# EPPO Study on the Risk of Imports of Plants for Planting

## Steps 1-3

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## NOTES ON THE DEVELOPMENT OF THE STUDY

In September 2009, the EPPO Council Colloquium considered whether the plant health systems that are in place in the EPPO region are able to deal with the challenges of increasing trade and climate change. The outcome of the Colloquium, in particular regarding the risks posed by the imports of plants for planting, was further discussed in different EPPO meetings and the EPPO Council decided to allocate funds for a study on past experiences with new trade (new origins, new commodities) of plants for planting and the associated risks. An Expert Working Group (EWG) convened in December 2010 described the six steps of the study, and decided that Steps 1, 2 and 3 would be presented to the Working Party (June 2011) after presentation of the first results at the Panel on Phytosanitary Measures (April 2011). The Working Party (June 2011) decided that an expert working group should work further on the pre-screening process (Step 3). The expert working group (December 2011) elaborated further on the criteria and proposed a modified screening process as a draft EPPO standard. Step 3 in the present document was therefore withdrawn and other adjustments made in February 2012.

## EXECUTIVE SUMMARY

The EPPO Study on the Risk of Imports of Plants for Planting covers all plants for planting, except true seeds. Plants for planting are defined as ‘Plants intended to remain planted, to be planted or replanted’ (ISPM 5, Glossary of phytosanitary terms; FAO, 2010) and include categories such as bare root plants, rooted plants, bulbs and tubers, cuttings, budwood and graftwood and meristem tissue culture. Plants for planting are generally considered as presenting a higher risk of pest introduction than other commodities. Firstly the pests can survive, and possibly reproduce, on their living hosts or in the soil during transport of the commodity. Secondly, once at destination, the plants will remain planted or be replanted, facilitating survival and transfer of the pest to a suitable host.

The study includes a brief review of the literature. A large number of recent studies review the introductions of pests into the EPPO region or its individual countries. They also identify factors that have contributed to the increase of pest movement and introductions in recent decades, such as increase in volumes of traded plants and plant products, diversity of commodities traded, diversification of origins, impossibility in the current plant health system to identify risks and implement appropriate actions for all pests in trade. Imports of propagating material and planting material are often mentioned as a source of pest introductions. Ornamentals in particular are mentioned as hosts for a large number of introduced pests. The trade of ornamentals is often identified as one major contributor to introductions, with characteristics such as huge volumes, rapid changes in the plant species traded and their origins, and the occurrence of suitable habitats at destination. Despite the high number of pest introductions, most pests introduced are minor and rarely come to the attention of phytosanitary circles at the international level. By contrast, the minority of species that become major pests are extensively discussed and studied, and some of these are regulated. The importance of plants for planting for pest introductions is also recorded from other regions, irrespective of the level of stringency of their phytosanitary system.

Regulatory systems for plants for planting in the EPPO region are briefly described. Most of the 50 EPPO member countries, including the 27 EU Member States, operate under an ‘open’ phytosanitary system, under which a commodity that is not specifically regulated can be imported. The system is called ‘open’ because the specific risk that the commodity poses from different origins is not always assessed before entry is allowed. EPPO as an organization has applied and encouraged the ‘open’ approach, in order to fulfil the aim of preventing the introduction of pests into the region and the spread of pests that are already established. Under an ‘open’ phytosanitary system, regulated pests are listed and requirements, ranging from prohibition to specific requirements, are made on relevant commodities and other articles from specified origins to prevent the introduction and spread of these pests. General measures for non-specified risks are also implemented. All commodities subject to requirements have to be accompanied by a Phytosanitary Certificate; this implies inspection in the exporting country and compliance inspection in the importing country at arrival. These inspections mostly target the regulated pests and may or may not detect the presence of other pests. In contrast to the ‘open’ system, a few EPPO countries operate a more closed system, in which imports of certain defined categories of plants and plant products are subject to assessment (pathway analysis) before a decision is taken on the possibility and requirements for import.

It is noted that the impossibility under the current ‘open’ system to identify and address all potential pest risks, ensure inspection and proper application of regulations, and take action in case of non-compliance, is sometimes mentioned as a reason contributing to the introduction of pests worldwide.

### Outbreak and safe trade under the current ‘open’ system (Step 1 of this study)

Examples of recent outbreaks of selected pests were analysed, and pathways for which experience of trade has not presented problems were considered. Trade data made available by the Netherlands, Germany, Italy and France was analysed, in general and in relation to specific examples.

The examples below are described in the study; in most cases an attachment that gives detailed information on the pest and its host plants is also provided:

- Four pests of palm: *Rhynchophorus ferrugineus*, *Paysandisia archon*, *Diocalandra frumenti*, *Opogona sacchari*
- A pest of fuchsia: *Aculops fuchsia*
- Pests of *Buxus* spp: *Diaphania perspectalis* and *Cylindrocladium buxicola.*
- Pests of unknown origin: *Calonectria pauciramosa* and *Fusarium foetens*
- A new pest on kiwi: *Pseudomonas syringae* pv. *actinidiae*

- A pest of chestnut: *Dryocosmus kuriphilus*
- Pests of wild and horticultural plants: *Phytophthora* species such as *Phytophthora ramorum*
- Plants as pests: intentional and accidental introductions
- Plants with growing medium attached
- Data from interceptions: *Anoplophora chinensis* and others
- A new pest of tropical origin that is not expected to survive: *Horidiplosis ficifolii*

These examples were used to identify factors, linked to the pests or their hosts, which led or facilitated incursions or introductions into the EPPO region. The following factors related to the pest could be identified:

**Factors related to the pest**

- Difficult to detect (e.g. hidden life stages, absence of symptoms at early stage, small insect)
- High reproductive potential (e.g. several generations per year, large number of eggs, short life cycle)
- Capacity and ease of natural spread
- In relation to the host range of the pest:
  - adaptation to new hosts or to hosts not previously reported as major hosts;
  - unknown or expanding host range (especially in the same plant family)
- Unknown pest, or lack of data, or data not easily accessible. Possibly prior known introductions did indicate a risk
- Tropical and subtropical pests that have established in parts of the region, even if not necessarily identified as an obvious risk for the region
- Pests not directly regulated at the time of entry
- Difficult to control
- Previous history of moving with plants for planting
- Belonging to a family with many recent cases of serious pests moving in trade or emerging as serious diseases
- Could spread if infested propagating material is used
- Disease remaining at low prevalence for years
- Possibly selection of more virulent strain, genetic diversity, potential for interspecific hybridization
- Species with a past history of invasiveness
- Invasive alien plants that may be imported by end-users through Internet sales
- Length of time for an invasion to be recognized

The following factors related to the host plants could be identified:

**Factors related to the host plants**

- Perennial plant
- Popular ornamentals, plant widely used and grown in the region
- Widely grown outdoors in the region (plants grown indoors were identified as being easier to control)
- Belonging to a large plant family, with many species grown in the region
- Grown in a large variety of environments, incl. outdoors in plantations, nurseries, gardens, parks, roads, in the wild, and indoors; in pots, in soil
- Intended use: for the end user / for propagation
- Large number of plants traded or increase in use and volume traded
- Importance of exchange of material between amateurs
- Commonly traded with growing medium
- Commonly traded as large plants, old plants (long exposure time at origin)
- May be collected in the wild
- Some new cultivars more susceptible to the pest considered
- The pest was not identified as a risk for that plant species, as the plant was already submitted to specific measures against other pests
- Volatility of the market
- Wide range of origins worldwide and shifts of origin in trade, use of propagating material from various origins
- Predominance of some origins in interceptions on the plants considered
- Very large consignments (difficult to inspect, small samples)

The notifications of non-compliance as reported by some EPPO member countries and published in the EPPO Reporting Service 2006-2010 on plants for planting and bonsais were reviewed. Analysis of available trade data in parallel to interception data was also conducted in relation to the examples above and other plant genera or families. For example Orchidaceae gave rise to only 7 notifications (for 9 pests) in 2006-2010 and to the only interceptions on tissue culture, while representing a very large volume of trade for the countries having provided data (over 56 million units). *Acer* spp. were subject to 52 interceptions, mostly related to bonsais and to the presence of nematodes or *Anoplophora chinensis*. Most interceptions (other than nematodes) were from China, while the total trade of *Acer* was relatively small (over 265000 units) with less than half of the units originating from China.

Trade that has not posed phytosanitary problems under the current regime was considered, although no examples valid for the whole region have been found so far. Chrysanthemum cuttings were suggested by experts, but although they have not posed problems in some countries, they are known to have posed problems in the past (e.g. *Puccinia horiana* outbreaks). The study makes hypotheses on the factors that could explain why a trade has not posed problems under the current regime. For chrysanthemum, it might be that growing conditions favour pest eradication, that main pests on the pathways are already identified and targeted, that the plants are produced in specialized systems under sophisticated conditions in the country of origin. Other factors envisaged in the study, are for example: heavily regulated plants (trade open for few origins, pests well known); long history of trade with specific origins and mutual experience; availability of inspection and testing capabilities both at import and at export; easy detection and suppression of pests (annual plant, not intended to be propagated, imported under protected conditions and intended to be used indoors). Finally, some plant genera traded in very high volumes emerge from the available trade data. Further analysis might allow the identification of some of those plants that have not posed problems under the current regime, assuming that problems would be known and would have been noticed for such high volumes of imports.

Data on trade of plants from planting into the Netherlands, Italy, Germany and France was made available (for a total of over 4 billion plant units for 2010; mostly non-EU origins). The most traded plant families and genera were extracted. Twelve plant families were traded in 2010 with over 50 million units, accounting for over 85% of all imported plants, Asteraceae representing over 54% of the total. Trade data was analysed in relation to examples in the study (e.g. palms, *Buxus*, *Fuchsia, Ilex*, *Acer*, *Ficus*, chrysanthemum) in order to consider possible patterns between trade and outbreaks or interceptions. Further analysis in relation to other plant species or genera might give useful indications on trends. Even if the data is not complete and relates to a few countries, such preliminary analysis seems to give useful information on the plant genera traded and their origins, and it can also be used in relation to analysis of interceptions. A more complete analysis of detailed trade patterns in the EPPO region, if it is to be carried out, might necessitate data from a wider range of countries in order to allow understanding of the trade of plants for planting in the EPPO region. Step 5 of this study will give consideration to the need and feasibility of undertaking a more detailed analysis of import data.

### Criteria linked to outbreaks of pests related to imports of plants for planting (Step 2 of this study)

The factors above were used to define criteria linked to risks and associated with the examples developed. While step 1 focused on pest outbreaks, the criteria are defined in relation to the plants. For the purpose of developing a screening system at step 3 of this study, the criteria were divided into 'primary' (i.e. associated with a high risk, have a major influence on the risk a commodity poses, more or less independently from other criteria) and 'secondary' (interact with many others, risk will be very different depending on the combination of criteria). It should be noted that the criteria identified and developed in this study were used as a basis by an expert working group (December 2011) to develop the screening process at step 3 of this study. Only the original criteria are presented here. The following criteria were identified:

**Criteria linked to the plants for planting**
C1. Perennial or biennial plant, versus annual plant (secondary)
C2. Large plants versus small plants (primary)
C3. Age of plants/exposure time in the country of origin (secondary)
C4. Production mode (primary if collected in the wild; secondary otherwise)
C5. Growing medium (soil) attached (primary)
C6. Existing record of invasiveness (primary)
C7. Documented evidence of spreading latent pests or pests that are difficult to detect (secondary)
C8. Documented non-compliance (secondary)

**Criteria linked to the country of destination**
C9. Importance of the plants or related species in the country of destination (primary)
C10. Plant (or related species) grown outdoors at destination (primary)
C11. Plants intended for further propagation or not (secondary)
C12. Climate comparable to origin (secondary)

**Criteria linked to the origin**
C13. Presence of quarantine pests at origin (secondary criteria, reevaluation of a pathway)

It is also argued that a number of elements are important in relation to the risk, but cannot be used as criteria in a pre-screening of specific plants for planting: the importance of the plants (or related species) in the region; the volatility of markets, especially important for ornamental species; the availability of information on recent cases of incursions or introductions, and timely communication of related information to help prevent further spread within the region; introduction of pests by man outside of trade; risks that are outside the scope of the study (fraud or hitch-hiker pests). Finally, the following were considered as possible criteria but discarded as it was not considered that they should be part of a screening process: confidence in trade; origin on the same continent; existence of a previous commodity PRA; accessibility to information allowing a proper risk assessment.

### Pre-screening process (Step 3 of this study)

A pre-screening process was developed taking into account the criteria above. However, based on the decision to carry out further work in an expert working group, the original pre-screening process was deleted from the present study and is now part of a draft Standard being developed in the EPPO framework.

Finally the present document closes with suggestions on additional studies in relation to introductions of pests in the EPPO region on plants for planting, and on pathways that have seemingly not led to introductions of pests.

## 1. BACKGROUND

The EPPO Study on the Risk of Imports of Plants for Planting arises from discussions in several EPPO fora regarding the challenges posed by trade of plants for planting for the plant health system. An Expert Working Group (EWG) was convened in December 2010 to describe the study and formulate terms of reference (Box 1).

**Box 1. Description of the study (EWG, 14-15 December 2010)**

In September 2009, the EPPO Council Colloquium considered whether the plant health systems that are in place in the EPPO region are able to deal with the challenges of increasing trade and climate change. The outcome of the Colloquium was further discussed during the Working Party on Phytosanitary Regulations in 2010. The Working Party agreed that new trade is an especially important challenge for plant health systems. In particular, it was concluded that past experiences with new trade (new origins, new commodities) of plants for planting and the associated risks require a thorough analysis. Pathway-analysis to address the risk of new commodities imported into EPPO countries may be required to manage the new risks properly and that preventative action may be needed instead of reacting to incidents and outbreaks. The EPPO Council was in favour of allocating funds for such a study. This study should focus on plants for planting and should identify trends relevant for the future. The output should also inform discussions on possible changes in the phytosanitary import policy in the EPPO region. This EPPO study coincides with an evaluation of the EU plant health regime and possible changes in this regime.

The EPPO Secretariat convened a small EWG to clarify the objectives of the study and to formulate the terms of reference for it. The EWG recognized that changes in the import policy in the EPPO region may be necessary to properly address risks from new trades. In the current plant health regimes in most EPPO countries new trades can develop without restrictions and usually are not properly assessed for the risk they pose to the EPPO region. Furthermore it is not possible to undertake pathway analyses for all potential new trades and for all existing trades. Therefore, the EWG considered that the study should give guidance on how a pre-screening process could be established to allow a rapid and preliminary assessment of risks of new trades.

The EWG formulated the following objectives and tasks for the study:

**Objectives**

Provide a supporting document for EPPO member countries which currently operate an « open[1] » phytosanitary policy for all commodities, specifically to address new high risks caused by the importation of plants for planting (other than true seeds)[2].

An expected output of the study will be the provision of guidance for a pre-screening process to enable identification of commodities that require an assessment prior to import. This pre-screening process should also be evaluated by applying it to a particular trade in plants for planting.

[1] « open » means that a commodity that is not specifically regulated can be imported.

[2] « Plants for planting » are plants intended to remain planted, to be planted or replanted.

The study focuses on plants for planting (except true seeds). The steps of the study as defined by the EWG are detailed in Box 2. As decided by the EWG, the present document initially focused on steps 1, 2 and 3. It was presented to the Working Party (June 2011), after presentation of the first results at the Panel on Phytosanitary Measures (April 2011). The Working Party decided that the pre-screening process (Step 3) should be considered further by an EWG, and the present document was adjusted to remove Step 3.

**Box 2. Steps (EWG, 14-15 December 2010)**

**1.** Analyze examples of outbreaks to highlight the limitations of the current 'open' system (i.e. PRA cannot predict unknown and/or undocumented risks). A list of possible examples is provided in Appendix 1. Consider examples where experience of import under the current regime has not resulted in phytosanitary problems. Consider how changes in trade or patterns of trade can influence occurrence of outbreaks. Investigate data that is readily available on trade of plants for planting to gain an overview of current trade and trade patterns.

**2**. Identify criteria linked to the (potential) risks, e.g. those that seem to be consistently associated with outbreaks related to imports of plant for planting

**3**. Develop a pre-screening process to be used by NPPOs to categorize plants for planting /origin risks (e.g. for new trade or a reevaluation of the current system), taking into account all criteria identified.

**4**. Testing the pre-screening process: Test the pre-screening process for a specific origin (e.g. one Asian country) to produce a list of commodities differentiating them according to their risk. Test the pre-screening process for a specific genus of plants for planting (e.g. *Acer* spp.) for multiple origins.

**5**. Give, based on the preliminary investigation on trade in point 1, consideration to the need and feasibility of undertaking a much more detailed analysis of import data.

**6**. Produce a list of commodities/origins differentiating them according to their risk.

## 2. PLANTS FOR PLANTING IN THIS STUDY

### 2.1 Definitions

This study covers all plants for planting, except true seeds. Plants for planting are defined in the International Standard for Phytosanitary Measures No. 5 (*Glossary of phytosanitary terms*) (ISPM 5, 2010) as 'Plants intended to remain planted, to be planted or replanted'. In addition Article 2.1(d) of EU Council Directive 2000/29/EC (EU, 2010), defines 'plants intended for planting', as:

- 'plants which are already planted and are intended to remain planted or to be replanted after their introduction, or
- plants which are not planted at the time of introduction, but are intended to be planted thereafter.'

The categories of plants for planting covered in this study include:

- bare root plants (soil free)
- plants rooted (in sterilized and/or soil-less growing media, in soil)
- bulbs, tubers, corms, rhizomes
- cuttings (rooted or not)
- budwood/graftwood
- meristem tissue culture/in vitro culture.

These categories were adapted from those listed in the draft ISPM on *Integrated measures approach for plants for planting in international trade* (IPPC, 2010).

### 2.2 Specificities of plants for planting as commodities

Plants for planting are generally considered as presenting a higher risk of pest introduction than other commodities, especially as:

- the pests can survive, and possibly reproduce, on their living hosts or in the soil during transport of the commodity;
- once at destination, the plants will remain planted or be replanted. The pest may survive on the plant it was introduced on and might transfer to a suitable host if the conditions are suitable, especially if the plants for planting are grown outdoors.

## 3. A BRIEF LITERATURE REVIEW

A large number of recent studies review the introductions of organisms into Europe or into individual countries. Some focus on groups of pests (e.g. arthropods, pathogens) while others are more general. DAISIE, an EU-funded project that aims, among other objectives, to create an inventory of invasive species that threaten European terrestrial, fresh-water and marine environments (DAISIE, 2011) has led to many such publications, one being the Handbook of Alien Species in Europe (Drake, 2009). Similarly, a whole issue of the journal Biorisk in 2010 is dedicated to alien arthropods in Europe (Roques *et al*., 2010), with individual chapters on taxonomic groups. In an introductory chapter, Roques (2010) notes that 1590 alien arthropod species have established in Europe and refers to many national checklists of alien arthropods. For example Sefrova & Lastuvka (2005) established a catalogue of alien animal species (incl. molluscs, arthropods, insects, vertebrates) deliberately or accidentally introduced into the Czech Republic. They listed 595 species of alien origin, 113 of which are considered invasive (i.e. have established and spread), and 28 are pests of agricultural crops.

Roques (2010) notes an acceleration of reports of invasive arthropod species since the 1950s. Many other authors of publications (cited below) identify factors that have contributed to the increase of pest movement and introductions in recent decades:

- increase in volumes of traded plants and plant products. This has also had an impact on the inspection of consignments at import,
- increase in the types of commodities traded,
- diversification of origins,
- changes of production areas for certain plants,
- impossibility in the current plant health system to identify risks and implement appropriate actions for all pests in trade.

Introduction of propagating material and planting material is often mentioned as a source of introduction of pests. For example:

- In Jones & Baker (2007), although only 20% of the pathogens of plants found in Great Britain between 1970 and 2004 can be linked to known imports, many pathogens are thought to have entered with vegetative plant material due to their biology. Nearly all of the 26 introduced viruses are considered to have been introduced with plants, cuttings or runners.
- In France, Desprez-Loustau *et al.* (2009) conclude that 227 alien pathogen species have been introduced since 1800, and many are suspected to have been introduced on living hosts; 178 are considered established, 65% of which are plant pathogens (46% on crop plants, 31% on ornamentals, 22% on forest trees).

Some articles give details of recent introductions and presumed pathways (e.g. Jones & Baker, 2007; Rabitsch, 2008; Smith *et al.*, 2007). Ornamentals are regularly described as hosts for a large number of introduced pests. The trade of ornamentals is often identified as a major contributor to introductions, with characteristics such as huge volumes, rapid changes in the plant species traded and their origins, rapid transport allowing survival of pests and hitch-hikers, together with the occurrence of suitable habitats at destination.

- Jones & Baker (2007) remark that over half of new pathogens in Great Britain were found on ornamentals, which reflected the magnitude of the trade and the commodities imported (plants rather than seed).
- In Italy, Ratti (2007) mentions ornamentals and bonsais among the known sources of introduction of Coleopteran species.
- Also in Italy, Pelizzari & Dalla Montà (1997) note that, amongst 115 insect pests introduced in 1945-1995, 57 are pests of ornamentals, many being widely distributed in gardens and parks, and 19 species were introduced into glasshouse crops. Some introductions are attributed to the bonsai trade. They also note that climatic conditions in Italy allow establishment of subtropical or tropical species in the South of the country. Eighty nine of the introduced species are considered to be established, with 35 of these being widely distributed. Some others are thought to be present in crops in restricted or very specific conditions, hampering their spread to further areas. Expanding the study to 1945-2004 and to mites, Pelizzari & Dalla Montà (2004) list 162 introduced pests, of which 79 are pests of ornamentals, 38 of woody plants, 16 of citrus, 15 of horticultural crops and 14 of fruit trees and grapevine.
- Rabitsch (2008) notes that 49% of alien Heteroptera species were introduced in Europe as contaminants, usually with ornamental plants. A total of 42 alien Heteroptera have established in Europe, 12 of which were alien to Europe (the remainings have unclear or cosmopolitan origins or originate from others parts of Europe).
- In a review of the establishment of invertebrate pests in Great Britain in 1970-2004, Smith *et al.* (2007) remark that plant trade, particularly of ornamentals, accounts for 89% of all introductions; 65 out of 114 human-assisted introductions were associated with ornamentals grown outdoors.
- Streito & Martinez (2005) establish a list of 41 pests of economic importance introduced into France in 2000-2005 (without consideration of pathway), and note that 61% are pests of trees and shrubs. This includes 23 species on ornamentals. In addition, five species were introduced on palm, three on bamboo and three on eucalyptus, and about ten species were found only in glasshouses.

Desprez-Loustau *et al.* (2007) indicate that the introduction of exotic tree species has been a vector of introduction of specific mycorrhizal species of fungi. A number of species have displayed different host ranges in introduced areas compared to their native origin, and such host jumps often occur between species of the same genera. Mattson *et al.* (1994) in a study on insects of woody plants introduced in the USA and Canada made a similar observation, noting that virtually all pests attack the same species as in their original range, or a species in the same genus. Webber (2010) notes that introduced fungi that attack tree species may have both economic and environmental impact, as they may spread to natural ecosystems and often evolve in new environments. Losses generally start some years after the introduction, when pest populations have increased and are beyond control measures.

The vast majority of the pests that are introduced are minor, and rarely come to the attention of phytosanitary circles at the international level. By contrast, the minority that become major pests receive much more attention and are extensively discussed and studied, and some of them regulated. Most examples of recent incursions, outbreaks and introductions in the EPPO region developed in section 5 of this document belong to the latter category, but some other examples are also used. Many publications include examples of organisms that have been introduced in the region and are not considered as major pests. In Jones & Baker (2007), 45 out of 234 plant pathogens introduced into Great Britain in 1970-2004 are considered important, with only few pathogens introduced on ornamentals regarded as being important. Although few of the 42 heteroptera species introduced into Europe have negative economic importance, five species are thought to have potential negative impacts in the future (Rabitsch, 2008).

Asia and North America are generally mentioned as major sources of introductions, reflecting the movement of trade and commodities to Europe over the period considered by these studies (Sefrova & Lastuvka, 2005; Smith *et al.*, 2007; Roques, 2010).

The importance of plants for planting for the introduction of pests is also recorded from other regions, irrespective of the level of stringency of their phytosanitary system. In the USA, Reichard & White (2001) note that 82% of the 235 woody invasive plants species identified had been used in landscaping; horticultural pathways identified as a continuing pathway of introduction of invasive plants include among others mail-order nurseries, horticultural societies and garden clubs, trade of aquatic plants. USDA (2007) also expands on the risks of plants for planting for the USA, based on introductions, trade data and interceptions. In a study on the status and causes of alien species invasions in China, Xu *et al.* (2006) list 19 introduced plant pathogens and identify seedlings, pot plants, soil and wood as the pathways for their introduction. They also note that increasingly rapid international trade is a factor for the risk of invasion of alien species. Finally in Canada, Langor (2009) reviews introduction of non-native terrestrial arthropods on woody plants and notes a significant increase in introductions of non-native species originating in Asia which is associated with the increase in trade from this region in the past 20 years. Finally, examples of pests of trees introduced by international trade of plants and plant products are included in the Supplement to the Montesclaros Declaration (IUFRO, 2011).

## 4. THE CURRENT 'OPEN' SYSTEM

Most of the 50 EPPO member countries operate under an 'open' phytosanitary system, under which a commodity that is not specifically regulated can be imported, whether the risk of this commodity has been assessed or not. The system is called 'open' because an assessment of the risk that the commodity poses from different origins is not always assessed before entry is allowed. Commodities are prohibited when the risk is assessed and it is considered that it can not be addressed sufficiently by import requirements, or when the commodity is considered to pose a too high risk, even when the risk is not fully known. All other commodities are either regulated with appropriate phytosanitary import requirements or just allowed in. EPPO as an organization has applied and encouraged this approach, in order to fulfil the aim of preventing the introduction of pests into the region and the spread of pests that are already established. EPPO identifies organisms that could present a risk, makes recommendations on pests that should be regulated and proposes technically-justified phytosanitary measures. This is part of a transparent documented process. A system for performing PRA at the level of EPPO has also been established, and risk analysis is conducted for individual pests using EPPO Standards on pest risk analysis, mainly the EPPO Standard PM 5/3 *Decision-support scheme for quarantine pests* (EPPO, 2011). The current study does not aim to analyze the current phytosanitary system in EPPO Member Countries. However a brief overview is useful to aid the understanding of context for the EPPO region.

<u>EU 27 Member States and associated countries</u>

EU Directive 2000/29/EC and subsequent amendments (EU, 2010) defines the plant health regulations of the 27 EU Member States. The regulations of two associated countries, Switzerland and Norway, are also based on this Directive to a great extent.

Regulated pests, or 'harmful organisms' in the Directive, are listed, and requirements are made on relevant commodities and other articles from specified origins to prevent the introduction and spread of these pests. At the most stringent level of requirement, the importation of 19 specified plants, plants products or groups thereof are prohibited, from defined origins (third-countries or specified countries) and an additional 2 are prohibited to part of the EU. Specific requirements are made against specified pests for specified commodities from specified origins (i.e. a pathway). The Directive also makes some provision for the movement of commodities within the region in relation to specific pests that are already present in part of the EU. Finally it includes general measures for non-specified risks, some applying to plants for planting, such as:

- trees and shrubs, annual and biennial plants, herbaceous perennial plants – free from plant debris, flowers and fruits, grown in nurseries, inspected;
- deciduous trees and shrubs – dormant, free from leaves;
- naturally or artificially dwarfed plants – complex growing regime;
- soil and growing medium attached to or associated with plants– detailed requirements.

All imports of commodities subject to specific requirements have to be accompanied by a Phytosanitary Certificate, which attests to the phytosanitary status of the consignment. This implies in particular inspection in the exporting country and compliance inspection in the importing country at arrival. However, inspections in both cases mostly target the regulated pests. They might or might not detect the presence of other pests, especially if these are small, hidden on or inside the plants, if the plants do not show symptoms or cannot be easily inspected, if the pest is present at very low levels in a large lot, etc.

The EU also targets 'harmful organisms that have a potential economic importance, and previously unknown to occur in the EU and not listed specifically in Directive 2000/29/EC'. As a result of identification of such pests, emergency measures are specified. Emergency measures are currently in place for 12 pests and 7 of these include provisions in relation to plants for planting (*Phytophthora ramorum*, *Bursaphelenchus xylophilus*, *Dryocosmus kuriphilus*, *Rhynchophorus ferrugineus*, *Potato spindle tuber viroid*, *Anoplophora chinensis*, *Gibberella circinata*) (EU, 2011).

Other EPPO countries

A few EPPO countries operate a more closed system, in which imports of certain defined categories of plants and plant products are subject to assessment before a decision is taken on the possibility and the requirements for import. This is arranged by a procedure for a commodity risk analysis for each new commodity-origin combination. Commodities are prohibited until the risk is assessed and appropriate management options are formulated. This is often linked with a system of import permits (e.g. for Israel). Other countries operate a similar system to the EU, with lists of organisms, some prohibitions and some specific requirements. General requirements for wide categories of commodities might also be in place, for example that all plants for planting be accompanied by a phytosanitary certificate.

In addition, some EPPO Member Countries exempt small quantities of commodities from requirements, and there are generally no regulations in place for transport of small quantities of material by individuals such as plane passengers, for their own use etc.

Throughout the region, notifications of non-compliance should be reported to the EPPO Secretariat and are published in the EPPO Reporting Service. In practice these data are not complete but still provide useful information. Notifications of non-compliance reported in the EPPO Reporting Service in the period January 2006-December 2010 were used in this study.

