The probability of contamination is less likely than for palms and *Musa* spp. produced in nurseries.
1.5. How likely is the concentration of the pest on the pathway at origin to be high, taking into account factors like cultivation practices, treatment of consignments?	**Moderately likely** **Uncertainty: low**	Passengers will choose healthy plants, therefore the probability of high concentrations of the pest is considered moderately likely. However, it is difficult to detect the pest since the eggs and larvae are found inside the stem and infestation can often go undetected (Weissling & Giblin-Davis, 2003).
1.6. How large is the volume of the movement along the pathway?	**Minimal** **Uncertainty: Medium**	Although there are many passengers crossing borders, few passengers are expected to carry palm or *Musa* spp. plants with them after visiting countries where the pest occurs. Moreover, many palms and *Musa* spp. are available for sale in the PRA area.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.7. How frequent is the movement along the pathway?	**Very rarely** **Uncertainty medium**	See Q 1.6.
1.8. How likely is the pest to survive during transport/storage?	**Very likely** **Uncertainty: low**	Larvae are found inside the stem of the plants and protected from adverse conditions. Adults may remain in the stem until conditions are favourable (Weissling & Giblin-Davis, 2003). It is, therefore, very likely that the pest will survive transport and storage conditions of living palm trees.
1.9. How likely is the pest to multiply/increase in prevalence during transport /storage?	**Unlikely** **Uncertainty: low**	The lifecycle is about 2 – 3 months (Weissling *et al*, 2003) and transport will only take a few hours/days of travel, or a few weeks for cruise ships. Thus, the pest cannot go through a complete life cycle during transport but development of different life stages that are present is possible (e.g. hatching of eggs, development of larvae).
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	**Very likely** **Uncertainty: low**	There are no restrictions for passengers to carry plants in most of the countries within the EU and probably also into the EPPO region. It is difficult to detect the pest since eggs and larvae are found inside the stem and infestation can often go undetected (Weissling & Giblin-Davis, 2003).
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	**Very widely** **Uncertainty: low**	Travellers travel in the whole EPPO region.
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	**Yes**	Travellers travel all year round.
1.13. How likely is the pest to be able to transfer from the pathway to a suitable host or habitat?	**Likely in the Southern EPPO countries** **Unlikely in Northern EPPO countries**	When infested palms and *Musa* spp. are planted outdoors in the southern part of the EPPO region, *M. hemipterus* could fly and colonize other palms and *Musa* spp. It is less likely in northern countries where palm trees are not frequent outdoors. When infested palms and *Musa* spp. are planted indoors, the pest could also escape through doors or windows. The plant might be thrown away into the garbage that will be placed outdoors, allowing the pest to escape.

Question	**Rating + uncertainty**	**Explanatory text of rating and uncertainty**
	Uncertainty: low	
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?	**NA**	
1.15. Do other pathways need to be considered?		No

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
Conclusion on the probability of entry. **Risks presented by different pathways.**		I. Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp. other than seeds, seedlings and plant *in vitro* Large numbers of host plants (approximately 3 million of palms per year accounted for and probably more) are imported from countries where the pest is present. The pest has been intercepted at least four times since 2006 in palms and the probability of entry is assessed as moderate to high. However, the pest can easily remain undetected and the probability of entry may be underestimated. **Probability of entry: moderate to high** Uncertainty: medium (No information is available from nurseries where most plants are being imported into the EPPO-region and the percentage of infested consignments may be underestimated since the pest can remain undetected during import inspection) II. Movement of palm and *Musa* spp. plants with passengers **Probability of entry: very low to low** Uncertainty: medium III. Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp sugar cane, and banana fruits (No detailed study of the entry potential as a hitchhiker is possible) **Probability of entry: low to moderate** Uncertainty: medium
1.16. Estimate the number of host plant species or suitable habitats in the PRA area (see question 6).	**Moderate number** **Uncertainty: low**	Palm tree species of many genera and *Musa* spp. are grown outside in the southern EPPO region (Mediterranean Basin, Macaronesia, Portugal). Import data include, for example, more than 40 palm genera (see Q 1.6). Sànchez de Lorenzo-Càceres (2007) lists more than 265 palm species present in Spain. In the Netherlands more than 20 palm genera are traded and the 4 most important ones (in numbers sold at auction) are: • *Dypsis* (new name for *Chrysalidocarpus*) • *Howea* • *Phoenix* (46% *P. canariensis*, 54% *P. roebelenii*) • *Chamaedora* Source: Anonymous, 2008.

<table>
<tr><th>Question</th><th>Rating + uncertainty</th><th>Explanatory text of rating and uncertainty</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>1.17. How widespread are the host plants or suitable habitats in the PRA area? (specify)</td><td><u>Southern EPPO-region (Mediterranean countries, Macaronesia, Portugal)</u>: widely

<u>Northern EPPO-region:</u> limited

Uncertainty: low</td><td>Ornamental palm trees are widespread in the southern areas of the EPPO region (Mediterranean countries, Macaronesia, Portugal) but limited in the northern areas (all other parts of the EPPO region) where they are present in glasshouses or buildings and only incidentally outdoors.

Palms are found in the wild in the Mediterranean Basin, Portugal and Macaronesia. Endemic species exist: Phoenix canariensis in the Canary Islands, P. theophrasti in Greece and Turkey, and Chamaerops humilis in Spain, Italy, France, Morocco (C. humilis subsp. cerasifera).

<u>Sugar cane (Saccharum officinarum)</u>
Sugar cane is a minor crop in the EPPO region.
Table 5: areas in ha covered by harvested sugar cane in 2005, 2006, 2007 in the EPPO region.
<table>
<tr><th>Country</th><th>2005</th><th>2006</th><th>2007</th></tr>
<tr><td>Morocco</td><td>13300</td><td>14340</td><td>13500</td></tr>
<tr><td>Portugal</td><td>50</td><td>50</td><td>60</td></tr>
<tr><td>Spain</td><td>614</td><td>950</td><td>1000</td></tr>
</table>
(source FAOSTAT)

<u>Banana (Musa spp.)</u>
Banana is a minor crop at the scale of the EPPO-region (see table 6).

Table 6. Area (ha) covered by harvested bananas in 2004, 2005 and 2006:
<table>
<tr><th>Countries</th><th>2004</th><th>2005</th><th>2006</th></tr>
<tr><td>Spain</td><td>9715</td><td>9553</td><td>10000</td></tr>
<tr><td>Morocco</td><td>5200</td><td>5300</td><td>5540</td></tr>
<tr><td>Turkey</td><td>3000</td><td>3600</td><td>4000</td></tr>
<tr><td>Israel</td><td>2656</td><td>2747</td><td>2747</td></tr>
<tr><td>Jordan</td><td>1287</td><td>1287</td><td>1449</td></tr>
<tr><td>Portugal</td><td>1204</td><td>1206</td><td>1206</td></tr>
<tr><td>Cyprus</td><td>262</td><td>250</td><td>260</td></tr>
<tr><td>Italy</td><td>11</td><td>8</td><td>8</td></tr>
</table>
</td></tr>
</table>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		Algeria | 14 | 12 | 1 (source FAO STATS) <u>Palms as crop for oil and food</u> Palms as crop for oil and food are found in the EPPO region (see table 7). Table 7. Area (ha) covered by harvested date palms in 2004, 2005 and 2006: **Country** | **2005** | **2006** | **2007** **Algeria** | 147906 | 154372 | 140000 **Morocco** | 34700 | 35500 | 36000 **Spain** | 893 | 900 | 950 **Tunisia** | 46000 | 40740 | 39830 (source FAO STATS)
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?		No alternate host is needed.
1.19. How similar are the climatic conditions that would affect pest establishment, in the PRA area and in the current area of distribution?	**Slightly – largely similar** **Uncertainty: medium**	Although no specific study has been conducted on the temperature requirements of this pest, some indications are given from the places where it is present. The pest is present in (sub)tropical areas and is also established in Jacksonville in Florida where there can be several frosts per year. Climatic conditions in the southern EPPO region (Mediterranean countries, Macaronesia, Portugal) are moderately or largely similar to those in the current area of distribution of the pest. The species is present in Western Africa (Cameroon, Congo, Equatorial Guinea, Gabon, Nigeria), and its spread may have been limited toward the north by the Sahara desert. It is expected that few palms are present along Western African coast (Mauritania and Spanish Sahara). Additionally, the natural spread of the pest has been assessed to be medium. Since the species spends most of its development phase in the trees protected from adverse climatic conditions, these do not appear to be very limiting at least at the immature stages. Major hosts of the species are palms, banana trees and sugarcane. Among these three hosts, palms have

