	European and Mediterranean Plant Protection Organisation
	Organisation Européenne et Méditerranéenne pour la Protection des Plantes
	11-16940
	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 *Diocalandra frumenti* (Fabricius) Coleoptera : Curculionidae	
Pest risk analyst:	A preliminary draft has been prepared by Elford Stuart Cooper Smith[1]. This document has been reviewed by an Expert Working Group composed by, Antonio Gonzalez Hernandez[4], Dirk Jan van der Gaag[2], Jose Maria Guitián Castrillon[3], Francisco Javier Garcia Domínguez[4], Rosa Martin Suarez[5], Jorge Peña[6], Francesco Salomone Suarez[7], Elford Stuart Cooper Smith[1]. [1] Biosecurity and Product Integrity Division, Department of Primary Industry, Fisheries and Mines, GPO Box 3000, 0801 Darwin, Northern Territory (AU) [2] Plant Protection Service, P.O. Box 9102, 6700 HC Wageningen, The Netherlands [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)
Date	Expert Working Group in 2008-12. Core member consultation in 2010-04 Review by the Panel on Phytosanitary Measures in 2010-04.

Stage 1: Initiation		
1 What is the reason for performing the PRA?		In March 1998, *Diocalandra frumenti* (Fabricius) (Coleoptera: Rhyncophoridae) a tropical pest of palms was detected in the region of Maspalomas, Gran Canaria, Canary Islands (Salomone Suárez *et al.*, 2000a) where it was associated with damage to *Phoenix canariensis, P. dactylifera* and their hybrids, and to damage to individual trees of *Cocos nucifera* and *Washingtonia* spp. How the pest entered Gran Canaria is unknown. Within the EPPO region, this pest is regulated in the Canary Islands (Orden de 29 Octubre de 2007) and Morocco (Moroccan Bulletin official n°5022 of the 18 July 2002). This PRA was initiated to assess the risk presented by *D. frumenti* to palms in other EPPO countries.
2 Enter the name of the pest		*Diocalandra frumenti* (Fabricius, 1801**)**
2A Indicate the type of the pest		Insect
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	A PRA has been undertaken by Republic of Korea but could be retrieved (PMC, 2002). The PRA area is nevertheless different.
Stage 2A: Pest Risk Assessment - Pest categorization		
6 Specify all the host plant species (for pests directly affecting plants) or suitable habitats (for non parasitic plants). Indicate the ones which are present in the PRA area.		*Diocalandra frumenti* is restricted to Arecaceae, and 17 genera of this family have been reported as hosts. These include economically important species cultivated for food, oil, housing or landscape plants. A large number of other landscape palm species are mentioned in the literature (eg. AVA 2006; NGIA 1998). Howard *et al.* (2001) report species of *Areca* and *Borassus* also attacked by this weevil. The EWG considered these records as unsubstantiated as no further records of these hosts were mentioned, and these genus were not taken into account in the PRA. From the species reported as hosts, the EWG differentiated major hosts (a regular host that is usually relatively highly infested or a major host for which a large proportion of the samples is infested) from minor hosts (an incidental host, with only one or a few

		records. Usually with low infestation rate; a host that is used more regularly, but often with very low infestation rate). Major host: *Cocos nucifera* (coconut) (Kahlshoven, 1981), and landscape palms such as *Phoenix canariensis* and its hybrids, *Phoenix dactylifera, Washingtonia* spp. (Kahlshoven, 1981, Salomone Suárez *et al.,* 2000b). Minor hosts: *Archontophoenix alexandrea, Bismarkia sp., Caryota sp., Chrysalidocarpus lutescens, Dypsis lutescens, D. lucebensis, Elaeis guineensis, Howea belmoreana, Mascarena verchaffeltii, Metroxylon sagu, Nypa fruticans, Phoenix loureirii, P. roebelenii, Ptychosperma macarthurii, Ravenea rivularis, Roystonea regia, Sabal palmeto,* and *Wodyetia bifurcata* (Lepesme, 1947, NGIA, 1998, Salomone & Caballero Ruano, 2008). This distinction between major and minor hosts is based on worldwide literature, however minor hosts may change into a major host depending on host availability. For instance, in the Canary Islands where there are few coconuts, *Phoenix canariensis, P. dactylifera* and their hybrids and *Washingtonia* spp. are heavily infested (Gobierno de Canarias, pers. comm., 2008). Hill (1983) listed sorghum as a host of *D. frumenti.* Experiments in laboratory have been conducted by González Núñez *et al.* (2002) with *D. frumenti* on sugar canes (Poaceae) as a food source. The Expert Working Group considered that growing *D. frumenti* on sugar cane under experimental conditions does not prove that sugar cane is a host. As a consequence, the EWG did not consider Poaceae as minor hosts but rather as inccidental hosts, as there were no additional records as Poaceae as hosts. Considering the uncertainty on its host range, all palm species are considered as potential host plants in the present PRA. *Cocos nucifera* (coconut), *Phoenix canariensis*, *Phoenix dactylifera* and *Washingtonia* spp. occur in the EPPO region (Tutin *et al.,* 1964). The other palms are not reported to occur in Europe according to Flora Europaea, but this flora does not include North-African countries and is dated 1964. *Cocos nucifera* (coconut) is known to be planted around the Mediterranean Basin.

7. Specify the pest distribution		*D. frumenti* has a wide distribution in countries within and bordering the Indian and Pacific Oceans, across tropical Asia, northern Australia, and in several African countries. It has also established in Ecuador. According to Lepesme (1947), the species appears to be native in the Indian Ocean Basin. The distribution appears to follow areas of low altitude and coastlines, possibly closely allied to the distribution of its major host, *Cocos nucifera*. It has recently been detected in the EPPO region in Canary Islands (Salomone Suárez *et al.*, 2000a). The CABI Distribution Map of Plant Pests (249) produced for *D. frumenti* lists its presence in the following countries (CABI 2008): **Europe:** Canary Islands (Gran Canaria, Lanzarote, Tenerife, Fuerteventura, it is still absent from other islands of the Canary Islands). First detected in 1998. **Asia**: Bangladesh, China, India, Indonesia, Japan (first detected in 1977), Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Taiwan, Thailand **Africa**: Madagascar, Mauritius, Seychelles, Somalia, Tanzania (including Zanzibar). **South America**: Ecuador. **Oceania:** Australia (Northern Territory, Queensland, Western Australia), Federated States of Micronesia, Guam, Palau, Papua New Guinea, Samoa, Solomon Islands, Vanuatu.
8. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	Yes	See Zimmerman (1993) for an identification key.
10. Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?	Yes	Certain palm species seem to be more affected by *D. frumenti* than others. *Cocos nucifera* and *Phoenix roebelenii* are frequently attacked, but suffer little damage, and large numbers of individuals of *D. frumenti* can be attracted to wounds on *Elaeis guineensis* but are not considered pests of this species in Malaysia (Wood, 1968). However, *Phoenix canariensis* may be killed by damage from this weevil (NGIA 1998; Salomone Suárez *et al.* 2000a). Later observations suggest that *D. frumenti* only in combination with other pests could kill plants of *Phoenix canariensis* in Canary Islands (Gobierno de Canarias, pers. comm. 2008). In the Canary Islands, some trees infested by *D. frumenti* were also infected with fungal organisms like *Gliocladium* spp., *Thielaviopsis* spp., *Fusarium* spp., etc. (NGIA 1998; Salomone Suárez *et al.* 2000b) suggesting that *D. frumenti* opens some ports of entry

		since these fungi usually infect only weakened palms.
12 Does the pest occur in the PRA area?	Yes	
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	Major hosts such as *Cocos nucifera* (coconut), *Phoenix canariensis* and its hybrids, *Phoenix dactylifera*, and *Washingtonia* spp. occur in the EPPO region (Tutin *et al*., 1964). Nevertheless, coconuts production is not reported by FAOSTAT in the EPPO region. *Phoenix canariensis* is by law the Canary Island vegetal symbol (Ley 7/1991 de Símbolos de la Naturaleza para las Islas Canarias) and is represented by over 5.000.000 natural palms in La Gomera (one of the smallest island of the archipelago), and by 55.000 palms in Gran Canaria where it is found in natural ecosystems (Salomone & Caballera Ruano, 2008).
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	Protected conditions in the northern part of the EPPO region and outdoor climate in the southern part of the EPPO region will help 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	On its own, the pest may not be likely to cause significant damage. However, in combination with primary pests and when infesting a weakened plant, *D. frumenti* can contribute to cause significant damage. Special mention must be stated about the sensitive ecosystems present in the Canary Island. The presence of the endemic palm *Phoenix canariensis* (protected by law) whose distribution coincides in part with the pest, and its social importance (landscapes, uses such as honey production, etc.) makes *D. frumenti* a significant pest for the Canary Islands. However, the PRA area is the whole EPPO region.
18. This pest could present a phytosanitary risk to the PRA area.	Yes	