It should be noted that the impossibility under the current system to identify and address all potential pest risks (especially unknown risks and highly evolving organisms), ensure inspection and proper application of regulations, and take action in case of non-compliance, is sometimes mentioned as a reason contributing to introduction of pests worldwide (e.g. Brasier, 2008; Webber, 2010). While wood packaging material, another pathway identified as contributing to movement and introduction of pests, is now covered under a pathway approach allowing all pest risks to be addressed (Webber, 2010), this is not the case for plants for planting in most EPPO countries. Finally although eradication may be attempted once a pest is introduced, its success is not guaranteed. Pluess *et al.* (2012) in a study on past eradication attempts identify a few factors linked to the success of eradication (such as pest occurring in closed systems (e.g. glasshouses), readiness to act, size of the infested area, accessibility to the outbreak).

## 5. OUTBREAKS AND SAFE TRADE UNDER THE CURRENT 'OPEN' SYSTEM (STEP 1 OF THIS STUDY)

The section below presents recent outbreaks of selected pests, as well as pathways for which experience of trade has not presented problems. An analysis of trade data is also given. Examples of pests were chosen based on the original suggestions of the EWG but an attempt was also made to cover a range of pests, host plants and areas of introduction. A large part of the study was written before April 2011 and events relating to pests after that date are not covered (e.g. the further spread of a specific pest). The examples are used to identify factors, linked to the pests or their hosts, which led or facilitated incursions or introductions into the EPPO region. The examples and factors identified are then used in section 6 to define criteria linked to risks and associated with the examples developed.

Some examples are described in attachments that provide information of relevance: on the pest, its spread and outbreaks, as well as on its host plants. Details on the biology of the pest are not given, as they are in most cases available in an EPPO data sheet or EPPO Alert List description at www.eppo.fr. When there is an attachment, relevant references are cited in the attachment. Extensive use was made of EPPO information systems when reviewing examples, especially the EPPO Reporting Service. References to Reporting Service articles are quoted as 'RS year/number'.

## 5.1 Four pests of palm: *Rhynchophorus ferrugineus*, *Paysandisia archon*, *Diocalandra frumenti*, *Opogona sacchari*

Several pests of palm have entered the EPPO region on plants for planting in recent decades. The most striking examples are *Rhynchophorus ferrugineus* (Insecta: Coleoptera: Curculionidae) and *Paysandisia archon* (Insecta: Lepidoptera: Castniidae) (Attachments 1a and 1b), because outbreaks and spread of these serious pests occurred in a similar way and over a similar time period. Both are insects whose larvae bore and feed within the stems of palm trees. Infestations often lead to the death of trees. The biology of these pests has facilitated their introduction, spread and establishment. For example larvae are difficult to detect in trunks, and symptoms often appear late. In many cases of introduction of these pests in the EPPO region and elsewhere, outbreaks were detected several years after the suspected introduction. Both insects were repeatedly introduced in infested palms and the pest has also spread by natural means. Another common feature of *R. ferrugineus* and *P. archon* is that, in importing countries, they were found on palm species that were previously not recorded as hosts. In both cases, although stringent measures were applied and were effective in suppressing and containing the pest, to date eradication has not been successful in the EPPO region. Both pests have caused heavy economic and aesthetic damage due to death and removal of trees. In the EPPO region, these pests were first recorded in an EU country, and the only specific measures in place on palm trees were for *Phoenix* spp. against Bayoudh disease. However these were targeting countries where these *R. ferrugineus* and *P. archon* did not occur at the time.

*R. ferrugineus* (Attachment 1a) has been spreading from its origin in Asia to the Middle East from the 1980s and to Europe throughout the 2000s. In the EPPO region, it was identified in Spain in 1995 on samples collected in 1994 and 1995 (EPPO RS 96/096), and is now reported from most countries of the Mediterranean area. It is interesting to note that it has recently been found in the Caribbean (Netherland Antilles, 2009) and North America (California, USA, 2010) and, as in the EPPO region, is presumed to have been introduced on plants for planting. Many outbreaks of *R. ferrugineus* have been attributed to repeated import of infested palm trees. Larger plants are more at risk and the emergency measures in place in the EU against *R. ferrugineus* target plants with a stem diameter above 5 cm (see Attachment 1e for details of emergency measures). In its original range, *R. ferrugineus* was known as a serious pest and was recorded on a wide range of plants; its main host plants were thought to be coconut, oil palm and sago palm. The main particularity of the spread of *R. ferrugineus* worldwide is its adaptation to other hosts in the palm family (Arecaceae). In the 1980s, date palm (*P. dactylifera*) was the major host as the pest spread in the Middle East causing serious damage. When *R. ferrugineus* entered the EPPO region, it most frequently attacked *Phoenix canariensis*, one of the most common ornamental palms in the Mediterranean area. It also attacked date palms where these are grown, i.e. in a limited part of the region, as well as palm species that were not previously recorded as hosts, as these species originate from areas outside its original distribution (e.g. the Americas). Additional host plants were identified when the pest reached the Netherlands Antilles in the Caribbean. There is still an uncertainty concerning the exact host range of the pest, because it seems that some palm species considered as resistant in some countries are attacked in others.

Unlike *R. ferrugineus, P. archon* (Attachment 1b) was not considered as a pest in its native range, South America, presumably either because it is controlled by natural enemies or as it mostly attacks palms in the wild. First outbreaks in France and Spain were recorded in 2001 but the pest is suspected to have been detected only several years after the import of infested palm trees from Argentina (EPPO RS 2002/012). The hypothesis has been made that the imported infested palms had been collected from the wild. Control of *P. archon* was initially hampered by the lack of data and experience on this pest. The distribution of *P. archon* in the EPPO region is currently more limited than that of *R. ferrugineus*. There is currently no other known cases of introduction of this pest in other regions of the world.

A third pest of palm has been found in the EPPO region. *Diocalandra frumenti* (Insecta: Coleoptera: Curculionidae) (Attachment 1c) is a palm weevil whose larvae attack palm fronds (and not stems). It was found in 1998 on one of the Canary Islands (ES) and later on several of the Canary Islands, but not in the rest of the EPPO region (EPPO RS 2003/080). Although data is lacking, it presents similarities with *R. ferrugineus* and *P. archon* in terms of pest biology, i.e. it has hidden life stages that can be transported on plants for planting.

*Opogona sacchari* (Insecta: Lepidoptera: Tiniidae) (Attachment 1d), probably introduced in the EPPO region in the 1970s, presents another interesting feature: palms are not among its major hosts, but outbreaks have been reported on palms. *O. sacchari* originates from humid tropical and subtropical areas of Africa, where it is not reported as a pest. It has spread to several regions of the world since the 1970s, and has become a major pest of a number of tropical plants, such as banana. *O. sacchari* has not established outdoors in the EPPO region, except on the Atlantic islands of Portugal and Spain. In the rest of the EPPO region, it has mostly been reported on ornamentals, including palms, and is considered as present in some EPPO countries under protected conditions. It has also been intercepted on a wide range of host plants. Because outbreaks occurred on plants grown under protection, many incursions or outbreaks have been eradicated.

Unlike many other plants in other examples in this study, palms (Arecaceae) were regulated by a relatively large number of countries at the time of introduction of the above pests (Attachment 1e). However the regulations targeted mostly Bayoudh disease, and therefore date (*Phoenix dactylifera*) more than ornamental palms. General requirements (not targeting specific pests) were also in place for all plants for planting in many countries, including in the EU. The measures in place were however not sufficient to prevent introductions. *R. ferrugineus* and *P. archon* have attracted a lot of attention worldwide. More genera have been targeted by measures since the introductions of these 2 pests. In the EPPO region, several other pests of palm have been identified as a phytosanitary risk (e.g. *Metamasius hemipterus, R. palmarum* both on EPPO A1 List).

The majority of outbreaks of the four pests above in the EPPO region have related to ornamental palms, although *R. ferrugineus* also causes serious damage on date palm. Ornamental palms have been used for a long time in the EPPO region. However in recent decades palms have been increasingly used as ornamentals in all areas where they can survive, including temperate oceanic climates. In the Mediterranean area, their use as street or garden trees has increased to improve the appearance of streets and seafronts. This has led to an increase of trade of 'ready-for-landscape' trees. Imports of not only large quantities of plants but also large plants have probably favoured pest entry and the occurrence of outbreaks. Palms are a group of plants for which trade data is already available. In 2008, the EPPO Secretariat sent a questionnaire regarding quantities of palms imported into EPPO countries. Although a limited number of countries answered, the answers provide useful data. Among respondants, the Netherlands was by far the biggest importer of palms (an average of 6644516 per year for 2005-2007), followed by Germany (222269), Turkey (45290) and Hungary (40000) (See Attachment 1e, Table 2). The imports per country and per year (Attachment 1e, Table 3) do not really show a general trend, but the data show increases in quantities for most countries. Among the countries that indicated the origin of palm imports, some imported all or most of their imported palms from within the EPPO region (Algeria, Turkey, Croatia), some a minor part (France, Netherlands), and some none (Germany, Malta). Moreover the Netherlands and France provided some data at genus level (although not for the same years) (Attachment 1e, Table 4), and some interesting facts emerge:

- Important variations from year to year - the data do not reflect any large consistent trend in the import of any one genus.
- Trade relates to many more genera than those covered under current regulations (e.g. in the EU). EU requirements target only those genera or species known to be hosts of regulated pests. Of the 6 genera imported in quantities above 100000 units in 2005-2007, only some species of *Livistona*, *Areca* and *Howea* are currently subject to specific requirements in the EU (Attachment 1e). The other 3 genera are not subject to specific requirements (*Chrysalidocarpus*, *Rhapis* and *Licuala*).
- Import patterns vary between individual countries. For example, small quantities of many genera are imported in France whereas the Netherlands imports large quantities of fewer genera.
- Imports of small numbers of a specific species from a specific country may take place on occasion. For example 60 *Nannorrhops* spp. were imported to France from Pakistan in 1996 and 2 *Raphia* spp. from Madagascar in 1999. These were the only imports of these genera and from these countries reported in the questionnaire.
- Sudden increases with some shifts of origin occur – for example for *Howea* spp. (Attachment 1e, Table 5a): increased imports from Australia in 2005-2007 were associated with shifts of origin in the same period, with imports from Kenya/New Zealand in 2005, from Norfolk Island in 2006, from China/USA in 2007.
- Large one-time imports from specific origins (e.g. over 1.6 million *Chrysalidocarpus* from Uganda to the Netherlands in 2005).
- Australia appears to trade the highest quantities in the data considered (i.e. mostly 2005-2007) (Attachment 1e, Table 6), mainly because of imports of *Howea* spp. to the Netherlands. Similarly, Uganda is fourth, but only because of *Chrysalidocarpus* spp. in 2005 to the Netherlands. Sri Lanka and Honduras exported a wider variety of genera in the period considered.
- Presumably due to the wide range of origin of palms, most genera were imported from at least two continents, some from all the regions of the world considered (Attachment 1e, Table 4).
- Import of large quantities of small plants, as in the case of imports of millions of palms. *Howea* and *Chrysalidocarpus*, the most imported palms, are imported in the Netherlands respectively as very small plants

(just germinated) and pot plants of stem diameter less than 5 cm (N. Horn, Plant Protection Service, Netherlands, personal communication).

Although trade and interception data may not originate from the same EPPO countries, nor relate to the same years, some additional observations can be made. The following should be interpreted cautiously as the trade and interception data are not for the same years, and interception data might not be complete.

- Many interceptions of pests are recorded on palm plants for planting (Attachment 1e, Table 8), many of which are soil or root nematodes, reflecting the fact that palms are often traded in or with growing medium attached.
- Some palm genera, although traded from outside the EPPO region (at least in 2005-2007) and regulated by general requirements or specific requirements against given pests (at least in the EU), do not show interceptions in 2006-2010. Of the 6 most traded genera, 5 (*Howea*, *Chrysalidocarpus*, *Areca*, *Rhapis* and *Licuala*) are not mentioned in the interceptions; the 6th genera, *Livistona* spp., appears once. Other genera, although not traded in large quantities (in 2005-2007) and regulated, are commonly intercepted from different origins (in 2006-2010). This is the case of *Trachycarpus* spp. This could simply reflect the fact that *Trachycarpus* spp. are commonly traded with growing medium, but this is also the case of some of the other species.
- No interceptions (2006-2010) were made from some continents (Africa and Oceania), although trade occurred (2005-2007). The data is not precise enough, neither on trade or on interceptions, to draw meaningful conclusions from this absence of interception; it may be linked to a low volume, or to satisfactory export practice with large volume and very small size of the plants (e.g. *Howea* from Australia). Here again, the reverse observation seems more interesting for this study: there are a substantial number of interceptions on palms from some origins in Asia, Central America and South America (and from within the EPPO region).

The following factors can be derived from the elements above.

**Box 3 - Important factors for the introduction of *R. ferrugineus*, *P. archon*, *O. sacchari*, *D. frumenti***

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • Hidden life stages, absence of symptoms at early stage: difficult to detect (all four)<br>• High reproductive potential (several generations per year, large number of eggs): *R. ferrugineus, O. sacchari*<br>• Adaptation to new hosts in the palm family (*R. ferrugineus*, *P. archon*, *O. sacchari*), or to hosts not previously reported as major hosts (*O. sacchari*).<br>• Natural spread occurs (at least *R. ferrugineus*, *P. archon*)<br>• Unknown pest or lack of data, especially on biology and control (*P. archon*, *D. frumenti*)<br>• Tropical and subtropical pests that have established in some parts of the EPPO region, even if not necessarily identified as an obvious risk for the region (*O. sacchari*, *D. frumenti*).<br>• Pests not directly regulated at the time of entry. | • Perennial plant, may grow as large trees.<br>• Large family with many species grown in the EPPO region.<br>• Widely grown in some parts of the EPPO region, in a wide variety of environments, plantations, nurseries, gardens, parks, roads,in the wild.<br>• Increase in use and trade of ornamental palms in the EPPO region<br>• Commonly traded as large trees, and with growing medium<br>• Wide range of origins worldwide and shifts of origin in trade occur.<br>• May be collected in the wild. |

### 5.2 A pest of fuchsia: *Aculops fuchsiae*

At the time of the first outbreaks in the EPPO region, *Aculops fuchsia* (Arachnida: Acarina: Eriophyidae) Attachment 2a) was known as a damaging pest in California where it had been detected in 1981, but not where it was first described (Brazil). All information available on *A. fuchsia* as a pest originated from the USA. *A. fuchsia* had been identified as a risk for Europe in the 1990s, and specific phytosanitary import requirements were in place in the EU for plants for planting of fuchsia from the USA and Brazil. However, requirements targeted fuchsia in trade, while most cases of introduction in the EPPO region could be traced back to plant material brought by amateurs[1] (EPPO RS 2004/01, 2007/172, 2008/003). *A. fuchsiae* was first reported in the EPPO region in France in 2003 and later in several other EPPO countries. In most countries, the pest was introduced from outside the region, and then spread; in one case introduction was due to natural spread by pollinators from an infested country (EPPO RS 2007/087). European outbreaks could not be eradicated where the pest was too widely distributed, especially where outbreaks started in private gardens, because natural spread via wind and pollinators occurred, or because of repeated introductions by amateurs. Based on the original distribution of the pest (Brazil and California), climatic comparisons may well have indicated that conditions are unlikely to be suitable for establishment in the EPPO

[1] Inspection of passenger luggage is usually limited in European countries.

region. However, after introduction in the EPPO region, it was observed that the important requirement for survival of *A. fuchsiae* outdoors is mild winters. Furthermore the pest is small and difficult to detect by general visual inspections; at early stages of infestation, plants do not show symptoms. In addition it has a high reproductive potential.

The host plants, fuchsias (Attachment 2b), could be described as an ‘old’ popular ornamental plant of economic importance in the EPPO region (i.e. imported and bred since the 19th century in Europe). Fuchsias are propagated commercially on a substantial scale, widely found in private gardens and also regularly exchanged privately by amateur growers. Many introductions in the EPPO region were linked to repeated introductions of infested material from outside the region by amateurs. Although fuchsia is widely propagated and grown under protected conditions, this is not mentioned as an important factor for the establishment of the pest in the EPPO region as most outbreaks started with material planted in private garden. The pest was found in private gardens outdoors in most outbreaks. EPPO interceptions reports for 2006-2010 include only one record: interception on fuchsia, for *Bemisia tabaci* on cuttings from Kenya in 2006. The data available on trade of fuchsia plants for planting (Attachment 2b, Table 1) indicate a large and growing trade with some shifts of origin, in particular from South America to Africa.

The following factors can be derived from the elements above.

**Box 4 - Important factors for the introduction of *A. fuchsiae* on fuchsia**

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • High reproductive potential (short life cycle, several generations during the growing season).<br>• Tropical or subtropical origin, but unknown climatic parameter before introduction: the only limiting factor is mild temperatures in winter (above 5°C).<br>• Easily spread naturally, especially by wind and pollinators.<br>• Difficult to detect (small insect).<br>• Difficult to control (by the time symptoms appear, the mites are likely to be hidden inside plant structures). | • Perennial plant, widespread in the EPPO region.<br>• Popular ornamental: many associations, fairs, amateurs exchanging material without any phytosanitary control.<br>• Grown indoors and outdoors, in pots or in soil. |

### 5.3 Pests of *Buxus* spp.: *Diaphania perspectalis* and *Cylindrocladium buxicola*

Several pests of *Buxus* spp. have recently been recorded, two of them are especially interesting. *Diaphania perspectalis* (Insecta: Lepidoptera: Pyralidae) (Attachment 3a) is a known pest of *Buxus* in Asia and had not been observed in the EPPO region until 2007. Within a few years, it was found in six EPPO countries. The origin of the first introduction is not known; it might be due to infested plants for planting or to hitchhiking on other commodities. However the role of infested plants for planting has been strongly suspected in some later outbreaks. Natural spread has also occurred. The pest is difficult to detect as eggs, larvae and pupae are difficult to find on leaves.

*Cylindrocladium buxicola* (Fungi: Ascomyta: Nectriaceae) (Attachment 3b) was totally unknown when it was first discovered in the UK and then in New Zealand in the 1990s. In the UK a first outbreak was detected in 1994, and it was only in 1997 that a second outbreak was detected. The pest is now widespread in the UK. In 2000, it was found in Belgium, and between 2006 and 2009 it was found in eight additional EPPO countries. Plants for planting are the main means of spread over long distance, but the fungus’ resting spores can also be spread with soil, water splashes, animals and humans. It is unclear why spread accelerated in the second half of the 2000s.

A common feature of the two pests is the lack of information on these pests prior to outbreaks occurring. *D. perspectalis* was known as a serious pest but most publications were in Asian literature, i.e. difficult to exploit in the EPPO region for language reasons. *C. buxicola* was totally unknown and had never been reported before the first outbreak in the UK occurred.

The hosts plants, *Buxus* spp. (Attachment 3c), are widespread in the EPPO region. They are used as ornamental shrubs and are also important in the wild in some ecosystems, especially in the Mediterranean region. In both cases, outbreaks still seem to be limited to *Buxus* grown as ornamentals, and the pests have apparently not reached areas where *Buxus* is an important component of ecosystems in mixed forest stands or open dry montaneous scrub lands. As an ornamental, *Buxus* is of economic importance and is grown in nurseries and in gardens. Data available on trade of *Buxus* plants (Attachment 3c, Table 1) show large increases in imports in recent years. There are only few notifications of non-compliance in relation to *Buxus* (Attachment 3c).

Interestingly, some companies or gardeners' information sites (see Reference section) mention possible replacements for *Buxus* spp. where *D. perspectalis* is a serious pest, such as *Ilex crenata* (origin: East Asia, including Japan), *Lonicera nitida* (origin China), *Berberis buxifolia* (origin South America), *Osmanthus* spp. (origin East Asia and North America) and *Taxus*. There are however risks associated with such a change. Firstly these species originate from other regions and, if from these origins, are liable to carry their own range of pests. *Ilex* is especially interesting as *D. perspectalis* has been reported on *Ilex* in Asia (but apparently not in Europe so far). In addition, while there are few notifications of non-compliance on *Buxus* spp. in the EPPO Reporting Service in 2006-2010, there are a large number of interceptions on *Ilex* spp., particularly from Japan and mostly due to the presence of nematodes. Finally, from the data available, it seems that the trade of *Ilex* is currently increasing (Attachment 9, Table 1).

The following factors can be derived from the elements above.

**Box 5 - Important factors for the introduction of *D. perspectalis* and *C. buxicola* on *Buxus* spp.**

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • Unknown pest, or pest for which data is not easily accessible because of language, resulting in lack of data on its biology, geographical distribution, damage and control.<br>• Difficult to detect.<br>• Pests not directly regulated at the time of entry. | • Perennial shrub<br>• Widespread in the EPPO region: popular ornamental and important component of ecosystems in some part of the region.<br>• Grown outdoors, in pots or in the soil.<br>• Volatility of the market. |

### 5.4 Pests of unknown origin: *Calonectria pauciramosa* and *Fusarium foetens*

Similar to *Cylindrocladium buxicola*, *Calonectria pauciramosa* (anamorph *Cylindrocladium pauciramosum*) (no attachment) is also a fungus of unknown origin and is recently described. It is presumed to originate in Central and South America. Its worldwide distribution is not well known, but it is thought to occur in many countries with some records having previously been confused with *C. scoparium*. Schoch *et al.* (2001) mention isolates from Australia, Brazil, Colombia, Italy, Mexico and South Africa. Taxonomy issues are not completely solved as Lombard *et al.* (2010) identified three cryptic species within (and in addition to) *C. pauciramosa*. *C. pauciramosa* has a wide host range, with eucalyptus being a major host. In South Africa it is indeed considered as one of the most important pathogens of eucalyptus (*Eucalyptus grandis*, *E. nitens*) in forestry nurseries and it was also isolated on *Azalea* spp., *Pinus* cuttings and *Prunus* sp. From the Americas, isolates are known from *Eucalyptus* spp. and soil (Brazil, Colombia, Mexico). In Zambia, it was found in one eucalyptus nursery (Chungu *et al.*, 2010). In Australia, isolates are available from *Fragaria* sp. (Schoh *et al.*, 2001) in addition to eucalyptus (Lombard, 2010).

In the EPPO region, *C. pauciramosa* was detected for the first time in 1993 in Italy (Polizzi & Crous, 1999) on *Polygala myrtifolia* and was then found in nurseries on at least *Callistemon* spp*., Callistemon viminalis, Callistemon citrinus, Acacia retinodes, Metrosideros robustus, Eucalyptus viminalis, Eucalyptus rostrata, Myrtus communis, Arbutus unedo* (Schoh *et al.*, 2001; Vitale *et al.*, 2009). Most of these could be considered as 'minor' ornamental plants overall within the EPPO region, which are not submitted to specific requirements at import. They are nevertheless very important in limited areas of the EPPO region, in this case the southern part of some EPPO countries. Camele *et al.* (2009) report an increase in damage in Italy since the introduction of *C. pauciramorosa*, with extensive losses in nurseries in the South (Sicily and Calabria). Although the origin and pathways into the EPPO region are not known, it is supposed that *C. pauciramosa* has been introduced on host plants for planting. Schoch *et al.* (2001) comparing isolates (mating type and DNA sequences) makes the hypothesis of more than one introduction into Italy, one of them origininating from South Africa.

The fungus has recently been reported on numerous new hosts in different countries, such as:

- 1999, USA (California) on Cape heather (*Erica capensis*) (new country, new host) (Koike & Crous, 1999) and later on myrtle (Koike & Crous, 2001);
- 2002, UK on *Ceanothus* (new country, new host, new family Rhamnaceae);
- 2002, Portugal on *Myrtus communis* (new country)
- 2004, Spain on *Polygala myrtifolia* (Pérez-Sierra *et al.*, 2005) (new country)
- 2007, intercepted in Japan on *Acacia armata*.

- 2008, Italy on *Melaleuca fulgens* (new host);

In the latest report to date, Lombard *et al.* (2010b) detected, among others *Calonectria* species, *C. ramorosa* in a commercial forest nursery of eucalyptus in the Guangdong Province of China.

This seems to be a fungus with a much wider host range than previously thought. Furthermore, not much was known on this pathogen before it started spreading. Its taxonomy and precise geographical distribution are still not fully known. Its major host seems to be eucalyptus, but in the EPPO region it is reported mostly on other plants. It is also not known whether it has been introduced on *Eucalyptus* spp., but the first outbreaks in the EPPO region and in the USA occurred on 'minor' ornamental hosts. Recent studies propose to separate isolates into several different species (Lombard, 2010a). From the point of view of outbreaks in the EPPO region, at least one species has entered and spread in the EPPO region on 'minor' ornamentals.

The following factors can be derived from the elements above.

**Box 6 - Important factors for the introduction of *C. paucirosum***

| *Linked to the pest*: | *Linked to the host plants:* |
|---|---|
| • Lack of data on taxonomy (may be several species), biology and distribution<br>• Has been moved on plants for planting<br>• Unknown or expanding host range<br>• Attacks are reported on nursery plants<br>• Pest not directly regulated at the time of entry. | • Mostly perennials<br>• Eucalyptus is widespread in part of the EPPO region, also in the wild. However the pest was reported in the EPPO region on 'minor ornamentals' that occur in a limited part of the region.<br>• Grown outdoors, in pots or in the soil. |

The case of *Fusarium foetens* (Fungi: Ascomyta: Nectriaceae) on begonia (Attachment 4a and 4b) is different from that of *C. ramorosa*. The fungus was unknown and was only described when it was detected for the first time in the Netherlands in 2003. Its origin is still unknown, although it is suspected that it might have been introduced with cuttings imported from South America or Africa. It has caused serious damage, but adequate methods of control have been developed. Begonias are perennials. They are propagated from cuttings, and import of infected material for further propagation could have resulted in the pest being widely distributed on this material. However, this did not happen. In the Netherlands official control was applied for propagating facilities. Appropriate measures have helped suppress *F. foetens* in propagation companies and to limit its incidence in pot plant companies. In addition begonias are grown indoors in the northern part of the region, thereby limiting the natural local spread of the pest. The pest occurs in a few other EPPO countries in glasshouses, but also seems to be under control. It is not present in the southern part of the EPPO region where begonias might be grown outdoors in the soil. However, its international spread continues and it has been found recently in countries on other continents, such as the USA, Canada and Japan. There is a very large trade of *Begonia* plants for planting into the EPPO region, as shown by data provided by some EPPO countries (see 5.13 and Table 5 in Attachment 9), with over 52 million plants (without distinction of type of plant for planting) imported in 2010.

The following factors can be derived from the elements above.

**Box 7 - Important factors for the introduction of *Fusarium foetens* on begonia**

| *Linked to the pest*: | *Linked to the host plants:* |
|---|---|
| • Unknown pest, unknown host range within begonia<br>• Lack of data<br>• Could spread if infested propagating material is used.<br>• Control is possible | • Perennial plants,<br>• Popular ornamental, grown indoors or outdoors, in soil or in pots.<br>• Propagated in nurseries<br>• Wide geographical origin and use of propagating material from various origins.<br>• Very large trade |

### 5.5 A new pest on kiwi: *Pseudomonas syringae* pv. *actinidiae*

Bacterial canker of kiwifruit caused by *Pseudomonas syringae* pv. *actinidiae* (Attachment 5a) was reported in 1992 in Italy, but economic losses started to be observed only in 2007-2008. The pest was later reported in France and Portugal in 2010. The area of origin of the bacterium is not known, but it has been introduced and has spread on four continents: Asia, Europe, Oceania and South America. It is suspected that long-distance spread has occurred via the movement of infected plants for planting. The risk was not obvious after the first introduction as the disease remained at low levels for 15 years in Italy.

Kiwi production (Attachment 5b) both in the EPPO region and worldwide has shown some interesting trends. A number of countries started establishing kiwi crops in the 1980s, and the area harvested has stabilized or is slowly growing. Others started cultivating this crop in the 2000s and have dramatically increased the area planted in kiwi (e.g. Turkey, from 1400 ha in 2000 to 20000 ha in 2009). Although there is no data to support this, establishment of large areas of a new crop probably partly relies on the import of planting material, new cultivars (some being more susceptible), etc. *P. syringae* pv. *actinidiae* has had a serious impact already in Italy and further spread in the region would be damaging for kiwi-growing at the scale of the region. It is unclear whether any EPPO countries target *P. syringae* pv. *actinidiae* in their regulations.

The following factors can be derived from the elements above.

**Box 8 - Important factors for the introduction of *Pseudomonas syringae* pv. *actinidiae* on kiwi**

| *Linked to the pest*: | *Linked to the host plant:* |
|---|---|
| • Requires testing for asymptomatic material<br>• Unknown pest, unknown risk, first introduction did not point to a risk<br>• Disease remained at a low prevalence for 15 years in Italy<br>• Possibly selection of more virulent strains | • Perennial tree, grown outdoors<br>• Expanding crop in a number of EPPO countries<br>• Some new cultivars shown to be more susceptible |

### 5.6 *Dryocosmus kuriphilus* on chestnut

*Dryocosmus kuriphilus* (Insecta: Hymenoptera: Cynipidae) insect originates from China and is considered among the most severe pests of chestnut worldwide. It was introduced in Japan, Korea and the USA in the 1940s-70s. Long-distance spread has occurred via infested stems (grafting material) and young plants. *D. kuriphilus* was first described in the EPPO region in 2003 in Italy, and later in several other countries. Outbreaks were found in nurseries, forests, orchards and gardens. Many outbreaks could be linked to the import of infested material, and natural spread has also occurred. In the EU, where it first entered the region, *Castanea* spp. were regulated through measures against the fungi *Cryphonectria parasitica* (A2 quarantine pest) and *Cronartium* spp. (A1 quarantine pest). They were also subject to an import prohibition from outside the region for isolated bark and for plants with leaves (other than fruits and seeds). Some other commodities such as wood or plants for planting were subject to specific requirements for the fungi above. These requirements were not directly targeted against *D. kuriphilus* and did not prevent its introduction. Chestnut is a long established and cropped plant in the EPPO region. It has now been established in new regions such as Oceania and South America, which are seemingly still free from this pest. The following factors can be derived from the elements above.