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		the less stringent climatic requirements, particularly regarding temperatures. It is considered that the places where palms are grown in the southern EPPO region are suitable for the establishment of the pest. A detailed climate study is therefore not considered useful. Köppen distribution map is showed in Appendix 2. The climatic conditions in the northern EPPO-region are not similar to those in the current area of distribution of the pest; conditions in palm glasshouses in the northern region are considered similar.
1.20. How similar are other abiotic factors that would affect pest establishment, in the PRA area and in the current area of distribution?	**Not relevant**	Considering that the species spends most of its development phase inside plants and protected from climatic conditions, abiotic factors other than climatic conditions are probably of minor importance for establishment.
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** **Uncertainty: medium**	No reports are known of the pest being found in protected cultivation. The pest is present in tropical and subtropical regions where host plants are grown outdoors. However, there is no reason to believe that the pest could not survive and multiply on host plants under protected cultivation.
1.22. How likely is it that establishment will occur despite competition from existing species in the PRA area?	**Very likely** **Uncertainty: low**	No competitors are known in the PRA area. *M. hemipterus* can be found in association with *Rhynchophorus palmarum*, but the species are not in competition (J Peña, pers. comm., 2008; Alpízar *et al.*, 2002).
1.23. How likely is it that establishment will occur despite natural enemies already present in the PRA area?	**Very likely** **Uncertainty: low**	Larvae of predaceous families may act as natural enemies. Siqueira *et al.* (1996) identified predators of *Metamasius* spp. from several predacious families in Brazil. Several fungi may act as natural enemies but it is very unlikely that they can prevent establishment. In Florida, naturally occurring populations of the entomopathogenic fungus *Beauveria bassiana* were found to kill adults of *M. hemipterus* (Peña *et al*, 1995). However, the presence of this fungus did not prevent introduction of the pest in Florida. In general, it is very unlikely that entomopathogens or other biological control agents will prevent establishment.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.24. To what extent is the managed environment in the PRA area favourable for establishment?	**<u>Southern EPPO-region</u>: highly favourable** **<u>Northern EPPO-region</u>: slightly favourable** **Uncertainty: medium**	<u>Southern areas (Mediterranean countries, Macaronesia, Portugal)</u> In the southern part of the EPPO region, palm plants are present in nurseries, in urban and private landscapes (e.g. forests and in neighbourhoods public and private gardens). Palm trees are usually pruned which will create wounds that may attract the pest for oviposition. Incorrect irrigation procedures (e.g. over-irrigation) is considered a major problem (although it is difficult to quantify) and may create a stressed situation for the palm, such as decaying of the trunk and anoxia of the roots. These factors may attract *M. hemipterus* and make plants more vulnerable to attack. High densities of planting may also favour the establishment of the pest. The over planting of palms in areas which are not favourable for these plants (e.g. in Maspalomas in Canary Islands) is also a factor that may stress palms and increase the probability of establishment of the pest. <u>Northern areas</u> In the northern part of the EPPO region, palm plants are grown in glasshouses and are only incidentally present outdoors. Most palm trees are imported from (sub)tropical areas and are usually sold 2 –3 months after import (information obtained from a Dutch importer of palm trees) or are even sold directly via auctions (Anonymous, 2008). The pest has a relatively long life cycle of 2 to 3 months (Weissling *et al*, 2003; Brito *et al*., 2005) and the short growing period of the palm into the glasshouse will, therefore, does not aid the pest establishment. The pest may even be fully removed from the glasshouse when all plants in the infested consignment have been sold and/or destroyed. The pest will only remain, and possibly establish, when beetles mate and deposit their eggs on host plants from other consignments when the infested consignment is still present and/or when beetles remain in the glasshouse after removal of the infested consignment. Female beetles can live about 73 days according to Brito *et al* (2005) and 140 days according to Weissling *et al* (2003). Beetles emerging from an infested consignment may transfer to another consignment. The probability that this will happen will depend on the vigour of the plants and the suitability of the host. In conclusion, the probability that beetles from infested consignments will attack other palm plants present in the same glasshouse is estimated to be low to moderate. It is unlikely that large populations will build up in glasshouses because of the short growing period of most palm plants in glasshouses and the relatively long life cycle. When the infested palm is sold to end consumer and planted indoors or outdoors, it is unlikely that the pest could escape and establish since there are very few other palms present.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.25. How likely is it that existing pest management practice will fail to prevent establishment of the pest?	**Moderately likely** **Uncertainty: medium**	In urban areas, pesticides may be applied depending on the countries' legislation. The eggs and larvae are found inside the stem but can be controlled by soil drenches and spraying of systemic insecticides. In nurseries, insecticides already applied against other pests may partly control the pest. The EWG considered that where *Rhynchophorus ferrugineus* is present, imidacloprid as well as other insecticides that are applied regularly would limit the potential for establishment of *M. hemipterus*. In forests (natural areas) and residential areas, pesticides are usually not applied.
1.26. Based on its biological characteristics, how likely is it that the pest could survive eradication programmes in the PRA area?	**<u>Southern areas (outdoors):</u>** **Likely** **<u>Northern areas (protected cultivation):</u>** **Unlikely** **Uncertainty: medium**	<u>Southern areas (outdoors)</u> Eradication may be difficult for the following reasons: • Delimiting infestations would be difficult since trees can be infested without visible symptoms • Control of the pest is difficult since the eggs and larvae are found inside the stem and adults can fly. Foliar application of insecticides will, therefore, probably not be effective enough for eradication (Risco, 1967; J. Peña, pers. comm., University of Florida, August 2008) • Infested plants may be symptomless (Weissling & Giblin-Davis, 2003) and removal of visibly infested plants will be insufficient to eradicate an infestation • The pest has a wide host range and adults feed on damaged fruit and other sugary and decaying materials (Giblin-Davis *et al*., 1996a), and could re-infest treated plants. Where early detection of the pest occurs, it may possibly be eradicated by removal of visibly infested host plants and removal of all other host plants, which may be infested around the visibly infested plants, combined with other control methods (e.g. pheromone traps). <u>Northern areas (protected cultivation; the pest is very unlikely to survive outdoors)</u> Foliar application of insecticides to kill beetles in combination with soil drenches of systemic insecticides and removal of visibly infested plants and pheromone traps will probably be sufficient to eradicate the pest in a glasshouse. Otherwise complete consignments harbouring the pest can be destroyed.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.27. How likely is the reproductive strategy of the pest and the duration of its life cycle to aid establishment?	**Southern EPPO region:** **Likely** **Uncertainty: low** **Northern EPPO-region: unlikely** **Uncertainty: medium**	Outdoors in southern EPPO region Beetles lived about 140 days in experiments performed by Weissling *et al.* (2003) and 73 days in an experiment performed by Brito *et al.* (2005). According to Castrillon and Herrera (1986), adults can live up to 60 days. Females can deposit about 500 eggs (Castrillon & Herrera, 1986). The hidden life stages (eggs an larvae) inside the palm likely aid establishment of the pest. Glasshouses in northern EPPO region The relatively long life cycle (2 to 3 months) and the generally short growing period of palms in nurseries following import (usually 2 to 3 months) makes it difficult for the pest to establish (see Q 1.24)
1.28 How likely are relatively small populations to become established?	**Moderately likely** **Uncertainty: high**	In all cases, at least one mated female or one female and one male beetle will need to be present to start a breeding population. A large infested palm tree can harbour hundreds of specimens of *M. hemipterus* (e.g. Giblin-Davis *et al*, 1996b) and in case one or more infested trees are imported, it is very likely that at least one male and female beetle (or larvae) are present. It is assumed that in principle one female beetle and one male beetle are sufficient to establish a new population. The species being attracted to decaying tissues, even a small number of individuals could encounter and mate. This is, however, uncertain.
1.29. How adaptable is the pest?	**Moderate** **Uncertainty: medium**	The pest is attracted to fermenting plant tissue and may oviposit in a wide range of plant species including palms and other monocotyledons (Giblin-Davis, 2001). Three subspecies of the species have been described. The size of the adults may vary according to the host plant quality and characteristics (J Peña, pers. comm. 2008). Adaptability to climatic factors cannot be extrapolated since the species spends most of its cycle inside the palm.
1.30. How often has the pest been introduced into new areas outside its original area of distribution? (specify the instances, if possible)	**Occasionally** **Uncertainty: medium**	The original area of distribution is not mentioned in literature. The pest is widely distributed in Central and Southern America and the Caribbean (see also Q 7) and from there it has probably been introduced into: - Indonesia (Kalimantan) (CABI, 2007a) (doubtful record, see Q. 6) - The Philippines (CABI, 2007a) (doubtful record, see Q 6) - West Africa (CABI, 2007a) - Florida (Woodruf & Baranowski, 1985)

Question	Rating + uncertainty	Explanatory text of rating and uncertainty

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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) ?	**Not applicable**	Establishment is very likely.
Conclusion on the probability of establishment		Southern EPPO region: Host plants are present outdoors on commercial nurseries, in urban areas, in gardens, in forests and in the wild. Palm weevils with a similar life cycle such as *Rhynchophorus ferrugineus* and *Diocalandra frumenti* have already established in parts of the southern EPPO region. **Probability of establishment: high** **uncertainty: low** Northern EPPO region: The pest may be able to establish in commercial palm glasshouses in the northern areas of the EPPO region. The climatic conditions in the glasshouses and the presence of host plants throughout the year make establishment possible. However, the generally short growing period of imported palms together with the relatively long life cycle of the pest could make it difficult for the pest to become established after entry in a glasshouse. **Probability of establishment:** **low to moderate in commercial palm glasshouses;** **very low outdoors** **uncertainty: low to medium**
1.32. How likely is the pest to spread rapidly in the PRA area by natural means?	**Moderately likely** **Uncertainty: high**	Adults are mobile but no data is available on their natural spread. *M. hemipterus* is described an active flyer and may fly 5 –10 metres when disturbed but are not known to fly over large distances (J. Peña, pers. comm., 2008). Alpízar (undated) reported that *M. hemipterus* can fly 30 m. In Florida, the pest was discovered for the first time in 1984. Ten years after this record, it was found about 100 to 130 km north of the initial discovery (J Peña, pers. comm., 2008). In 2005, the species was found in Jackson North Florida (about 650 km from the south of Florida).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		These observations suggest a high potential of spread in areas where host plants are present. However, spread over larger distances may have resulted from movement of infested sugar cane and nursery stock (see Q 1.32). The continuous presence of palm trees in the landscape acts as a pathway for the spread of the pest.
1.33. How likely is the pest to spread rapidly in the PRA area by human assistance?	**Likely** **Uncertainty: medium**	The pest can remain undetected and be spread by movement of infested plants or material (see also Q 1.8).
1.34. Based on biological characteristics, how likely is it that the pest will not be contained within the PRA area?	**Moderately likely** **Uncertainty: high**	*M. hemipterus* is described as an active flier (Ashby, 1917 cited in CABI, 2007a). There is no precise data about flying distances, but according to Alpízar (undated) they can fly 30 m in one go. Palm trees can be infested without any (clear) external symptoms which increase the probability that the pest can spread over a large area by movement of infested nursery stock before the pest is actually detected and measures can be taken to contain or eradicate the pest. The fact that infested trees can easily remain undetected decreases the probability of containment. In the case of an early detection the pest might be eradicated or contained by removal of visibly infested trees and non-visibly infested palm trees around the visibly infested trees.
Conclusion on the probability of spread		The pest can remain undetected in nursery stock and be spread over large distances by movement of infested nursery stock and material. Sparse information is available about the natural dispersal ability of adults. **Probability of spread: moderate** Uncertainty: medium
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**		**Probability of entry**: medium to high Uncertainty: Medium **Probability of establishment**

