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Report of a Pest Risk Analysis

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

Pest: *Metamasius hemipterus* L. (= *Metamasius sericeus* (Olivier))

PRA area: EPPO region

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STAGE 1: INITIATION

Reason for doing 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).

Taxonomic position of pest: Order: Coleoptera
Family: Curculionidae

STAGE 2: PEST RISK ASSESSMENT

Probability of introduction

Entry

Geographical 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).

According to the CABI Crop Protection Compendium (CABI, 2007a), *M. hemipterus* is present in the following countries:
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.

Major host plants or habitats:

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).

Host list according to CABI (2007a):
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.

Notes on the host list

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.

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

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

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. Movement of palm trees (Arecaceae) and *Musa* spp. with passengers

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 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 plant species and based on these interceptions the probability of entry is assessed to be low to moderate.

Establishment

Plants or habitats at risk in the PRA area:

Plants at risk are:

- Palms (Arecaceae)

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*).

- Sugar cane (*Saccharum officinarum*)

Sugar cane is a minor crop in the EPPO region.

- Banana (*Musa* spp.)

Banana is a minor crop at the scale of the EPPO-region.

- Palms as crop for oil and food

Palms as crop for oil and food are found in the EPPO region.

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

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 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 1.

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.

Aspects of the pest's biology that would favour establishment:

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 cycle inside the palm assists 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.

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.

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

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.

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).

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.

Managed environment in the Southern areas (Mediterranean countries, Macaronesia, Portugal)
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.

Managed environment in the Northern areas
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.

Existing pest management practice

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.

Which part of the PRA area is 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 1.

POTENTIAL ECONOMIC CONSEQUENCES

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

Effect on crop yield and/or quality to cultivated plants or on control costs

Sugar cane

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 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*.

Banana plants

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).

Palms for ornamental purposes
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).

Palms as a crop for oil or food
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.

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).

Environmental damage
No environmental damage caused by *M. hemipterus* is reported.

Social impacts
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.

Describe damage to potential hosts in PRA area:

Effect on crop yield and/or quality to cultivated plants or on control costs

Sugar cane (*Saccharum officinarum*)

Sugar cane is a minor crop in the EPPO region 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. 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.

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). 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.).

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

Production costs

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.

Environmental impacts

Southern EPPO-region

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, 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 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.

Northern EPPO-region

Host plants are not or only incidentally present in the environment, so minimal impacts are expected.

Social impacts

Southern EPPO-region

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.

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 (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.

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. Impacts are not reported on this crop, but if it does occur, it could affect lifestyle.

Northern EPPO-region
No social damage expected.

CONCLUSIONS OF PEST RISK ASSESSMENT

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

- This pest has been intercepted at least 4 times since 2006, and can often go undetected (Weissling & Giblin-Davis, 2003).
- The pest has a relatively broad host range: Arecaceae, Musa *spp*., *Sachharum officinarum*.
- The hidden life cycle inside the palm assists establishment of the pest.
- The hidden life cycle inside the palm makes the pest likely to survive eradication measures in the southern part of the EPPO region.
- The pest is likely to spread rapidly by human assistance.
- The pest may have impacts economic impacts (effects on crops, control costs, environmental and social impacts) considered as moderate.
- For both ornamental and palms as crops for oil and food, the damage caused by *M. hemipterus* increases the chances of infestation by other pests such as *Rhynchophorus cruentatus, Diocalandra frumenti* in the Canary Islands, *Oryctes nasicornis, Paysandisia archon,* etc..

Estimate the probability of entry:

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
Palms are imported regularly and in large numbers from countries where *Metamasius hemipterus* is present.
Probability of entry: **medium to high**

Pathway II "Movement of palm or *Musa* spp. plants with passengers"
Probability of entry: **very low to low**

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)
Probability of entry: **low to moderate**

Estimate the probability 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.
Environmental impacts might be expected, particularly on endemic palms (*Phoenix canariensis* in Canary islands, and *Phoenix theophrasti* in Greece).

Probability of establishment:
Southern EPPO-region:
- high (outdoors and protected cultivation)
Northern EPPO-region:
- very low (outdoors)
- low to moderate (protected cultivation)

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

Estimate the potential economic impact:

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.