**Box 9 - Important factors for the introduction of *Dryocosmos kuriphilus* on chestnut**

| *Linked to the pest*: | *Linked to the host plants:* |
|---|---|
| • Difficult to detect (galls readily detected, but not eggs or first instar larvae inside buds)<br>• Known pest in several areas of the world, but unidentified risk in the EPPO region. Pest not directly regulated at the time of entry.<br>• High natural spread | • Perennial tree, grown outdoors, in a variety of habitats: gardens, nurseries, orchards, forests.<br>• Unidentified pest risk for that species: measures targeting other pests |

### 5.7 Pests of wild and horticultural plants: *Phytophthora* species such as *Phytophthora ramorum*

*Phytophthora ramorum* (EPPO Alert list[2]) (no attachment) is a pathogen of unknown origin, which was first observed around the same time in Europe and North America, and was introduced from an unknown origin. It has a wide host range with many important shrubs and trees of ornamental or environmental significance (FERA, 2009). *P. ramorum* is a new species, first identified in the EPPO region on rhododendron in Germany and the Netherlands

[2] *P. ramorum* should be proposed for addition to the EPPO A2 List in September 2012

in 2001, and then shown to be morphologically identical to a *Phytophthora* sp. causing sudden oak death in California since 1995 (Kliejunas, 2010). Main pathways for long-distance spread have been identified as plants for planting and soil (Sansford *et al.*, 2009). Following the first detections, the pathogen was found in a number of other EPPO countries. The first records were mainly on non-tree hosts (hardy ornamentals and nursery stock) growing in containers in nurseries. Outbreaks in a number of cases could be directly linked to the import of rhododendron or viburnum. Infected plants have since been found, with restricted distribution, outside nurseries, in parks, gardens and woodlands in many countries. The pest was also found on other hosts, such as *Vaccinium vitis-idaea*, *Arbutus unedo*, *Pieris forrestii*, Japanese larch (*Larix kaempferi*). Infected rhododendron plants were often reported in the immediate vicinity of infected trees. Rhododendron seems to play an important role in Europe as a source of inoculum for other species and in the spread of the disease via the movement of infested material between countries. There are 85 notifications of non-compliance for *Phytophthora ramorum* in the 2006-2010 Reporting Service. All of them are from EPPO origins. 74 relate to the family Ericaceae (68 on rhododendron, 3 on *Pieris* spp, 3 on mixed consignments of rhododendron, *Pieris* spp. or *Leucothoe* spp.). Other plants include *Viburnum* (Caprifoliaceae, 6 notifications), *Aucuba japonica*, *Magnolia*, *Photinia*, *Camellia*, *Hamamelis* (1 each). It has now been shown that *P. ramorum* has three different lineages, that may need to be regulated separately in order to prevent their intermixing, and *Phytophthora* spp. are recognized to both be moved along plant pathways and to evolve once in a new environment (Webber, 2010).

In addition to *P. ramorum*, many new species of *Phytophthora* have been discovered since the 1990s. Cline *et al.* (2008) provide lists of *Phytophthora* spp., their hosts and geographic distribution. Several diseases caused by *Phytophthora* spp. have emerged in the EPPO region in the same period, with impact on wild and horticultural plants, such as *P. kernoviae* and *P. alni* (Sache *et al.*, 2011). Some others *Phytophthora* species, similar to *P. ramorum*, have the potential to be spread with trade of nursery plants. One recent example is *Phytophthora niederhauserii* (not formally described), which was first found and described in 2003 in the USA on *Thuja occidentalis* and *Hedera helix* under glass, and later was found on *Ceanothus* sp. It has since been found on several continents on a wide range of ornamentals. In the EPPO region, it was found in glasshouses and nurseries: in Norway (*Hedera helix*, *Begonia × hiemalis*, *Begonia × cheimantha*, *Sinninga speciosa, Kalanchoë blossfeldiana*, *Peperomia clusiifolia*; Herrero *et al.* 2008, EPPO, 2009); in the UK (*Cistus* sp.); in Spain (almond - *Prunus dulcis*, *Cistus monspeliensis*, *C. salvifolius*, *Hedera* sp.; Moralejo *et al.* 2009; Pérez-Sierra *et al.*, 2010); in Italy (*Callistemon citrinus*, *Cistus salvifolius*, *Banksia speciosa*; Cacciola *et al.*, 2009). The last available record is from Hungary with findings on *Buxus sempervirens* in a public garden, and on *Abies nordmanniana* and *Chamaecyparis lawsoniana* in a nursery, with 25-30% mortality on some host species (Józsa *et al.*, 2010). In Australia, *P. niederhauserii* was also recorded on imported nursery plants.

The following factors can be derived from the elements above.

**Box 10 - Important factors for the introduction and spread of *Phytophthora ramorum* and other *Phytophthora* spp.**

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • Difficult to detect<br>• Lack of data on the pest<br>• Wide host range, adaptation to new hosts, genetic diversity<br>• Belong to a family with many recent cases of serious pests moving in trade or emerging as serious diseases.<br>• Potential for interspecific hybridization.<br>• Pests not directly regulated at the time of entry. | • Perennial trees or shrubs, grown outdoors in a variety of environments, gardens, nurseries, orchards, forests.<br>• One host, rhododendron, widely traded as plants for planting within the EPPO region.<br>• Unidentified pest risk for *P. ramorum* prior to introduction (as for other emerging *Phytophthora* spp.). |

## 5.8 Plants as pests: intentional or accidental introductions

There are many examples of plant species that have been introduced in the EPPO region either accidentally or intentionally, and have later been identified as having negative economic, environmental or social impacts, such as a negative impact on agriculture by effects on crops (as weeds), on grazing animals (e.g. toxicity) or on structures (e.g. blocking irrigation channels), loss of biodiversity by outcompeting the native flora or fauna, effects on human or animal health, and loss of recreational value. Such plants can entail huge costs for control and removal.

Many such plants would commonly move internationally as seeds or grain, either imported for planting or other uses (e.g. animal feed, biofuel), or as contaminants (e.g. in grain shipment, with machinery). As true seeds are not covered in this study, intentional introduction of seeds of plants is outside the scope of this study. This study only considers those species of plants that may move as plants for planting or in association with plants for planting.

Within EPPO, there is already information on plants that are considered as invasive, with the EPPO List of Invasive Alien Plants (EPPO, 2011). A prioritization process[3] has also been developed for invasive alien plants, with the aim of establishing a list of invasive alien plants for the EPPO region and to determine which species have the highest priority for an EPPO pest risk analysis.

Three main categories of plants can be distinguished which move in trade as plants for planting or with plants for planting:
- aquatic plants,
- terrestrial plants introduced as ornamentals,
- terrestrial plants transported in association with import of other plants for planting.

The first category, aquatic plants, comprises a large amount of plants for planting introduced as plants. A pathway analysis based on the import data of 10 countries was conducted by EPPO (Brunel, 2009). Of the 247 plants considered in the study, 185 were intended only for indoor use. The following 11 plants have already been identified as a threat for the EPPO region and are already listed in the EPPO A2 List (*Crassula helmsii*, *Eichhornia crassipes, Hydrocotyle ranunculoides***,** *Ludwigia grandiflora, Ludwigia peploides, )* or in the EPPO List of Invasive Alien Plants (e.g. *Egeria densa, Elodea nuttalli, Lagarosiphon major, Myriophyllum aquaticum, Hydrilla verticillata* and *Pistia stratiotes*). These plants continue to be traded, sometimes in huge quantities. For example *Egeria densa* was the most numerous imported species in the period considered by the study (1 878 098 plants) (Brunel, 2009). Such aquatic plants have been sold for many years as plants for aquaria or gardens ponds before being discarded in the environment and starting to cause problems. They cause environmental, social, human and animal health impacts, as well as entailing huge costs of control and removal. Other aquatic species might be introduced as contaminants in consignments of other species of aquatic plants (RS 2007/018).

Among terrestrial plants, some species may be introduced for specific purposes, most often as ornamentals, but also as forest plants, depollutants, etc. Garden escapees represent a substantial number of invasive plants. A pathway analysis for terrestrial plants is currently being carried out in the framework of the EPPO Panel on Invasive Alien Species. The following plants are examples of plants listed on the EPPO List of Invasive Alien Plants, which might be introduced as plants for planting (in addition to seeds for some).
- *Rhododendron ponticum* (ornamental; EPPO, 2005a) has become a serious pest in managed areas.
- *Prunus serotina* (ornamental and forestry; EPPO, 2005b) has negative impacts on managed forestry, also affecting natural forests, biodiversity and the environment in general.
- *Baccharis halimifolia* (ornamental, tolerant to salt and wind; EPPO, 2009a) competes with native vegetation, is a fire hazard, is detrimental to salt production and reduces the value of pastures.

The third category relates to terrestrial plants transported in association with plants for planting. Transport with soil associated with plants, especially nursery plants, occurs for plants as is the case for other pests considered in 5.8.
- *Polygonum perfoliatum* (EPPO A2 list; EPPO, 2007a) can be transported in association with nursery material. Association with rhododendron was mentioned in the USA.
- *Cenchrus incertus* (EPPO List of Invasive Alien Plants; EPPO, 2002) might be transported as a contaminant of seed lots, but also as seeds in soil attached to plants, and is a serious weed for example on arable land, vineyards, orchards.
- The main pathway for the long-distance spread of *Cyperus esculentus* (EPPO List of Invasive Alien Plants; EPPO, 2005c), a serious weed of many crops, is the dispersion of the plant's bulbs by movement of plant propagation material such as bulbs, corms or whole plants (perennial ornamentals and shrubs).
- Rooted nursery plants are considered as a possible pathway for *Solanum eleagnifolium* (EPPO A2 list; EPPO, 2007b). Cut root sections, in addition to seed, can ensure spread of the plant.

Plant invasions often take a long time to be observed. Plants identified as invasives may have typically been introduced in the region over a century ago, might have been noticed as first to be a problem in the middle of the 1900s, and be recognized as a problem only now. Internet sales have also been identified as a recent factor of spread of invasive plants, especially aquarium plants, by allowing end-users to import plants from anywhere in the world (RS 2007/017, RS 2007/018).

[3] EPPO Standard in series PM 5 to be proposed for adoption in September 2012.

The following factors can be derived from the elements above.

**Box 11 - Important factors for plants introduced as or with plants for planting**

| |
|---|
| *Linked to the plants*:<br>• Species with a past history of invasiveness<br>• Introduced intentionally as aquatic plants, ornamentals, forest species, or for specific purposes.<br>• May be imported by end-users through Internet sales.<br>• Introduced unintentionally in association with soil or plants for planting (especially nursery plants)<br>• Difficult to control<br>• Length of time to recognize an invasion. |

## 5.9 Plants with growing medium attached

Plants with growing medium attached may transport nematodes, insects, fungi and other plants. Soil associated with plants is subject to specific requirements in the EU to ensure that it is free from insects and harmful nematodes (EU 2010, Annex IV.A. I.34). Cannon *et al.* (2010) detail the current soil regulations in Europe and identify some issues remaining to be solved in relation to association of growing media with plants, such as determination of the components of growing media that present a risk and the volume of soil that can be associated with plants for planting. Notifications of non-compliance due to the presence of soil or root nematodes are given in Attachment 6. Many of these relate to bonsais, trees or bushes.

Plants may be collected in the wild or grown in soil in the nursery. The former is especially the case for bonsais. Some countries, including the EU, have put in place measures in addition to the specific requirements that might apply to the plant species concerned (EU 2010, Annex IV.A. I.43). Bonsais ('naturally or artificially dwarfed plants'), including those collected in the wild, should be grown in officially registered nurseries for at least two consecutive years, and are submitted to measures targeting specific pests. These measures aim to ensure the absence of these pests and include replacement or treatment of the original growing medium. Despite these stringent measures, a significant number of bonsais from certain origins is intercepted with soil pests, indicating that the requirements have not been successfully applied. The presence of some soil nematodes in particular is used as an indicator for failure of correct application of the measures. The number of interceptions might correspond to a large volume of trade, but it probably also reflects the practical difficulty of making sure soil pests are not traded with plants with roots. An extensive study of non-indigenous plants pathogenic nematodes in soil from China noted the presence of many nematodes associated with bonsai (of known or unknown pathogenicity), an increase of the number of nematodes transported per unit of soil over some years, and the fact that methods to destroy the nematodes are either not successful or not applied (R. Cannon & S. Bishop, FERA, UK, unpublished, 2009).

Available data on trade (see 5.13) was analysed for *Acer* (Attachment 9, Table 2). Japan accounted for most interceptions of nematodes on *Acer* in 2006-2008, corresponding to high volumes of trade in these years (at least with the countries having provided trade data). The absence of interceptions in 2009-2010 could be explained by discontinuation of trade, as indicated by the trade data provided. In parallel, trade with New Zealand greatly increased in 2009-2010, but no interception has been notified during this period. A similar analysis could be done for other species that are used as bonsais to see if the frequent mention of China and Japan in interceptions of soil nematodes is also linked to high volumes of trade or if other countries trading bonsais with Europe are more successful in fulfilling the requirements. Bonsais might also transport other pests (see 5.10).

In itself, the presence of soil pests with bonsais might not be a problem, as bonsais are likely to be sold to end-users and to be grown indoors (even if soil, and pest, might be discarded at occasional changes growing medium). However, spread may become an issue when pests are intercepted with species of trees of bushes that would be planted outdoors at destination.

The following factors can be derived from the elements above.

**Box 12 - Important factors for soil and root nematodes and other pests intercepted on bonsais, or other trees and shrubs**

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • Difficult to detect and to control.<br>• Good indicators that requirements are not fulfilled: if soil nematodes are present, some other types of pests might also be there.<br>• Large variety of pests that might be transported in soil. | • Plants, especially perennials, trees and shrubs, moved with soil<br>• Plants might be collected in the wild<br>• Bonsais will be grown indoors, with lower risk that soil, and pests, are discarded outdoors. Other plants, trees or shrubs might be grown outdoors.<br>• Predominance of some origins in the interception records; these origins have difficulties fulfilling the requirements. |

### 5.10 Data from interceptions: *Anoplophora chinensis* and others

*Anoplophora chinensis* (Insecta: Coleoptera: Cerambycidae) (EPPO A2 List) was first recorded in the EPPO region in the late 1990s. In the 2000s, local isolated outbreaks of *A. chinensis* have occurred in several EPPO countries, some of which were eradicated or are still under eradication. Many outbreaks could be linked to imports of bonsais or small garden trees from China. *A. chinensis* is considered as a tropical/subtropical pest and on the basis of Climex studies was not expected to establish in most parts of the EPPO region. Its long-distance spread has been repeatedly linked to the import of bonsais. *A. chinensis* is regularly intercepted on plants for planting and bonsais of *Acer* spp., in a few cases on other plant species (Table 1, Attachment 7), whereas *A. glabripennis* is mainly intercepted on wood packaging material. Most interceptions on plants for planting are on consignments from China, and a few from Japan or on imported plants moved within the EPPO region.

The following factors can be derived from the elements above.

**Box 13 - Important factors for *Anoplophora chinensis* intercepted on bonsais, or other trees and shrubs**

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • Difficult to detect (and requiring destructive sampling). | • Bonsais, trees.<br>• Very large consignments (difficult to inspect, small samples compared to consignment size).<br>• Long exposure time at origin.<br>• Predominance of some origins in the interception records. |

The notifications of non-compliance as reported by some EPPO member countries and published in the EPPO Reporting Service 2006-2010 on plants for planting and bonsais were reviewed. They represent over 1000 reports of non-compliance, some including several notifications, for a total of over 1350 notifications. Apart from the cases developed in examples above (palms, *Buxus* spp., begonia, fuchsia, soil and root nematodes, *Anoplophora chinensis*), a few cases are extracted below. Without considering in parallel data on trade, it is difficult to say if the predominance of some origins, plant species or pests is due to the volume of trade or other factors. A few possible factors linked to the pests are mentioned below. Trade data made available by some countries (see 5.13) was also examined for some examples below.

- *Bemisia tabaci* is the pest most commonly intercepted on a wide range of commodities. It accounts for one-third of all reports of non-compliance in the EPPO Reporting Service in 2006-2010 on plants for planting, cuttings, pot plants and aquarium plants. There were over 450 notifications, from many origins including within the EPPO region. 38 plant families were mentioned in interceptions, with over 190 notifications on Euphorbiaceae and over 50 on aquarium plants. The high numbers of notifications in 2006-2010 might reflect the fact that the pest has a wide geographical distribution and is very polyphagous. It is also easier to detect than the pests in the examples above.
- Another pest with a similarly wide host range, *Frankliniella occidentalis*, is not intercepted on consignments of plants for planting as often as *B. tabaci*. It accounts for only 27 notifications on plants for planting, on 12 plant families, the large majority as cuttings or pot plants. Most interceptions were from within the EPPO region, with only 2 from outside (China and the Republic of Korea.). Both *Bemisia tabaci* and *Frankliniella occidentalis* are also found on other types of commodities, such as fruits, cut flowers, vegetables. The fact that *B. tabaci* is more widespread than *F. occidentalis*, both worldwide and within the EPPO region, could contribute to the difference in interceptions. In addition, *F. occidentalis* is not regulated in the EU, and therefore not intercepted in trade into or within the EU.
- Aquarium plants generated a large number of notifications (139). The pests found were nematodes (over 85 notifications; mainly *Radopholus* and *Hirshmaniella*, but also *Meloidogyne*), *Bemisia tabaci* (over 45 notifications), Aleyrodidae and *Spodoptera* spp. (2 notifications each). There is a large predominance of Asian origins, with over 85 notifications from Singapore, over 30 from Thailand, 11 from Malaysia and 4 from Indonesia. Other notification were from USA (1) and from within the region (3).
- Orchidaceae gave rise to only 7 notifications (on 4 orchid genera) but with 9 pests associated (Table 2, Attachment 7). Thailand was the origin of 5 of the notifications. The 9 pests intercepted were: 1 virus (*Impatiens necrotic spot virus*), 1 bacterium (*Erwinia chrysanthemi*), 3 nematodes (*Paratylenchus*, *Helicotylenchus dihystera*, *Scutellonema brachyurus*), 4 insects (*Diaspis boisduvalii*, *Thrips*; *Thrips palmi*; *Dichromothrips corbetti*). Among all interceptions on plants for planting in 2006-2010, the only interceptions on tissue cultures were made for Orchidaceae (from Thailand, due to the presence of *Dichromothrips corbetti*

and *Erwinia chrysanthemi*). Available trade data indicate a large volume of import of Orchidaceae with over 56 million plants for planting in 2010 for countries having provided data (see 5.13 and Table 6 in Attachment 9).

- Genera of trees that are commonly grown outdoors, in gardens or in the wild in the EPPO region were associated with over 115 notifications, related to the genera *Acer, Cryptomeria, Cupressocyparis*, *Juniperus, Chamaecyparis, Castanea*, *Quercus, Pinus, Taxus, Ulmus*. Most interceptions were due to the presence of nematodes, and many were made on bonsais. Regarding the different genera:
  - 52 notifications are for *Acer* spp., mostly *Acer palmatum* as bonsais (nematodes and *Anoplophora* as detailed above, also 1 *Cnidocampa flavescens* and 1 'Cerambycidae and Lamiinae'). Most interceptions other than nematodes were from China. In contrast to Orchidaceae, the trade of *Acer* spp. in 2010 (for three countries having provided data, see 5.13 for details) represents only 265864 units, of which less than half from China (Attachment 9, Table 2). There were shifts of origins during 2006-2010, with no more imports from Japan and the Republic of Korea in 2009-2010, New Zealand gaining importance over several years and Egypt becoming an origin in 2010. Imports of *Acer* seem to be relatively stable for the countries having provided trade data.
  - 27 notifications relate to *Juniperus* and other Cupressaceae (Table 3, Attachment 7), 26 being from Japan; these include the only 11 notifications of *Gymnosporangium* spp. in all interceptions on plants for planting and the only 2 interceptions of *Oligonychus perditus* (for which Cupressaceae are main hosts).
  - There were 16 notifications for pine, including 15 from Japan, of which 12 were *Pinus pentaphylla*, all for nematodes. According to available trade data (see 5.13), most *Pinus* imported to the countries concerned came from Japan (in 2010, all but four of 9727 *Pinus* plants).
  - Finally the 13 notifications on *Taxus* were from Japan.
  - Other genera were not intercepted.

  The relatively few interceptions are probably linked to the fact that these pathways are heavily regulated, but the few interceptions give indications of origin.
- Families that include fruit crops of major economic importance in the EPPO region are also represented in notifications. The families Rosaceae and Viticeae are generally heavily regulated in the EPPO region. Among the 49 notifications on Rosaceae, only 8 are from outside the region (1 on Spirae from Costa Rica, 1 on Rosa from South Africa, 1 on Pyracantha from Japan and 5 on Rosa from China). Others are from within the EPPO region, e.g. *Pyrus communis* (1), *Fragaria ananassa* (*5*), *Rubus idaeus* (1), *Malus* (1). Of the 25 notifications on *Prunus* spp., 22 relate to *Plum pox potyvirus* (with origins in the EPPO region). Finally there are only 4 notifications on *Vitis vinifera,* all from within the EPPO region. Information for the family Arecaceae, to which date (*Phoenix dactylifera*) belongs, is given in Table 8 of Attachment 1e. Other fruit crops (e.g. *Ribes*) do not appear in interceptions.

## 5.11 A new pest of tropical origin that is not expected to survive: *Horidiplosis ficifolii*

*Horidiplosis ficiifoli* (Insecta: Diptera: Cecidomyiidae) (Attachment 8) is a gall midge of Ficus, that was described only in 2003. It has been intercepted in Europe since the beginning of the 2000s (older records were linked to the newly described species based on conserved specimens). The species is considered as tropical and not likely to establish outdoors. From experience of incursions in glasshouses in the Netherlands and other EPPO countries, mostly in the North and Eastern parts of the region, control is possible and the species is not considered as a serious threat. In these parts of the region, Ficus are grown in pots indoors. *H. ficiifoli* is also recorded in Southern USA (2008, Florida), where a risk for nursery production was perceived at the time introduction, and in the South of the EPPO region (2007, Sicily). However no publications reporting damage were found. The most recent incursion is from the Czech Republic, on a bonsai at an end-user. This is an example of a species which is sometimes intercepted by a country for which it is not a risk, but establishes in another. In this specific case, there does not seem to be a problem so far as the pest can be controlled. However, one can speculate as to why this pest suddenly appeared in trade and started spreading. Ficus bonsais are widely used, and there might have been a shift in trade. It would be interesting to have more data on the trade of Ficus plants in the whole region, in order to see if its repeated entry in current years corresponds to an increase in trade. Considering the Netherlands only (Attachment 9, Table 3), imports of *Ficus* reached a peak in 2008, and have decreased since. The imported volume is still large with over 380000 plants and some irregular shifts of origin.

The pest might remain one of the numerous species introduced in the region and considered as minor pests. As elaborated in section 3, the literature includes many examples of pests introduced into Europe and considered as minor pests (Rabitsch, 2008; Jones & Baker, 2007). Pellizzari and Dalla Montà (1997) also mention pests that are present in crops grown in a limited number of areas, hampering their further spread.

The following factors can be derived from the elements above.

**Box 14 - Important factors for minor pests introduced on various commodities of plants for planting**

| *Linked to the pests*: | *Linked to the host plants:* |
|---|---|
| • The assessment of the organism as a pest might vary depending on country of introduction<br>• Unknown pest, no data on host range, possible damage, no previous experience of how the pest will behave once introduced.<br>• Tropical and subtropical pests might be able to establish in some parts of the EPPO region | • Perennial plants grown indoors in most of the EPPO region (even if outdoors in the South)<br>• Plant species grown in restricted areas, i.e. difficult to spread<br>• Incursions indoors are generally easier to control<br>• The assessment of the organism as a pest varies depending on the importance of the host in the country where it is assessed. |

### 5.12 Trade that has not posed phytosanitary problems under the current regime

Chrysanthemum was suggested by the EWG as an example of good experience with import that has not resulted in phytosanitary problems under the current regime. However, it is noted that this has not always been the case. In the past, several outbreaks of *Puccinia horiana* have occurred and it is only recently that a better organization in the chrysanthemum cutting production has resulted in a reduction of risk. Chrysanthemums are produced and imported in massive volumes in the EPPO region. They are grown indoors or in pots outdoors. In the EU, phytosanitary requirements exist against *Chrysanthemum stunt viroid*, *Puccinia horiana*, *Didymella ligulicola*, *Chrysanthemum stem necrosis virus*. In those countries where imports have not resulted in phytosanitary problems under the current regime, it might be that the main pests on the pathways have been identified, or that the pests, if introduced, can be successfully eradicated, as was the case for *Chrysanthemum stem necrosis virus* in a number of EPPO countries. However as noted above chrysanthemum plants for planting would also be produced in specialized systems under sophisticated conditions. The data made available for this study by the Netherlands, Germany, Italy and France show imports of approximately 1600 billions units of chrysanthemum plants for planting in 2010 (see 5.13 for details on trade data provided - no distinction made on the type of plants for planting). Imports seem relatively stable with a diversity of origins (Attachment 9, Table 4) and chrysanthemums were by far the most imported plants for planting in 2010 (Attachment 9, Table 5).

Reviewing plant genera traded in high volumes might allow identification of other plants that have not posed problems under the current regime, assuming that phytosanitary problems would be known and would not have been unnoticed for very large imports. The data provided indicate over 100 plant genera were traded above 2 million units in 2010 (Attachment 9, Table 5 - these numbers are underestimates, as they do not take account of mixed consignments of ornamental plants, and French data relate only to propagating material). The limit of 2 million was chosen arbitrarily to limit the number of genera considered at this stage. Reviewing this list will require additional practical knowledge of the plants and trades concerned.

At the other extreme, some plants have been traded in very low volumes (e.g. starting at 1 unit in 2010), but this is not an indication that the plant has not posed problems or would not pose problems if trade increased.

Other examples would be those species that are currently heavily regulated, or submitted to prohibitions especially from third countries. These might have posed problems before regulations were put in place, but current regulations prohibit the introduction of new pests on these plants. Import is open only from a limited number of countries with which there is experience of trade of this crop, which also prevents sudden trade of the commodity from an unknown origin with an unknown range of pests. The level of scrutiny given to some species and testing of these species might also allow detection of pests and appropriate action (e.g. pests on pome fruits, stone fruits, grapevine).

It seems unlikely that a pest of potato would arrive in the EPPO region with seed potatoes given the current prohibition. However, this does not guarantee that a polyphagous pest will not arrive in the region or part of the region on another commodity. *Potato spindle tuber viroid*, for example, is regularly intercepted on other solanaceous plants, such as *Brugmansia*, *Calibrachoa*, *Datura*, *Petunia*, *Solanum jasminoides*, *Solanum rantonnetii*. The main reason why this pest would not spread extensively on potato crops would be the level of importance given to potato in the EPPO region. Finally, although new pathogens, especially phytoplasmas or viruses, might be imported with starting material in the framework of a certification scheme (e.g. on *in vitro* plants), such material is also normally subject to stringent testing and controls. It is worth noting that the data provided for 2010 includes over 85 million units of Solanaceae, the majority being from European and Mediterranean origins (Attachment 9, Table 6).

Some factors that seem to influence the fact that a pathway of plants for planting has not resulted in phytosanitary problem could be:

- a major crop for which the pest status is extensively known and studied, or which is submitted to many measures against other pests,
- a crop with a limited number of origins for which experience has progressively been gained. This could amount to having carried out, without necessarily writing it up, a pathway analysis for that plant from that origin, the main pests having already been targeted, as was the case for chrysanthemum.
- a long history of trade with specific origins, with mutual experience, has been established with trade partners.
- a long history of growing and trading the plant at origin, and plants for planting produced under specialized and sophisticated systems.
- the availability of inspection and testing capabilities both at import and at export (e.g. for potato viruses).
- a crop with specific characteristics making the detection and the suppression of pests easy: an annual plant, not intended to be propagated, imported under protected conditions and intended to be used indoors.
- a crop whose pests are already present in the EPPO region (e.g. olive), provided new regions of production do not lead to emerging new pests.

### 5.13 Trade and trade patterns

A rough analysis of limited data on palm imports has been analyzed under 5.1, as an illustration of possible use of such data to analyze trade and trade patterns. The data available is limited to the small number of countries that answered the questionnaire in 2008. However, some major importers of palms responded, including the Netherlands. The data available still provides useful information about trade of certain palm genera and origins. Data from more EPPO countries might help identify trade patterns, which are not visible from the data provided. It might also be useful to study trade data with interception data to identify differences between palm genera and origins.

In addition, data on trade of plants for planting was provided for the purpose of this EPPO study by four countries as detailed below. The data provided relate to plants subject to phytosanitary certificates, i.e. from non-EU origins, with a few occurrences of EU origins in the data.

| Country | Period | Type | Units for 2010 |
|---|---|---|---|
| Netherlands | 2006-2010 | All PFPs | 3,446,264,528 |
| Germany | 2009-2010 | All PFPs | 754,579,237 |
| Italy (some regions*) | Mostly 2009-2010; some data for 2006-2008 for some regions | All PFPs | 138,964,446** |
| France | 2010 | Propagation material only | 43,505,932 |
| **NL, DE, IT, FR** | **2010** | **Total - units for 2010** | **4,383,313,707** |

* Calabria, Campania, Emilia Romagna, Lazio, Lombardia, Toscana, Veneto.