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
comparison with PRAs on other pests.		Southern EPPO area: very high Northern EPPO area: low to moderate in commercial palm glasshouses; very low outdoors Uncertainty: medium **Probability of spread**: moderate Uncertainty: medium
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.**		The endangered area is primarily the southern part of the EPPO region (Mediterranean countries, Macaronesia, Portugal) where palm trees are grown outdoors as crops or present in the urban landscape and in forests. The following countries within the EPPO region and the neighbouring countries have these climate categories and are therefore the most at risk: Albania, Algeria, Bosnia Herzegovina, Bulgaria, Croatia, France, Greece (including Crete), Cyprus, Egypt, Israel, Italy, Jordan, Lebanon, Libya, Malta, Montenegro, Morocco, Palestine, Portugal, Republic of Macedonia, Republic of Serbia, Romania, Slovenia, Spain, Switzerland (Tessin), Syria, Tunisia, Turkey. A map is provided in Appendix 2.
2. In any case, providing replies for all hosts (or all habitats) and all situations may be laborious, and it is desirable to focus the assessment as much as possible. The study of a single worst-case may be sufficient. Alternatively, it may be appropriate to consider all hosts/habitats together in answering the questions once. Only in certain circumstances will it be necessary to answer the questions separately for specific hosts/habitats.		
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** **Uncertainty: medium**	<u>Sugar cane</u> The pest is generally considered a secondary pest of sugar cane since the beetles are attracted to dead or damaged tissue. However, cracks on cane stalks and other types of stalk damage attract the pest and are likely to result in infestation (Woodruff & Baranowski, 1985; Weissling & Giblin-Davis, 2003). Significant yield losses have been reported in literature (CABI, 2007a). For example, the pest caused heavy yield losses, up to 100%, at plantations in Ecuador in 1964. Since

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		1965, chemical traps have been used resulting in much lower yield losses and infestation levels have been reduced to less than 2% (Risco, 1967; Rossignoli, 1972). In Florida, *M. hemipterus* infested 8 to 32 % of the sugar cane stalks on 3 farms with estimated financial losses up to $ 402 per ha (Sosa *et al.*, 1997). In Florida, these high yield losses only occurred in one cultivar. The other cultivars were not significantly affected by *M. hemipterus*. <u>Banana plants</u> Damage to the pseudostem will cause early fall of the plant (Wyniger, 1962). No records of yield losses in percentages or monetary units are known from the literature. In Florida, *M. hemipterus* is considered a minor pest on bananas (J Peña, pers. comm. 2008). <u>Palms for ornamental purposes</u> Losses in palm nurseries due to weevils, including *M. hemipterus* are high in Florida (Weissling & Giblin-Davis, 2003). *M. hemipterus* usually does not kill the plants but aesthetic problems make the plants unsaleble and attacks also make the plant more vulnerable to attack by other pests. In Florida, damage by *M. hemipterus* is most severe to the palm species *Phoenix canariensis* and at least 5 nurseries are suffering from this problem with estimated losses of at least 20,000 US dollars per year per farm because of *M. hemipterus* alone (J. Peña, pers. comm. August 2008, University of Florida). The cost for replacing a very tall *Phoenix canariensis* palm (about 10 m high) attacked by *M. hemipterus* in Miami was about 10,000 US dollars (J. Peña, pers. comm. August 2008, University of Florida). Nevertheless, with proper management and no other palm weevils present, *M. hemipterus* may be a minor pest for palm nurseries (J. Peña, pers. comm. August 2008, University of Florida). <u>Palms as a crop for oil or food</u> There is no record of impacts. In palmito (*Bactris gasipaes*) infested by both *Rhynchophorus palmarum* and *M. hemipterus* in Costa Rica, Alpízar *et al*. (2002) found an increase in yield of 58% after trapping adults, and an increase of 70% in plots with pruning. From these data it is not possible to assess the impact by *M. hemipterus* alone. The pest may act as a vector of red ring of coconut caused by the nematode *Bursaphelenchus cocophilus* (=*Rhadinaphelenchus*) (Hagley, 1964 cited in CABI, 2007b) and other fungi such as *Pantoea stewarti* and *Fusarium* spp. (Sánchez *et al*., undated) . Coconut is not an important crop in the PRA area.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		In conclusion, the pest is generally considered a secondary pest of sugar cane in Florida that especially attacks wounded tissue. In the past, one cultivar has been seriously damaged but other cultivars suffered little from the pest. Significant damage has been reported in ornamental palm nurseries in Florida. Yield losses can be reduced by proper pest management practices. In Florida, palm trees and sugar cane are still being produced despite the introduction of *M. hemipterus* in the mid-eighties. In Ecuador, large yield losses were reported in sugar cane in 1964, but since 1965 the damage has been limited due to the use of chemical traps (Risco, 1967; Rossignoli, 1972).
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?	**Southern EPPO region: Low to Moderate** **Northern EPPO region: Minor** **Uncertainty: medium**	Sugar cane (*Saccharum officinarum*) Sugar cane is a minor crop in the EPPO region (see Table 5 in Q 1.17) and the effect of the pest on this crop in the PRA area will, therefore, not be discussed. Banana (*Musa* spp). Banana is a minor crop on the scale of the EPPO-region, but the Expert Working Group considered it is a very important crop locally in some countries (e.g. in Macaronesia). Some countries produce banana in the EPPO region (Table 6 in Q. 1.17). Although *M. hemipterus* is a minor pest on banana plants in Florida, the EWG considered that the impacts may be higher in the EPPO countries which produce bananas because of different production practices such as the use of green parts for livestock feed and the use of other varieties. Palms (Arecaceae) for ornament *Southern region (outdoors)* The pest is expected to have similar effects as it presently has for example in Florida on palm nurseries where it causes significant damage to palm trees in combination with other weevils. The EWG considered that the nursery industry could be damaged by this pest. Additionally, there will be costs for municipalities to remove infested ornamental palms for aesthetic and/or security reasons. The removal of one tree could cost around 500 euros (F Salomone, pers. comm. 2008), depending on plants characteristics (planting site, size, species, etc.). *Northern region (protected cultivation)* The effect is expected to be limited since it seems unlikely that large populations will build up in glasshouses and damage will probably be limited to plants already infested at the time of import

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		(see also Q 1.24). Palms as a crop for oil and food It is unknown whether the pest could negatively affect yield of date palms *(Phoenix dactylifera)* which is an important crop in Northern Africa (Anonymous, 2003) (see table 7 in Q 1.17). However, the pest usually does not kill trees and mainly infests damaged or weakened trees and, therefore, large losses of palm trees/forests are not expected. Synergistic effects with pests already present in the PRA area For both ornamental and palms as crops for oil and food, Weissling & Giblin-Davis (2003) report that the damage caused by *M. hemipterus* increases the chances of infestation by *Rhynchophorus cruentatus*. The Expert Working Group considered that the same may happen with *Rhynchophorus ferrugineus* which is present in some EPPO countries, as well as with other palm pests (e.g. *Diocalandra frumenti* in the Canary Islands, *Oryctes nasicornis, Paysandisia archon*, etc.).

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?	**With some difficulty** **Uncertainty: medium**	The pest is difficult to control because of the hidden life stages (see also Q 1.26) and because the adults are active fliers. Different control methods are discussed below. Foliar application of insecticides can kill the adults when they have left the stem tissue and are therefore exposed. Giblin-Davis *et al.* (1996 b) have shown that the following pesticides are effective against adults: acephate, chlorpyrifos, carbofuran, cyfluthrin, disulfoton, imidacloprid, isofenphos, lindane and oxamyl. Several of these pesticides are not registered in at least a large part of the PRA area (the EU-countries): acephate, carbofuran disulfoton, isofenphos and lindane are not registered any longer or will be phased out. Imidacloprid, cyfluthrin and oxamyl are registered in the EU or registration is pending (http://ec.europa.eu/food/plant/protection/evaluation/3010_rev_040808_2008.xls; website visited September 2008). Chlorpyrifos has also been registered in the EU but its use may be restricted in some countries. For instance, in the Netherlands, it may presently only be applied to potting soil prior to planting of pot plants (http://www.ctb.agro.nl/ctb_files/11299.doc; website visited August 2008). Fosmet (spraying) and Imidacloprid (usually drip irrigation) are presently being used against *R. ferrugineus* in Spain in nurseries and crops, and will probably be effective against *M. hemipterus* (Spanish Ministry of Environment, pers. comm., 2008). In general, foliar application will not be very effective because larvae are difficult to hit and adults can shelter between petioles or under plant debris. Moreover, adults are active fliers and can easily re-infest trees (Pers. comm. J. Peña, University of Florida, August 2008). Soil injections/drenches with systemic insecticides such imidacloprid are probably more effective than foliar applications. Soil-drenches with imidacloprid have given good control of larvae of the related species *Rhynchophorus ferrugineus* in (semi-)field experiments (Kaakeh, 2006). Giblin-Davis *et al* (1996b) poured an imidacloprid solution onto stems of infested *Phoenix* palms about 3 m high (crown drench) and achieved a larval mortality approaching 100% after a single application (2.5 L, 1.2 g a.i. per L). Such an application method and high dosage may not be registered in the EPPO countries. Moreover, this method is not very practical, especially for tall trees. In the Netherlands, for example, drip irrigation of imidacloprid is registered as a treatment in ornamentals grown in a closed irrigation system using a dosage of 9.8 g a.i. per 1000 plants (foliar applications are allowed at a dosage of 0.07 g.a.i per L). Experiments will be needed to determine the efficacy of drip irrigation of imidacloprid against *M. hemipterus*. Entomopathogens, like *Beauveria bassiana* and *Metarhizium anisopliae* can partially control