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. Commercial import of seedlings of *Howea forsteriana* This pathway is very unlikely since the EWG mentioned that *Howea* are imported as very small seedlings. *Howea forsteriana* is imported as seedlings or germinated seeds and is one of the most popular palms 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 plant protection products 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). This pathway **is not considered further**. II. Commercial import of plants for planting of palm species (Arecaceae) other than seedlings of *Howea forsteriana* from where the pest occurs (except Canary Islands) *Diocalandra frumenti* is a pest of Arecaceae, and has at least 23 species from 17 genera as hosts. These include economically important species cultivated for food, oil, housing or landscape plants. In this PRA, we consider all palm species as potential host plants. **Uncertainty/lack of information:** Few references are available, including for the native area of the species. It is unknown/uncertain whether palm species not mentioned in Question 6 above are host plants of *D. frumenti* but the EWG considered that palm species not yet determined to be hosts could be infested. III. Commercial import of plants for planting of palm species (Arecaceae) from where the pest occurs in the Canary Islands All palms including *Howaea* are considered since these are exported from Canary Island as juvenile plants of up to 2 m in height in pots with diameter of 17-25 cm. In the Canary Islands, there is currently strong legislation regulating *D. frumenti*, there is also preventive treatments for *Rhyncophorus ferrugineus* (Coleoptera: Curculionidea, another weevil pest of palms) and both pests are officially monitored (Gobierno de Canarias, pers. comm. 2008). The pest is therefore less likely to be found on this pathway which is why it

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		is considered as a separate pathway. IV. Commercial import of seeds of host plants from where the pest occurs *D. frumenti* adults may be present as a hitchhiker on imported seeds of host plants, but the **probability is very low** as the seeds will be cleaned before shipment. The presence of larvae in commercial imports of seeds is **very unlikely and this pathway is not considered further.** V. Import of consignments of fruits of palms (coconuts, dates) from where the pest occurs There are no records of *D. frumenti* being a hitchhiker on palm fruits, or a contaminant in fruits. The species does not lay eggs in fruits, it is therefore very unlikely that fruits could be infected, and this pathway **is not considered further.** VI. Import of consignments other than fruits/seeds of palms from where the pest occurs *D. frumenti* may enter as a hitchhiker on consignments imported from areas where the pest is present, but the probability would be **very low** as there is no obvious reason for the pest to enter consignments other than host plants. This pathway **is not considered further**. VII. Movement of palm trees with passengers from where the pest occurs Passengers can import (parts of) host plants including palm trees from areas where the pest is present (F Petter, European and Mediterranean Plant Protection organization, pers. obs, 2011). Introduction of the pest as a contaminant of Palms introduced with passengers is considered as a probable pathway. VIII. Commercial import of palm fronds from where the pest occurs Females of *D. frumenti* lay eggs in various sites: inflorescences, the bases of petioles or peduncles, or in cracks near adventitious roots at the base of the stem. The larvae can bore galleries in any part of the palm: roots, petioles, inflorescences, fronds, leaf sheaths, fruits and to all heights of the trunk (González Núñez *et al*., 2002; Hill, 1983). Eggs or larvae of *D. frumenti* can be present in palm fronds.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		Little information is available on the abundance and management practice of the pest on palm nurseries in which plants are grown. Palm fronds can be produced in palm nurseries, or can be taken from wild palm trees, as it is the case for *Chamaedorea* palms in Central America (Current, 2006). Concerning the concentration of the species in palm fronds, Liao & Chen (1997) indicated that 10 or more larvae could develop in each leaf sheath. Nevertheless, importers are willing to ship fronds with high quality so that the consignment is not blocked in custom, and most commercial nurseries will inspect and treat palms infested with weevils and use persistent insecticides in the nursery areas so that the levels of the pest will not be high. The palms are valued by the floral and horticultural industries for their size and shade tolerance. These attributes have earned them a well-established international market for interior decorating and floral displays, with peak demand during the Easter and Palm Sunday holiday seasons (Current, 2006). As stated by Current (2006), there is no register of sales of palms imports in Europe, and when they are registered, they are often lumped with other cut greens or ornamentals and cannot be tracked. Current (2006) report that according to a study performed by the Instituto para el Desarollo Sustentable en MesoAmerica (IDESMAC) in 2002, “imports in Holland are dominated by 3 principal companies whose imports represent 98% of the market for the palm in Holland and 47% of the European market. The German market accounts for 51% of the European market and is distributed between 6 companies”. As in the case of the United States and the world market, Current (2006) mentions that in general, the source of palms is imports from Mexico and Guatemala. Although *D. frumenti* is not occurring in Central America, places from where the palm fronds are imported, the market and the distribution of this pest could change, and the pathway is therefore worth considering. Eggs and larvae develop in the fronds and will be protected from adverse conditions. As the palm fronds will be transported by airplane, the duration of transportation will only last a few hours and the pest is very unlikely to multiply/increase in prevalence during transport. Concerning existing management procedures, adults can be cryptic and difficult to detect (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. comm., 2008), but symptoms (e.g. galleries, holes, gumming, etc.) can be recognizable with little training. In the EU Directive 2000/29/EC, according to part B of Annex 5, a PC is required for the import of any part of *Phoenix* spp., but this does not

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		imply any specific requirement. In addition, according to Part A of Annex 3 plants of *Phoenix* spp. are prohibited only when they originate from Algeria or Morocco. *D. frumenti* is therefore likely to survive or remain undetected during existing management procedures. Although the palm frond may be imported in the Netherland and Germany, these 2 countries can re-export the palm fronds to the whole EPPO countries, in particular in EU countries. The commodity is therefore likely to be widely distributed in the EPPO region. Larvae are present inside the fronds and stem of the plants and protected from adverse conditions, and palm fronds are considered to be imported throughout the year. Consignments therefore arrive at a suitable time of year for pest establishment. When imported, palm fronds will be sent to floriculturists who shall then sell the fronds to end consumers. Palm fronds are intended to be used indoors, the pest could only transfer from the palm frond to unintended habitats when the fronds are disposed outdoors in southern EPPO countries. This lowers the probability of transfer of the species. 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, which is very likely. In conclusion, **the probability of entry of the species as a contaminant of palm fronds is considered as unlikely.** **Uncertainties**: High. No information is available from nurseries where palm fronds are being imported into the EPPO region. Trade from areas of *D. frumenti* occurs is unknown as well. IX. Natural spread Since *D. frumenti* is not recorded to fly long distances, natural spread of the species from Canary Islands is not considered possible.
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		I. Commercial import of plants for planting of palm species (Arecaceae) except *Howea* from areas from where the pest occurs This pathway is probably the most important one. Movement of infested plant material is probably the main way by which the pest has spread over large distances as the pest is of

Commentaire [SB1]: This pathway of entry was envisaged as a later stage, and is considered in this paragraph rather than following the questions of pathways of entry, as suggested during the discussions of the Panel on PRA Development.

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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.		cryptic nature and could go undetected (EPPO Alert list 2003). Recorded interceptions are as follows: Australia: • Examination of border inspection database for the last 5 years indicates that no *D. frumenti* (or anything from the genus *Diocalandra*) have been intercepted. • On the other hand, within Australia, nursery infestation is most likely to be caused by infested plants brought from outside or possibly from adjacent infested palm plantings (NGIA, 1998), however this latter natural spread is slow. Japan: • the weevil was discovered on Okinawa from palm trees introduced from Taiwan (Morimoto, 1985) Spain: • it is possible that *D. frumenti* was introduced to the Canary Islands on commercial shipments (of host material) arriving in the affected area of Maspalomas (Salomone Suárez *et al.*, 2000a). There is no record of interception of this pest in the EPPO region (Peter Oostelbos, Plant Protection Service of the Netherlands 2008; EPPO Secretariat). II. Commercial import of plants for planting of palm species (Arecaceae) from where the pest occurs in Canary Islands III. Movement of palm trees (Arecaceae) with passengers from where the pest occurs IV. Commercial import of palm fronds from where the pest occurs (considered previously)
Pathway n°: I		**Commercial import of plants for planting of palms except *Howea* from areas where the pest occurs**

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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**	*D. frumenti* lays eggs in various sites: inflorescences, the bases of petioles or peduncles, or in cracks near adventitious roots at the base of the stem. The species is cryptic and is difficult to detect. Little information is available on the abundance and management practice of the pest on palm nurseries in which plants are grown for export to the EPPO region. The pest is present in several countries from which palms are imported into the EPPO region. It is, however, unknown if the pest generally occurs in palm nurseries in countries where the pest is present (Africa, Indian Ocean, Oceania, Asia), although it has been reported in some nurseries in Queensland.
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. High infestations are visible, but low infestations may go unnoticed. Liao & Chen (1997) indicated that 10 or more larvae could develop in each leaf sheath and Salomone Suárez *et al.*, (2000b) estimated that hundreds of individuals could be found in a single palm. Importers are willing to ship trees with high quality so that the consignment is not blocked in custom (e.g. palms without dead fronds). Most commercial nurseries will inspect and treat palms infested with weevils and use persistent insecticides in the nursery areas so that the levels of the pest will not be high. If the pest is present in areas where the palms are grown there is a risk that palms will not be completely free of the pest because of hidden life stages (see also Q 1.10). Nevertheless, there are no records of interception while high infestations would be quite visible.
1.6. How large is the volume of the movement along the pathway?	**Medium** **Uncertainty: Low**	No information is available in EUROSTAT at the genus level for t(he imports of Plants for plating, the EPPO Secretariat therefore launched a questionnaire on the imports of palm trees into the EPPO region. More than 40 genera of palms are imported into the EPPO region. Import data for the years 2005 to 2007 were received from the following EPPO countries: Algeria, Croatia, Czech Republic, France, Germany, Hungary, Malta, the Netherlands and Turkey. At least 1.8 million of palms trees are imported per year from countries where *D. frumenti* is present (Table 1).