** Also 9910 kg for which no number of units were given; an additional 3,310,462 units were imported by another region but detailed data was not available.

The data was analysed in relation to the examples in this study and to section 5.12 above. Only consignments with indication of plant (species, genus or family), origin and number of units imported were considered. For 2010, this represented over 50600 consignments, for a total of 4,241,049,766 units (i.e. plants)[4], covering over 1140 plant genera from over 210 families[5].

A general analysis was performed in order to identify the most traded genera and families (Attachment 9, Tables 5 and 6). Fourteen plant families were traded in 2010 at a level of over 50 million units. They accounted for over 88% of all imported plants, and Asteraceae was by far the most traded family (over 54% of the total). A list of all families is attached as Table 7.

[4]The number of units excluded from the preliminary analysis is over 140 million, representing ca. 3% of the total number of units. The following consignments were not taken into account:
- no number of units (25 consignments) or only kilos (10 consignments, ca. 9910 kg)
- mixed consignments with one number of units covering several plant species (53 833 982 plants, 452 consignments).
- general categories (e.g. Plantae, ornamental plants, 'miscellaneous',) (85 178 847 plants, 43 consignments).
- no indication of plant species, genus or family (2 050 948 plants, 15 consignments).

[5] These numbers might be slightly lower due to typing errors and synonyms. The data was partly reviewed in 2012 to align plant families with the EPPO Plant Protection Thesaurus (EPPT - eppt.eppo.org). A few adjustments were also made for genera and species, but synonymy was only partly checked.

Data related to examples in this study were also extracted in order to consider trade patterns in relation to outbreaks or interceptions (*Buxus*, *Fuchsia, Ilex*, *Acer*, *Ficus*), as well as for chrysanthemums in relation to section 5.12. Within this study time was not available to analyse data for palms or for other plants in the examples (e.g. begonia, species of bonsais intercepted in trade, kiwi), but this might give useful indications on trends.

Such preliminary analysis seems to give some useful indication even if the data is not complete and relates to a few countries. It probably gives good indications for ornamental plants as the Netherlands is a major importer in Europe. However, a more complete analysis of detailed trade patterns in the EPPO region, if it is to be carried out, would necessitate data from a wider range of countries, in order to give understanding of the trade of plants for planting in the EPPO region. Step 5 of this study will consider the need and feasibility of undertaking a more detailed analysis of import data.

## 6. CRITERIA LINKED TO OUTBREAKS OF PESTS RELATED TO IMPORTS OF PLANTS FOR PLANTING (STEP 2 OF THIS STUDY)

One common feature for most examples of pests described under section 5 is an unknown or rather unidentified risk: the pests considered were not specifically regulated, although their host plants might have been subject to general requirements, or to specific requirements against other pests. They were not known to represent a risk prior to introduction. Additionally they might have had features that would not suggested a risk if assessed individually, for example because they were of tropical or subtropical origin. Consequently pest characteristics are not discriminatory criteria as such and are not considered further. Indeed, pest outbreaks were associated with commodities that had their own important features in relation to these outbreaks. The current section considers the factors that might have facilitated the outbreaks described in section 5 in order to determine some criteria that could be used to evaluate the risk linked to the import of given plants or groups of plants. The criteria are not in any order of importance at this stage. Criteria linked to the plants for planting, the country of destination, the origin and availability of information were considered. These criteria were reconsidered by an expert working group in December 2011 in order to to develop the pre-screening process (Step 3). They were consequently further defined, modified, and some were discarded.

For the purpose of the development of a screening system at step 3 of this study, these criteria were identified as ‘primary’, ‘secondary’ or ‘discarded’ based on the examples or on publications considered during this study. Most criteria are dependant from each other, and this is also considered.

- The objective of defining ‘primary’ criteria was to simplify pre-screening for those plants that fulfil criteria identified as being associated with a high risk. A primary criterion is one that is considered to have a major influence on the risk a commodity poses, more or less independently from other criteria. Therefore a plant fulfilling a ‘primary’ criterion is considered to present a risk irrespective of how it fulfils other criteria (e.g. C2 - Large plants). ‘Primary’ criteria give an indication of risk on their own or with few others.
- ‘Secondary’ criteria are those that interact with many others, depending on other criteria they have a high predictive value or not, i.e. for which the risk will be very different depending on the combination of criteria (e.g. C8 – documented non-compliance with the commodity).
- Some possible criteria envisaged by the EWG at the preliminary stage of this study were ‘discarded’ as they were not thought to be criteria (although they might be useful in considering the pathway). They are included in Attachment 10. In particular, all possible criteria linked to availability of information were discarded.

### 6.1 Criteria linked to the plants for planting

- **C1. Perennial or biennial plant, versus annual plant**

Host plants considered in the examples above are mostly perennials. A perennial or biennial plant will allow survival of the pest for a longer period, and improve chances for further multiplication and spread. Other criteria will interact, such as whether the plants for planting are intended for propagation (C11), whether they are grown outdoors or indoors (C10). On the other hand, a pest of an annual plant is more likely to die with its host at the end of the growing season, but might find another host or be able to survive in another form (e.g. resting spores in the soil), or be propagated with the plant (C11). An annual plant which is not intended for propagation and will be grown indoors gives a smaller chance to a pest to establish.

➔ Secondary.

- **C2. Large plants versus small plants**

The size of the plants has an impact on the ability of the pests to infest the plant, feed on it and hide on it, and on the difficulties to inspect the plants (e.g. palm pests *R. ferrugineus, P. archon, D. frumenti, O. sacchari*). It is difficult to ensure that large consignments of large trees are inspected to a level allowing detection of pests. Although this criteria is linked to the next one (C3) (i.e. large plants will have been exposed for longer), it is considered as a primary criteria. Large plants are also more likely to have larger quantities of soil or growing medium attached to roots (C5).

➔ Primary.

- **C3. Age of plants/exposure time in the country of origin**

Older plants are exposed to pests for longer than young plants in the country of origin and are also more likely to be infested (at higher levels) by pests that attack plants of a certain size (e.g. *Rhynchophorus ferrugineus*). However this also gives time for latent infections to become symptomatic and infected plants are then more likely to be discarded before export. This criterion might be especially relevant combined with other criteria such as production mode (C4), e.g. young plants produced in glasshouses might present a lesser risk.

➔ Secondary.

- **C4. Production mode**

The production mode of the plants at origin (in-vitro, glasshouse, nursery, small growers' gardens, gardens, collected in the wild) will lead to a gradation of risk due to the conditions of production, exposure to pests, quantity of pest associated with the plants and level of control on the plants. Whether the plants were produced in a certification scheme will also influence the risk. However, the production mode needs to be considered with others. For palms traded as large plants (C2), it could be considered that all plants present a higher risk irrespective of the production mode, due to the difficulties intrinsic to the inspection of large plants and the long exposure time (C3). The production mode as a criterion to evaluate plants will also be highly dependant on the capacity of the producers and of the authorities of the exporting country to ensure that plants are not infested. Information on documented non-compliances (C8) may usefully be considered in combination with the production mode. *In vitro* plants might also present a risk if they are known to carry latent pests (C7), such as orchids in section 5.10. The only production mode that could be considered separately is plants collected in the wild, as these can be considered to always present a risk of introducing pests that are unknown in cultivation, without associated control.

➔ Primary: collected in the wild.
➔ Secondary: production mode (except from collected in the wild).

- **C5. Growing medium (soil) attached**

The presence of growing medium, especially soil, may lead to the transport of many types of pests, including nematodes, fungi, insects and invasive plants. If growing medium or soil is attached, the risk will depend on whether or how it has been treated at origin. It will also depend on the size of the plant (C2) and exposure time (C3). While bonsais or small pot plants can be submitted to measures to ensure absence of relevant pests in the growing medium, this will be difficult for larger plants, especially trees. This criterion also depends on the knowledge that such treatments can be carried out effectively at origin for the type of plants considered, which might be reflected in available data on non-compliance (C8). Although this criterion interacts with many others, it has been classified as a primary criterion due to the variety of pests that might be introduced and to the fact that it plays a role irrespective of whether the imported plant itself is important at destination (C9).

➔ Primary.

- **C6. Existing record of invasiveness**

Invasiveness is an important criterion for plants for planting themselves. For plants that are new in trade, especially those which are to be introduced as ornamentals or aquarium plants, there might be prior indications that they are invasive. Although the timeline for identifying pest invasions is very long (5.8), the knowledge about invasive plants is increasing rapidly and there is already a lot of data available on the subject. In particular, information on many plant species that are considered invasive or might be invasive has already been made available by EPPO. For all plants that have been traded for a long time, it is likely that some indication of the invasive status is available. If a plant has a record as invasive, the *EPPO prioritization for invasive alien plants* can be applied. This criterion does not exclude that the plant is also evaluated for its capacity to introduce pests.

Note: it could be argued whether in some cases the *EPPO prioritization process for invasive plants* should be applied irrespective of whether the plant already has a record of invasiveness, for example: all aquarium plants; all ornamental plants that are new in trade for the country.

➔ Primary.

- **C7. Documented evidence of spreading latent pests or pests that are difficult to detect**

No example has been found of a plant species that, in itself, is not known to have spread latent pests or pests that are difficult to detect. Several plants in this study have recurrently led to the introduction of serious pests that were not detected at visual inspection (i.e. latent pests but also hidden life stages), such as *Phoenix* spp., *Buxus* spp. and *Castanea* spp. *Eucalyptus* spp. are not covered in this study but are another example of plants that are often mentioned in the literature in relation to introduced pests. In some examples in this study, the plant species was submitted to specific requirements against other pests at the time of pest entry into the region, in most cases it was also submitted to a general requirement for inspection. However, these pests were also difficult to detect and the requirements were not sufficient to prevent introduction. Many major crops or wild plants are known to have spread pests in the past, but there are no recent examples of introduction because of current stringent regulations.

Other plant species have shown to harbour and spread pests once introduced into the region, although they might have been introduced on another species (e.g. *Rhynchophorus ferrugineus* on *Howea* spp.; *Phytophthora ramorum* on rhododendron*; Calonectrica ramorosa* on *Erica* spp. in the USA, on *Myrtus* spp. in Italy).

It would be possible to perform a more complete analysis, and possibly identify some plant species that are traded but are not known to have introduced pests, by comparing trade data with the list of pests recently introduced into the EPPO region. This would require compiling this information from the available literature. The trade data provided so far would probably give good indications of the range of plant species traded into the region.

This criterion does not seem relevant for species of trees and bushes, or grown plants (e.g. palm, *Buxus*, begonia), nor for grafting material (kiwi, chestnut), as these types of plants are likely to always spread latent pests or pests difficult to identify. It would be useful only for a limited type of material and would depend on other criteria such as production mode (C4), age of the plants (C3). The criterion would also depends on how the plants were introduced, e.g. whether they will be planted in conditions where possible outbreaks can be observed and acted upon (nurseries, post entry quarantine). The criterion cannot be restricted to latent pests, but should also cover those that are difficult to detect (e.g. insects in stems or buds, *Fusarium foetens* on begonia).

➔Secondary criteria.

- **C8. Documented non-compliance**

This criterion relates to non-compliance in relation to both the commodity considered and the origin. With regards to the commodity, bonsais and palms, among the examples above, led to numerous interceptions of pests. The criterion is both linked to the production mode (C4), the presence of soil (C5), the origin (C8), and the volume of trade as more trade might lead to more interceptions. Other plants recurrently appear in the notifications of non-compliance. For example, trade of *Acer* spp., *Trachycarpus* spp. or Euphorbiaceae give rise to many notifications of non-compliance from certain origins, and could trigger additional consideration of these species. The history of interceptions on a plant by a country could be used as information on a specific pathway.

Some origins repeatedly lead to cases of non-compliance, irrespective of the plant considered, and this might also be taken into account. Numerous instances of non-compliance from an origin might be due to high volumes of trade, but probably also reflect the capacity of the exporting country to fulfil phytosanitary requirements. This might raise questions as to whether that country is able to implement suitable measures on other pathways, except if there are good indications that some pathways are more controlled than others, e.g. fruit crops versus bonsais. For this reason interception data for the country of origin can be taken into account but should be used with caution.

This criterion is certainly useful when the data for non-compliance has been observed to indicate a risk associated with the commodity or the origin, and even more when the risk has been associated with a plant from a specific origin. On the other hand, this criterion might be less meaningful on its own when there have been no interceptions on the plant or from the origin. There are for example no interceptions of pests of palm from Oceania or Southern Africa. Whether this arises from the absence of pests that could establish in the region or from the measures applied in the country of origin is not clear and may not be relevant. The fact that over a million of *Chrysalicarpus* from Uganda in one year and millions of *Howea* palms from Australia where imported without identified problems does not seem sufficient to conclude that these pathways are safe, without looking at the conditions in which the plants were produced and imported. For example in the Netherlands, *Howea* palms are introduced as very small plants, just germinated, and the size of the plants (C2) and age of the plants (C3) probably play a more important role. Other important criteria could be C4-production mode; C10 - plants grown outdoors).

➔ Secondary criteria

### 6.2 Criteria linked to the country of destination

- **C9. Importance of the plants or related species in the country of destination**

The extent to which a plant is grown in a country is an obvious criterion to be considered. It is linked to the potential economic, environmental or social impact in case of introduction of a pest, as well as to the general knowledge of the pests of that plant. A plant may for example have an importance as a crop (direct economic impact in case of pest introduction); in the wild (environmental and social impact); or because it is related to other important plants (e.g. solanaceous species) as its pests might have an impact on other plants in case of introduction.

Many plants for planting commonly prohibited in EPPO member countries have such an importance, such as: potatoes and other Solanaceae, *Citrus*, *Malus*, *Abies*, *Pinus*, *Castanea*, and *Vitis*. Pests generally establish on plants in the same genera or family (palm), although this is not always the case. Establishment on related species is highlighted by some examples in this study: several serious pests of palm have adapted to other plants in the family; *Potato spindle tuber viroid* is commonly intercepted on other plants than potato. Counter examples of family/genus of plants that are not used in the region and have not posed problems in trade might emerge from analysis of trade.

It could be noted that even if the plant or related species are not important in the country of destination, they might serve as pathway for pests, for example if growing medium is associated with the plants.

➔ Primary criteria.

- **C10. Plant (or related species) grown outdoors at destination**

Some plants species or related species are present in restricted conditions at destination (e.g. only as pot plants indoors), while others occur in a variety of conditions indoors and outdoors, for example glasshouse, nurseries, gardens, cities, parks, forests (palms), or nurseries, parks, gardens, forests (chestnut). If neither the plant species to be imported nor related species are grown outdoors at destination, it considerably decreases the risk that any pest present on imported plants establishes outdoors at destination. It is also likely in this case that the imported plants will be used indoors. On the other hand, if the plant (or related species) is present outdoors at destination, it will increase the risk that any pest present on similar imported plants will establish at destination. This is considered as a primary criterion.

This criterion also takes account of whether the plants imported are intended to be used indoors or outdoors at destination. This might be known in some cases due to the species and the nature of the material (e.g. material for propagation of plants propagated only indoors, bonsais for end-users, small trees for gardens, and orchids in most parts of the region). If the imported plants are intended to be grown outdoors, pests will not be confined and plants might present a higher risk of introducing pests. If the imported plants are to be grown indoors, other criteria will be play a role, such as whether the plants will be propagated (C11), the production mode (C4) (e.g. in vitro plants).

This criterion has an influence on how pest control can successfully be applied and pests eradicated in case of outbreaks. If the plant to be imported (or related species) is grown in gardens or in the wild, eradication of pests will be more difficult than if the plant is used in greenhouses.

➔ Primary criteria

- **C11. Plants intended for further propagation or not**

Propagation might facilitate multiplication of the pest, as well as its distribution with propagated material and therefore spread. It might also influence the possibilities for eradication of the pest. However, this criterion seems to relate to many others, such as the documented non-compliance for the origin considered (C8), the production mode (C4). It will also combine with the knowledge and experience in the country of destination of how the propagators are able to react to an outbreak (e.g. of *Fusarium foetens*). If plants are not intended to be multiplied, the intended use will combine with other criteria such as whether the plant is grown outdoors at destination (C10). For example ficus bonsais imported to Northern Europe (plant not grown outdoors) and intended for the end-user will be used indoors (*Horidiplosis ficifolii* – lesser risk); in the northern part of the EPPO region, Begonia might be used mostly outdoors in pots or indoors (*Fusarium foetens* - lesser risk); *Buxus* or palms are present outdoors in the southern part of the EPPO region and new imports are also likely to be planted outdoors (*Rhynchophorus ferrugineus, Diaphania perspectalis* – higher risk).

➔ Secondary criteria

- **C12 - Climate comparable to origin**

This is a criterion that is consistently used in PRA. It can be based on a simple comparison of climate using the Köppen-Geiger classification (Peel *et al.*, 2007). However, it should be used with caution. Pests introduced on a tropical plant or from a tropical origin might find suitable conditions for establishment at arrival. For example, considering its original range, *A. fuchsiae* could be thought to be able to establish outdoors only in some parts of the South of the region. However, it has established outdoors in Northern oceanic parts of the EPPO region. If the climate is very different to that of the original range (e.g. a tropical plant in Northern Europe), other criteria will be useful such as whether the plant is intended for propagation (C11). Some pests of tropical plants might also establish indoors in non-suitable climates (e.g. *Opogona sacchari*).

➔ Secondary criteria

### 6.3 Criteria linked to the origin

- **C13. Presence of quarantine pests at origin**

Especially in case of reevaluation of a pathway, the presence of previously-identified quarantine pests at origin can be taken into account when deciding on how to classify the pathway (e.g. for reevaluating those pathways for which the specific requirements targeting a pest apply to all third countries).

➔ Secondary criteria

### 6.4 Additional considerations

**Importance of the plants (or related species) in the region.** When using criteria to categorize specified plants for planting from an origin, an NPPO will presumably use parameters for its own country (e.g. importance of the plant or related species at destination - C9, intended use - C11, plants grown indoors - C10). It would be interesting to also consider the wider situation in the region and strategies to exchange information. Countries should have access to sources of information allowing them to judge:

- whether the trade of the plant has led to recent introductions of pests (e.g. *Buxus*, palms) - timely exchange of information might help to avoid repeated introductions at short intervals.
- if there are cases of introductions considered 'minor' in another country of the region (where a minor pest is under control and for example under glasshouse) - the pest might have a different level of importance if it reaches another country.

**Volatility of markets.** The examples developed for *Buxus* spp. (section 5.3) and palms (5.1) provide two examples where markets are volatile. There might be sudden shift of plant species (e.g. if *Buxus* is replaced by other species due to damage by *Diaphania perspectalis*). Shifts in origin are common according to the trade data analysed for examples in this study (e.g. *Howea* palms, *Acer*). These shifts will probably be unexpected and impossible to anticipate. This aspect has not been covered further.

**Availability of information on recent cases of incursions or introductions.** In several examples in this study, a newly introduced pest was spread further within the region on plants for planting within a few years. In some cases, information is not available even in the country of origin, and this lack of information may not be possible to prevent. However if information is available, its timely communication might help preventing further spread of pests.

**Introduction of pests by man outside of trade.** The screening process is intended to be used for traded plants for planting. The example of *Aculops fuchsiae* (a damaging pest identified as a risk on a widely-grown ornamental of economic value) raises the issue of introductions with material brought by amateurs from outside the region without any phytosanitary controls. There might be other solutions to address this type of case, such as an increased communication with the public concerning the risks of bringing plants for planting from other countries. Passengers are also a possible pathway for introductions. The case of fuchsia is especially striking as this is also a major trade into the region (over 55 million plants in 2010 for the data available for this study), subject to regulations and apparently functioning without phytosanitary problems.

**Risks that are outside the scope of this study.** No criteria aimed at evaluating the risk posed by a plant species can take account of the risk of fraud, nor of the risk posed by hitch-hiker pests. Such threats might be addressed by other means, such as appropriate monitoring for early detection of outbreaks and timely implementation of measures in case of detection.

## 7. PRE-SCREENING PROCESS (STEP 3 OF THIS STUDY)

The pre-screening process is intended to be used by NPPOs to categorize risks posed by specified plants for planting from a given origin(s). It should be applicable both for new trades and for reevaluation of the current system. A pre-screening process was originally drafted in the framework of this study. However the Working Party decided that it should be developed further by an expert working group, and this step was removed from the study.

### Final remarks to steps 1 to 3

From the example of palm (section 5.1) and several of the criteria it already seems relevant that trade data is obtained in order to complete Step 6. However this will be evaluated further at Step 5 according to the description of the study.

While this study is based on a limited number of examples, an additional study might be useful to gain further knowledge on introductions of pests in the EPPO region on plants for planting, and on pathways that have seemingly not led to introductions of pests. This could be done by compiling, from the literature and the Reporting Service, incursions or introductions of pests in the EPPO region (e.g. in the past 20 years), including whether they are suspected to have occurred on plants for planting, the host, the country or region of origin, the country of introduction, whether the pest is considered as major. Such information could be stand-alone data integrated into PQR.

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# ATTACHMENT 1. FOUR PESTS OF PALM AND TRADE OF PALM INTO THE EPPO REGION

## Attachment 1a. *Rhynchophorus ferrugineus* (Insecta: Coleoptera: Curculionidae)

**Common names.** Asiatic palm weevil, coconut weevil, red palm weevil, red stripe weevil (English), picudo asiático de la palma (Spanish), charançon asiatique du palmier (French), Indomalaiischer Palmen-Rüssler (German) (EPPO, 2008)

**Hosts**. Mostly palms (Arecaceae): as of 2008, *R. ferrugineus* had been recorded on *Areca catechu*, *Arenga pinnata*, *Borassus flabellifer, Calamus merillii, Caryota cumingii*, *C. maxima, Cocos nucifera, Corypha gebanga*, *C. elata, Elaeis guineensis, Livistona decora*, *Metroxylon sagu, Oreodoxa regia, Phoenix canariensis*, *P. dactylifera, P. sylvestris, Sabal palmetto, Trachycarpus fortunei*, *Washingtonia* sp., etc. It was also reported on *Agave americana* and sugarcane (*Saccharum officinarum*) (EPPO, 2008).

In outbreaks in the EPPO region, *R. ferrugineus* was also found on *Brahea armata*, *Butia capitata*, *Howea forsteriana*, *Jubea chilensis*, *Livistonia australis*, *Phoenix theophrasti*, *Syagrus romanzofianum* (Anon., 2010; EU, 2010). Since its introduction in the Netherland Antilles, *R. ferrugineus* has also been found on *Bismarckia nobilis, Pritchardia pacifica*, *Dictyosperma album* (Kairo *et al.*, 2010).

In China (Ren, 2010), *Bismarckia nobilis*, *Livistona chinensis*, *L. cochinensis*, *Neodypsis decaryi*, *Phoenix hamceana* var. *formosana*, *Saccharum sinense* were also found to be attacked (Ren, 2010).

A number of palm trees species that have been shown to be hosts following recent introductions do not occur in the area of origin of the pest. The precise host range of the pest is uncertain, due both to records on new species and to conflicting resistance reports. For example resistance to the pest was shown in controlled trials in Spain on *Chamaerops humilis* and *Washingtonia robusta* (Barranco *et al.*, 2000), but these species were later found to be infested during outbreaks in Italy.

**History of the organism as a pest**. *R. ferrugineus* was discovered in 1891 in India. In Asia it was known as a serious pest of coconut (*C. nucifera*) and oil palm (*E. guineensis*) in India and Sri Lanka, and of sago palm (*M. sagu*) in Malaysia. During outbreaks in the Middle East in the 1980s, serious damage was caused to date palm (*P. dactylifera*) (EPPO, 2008). In the EPPO region, outbreaks accompanied by serious damage occurred mostly on ornamental *P. canariensis*, but also date palm and other ornamental species. *R. ferrugineus* causes both economic and environmental damage, and caused mortality and removal of large numbers of 'landscape' and garden trees.

**Means of spread.** Long-distance spread by infested plants for planting of host palms. The EU emergency measures (EU, 2007) target trees of a diameter above 5 cm. Natural spread by flight of adults (EPPO, 2008).

### Spread and outbreaks of *Rhynchophorus ferrugineus*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Albania (2009), Cyprus (2006), France (2006), Greece (2006), Israel (1999), Italy (2004), Jordan (1999), Malta (2007), Morocco (2008, under eradication), Portugal (2007), Slovenia (2009), Spain (1993), Turkey (2005) |
| **Asia** | Bahrain, Bangladesh, Cambodia, China (1990s), India, Indonesia, Iran (1992), Iraq, Israel (1999), Japan (1975), Jordan (1999), Kuwait, Laos, Malaysia, Myanmar, Oman (1993), Pakistan, Philippines, Qatar (1996), Saudi Arabia (1985), Singapore, Sri Lanka, Syria (2006), Taiwan, Thailand, United Arab Emirates (1986), Vietnam |
| **Africa** | Egypt (1992), Libya (2009), Morocco (2008, under eradication) |
| **Oceania** | Australia, Papua New Guinea, Samoa, Solomon Islands |
| **North America** | USA (2010, California) |
| **Caribbean** | Netherland Antilles (2008 Curaçao, 2009 Aruba) |

**Origin.** *R. ferrugineus* originates from South-East Asia and Oceania. It continues to spread in Asia. First detected in China in the 1990s, it has spread throughout the South-Eastern part of the country, but has not yet established in all areas considered suitable (Li, 2009; Ren, 2010).

**Introduction and spread in the Middle East.** *R. ferrugineus* spread to the Middle East in the mid-1980s. It was first recorded in 1985 in Saudi Arabia and then in several other countries (Ferry & Gómez, 2002). It reached Syria in 2006. Ferry & Gómez (2002) attribute the high rate of spread to transport of infested young or adult date palm trees and palm offshoots from contaminated to uninfested areas.

**Introduction and spread in Africa.** The pest was reported in Egypt in 1992, and this introduction was related to import of palm offshoots from the United Arab Emirates (Ferry & Gómez, 2002). It has recently been introduced into Morocco (2008) and Libya (2009).

**Introduction and spread in the EPPO region**. *R. ferrugineus* was identified in Spain in 1995 on samples collected in 1994 and 1995; Symptoms had already been observed in Andalusia in 1993 on *Phoenix canariensis* (RS 96/096). It started spreading in the country and causing serious damage on *P. canariensis* despite stringent measures. It was later detected in several other regions of Spain and in 12 other EPPO countries of the Mediterranean Basin, mostly on *P. canariensis* and *P. dactylifera*, but also on other ornamental palm species. In many outbreaks, it is suspected that *R. ferrugineus* was introduced in infested palm trees. Many reported detections were made in gardens, public parks or ornamental palms along city avenues and seafronts, some were made in nurseries and garden centres and some in date palm plantations. In all cases, stringent measures were applied. Some containment of this pest was possible in some cases, but eradication has not been reported in the region.

**Introduction into North America and the Caribbean**. *R. ferrugineus* was detected in December 2008/January 2009 on the Island of Curaçao, Netherlands Antilles. It is suspected that it was introduced with trade of ornamental palm (Kairo *et al.*, 2010). In 2010, it was detected for the first time in the USA (California, CDFA, 2010) and on Aruba, also in the Netherlands Antilles (Kairo *et al.*, 2010).

**Biological characteristics known to be of relevance for the outbreaks**

- High reproductive potential (may have 3 generations per year, females may lay 200 eggs)
- Adaptation to new hosts, not reported as major hosts prior to introduction into other regions.
- Difficult to detect during early stages of infestation (hidden life stages, absence of symptoms on plants).

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## Attachment 1b. *Paysandisia archon* (Insecta: Lepidoptera: Castniidae)

**Common names**: palm both, palm borer moth (English)

**Hosts**. Palms (Arecaceae). In South America*, P. archon* was recorded on *Butia yatay, B. capitata, Chamaerops humulis, Livistona chinensis, Phoenix canariensis, Syagrus romanzoffiana, Trithrinax campestris, Washingtonia robusta.* In the EPPO region, it was found on: *Brahea armata*, *B. edulis*, *Butia capitata*, *Chamaerops humulis, Livistona sp., Phoenix canariensis, P. dactylifera, P. reclinata, P. roebelenii, P. sylvestris, Sabal mexicanam S. minor, S. palmetto, Syagrus romanzoffiana, Trachycarpus fortunei, T. wagnerius, Trithrinax campestris, Washingtonia filifera* and *W. robusta* (EPPO, 2008).

**Means of spread.** Natural spread by flight of adults (25-30 km flights recorded). Long-distance spread by movement of infested plants (EPPO, 2008; Reid & Moran, 2009).

**History of the organism as a pest**. *P. archon* is not known as a pest in its area of origin in South America. In the EPPO region, serious mortality has been reported on ornamental palms. Damage is caused by larvae boring into the stem, and can be observed on leaves, rachis and top of the stem. Large palms can survive if they are not too severely attacked, but small ones or plants in nursery or containers are very vulnerable (EPPO, 2008).

### Spread and outbreaks of *P. archon*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Cyprus (2009), France (2001), Greece (2006), Italy (2002), Slovenia (2008), Spain (2001), Switzerland (2010, under eradication). |
| **South America** | Argentina, Brazil (Rio Grande do Sul), Paraguay, Uruguay |

**Origin.** *P. archon* originates from South America, where it is not considered to be a pest of economic importance.

**Introductions and spread in the EPPO region**. The first two introductions in the EPPO region were reported in 2001 (RS 2002/011, 2002/012). *P. archon* was found in France in nurseries and flying adults were also detected. The insect was thought to have introduced 4 years earlier on *Butia yatay* and *Trithrinax campestris* from Argentina. In Spain, *P. archon* was found in one nursery on *Trachycarpus fortunei, Phoenix canariensis* and *Chamaerops humilis*. It was thought that *P. archon* was probably introduced between 1985 and 1995 on palm trees from Argentina. In both cases, the pest then spread to other regions. Since these initial outbreaks, the pest was detected in five other EPPO countries. The outbreaks were very limited in some cases and are under eradication. Isolated findings of *P. archon* were made in the UK in 2003 and 2007 but were eradicated.