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		adults of *M. hemipterus*, and the nematode *Steinernema carpocapsae* can partially control larvae of *M. hemipterus* (Mesquita *et al.* 1981; Peña *et al.* 1995; Giblin-Davis *et al.*, 1996b). Both entomopathogen agents have been registered in the EU as active substances in plant protection products (http://ec.europa.eu/food/plant/protection/evaluation/3010_rev_040808_2008.xls; visited September 2008). There is (presently) no necessity to register nematodes for crop protection purposes in the EU. Application of insecticides in private and public areas (outside commercial nurseries) including biological control agents is limited or even banned in many EPPO countries. Thus, chemical control will not be possible in public and private areas in many countries due to legislation. Even if it is allowed, authorities are reluctant to apply pesticides in public areas. In such situations, the pest may be controlled by removal of (heavily) infested plants and possibly by the use of mass-trapping (Weissling & Giblin-Davis, 2003). Mass-trapping has been efficiently used in South and Central American (Risco, 1967; Rossignoli, 1972; Alpizar *et al*., 2002) plantations. In general, control is possible on commercial nurseries but complete elimination is unlikely because of the hidden life stages and the fact that infested plants can remain undetected. Giblin-Davis *et al*. (1996 b) concluded that insecticides would need to be applied frequently and over a long period for effective management.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.4. How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area?	**<u>Southern EPPO-region:</u>** **Moderate** **<u>Northern EPPO-region</u>:** **Minor** **Uncertainty: medium**	Production costs will increase due to increases in control costs for palms and *Musa* spp. For palms, control costs will increase, except where *Rhynchophorus ferrugineus* is present since control measures are implemented for this pest. In the northern regions of the PRA area, the pest can only establish in glasshouses. Pest control costs are usually much lower than other costs in glasshouse production. In the Netherlands, pest control costs are about 1 – 2 % of the total production costs (Van Woerden, 2005). Thus in the northern regions increase in production costs will be mainly caused by loss of plants due to the pest. These losses are, however expected to be mainly limited to plants that had already been infested prior to import (See Q 1.24).
2.5. How great a reduction in consumer demand is the pest likely to cause in the PRA area?	**Minor** **Uncertainty: medium**	The pest can be present without visible symptoms. Thus, consumers may buy palm trees that later show disease symptoms and may even die. This may lead to a reduction in consumer demand. For example, it was stated that the price of certain palm tree species had decreased in 2007 in the Netherlands especially because of poor quality of the palm trees caused by a short growing period after import and resulting in poorly-rooted plants being sold (Anonymous, 2008). Damage of palms in gardens and urban areas (in the southern EPPO region) may also make palm trees less popular. Generally, it is expected that these effects will be limited since the pest mainly attack trees that are already weakened or have been damaged and most trees that are being sold will not be infested by the pest due to control measures applied in the nurseries.
2.6. How important is environmental damage caused by the pest within its current area of distribution?	**Minor** **Uncertainty: low**	No environmental damage caused by *M. hemipterus* is reported.
2.7. How important is the environmental damage likely to be in the PRA area (see note for question 2.6)?	**<u>Southern EPPO-region:</u>** **Moderate** **<u>Northern EPPO-region:</u>** **Minimal**	<u>Southern EPPO-region</u> The pest can attack palms that are present as amenity trees in the whole Mediterranean area and also threaten palm forests (e.g. the Elche palm forest in Spain which is a UNESCO site) and palms in historical parks and collections. *M. hemipterus* could be a threat for the endemic *Phoenix canariensis* in the Canary Islands, or the endemic *Phoenix theophrasti* in Greece and Turkey (registered on the IUCN red list), *Chamaerops humilis* in Spain, Italy, France, Morocco (*C. humilis subsp. cerasifera*) etc. *P. canariensis* seems to be more susceptible than other palm species to borer weevils (NGIA,

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	 Uncertainty: Medium	1998). In natural forests, no treatments are implemented to control the pest. Plants of natural forests are likely to be more resistant to pests since they are not pruned or subject to inefficient irrigation practices (see Q. 1.24) and would be at risk from wounds. Nevertheless, environmental impacts have not been recorded in areas where the pest is present, the uncertainty is therefore considered to be medium. <u>Northern EPPO-region</u> Host plants are not or only incidentally present in the environment, so minimal impacts are expected.
2.8. How important is social damage caused by the pest within its current area of distribution?	**Minor** **Uncertainty: medium**	No reports are available on social damage caused by the pest in its current area of distribution. Introduction of a pest may have consequences for a farmer's income. In Florida, palm trees and sugar cane are, however, still being produced despite the introduction of *M. hemipterus* in the mid-eighties. In Ecuador, large yield losses were reported in sugar cane in 1964, but since 1965 the damage has been limited due the use of chemical traps (Risco, 1967; Rossignoli, 1972), limiting social impacts on workers.
2.9. How important is the social damage likely to be in the PRA area?	**<u>Southern EPPO-region:</u> Minor – Moderate in some parts like Canary Islands** **<u>Northern EPPO-region:</u> Minimal** **Uncertainty: Medium**	<u>Southern EPPO-region</u> The pest can attack palm trees in the environment and may, thereby, decrease the recreational value of landscapes, private gardens, historical palm sites and botanical gardens (see Q. 2.7). See Q. 2.2 for costs of removal of palms in urban areas. Damage to palms used in urban areas could lead to security problems due to the possible collapse of palm parts (e.g. crown, leaves, etc.). In Macaronesia, *Musa* spp. is an important crop and stems are used as food for livestock. Insecticides are presently not used in *Musa* plantations. If *M. hemipterus* developed into an important pest, and insecticides needed to be applied for control in *Musa* spp., this would prevent the plant parts being used to feed livestock, and could lead to a change in livelihood of farmers (see Q.2.2) (R Sanchez & F Saolomne, pers. comm., 2008). Note: In the Canary Islands, the legislation which was implemented after the introduction of *Rhynchophorus ferrugineus* and *Diocalandra frumenti* (ORDEN 29 Octubre 2007) regulates the movement of palm fronds. This management option has a social impact since palm fronds were used for artcrafts, to feed livestock and traditionally to sweep the streets.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		In La Gomera (Canary Islands), the traditional production of palm honey (guarapo) obtained from *P. canariensis* could be affected by the presence of *M. hemipterus* (R Martin & F Salomone, pers., comm, 2008). The production practices to yield the honey are assumed to make the plant vulnerable to attacks by *M. hemipterus*, leading to higher palm damages. In North African countries, date palm production is an important crop (see Q. 2.3). Impacts are not reported on this crop, but if it does occur, it could affect lifestyle. Northern EPPO-region No social damage expected.
2.10. How likely is the presence of the pest in the PRA area to cause losses in export markets?	**unlikely** **Uncertainty: low**	The EWG considered that most trees are traded within the EPPO region. The Netherlands for example import many millions of palm trees and seedlings from countries in Central and South America, from Australia and several countries in Asia. Most of these palms are re-exported to countries within the EPPO region (information obtained from Dutch companies). Trade within the EPPO region could be affected in particular countries by their imposed measures. If palms are exported, the presence of the pest may affect export markets. *Metamasius* spp. is for example listed as a regulated pest in the USA (http://www.aphis.usda.gov/import_export/plants/plant_imports/regulated_pest_list.shtml), however the USA is not an important export market for the EPPO-region.
As noted in the introduction to section 2, the evaluation of the following questions may not be necessary if the responses to question 2.2 is "major" or "massive" and the answer to 2.3 is "with much difficulty" or "impossible" or any of the responses to questions 2.4, 2.5, 2.7, 2.9 and 2.10 is "major" or "massive" or "very likely" or "certain". You may go directly to point 2.16 unless a detailed study of impacts is required or the answers given to these questions have a high level of uncertainty.		

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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** **Uncertainty: low**	In Florida, the pest has caused significant losses on palm nurseries since its introduction (see Q 2.1). It is expected that the same will happen in the EPPO region since no natural enemies are known to be present that are not present in Florida and they could not significantly suppress *M. hemipterus* populations.
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** **Uncertainty: medium**	As far as we know, biological or integrated systems are not used (see also Q 1.25) in the EPPO region. An increased use of insecticides may lead to a decline in naturally occurring enemies of certain pests and, thereby, harm existing naturally occurring control systems.
2.13. How important would other costs resulting from introduction be?	**Moderate** **Uncertainty: low**	Since it is a new pest, money will need to be spent on: - Monitoring and detection of the pest - Information brochures, advice, training and consultancy - Research: optimizing control strategies
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?	**Very unlikely** **Uncertainty: low**	No reports are known about transfer of genetic traits from palm weevils to other species.

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?	**Moderately likely** **Uncertainty: high**	M. *hemipterus* might act as a vector of fungi, bacteria and nematodes. *M. hemipterus* has been suggested to transmit spores of fungi causing leaf-bitten diseases of coconut (Ashby, 1917). Hagley (1964) collected 465 adults in Trinidad and found the nematode species *Bursaphelenchus cocophilus* which is the causal agent of red ring disease in palm trees in 13 specimens. However, no data or reports are known that have shown that *M. hemipterus* actually transmit this or other diseases. Red ring disease has a very serious economic impact on palm trees in South and Central America but is absent from the EPPO region (CABI, 2007b). The palm weevil *Rhynchophorus palmarum* is known as the vector of red ring disease (CABI, 2007b) but is not present in the EPPO-region. Sánchez *et al*. (undated) report that *M. hemipterus* may act as a vetor of *Pantoea stewarti* and *Fusarium* sp.
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.		Southern EPPO region: - palm nurseries, - Musa *spp*. plantations - palm trees planted in the landscape and in private and public areas, - palm plantations (e.g. date), - palm forests - palms in nature areas Of the following countries: Albania, Algeria, Bosnia Herzegovina, Croatia, France, Greece (including Crete), Cyprus, Egypt, Israel, Italy, Lebanon, Malta, Montenegro, Morocco, Palestine, Portugal, Serbia, Slovenia, Spain, Switzerland (Tessin), Syria, Tunisia, Turkey (see Appendix 2). Northern EPPO region: - greenhouses that grow palm trees
Degree of uncertainty **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**		The following uncertainties have been identified: - hosts of the species (in particular whether date palms are host) - dispersal capacity - the impacts on *Musa* spp. in the EPPO region - the impacts on natural forests of palms - the probability of disease transmission.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
uncertainty (including identifying and prioritizing of additional data to be collected and research to be conducted) 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.**		
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.		<u>Pathway I "Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp., other than seeds, seedlings and plants *in vitro* from areas where the pest occurs</u> Palms are imported regularly and in large numbers from countries where *Metamasius hemipterus* is present. The pest has been intercepted at least four times since 2006. The pest may however go undetected during visual import inspections since larvae and pupae can be present without any visual symptoms. **Probability of entry: medium to high** <u>Pathway II "Movement of palm or *Musa* spp. plants with passengers"</u> **Probability of entry: very low to low** <u>Pathway III "Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp sugar cane, and banana fruits" (No detailed study of the entry potential as a hitchhiker was possible)</u> **Probability of entry: low to moderate**

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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 species spends most time of its life cycle inside the stem of the palms where it is protected from adverse conditions. Another palm weevil *Rhynchophorus ferrugineus* has established in several Mediterranean countries. For these reasons it is very likely that *M. hemipterus* can establish outdoors in the Southern EPPO region. In the Northern EPPO region no or only incidental host plants are present outdoors. The climate in the Northern EPPO region is also not comparable to that in the present area of distribution. The pest may, however, establish in palm tree glasshouses. **Probability of establishment:** **Southern EPPO-region:** **- high (outdoors and protected cultivation)** **Northern EPPO-region:** **- very low (outdoors)** **- low to moderate (protected cultivation)**
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.		Areas where palms are grown outdoors (Mediterranean area, Portugal, Macaronesia) are most at risk. The pest usually does not kill the infested palm tree but lead to a loss of aesthetic value. It may also weaken the tree making it more vulnerable to attack by other pests, for example *Rhynchophorus* spp. *M. hemipterus* is also a pest of *Musa* spp. Environmental impacts might be expected, particularly on endemic palms (*Phoenix canariensis* in Canary islands, and *Phoenix theophrasti* in Greece). The pest may establish in palm glasshouses in the Northern EPPO region but its impact is assessed to be low since palm trees are only grown for a short period (8- 12 weeks) in glasshouses before being sold. **The potential economic impact:** **Southern EPPO-region:** **- moderate (outdoors and protected cultivation)** **Northern EPPO-region:** **- minor (protected cultivation)**

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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 pest is presently not listed as a quarantine pest in the EPPO region or in the European Union. The pest has been shown to cause significant damage to ornamental palm trees in Florida after its introduction. It is expected that similar damage will occur in the Southern EPPO region once introduced. Recent interceptions in 2006 and 2008 and the difficulties in visually detecting the pest indicate a moderate to high probability of introduction. For these reasons management options may need to be considered to decrease the probability of introduction.