<table>
<tr><th>Question</th><th>Rating + uncertainty</th><th>Explanatory text of rating and uncertainty</th></tr>
<tr><td></td><td></td><td>From Sri Lanka, Livingstona spp. are the main palm species that are being imported. From China, Malaysia, and Indonesia, Rhapis spp. are mainly imported. Other palm species that are being imported from countries where Diocalandra frumenti is present belong to various genera such as Areca, Caryota, Chamaedorea, Phoenixa.

Table 1. Average number of palm trees imported per year (period 2005 – 2007) from countries where D. frumenti is present.
<table>
<tr><th>Origin</th><th>Average number of palm trees per year</th></tr>
<tr><td>Sri Lanka</td><td>1,166,029</td></tr>
<tr><td>China</td><td>510,939</td></tr>
<tr><td>Malaysia</td><td>63,217</td></tr>
<tr><td>Indonesia</td><td>37,029</td></tr>
<tr><td>Thailand</td><td>4,601</td></tr>
<tr><td>Singapore</td><td>1,170</td></tr>
<tr><td>Taiwan</td><td>100</td></tr>
<tr><td>Total</td><td>1,783,085</td></tr>
</table>

Note: the total number of palm trees imported into the EPPO-region from countries where D. frumenti is present is probably more than 1.8 million per year since data were 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.</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 is imported on a daily basis throughout the whole year in sea containers (Dirk van der Gaag, Plant Protection Service of the Netherlands, pers. comm., 2008).</td></tr>
</table>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.8. How likely is the pest to survive during transport/storage?	**Very likely** **Uncertainty: low**	Eggs and larvae develop in the fronds and stem of the plants and are protected from adverse conditions. It is therefore very likely that the pest will survive transport and storage conditions within 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 10-12 weeks (Hill, 1983) in the wild and transport takes about 3 weeks from Indonesia (information obtained from a Dutch importer by Dirk van der Gaag, Plant Protection Service of the Netherlands, November 2008). Thus, the pest cannot go through a complete life cycle during transport, even more as large plants are usually transported at temperatures comprised between 10 and 16°C, which may be lower than the optimal temperatures of development of *D. frumenti* (Franco Finelli, pers. comm., 2010). Nevertheless, development of different life stages that are present is possible (e.g. hatching of eggs, development of larvae). If females have already mated, they might lay eggs during transport leading to an increase in population size.
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	**Moderately likely** **Uncertainty: low**	Larvae are cryptic and adults can be cryptic and difficult to detect (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. comm., 2008), but symptoms (e.g. galleries, holes, gumming, etc.) can be recognizable with little training. - In the EU Directive 2000/29/EC Annex IV Part A (Special requirement which must be laid down by all Member States for the introduction and movement of plants, plant products and other objects into and within all Member States), section 1 (Plants, plant products and other objects originating outside the Community), point 39 states that: Trees and shrubs, intended for planting, other than seeds and plants in tissue culture, originating in third countries other than European and Mediterranean countries should: - be clean (i.e. free from plant debris) and free from flowers and fruits, - have been grown in nurseries, - have been inspected at appropriate times and prior to export and found free from symptoms of harmful bacteria, viruses and virus-like organisms, and either found free from signs or symptoms of harmful nematodes, insects, mites and fungi, or have been subjected to appropriate treatment to eliminate such organisms. These are therefore generic provisions for trees and shrubs requiring inspections at

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		appropriate times for signs or symptoms of *inter alia* insects that may guarantee some protection against *D. frumenti*. - In the 27 member countries of the EU, inspection of plants for planting are made, according to Annex V, Plants and plant products must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community – in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the community, Part B (referring to plants, plant products and objects originating from outside the Community) of Directive 2000/29/EC. Such general requirements may guarantee some protection against *D. frumenti*. There is currently a regulation on palm species against *Rhynchophorus ferrugineus*, but the area of origin of this pest is totally different from *D. frumenti* distribution. - According to part B of Annex 5, a PC is required for the import of any part of *Phoenix* spp., but this does not imply any specific requirement. In addition, according to Part A of Annex 3 plants of *Phoenix* spp. are prohibited when they originate from Algeria or Morocco. In North African countries, imports of palms are generally prohibited. Other countries might have specific measures on palms (e.g. Canary Islands, Israel). For instance, in Canary Islands, import of palms is restricted to seeds and palms smaller than 5 cm of stem diameter at the base (BOE n°24 de 28/1/2006).
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, palms are imported by Algeria, Croatia, Czech Republic, France, Germany, Hungary, Malta, the Netherlands and Turkey, but additional countries would also import palms. Importing countries, such as the Netherlands and France then export palms to other EU countries. Spain, Italy, and Portugal also re-export palms to other EPPO countries (F. Salomone Suarez, Jefe de la Sección de Medioambiente y Servicios Municipales Ayuntamiento de San Cristóbal de La Laguna, pers comm., 2008).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	**Yes**	Larvae are present inside the fronds and stem of the plants and protected from adverse conditions. Palm trees are imported throughout the year.
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. Salomone Suárez *et al.* (2000b) estimated that hundreds of individuals could be found in a single palm tree 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 are planted outdoors or located in nurseries, *D. frumenti* could fly and colonize other host plants.
Pathway n°: II		Commercial import of plants for planting of palms from the Canary Islands 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?	**Unlikely** **Uncertainty: low**	Due to the specific legislation in the Canary Islands to prevent infestations of both *R. ferrugineus* and *D. frumenti* in nurseries, it is expected that nurseries are free of the pest (Commission Decision on *R. ferrugineus* of 2007 May 25th and BOC Orden de 29 de octubre de 2007). Specific controls are carried out in nurseries since January 2007 and no signs of the pest have been detected (Gobierno de Canarias, pers. comm., 2008).
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?	**Unlikely** **Uncertainty: Low**	See Q 1.4

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.6. How large is the volume of the movement along the pathway?	**Major** **Uncertainty: Low**	In 2007, €18 million production of palm trees are exported, of which €11 million are shipped to mainland Spain , and other €7 million to other EPPO countries (e.g. the Netherlands, Germany, France, Italy, Portugal) (ASOCAN, Asociacion de cosecheros y exportadores de flores y plantas vivas de Canarias, pers. comm., 2008). The percentage of the palms traded is the following: - *Kentia* spp. (60%) - Areca spp. (14%) - *Chamaedorea* spp. (14%) - others (12%)
1.7. How frequent is the movement along the pathway?	**Very often Uncertainty low**	Palm species are exported from Canary Islands during the whole year in sea containers without climate control and occasionally there are some airfreight consignments (Gobierno de Canarias, pers. comm., 2008).
1.8. How likely is the pest to survive during transport/storage?	**Very likely Uncertainty: low**	Eggs and larvae develop in the fronds and stem of the plants and may be protected from adverse conditions. It is therefore very likely that the pest will survive transport and storage conditions within 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 10-12 weeks (Hill 1983) in the wild and transport should take less than one week (Gobierno de Canarias, pers. comm., 2008). Thus, the pest cannot go through a complete life cycle during transport(e.g. hatching of eggs, development of larvae), even more as large plants are usually transported at temperatures comprised between 10 and 16°C, which may be lower than the optimal temperatures of development of *D. frumenti* (Franco Finelli, pers. comm., 2010). If female have already mated, they may lay eggs during transport leading to an increase in population size.
1.10. How likely is the pest to survive or remain undetected during existing management procedures (including phytosanitary measures)?	**Unlikely** **Uncertainty: low**	See Q1.4. Imports from Canary Islands are considered as imports from third countries according to the Directive 2000/29. The point number 15 of the “Whereas” of the Directive 2000/29 consolidated document, the mentions the Canary Islands and in the Article 1 point 2 it is stated as follows:

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		"2. Without prejudice to the conditions to be established for the protection of the plant-health situation existing in certain regions in the Community, taking into account the differences in agricultural and ecological conditions, protective measures which are justified on grounds of the protection of health and life of plants in the French overseas department and in the Canary islands which are additional to those laid down in this Directive may be determined in accordance with the procedure referred to in Article 18 (2)". According to part B of Annex 5, a PC is required for the import of any part of *Phoenix* spp., but this does not imply any specific requirement. Additionally, there is a specific legislation for the introduction and spread of the Canary Islands: "Orden de 12 de Marzo de 1987 por la que se establecen par alas isles Canarias las normas fitosanitarias relatives a la importacion, exportacion y transito de vegetales y productos vegetales." In the EU Directive 2000/29/EC Annex V Part A (referring to plants, plant products and objects originating in the Community), plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community – in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the community. Such general requirements may guarantee some protection against *D. frumenti*. Adults can be cryptic and difficult to detect (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. observ., 2008), but symptoms (e.g. galleries, holes, gumming, etc.) can be recognizable with little training. Other countries might have specific measures on palms (e.g. Canary Islands, Israel). For instance, in Canary Islands, import of palms is restricted to seeds and palms smaller than 5 cm of stem diameter at the base (BOE n°24 de 28/1/2006).
1.11. In the case of a commodity pathway, how widely is the commodity to be distributed throughout the PRA area?	**Widely** **Uncertainty:**	From the data received by the Gobierno de Canarias, palms are exported to mainland Spain, Portugal, Italy, the Netherlands, and other EPPO countries (Gobierno de Canarias, pers. comm., 2008).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	low	
1.12. In the case of a commodity pathway, do consignments arrive at a suitable time of year for pest establishment?	**Yes**	Larvae are present inside the fronds and stem of the plants and protected from adverse conditions. Palm trees are imported throughout the year.
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. Salomone Suárez *et al.* (2000b) estimated that hundreds of individuals could be found in a single palm tree 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 are planted outdoors or located in nurseries, *D. frumenti* could fly and colonize other host plants.
Pathway n°: III **This pathway analysis should be conducted for all relevant pathways**		**Movement of palm plants with passengers from where the pest occur**
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 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 are most likely to be carried by passengers than large ones, but may still contain the pest.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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**	It is difficult to detect the pest since it is cryptic, and passengers are not trained to recognize pests.
1.6. How large is the volume of the movement along the pathway?	**Minimal** **Uncertainty: Medium**	Although there are many passengers crossing borders, passengers are not expected to carry palm plants with them after visiting countries where the pest occurs. Moreover, many palms are available for sale in the PRA area.
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 present inside the stem of the plants and protected from adverse conditions. 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 10 to 12 weeks (Hill, 1993) and transport will only take a few hours/days of travel, or a few weeks for cruiser. 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 limitations for passengers to carry plants in most of the countries of the EU and probably also into the EPPO region. It is difficult to detect the pest since the larvae are inside the stem for an inspector, it is therefore very likely that a passenger could not detect it.
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.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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** **Uncertainty: low**	When infested palms are planted outdoors in the southern part of the EPPO region, *D. frumenti* could fly and colonize other palms. It is less likely in northern countries where palm trees are not frequent outdoors. When infested palms 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.
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. <u>Commercial import of plants for planting of palms except *Howea* from areas where the pest occurs</u> Large numbers of palm host plants are imported per year into the EPPO region. The pest is thought to have been introduced into new countries as a contaminant of palms (e.g. into Japan from Taiwan (Morimoto, 1985)). The probability of entry is assessed as moderate. **Probability of entry: moderately likely** Uncertainty: high (No information is available from nurseries where most plants are being imported into the EPPO region) II. <u>Commercial import of plants for planting of palms from Canary Islands</u> The pest is under official control and nurseries are inspected intensively. **Probability of entry: very unlikely to unlikely** Uncertainty: low III. <u>Movement of palm plants with passengers</u> **Probability of entry: very unlikely to unlikely** Uncertainty: medium IV. <u>Commercial import of palm fronds</u> **Probability of entry: unlikely** Uncertainty: high (No information is available from nurseries where palm fronds are being imported into the EPPO region)
1.16. Estimate the number of host plant species or suitable habitats in the PRA area (see question 6).	**Moderate number** **Uncertainty: low**	Palm species are grown in protected cultivation in the northern region of the PRA area and outside in the southern EPPO region (Mediterranean Basin, Macaronesia, Portugal). Import data include for example more than 40 palm genera (see Q 1.6 of the pathway 1) to be planted. Sànchez de Lorenzo-Càceres (2007) lists more than 265 palm species present in Spain. *D. frumenti* is known to infest at least 17 genera of Aracaceae. More than 20 palm genera are traded in the Netherlands. *D. frumenti* is known to infest 3 of the 4 most important ones (in numbers sold at auction) ie: • *Chrysalidocarpus* (old name for *Dypsis*)

<table>
<tr><th>Question</th><th>Rating + uncertainty</th><th>Explanatory text of rating and uncertainty</th></tr>
<tr><td></td><td></td><td>

Howea
Phoenix (46% P. canariensis, 54% P. roebelenii)
Chamaedora

Source: Anonymous (2008).
Phoenix canariensis, Phoenix dactylifera and Washingtonia spp. are recorded in the Flora Europaea (Tutin et al., 1964).
</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</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 into the wild in the Mediterranean Basin and Macaronesia. Endemic species exist: Phoenix canariensis in the Canary Islands, P. theophrastii in Greece and Turkey, and Chamaerops humilis in Spain, Italy, France, Morocco (C. humilis subsp. cerasifera).

<u>Palms as crop for oil and food</u>
Palms as crop for oil and food are found into the EPPO region (see table 7).

Table 7. Area (ha) of harvested date in 2005, 2006 and 2007:
<table>
<tr><th>Country</th><th>2005</th><th>2006</th><th>2007</th></tr>
<tr><td>Algeria</td><td>147,906</td><td>154,372</td><td>140,000</td></tr>
<tr><td>Morocco</td><td>34,700</td><td>35,500</td><td>36,000</td></tr>
<tr><td>Spain</td><td>893</td><td>900</td><td>950</td></tr>
<tr><td>Tunisia</td><td>46,000</td><td>40,740</td><td>39,830</td></tr>
</table>
(source FAO STAT)
</td></tr>
<tr><td>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.</td><td>N/A</td><td>No alternate host is needed.</td></tr>
</table>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
root symbionts), reproduction (e.g. pollinators) or spread (e.g. seed dispersers), how likely is the pest to come in contact with such species?		
1.19. How similar are the climatic conditions that would affect pest establishment, in the PRA area and in the current area of distribution?	**Moderately similar** **Uncertainty: low**	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. *D. frumenti* is present in tropical and subtropical areas in countries of the Pacific and Indian Ocean basins, in Asia and with a limited distribution in Africa. The pest is already established in the Canary Islands where it has only been found in subtropical areas within areas of low altitude and coastlines (see Appendix 2). 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, and 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. Climatic conditions in the southern EPPO region are moderately similar to those in the current area of distribution of the pest. The climatic conditions in the northern EPPO-region are not similar to those in the current area of distribution of the pest; conditions in protected conditions 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 into the trees 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 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 under protected cultivation.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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 recorded where the pest occurs, and no competitors are known in the PRA area. *D. frumenti* may be found in association with *Rabdoscelus obscurus* and other pests in Australia, but the species are not in competition (NGIA, 1998).
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. Vanderplank (1953) reported several ant species (Formicidae, Hymenoptera) as predatory and Lever (1979) identified predators of this weevil from several other predacious orders – Histeridae (Coleoptera) and Rhagionidae (Diptera). The latter also reported that 40% of *D. frumenti* larvae were found to be parasitised by a braconid wasp *Spathius apicalis.* In Canary Islands, 4 species of *Spathius* are also present (*S. canariensis, S. depressus, S. moderabilis, S. pedestris*, (Acebes *et al.,* 2004) and did not prevent the establishment of *D. frumenti*. It is possible that if these species or other generalist predators are present in an area, that they may maintain some control over *D. frumenti*, but it is very unlikely that they can prevent establishment. In general, the EWG considered that it is very unlikely that predators, entomopathogens or other biological control agents will prevent establishment.
1.24. To what extent is the managed environment in the PRA area favourable for establishment?	**Southern EPPO-region: highly favourable** **Northern EPPO-region: slightly**	Southern areas In the southern part of the EPPO region, palm plants are present in nurseries, in urban and private landscape (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 (NGIA, 1998; Zimmerman, 1993). Incorrect irrigation procedures (e.g. over-irrigation) may create a stressed situation for the palm, such as decaying of the trunk and anoxia of the roots. 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 is also a factor that may stress palms and increase the probability of establishment of the pest. Adults of *D. frumenti* are attracted to sap exuding from wounded palm tissues (Kalshoven, 1981). In Canary Islands, it is forbidden to cut fresh fronds without painting since the pest is attracted by freshly cut material (BOC Orden 29 Octubre 2007). Northern areas In the northern part of the EPPO region, palm plants are grown in protected conditions 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

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	favourable **Uncertainty: medium**	from a Dutch importer by Mr van der Gaag (Plant Protection Service of the Netherlands, November 2008) or are even sold directly via auctions (Anonymous, 2008). The pest has a life cycle of 2 to 3 months (Hill, 1983) and the short growing period in glasshouses will not aid 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. Adult beetles live only 15-20 days (Liao & Chen, 1997). 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. When palms are maintained for longer period in glasshouses such as botanical palm collections, or any place with permanent palm plantations (e.g. recreation centers) establishment is more likely.
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, plant protection products applications tend to be limited, 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 *D. frumenti*. In forests (natural areas) and residential areas, plant protection products 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?	**Southern areas (outdoors): Moderately likely**	Southern areas (outdoors) Eradication may be difficult for the following reasons: • Delimiting infestations would be difficult since trees can be infested without visible symptoms (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. comm., 2008);