**Biological characteristics known to be of relevance for the outbreaks**

- Larvae are difficult to detect (hidden mode of life).
- Natural spread occurs.
- Unknown pest, i.e. lack of data on its biology and control.
- Adaptation to new hosts

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### Attachment 1c. *Opogona sacchari* (Insecta: Lepidoptera: Tineidae)

**Common names.** banana moth, sugarcane borer.

**Hosts**. *O. sacchari* has a wide host range. In the tropics: mainly banana, pineapple, bamboo, maize and sugarcane in the field and on various stored tubers. In Europe, it has been found infesting various tropical or subtropical ornamentals in glasshouses, including mainly *Dracaena* and *Yucca*, but also occasionally *Chamaedorea* and other palms, as well as *Alpinia*, *Begonia*, *Bougainvillea*, Bromeliaceae, Cactaceae, *Cordyline*, *Dieffenbachia*, *Euphorbia pulcherrima*, *Ficus*, *Gloxinia*, *Heliconia*, *Hippeastrum*, *Maranta*, *Philodendron*, *Sansevieria, Saintpaulia, Strelitzia*, *Capsicum,* aubergines (EPPO, 1997).

**History of the organism as a pest**. *O. sacchari* is not considered as a significant pest in its area of origin. It was first recorded as a serious pest of banana following introductions in Brazil and the Canary Islands (Spain). In other parts of the EPPO region, it has not been able to establish outdoors but has been causing damage in glasshouses on ornamental plants in some countries. The larvae mostly burrow in the stem (woody or fleshy plants like cacti, *Dracaena*) or sometimes leaves and petioles (EPPO, 1997).

**Means of spread.** Natural spread by flight over short distances and within glasshouses. Long-distance spread by plants for planting and propagation material of host plants. (EPPO, 1997)

#### Spread and outbreaks of *Opogona sacchari*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Germany (2005), Israel (1999), Italy (1970s), Netherlands (1980s), Poland (1992), Portugal (Azores, Madeira), Spain (Canary Islands, 1920s), Switzerland (1980s) |
| **Asia** | China (1995), Israel (1999), Japan (1986) |
| **Africa** | Cape Verde, Madagascar, Mauritius, Morocco, Nigeria, Reunion, Saint Helena, Seychelles, South Africa (Possibly wider distribution) |
| **Caribbean** | Barbados, Guadeloupe (2000) (Possibly wider distribution) |
| **Central America** | Honduras (Possibly wider distribution) |
| **South America** | Brazil, Peru, Venezuela (Possibly wider distribution) |
| **North America** | Bermuda, USA (Florida 1986, Hawaii) |

*O. sacchari* is thought likely to be more widely distributed in some regions, especially Africa, South and Central America, Carribean (EPPO, 1997; Heppner, 1987).

**Origin.** *O. sacchari* originates from humid tropical and subtropical regions of Africa where it is not considered as a significant pest.

**Introduction and spread in various regions.** Little data was found on earlier introductions on other continents. In the USA, *O. sacchari* had been regularly intercepted since the late 1950s before it established in Florida in the 1980s (Heppner *et al.*, 1987). In Japan, it was first detected in 1986 on *Dracaena* spp. and occurs in many localities (Yoshimatsu, 2004).

**Introduction and spread in the EPPO region.** *O. sacchari* was introduced in the Canary Islands in the 1920s, and is established outdoors only on the Atlantic islands of Spain and Portugal. In addition it has established in glasshouse in a number of EPPO countries, with restricted distribution or few occurrences. Because it cannot survive outdoors, it could be eradicated in some cases (e.g. Denmark, France, Greece, Hungary, UK) (EPPO, 2011).

**Biological characteristics known to be of relevance for the outbreaks**
- Difficult to detect infestations in plants (early stages of tunnelling might not be visible)
- May attack young plants
- Effective reproduction strategy (50-200 eggs, 8 generations per year in optimal conditions)
- Has adapted to new hosts.

**Interceptions in the EPPO region**

The EPPO Reporting Services 2006-2010 includes over 20 notifications of non-compliance for *Opogona sacchari*, mostly on families such as Ruscaceae (*Dracaena*) or Malvaceae (*Pachira* aquatic). There are only three notifications on palm.

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### Attachment 1d. *Diocalandra frumenti* (Insecta: Coleoptera: Curculionidae)

**Hosts**. Palm species (Arecaceae) such as: *Cocos nucifera, Phoenix dactylifera, P. canariensis, Elaeis guineensis*. Other palms mentioned in the literature: *Archontophoenix alexandrea, Chrysalidocarpus lutescens, Howea belmoreana, Mascarena verchaffeltii, Phoenix loureirii, Phoenix roebelenii, Roystonea regia* (EPPO, 2010).

**History of the organism as a pest**. Mortality of mature *P. canariensis* infested by this pest is reported from Australia. Data is lacking on the severity of attacks on *P. canariensis* in the EPPO region. Larvae cause premature yellowing and collapse of palm fronds, emergence holes in new and old fronds, premature shedding of fruits (EPPO, 2010).

**Means of spread.** No data is available on natural spread, but adults can move over at least small distances. Infested plants or palms can lead to spread of the pest over long distances (EPPO, 2010).

#### Spread and outbreaks of *Diocalandra frumenti*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Spain (Islas Canarias only, 1998) |
| **Asia** | Bangladesh, China, India, Indonesia, Japan (Ryukyu archipelago 1977), Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Taiwan, Thailand |
| **Africa** | Madagascar, Seychelles, Somalia, Tanzania |
| **Oceania** | Australia (Northern Territory, Queensland, Western Australia), Federated States of Micronesia, Guam, Palau, Papua New Guinea, Samoa, Solomon Islands, Vanuatu. |
| **South America** | Ecuador |

**Origin.** The pest probably originates in South-East Asia and has spread in several regions of the world. It continues to spread in Asia in recent decades.

**Introductions and spread in the EPPO region**. *D. frumenti* was observed for the first time in 1998 on *Phoenix canariensis* in the south of Gran Canaria (Islas Canarias, Spain) (González-Núñez *et al.*, 2002). It was then found on other islands of Islas Canarias (Fuerteventura, Lanzarote and Tenerife). It has not spread to the mainland and other countries in the EPPO region, possibly because of climatic conditions.

**Biological characteristics known to be of relevance for the outbreaks.**

- Difficult to detect during early stages of infestation (hidden life stages, larvae can be transported in palms and plants for planting).
- Tropical and subtropical original range and host range.

#### References

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### Attachment 1e. Palms (Arecaceae) and their trade into the EPPO region

**The plants.** The family Arecaceae comprises nearly 200 genera and approximately 2300 taxa. Most palm trees originate from tropical and subtropical areas, and occupy a large range of habitats. Palms are found worldwide in the wild, and are cultivated or exploited for a variety of uses, such as for food, oil, fibres, as ornamentals, etc. Palms are perennial plants. There is a wide range of variety between palm species, in particular regarding their size, which can be from 25 cm to 60 m depending on species.

**Use in the EPPO region.** In the EPPO region, palms are present in the wild in the Mediterranean Basin and Atlantic Islands of Portugal and Spain. There are some endemic forests. Endemic species in the region are *Phoenix canariensis* in the Canary Islands, *P. theophrasti* in Greece and Turkey and *Chamaerops humilis* in Spain, Italy, France, Morocco (*C. humilis* subsp. *cerasifera*). The main palm trees in the EPPO region are probably date palm (*P. dactylifera*) and ornamental species (in particular *P. canariensis*). Date is a long-established crop in some EPPO countries. The following data for the area covered with harvested date for EPPO countries is available in FAOSTAT (FAO, 2011).

Table 1 -. Area (ha) covered by harvested date in between 2005 and 2009.

| country | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Albania | 2500 | 3000 | 3200 | 3200 | 3200 |
| Algeria | 147906 | 154372 | 159871 | 162033 | 160867 |
| Israel | 2900 | 3200 | 3200 | 3300 | 4000 |
| Jordan | 615 | 656 | 1573 | 1637 | 1668 |
| Morocco | 34700 | 35500 | 36100 | 37300 | 38000 |
| Spain | 893 | 865 | 950 | 837 | 850 |
| Tunisia | 39970 | 40740 | 39830 | 39300 | 40000 |
| Turkey | 3400 | 3400 | 3400 | 3400 | |

(source FAO STATS) Empty cells represent data that has not been provided, not zero

Ornamental palm trees are widespread in the Southern part of the EPPO region, both outdoors and indoors. In the Mediterranean area, ornamental palms have been used for a long time in parks, gardens, streets etc. In areas widely visited by tourists in Southern Europe, intensive planting, using mature trees, has been carried out along beach promenades and boulevards. In the rest of the EPPO region, palms are mostly grown indoors in glasshouses or buildings and only occasionally outdoors. However their use in gardens has increased in the past decade in the oceanic Western part of the EPPO region, i.e. areas of mild winters. Palm trees are extensively grown in nurseries in many parts of the region.

### Plants for planting

*Propagation*. Date palms are propagated mostly by offshoots or in vitro. Ornamentals palms are mostly produced from seed in nurseries.
*Trade*. In trade, date palms may be exchanged as in vitro material or as offshoots, while ornamental palm trees in international trade are commonly exchanged as stipes or plants rooted in soil, from small plants to adult trees that can measure several meters. Mature trees have also commonly been imported from countries outside of the EPPO region for ornamental purposes.

## Trade data

Palm is one group of plants for which some data is available on trade to the EPPO region. In 2008, a questionnaire was sent to EPPO member countries asking them to provide quantities of imported palm and date trees between 2004 and 2008. Data was received from Algeria, Croatia, Czech Republic, France, Germany, Hungary, Malta, the Netherlands, Turkey (Belgium also answered but had no data to provide). The data is used in section 5.1.

Table 2. Average imports of palm per year

| Country | Average of palm traded per year | Country | Average numbers of palm traded per year |
|---|---|---|---|
| The Netherlands | 6644516 | Croatia | 18018 |
| Germany | 222269 | Algeria | 778 |
| Turkey | 45290 | Malta | 625 |
| Hungary | 40000 | Czech Republic | 275 |
| France | 21297 | | |

(source: table provided by S. Brunel, EPPO document “imported palms and Musa”)

Table 3. Detailed imports in quantities (per country and per year) - Empty cells represent data that has not been provided, not zero

| | 2005 | 2006 | 2007 | | | | |
|---|---|---|---|---|---|---|---|
| Algeria | | 778 | | | | | |
| Croatia | 5038 | 6914 | 42085 | | | | |
| Czech Republic | | 300 | 50 | | | | |
| Germany | | | 222269 | | | | |
| Hungary | 40000 | 40000 | | | | | |
| Malta | 914 | 942 | 1856 | | | | |
| Netherlands | 8755671 | 6416683 | 9931715 | | | | |
| Turkey | 59713 | 45750 | 30405 | | | | |
| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| France | 15329 | 17628 | 29827 | 14872 | 25297 | 30808 | 15324 |

Table 4. Genera, quantities and origin of palms (imported into France and the Netherlands only)

| Genus | Quantity | Africa | Asia | Near East | N. America | Central/South America/Caribbean | Oceania | EPPO region |
|---|---|---|---|---|---|---|---|---|
| *Howea* | 7326789 | Kenya, Togo | China | | USA | | Australia, New Zeal., Norfolk Isl. | Spain, Switzerland |
| *Chrysalidocarpus* | 4536724 | Senegal, Uganda | Indonesia, Malaysia, Singapore, Sri Lanka, Thailand | | USA | Costa Rica, Dominica, Dominican Rep., El Salvador, Guatemala, Honduras | | Spain, Turkey |
| *Livistonia spp* | 3365389 | Côte d'Ivoire, Liberia, South Africa | China, Indonesia, Malaysia, Sri Lanka, Thailand | | USA | Brazil, Chili, Costa Rica, Dominican Republic, Guatemala, Honduras, Argentina | Australia | Netherlands, Spain, Switzerland, Turkey |
| *Areca* | 2643277 | Egypt, Burundi, Côte d'Ivoire, Reunion, Togo | Indonesia,Sri Lanka, Thailand, Vietnam | | | Argentina, Brazil, Costa Rica, Cuba,Dominica, Dominican Rep., El Salvador, Guatemala, Honduras | | Spain, Turkey, USA, Switzerland |
| *Rhapis* | 1678865<br><br>+96577 Raphis | Kenya, South Africa | China, Hong-Kong, Indonesia, Malaysia, Singapore, Sri Lanka, Taiwan, Thailand | | | Costa Rica, Honduras, Brazil | | Spain |
| *Licuala* | 110364 | Togo | Malaysia, Sri Lanka, Thailand | | USA | Costa Rica,Guatemala, Honduras | | |
| *Caryota* | 78735 | Côte d'Ivoire, Senegal, South Africa, Togo | China, Malaysia, Sri Lanka, Thailand | | USA | Costa Rica, El Salvador, Honduras | | Israel, |
| *Chamadorea* | 74126 | South Africa, | China, Indonesia, Malaysia, Thailand | | USA | Brazil, Costa Rica, Honduras | | Canary Isl., Switzerland |
| *Neodypsis* | 60265 | Madagascar, South Africa | | | | Brazil, Costa Rica, El Salvador, Guatemala, Honduras | | Canary Isl.,Israel |
| *Phoenix* | 35991 | Egypt, Côte d'Ivoire, Libya, Morocco, South Africa, Tunisia | China, Thailand, Vietnam | UAE, Koweit | USA | Argentina, Brazil, Costa Rica, Cuba, Guatemala, Paraguay | | France, Italy, Israel, Jordan, Switzerland, Netherlands |
| *Cocos* | 25314 | Egypt, Côte d'Ivoire, South Africa | Sri Lanka, Thailand, Vietnam | | USA | Argentina, Brazil, Costa Rica, Dominican Rep., El Salvador, Guadeloupe, Honduras | French Polynesia | Canary Isl. |
| *Mascarena* | 6905 | | Japan, Thailand | | | Costa Rica, Honduras | | |
| *Washingtonia* | 5907 | Egypt | China, Sri Lanka, Iran | | USA | Chili, Costa Rica, El Salvador | | France, Italy, Spain, Morocco, Switzerland, Turkey, Israel |
| *Ravenea* | 4524 | South Africa | Indonesia | | USA | Costa Rica | Australia | |
| *Euterpe* | 2117 | Kenya | Thailand | | | Brazil, Costa Rica, | | |
| *Chamaerops* | 1837 | | | | | Argentina, Brazil | | Morocco, Switzerland |
| *Trachycarpus* | 1726 | South Africa | China | | | Brazil | | Switzerland |
| *Syagrus* | 1601 | South Africa | | | | Argentina, Paraguay | | |
| *Thrinax* | 1492 | | Indonesia | | | Argentina | | |
| *Jubaea* | 1161 | South Africa | | | | Chili, Paraguay | | Morocco |
| *Roystonea* | 559 | Togo, Egypt, South Africa | | | | | | |
| *Copernicia* | 394 | South Africa | Thailand | | USA | Argentina | | |
| *Sabal* | 198 | South Africa | Thailand | | USA | | | Morocco |
| *Hyophorbe* | 185 | | Thailand, Vietnam | | | | | |
| *Latania* | 137 | South Africa | | | | | | Morocco |

| Genus | Quantity | Africa | Asia | Near East | N. America | Central/South America/Caribbean | Oceania | EPPO region |
|---|---|---|---|---|---|---|---|---|
| *Bismarckia* | 110 | South Africa | | | | | | Morocco |
| *Cyrtostachys* | 65 | Togo | Thailand | | | Panama | | |
| *Nannorrhops* | 60 | Pakistan | | | | | | |
| *Arenga* | 48 | South Africa | Thailand | | | | | |
| *Brahea* | 28 | South Africa | | | | | | |
| *Rhapidophyllum* | 34 | South Africa | | | | | | |
| *Serenoa* | 30 | | | | USA | | | |
| *Hyphaene* | 16 | South Africa | Thailand | | | | | |
| *Elaeis* | 13 | Cameroun, Senegal, Togo | | | USA | | | |
| *Archonthophoenix* | 10 | | Thailand | | | | | Switzerland |
| *Borassus* | 10 | Senegal | | | | | | |
| *Ptychosperma* | 10 | | | | | | Australia | |
| *Acoelorrhaphe* | 9 | | Thailand | | | | | |
| *Pseudophoenix* | 7 | | | | USA | | | Morocco |
| *Pritchardia* | 7 | | | | | | | Morocco |
| *Pinanga* | 4 | | Vietnam | | | | | |
| *Polyandrococos* | 3 | | | | USA | | | |
| *Raphia* | 2 | Madagascar | | | | | | |
| *Arikuryroba* | 1 | | Thailand | | | | | |
| *Rhopalostylis* | 1 | | | | | | | Morocco |

Table 5. Details on imports of 3 palm genera into the Netherlands in 2005-2007 (Empty cells represent data that has not been provided, not zero)

a. *Howea* spp.

| Country | 2005 | 2006 | 2007 |
|---|---|---|---|
| Australia | 1454000 | 1250850 | 3923546 |
| China | | | 81400 |
| Kenya | 30000 | | |
| New Zealand | 305800 | 74800 | 93936 |
| Norfolk Isl. | | 96000 | |
| Spain | 120 | 270 | 6 |
| USA | | | 16000 |
| **Total** | **1789920** | **1421920** | **4114888** |

b. *Chrysalidocarpus* spp.

| Country | 2005 | 2006 | 2007 |
|---|---|---|---|
| Costa Rica | 77534 | 96585 | 75796 |
| Dominica | | 2250 | |
| Domin. Rep. | 33030 | 32159 | 15343 |
| El Salvador | 62681 | 306443 | 169105 |
| Guatemala | 23486 | 12240 | 41220 |
| Honduras | 358523 | 716659 | 888184 |
| Indonesia | | | 10 |
| Malaysia | | | 1302 |
| Singapore | | 1000 | |
| Spain | | | 3140 |
| Thailand | | | 2 |
| Turkey | | 5000 | |
| Uganda | 1611300 | | |
| Sri Lanka | 3502 | | |
| **Total** | **2170056** | **1172336** | **1194102** |

c. *Livistonia* spp.

| Country | 2005 | 2006 | 2007 |
|---|---|---|---|
| Brazil | | 5 | 2000 |
| Chili | | | 1 |
| China | 173 | 800 | |
| Costa Rica | 21776 | 20721 | 1444 |
| Dominic.Rep. | | | 51 |
| Guatemala | 13451 | 29115 | 3081 |
| Honduras | 3970 | 3705 | 28 |
| Indonesia | | 150 | |
| Liberia | | | 500 |
| Malaysia | 5026 | 8750 | |
| Netherlands | 1600 | | |
| Spain | | 2700 | |
| Sri Lanka | 969100 | 1215541 | 1054513 |
| Thailand | 380 | 3 | 6 |
| USA | 10 | | 4 |
| South Africa | | | 4100 |
| **Total** | **1015486** | **1281490** | **1065728** |

Table 6 - Exporting countries

| Origin | Continent | Quantities |
|---|---|---|
| Australia | Oceania | 6628501 |
| Sri Lanka | Asia | 3498088 |
| Honduras | S. America | 3436990 |
| Uganda | Africa | 1611300 |
| China | Asia | 1532816 |
| El Salvador | S. America | 1114346 |
| Costa Rica | S. America | 703777 |
| New Zealand | Oceania | 474536 |
| Dominic. Rep. | Caribbean | 406267 |
| Guatemala | S. America | 261987 |
| Malaysia | Asia | 189650 |
| Indonesia | Asia | 111087 |
| Norfolk Island | Oceania | 96000 |
| Côte d'Ivoire | Africa | 41502 |
| Egypt | Africa | 38464 |
| Kenya | Africa | 33200 |
| Argentina | S. America | 31500 |
| USA | N. America | 22142 |
| Turkey | Eurasia | 15961 |

| Origin | Continent | Quantities |
|---|---|---|
| Thailand | Asia | 13803 |
| Dominica | Caribbean | 11200 |
| Reunion | Africa | 7125 |
| Brazil | S. America | 5884 |
| South Africa | Africa | 5609 |
| Morocco | Africa | 4055 |
| Georgia | Eurasia | 2260 |
| Cuba | S. America | 1285 |
| Singapore | Asia | 1170 |
| Paraguay | S. America | 994 |
| Chili | S. America | 638 |
| Taiwan | Asia | 300 |
| Israel | Asia | 221 |
| Togo | Africa | 498 |
| Tunisia | Africa | 144 |
| India | Asia | 100 |
| Vietnam | Asia | 87 |
| Senegal | Africa | 61 |
| Pakistan | Asia | 60 |

| Origin | Continent | Quantities |
|---|---|---|
| United Arab Emirates | Asia | 43 |
| Hong Kong | Asia | 38 |
| New Caledonia | Oceania | 23 |
| Japan | Asia | 20 |
| Guadeloupe | Caribbean | 19 |
| Jordan | Asia | 10 |
| French Polynesia | Oceania | 5 |
| Panama | S. America | 4 |
| Iran | Asia | 3 |
| Burundi | Africa | 2 |
| Cameroon | Africa | 2 |
| Other | | 16333 |
| **Total** | | **20320110** |

(source: table provided by S. Brunel, EPPO document "imported palms and Musa")

## Measures in EPPO countries at the time of pest entry

Note: this section is only indicative, for the reasons indicated below, but gives a broad idea of the kind of measures that were in place:
- some countries were not members of the EU at the time of pest entry, but it has not been attempted to retrieve their regulation at the time, as these countries were already in the process of aligning with the EU Directive.
- for non-EU countries, summaries of phytosanitary regulations were reviewed (for Albania, Algeria, Israel, Jordan, Kyrgyzstan, Morocco, Moldova, Russian Federation, Tunisia, Turkey, Ukraine). These were prepared in 1999-2001, and regulations might have changed since.
- Switzerland and Norway's plant health regulations are currently mostly similar to the EU's and have not been reviewed.

At the time of entry in the EPPO region, there were some general and specific requirements targeting palms.

EU27

In the EU, specific requirements were already in place against *Fusarium oxysporum* f. sp. *albedinis* (causal agent of bayoudh disease), with imports of *Phoenix* spp. being prohibited from Algeria and Morocco (EU, 2010a). General requirements were also made for plants for planting. In 2007, emergency measures (EU, 2007) were introduced against *R. ferrugineus* for plants, other than fruit and seeds, with a diameter at the base of the stem of over 5 cm of *Areca catechu*, *Arenga pinnata*, *Borassus flabellifer*, *Brahea armata, Butia capitata, Calamus merillii, Caryota maxima, Caryota cumingii, Chamaerops humilis, Cocos nucifera, Corypha gebanga, Corypha elata, Elaeis guineensis, Livistona australis, Livistona decipiens, Metroxylon sagu, Oreodoxa regia, Phoenix canariensis, Phoenix dactylifera, Phoenix theophrasti, Phoenix sylvestris, Sabal umbraculifera (*syn. *S. Palmetto), Trachycarpus fortunei* and *Washingtonia* spp. In 2010, the emergency measures were amended to include species discovered as hosts of *R. ferrugineus* in Europe: *Arecastrum romanzoffianum* (syn. *Syagrus romanzoffiana*), *Arenga pinnata*, *Howea forsteriana* and *Jubea chilensis* (EU, 2010b). Finally requirements against *P. archon* were introduced in 2009 for palms for planting with a diameter at the base of the stem of over 5 cm belonging to the genera *Brahea*, *Butia*, *Chamaerops*, *Jubaea, Livistona*, *Phoenix*, *Sabal*, *Syagrus* (syn. *Arecastrum*), *Trachycarpus, Trithrinax*, *Washingtonia* (EU, 2009).

Other EPPO countries

Some other EPPO countries had general requirements for all plants, for example import permits, phytosanitary certificates, freedom from soil, or origin from areas where certain pests did not occur. According to the EPPO Summaries of phytosanitary regulations, the following specific requirements in place in other EPPO countries would have applied to palm.

Table 7. Requirements for plants for planting of palm

| Country* | Type of plant | | Requirement |
|---|---|---|---|
| Algeria (2000) | *Phoenix* | All plants | Import permit |
| | | Plants originating in countries where *Fusarium oxysporum* f. sp. *albedinis*<br>A. occurs<br>B. does not occur | A. Prohibited<br>B. Free from *Fusarium oxysporum* f. sp. *albedinis* and practically free from other pests |
| Israel (1999) | Plants originating in tropical or subtropical countries | | Prohibited |
| Tunisia (1999) | Plants originating in countries where *Fusarium oxysporum* f. sp. *albedinis* occurs | | Prohibited |
| | *Arecaceae* | Ornamental plants | Prohibited |
| | *Phoenix dactylifera* | All plants | Prohibited |
| Turkey (1999) | *Arecaceae* | All plants | Free from coconut cadang-cadang viroid and palm lethal yellowing phytoplasma |
| | *Phoenix* | Plants originating in countries where *Fusarium oxysporum* f. sp. *albedinis* occurs | Prohibited |

* The date between brackets is the year of preparation of the EPPO Summary of Phytosanitary Regulations for that country.

## Interception data

EPPO Reporting Services 2006-2010 include the following notifications of non-compliance for plants for planting of palm trees (and bonsais).

Table 8. Interceptions on palms in 2006-2010

| Palm species | Intercepted pest | Pest* | Origin | No. Notif. | Reporting Service Reference |
|---|---|---|---|---|---|
| *Adonidia* | *Meloidogyne*⬩ | N | USA | 2 | 2009/121, 2010/109 |
| *Areca* | *Chrysomphalus dictyospermi, Eutetranychus, Icerya purchasi, Lecanoideus floccissimus, Psocoptera* | I, A | Spain (Canary Isl.) | 1 | 2010/121 |
| *Butia capitata* | *Helicotylenchus dihystera*⬩ | N | Brazil | 1 | 2007/138 |
| *Butia capitata, Bismarckia nobilis, Rhapis excelsa* | *Opogona sacchari, Pseudococcidae* | I | Spain (Canary Isl.) | 1 | 2010/190 |
| *Chamaerops humilis* | *Paysandisia archon* | I | Spain | 1 | 2010/121 |
| *Chamaerops humilis, Chamaerops excelsa* | *Paysandisia archon* | I | Italy | 1 | 2007/160 |
| *Jubaea* | *Criconematidae*⬩ | N | Chile | 1 | 2006/088 |
| *Livistona* | *Meloidogyne*⬩ | N | USA | 1 | 2010/088 |
| *Phoenix canariensis* | *Helicotylenchus*⬩ | N | Uruguay | 1 | 2009/100 |
| *Phoenix canariensis* | *Paysandisia archon* | I | Spain | 1 | 2007/138 |
| *Phoenix canariensis, Washingtonia filifera* | *Rhynchophorus ferrugineus* | I | Egypt | 2 | 2006/088, /132 |
| *Phoenix dactylifera (cuttings)* | *Helicotylenchus*⬩ | N | Egypt | 1 | 2006/132 |
| *Phoenix dactylifera* | *Rhynchophorus ferrugineus* | I | Egypt | 3 | 2006/238, 2007/015, 2010/109 |
| *Phoenix dactylifera, Washingtonia* | *Temnorhynchus*⬩ | N | Egypt | 2 | 2006/088, /132 |
| *Phoenix roebelenii* | *Criconematidae, Helicotylenchus, Meloidogyne, Pratylenchus*⬩ | N | Costa Rica | 2 | 2009/144, /183 |
| *Phoenix roebelenii* | *Insecta* | I | Costa Rica | 1 | 2006/238 |
| *Phoenix roebelenii* | *Meloidogyne*⬩ | N | Japan | 1 | 2009/121 |
| *Phoenix roebelenii* | *Metamasius hemipterus* | I | Costa Rica | 2 | 2008/167, 2009/100 |
| *Phoenix roebelenii* | *Metamasius, Blattodea, Orthoptera, Platyhelminthes*(⬩) | I, N | Costa Rica | 1 | 2010/121 |
| *Phoenix roebelenii* | *Rhabdoscelus obscures* | I | Indonesia | 1 | 2007/160 |
| *Phoenix, Washingtonia* | *Rhynchophorus ferrugineus* | I | Egypt | 1 | 2008/229 |
| *Ravenea* | *Opogona sacchari* | I | Netherlands | 2 | 2006/238, 2007/015 |
| *Roystonea regia (with Polyscias fructicosa, Adenium, Ficus, Isatis)* | *Meloidogyne*⬩ | N | Vietnam | 1 | 2010/121 |
| *Trachycarpus excelsa* | *Paratrichodorus porosus, Meloidogynidae, Helicotylenchus dihystera, Criconema*⬩ *Pseudo-parlatoria parlatoriodes, Aspidiotus destructor* | N, I | Brazil | 1 | 2007/160 |
| *Trachycarpus excelsa (with Acer palmatum, Ilex, Loropetalum, Phyllostachys, Podocarpus, Rhododendron, Serissa* | *Paratylenchus*⬩ | N | China | 1 | 2008/167 |
| *Trachycarpus excelsa (with Acer palmatum, Taxus cuspidata) (bonsais)* | *Meloidogyne, Pratylenchus*⬩ | N | Japan | 1 | 2008/107 |
| *Trachycarpus fortunei* | *Aleyrodidae, Melanaspis paulista, Pseudoparlatoria parlatorioides, Helicotylenchus dihystera, Criconemoides*⬩ | N, I | Brazil | 1 | 2007/138 |
| *Trachycarpus fortunei* | *Ditylenchus, Helicotylenchus, Meloidogyne*⬩ | N | China | 1 | 2008/187 |
| *Trachycarpus fortunei* | *Helicotylenchus dihystera, Helicotylenchus*⬩ | N | China | 1 | 2009/183 |
| *Trachycarpus fortunei* | *Meloidogyne*⬩ | N | Korea Rep. | 1 | 2008/187 |
| *Trachycarpus fortunei* | *Meloidogyne*⬩ | N | China | 3 | 2009/144, /183, 2010/088 |
| *Trachycarpus fortunei* | *Paysandisia archon* | I | Italy | 1 | 2008/187 |
| *Trachycarpus fortunei* | *Xiphinema*⬩ | N | China | 1 | 2010/190 |
| *Trachycarpus fortunei* | *Xiphinema rivesi*⬩ | N | Spain | 1 | 2008/187 |
| *Trachycarpus fortunei (with Phyllostachys)* | *Helicotylenchus, Meloidogyne*⬩ | N | China | 1 | 2008/187 |
| *Trachycarpus fortunei, Trachycarpus wagnerianus (bonsais)* | *Meloidogyne*⬩ | N | Japan | 1 | 2008/063 |
| *Trachycarpus fortunei (with Acer, Enkianthus, Ilex crenata, Podocarpus, Taxus) (bonsais)* | *Xiphinema americanum*⬩ | N | Japan | 1 | 2007/160 |
| *Veitchia merrillii (bonsais)* | *Meloidogyne*⬩ | N | USA | 1 | 2008/167 |
| *Washingtonia filifera* | *Opogona sacchari* | I | Netherlands | 1 | 2009/121 |
| *Washingtonia filifera* | *Rhynchophorus ferrugineus* | I | Egypt | 1 | 2006/132 |

* N: Nematoda, I: Insecta, A: Arachnida

⬩ Root and soil nematodes. These pests might have been present in growing media attached to the plants

## References

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## ATTACHMENT 2. A PEST OF FUCHSIA: *ACULOPS FUSCHIAE*

### Attachment 2a. *Aculops fuschiae* (Arachnida: Acarina: Prostigmata: Eriophyidae)

**Common name**: Fuschia gall mite

**Hosts**. *Fuchsia* spp., including at least three species (*F. arborescens*, *F. magellanica*, *F. procumbens*) and over 30 cultivars (Koehler *et al.*, 1985, cited in EPPO, 2008). There is considerable variation in susceptibility and two species (*F. microphylla* subsp. *microphylla*, *F. thymifolia*) and seven cultivars have been noted as being highly resistant to *A. fuchsiae* (Koehler *et al.*, 1985). Only a small proportion of the thousands of cultivars and hybrids have been evaluated for their susceptibility to the pest (Koehler *et al.*, 1985).