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?	**No**	
Pathway 1		**Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp, other than seeds, seedlings and plants *in vitro* from areas where the pest occurs**
3.2. Is the pathway that is being considered a commodity of plants and plant products? **If yes, go to 3.11,** **If no, go to 3.3**	**Yes**	
3.3. Is the pathway that is being considered the natural spread of the pest? (see answer to question 1.32) **If yes, go to 3.4,** **If no, go to 3.9**		
3.4. Is the pest already entering the PRA area by natural spread or likely to enter in the immediate future? (see answer to question 1.32)		

3.5. Is natural spread the major pathway? **If yes, go to 3.29,** **If no, go to 3.6**		
3.6. Could entry by natural spread be reduced or eliminated by control measures applied in the area of origin? **If yes, possible measures: control measures in the area of origin, go to 3.7**		
3.7. Could the pest be effectively contained or eradicated after entry? (see answer to question 1.26, 1.34) **If yes, possible measures: internal containment and/or eradication campaign, Go to 3.8**		
3.8. Was the answer "yes" to either question 3.6 or question 3.7? **If yes, go to 3.38,** **If no, go to 3.44**		
3.9. Is the pathway that is being considered the entry with human travellers? **If yes, possible measures: inspection of human travellers, their luggage, publicity to enhance public awareness on pest risks, fines or incentives. Treatments may also be possible, Go to 3.29** **If no, go to 3.10**		
3.10. Is the pathway being considered contaminated machinery or means of transport? **If yes, possible measures: cleaning or disinfection of machinery/vehicles**		

3.11. If the pest is a plant, is it the commodity itself? **If yes, go to 3.29,** **If no (the pest is not a plant or the pest is a plant but is not the commodity itself), go to 3.12**	**No**	
3.12. Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest? **if appropriate, list the measures and identify their efficacy against the pest of concern, Go to 3.13**	**Yes**	In the EU Directive 2000/29/EC Annex IV A I point 39, there are generic provisions for trees and shrubs requiring inspections at appropriate times for signs or symptoms of *inter alia* insects. Such general requirements may guarantee some protection against *M. hemipterus* (see also Q 3.13). No information from other EPPO countries was obtained. In Tunisia and Israel, import of ornamental palms or parts of palms is prohibited. In Algeria, import of palm trees from areas where *Fusarium oxysporum* var. *albedinis* is present is prohibited, but the geographical area of this pest is different from the one of *M. hemipterus*.
3.13. Can the pest be reliably detected by a visual inspection of a consignment at the time of export, during transport/storage or at import? **If yes, possible measure: visual inspection, go to 3.14**	**Yes**	The pest may be detected as was the case for interceptions in the Netherlands and Belgium. However, eggs and larvae are hidden in the petiole, trunk and stems making it difficult to detect in the early stages of invasion. They may go undetected using visual inspections only. Therefore, this measure is not considered sufficient.
3.14. Can the pest be reliably detected by testing (e.g. for pest plant, seeds in a consignment)? **If yes, possible measure: specified testing, go to 3.15**	**No**	
3.15. Can the pest be reliably detected during post-entry quarantine? **If yes, possible measure: import under special licence/permit and post-entry quarantine, go to 3.16**	**No**	The Panel on Phytosanitary Measures considered that such measure was not practical for commercial trade of palm trees or *Musa* spp. In addition, the following uncertainties were noted: <u>Duration of the period of post-entry quarantine</u> The duration of the life cycle of the pest is considered to be 2-3 months (Weissling *et al*., 2003, Brito *et al*., 2005). The life cycle may be longer than 2-3 months at relatively low temperatures, e.g. during winter time and a longer post-entry quarantine period may be needed for cooler periods or regions. Brito *et al*. (2005) determined average life cycle duration of 62 days at 27ºC under laboratory conditions in sugar cane pieces. Woodruff & Baranowski (1985) described a life cycle of about 9 weeks but did not mention the environmental conditions. No data

		is available on the effect of temperature on the duration of the life cycle and it is, therefore, difficult to indicate the minimum duration of the quarantine period during cooler periods of the year (e.g. winter time) and in non-heated glasshouses. Period of the post-entry quarantine according to the place of entry The life cycle duration may vary according that the whether the host plants are imported into heated/non heated glasshouses. If host plants are introduced into non-heated glasshouses in the southern hemisphere, the duration of the life cycle may depend when in the year the host plants are imported. Inappropriateness of the use of pheromone traps The Panel on Phytosanitary Measures considered that the use of pheromone traps is not feasible in areas where other palm weevils are present since they can also be attractedby the traps. Limitation of the use of pheromone traps It may, however, be possible that during the quarantine period adults may remain inside the trees without being attracted by the pheromone traps, and the infested plants may not show any clear symptoms. Such a situation has occurred with *Rhynchophorus ferrugineus* infestations on *P. dactylifera* (Government of Canary Islands, pers. comm. 2008). Symptoms of attacks by *M. hemipterus* are, however, more obvious on the plant surface than on *R. ferrugineus* and usually develop within 3 months when they can be detected by trained personnel (J Peña, pers. comm., 2008). There are uncertainties on the reliability of this measure. Lightly infested trees may not show clear symptoms after a 3-months period and beetles may not be caught in the pheromone traps.
3.16. Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)? **If yes, possible measure: specified treatment, go to 3.17**	**No** **Presently not.**	Chemical treatment Treatments with fumigants are probably effective, but no data is available on their efficacies. Thermal treatment Thermal treatments like hot water treatments that will kill larvae and adults found inside the stem will have negative effects on the viability of the plant and will, therefore, not be a good option.

		Irradiation The dosages needed to kill insects could cause damage to the plants (Hansen & Hara, 1994). Experimental treatments such as X-rays, sonar, and acoustic methods may be an option for the future but are currently not available.
3.17. Does the pest occur only on certain parts of the plant or plant products (e.g. bark, flowers), which can be removed without reducing the value of the consignment? (This question is not relevant for pest plants) **If yes, possible measure: removal of parts of plants from the consignment, go to 3.18**	**No**	
3.18. Can infestation of the consignment be reliably prevented by handling and packing methods? **If yes, possible measure: specific handling/packing methods, go to 3.19**	**No**	
3.19. Could consignments that may be infested be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry, and can such limitations be applied in practice? **If yes, possible measure: import under special licence/permit and specified restrictions, go to 3.20**	**No**	
3.20. Can infestation of the commodity be reliably prevented by treatment of the crop? **If yes, possible measure: specified treatment and/or period of treatment, go to 3.21**	**No**	Available measures are not totally reliable. Chemical control Giblin-Davis *et al*. (1996b) demonstrated that adults of *M. hemipterus* were controlled by on-label rates of acephate, carbofuran, chlorpyrifos, cyfluthrin, disulfoton, imidacloprid, isofenphos, lindane or vydate. Foliar application of insecticides are, however, not totally reliable (see Q 2.3). In Florida, insecticides are regularly applied at palm nurseries but this cannot completely prevent infestation (J. Peña, pers. comm., December 2008). Trunk injection or soil drenches with systemic insecticides like imidacloprid may prevent infestation but presently no data is available about the efficacy of these methods

		against *M. hemipterus*. Experimental research is needed to test the efficacy of these methods. Mass trappings Mass-trapping ("attract and kill") is being used in sugar cane plantations of Central and Southern America to control the pest (Rossignoli, 1972; Oehlschlager *et al*., 2002). The usual practice is the placement of 30 insecticide-laced sugarcane-containing bamboo traps per ha at time of planting (Oehlschlager *et al*., 2002). Since the use of traps, infestation levels in sugar cane have been reduced to less than 2% (Risco, 1967; Rossignoli, 1972). Alpízar *et al*. (2002) also showed a large decrease in infestation levels in *Chamaerops humilis* infested by *Rhynchophorus palmarum* and *M. hemipterus* due to the use of traps. Thus trapping can significantly reduce infestation levels but not completely prevent infestation.
3.21. Can infestation of the commodity be reliably prevented by growing resistant cultivars? (This question is not relevant for pest plants) **If yes, possible measure: consignment should be composed of specified cultivars, go to 3.22**	**No**	

3.22. Can infestation of the commodity be reliably prevented by growing the crop in specified conditions (e.g. protected conditions such as screened greenhouses, physical isolation, sterilized growing medium, exclusion of running water, etc.)? **If yes, possible measure: specified growing conditions, go to 3.23**	**Yes**	Growing the plants under net screens or in screened glasshouses can prevent infestation of the host plants. This method is applied for *Rhynchophorus ferrugineus* (EU, 2007), and could therefore be used for *M. hemipterus*. Adults of *M. hemipterus* are 12-18 mm in length, the maximum mesh size of the net should be sufficient to prevent the entry of the weevil (adult length measured by J Peña, 2008) and the material should be resistant to the weevil mandibles. Pheromone traps should be placed at the production site (5 per ha recommended by the EWG, see also Oehlschlager *et al.*, 2002). Symptoms develop usually within 3 months after infestation and can be detected by trained personnel. Symptoms become clearer between 3 and 6 months (J Peña, pers. comm. 2008). For these reasons, 6 months prior to export is considered to be sufficient. Plants showing any of the following symptoms should be inspected intensively for insects and if required, by destructive sampling: - plants producing amber-coloured or gummy exudates - chewed plant tissue issuing from the galleries at the base of fronds - exit holes - pupal cocoons on the outside of the trunk.
3.23. Can infestation of the commodity be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages? **If yes, possible measure: specified age of plant, growth stage or time of year of harvest, go to 3.24**	**Not applicable**	
3.24. Can infestation of the commodity be reliably prevented by production in a certification scheme (i.e. official scheme for the production of healthy plants for planting)? **If yes, possible measure: certification scheme, go to 3.25**	**Not applicable**	