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
	<u>Northern areas (protected cultivation):</u> Unlikely **Uncertainty: medium**	• Removal of visibly infested plants will be insufficient to eradicate an infestation; • The pest attacks a wide host range of cultivated and native palm species, and could re-infest treated plants. Nevertheless, once detected the pest can be easily controlled by chemical treatment (Gobierno de Canarias, pers. comm. 2008) 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. <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.
1.27. How likely is the reproductive strategy of the pest and the duration of its life cycle to aid establishment?	**<u>Southern EPPO region:</u> Likely** **<u>Northern EPPO-region:</u> Unlikely/ likely** **Uncertainty: medium**	<u>Outdoors in southern EPPO region</u> The pest has already established in Canary Islands. The hidden life stages (eggs and larvae) inside the palm likely aid establishment of the pest. <u>Protected condition in northern EPPO region</u> In nurseries, the relatively long life cycle of the pest (2 to 3 months) and the generally short growing period of palms in nurseries following import (usually 2 to 3 months) makes it less likely for the pest to establish (see Q 1.24). When palms are maintained for longer period in glasshouses such as botanical palm collections, or any place with permanent palm plantations (e.g. recreation centers) establishment is more likely to aid establishment.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
1.28 How likely are relatively small populations to become established?	**Moderately likely** **Uncertainty: high**	It is assumed that in principle one female beetle and one male beetle is sufficient to establish a new population. Salomone Suárez *et al.* (2000b) estimated that hundreds of individuals could be found in a single palm tree 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. This is, however, uncertain, and there is no precise genetic information on the ability of the ability of one male and one female to establish a durable population.
1.29. How adaptable is the pest?	**Low** **Uncertainty: Low**	The pest can attack a large range of host plant species but only from one plant family, Arecaceae (CABI, 2008). The record of sorghum (Lever, 1969) is likely to be incorrect (see Q. 6). There are 9 species within the *Diocalandra* genus (Morimoto, 1978). The adults vary greatly in size and colour (Zimmerman, 1983). Adaptability to climatic factors cannot be extrapolated since the species spends most of its cycle inside the palm. There is no further information about pesticide resistance or shifts to new climates.
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: low**	The original area of distribution of the pest is probably south-east Asia (Zimmerman, 1983). It is widely distributed from East Africa to Samoa, but Zimmerman (1993) indicates that it was introduced to Australia where it is now "widely distributed" and was perhaps first collected in 1835. The pest has been introduced in: - Japan (Morimoto, 1985), - the Canary Islands (Salomone Suárez *et al*., 2000a), - Australia (Zimmerman, 1983), - Indonesia (Kalshoven, 1991), - Africa (Kalshoven, 1991).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
Conclusion on the probability of establishment		Southern EPPO region: Host plants are present outdoors in commercial nurseries, in urban areas, in gardens, in forests and in the wild. The climate is moderately similar to the climate in areas where the pest is present (e.g. tropical and subtropical areas such as Taiwan and Japan), but *D. frumenti* spends most of its development protected from adverse conditions. Management measures of palms (i.e. pruning, irrigation, high densities of planting, etc.) are highly favourable for the establishment of *D. frumenti*. **Probability of establishment: very likely** **Uncertainty: low** Northern EPPO region: The pest may be able to establish in commercial palm glasshouses in the northern areas of the EPPO region as climatic conditions are suitable and host plants are present throughout the year. 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. When palms are maintained for longer period in glasshouses such as botanical palm collections, or any place with permanent palm plantations (e.g. recreation centers) establishment is very likely, however the species would be easy to eradicate. **Probability of establishment:** **Moderately in commercial palm glasshouses (with rapid turnover of plants) and very likely under protected conditions with "permanent" palms;** **Very unlikely outdoors** **uncertainty: low to medium**
1.32. How likely is the pest to spread rapidly in the PRA area by natural means?	**Unlikely** **Uncertainty: medium**	Adults are not particularly mobile but limited data is available on their natural spread (e.g. data only available in Queensland, Australia). The pest usually does not fly much and is unlikely to be transported by the wind (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. comm. 2008). Data from Queensland and Northern Territory in Australia indicates that natural spread does occur within and between neighbouring properties (NGIA, 1998). The observations suggest a low spread potential in areas where host plants are present. Observations in the

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		Canary Islands may provide data on this aspect in areas of densely distributed and susceptible, naturally growing, host plants, but such information does not exist. 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 plant parts (see also Q 1.3). Spread over larger distances likely resulted from movement of infested palm nursery stock. In Canary Islands, movement of fronds within an island is now regulated (Orden de 29 octubre 2007).
1.34. Based on biological characteristics, how likely is it that the pest will not be contained within the PRA area?	**Likely** **Uncertainty: medium**	The pest usually does not fly much and is unlikely to be transported by the wind (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. comm. 2008). The fact that *D. frumenti* is an internal borer renders treatment more difficult. Palm trees can be infested without 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. In Gran Canaria, the pest had spread over at least 3 km² before it was detected (Gobierno de Canarias, pers. comm. 2008). Additionally, 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. In the Canary Islands, containment is unlikely due to the densely distributed and very susceptible, naturally growing, host plants. Canary Islands are composed of 7 isolated islands, and the pest has established on 3 of these, and an additional one (Tenerife) is in an outbreak phase (Gobierno de Canarias, pers. comm. 2008).

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
Conclusion on the probability of spread		No definitive information is available about the natural dispersal ability of adults, but evidence in Queensland and Northern Territory indicates that natural spread does occur within and between neighbouring properties. There is also evidence from Japan and the Canary Islands that the pest can remain undetected and be spread over large distances by movement of infested palms and palm parts. **Probability of spread: likely** **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 comparison with PRAs on other pests.**		*Diocalandra frumenti* can be introduced by imports of infested palm plants or palm parts from countries that are infested. The probability of entry is assessed as moderate. The plant could enter by the movement of passenger, probability very low to low **Probability of entry: moderately likely** **Uncertainty: medium** (No information is available from nurseries where most plants are being imported into the EPPO-region) **Probability of establishment** In the Southern EPPO region: **very likely** **Uncertainty: low** In the Northern EPPO region **Moderately in commercial palm glasshouses (with rapid turnover of plants) and very likely under protected conditions with "permanent" palms;** **very unlikely outdoors** **uncertainty: low to medium** **Probability of spread: likely** No definitive information is available about the natural dispersal ability of adults. **Uncertainty: Medium**

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		The overall probability of introduction is considered to be moderately likely.
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 the most at risk are: 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, Serbia, Spain, Syria, Tunisia, Turkey. A map is provided in Appendix 2.
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?	**Minor to Moderate** **Moderate for Canary Islands** **Uncertainty: low to medium**	The pest only attacks palms and the host range is quite broad (at least 17 genera). However, the precise status of this weevil as a pest is open to dispute. <u>Effects on crop yields</u> According to Hill (1983), some entomologists believe that the damage is primary and results in appreciable crop losses while, others maintain that damage is purely secondary. Hill (1983) reported that *D. frumenti* is a major pest of coconut (*Cocos nucifera*) and oil palm (*Elaeis guineensis*). *D. frumenti* has also been found attacking *Phoenix canariensis* as well as the date palm *Phoenix dactylifera* and its hydrids, though impacts on this crop are not detailed (Salomone Suárez *et al.*, 2000b). Hill (1983) considered *D. frumenti* to be a minor pest of date palms, but this is an important crop in the southern EPPO region. In China, Yani *et al*. (2007) list *D. frumenti* among the primary disease in South China. Lu *et al*. (2003) present *D. frumenti* as “an important pest on coconut and other palms in mainland Africa, Madagascar, India, Japan, South-East Asia, Pacific region and Taiwan, China”, although impacts for all the countries quoted cannot be traced back. Such publications are in Chinese and cannot be accessed.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		In Taiwan, Liao & Chen (1997) reported attacks of *D. frumenti* on ornamental palm seedlings of *Mascarena verchaffeltii, Roystonea regia* with a damage comprised between 5 and 20%, while the damage on *Phoenix loureiri* was estimated to be lower than 5%. Feeding damage by larvae may cause premature yellowing and collapse of palm fronds in the crowns (NGIA, 1998; Salomone & Caballero Ruano, 2008). Damage can occur on roots (Liver, 1969), fronds and fruit stalks which will reduce the vigour of the plant. The larvae of *D. frumenti* have been reported to cause gumosis and nutfall of immature coconuts (van der Planck, 1951; Hill, 1983), but other insects were likely to have been involved. <u>Synergistic effects with other pests</u> Although *D. frumenti* is known to have caused the death of mature ornamental palms of *Phoenix canariensis* in Queensland (Australia) (Giblin-Davis, 2001), later observations suggest that *D. frumenti* only in combination with other pests could kill plants of *Phoenix canariensis* in Canary Islands (Gobierno de Canarias, pers. comm. 2008). The activity of *D. frumenti* may favour the entry of pathogens. *Aspergillum* spp., *Cladosporium* spp. *Fusarium* spp., *Gliocladium vermoeseni*, *Thielaviopsis paradoxa*, and *Pennicillium* spp. were detected in tissue samples of palms damaged by *D. frumenti* in the Canary Islands (Salomone & Caballero Ruano, 2008). Nevertheless, these fungi are widespread and there is no proof that *D. frumenti* acts as a vector. In Australia, damage by this pest is usually very minor, although where it is associated with another weevil pest, the sugarcane weevil borer *Rhabdoscelus obscurus*, the combined attack can cause significantly greater damage and even death of susceptible host palms (NGIA, 1998). In the Northern Territory, where *R. obscurus* is absent, the impact is low and there is no effort to manage *D. frumenti* (S Smith, Department of Primary Industry, Fisheries and Mines, Northern Territory, Australia, pers. comm., 2008). <u>Quality to cultivated plants and control costs</u> Even when the pest does not kill the palm host plants, the aesthetic damage may make the plants unmarketable and makes them more vulnerable to attack by other pests.