**History of the organism as a pest**. The pest status of *A. fuchsiae* at its origin and its detailed distribution in South America are not precisely known. In the original description of this species from Brazil (Kiefer, 1972), *A. fuchsiae* is only reported to develop in large numbers on the leaves, and lead to rusting and deformation of the leaves. It is only following its introduction in California (USA) in the early 1980s that the insect was recorded as a serious pest of fuchsia causing damage to the fuchsia industry and to gardens, and that information became available on this insect as a pest. *A. fuchsia* was identified as a risk for Europe in the 1990s (EPPO/CABI, 1997). Following introduction in the EPPO region, damage and spread was reported (RS 2004/01, 2007/087, 2007/109, 2007/170). *Aculops fuchsia* is now considered as a major pest of all but the most resistant species and cultivars of fuchsia.

**Means of spread.** Movement of infested plants and cuttings. Natural spread through wind and over larger distances by pollinators, especially bees. Can also spread within a crop through tools, clothes, pruning waste etc. (EPPO/CABI, 1997).

### Spread and outbreaks of *A. fuchsiae*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | France (2003), Germany (2005), Jersey (2006), Guernsey (2006), UK (2007) |
| **South America** | Brazil (Sao Paulo; probably more widespread). |
| **North America** | USA (1981 California) |

**Origin.** *A. fuchsiae* is believed to originate from South America. It was first described in 1972 (Keifer, 1972) from Southern Brazil (Sao Paulo). It probably occurs more widely in South America.

**Introduction into the USA.** *A. fuchsiae* was detected in the San Francisco area of California (USA) in 1981 causing damage on fuchsia and spread rapidly in that state (Ostojá-Starzewski *et al.*, 2009). It has caused severe losses to the fuchsia industry. In the Pacific Northwest area of the USA, fuchsia gall mite caused intermitren infestation, but did not appear to survive harsh winters. Damage was recorded in years with mild winters (e.g. 2004 & 2005).

**Introductions and spread in the EPPO region**. *A. fuchsiae* was detected for the first time in 2003 in France (RS 2004/01). Origin of the infestation could not be clearly established, but infestations found in collector gardens suggest that the pest may have been introduced by private exchanges of plant material. The pest was then found in four other countries and territories by 2007, mostly in private and public gardens. In many cases, outbreaks could be traced back to amateurs that had brought back material in their luggage (EPPO RS 2004/01, 2007/172, 2008/003). Inspection of passenger luggage is usually limited in European countries.

**Biological characteristics known to be of relevance for the outbreaks**

- High reproductive potential (life cycle completed in 21 days, several generations during the growing season, females lay approximately 50 eggs).
- Unknown climatic parameter prior to introduction: able to overwinter in mild temperatures (above 5°C).
- Easily spreads naturally via air currents and pollinators, and via man.
- Difficult to detect (small insect).
- Difficult to control (by the time symptoms appear, the pest is likely to be hidden inside plant structures).

## References

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## Attachment 2b. Fuchsia (Onagraceae)

**The plants.** More than 100 fuchsia species are known, most being native from Central and South America, and a few from the Caribbean, New Zealand and Tahiti. There are over 12000 cultivars and hybrids (CSL, 2007; Euro-Fuchsia, 2011; Wagner & Hoch, 2005). Fuchsias are perennial plants.

**Use in the EPPO region.** Fuchsia has been grown as an ornamental for a long time in Europe.It was imported into Europe as an ornamental in the late 18th and the 19th century (e.g. Britain around 1789). The species gained popularity and crossings were performed between imported varieties throughout the 1800's.
Fuchsias remain popular ornamental plants at least in the Western part of the European region. There are numerous local or national societies dedicated to them (e.g. European or national, available at http://www.dfs-fuchsia.dk/__cont/file/Udenlandske_Selskaber.htm). Fuchsias are grown under protected conditions but also widely grown outdoors in gardens and in private collections. Fuchsias are commonly exchanged between amateur growers and are also produced in nursery. CSL (2007) reports that in 2005, 8.1 million boxes, trays, packs and pots of fuchsias were produced by the UK horticultural industry, with a value of over £4.5 million.

### Plants for planting

*Propagation.* Fuchsia is propagated by cuttings. It is commonly propagated under protected conditions. As many producers propagate fuchsias under protection there is a danger of infected plant material being introduced to a protected system.
*Trade.* It is likely that fuchsia is mostly traded as cuttings or rooted plants.

**Trade data.** The following data is extracted from data on trade of plants for planting provided from the Netherlands, Germany, Italy and France (see 5.13 for details on data provided).

Table 1. Units and origins of *Fuchsia* plants for planting for some EPPO countries

| Origin | 2006 (NL only) | | 2007 (NL only) | | 2008 (NL only) | | 2009 (NL, DE, IT**) | | 2010 (NL, DE, IT**, FR*) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | 800 | NL | | | | | 6900 | NL | 10600 | NL |
| | | | | | | | 12500 | DE | 7500 | DE |
| China | 223150 | NL | 623900 | NL | | | | | | |
| Costa Rica | 29650 | NL | 38550 | | 300 | NL | 3200 | NL | 1000 | NL |
| | | | | | | | 921440 | DE | 1451700 | DE |
| Ecuador | 1333919 | NL | 1557272 | NL | 808620 | NL | 1456225 | NL | 428580 | NL |
| | | | | | | | 135814 | DE | 97500 | DE |
| El Salvador | | | | | | | 46600 | DE | 356455 | DE |
| Ethiopia | 1950 | NL | | | | | | | 5600 | DE |
| (Germany) | | | | | | | | | 400 | DE |
| Guatemala | 375124 | NL | 179897 | NL | 14212 | NL | | | 4524 | NL |
| Israel | 1252150 | | 1221084 | NL | 1707460 | NL | 646844 | NL | 1093556 | NL |
| | | | | | | | 367600 | DE | 676225 | DE |
| | | | | | | | 45100 | IT | 122800 | IT |
| Japan | 15 | NL | 2 | NL | | | 6 | NL | 3 | NL |
| | | | | | | | | | 6 | DE |
| Kenya | 27578288 | NL | 36118069 | NL | 27404577 | NL | 42290489 | NL | 47698515 | NL |
| | | | | | | | 2178300 | DE | 2748825 | DE |
| | | | | | | | | | 200 | FR |
| | | | | | | | 45300 | IT | 38500 | IT |
| Mexico | | | | | | | 13700 | DE | | |
| Norway | | | 120 | NL | | | | | | |
| Tanzania | 12550 | NL | 10000 | NL | 38800 | NL | 190913 | NL | 312851 | NL |
| USA | | | 600 | NL | 7000 | NL | | | 2000 | NL |
| *Total* | | | | | | | | *3766754* | | *55057340* |

* propagating material only.
** mixed consignments containing fuchsia are not counted here, i.e. the quantities imported were higher.
Totals for 2006-2008 are not presented in the absence of data for Italy and Germany, significant importers in 2009-2010.

## Measures in EPPO countries at the time of pest entry

Note: this section is only indicative, for the reasons indicated below, but gives a broad idea of the kind of measures that were in place:
- some countries were not members of the EU at the time of pest entry, but it has not been attempted to retrieve their regulation at the time, as these countries were already in the process of aligning with the EU Directive.
- for non-EU countries, summaries of phytosanitary regulations were reviewed (for Albania, Algeria, Israel, Jordan, Kyrgyzstan, Morocco, Moldova, Russian Federation, Tunisia, Turkey, Ukraine). These were prepared in 1999-2001, and regulations might have changed since.
- Switzerland and Norway's plant health regulations are currently mostly similar to the EU's and have not been reviewed.

At the time of entry of *A. fuchsiae* in the EPPO region, the pest had been identified as a risk due to outbreaks in California. It was listed as an A1 quarantine pest by EPPO.

EU27

At the time of entry, the EU Council Directive included specific requirement for plants of *Fuchsia* L. intended for planting, other than seeds, originating in the USA or Brazil: Official statement that no symptoms of *Aculops fuchsiae* Keifer have been observed at the place of production and that immediately prior to export the plants have been inspected and found free from *Aculops fuchsiae* Keifer. (Annex IV, Part A, 38.2). The Directive also included general requirements for plants for planting.

Other countries

Some other EPPO countries had general requirements for all plants, for example import permits, phytosanitary certificates, freedom from soil, or origin from areas where certain pests did not occur. According to the EPPO Summaries of phytosanitary regulations, no specific requirements were made for fuchsia.

### Interception data

There is only one record of pest interception on fuchsia in the EPPO notifications of non-compliance from 2006-2010.

| Species | Intercepted pest | Type of pest* | Origin | Reporting Service Reference |
|---|---|---|---|---|
| *Fuchsia (cuttings)* | *Bemisia tabaci* | I | Kenya | RS 2006/132 |

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## ATTACHMENT 3. THE CASE OF *BUXUS* SPP.

### Attachment 3a. *Diaphania perspectalis* (Insecta: Lepidoptera: Pyralidae)

**Synonyms:** *Cydalima perspectalis* (new name)*, Glyphodes perspectalis, Neoglyphodes perspectalis*, *Phakellura perspectalis*.

**Common names**: box tree moth (English), pyrale du buis (French), Buchsbaumzünsler (German).

**Hosts**. In Europe, it has been reported on *Buxus* species (e.g. *B. microphylla, B. microphylla* var. *insularis, B. sempervirens, B. sinica;* also found in France on a new host, *B. colchica*) (EPPO, 2010). At its origin in Asia, it has also been reported on *Ilex purpurea*, *Euonymus japonicus*, *Euonymus alata* and *Murraya paniculata* (FERA, 2009; Wang, 2008).

**History of the organism as a pest** *D. perspectalis* causes defoliation, which can lead to death of plants. It is a known pest of *Buxus* in Asia, where it has high economic importance and has been extensively studied (Mally & Nuss, 2010). It has caused serious damage on *Buxus* in some outbreaks in the EPPO region.

**Means of spread.** Adults can fly, but no data is available on natural spread. Long-distance spread with infested *Buxus* plants or parts of plants. It is suspected that the pest could also be transported as a hitchhiker (EPPO, 2010).

#### Spread and outbreaks of *Diaphania perspectalis*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Austria (2009), Croatia (2009), France (2008), Germany (2007), Netherlands (2007), Switzerland (2007), United Kingdom (2008) |
| **Asia** | China, India, Japan, Republic of Korea., Russian Federation (Far East) |

**Origin and first introductions.** The pest is thought to originate from Asia. Mally & Nuss (2010) mention that it is native to India, China, Japan and Republic of Korea, and the Russian Far East. In Asia, it has been found on hosts other than *Buxus* spp. (FERA, 2009; Wang, 2008).

**Introductions and spread in the EPPO region**. *D. perspectalis* was reported for the first time in 2007 in Germany on damaged *Buxus* plants (mainly *B. sempervirens*) (RS 2007/215). Because of the high infestation level, it was assumed that the pest had been introduced several years before (probably around 2005). *D. perspectalis* was then found in several regions and EPPO countries. In 2007, it was found in Switzerland at several locations and has then spread rapidly to other cantons; such a rapid spread surpassed the flight ability of the insect and was suspected to be due to trade or movements of infested plants (RS 2008/199, 2009/106). In France, the pest was also found on a new host, *B. colchica* (RS 2010/106). The movement of *Buxus* plants is suspected to have transported the pest within Europe (Mally & Nuss, 2010, citing others).

**Biological characteristics known to be of relevance for the outbreaks**

- The biology of the pest is not well known, but it seems to have several generations per year.
- Eggs, pupae, larvae can be present on leaves and are difficult to detect.
- Data was available on this pest, including biology, ecology and economic impact, but from Japan, China and Republic of Korea i.e. in languages that are not readily understandable in EPPO countries.

#### References

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Wang YM. 2008. The biological character and control of a new pest (*Diaphania perspectalis*) on *Murraya paniculata*. Journal of Fujian Forestry Science and Technology. 4:161-164 [abstract only]

### Attachment 3b. *Cylindrocladium buxicola*

**Common names**: box blight (English), dépérissement des rameaux du buis (Francais), atizonamiento del boj (Spanish)

**Hosts**. *Buxus sempervirens*, *B. microphylla* and *B. sinica* (EPPO, 2006).

**Means of spread.** Resting spores could be spread by soil, water splashes, animals and gardeners (EPPO, 2006).

**Damage**. *C. buxicola* causes a blight, with leaf spots and stem lesions that may lead to complete defoliaition. Damage with sudden and severe defoliation has been observed in some cases (EPPO, 2006; Cech *et al.*, 2010; Henricot *et al.*, 2000).

#### Spread and outbreaks of *Cylindrocladium buxicola*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Austria (2008), Belgium (2000), Croatia (2009), France (2006), Germany (2005), Ireland (2006), the Netherlands (2007), Italy (2008), Spain (2008), UK (1994). |
| **Oceania** | New Zealand (1998) |

**Origin.** The origin of this fungus remains unknown, but it is suspected that it has been introduced to Europe quite recently.

**Introduction and spread in the EPPO region.** In 1994 the disease was discovered in a nursery in UK. No new records were reported until 1997, but the disease is now considered as widespread. *C. buxicola* was found and reported to spread in four other countrie bu 2006 (EPPO, 2006) and five further countries by 2009. Reports are mostly from gardens and nurseries, and it is not clear whether the pest is present on wild buxus. In some cases, the outbreaks could be traced back to import of infested plant material (RS 2009/092, 2010/143).

**Other introductions**. *C. buxicola* was first observed in New Zealand in 1998. This is the only recorded introduction outside of the EPPO region.

**Biological characteristics known to be of relevance for the outbreaks**

- Unknown pest prior to introduction into UK
- Still lacking data on biology, distribution

#### References

Cech T, Diminic D, Heungens K. 2010. *Cylindrocladium buxicola* causes common box blight in Croatia. New Disease Reports 22: 9.
Crepel C, Inghelbrecht S. 2003. First report of blight on *Buxus* spp. caused by *Cylindrocladium buxicola* in Belgium. Plant Disease, 87: 1539
EPPO. 2006. *Cylindrocladium buxicola*. Alert List Data Sheet.
EPPO. 2011. PQR Version 5 (available online). http://www.eppo.int
Henricot B, Culham A. 2002. *Cylindrocladium buxicola*, a new species affecting *Buxus* spp., and its phylogenetic status. Mycologia, 94: 980–997.
Henricot B, Pérez-Sierra A, Prior C. 2000. A new blight disease on *Buxus* in the UK caused by the fungus *Cylindrocladium*. New Disease Reports, 1: 8.

## Attachment 3c. *Buxus* spp. (Buxaceae)

**The plants.** There are approximately 90 species of *Buxus* (Balthazar *et al.*, 2000). *Buxus* spp. are native in several areas of the world (Europe, Asia, Africa, South America, Central America, Mexico and the Caribbean). Most species are recorded as tropical or subtropical; only the European and some Asian species are frost-tolerant (Anon., 2011).

**Use in the EPPO region.** In the EPPO region, *Buxus* spp. grow in the wild as understorey shrubs in forests or in open dry montaneous scrubs, particularly in the Mediterranean region. In most parts of the region, *Buxus* spp. are also popular ornamental shrubs in gardens and parks (parterres, hedges, topiary work). They are extensively grown in nurseries. The wood is used for furniture or carving of objects in some areas.

### Plants for planting

*Propagation.* Normally propagated from cuttings**,** although propagation from seed is reported as possible.
*Trade*. *Buxus* plants may be traded as potted plants or cuttings.

### Trade data

The following data is extracted from data on trade of plants for planting provided by the Netherlands, Germany and Italy (see section 5.13 for details on data provided).

Table 1. Units and origin of *Buxus* plants for planting for some EPPO countries

| | 2006 (NL only) | 2007 (NL only) | 2008 (NL only) | 2009 (NL, DE, IT) | 2010 (NL, DE, IT) |
|---|---|---|---|---|---|
| China | 1186 NL | 0 | 10792 NL | 219582 NL<br>100 IT | 996054 NL<br>11 IT |
| Taiwan | | | 1000 NL | 2900 NL | 800 NL |
| Indonesia | | | 129 NL | 327 NL | 408 NL |
| USA | | | 25 NL | 64 NL | 46 NL |
| Ethiopia | | | | | 41175 NL |
| Vietnam | | | | 5 DE | |
| Turkey | | | | | 1 DE |
| *Total* | *1186* | | *10792* | *222978* | *1038495* |

### Measures at the time of pest entry

Note: this section is only indicative, for the reasons indicated below, but gives a broad idea of the kind of measures that were in place:
- some countries were not members of the EU at the time of pest entry, but it has not been attempted to retrieve their regulation at the time, as these countries were already in the process of aligning with the EU Directive.
- for non-EU countries, summaries of phytosanitary regulations were reviewed (for Albania, Algeria, Israel, Jordan, Kyrgyzstan, Morocco, Moldova, Russian Federation, Tunisia, Turkey, Ukraine). These were prepared in 1999-2001, and regulations might have changed since.
- Switzerland and Norway's plant health regulations are currently mostly similar to the EU's and have not been reviewed.

At the time of entry of the pests in the EPPO region, there were no specific requirements targeting pests of *Buxus* spp. from outside the region. In the EU, there was the general requirement for inspection in the country of origin for plants for planting (EU Directive 2000/29/EC, Annex V, Part B, I.1). Some other EPPO countries had general requirements for all plants, for example import permits, phytosanitary certificates, freedom from soil, or origin from areas where certain pests did not occur. However, according to the EPPO Summaries of phytosanitary regulations, there were no specific requirements in place for *Buxus* spp. in other EPPO countries.

### Interception data

There are two records of pest interceptions on *Buxus* in the EPPO notifications of non-compliance from 2006-2010.

| Species | Intercepted pest | Type of pest* | Origin | No. notifications | Reporting Service Reference |
|---|---|---|---|---|---|
| *Buxus* | *Diaphania perspectalis* | I | Netherlands (re-export) | 1 | 2008/229 |
| *Buxus (with Bougainvillea, Cudrania, Ulmus)* (bonsais) | *Helicotylenchus, Tylenchorhynchus, Criconematidae*♦ | N | Indonesia | 1 | 2006/132 |

* N: Nematoda, I: Insecta; ♦ Root and soil nematodes, which might have been present in growing media attached to the plants

### References

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## ATTACHMENT 4. *FUSARIUM FOETENS* ON BEGONIA

### Attachment 4a. *Fusarium foetens*

**Hosts**. Primarily *Begonia* x *hiemalis* (known as *B. elatior* hybrid), with differences in susceptibility between cultivars. Other Begonia hybrids, such as *Begonia* x *rex-cultorum*, *Begonia* x *cheimantha* and *Begonia* x *tuberhybrida* are also susceptible (Elmer, 2008). Other *Begonia* species (i.e. *B. partita, B. boliviensis*, B. *cinnabarina*, B. coccinea, *B. schmidtiana* and *B. semperflorenscultorum*) are not recorded to develop typical symptoms (Brand *et al.*, 2005). In *Begonia rex* a stunting is observed in two cultivars. The pathogenicity within the genus *Begonia* is not fully established (van der Gaag & Raak, 2010).

**History of the organism as a pest**. *F. foetens* causes basal rot, vein yellowing and wilting symptoms. It can cause up to 100% mortality of the plants. It is estimated that 79% of companies growing begonia pot plants year round in the Netherlands had problems with *F. foetens* in 2002; it now causes low or minimal losses due to measures in place (van der Gaag & Raak, 2010).

**Means of spread.** Spread over short distance is by microconidia (water), macroconidia (air and water) and chlamydospores (survival in soil). Long-distance spread by infected plants or soil.

#### Spread and outbreaks of *Fusarium foetens*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Germany (2001), Netherlands (2000), Norway (2006) |
| **North America** | Canada (2010), USA (2003) |
| **Asia** | Japan (2005) |
| **Oceania** | New Zealand (2008) |

**Origin.** The origin of the pest is unknown. Van der Gaag & Raak (2010) make the hypothesis that it originates in South America or Africa, where nursery stock of *Begonia elatior* is regularly obtained.

**Introductions and spread in the EPPO region**. *F. foetens* was first found and described in the Netherlands in 2000, and also found in Germany (Schroers *et al.*, 2004). In the Netherlands, official measures have been implemented for propagation material since 2002, and official eradication measures were implemented after a new outbreak was found in a propagation company in 2004; *F. foetens* has not been found at propagators since. It is still present in begonia pot plant companies, with low or minimal losses (but with relatively high investments for control) (van der Gaag & Raak, 2010). Hygiene measures, especially disinfection of drain water after irrigation, are effective in controlling *F. foetens*. Import and movement of infected propagation material is probably the only relevant pathway for *F. foetens* (van der Gaag & Raak, 2010). *F. foetens* is reported to have been intercepted a few times on traded cuttings and pot plants in Europe, showing its potential to be spread by trade. The pest was introduced into a few EPPO countries, with planting material from Europe or from outside the region. It was eradicated in the UK (Jones & Baker, 2007).

**Introduction and spread in other regions.** *F. foetens* has recently been reported in three new regions: North America, Oceania and Asia. In the USA, it was first reported in 2003, causing 10 % losses in a glasshouse (Elmer *et al.*, 2004), and in 2007, it was reported to be of limited incidence but needing measures if present. In addition to irrigation water, the role of fungus gnats (*Bradysia* spp.) in disseminating the pest in glasshouses was shown (Elmer *et al.*, 2007; Elmer, 2008). In Asia, *F. foetens* was first found in Japan in 2005 (Sekine *et al.*, 2008) and was reported to occur at another location with serious damage in nursery (Timote, 2009). Finally *F. foetens* was reported in New Zealand in 2008 (Anon., 2008) and in 2010 in Canada in a commercial greenhouse (Tian *et al.*, 2010). No details were found on these two records.

**Biological characteristics known to be of relevance for the outbreaks.**

- Unknown pest at the time of introduction.
- Difficult to detect on young plants.

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## Attachment 4b. *Begonia* spp.

**The plants.** There are over 1400 species of begonias, and large numbers of hybrids and cultivars. Most begonias originate from humid subtropical and tropical climates, in South and Central America, Africa and Southern Asia. One of the most common cultivated hybrids is *Begonia* x *elatior*. Most begonia species are perennial plants (including the known hosts of *F. foetens*) and very few are annual.

**Use in the EPPO region.** Begonias are popular ornamentals. In the coldest parts of the region they are mostly grown indoors as perennial pot plants as they do not tolerate frost, but might also be used as annuals outdoors. In other parts of the region, they can be planted as perennial outdoors. When grown outdoors, begonias are grown in the soil or in containers. Begonias are propagated in nurseries and sold as pot plants.

### Plants for planting

*Propagation*. Normally propagated from seeds or cuttings depending on cultivars.
*Traded commodities*. Begonia plants may be traded as potted plants or cuttings for propagation. Data on begonia is available in the trade data provided by some countries (see section 5.13) but has not yet been analysed.

### Measures at the time of pest entry

Note: this section is only indicative, for the reasons indicated below, but gives a broad idea of the kind of measures that were in place:
- some countries were not members of the EU at the time of pest entry, but it has not been attempted to retrieve their regulation at the time, as these countries were already in the process of aligning with the EU Directive.
- for non-EU countries, summaries of phytosanitary regulations were reviewed (for Albania, Algeria, Israel, Jordan, Kyrgyzstan, Morocco, Moldova, Russian Federation, Tunisia, Turkey, Ukraine). These were prepared in 1999-2001, and regulations might have changed since.
- Switzerland and Norway's plant health regulations are currently mostly similar to the EU's and have not been reviewed.

At the time of entry of the pests in the EPPO region, there were few specific requirements targeting pests of *Begonia* spp.

<u>EU27</u>
There were no specific requirements for Begonia spp. from outside the EU. Specific requirements for *Begonia* plants originating within the EU (protected zones for *Bemisia tabaci*) were put in place in 2002 (Commission Directive 2002/36/EC of 29 April 2002)

<u>Other countries</u>
Some other EPPO countries had general requirements for all plants, for example import permits, phytosanitary certificates, freedom from soil, or origin from areas where certain pests did not occur. According to the EPPO Summaries of phytosanitary regulations, only one country had specific requirements for *Begonia* spp.

| Country* | Type of plant | | Requirement |
|---|---|---|---|
| Turkey (1999) | Begonia | All plants | Free from *Xanthomonas axonopodis* pv. *begoniae* |

* The date between brackets is the year of preparation of the EPPO Summary of Phytosanitary Regulations for that country.

### Interception data

There is only one record of pest interception on *Begonia* in the EPPO notifications of non-compliance from 2006-2010.

| Species | Intercepted pest | Type of pest* | Origin | No. notifications | Reporting Service Reference |
|---|---|---|---|---|---|
| *Begonia* | *Duponchelia fovealis* | I | Netherlands | 4 | 2008/063 |

* I: Insecta

There were a few interceptions of *F. foetens* on *Begonia* & *Begonia elatior* reported in 2002 (6), 2003 (2), 2004 (1) from the Netherlands, Denmark (1) and Brazil (1).

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# ATTACHMENT 5. *PSEUDOMONAS SYRINGAE* PV. *ACTINIDIAE* ON KIWI

## Attachment 5a. *Pseudomonas syringae* pv. *actinidiae*

**Common name**: Bacterial canker of kiwifruit.

**Hosts**. Kiwifruit (*Actinidia* spp.)*: Actinidia deliciosa, A. chinensis, A. arguta*, *A. kolomikta*. Observations in Italy suggested that damage is more severe on yellow fleshed kiwifruit (i.e. *A. chinensis* cvs. 'Hort 16A' and 'Jin Tao') than on green fleshed kiwifruit (i.e. *A. deliciosa* cv. 'Hayward') (EPPO, 2010)

**History of the organism as a pest.** Economic losses were reported in Japan, the Republic of Korea and China in the 1990s. The disease is considered as a limiting factor for the production of kiwifruit. In Italy, high economic losses have occurred since 2007-2008. *P. syringae* pv. *actinidiae* causes brown discolouration of buds, dark brown spots on leaves, cankers on twigs and trunks, fruit collapse, wilting and eventually plant death.

**Means of spread**. Natural spread is thought to be caused by heavy rainfalls, strong winds, animals and humans. Long-distance spread occurs by the movement of infected planting material. Pollen has recently been found to be infected, but it is not known whether it can transmit the disease (MAF, 2010).

### Spread and outbreaks of *Pseudomonas syringae* pv. *actinidiae*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Italy (1992), France (2010), Portugal (2010) (restricted distribution in the three cases) |
| **Asia** | China (Anhui 1990, Sichuan 1989; Shaanxi, 1990; Hubei, no date), Japan (1980s), Republic of Korea (1988) |
| **South America** | Chile (2010) |

**Origin.** *P. syringae* pv. *actinidiae* was originally described in Japan, but its area of origin has not been ascertained. Comparison studies between Korean and Japanese strains showed that they have different phylogenic origins.