3.25.Is the pest of very low capacity for natural spread? **If yes, possible measures: pest freedom of the crop, or pest-free place of production or pest-free area, Go to 3.28** **If no, go to 3.26**	**No**	
3.26.Is the pest of low to medium capacity for natural spread? **If yes, possible measures: pest-free place of production or pest free area, Go to 3.28** **If no, go to 3.27**	**Yes**	Possible measures are: - Pest free places of production as guaranteed by a buffer zone or pest free production site guaranteed by growing in protection (screens) (see Q 3.22). or - Pest free areas. See ISPM n°4 *Requirements for the establishment of pest free areas* and ISPM n°10 *Requirements for the establishment of pest free places of production and pest free production sites*. It should be noted that data is lacking concerning the potential dispersal capacity of *M. hemipterus*. Beetles can fly 30 metres in one go (see Q 1.34) but it is unknown how far beetles can fly for example when no suitable host plant or habitats are present in the immediate vicinity.
3.27.The pest is of medium to high capacity for natural spread **Possible measure: pest-free area, go to 3.28**	**No**	
3.28.Can pest freedom of the crop, place of production or an area be reliably guaranteed? **If no, possible measure identified in questions 3.25-3.27 would not be suitable, go to 3.29**	**Yes**	The following measures are proposed to guarantee pest freedom of the crop or place of production: <u>Pest free production sites guaranteed by complete physical protection</u> For details see Q. 3.22. <u>or</u> <u>Pest free production places guaranteed by a buffer zone</u> The minimum size of a buffer zone is difficult to indicate since there is only one report of the pest flying 30 m in one go (see Q 3.26). Beetles do not seem to fly over large distances (see Q 3.26) and, therefore, the EWG assumes that a buffer zone of 1 km is possibly sufficient. The EWG considered that the pest free place of production should be inspected and free of pest for at least 6 months before shipment. The buffer zone should be preferably free of host plants (however they

		could be used as monitoring plants). Regular visual inspections of the production place and buffer zone, carried out at least every three months and immediately prior to export, will be needed to guarantee the pest freedom of the production place. In case the pest is found in the buffer zone, measures should be taken to eradicate the pest.
3.29. Are there effective measures that could be taken in the importing country **If yes, possible measures: internal surveillance and/or eradication campaign, go to 3.30**	**No**	Internal surveillance and/or eradication campaign are not considered sufficient to prevent introduction of the pest. The probability of establishment is highest near host plant nurseries with large numbers of imported trees. Phytosanitary surveillance at these nurseries and in their surroundings will increase the likelihood of detecting introduced populations at an early stage when it is still possible to eradicate the pest. Pheromone traps could be placed within the importing nursery in countries where *Rhynchophorus ferrugineus* is absent, otherwise *R. ferrugineus* could be attracted to these traps. Based on observations of the behaviour of beetles, which can fly 30 metres (see Q 3.26), it is considered sufficient to perform an initial survey in the nurseries up to about 200 m around the nursery if host plants are present in this zone (see also Q 3.28). Populations could however also establish elsewhere (near garden centres or even in private gardens, or cities) and it is impossible to perform surveys throughout the whole PRA area.
3.30. Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest? List them. **If yes, go to 3.31** **If no, go to 3.38**	**Yes**	• Visual inspection of the consignment (Q 3.13) • Complete physical protection of the production site (Q 3.22 and Q 3.28) • Pest free areas (Q 3.26) • Pest free production place guaranteed by a buffer zone (Q 3.26 and 3.28)

3.31. Does each of the individual measures identified reduce the risk to an acceptable level? **If yes, go to 3.34** **If no, go to 3.32**	**No**	
3.32. 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? **If yes, go to 3.34** **If no, go to 3.33**	**No**	The following measures do not reduce the risk to an acceptable level on their own: • Visual inspection of the consignment (Q 3.13) Treatment of the crop has been considered as not reducing the risk to an acceptable level. Visual inspection is already combined with other options.
3.33. If the only measures available reduce the risk but not down to an acceptable level, such measures may still be applied, as they may at least delay the introduction or spread of the pest. In this case, a combination of phytosanitary measures at or before export and internal measures (see question 3.29) should be considered. **Go to 3.34**		The measures identified in Q. 3.30 reduce the level to an acceptable level.

3.34.Estimate to what extent the measures (or combination of measures) being considered interfere with trade. **Go to 3.35**		Information is lacking about the prevalence of the pest at nurseries in Central and Southern America from which EPPO countries import palm trees. It is, therefore, difficult to assess to what extent the measures will interfere with trade. The option "pest free areas" will have the largest effect on international trade since this option on its own (with no alternatives) prohibits trade from areas where the pest is present. The option "pest free production places" is less restrictive but this requirement may be difficult to fulfill in areas with high pest prevalence. Growing the plants under complete physical protections for 3 or 6 months prior to export will require additional investments by the growers but may be applicable in areas with a high pest prevalence. The post-entry quarantine is not considered a practical measure with information available so far (see Q. 3.15) Importing nurseries will have to invest in a quarantine area (e.g. building of net screens) and the growing period will be prolonged which will increase the production costs significantly (e.g. heating costs in glasshouses of northern EPPO countries).

3.35.Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences. **Go to 3.36**		Pest free areas This option would affect imports from areas where the pest occurs, particularly South and Central America. Palms may be imported from other countries instead e.g. from Asia. In the short term this option may, however, lead to increase of prices for palms because at present large numbers are being imported from Central and South America. Furthermore, it will have a major negative effect on companies within the EPPO countries that mainly import palms from South and Central America. It may also increase the price of palm plants within the EPPO region and thus have negative consequences for consumers within the EPPO region. Pest free production places guaranteed by a buffer zone This option may affect the import of host plants from countries where the pest is present at high densities because it may require large investments or it may even be impossible to establish pest free places in such areas. A decrease in import from these countries may lead to higher prices for palm trees in the EPPO region and have a negative effect on companies that mainly import palms from South and Central America. Removal of host plants in the buffer zone would have environmental consequences. Pest free production places guaranteed by complete physical protection In areas where it is not possible to establish pest free production places, it may be an option to use physical protection on production sites for 3 months. This option may have less consequence for trade than the options "pest free areas" and "pest free production places" and thereby fewer undesirable social consequences (see also Q 3.36).
3.36.Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences? **If yes, For pathway-initiated analysis, go to 3.39** **For pest-initiated analysis, go to 3.38** **If no, go to 3.37**	**Yes**	Pest free areas or Pest free production places guaranteed by a buffer zone or Pest free production sites guaranteed by complete physical protection
3.37.Envisage prohibiting the pathway **For pathway-initiated analysis, go to 3.43 (or 3.39),** **For pest-initiated analysis go to 3.38**	**No**	

3.38.Have all major pathways been analyzed (for a pest-initiated analysis)? **If yes, go to 3.41,** **If no, Go to 3.1 to analyze the next major pathway**	**No**	
Pathway II		**Movement of palm or *Musa* spp. plants with passengers from areas where the pest occurs**
Is the pathway that is being considered a commodity of plants and plant products? **If yes, go to 3.11,** **If no, go to 3.3**	**No**	
Is the pathway that is being considered the natural spread of the pest? (see answer to question 1.32) **If yes, go to 3.4,** **If no, go to 3.9**	**No**	
3.9 Is the pathway that is being considered the entry with human travellers? **If yes, possible measures: inspection of human travellers, their luggage, publicity to enhance public awareness on pest risks, fines or incentives. Treatments may also be possible, Go to 3.29** **If no, go to 3.10**	**Yes**	Possible measures are: - publicity to enhance awareness. - the requirement of a phytosanitary certificate for passengers traveling with host plants. - prohibition on the carriage of living host plants. - inspection of luggage.
3.29. Are there effective measures that could be taken in the importing country (surveillance, eradication) to prevent establishment and/or economic or other impacts? **If yes, possible measures: internal surveillance and/or eradication campaign, go to 3.30**	**No**	Populations could establish anywhere in private gardens or in cities and it is impossible to perform surveys throughout the whole PRA area.

3.30. Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest? List them. **If yes, go to 3.31** **If no, go to 3.38**	**Yes**	Possible measures are: - publicity to enhance awareness. - the requirement of a phytosanitary certificate for passengers traveling with plants of palms and *Musa* spp. - prohibition on the carriage of living plants of palm and *Musa* spp. plants. - inspection of luggage.
3.31 Does each of the individual measures identified reduce the risk to an acceptable level? **If yes, go to 3.34** **If no, go to 3.32**	**Yes**	Possible measures are: - the requirement of a phytosanitary certificate for passengers traveling with plants of palms and *Musa* spp. - prohibition on the carriage of living host plants.
3.34 Estimate to what extent the measures (or combination of measures) being considered interfere with trade. **Go to 3.35**		The measures do not interfere with trade.
3.35 Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences. **Go to 3.36**		Inspection of luggage and requirement of a PC will imply more resources to be made available for inspection. This has a cost for importing countries. Palm enthusiasts might be unhappy with these measures. Nevertheless, these measures have beneficial effects in raising awareness on the dangers of bringing plants from an area to another.
3.36 Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences? **If yes, For pathway-initiated analysis, go to 3.39** **For pest-initiated analysis, go to 3.38** **If no, go to 3.37**	**Yes**	Possible measures are: - The requirement of a phytosanitary certificate for passengers traveling with host plants - prohibition on the carriage of living host plants.
3.37 Envisage prohibiting the pathway **For pathway-initiated analysis, go to 3.43 (or 3.39),** **For pest-initiated analysis go to 3.38**	**Yes**	

3.38 Have all major pathways been analyzed (for a pest-initiated analysis)? **If yes, go to 3.41,** **If no, Go to 3.1 to analyze the next major pathway**	**Yes**	
3.41 Consider the relative importance of the pathways identified in the conclusion to the entry section of the pest risk assessment **Go to 3.42**		Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp., other than seeds, seedlings and plants *in vitro* from areas where the pest occurs: moderate to high risk Movement of palm or *Musa* spp. plants with passengers from areas where the pest occurs: low risk Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp sugar cane, and banana fruits: low to moderate risk
3.39 For a pathway-initiated analysis, compare the measures appropriate for all the pests identified for the pathway that would qualify as quarantine pests, and select only those that provide phytosanitary security against all the pests. **Go to 3.41**	**Not applicable**	