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)

Degree of uncertainty

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.

OVERALL CONCLUSIONS 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.

STAGE 3: PEST RISK MANAGEMENT

IDENTIFICATION OF THE PATHWAYS

Pathways studied in the pest risk management

Commercial import of plants for planting of palm trees (Arecaceae) and *Musa* spps., other than seeds, seedlings and plants in vitro from areas where the pest occurs
Probability of entry: medium to high

Movement of palm or *Musa* spp. plants with passengers
Probability of entry: very low to low

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)
Probability of entry: low to moderate

Other pathways identified but not studied

- Commercial import of fruits from areas where the pest occurs

- Commercial import of sugar cane from countries where the pest occurs

- Commercial import of *Phoenix* fronds

- Commercial import of palms and *Musa* spp. as tissue culture plantlets.

IDENTIFICATION OF POSSIBLE MEASURES

Possible measures for pathways Commercial import of plants for planting of palm trees (Arecaceae), *Musa* spp. other than seeds, seedlings and plants in vitro from areas where the pest occurs

Measures related to consignments: The Panel on Phytosanitary Measures considered that such measure was not practical for commercial trade of palm trees or *Musa* spp.

Measures related to the crop or to places of Pest free areas (see ISPM no. 4)

production:	Or <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. Beetles do not seem to fly over large distances 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. Or <u>Pest free production sites guaranteed by complete physical protection</u> 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.
Other possible measures	Internal surveillance and/or eradication measures are not considered sufficient to prevent introduction of the pest.

Possible measures for pathways	Movement of palm or *Musa* spp. plants with passengers
Measures related to consignments:	Possible measures are: - The requirement of a phytosanitary certificate for passengers traveling with host plants - prohibition on the carriage of living host plants.
Measures related to the crop or to places of production:	/
Other possible measures	/

Possible measures for pathways	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)
Measures related to consignments:	/
Measures related to the crop or to places of production:	/
Other 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).

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

Degree of uncertainty	Commercial import of plants for planting of palm trees (Arecaceae) other than seeds, seedlings and plants *in vitro* from areas where the pest occurs - 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

CONCLUSION:
Recommendation for possible measures (type presentation):

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	*PC* and Pest free areas (see ISPM no. 4) Or Pest free production places as guaranteed by a buffer zone Or Pest free production sites as guaranteed by complete physical protection

Movement of palm or *Musa* spp. plants with passengers	PC for passengers travelling with host plants Or Prohibition on the carriage of living host plants.

Hitchhiker on imports of plants or plant parts other than palm trees, *Musa* spp. sugar cane, and banana fruits	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).

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Appendix 1

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.