**Situation in Asia.** *P. syringae* pv. *actinidiae* was first detected in Japan in 1984. The causal agent was identified as a new pathovar of *Pseudomonas syringae* and called *Pseudomonas syringae* pv. *actinidiae*. It was then detected in other regions of Japan. In the Republic of Korea, the bacterium was first detected in 1988 and it rapidly spread across the production areas of kiwifruit. Finally in China (where *Actinidia* species originate from), available literature indicates that outbreaks occurred in several provinces around 1990. In Shaanxi, it is reported as the most destructive disease in the region (Liang *et al.*, 2000).

**Introductions and spread in the EPPO region**. The disease was first noticed in Northern Italy in 1992. It remained sporadic and with a low incidence until 2007/2008, when high economic losses started to be observed particularly in Lazio. The origin of the introduction is not known but it was assumed that the disease had been introduced by infected propagation material, because 2-year old plants were mainly affected. It was then found in several other regions in 2009 and 2010. *P. s.* pv. *actinidiae* was detected in 2010 in France (subject to official control) and in Portugal (Balestra *et al.*, 2010).

**Introduction into other regions.** *P. syringae* pv. *actinidiae* was found in New Zealand in 2010 in several orchards in the North Island. It is under official control. The origin of the introduction is not known. During an investigation in December 2010-January 2011, *P. syringae* pv. *actinidiae* was found in Chile (Promed, 2011).

**Biological characteristics known to be of relevance for the outbreaks**
- Transmitted on planting material.
- Difficult to detect (requires testing for asymptomatic material)
- Data lacking on epidemiology, spread (possible role of pollen)

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## Attachment 5b. Kiwi, *Actinidia* spp. (Actinidiaceae)

**The plants.** Kiwi (*Actinidia* spp.) belongs to the family Actinidiaceae. There are 76 *Actinidia* spp. according to Huang & Ferguson (2006). The best known species are *A. deliciosa* (green-fleshed variety) and *A. chinensis* (golden-fleshed variety) from which most commercial kiwifruit varieties have been developed. *Actinidia* spp. have a wide geographic distribution in Eastern Asia, from tropical to cold temperate regions. *Actinidia* spp. are perennial, dioecious plants, which are are characterised by obligate outcrossing.

**Use in the EPPO region.** Kiwi is a relatively new commercial crop worldwide. At its origin in China, kiwi fruits are traditionally collected in the wild (150000 tonnes per year estimated by Huang & Ferguson, 2003). Kiwi was brought to New Zealand at the beginning of 1900s. In the EPPO region, commercial cultivation started in Italy at the beginning of the 1960s (Morton, 1987). In Italy it is principally *A. deliciosa* which is grown, but cropping of *A. chinensis* has increased in recent years (RS 2009/215). Kiwi-growing in the world has undertaken drastic changes in recent decades. In the EPPO region, the number of countries growing kiwis has increased, and some have substantially increased their production recently. For example within the past ten years, Turkey became the 2nd country for the area harvested in the world (but still with a relatively small production compared to major producers). Kiwifruit is an important export crop in many growing countries.

**Table 1**. Area harvested and kiwi export in EPPO countries and other major producers worldwide (source: FAOSTAT, FAO, 2011)

| | | Area harvested (ha) | | | | | Fruit production | Fruit export |
|---|---|---|---|---|---|---|---|---|
| | countries | 1970 | 1980 | 1990 | 2000 | 2009 (*2008) | 2009 (*2008) | 2009 (*2008) |
| EPPO | Bulgaria | | | | | 17 | 106 | *904 |
| | Cyprus | | | 35 | 40 | 8 | 160 | 0 |
| | France | | 700 | 4333 | 4270 | 4200 | 70000 | *25810 |
| | Greece | | 148 | 3831 | 3940 | 4800 | 84000 | *37712 |
| | Israel | | | 130 | 140 | 400 | 4099 | *131 |
| | Italy | | | 16314 | 17731 | 23800 | 436300 | *307272 |
| | Kyrgyzstan | | | | 50 | 40 | 400 | 0 |
| | Portugal | | | 855 | 978 | 1405 | 12777 | *3401 |
| | Slovenia | | | | | 11 | 252 | *5865 |
| | Spain | | | 2000 | 896 | *1187 | *14036 | *10151 |
| | Switzerland | | | 19 | 17 | 18 | 548 | 11 |
| | Tunisia | | | | 4 | *4 | *25 | - |
| | Turkey | | | | 1400 | 20000 | 23689 | *51 |
| Non-EPPO | Chile | | | 12260 | 7775 | *9448 | *170000 | *157060 |
| | Iran | | | 2 | 1500 | *2300 | *30000 | *19925 |
| | Japan | | | 5210 | 2960 | 2300 | 36000 | *23 |
| | New Zealand | 400 | 5372 | 17508 | 12184 | *13250 | *365000 | *376598 |
| | Rep. of Korea | | | 813 | 1041 | *800 | *10500 | *1 |
| | USA | | 650 | 2950 | 2145 | 1700 | 23133 | *15500 |

Note. There are no statistical data for China. Commercial cultivation started only at the beginning of the 1980s, reaching 45000 ha in 1998 (Huang and Ferguson, 2003). As of 2002, the area planted in kiwi exceeded that in other countries. By 2002, production was to 340000 tonnes, equal to the production in Italy and estimated to possibly reach 400 000–500 000 t by 2006. China might be among the top growers and producers in 2011.

### Plants for planting

*Propagation.* Rooted cuttings, in vitro material.

*Trade.* Kiwi plant material is exchanged mostly as tissue culture and dormant cuttings. Rooted nursery plants may also be sold. Data on kiwi plants for planting is available in the trade data provided by some countries (see section 5.13) but has not yet been analysed. In New Zealand, before the detection of outbreaks in 2010, some pollen was imported from Chile for artificial pollination of crops (MAF, 2011). Commercial pollen is available in Europe (Anon. 2010), but no data was found on imports.

### Measures in EPPO countries at the time of pest entry

Note: this section is only indicative, for the reasons indicated below, but gives a broad idea of the kind of measures that were in place:
- some countries were not members of the EU at the time of pest entry, but it has not been attempted to retrieve their regulation at the time: as these countries were already in the process of aligning with the EU Directive.
- for non-EU countries, summaries of phytosanitary regulations were reviewed (for Albania, Algeria, Israel, Jordan, Kyrgyzstan, Morocco, Moldova, Russian Federation, Tunisia, Turkey, Ukraine). These were prepared in 1999-2001, and regulations might have changed since.
- Switzerland and Norway's plant health regulations are currently mostly similar to the EU's and have not been reviewed.

At the time of pest discovery in the EPPO region, one country had specific measures for kiwi.

EU27
In the EU, there was the general requirement for inspection in the country of origin for plants for planting (EU Directive 2000/29/EC, Annex V, Part B, I.1).

Other countries
Some other EPPO countries had general requirements for all plants, for example import permits, phytosanitary certificates, freedom from soil, or origin from areas where certain pests did not occur. According to the EPPO Summaries of phytosanitary regulations only one country had specific requirements that would apply to *Actinidia* spp. in 1999. This requirement is not mentioned in the latest regulation (2007), that contains a general requirement for plants:

| Country* | Type of plant | Requirement |
|---|---|---|
| Turkey (1999) | Woody plants | Dormant and free from leaves, flowers and fruit |
| | *Actinidia chinensis* - All plants | Free from virus and virus-like diseases |
| Turkey (2007) | 47. Trees and shrub, intended for planting, other than seeds and plants in tissue culture, originating in third countries other than European and Mediterranean countries | It should be indicated on the Phytosanitary Certificate that:<br>a) the plants are clean (free from plant debris) and free from flowers and fruits,<br>b) they have been grown in nurseries,<br>c) they have been inspected at appropriate times prior to export at and found free from symptoms of harmful<br>bacteria, viruses and virus-like organisms, and found free from signs or symptoms of harmful nematodes, insects, mites and fungi,<br>or<br>-they have been subjected to appropriate treatment to eliminate such harmful organisms. |

### Interception data

No interceptions have been reported on plants for planting of *Actinidia* spp. in EPPO notifications of non-compliance in EPPO Reporting Services 2006-2010.

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## ATTACHMENT 6. INTERCEPTIONS OF SOIL AND ROOT NEMATODES

The table below gives interceptions of nematode genera/families that include soil and root species, classified by plant family. When a consignment was composed of plants of various families, the interception is repeated under each family. The following interceptions have been excluded: soil and root nematodes on palm (see Attachment 1e); nematodes on aquatic plants; *Aphelenchoides* spp. and *Hirschmaniella* spp.; plants for planting specified as tubers, bulbs, cuttings or rhizomes (some interceptions labelled as plants for planting might be of these commodities). Although some plants for planting might be bare rooted plants, most below are thought to be plants with growing medium.

Table 1 - Interceptions 2006-2010 per plant family

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| **Family Aceraceae** | | | | | | |
| *Criconematidae, Pratylenchus* | *Acer, Ilex crenata, Juniperus chinensis* | Sapindaceae, Aquifoliaceae, Cupressaceae | Bonsais | Japan | 2 | 2006/132, /088 |
| *Helicotylenchus* | *Acer palmatum* | Sapindaceae | Bonsais | Japan | 1 | 2007/098 |
| *Meloidogyne, Pratylenchus* | *Acer palmatum, Taxus cuspidata, Trachycarpus excels, Camellia, Ilex crenata* | Sapindaceae, Taxaceae, Arecaceae, Theaceae, Aquifoliaceae | Bonsais | Japan | 2 | 2006/132, 2008/107 |
| *Paratylenchus* | *Acer palmatum, Ilex, Loropetalum, Phyllostachys, Podocarpus, Rhododendron, Serissa, Trachycarpus excelsa* | Sapindaceae, Aquifoliaceae, Hamamelidaceae, Poaceae, Podocarpaceae, Ericaceae, Rubiaceae, Arecaceae | Plants for planting | China | 1 | 2008/167 |
| *Paratylenchus, Helicotylenchus, Meloidogyne* | *Acer* | Sapindaceae | Bonsais | Japan | 1 | 2007/138 |
| *Pratylenchus* | *Acer buergerianum* | Sapindaceae | Bonsais | Japan | 2 | 2007/138, 2008/167 |
| *Pratylenchus* | *Acer palmatum* | Sapindaceae | Bonsais | Japan | 3 | 2007/098, 2008/107 |
| *Pratylenchus, Longidoridae* | *Acer palmatum* | Sapindaceae | Bonsais | Japan | 1 | 2007/098 |
| *Pratylenchus, Tylenchorhynchus,Trichodorus* | *Acer* | Sapindaceae | Bonsais | Japan | 1 | 2007/138 |
| *Trichodoridae, Tylenchorhynchus* | *Acer palmatum, Ilex crenata* | Sapindaceae, Aquifoliaceae | Bonsais | Japan | 1 | 2008/107 |
| *Xiphinema* | *Acer palmatum, Ilex crenata* | Sapindaceae, Aquifoliaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema americanum* | *Acer palmatum* | Sapindaceae | Bonsais | Japan | 1 | 2008/063 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Taxus* | Sapindaceae, Ericaceae, Aquifoliaceae, Taxaceae | Bonsais | Japan | 1 | 2007/098 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Podocarpus, Taxus, Trachycarpus fortunei* | Sapindaceae, Aquifoliaceae, Podocarpaceae, Taxaceae, Arecaceae | Bonsais | Japan | 1 | 2007/160 |
| **Family Aquifoliaceae** | | | | | | |
| *Criconematidae, Pratylenchus* | *Acer, Ilex crenata, Juniperus chinensis* | Sapindaceae, Aquifoliaceae, Cupressaceae | Bonsais | Japan | 2 | 2006/132, /088 |
| *Globodera, Tylenchorhynchus* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 1 | 2009/121 |
| *Helicotylenchus dihystera* | *Ilex,Eugenia,Bougainvillea, Ligustrum, Portulacaria, Sageretia thea, Serissa, Zanthoxylum* | Aquifoliaceae, Myrtaceae, Nyctaginaceae, Oleaceae, Portulacaceae, Rhamnaceae, Rubiaceae | Bonsais | China | 10 | 2009/183 /056 2007/015 |
| *Helicotylenchus, Tylenchorhynchus* | *Ilex crenata, Podocarpus macrophyllus* | Aquifoliaceae | Bonsais | Japan | 2 | 2009/183/144 |
| *Meloidogyne, Pratylenchus* | *Acer palmatum, Taxus cuspidata, Trachycarpus excels, Camellia, Ilex crenata* | Sapindaceae, Taxaceae, Arecaceae, Theaceae, Aquifoliaceae | Bonsais | Japan | 2 | 2006/132, 2008/107 |
| *Meloidogyne, Pratylenchus* | *Acer palmatum, Taxus cuspidata, Trachycarpus excels, Camellia, Ilex crenata* | Sapindaceae, Taxaceae, Arecaceae, Theaceae, Aquifoliaceae | Bonsais | Japan | 2 | 2006/132, 2008/107 |
| *Meloidogyne, Pratylenchus, Xiphinema* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 1 | 2009/121 |
| *Paratylenchus* | *Acer palmatum, Ilex, Loropetalum, Phyllostachys, Podocarpus, Rhododendron, Serissa, Trachycarpus excelsa* | Sapindaceae, Aquifoliaceae, Hamamelidaceae, Poaceae, Podocarpaceae, Ericaceae, Rubiaceae, Arecaceae | Plants for planting | China | 1 | 2008/167 |
| *Pratylenchus* | *Ilex crenata, Pinus pentaphylla* | Aquifoliaceae, Pinaceae | Bonsais | Japan | 1 | 2007/160 |

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| *Pratylenchus* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Pratylenchus loosi, Phytonemus pallidus subsp. pallidus, Agistemus* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2007/098 |
| *Pratylenchus, Trichodoridae, Xiphinema* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 2 | 2009/121, 2010/121 |
| *Pratylenchus, Trichodorus* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2007/138 |
| *Pratylenchus, Tylenchorhynchus, Rotylenchus* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 1 | 2007/138 |
| *Pratylenchus, Xiphinema* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Trichodoridae, Tylenchorhynchus* | *Acer palmatum, Ilex crenata* | Sapindaceae, Aquifoliaceae | Bonsais | Japan | 1 | 2008/107 |
| *Trichodoridae, Tylenchorhynchus,* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 3 | 2009/121, 2010/121 |
| *Trichodorus cedarus* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Italy | 1 | 2007/160 |
| *Tylenchorhynchus* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 2 | 2006/132, 2008/167 |
| *Xiphinema* | *Ilex crenata* | Aquifoliaceae | Bonsais, Plants for planting | Japan | 7 | 2006/132, /169, 2007/138, 2008/107, 2009/144, /183 |
| *Xiphinema* | *Acer palmatum, Ilex crenata* | Sapindaceae, Aquifoliaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema americanum* | *Ilex crenata* | Aquifoliaceae | Bonsais, Plants for planting | Japan | 5 | 2008/167, /107 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Taxus* | Sapindaceae, Ericaceae, Aquifoliaceae, Taxaceae | Bonsais | Japan | 1 | 2007/098 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Podocarpus, Taxus, Trachycarpus fortunei* | Sapindaceae, Ericaceae, Aquifoliaceae, Podocarpaceae, Taxaceae, Arecaceae | Bonsais | Japan | 1 | 2007/160 |
| *Xiphinema americanum, Meloidogyne* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 2 | 2008/207, /107 |
| *Xiphinema americanum, Pratylenchus, Trichodoridae* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2008/167 |
| *Xiphinema americanum, Pratylenchus, Tylenchorhynchus* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2006/132 |
| *Xiphinema americanum, Tylenchorhynchus* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2006/132 |
| *Xiphinema americanum, Xiphinema diffusum, Xiphinema incognitum* | *Ilex crenata* | Aquifoliaceae | Plants for planting | Japan | 1 | 2009/121 |
| *Xiphinema incognitum, Paratrichodrus* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2007/098 |
| *Xiphinema, Tylenchorhynchus, Pratylenchus, Trichodorus, Criconemoides, Longidoridae* | *Ilex crenata* | Aquifoliaceae | Bonsais | Japan | 1 | 2007/098 |
| **Family Araceae** | | | | | | |
| *Meloidogyne* | *Anubias* | Araceae | Plants for planting | Taiwan | 1 | 2008/187 |
| *Radopholus similis* | *Anthurium, Philodendron* | Araceae | Plants for planting | Malaysia | 1 | 2008/207 |
| *Radopholus similis* | *Anubias* | Araceae | Plants for planting | Thailand | 1 | 2008/187 |
| *Radopholus similis* | *Cryptocoryne* | Araceae | Plants for planting | Philippines | 1 | 06/088 |
| *Radopholus similis* | *Scindapsus* | Araceae | Plants for planting | Sri Lanka | 1 | 2010/088 |
| *Helicotylenchus dihystera* | *Anthurium, Philodendron mamei, Alocasia,Tacca integrifolia* | Araceae x 3, Dioscoreaceae | Plants for planting | USA | 1 | 2007/098 |
| **Family Araliaceae** | | | | | | |
| *Ditylenchus* | *Schefflera* | Araliaceae | Plants for planting | Guatemala | 1 | 2007/138 |

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| *Meloidogyne* | *Schefflera* | Araliaceae | Plants for planting | Côte d'Ivoire | 1 | 2007/015 |
| *Meloidogyne* | *Schefflera arboricola* | Araliaceae | Plants for planting | USA | 1 | 2010/121 |
| *Meloidogyne javanica* | *Schefflera* | Araliaceae | Plants for planting | Côte d'Ivoire | 2 | 2007/015 |
| *Meloidogyne* | *Polyscias fructicosa, Adenium, Ficus, Isatis, Roystonea regia* | Araliaceae, Apocynaceae, Moraceae, Brassicaceae, Arecaceae | Plants for planting | Vietnam | 1 | 2010/121 |
| *Helicotylenchus, Meloidogyne, Pratylenchus, Rotylenchus, Trichodoridae, Tylencho-rhynchus, Xiphinema* | *Ficus altissima, Ficus lyrata, Schefflera* | Moraceae x 2, Araliaceae | Plants for planting | USA | 1 | 2009/121 |
| *Helicotylenchus* | *Ficus benjamina, Schefflera, Pleioblastus* | Moraceae, Araliaceae, Poaceae | Plants for planting | Côte d'Ivoire | 2 | 2007/015 |
| **Family Cupressaceae** | | | | | | |
| *Pratylenchus* | *Cryptomeria japonica* | Cupressaceae | Bonsais | Japan | 1 | 06/088 |
| *Pratylenchus* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 4 | 2007/098, 2008/167, 2008/107 |
| *Pratylenchus, Helicotylenchus* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 2007/098 |
| *Pratylenchus, Tylenchorhynchus, Heterodera, Criconemoides* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema americanum* | *Cryptomeria japonica,* | Cupressaceae | Bonsais | Japan | 1 | 2008/063 |
| *Xiphinema americanum* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 2006/132 |
| *Xiphinema americanum, Trichodoridae* | *Chamaecyparis obtusa* | Cupressaceae | Bonsais | Japan | 1 | 2008/167 |
| *Xiphinema americanum, Trichodoridae, Criconematidae* | *Chamaecyparis obtusa* | Cupressaceae | Plants for planting | Japan | 1 | 2008/167 |
| *Criconematidae, Pratylenchus* | *Acer, Ilex crenata, Juniperus chinensis* | Sapindaceae, Aquifoliaceae, Cupressaceae | Bonsais | Japan | 2 | 2006/132, /088 |
| **Family Ericaceae** | | | | | | |
| *Meloidogyne* | *Enkianthus perulatus* | Ericaceae | Plants for planting | Japan | 3 | 2009/144 /183, 2010/121 |
| *Meloidogyne, Trichodoridae* | *Enkianthus perulatus* | Ericaceae | Bonsais, plants for planting | Japan | 2 | 2008/167, 2009/121 |
| *Meloidogyne, Xiphinema* | *Enkianthus perulatus* | Ericaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Trichodoridae* | *Enkianthus perulatus* | Ericaceae | Plants for planting | Japan | 1 | 2008/167 |
| *Trichororidae* | *Enkianthus perulatus* | Ericaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Tylenchorhynchus* | *Rhododendron indicum* | Ericaceae | Bonsais | Japan | 1 | 2007/098 |
| *Xiphinema americanum* | *Enkianthus perulatus* | Ericaceae | Bonsais | Japan | 1 | 2008/107 |
| *Xiphinema americanum, Meloidogyne, Trichodoridae* | *Enkianthus perulatus* | Ericaceae | Bonsais | Japan | 1 | 2008/167 |
| *Xiphinema americanum, Trichodoridae, Criconematidae* | *Enkianthus perulatus* | Ericaceae | Plants for planting | Japan | 1 | 2008/167 |
| *Meloidogyne, Pratylenchus, Trichodorus* | *Enkianthus perulatus, Ilex crenata* | Ericaceae, Aquifoliaceae | Bonsais | Japan | 1 | 2007/138 |
| *Paratylenchus* | *Acer palmatum, Ilex, Loropetalum, Phyllostachys, Podocarpus, Rhododendron, Serissa, Trachycarpus excelsa* | Sapindaceae, Aquifoliaceae, Hamamelidaceae, Poaceae, Podocarpaceae, Ericaceae, Rubiaceae, Arecaceae | Plants for planting | China | 1 | 2008/167 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Podocarpus, Taxus, Trachycarpus fortunei* | Sapindaceae, Ericaceae, Aquifoliaceae, Podocarpaceae, Taxaceae, Arecaceae | Bonsais | Japan | 1 | 2007/160 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Taxus* | Sapindaceae, Ericaceae, Aquifoliaceae, Taxaceae | Bonsais | Japan | 1 | 2007/098 |
| **Miscellaneous (1 or 2 notifications per family)** | | | | | | |
| *Milviscutulus mangiferae, Helicotylenchus, Tylenchorhynchus* | *Mangifera indica* | Anacardiaceae | Plants for planting | USA | 1 | 2009/100 |
| *Meloidogyne* | *Polyscias fructicosa, Adenium, Ficus, Isatis, Roystonea regia* | Araliaceae, Apocynaceae, Moraceae, Brassicaceae, Arecaceae | Plants for planting | Vietnam | 1 | 2010/121 |
| *Helicotylenchus dihystera* | *Chrysanthemum* | Asteraceae | Plants for planting | Kenya | 1 | 2007/098 |

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| *Helicotylenchus* | *Ficus, Ligustrum, Serissa, Zelkova, Carmona retusa, Ilex, Taxus* | Moraceae, Oleaceae, Rubiaceae, Ulmaceae Boraginaceae, Aquifoliaceae, Taxaceae | Bonsais, Plants for planting | China | 6 | 2008/187, 2010/109, 2010/190 |
| *Pratylenchus penetrans* | *Canna* | Cannaceae | Plants for planting | Netherlands | 1 | 2007/160 |
| *Pratylenchus* | *Bucida buceras* | Combretaceae | Plants for planting | USA | 3 | 2007/160, 2007/201, 2009/201 |
| *Helicotylenchus dihystera* | *Anthurium, Philodendron mamei, Alocasia,Tacca integrifolia* | Araceae x 3, Dioscoreaceae | Plants for planting | USA | 1 | 2007/098 |
| *Helicotylenchus* | *Peltophorum pterocarpum* | Fabaceae | Plants for planting | USA | 1 | 2009/201 |
| *Pratylenchus* | *Wisteria* | Fabaceae | Bonsais | Japan | 1 | 2006/132 |
| *Tylenchorhynchus* | *Loropetalum, Phoenix* | Hamamelidaceae, Arecaceae | Plants for planting | China | 1 | 2010/190 |
| *Paratylenchus* | *Acer palmatum, Ilex, Loropetalum, Phyllostachys, Podocarpus, Rhododendron, Serissa, Trachycarpus excelsa* | Sapindaceae, Aquifoliaceae, Hamamelidaceae, Poaceae, Podocarpaceae, Ericaceae, Rubiaceae, Arecaceae | Plants for planting | China | 1 | 2008/167 |
| *Radopholus similis* | *Heliconia* | Heliconiaceae | Plants for planting | Costa Rica | 1 | 2008/187 |
| *Heteroderidae* | *Premna* | Lamiaceae | Bonsais | Japan | 2 | 06/088, 2006/132 |
| *Meloidogyne* | *Punica granatum* | Lythraceae | Plants for planting | Turkey | 1 | 2010/121 |
| *Helicotylenchus, Meloido-gyne, Pratylenchus, Tylenchorhynchus* | *Punica granatum, Stewartia monadelpha* | Lythraceae, Theaceae | Bonsais | Japan | 1 | 2008/167 |
| *Pratylenchus* | *Magnolia* | Magnoliaceae | Plants for planting | Japan | 1 | 2010/190 |
| *Meloidogyne* | *Adansonia digitata* | Malvaceae/Bombacoideae (baobab) | Plants for planting | USA | 1 | 2009/121 |
| *Radopholus similis* | *Calathea* | Marantaceae | Plants for planting | Thailand | 1 | 2008/167 |
| *Helicotylenchus* | *Musaceae* | Musaceae | Plants for planting | Spain (Can. Isl.) | 1 | 2007/201 |
| *Helicotylenchus dihystera* | *Ilex,Eugenia,Bougainvillea, Ligustrum, Portulacaria, Sageretia thea, Serissa, Zanthoxylum* | Aquifoliaceae, Myrtaceae, Nyctaginaceae, Oleaceae, Portulacaceae, Rhamnaceae, Rubiaceae, Rutaceae | Bonsais | China | 10 | 2009/183 /056 2007/015 |
| *Helicotylenchus, Tylenchorhynchus, Criconematidae* | *Bougainvillea, Buxus, Cudrania, Ulmus* | Nyctaginaceae, Buxaceae, Moraceae, Ulmaceae | Bonsais | Indonesia | 1 | 2006/132 |
| *Helicotylenchus* | *Cymbidium* | Orchidaceae | Plants for planting | Guatemala | 1 | 2007/138 |
| *Paratylenchus* | *Oncidium* | Orchidaceae | Plants for planting | Guatemala | 1 | 2007/138 |
| *Helicotylenchus* | *Phormium* | Phormiaceae | Plants for planting | Argentina | 2 | 2006/132 |
| *Helicotylenchus, Meloidogyne* | *Phyllostachys (with Trachycarpus fortune)* | Poaceae (with Arecaceae) | Plants for planting | China | 1 | 2008/187 |
| *Helicotylenchus* | *Ficus benjamina, Schefflera, Pleioblastus* | Moraceae, Araliaceae, Poaceae | Plants for planting | Côte d'Ivoire | 2 | 2007/015 |
| *Helicotylenchus, Trichodorus* | *Ficus, Podocarpus, Sageretia thea, Serrisa, Zanthoxylum, Zelkova* | Moraceae, Podocarpaceae, Rhamnaceae, Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/121 |
| *Helicotylenchus dihystera, Pratylenchus brachyurus, Scutellonema* | *Serissa, Zanthoxylum, Zelkova* | Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/109 |
| *Helicotylenchus, Xiphinema* | *Ficus benjamina, F. microcarpa, Jasminum, Strelitzia, Yucca* | Moraceae x 2, Oleaceae, Strelitziaceae, Agavaceae | Plants for planting | Egypt | 1 | 2008/229 |
| *Xiphinema* | *Vitis vinifera* | Vitaceae | Plants for planting | Turkey | 1 | 2010/088 |
| **Family Moraceae** | | | | | | |
| *Helicotylenchus, Tylenchorhynchus* | *Ficus microcarpa* | Moraceae | Bonsais | China | 1 | 2010/121 |
| *Meloidogyne enterolobii* | *Ficus microcarpa* | Moraceae | Plants for planting | China | 1 | 2008/229 |
| *Meloidogyne javanica* | *Ficus* | Moraceae | Bonsais | China | 1 | 2007/015 |
| *Meloidogyne, Pratylenchus* | *Ficus microcarpa* | Moraceae | Bonsais | China | 1 | 2010/190 |
| *Pratylenchus* | *Ficus* | Moraceae | Plants for planting | Côte d'Ivoire | 1 | 2007/015 |