3.42 Consider the relative importance of the pathways identified in the conclusion to the entry section of the pest risk assessment **Go to 3.42**		A phytosanitary certificate will be needed in case of options to attest that the requirements have been fulfilled: <u>Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp. other than seeds, seedlings and plants *in vitro* from areas where the pest occurs</u> - Pest free areas (see ISPM no. 4), - Pest free production places guaranteed by a buffer zone (for details see Q 3.28), and - Pest free production sites guaranteed by complete physical protection (for details see Q 3.28 and Q 3.22) <u>Movement of palm or *Musa* spp. plants with passengers from areas where the pest occurs:</u> - the requirement of a phytosanitary certificate for passengers travelling with host plants Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp sugar cane, and banana fruits Possible measures: list the pest as an organism whose introduction into countries should be prohibited (allowing countries to take action when the pest is detected in any type of consignment).
3.40 All the measures or combination of 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. **Go to 3.43**		

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.**	60	<u>Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spp. other than seeds, seedlings and plants *in vitro* from areas where the pest occurs</u> The following options are considered sufficiently effective: Pest free areas (see ISPM no. 4) Or Pest free production places guaranteed by a buffer zone (for details see Q 28) Or Pest free production sites guaranteed by complete physical protection (for details see Q 3.28 and Q 3.22) <u>Uncertainties:</u> - The size of the buffer zone needed to guarantee a pest free production place - If newly formed adults will leave the trees if traps are placed at the production site - Post entry quarantine reliability <u>Movement of palm or *Musa* spp. plants with passengers from areas where the pest occurs:</u> Possible measures are: - the requirement of a phytosanitary certificate for passengers traveling with host plants - prohibition on the carriage of living host plants. <u>Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp sugar cane, and banana fruits</u> Possible measures: list the pest as a organism whose introduction into countries should be prohibited (allowing countries to take action when the pest is detected in any type of consignment).

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Appendix 1

Data on trade on ornamental plants imported within the European Union

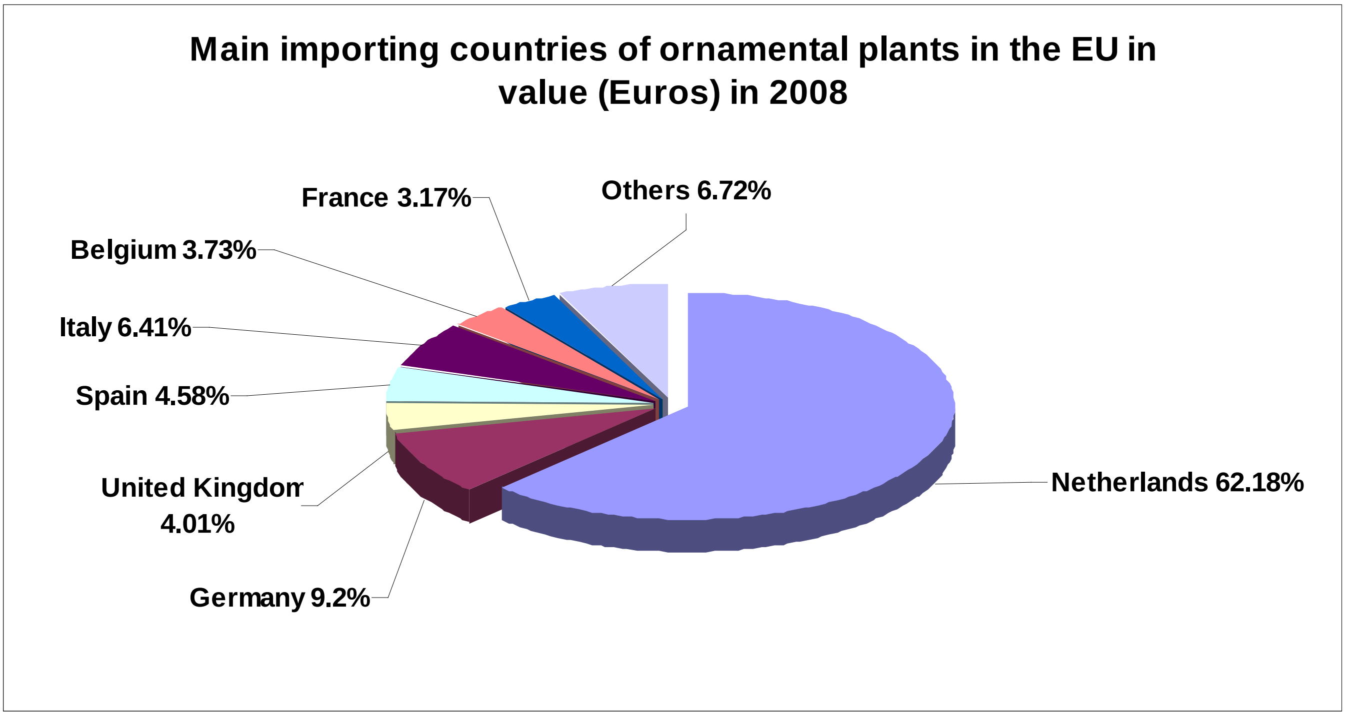
Data on imports of ornamental plants within the European Union has been gathered on the Eurostat website (http://epp.eurostat.ec.europa.eu/portal/page/portal/external_trade/data/database).
Data is available in “External trade, detailed data”, “EU trade since 1995 by CN8”, the selected codes were 06029045, 06029049, 06029050, 06029051, 06029055, 06029059, 06029070 corresponding to categories of plants for planting into which palms and *Musa* spp. could fall. These figures correspond to import from third countries.

The figures are the following in volumes and value (euro):

Volumes of plants for planting imported into the European Union in 2007 and 2008 in value (Euros), countries are ordered by importance of values for 2007:

REPORTER/PRODUCT	2007	%	2008	%
Netherlands	56129806	58.17	60385366	62.18
Germany	10085585	10.45	8935628	9.20
United Kingdom	6181049	6.41	3898431	4.01
Spain	5735615	5.94	4443360	4.58
Italy	5509604	5.71	6226787	6.41
Belgium	3253520	3.37	3626139	3.73
France	2869967	2.97	3079195	3.17
Cyprus	1852746	1.92	1880951	1.94
Denmark	1700531	1.76	1705030	1.76
Ireland	823900	0.85	847790	0.87
Portugal	795662	0.82	592611	0.61
Czech Republic	323086	0.33	376480	0.39
Poland	311268	0.32	221988	0.23
Hungary	283399	0.29	313160	0.32
Bulgaria	137451	0.14	51846	0.05
Sweden	135977	0.14	116154	0.12
Latvia	94119	0.10	2684	0.00
Austria	79079	0.08	76434	0.08
Slovenia	66173	0.07	51713	0.05
Greece	52086	0.05	41602	0.04
Finland	18658	0.02	85750	0.09
Malta	15888	0.02	8454	0.01
Lithuania	15331	0.02	21427	0.02
Romania	11019	0.01	69064	0.07
Slovakia	8774	0.01	59546	0.06
Estonia	0	0.00	0	0.00
Luxembourg	0	0.00	0	0.00
Total	96490293	100	97117590	100

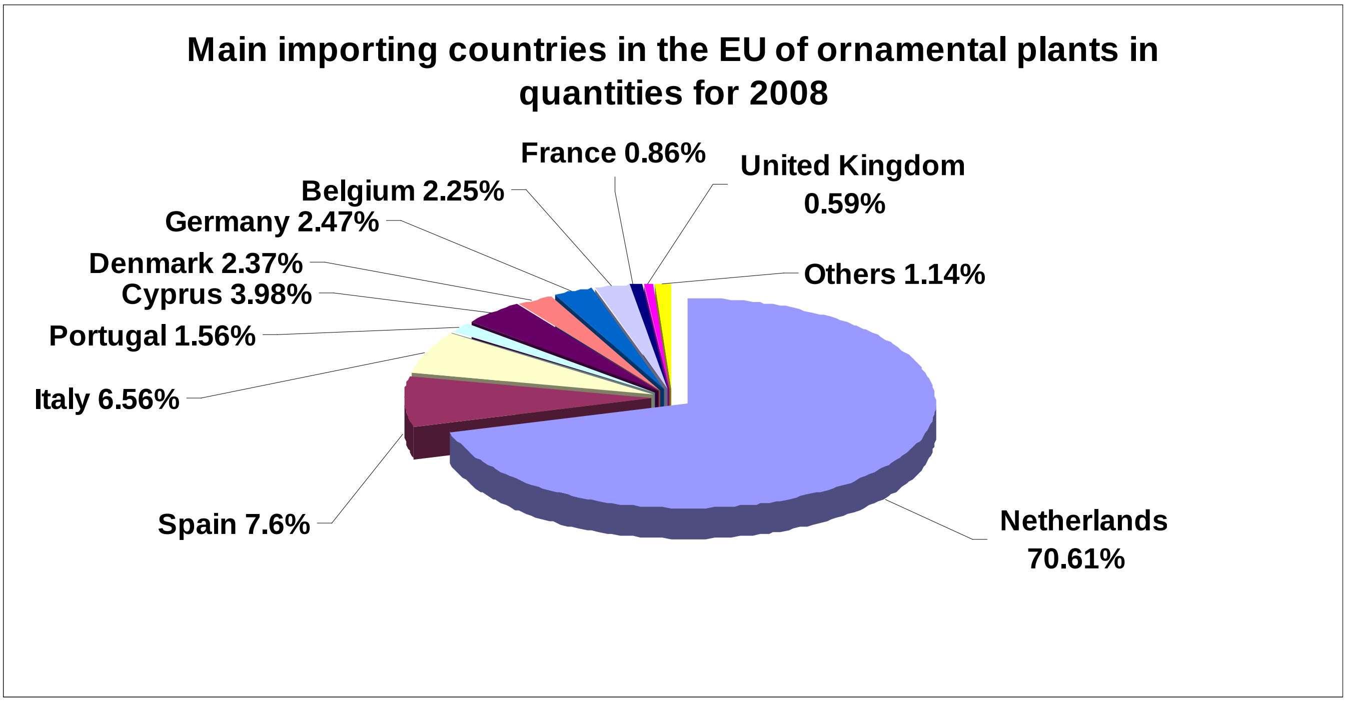
Graph of the percentages of value (in Euros) of ornamental plants imported in the main UE countries for 2008:



Quantities of plants for planting imported into the European Union in 2007 and 2008 in quantities (by 100 kg), countries are ordered by importance of volumes for 2007:

REPORTER/PRODUCT	2007	%	2008	%
Netherlands	347701	55.49	407586	70.61
Spain	94785	15.13	43882	7.60
Italy	50073	7.99	37849	6.56
Portugal	39599	6.32	8993	1.56
Cyprus	23824	3.80	22997	3.98
Denmark	16487	2.63	13685	2.37
Germany	16308	2.60	14275	2.47
Belgium	13384	2.14	12994	2.25
France	6912	1.10	4945	0.86
United Kingdom	6038	0.96	3398	0.59
Poland	2574	0.41	386	0.07
Bulgaria	1851	0.30	386	0.07
Latvia	1501	0.24	2	0.00
Ireland	1285	0.21	1344	0.23
Slovenia	1147	0.18	589	0.10
Czech Republic	987	0.16	662	0.11
Sweden	417	0.07	837	0.15
Greece	396	0.06	71	0.01
Hungary	368	0.06	553	0.10
Malta	328	0.05	3	0.00
Romania	299	0.05	1054	0.18
Slovakia	160	0.03	253	0.04
Austria	146	0.02	196	0.03
Lithuania	7	0.00	268	0.05
Estonia	0	0.00	0	0.00
Luxembourg	0	0.00	0	0.00
Total	626587	100	577208	100

Graph of the percentages of quantities (by 100 kg) of ornamental plants imported in the main UE countries for 2008:



The Netherlands is the main importing country of ornamental plants, importing about 62% in value, and 70% in quantity. Then Spain, Italy, Portugal, Cyprus, Denmark, Germany, Belgium, France and the United Kingdom play a small role in the import of ornamental plants.