<table>
<tr><th>Question</th><th>Rating + uncertainty</th><th>Explanatory text of rating and uncertainty</th></tr>
<tr><td></td><td></td><td>It is estimated that around 2000 heavily infested palm trees were removed in Gran Canaria where no chemical treatment can be applied to avoid risks of collapse of the palms (Gobierno de canarias, pers. comm. 2008). The removal of one tree could cost around 500 euros (F Salomone, Jefe de la Sección de Medioambiente y Servicios Municipales Ayuntamiento de San Cristóbal de La Laguna, pers. comm. 2008), depending on plants characteristics (planting site, size, species, etc.).</td></tr>
<tr><td>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?</td><td><u>Southern EPPO region</u>: Minor to Moderate

<u>Northern EPPO region:</u> Minimal

Uncertainty: medium</td><td><u>Palms (Arecaceae) for ornament</u>
Southern region (outdoors)
The pest is expected to have varied effects similar to those experienced in other areas of the world (see Q 2.1). In combination with other weevils or pathogens, it may cause very significant damage (and death) to palm trees.
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, and the pest could easily be managed (see also Q 1.24).

<u>Palms as crop for oil and food</u>
The pest may negatively affect yield of date palms (Phoenix dactylifera) which is an important crop in Northern Africa (Anonymous, 2003) (see table 7), but impacts on this crop are not detailed (Hill, 1983; Salomone Suárez et al., 2000a). 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.

Table 7 Area (ha) covered by harvested dates in 2005, 2006 and 2007.
<table>
<tr><th>Countries</th><th>2005</th><th>2006</th><th>2007</th></tr>
<tr><td>Algeria</td><td>147,906</td><td>154,372</td><td>140,000</td></tr>
<tr><td>Morocco</td><td>34,700</td><td>35,500</td><td>36,000</td></tr>
<tr><td>Tunisia</td><td>46,000</td><td>40,740</td><td>39,830</td></tr>
<tr><td>Turkey</td><td>3,850</td><td>3,850</td><td>3,900</td></tr>
<tr><td>Israel</td><td>2,600</td><td>2,600</td><td>2,600</td></tr>
<tr><td>Spain</td><td>893</td><td>900</td><td>950</td></tr>
</table>
(source FAO STAT)</td></tr>
</table>

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		Synergistic effects with pests already present in the PRA area In Australia, the combined attack with the sugarcane weevil borer *Rhabdoscelus obscurus* can cause significantly greater damage and even death of susceptible host palms (NGIA, 1998). 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 palms pests (e.g. *Oryctes nasicornis, Paysandisia archon*, etc.*).*
2.3. How easily can the pest be controlled in the PRA area without phytosanitary measures?	**Easily in protected conditions** **With much difficulty In urban and natural areas** **Uncertainty: low**	The pest can be controlled by chemical treatment (Gobierno de Canarias, pers. comm. 2008) that can be applied in nurseries, but in a very limited way in urban areas and natural environments. In Canary Islands, Phosmet (spraying) and Imidacloprid (usually drip irrigation) are being used to control *D. frumenti* and *R. ferrugineus* in nurseries and crops. In the EU regulation, Imidacloprid and Phosmet are registered (http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.selection, website visited March 2011). In general, foliar application will not be very effective because larvae are difficult to reach and adults can shelter between petioles or under plant debris. Soil injections/drenches with systemic insecticides such as imidacloprid are probably more effective than foliar applications. The EWG considered that 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 plant protection products in public areas. In such situations, the pest may be controlled by removal of (heavily) infested plants. In Canary Islands, experiments are being carried out to consider whether *Beauveria bassiana* and *Steinernema carpocapsae* could control *D. frumenti*. *Beauveria bassiana* has been registered in the EU as an active substance in plant protection products (http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.selection; visited March 2011). There is (presently) no necessity to register nematodes for crop protection purposes in the EU.

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?	**Southern EPPO-region: Minor** **Northern EPPO-region: Minimal** **Uncertainty: low**	In the southern EPPO region For indoor palms, nurseries apply already frequently pesticides against other pests (eg. *Rhynchophorus ferrugineus*). These applications will also be effective against *D. frumenti*. For landscape palms, there would be 2 to 3 extra treatments per year, but the EWG considered that the cost would not be significant since the irrigation system can be used. Additionally, there will be costs for municipalities to remove infested ornamental palms for aesthetic and/or security reasons (see Q. 2.1). In the northern EPPO region In the northern regions of the PRA area, the pest can only establish in protected conditions. 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.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.6. How important is environmental damage caused by the pest within its current area of distribution?	**Minor** **Moderate in Canary Islands** **Uncertainty: medium**	No reports are known of environmental damage caused by *D. frumenti*, except in Canary Islands. Observations suggest that *D. frumenti* only in combination with other pests could kill plants of *Phoenix canariensis* in Canary Islands (Gobierno de Canarias, pers. comm. 2008). In Canary Island, where *Phoenix canariensis* is by law the vegetal symbol (Ley 7/1991 de Símbolos de la Naturaleza para las Islas Canarias) and is represented by over 300.000 natural palms in La Gomera (one of the smallest island of the archipelago), and by 55.000 palms in Gran Canaria where it is found in natural ecosystems (Salomone & Caballero Ruano, 2008).
2.7. How important is the environmental damage likely to be in the PRA area (see note for question 2.6)?	**Southern EPPO-region: Moderate** **Northern EPPO-region: Minimal** **Uncertainty: medium**	Southern EPPO-region The pest can attack palms that are present as landscape trees in the whole Mediterranean area, Macaronesia and Portugal 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. *D. frumenti* is a threat for the endemic *Phoenix canariensis* in the Canary Island, particularly in combination with other pests. Although *Phoenix canariensis* seems to be more susceptible than other palm species to borer weevils (NGIA, 1998), *D. frumenti* could be a threat to the endemics *Phoenix theophrasti* in Greece and Turkey (registered on the IUCN red list) and *Chamaerops humilis* in Spain, Italy, France and Morocco (*C. humilis* subsp. *cerasifera*). 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 less at risk from wounds. Northern EPPO-region Host plants are not or only incidentally present in the environment, so minimal impacts are expected.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
2.8. How important is social damage caused by the pest within its current area of distribution?	**Moderate** **Uncertainty: medium**	*D. frumenti* is known to be associated with deaths of mature palms of *Phoenix canariensis* in Gran Canaria in association with other pests. The situation is peculiar, and the social impact increased as *Phoenix canariensis* is by law the Canary Island vegetal symbol (Ley 7/1991 de Símbolos de la Naturaleza para las Islas Canarias) (See Q. 2.6). In Canary Islands, some trees have been removed because they presented a security problem for the public. In Canary Islands, the legislation which was implemented after the introduction of *Rhynchophorus ferrugineus* and *D. 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 the livestock and traditionally to sweep the streets. In La Gomera (Canary Islands), the traditional production of honey palm (guarapo) obtained from *P. canariensis* could be impacted by the presence of *D. frumenti* (R Martin & F Salomone, Jefe de la Sección de Medioambiente y Servicios Municipales Ayuntamiento de San Cristóbal de La Laguna, pers. comm.., 2008). The production practices to yield the honey are assumed to make the plant vulnerable to attacks by *D. frumenti*, leading to higher palm damages. There are no other social impacts reported in other areas where the pest is present.
2.9. How important is the social damage likely to be in the PRA area?	**Southern EPPO-region: Minor to Moderate** **Northern EPPO-region: Minimal** **Uncertainty: Medium**	Southern EPPO-region See 2.8 above. 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. 2.4 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 North African countries, date palm production is an important crop (see Q. 2.3). Damages on this crop could affect lifestyle.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		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?	**Likely** **Uncertainty: medium**	The EWG considered that most trees produced in the EPPO region 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 by Dirk van der Gaag, Plant Protection Service of the Netherlands, November 2008). 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. Canary Islands and Morocco have implemented a regulation on *D. frumenti*, but these countries are more susceptible to export than to import palms.
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 Gran Canaria, the pest has caused damage to native palms since its introduction (Salomone Suárez *et al.*, 2000b). It is not expected that natural enemies could significantly suppress *D. frumenti* populations. See Q. 1.23.
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 invested in: - Monitoring and detection of the pest; - Information brochures, advice, training and consultancy; - Research: optimizing control strategies (e.g. development of pheromone traps).
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: medium**	See Q. 2.1 In Canary Islands, the activity of *D. frumenti* may favour the entry of pathogens, as *Aspergillum* spp., *Cladosporium* spp. *Fusarium* spp., *Gliocladium vermoeseni*, *Thielaviopsis paradoxa*, and *Pennicillium* spp. were detected in tissue samples of palms damaged by *D. frumenti* (Salomone & Caballero Ruano, 2008). Nevertheless, these fungi are widespread and there is no proof that *D. frumenti* acts as a vector.
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, - 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, Bulgaria, Croatia, France, Greece (including Crete), Cyprus, Egypt, Israel, Italy, Jordan, Lebanon, Libya, Malta, Montenegro, Morocco, Palestine, Portugal, Republic of Macedonia, Serbia, Spain, Syria, Tunisia, Turkey (see Appendix 2). Northern EPPO region: - production glasshouses - botanical palm collections or any place with permanent palm plantations (e.g. recreation centers)
Degree of uncertainty **.**		It is to be noted that most data and experience come from the Canary Island as there are very few bibliographical references on this species, some of which are only available in other languages (eg. Chinese). The following uncertainties have been identified: - Potential host range; - damage levels to various palms, including the endemic palms in the Mediterranean basin; - Prevalence in nurseries in areas where the pest occurs from which plants are being imported (except Canary Islands); - Probability of disease transmission.