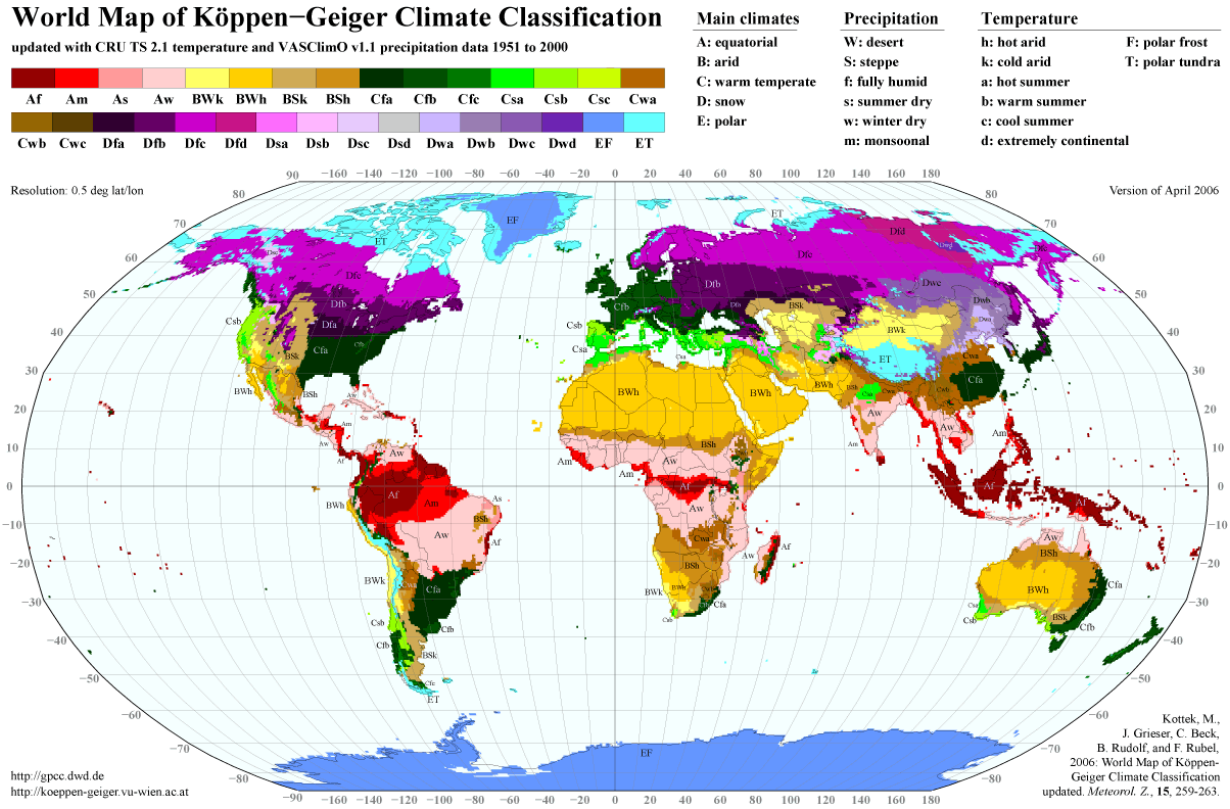
The climatic conditions in the northern EPPO-region are not similar to those in the current area of distribution of the pest; conditions in palm glasshouses in the northern region are considered similar.

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

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

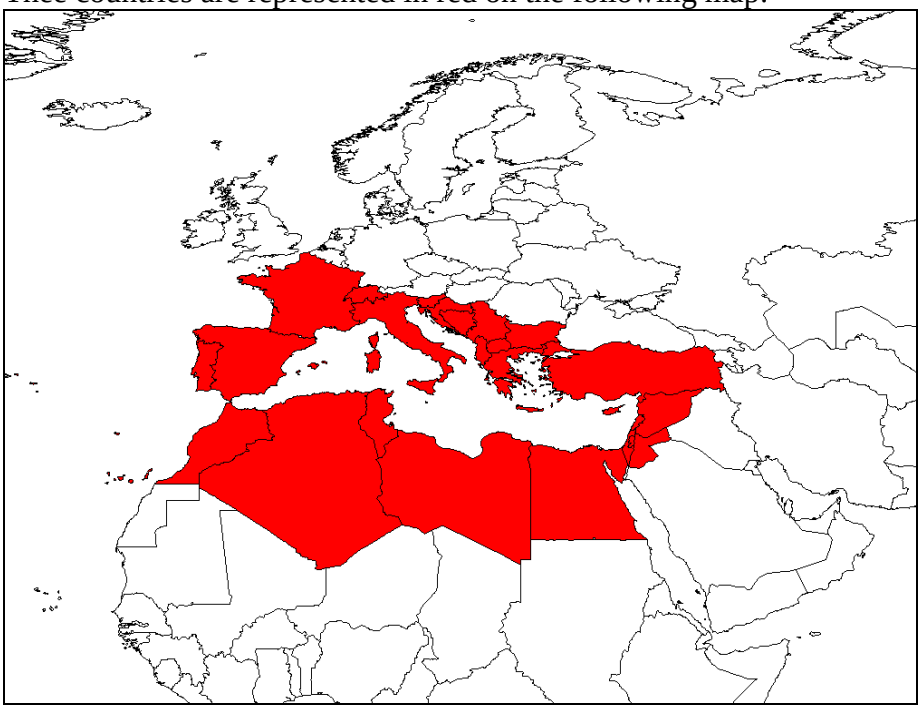
- Csa: warm temperate, summer dry, hot summer
- BWh: arid, desert, hot arid
- BSh: arid, steppe, hot arid
- BSk: arid, steppe, cold arid.

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.



Köppen World Map

Thee countries are represented in red on the following map:



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