Appendix 2

Climatic suitability of *Metamasius hemipterus*

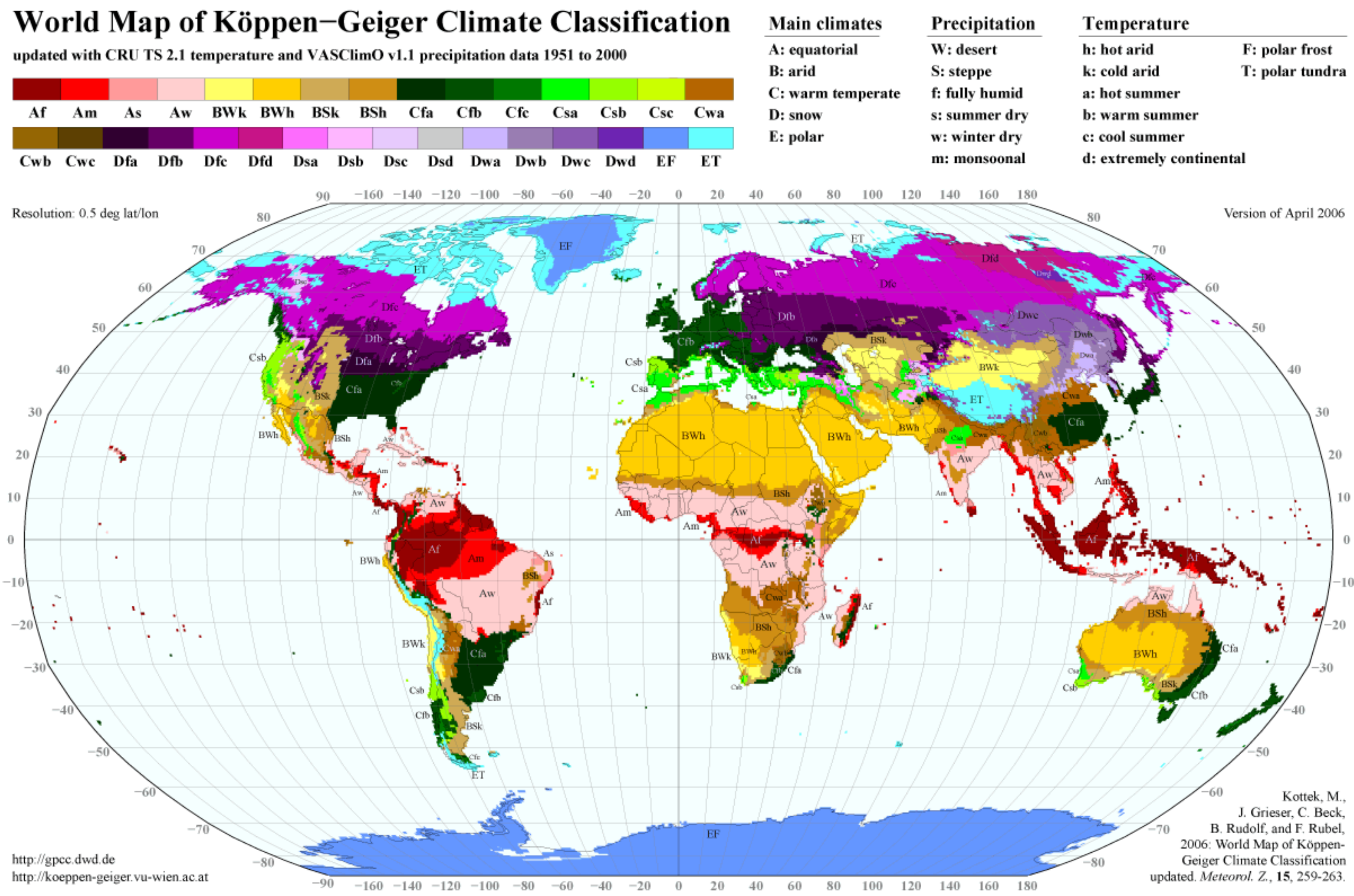
The pest is present in (sub)tropical areas. Temperature requirements of the pest are unknown. The species is also established in Jacksonville in Florida where there can be several frosts per year. Climatic conditions in the southern EPPO region (Mediterranean countries, Macaronesia, Portugal) are moderately or largely similar to those in the current area of distribution of the pest.

The species is present in Western Africa (Cameroon, Congo, Equatorial Guinea, Gabon, Nigeria), and its spread should have been limited north by the Sahara desert. It is expected that few palms are present along Western African coast (Mauritania and Spanish Sahara). Additionally, the natural spread of the pest has been assessed to be medium.

Since the species spends most of its development phase in the trees protected from adverse climatic conditions, these do not appear to be very limiting at least at the immature stages. Major hosts of the species are palms, banana trees and sugarcane. Among these three hosts, palms have the less stringent climatic requirements, particularly regarding temperatures. It is considered that the places where palms are grown in the southern EPPO region are suitable for the establishment of the pest. A detailed climate study is therefore not considered useful.

The climatic conditions in the northern EPPO-region are not similar to those in the current area of distribution of the pest; conditions in palm glasshouses in the northern region are considered similar.

Köppen World Map (http://koeppen-geiger.vu-wien.ac.at/)



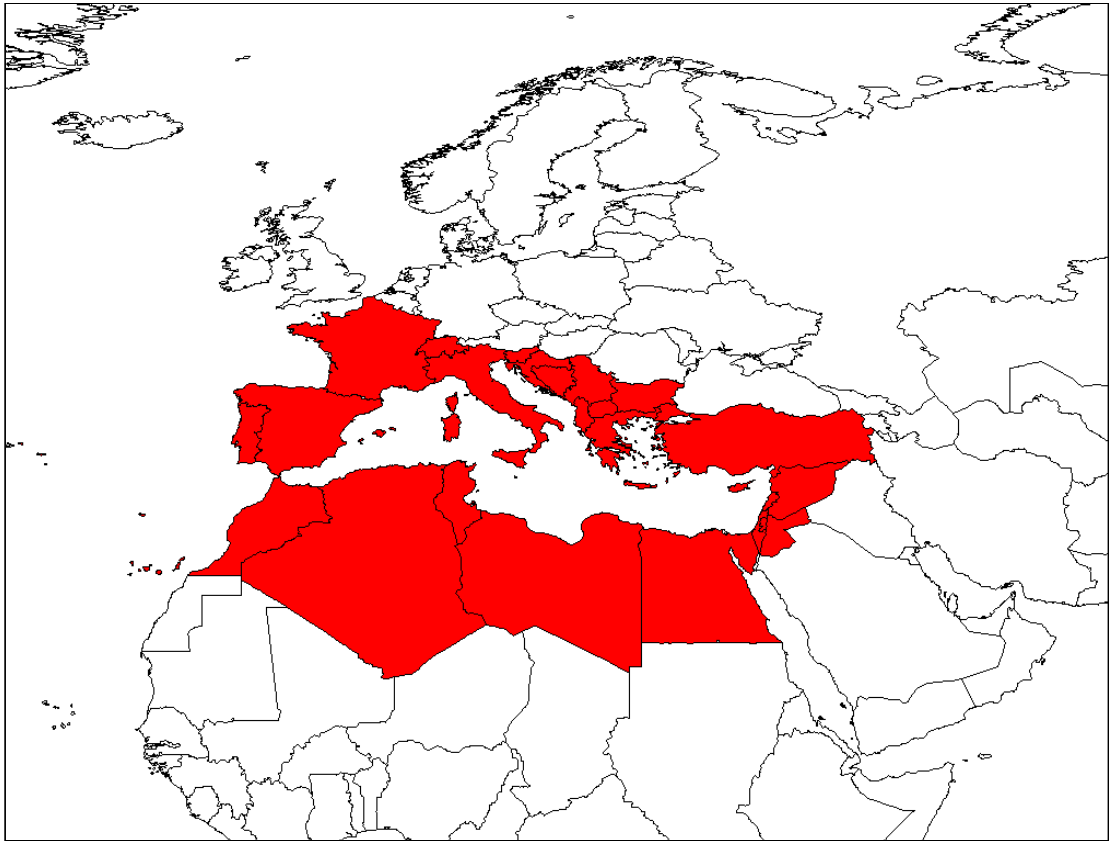
Within the EPPO region, the following climate categories are considered to be suitable for palms:

- Csa: warm temperate, summer dry, hot summer
- BWh: arid, desert, hot arid

- BSh: arid, steppe, hot arid
- BSk: arid, steppe, cold arid.

The following countries within the EPPO region and the neighbouring countries have these climate categories and are therefore at risk:
Albania, Algeria, Bosnia Herzegovina, Bulgaria, Croatia, France, Greece (including Crete), Cyprus, Egypt, Israel, Italy, Jordan, Lebanon, Libya, Malta, Montenegro, Morocco, Palestine, Portugal, Republic of Macedonia, Republic of Serbia, Romania, Slovenia, Spain, Switzerland (Tessin), Syria, Tunisia, Turkey.

Thee countries are represented in red on the following map:



EPPO countries considered the most at risk from *Metamasius hemipterus*.