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
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.		I. Commercial import of plants for planting of palms except *Howea* from areas where the pest occurs Large numbers of palm host plants are imported per year into the EPPO region. The pest is thought to have been introduced into new countries as a contaminant of palms (eg into Japan from Taiwan (Morimoto, 1985)). The probability of entry is assessed as moderate. **Probability of entry: moderately likely** Uncertainty: high (No information is available from nurseries where most plants are being imported into the EPPO-region) II. Commercial import of plants for planting of palms from Canary Islands The pest is under official control and nurseries are inspected intensively. **Probability of entry: very unlikely to unlikely** Uncertainty: low III. III Movement of palm plants with passengers **Probability of entry:** very unlikely to unlikely Uncertainty: medium IV. Commercial import of palm fronds **Probability of entry: unlikely** Uncertainty: high (No information is available from nurseries where palm fronds are being imported into the EPPO region)
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		Southern EPPO region: Host plants are present outdoors in commercial nurseries, in urban areas, in gardens, in forests and in the wild. The climate is moderately similar to the climate in areas where the pest is present (e.g. tropical and subtropical areas such as Taiwan and Japan), but *D. frumenti* spends most of its development protected from adverse conditions. Management

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
establishment.		measures of palms (i.e. pruning, irrigation, high densities of planting, etc.) are highly favourable for the establishment of *D. frumenti*. **Probability of establishment: very likely** **Uncertainty: low** Northern EPPO region: The pest may be able to establish in commercial palm glasshouses in the northern areas of the EPPO region as climatic conditions are suitable and host plants are present throughout the year. 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. When palms are maintained for longer period in glasshouses such as botanical palm collections, or any place with permanent palm plantations (e.g. recreation centers) establishment is very likely, however the species would be easy to eradicate. **Probability of establishment:** **Moderately in commercial palm glasshouses (with rapid turnover of plants) and very likely under protected conditions with "permanent" palms;** **Very unlikely outdoors** **uncertainty: low to medium**
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.		Southern EPPO region: Areas where palms are grown outdoors (Mediterranean area, Macaronesia, Portugal) are most at risk. The biggest dangers are to culturally and socially significant palm species, such as *Phoenix canariensis* and date palms. There are already damage symptoms and palm deaths to palms on Gran Canaria, whether directly or indirectly (via invasion of microorganisms) attributable to *D. frumenti*. It is estimated that there is **moderate** risk of economic damage occurring in the Canary Islands. There is a **moderate** risk to areas within the southern EPPO region. **Uncertainty: Medium**

Question	Rating + uncertainty	Explanatory text of rating and uncertainty
		Northern EPPO region: The only impacts expected are on the quality of imported palms and potential control costs in glasshouses. **minor (protected cultivation): very low** **uncertainty: low**
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.		There are damage symptoms and palm deaths to palms on Gran Canaria, but they are rather indirectly (via invasion of microorganisms) attributable to *D. frumenti*. There is in addition contradictory and scares information on the impacts of *D. frumenti* in countries where it has been introduced, as for example in Australia. For these reasons, the EPPO Panel on Phytosanitary Measures considered that *D. frumenti* does not qualify as a quarantine pest as there are too many uncertainties on its impacts. Management options are therefore not considered, but this conclusion could be revised in the case of additional data found on impacts.

This is the end of the Pest risk assessment	

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Appendix 1

Data on trade on ornamental plants imported within the European Union

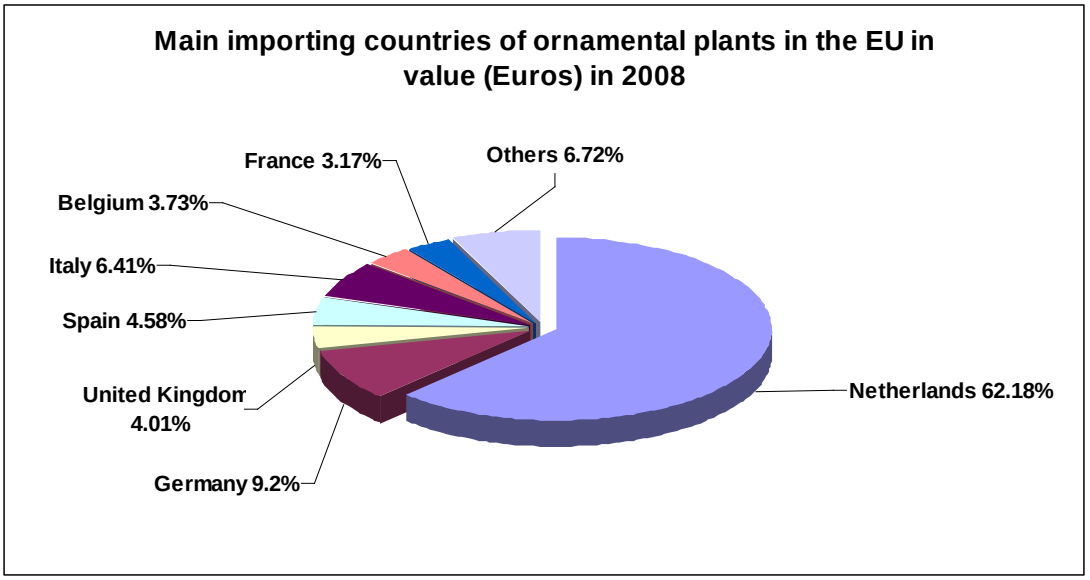
Data on imports of ornamental plants within the European Union has been gathered on the Eurostat website (http://epp.eurostat.ec.europa.eu/portal/page/portal/external_trade/data/database).
Data is available in "External trade, detailed data", "EU trade since 1995 by CN8", the selected codes were 06029045, 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

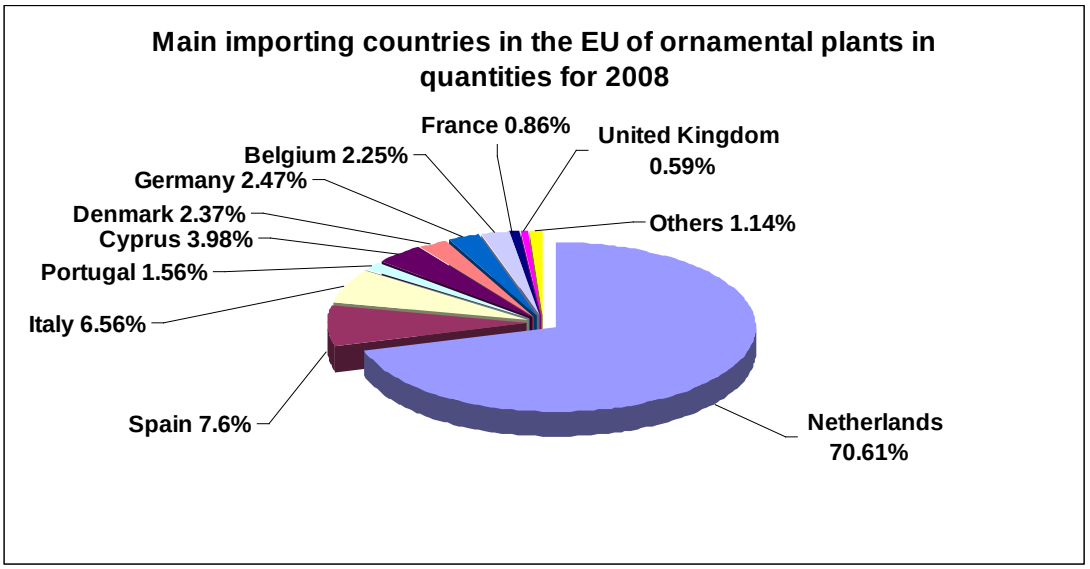
Graph of the percentages of value (in Euros) of ornamental plants imported in the main UE countries for 2008:



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

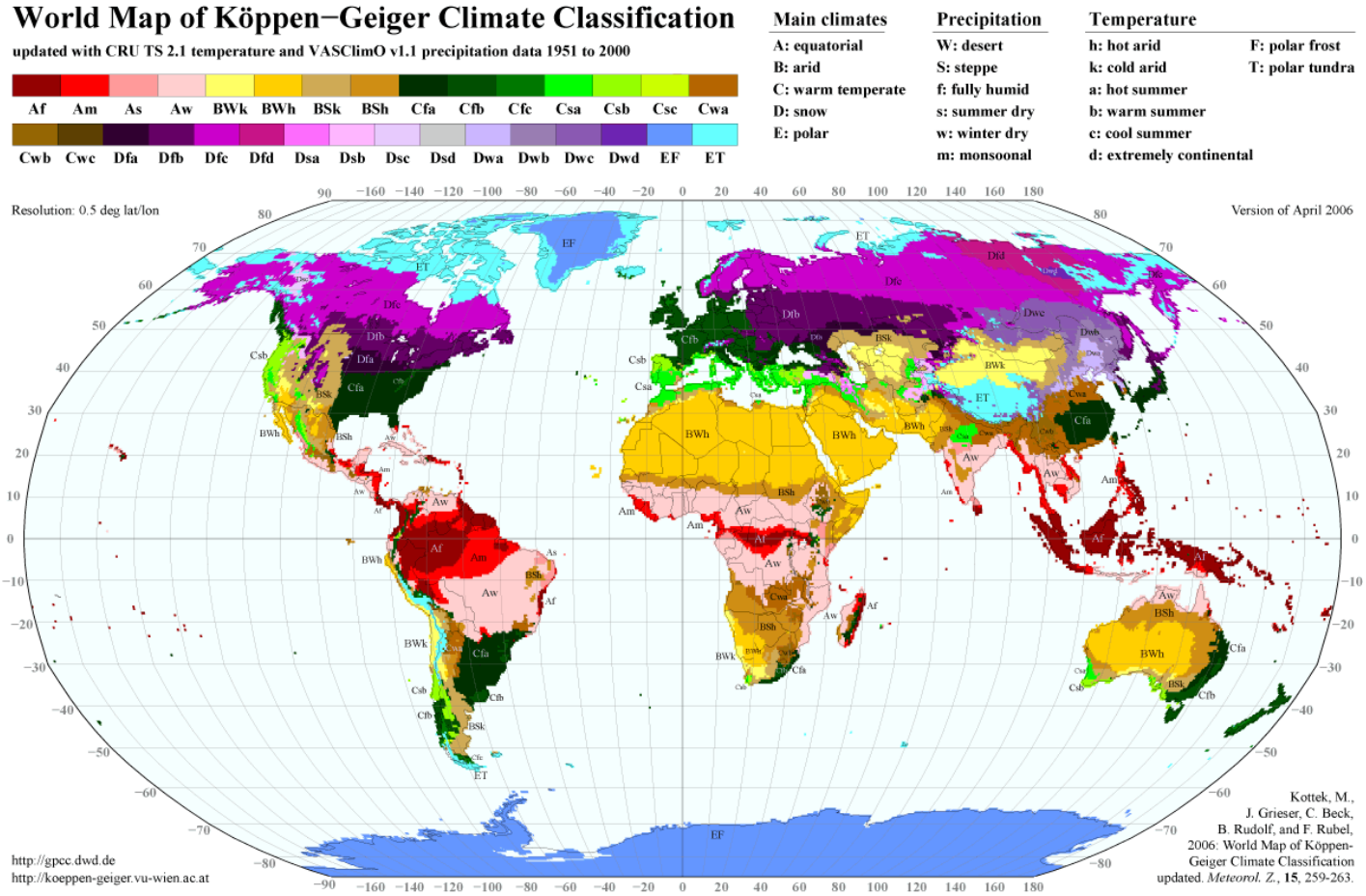
Climatic suitability of the EPPO region for *Diocalandra frumenti*

Diocalandra frumenti is present in (sub)tropical areas. Temperature requirements of the pest are unknown. 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 Canary Islands, in Africa (Madagascar, Mauritius, Seychelles, Somalia, Tanzania (including Zanzibar)), in Asia (Bangladesh, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Taiwan, Thailand), as well as in Oceania (Australia, Guam, Palau, Papua New Guinea, Samoa, Solomon Islands) and South America (Ecuador).

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, and have stringent climatic requirements 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.

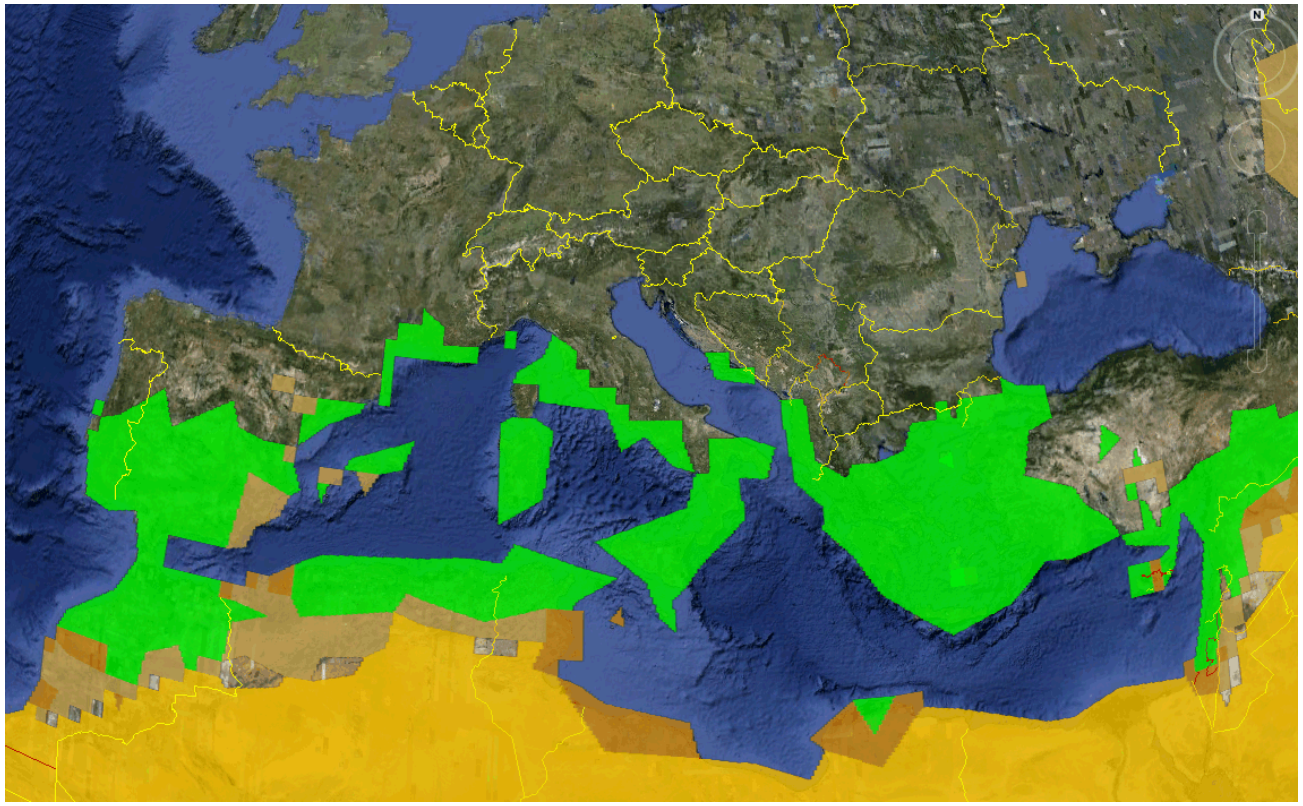
Köppen World Map (http://koeppen-geiger.vu-wien.ac.at/)



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.

These categories are presented in the map below for the EPPO region (map provided by Philippe Reynaud, Responsable du pôle expertise et analyse du risque phytosanitaire Laboratoire national de la protection des végétaux Station d'Angers, France):



Legend: Köppen-Geiger classification maps in the EPPO region with the categories considered to be suitable for palms.

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, Serbia, Spain, Syria, Tunisia, Turkey.