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| *Pratylenchus* | *Ficus carica* | Moraceae | Plants for planting | Israel | 1 | 2008/207 |
| *Xiphinema* | *Ficus carica* | Moraceae | Plants for planting | Iran | 1 | 2010/109 |
| *Xiphinema* | *Morus* | Moraceae | Plants for planting | Turkey | 1 | 2010/190 |
| *Xiphinema americanum* | *Ficus* | Moraceae | Bonsais | China | 1 | 2006/238 |
| *Xiphinema incognitum* | *Ficus* | Moraceae | Plants for planting | China | 1 | 2008/167 |
| *Helicotylenchus, Meloidogyne, Pratylenchus, Rotylenchus, Trichodoridae, Tylencho-rhynchus, Xiphinema* | *Ficus altissima, Ficus lyrata, Schefflera* | Moraceae x 2, Araliaceae | Plants for planting | USA | 1 | 2009/121 |
| *Helicotylenchus, Xiphinema* | *Ficus benjamina, F. microcarpa, Jasminum, Strelitzia, Yucca* | Moraceae x 2, Oleaceae, Strelitziaceae, Agavaceae | Plants for planting | Egypt | 1 | 2008/229 |
| *Helicotylenchus* | *Ficus benjamina, Schefflera, Pleioblastus* | Moraceae, Araliaceae, Poaceae | Plants for planting | Côte d'Ivoire | 2 | 2007/015 |
| *Helicotylenchus* | *Ficus, Ligustrum, Serissa, Zelkova, Carmona retusa, Ilex, Taxus* | Moraceae, Oleaceae, Rubiaceae, Ulmaceae Boraginaceae, Aquifoliaceae, Taxaceae | Bonsais, Plants for planting | China | 6 | 2008/187, 2010/109, 2010/190 |
| *Helicotylenchus, Trichodorus* | *Ficus, Podocarpus, Sageretia thea, Serrisa, Zanthoxylum, Zelkova* | Moraceae, Podocarpaceae, Rhamnaceae, Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/121 |
| *Meloidogyne* | *Polyscias fructicosa, Adenium, Ficus, Isatis, Roystonea regia* | Araliaceae, Apocynaceae, Moraceae, Brassicaceae, Arecaceae | Plants for planting | Vietnam | 1 | 2010/121 |
| *Helicotylenchus, Tylenchorhynchus, Criconematidae* | *Bougainvillea, Buxus, Cudrania, Ulmus* | Nyctaginaceae, Buxaceae, Moraceae, Ulmaceae | Bonsais | Indonesia | 1 | 2006/132 |
| **Family Myrtaceae** | | | | | | |
| *Tylenchus* | *Syzygium* | Myrtaceae | Plants for planting | China | 1 | 2008/167 |
| *Helicotylenchus dihystera* | *Ilex,Eugenia,Bougainvillea, Ligustrum, Portulacaria, Sageretia thea, Serissa, Zanthoxylum* | Aquifoliaceae, Myrtaceae, Nyctaginaceae, Oleaceae, Portulacaceae, Rhamnaceae, Rubiaceae, Rutaceae | Bonsais | China | 10 | 2009/183 /056 2007/015 |
| **Family Oleaceae** | | | | | | |
| *Helicotylenchus dihystera, Meloidogyne* | *Fraxinus* | Oleaceae | Bonsais | China | 1 | 2009/183 |
| *Meloidogyne* | *Osmanthus* | Oleaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Pratylenchus, Tylenchorhynchus* | *Olea* | Oleaceae | Plants for planting | Syria | 1 | 2009/183 |
| *Helicotylenchus dihystera* | *Ilex,Eugenia,Bougainvillea, Ligustrum, Portulacaria, Sageretia thea, Serissa, Zanthoxylum* | Aquifoliaceae, Myrtaceae, Nyctaginaceae, Oleaceae, Portulacaceae, Rhamnaceae, Rubiaceae | Bonsais | China | 10 | 2009/183 /056 2007/015 |
| *Helicotylenchus, Xiphinema* | *Ficus benjamina, F. microcarpa, Jasminum, Strelitzia, Yucca* | Moraceae x 2, Oleaceae, Strelitziaceae, Agavaceae | Plants for planting | Egypt | 1 | 2008/229 |
| **Family Pinaceae** | | | | | | |
| *Criconematidae* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 06/088 |
| *Cryphodera brinkmanii* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 06/088, 2007/138 |
| *Heteroderidae* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2007/098 |
| *Heteroderidae, Criconemoides, Tylenchorhynchus, Pratylenchus, Rotylenchus* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2007/138 |
| *Pratylenchus* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2008/167 |
| *Pratylenchus* | *Ilex crenata, Pinus pentaphylla* | Aquifoliaceae, Pinaceae | Bonsais | Japan | 1 | 2007/160 |
| *Pratylenchus, Criconemoides, Cryphodera brinkmanii* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2010/190 |
| *Trichodoridae, Criconematidae* | *Pinus pentaphylla* | Pinaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Tylenchorhynchus, Trichodorus, Criconemoides* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema* | *Pinus* | Pinaceae | Plants for planting | Japan | 1 | 2009/183 |
| *Xiphinema americanum* | *Pinus parviflora* | Pinaceae | Bonsais | Japan | 1 | 2010/121 |
| *Xiphinema americanum, Criconematidae, Pratylenchus, Tylenchidae* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2006/132 |

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| *Xiphinema incognitum* | *Pinus* | Pinaceae | Plants for planting | Japan | 1 | 2009/144 |
| *Xiphinema, Trichodorus, Criconemoides, Heterodera* | *Pinus pentaphylla* | Pinaceae | Bonsais | Japan | 1 | 2007/098 |
| **Family Podocarpaceae** | | | | | | |
| Xiphinema diffusum | *Podocarpus* | Podocarpaceae | Bonsais | China | 1 | 2008/187 |
| Paratylenchus | *Acer palmatum, Ilex, Loropetalum, Phyllostachys, Podocarpus, Rhododendron, Serissa, Trachycarpus excelsa* | Sapindaceae, Aquifoliaceae, Hamamelidaceae, Poaceae, Podocarpaceae, Ericaceae, Rubiaceae, Arecaceae | Plants for planting | China | 1 | 2008/167 |
| Xiphinema americanum | *Acer, Enkianthus, Ilex crenata, Podocarpus, Taxus, Trachycarpus fortunei* | Sapindaceae, Ericaceae, Aquifoliaceae, Podocarpaceae, Taxaceae, Arecaceae | Bonsais | Japan | 1 | 2007/160 |
| Helicotylenchus, Trichodorus | *Ficus, Podocarpus, Sageretia thea, Serrisa, Zanthoxylum, Zelkova* | Moraceae, Podocarpaceae, Rhamnaceae, Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/121 |
| **Family Rosaceae** | | | | | | |
| *Globodera pallida* | *Fragaria ananassa* | Rosaceae | Plants for planting | Ukraine | 1 | 2006/169 |
| *Globodera rostochiensis* | *Rosa* | Rosaceae | Plants for planting | Germany | 1 | 2007/035 |
| *Meloidogyne* | *Rosa* | Rosaceae | Plants for planting | China, South Africa | 2 | 06/088, 2007/015 |
| *Meloidogyne enterolobii* | *Rosa* | Rosaceae | Plants for planting | China | 3 | 2008/107 |
| *Meloidogyne enterolobii, Meloidogyne hapla* | *Rosa* | Rosaceae | Plants for planting | China | 1 | 2008/107 |
| *Pratylenchus* | *Pyracantha* | Rosaceae | Bonsais | Japan | 1 | 2008/167 |
| **Family Rubiaceae** | | | | | | |
| *Pratylenchus* | *Serissa foetida* | Rubiaceae | Bonsais | Japan | 1 | 06/088 |
| *Helicotylenchus dihystera, Tylenchorhynchus* | *Serissa, Ficus* | Rubiaceae, Moraceae | Bonsais | China | 2 | 2009/056, /183 |
| *Helicotylenchus dihystera, Pratylenchus brachyurus, Scutellonema* | *Serissa, Zanthoxylum, Zelkova* | Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/109 |
| *Helicotylenchus dihystera* | *Ilex,Eugenia,Bougainvillea, Ligustrum, Portulacaria, Sageretia thea, Serissa, Zanthoxylum* | Aquifoliaceae, Myrtaceae, Nyctaginaceae, Oleaceae, Portulacaceae, Rhamnaceae, Rubiaceae, Rutaceae | Bonsais | China | 10 | 2009/183 /056 2007/015 |
| *Helicotylenchus, Trichodorus* | *Ficus, Podocarpus, Sageretia thea, Serrisa, Zanthoxylum, Zelkova* | Moraceae, Podocarpaceae, Rhamnaceae, Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/121 |
| **Family Taxaceae** | | | | | | |
| *Pratylenchus* | *Taxus cuspidate* | Taxaceae | Bonsais, Plants for planting | Japan | 4 | 2008/167, 2010/121 2010/190 |
| *Pratylenchus vulnus, Scutellonema* | *Taxus baccata* | Taxaceae | Bonsais | Japan | 1 | 2008/107 |
| *Rotylenchus* | *Taxus cuspidata* | Taxaceae | Bonsais | Japan | 1 | 2008/167 |
| Scutellonema | *Taxus cuspidata* | Taxaceae | Bonsais | Japan | 2 | 2009/100, 2010/190 |
| *Trichodoridae* | *Taxus cuspidate,* | Taxaceae | Bonsais | Japan | 1 | 2010/190 |
| *Xiphinema* | *Taxus cuspidata* | Taxaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema americanum* | *Taxus cuspidata* | Taxaceae | Bonsais | Japan | 1 | 2006/132 |
| *Xiphinema, Pratylenchus, Rotylenchus, Macroposthonia* | *Taxus cuspidata* | Taxaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Taxus* | Sapindaceae, Ericaceae, Aquifoliaceae, Taxaceae | Bonsais | Japan | 1 | 2007/098 |
| *Xiphinema americanum* | *Acer, Enkianthus, Ilex crenata, Podocarpus, Taxus, Trachycarpus fortunei* | Sapindaceae, Aquifoliaceae, Podocarpaceae, Taxaceae, Arecaceae | Bonsais | Japan | 1 | 2007/160 |
| *Meloidogyne, Pratylenchus* | *Acer palmatum, Taxus cuspidata, Trachycarpus excels, Camellia, Ilex crenata* | Sapindaceae, Taxaceae, Arecaceae, Theaceae, Aquifoliaceae | Bonsais | Japan | 2 | 2006/132, 2008/107 |
| *Helicotylenchus* | *Ficus, Ligustrum, Serissa, Zelkova, Carmona retusa, Ilex, Taxus* | Moraceae, Oleaceae, Rubiaceae, Ulmaceae Boraginaceae, Aquifoliaceae, Taxaceae | Bonsais, Plants for planting | China | 6 | 2008/187, 2010/109, 2010/190 |
| **Family Theaceae** | | | | | | |
| *Criconemoides, Trichodorus, Longidoridae* | *Camellia sasanqua* | Theaceae | Bonsais | Japan | 1 | 2007/098 |
| *Meloidogyne* | *Stewartia* | Theaceae | Bonsais | Japan | 1 | 2008/167 |

| Pest | Plant | Family | Commodity | Origin | nb | Reporting Service reference |
|---|---|---|---|---|---|---|
| *Pratylenchus* | *Camellia sasanqua* | Theaceae | Plants for planting | Japan | 1 | 2010/121 |
| *Pratylenchus, Criconemoides* | *Camellia sasanqua* | Theaceae | Bonsais | Japan | 1 | 2007/098 |
| *Xiphinema* | *Camellia* | Theaceae | Bonsais | Japan | 1 | 2007/138 |
| *Meloidogyne, Pratylenchus* | *Acer palmatum, Taxus cuspidata, Trachycarpus excels, Camellia, Ilex crenata* | Sapindaceae, Taxaceae, Arecaceae, Theaceae, Aquifoliaceae, | Bonsais | Japan | 2 | 2006/132, 2008/107 |
| *Helicotylenchus, Meloido-gyne, Pratylenchus, Tylenchorhynchus* | *Punica granatum, Stewartia monadelpha* | Lythraceae, Theaceae | Bonsais | Japan | 1 | 2008/167 |
| **Family Ulmaceae** | | | | | | |
| *Helicotylenchus dihystera* | *Ulmus* | Ulmaceae | Bonsais | Netherlands | 1 | 2010/088 |
| *Xiphimena incognitum* | *Ulmus* | Ulmaceae | Bonsais | China | 1 | 2008/107 |
| *Xiphinema americanum* | *Ulmus* | Ulmaceae | Bonsais | China | 1 | 2006/132 |
| *Xiphinema diffusum* | *Ulmus* | Ulmaceae | Bonsais | China | 1 | 2008/107 |
| *Helicotylenchus, Tylenchorhynchus, Criconematidae* | *Bougainvillea, Buxus, Cudrania, Ulmus* | Nyctaginaceae, Buxaceae, Moraceae, Ulmaceae | Bonsais | Indonesia | 1 | 2006/132 |
| *Ditylenchus, Helicotylenchus dihystera, Helicotylenchus, Meloidogyne* | *Zelkova* | Ulmaceae | Bonsais | China | 1 | 2009/183 |
| *Helicotylenchus dihystera, Trichodorus, Tylenchorhynchus* | *Zelkova* | Ulmaceae | Bonsais | China | 1 | 2010/109 |
| *Helicotylenchus, Tylenchorhynchus annulatus* | *Zelkova* | Ulmaceae | Bonsais | China | 1 | 2009/183 |
| *Tylenchorhynchus annulatus* | *Zelkova* | Ulmaceae | Bonsais | China | 1 | 2009/144 |
| *Helicotylenchus* | *Ficus, Ligustrum, Serissa, Zelkova, Carmona retusa, Ilex, Taxus* | Moraceae, Oleaceae, Rubiaceae, Ulmaceae Boraginaceae, Aquifoliaceae, Taxaceae | Bonsais, Plants for planting | China | 6 | 2008/187, 2010/109, 2010/190 |
| *Helicotylenchus, Trichodorus* | *Ficus, Podocarpus, Sageretia thea, Serrisa, Zanthoxylum, Zelkova* | Moraceae, Podocarpaceae, Rhamnaceae, Rubiaceae, Rutaceae, Ulmaceae | Bonsais | China | 1 | 2010/121 |

## ATTACHMENT 7. OTHER INTERCEPTION DATA

The following tables present some information on interceptions extracted from the EPPO Reporting Services 2006-2010.

Table 1 – Interceptions of *Anoplophora chinensis*

| Pest | Plant | Family | Type of commodity | Origin | No. | Reference in RS |
|---|---|---|---|---|---|---|
| *Anoplophora* | *Acer* | Sapindaceae | Bonsais | China | 2 | 2008/187, 2009/183 |
| *Anoplophora* | *Acer* | Sapindaceae | Plants for planting | China | 3 | 2008/107, 2009/144, /183 |
| *Anoplophora chinensis* | *Acer* | Sapindaceae | Bonsais | Japan | 1 | 2008/107 |
| *Anoplophora chinensis* | *Acer* | Sapindaceae | Plants for planting | China | 5 | 2008/107, 2008/187, 2010/121 |
| *Anoplophora chinensis* | *Acer buergerianum* | Sapindaceae | Bonsais | China | 1 | 2006/238 |
| *Anoplophora chinensis* | *Acer buergerianum, Acer* | Sapindaceae | Plants for planting | China | 1 | 2008/107 |
| *Anoplophora* | *Acer palmatum* | Sapindaceae | Cuttings | China | 1 | 2006/132 |
| *Anoplophora* | *Acer palmatum* | Sapindaceae | Plants for planting | China | 4 | 2008/107, 2009/144, /183 |
| *Anoplophora chinensis* | *Acer palmatum* | Sapindaceae | Bonsais | (Netherlands) | 1 | 2006/238 |
| *Anoplophora chinensis* | *Acer palmatum* | Sapindaceae | Bonsais | China | 2 | 2008/107 |
| *Anoplophora chinensis* | *Acer palmatum* | Sapindaceae | Plants for planting | China | 10 | 2007/160, 2008/107, 2009/121, 2010/109, 2010/121 |
| *Anoplophora chinensis* | *Acer palmatum* | Sapindaceae | Plants for planting | Japan | 1 | 2008/229 |
| *Anoplophora chinensis* | *Acer palmatum* (and many other ornamentals*) | Sapindaceae | Plants for planting | Japan | 1 | 2009/056 |
| *Anoplophora chinensis* | *Cercis* | Fabaceae | Plants for planting | China | 1 | 2010/109 |
| *Anoplophora* | *Ilex* | Aquifoliaceae | Bonsais | China | 1 | 2009/183 |
| *Anoplophora* | *Taxus cuspidata* | Taxaceae | Plants for planting | Japan | 1 | 2010/190 |

* *Acer, Cornus, Euonymus, Fagus crenata, Hamamelis, Ilex, Malus, Magnolia, Pinus, Prunus, Quercus, Rhododendron, Sorbus, Styrax, Stewartia, Taxus cuspidata, Thuja occidentalis, Viburnum dilatatum.*

Table 2 – Interceptions on Orchidaceae

| Pest | Plant | Family | Type of commodity | Origin | No. | Reference in RS |
|---|---|---|---|---|---|---|
| *Impatiens necrotic spot virus* | *Phalaenopsis* | Orchidaceae | Plants for planting | Netherlands | 1 | 2008/167 |
| *Paratylenchus* | *Oncidium* | Orchidaceae | Plants for planting | Guatemala | 1 | 2007/138 |
| *Thrips* | *Dendrobium* | Orchidaceae | Plants for planting | Thailand | 1 | 2010/121 |
| *Thrips palmi* | *Dendrobium* | Orchidaceae | Plants for planting | Thailand | 1 | 2008/037 |
| *Dichromothrips corbetti* | *Dendrobium* | Orchidaceae | Tissue cultures | Thailand | 1 | 2007/098 |
| *Erwinia chrysanthemi* | *Phalaenopsis* | Orchidaceae | Tissue cultures | Thailand | 1 | 2008/063 |
| *Diaspis boisduvalii, Helicotylenchus dihystera, Scutellonema brachyurus* | *Paphiopedilum hybrids* | Orchidaceae | Plants for planting | Thailand | 1 | 2007/015 |

Table 3 – Interceptions on Cupressaceae

| Pest | Plant | Family | Type of commodity | Origin | No. | Reference in RS |
|---|---|---|---|---|---|---|
| *Pratylenchus* | *Cryptomeria japonica* | Cupressaceae | Bonsais | Japan | 1 | 06/088 |
| *Criconematidae, Pratylenchus* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 06/088 |
| *Seiridium cardinale* | *Cupressocyparis leylandii* | Cupressaceae | Plants for planting | Italy | 1 | 2010/121 |
| *Xiphinema americanum* | *Cryptomeria japonica* | Cupressaceae | Bonsais | Japan | 1 | 2008/063 |
| *Gymnosporangium asiaticum* | *Junipenus chinensis, J. rigida, unspecified plant* | Cupressaceae | Bonsais | Japan | 1 | 2009/183 |
| *Gymnosporangium asiaticum* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 8 | 2009/183, 144, 056 |
| *Gymnosporangium asiaticum* | *Juniperus chinensis, J. rigida* | Cupressaceae | Bonsais | Japan | 1 | 2009/144 |
| *Gymnosporangium asiaticum* | *Juniperus chinensis* | Cupressaceae | Plants for planting | Japan | 1 | 2008/187 |
| *Oligonychus perditus* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 2 | 06/088, 2007/160 |
| *Oligonychus perditus* | *Juniperus chinensis, J. rigida* | Cupressaceae | Bonsais | Japan | 1 | 2006/238 |
| *Pratylenchus* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 4 | 2007/098, 2008/167, 2008/107 |
| *Pratylenchus, Helicotylenchus* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 2007/098 |
| *Pratylenchus, Tylenchorhynchus, Heterodera, Criconemoides* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 2007/138 |
| *Xiphinema americanum,* | *Juniperus chinensis* | Cupressaceae | Bonsais | Japan | 1 | 2006/132 |
| *Xiphinema americanum, Trichodoridae* | *Chamaecyparis obtusa* | Cupressaceae | Bonsais | Japan | 1 | 2008/167 |
| *Xiphinema americanum, Trichodoridae, Criconematidae* | *Chamaecyparis obtusa* | Cupressaceae | Plants for planting | Japan | 1 | 2008/167 |

## ATTACHMENT 8. *HORIDIPLOSIS FICIFOLII* (INSECTA: DIPTERA: CECIDOMYIIDAE)

**Hosts**. *Ficus* spp., but the precise host range is unclear. It was described on *Ficus benjamina* (Harris & de Goffau, 2003). In Florida, where *F. benjamina* is abundant, it has been found only on *F. microcarpa* (Steck & Krueger, 2008). In interceptions in the Netherlands, it was found on *F. microcarpa, F. retusa, F. nitida* and *F. panda* (van der Gaag *et al.*, 2006).

**History of the organism as a pest**. *H. ficifolii* was described for the first time in 2003 (Harris & de Goffau, 2003). Its pest status is not is not mentioned in the literature, although it is reported from a few countries in restricted conditions (Florida, USA in nursery and landscape trees; Sicily, Italy in a nursery; the Czech Republic, one bonsai at an end-user). It is assumed that it is a minor pest. From experience of interceptions on *Ficus* pot plants in the Netherlands, control is available (van der Gaag *et al.*, 2006). No publications were found on its biology or economic importance. Young leaves may become discoloured and disfigured and heavily infested leaves may drop from the plant.

**Means of spread.** Movement of infested plants and cuttings. Natural spread through wind and over larger distances by pollinators. Can also spread within a crop through tools, clothes, pruning waste etc.

### Spread and outbreaks of *H. diplosis*

**Current known distribution.** The date indicates the year of first record, when this is known.

| | |
|---|---|
| **EPPO region** | Italy (2007, Sicily), Czech Republic (2009 – one bonsai); intercepted in Denmark, UK, Netherlands |
| **South America** | China |
| **North America** | USA (2008, Florida) |

**Origin.** The origin of the pest is not known. It was first described from ficus plants imported from China. Van der Gaag *et al.* (2006) note that about 40% of shipments from China in the period December 2005 – February 2006 presented symptoms.

**Introductions and spread in the EPPO region.** *H. ficifolii* was intercepted at several occasions in the EPPO region on *Ficus* (the Netherlands, the UK, Denmark). In the Netherlands, the plants were kept in a glasshouse for several months before being sold, and this allowed application of control measures against the pest (van der Gaag *et al.*, 2006). In the Czech Republic, it was reported on one bonsai by a bonsai end-user; it is not expected to survive outdoors due to climatic conditions (Beránek & Šafránková, 2009). *H. ficifolii* is also reported in a nursery in Sicily, Italy (Sumo, 2007; Suhkrava *et al.*, 2007).

**Introductions and spread in the USA**. The pest was found in Florida in 2008 (Steck & Krueger, 2008) on *F. microcarpa* as bonsai plants in at least one nursery and on large trees in the landscape. There were no indications of economic importance at this time. No further data was found on this pest in the USA.

### Biological characteristics known to be of relevance for the outbreaks

- Unknown/unexpected pest.
- Spreads with trade of ficus plants.

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## ATTACHMENT 9. EXTRACTS FROM TRADE DATA

The tables below were compiled from trade data provided by the Netherlands, Germany, Italy and France. See section 5.13 for details on the type of data provided (and the data excluded from the analysis) [6].

Table 1. Units and origin of *Ilex* plants (labeled as plants for planting or bonsais) (see 5.13 for details on data provided).

| | 2006 (NL only) | | 2007 (NL only) | | 2008 (NL only) | | 2009 (NL, DE, IT) | | 2010 (NL, DE, IT) | |
|---|---|---|---|---|---|---|---|---|---|---|
| China | 1980 | NL | 5600 | NL | 2920 | NL | 7767 | NL | 4710 | NL |
| | | | | | | | 3050 | IT | 6320 | IT |
| | | | | | | | 1750 | DE | 8517 | DE |
| Japan | | | | | | | 287 | NL | 61 | NL |
| | | | | | | | 2517 | IT | 1286 | IT |
| | | | | | | | 336 | DE | 601 | DE |
| Egypt | | | | | | | | | 96 | IT |
| Israel | | | | | | | | | 1508 | NL |
| (Netherlands) (re-export) | | | | | | | | | 2000 | NL |
| South Africa | | | | | | | | | 5 | NL |
| *Total* | | | | | | | *15707* | | *25104* | |

Totals for 2006-2008 are not presented in the absence of data for Italy and Germany, significant importers in 2009-2010.

Table 2. Units and origins of *Acer* spp. (see 5.13 for details on data provided)

| | 2006 (NL only) | | 2007 (NL only) | | 2008 (NL only) | | 2009 (NL, DE) | | 2010 (NL, DE, IT*) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Canada | | | | | 500 | NL | | | | |
| China | 195376 | NL | 155855 | NL | 317838 | NL | 106500 | NL | 125000 | NL |
| | | | | | | | 6400 | DE | 2042 | DE |
| Egypt | | | | | | | | | 44000 | NL |
| Israel | | | 1216 | NL | 303 | NL | 100 | NL | 98 | NL |
| | | | | | | | 250 | DE | 252 | DE |
| Japan | 7000 | NL | 42150 | NL | 15000 | NL | | | | |
| (Netherlands) (re-export) | | | 575 | NL | 1150 | NL | | | | |
| New Zealand | 8953 | NL | 3832 | NL | 8355 | NL | 10826 | NL | 26382 | NL |
| | | | | | | | 11182 | DE | 57185 | DE |
| | | | | | | | | | 1250 | IT |
| Korea Rep. | 80000 | NL | | | | | | | | |
| USA | 770 | NL | 2000 | NL | 700 | NL | 486 | NL | 3963 | NL |
| | | | | | | | 8933 | DE | 3527 | DE |
| | | | | | | | | | 2165 | IT |
| *Total* | *292099 (NL)* | | *205628 (NL)* | | *343346 (NL)* | | *144677* | | *265864* | |

* Mixed consignments containing *Acer* are not counted here, i.e. the quantities imported were higher.

Table 3. Units and origins of *Ficus* imported to the Netherlands (see 5.13 for details on data provided)

| | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Chile | | | | | 5400 |
| China | 379853 | 972424 | 1691777 | 2329173 | 2800007 |
| Costa Rica | 195318 | 169511 | 145311 | 139189 | 228312 |
| Dominican Rep. | 7103 | 2650 | | 1 | |
| Egypt | 32 | | 21378 | | |
| El Salvador | | 1703 | | | |
| Guatemala | 1 | 10348 | 39210 | | 48 |
| India | | | | | 500 |
| Indonesia | | | 111 | 245 | 286 |
| Israel | 14290 | 76 | 1690 | | |
| Kenya | | | | | 60560 |
| Korea Rep. | 20 | | | | |
| Malaysia | | 33 | 197 | 69 | |
| Mexico | | | | | 48 |
| Singapore | | 1 | | | |
| Sri Lanka | 641154 | 481422 | 429396 | 233172 | 208124 |
| Taiwan | 830 | 1818 | 3000 | 2150 | 800 |
| Tanzania | 401270 | 355010 | 387558 | 207276 | 350557 |
| Thailand | 1249 | | 1432 | 760 | |
| Uganda | | 44400 | 2158697 | 1447787 | 194791 |
| USA | | 12 | 40 | 8660 | 75 |
| ***Total*** | ***1641120*** | ***2039408*** | ***4879797*** | ***4368482*** | ***3849508*** |

[6] In 2011, the data on families (Tables 5 and 6) was reviewed to eliminate synonyms and Table 7 was added. The families are as indicated according to the taxonomic information in EPPT (www.eppt.org).

Table 4. Units and origin of *Chrysanthemum* plants for planting (see 5.13 for details on data provided)

| | 2006 (NL only) | | 2007 (NL only) | | 2008 (NL only) | | 2009 (NL, DE, IT**) | | 2010 (NL, DE, IT**, FR*) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bolivia | | | | | 54328220 | NL | 997390 | NL | | |
| Brazil | 189135958 | NL | 168460408 | NL | 53066920 | NL | 17817447 | NL | 28785876 | NL |
| | | | | | | | 487604 | IT | 149280 | IT |
| Chile | 1825 | NL | | | 1802 | NL | | | | |
| China | | | | | | | | | 50 | NL |
| Colombia | 7965 | NL | 401 | NL | | | 5894 | NL | 9287 | NL |
| Costa Rica | 40200 | NL | 29150 | NL | | | 2700 | DE | | |
| Ecuador | | | | | 185000 | NL | 200 | NL | 40300 | NL |
| Ethiopia | 81584074 | NL | 142208500 | NL | 156891565 | NL | 225252542 | NL | 189526007 | NL |
| | | | | | | | | | 2740853 | DE |
| Ghana | | | 23120 | NL | | | | | | |
| Guatemala | 4 | NL | | | | | | | | |
| India | | | | | | | | | 50 | NL |
| Indonesia | 4069600 | NL | 759600 | NL | 167350 | NL | 1904900 | NL | 2063400 | NL |
| Israel | | | | | | | 2785 | IT | 1100 | IT |
| | 20244 | NL | 2107 | NL | | | 1000 | NL | 300 | NL |
| Japan | | | 3352 | NL | 3754 | NL | 50 | NL | 1877 | NL |
| Kenya | 257002372 | NL | 273159628 | NL | 237503469 | NL | 226936348 | NL | 249979909 | NL |
| | | | | | | | 11302300 | DE | 9206350 | DE |
| | | | | | | | 3557150 | IT | 2056000 | IT |
| South Africa | 18621734 | NL | 13709361 | NL | 43793825 | NL | 4484211 | NL | 688000 | DE |
| | | | | | | | | | 1083975 | NL |
| South Korea | | | | | | | 521 | NL | | |
| Spain | 1215778 | NL | 110280 | | | | | | | |
| Sri Lanka | | | | | | | | | 11246700 | DE |
| Tanzania | 408807721 | NL | 529812518 | NL | 558128926 | NL | 602926434 | NL | 593786964 | NL |
| Uganda | 743579115 | NL | 587156233 | NL | 438747555 | NL | 447863455 | NL | 504059552 | NL |
| USA | 100 | NL | 135525 | NL | 100 | NL | 16075 | NL | 127926 | NL |
| | | | | | | | 32974 | DE | 29268 | DE |
| Zimbabwe | | | | | | | 1002360 | NL | | |
| ***Total*** | ***1 704 086 690 (NL)*** | | ***1 715 570 183 (NL)*** | | ***1 542 818 486 (NL)*** | | ***1 544 594 340*** | | ***1 595 583 024*** | |

* propagating material only; ** mixed consignments containing fuchsia are not counted here, i.e. the quantities imported were higher.

Table 5. Plant genera with over 2 million units imported in 2010

| Genus | Family | Units in 2010* |
|---|---|---|
| 1. Chrysanthemum | Asteraceae | 1 595 583 024 |
| 2. Dendranthema | Asteraceae | 494 027 572 |
| 3. Pelargonium | Geraniaceae | 491 313 712 |
| 4. Kalanchoe | Crassulaceae | 160 129 960 |
| 5. Euphorbia (incl Poinsettia) | Euphorbiaceae | 118 147 869 |
| 6. Hedera | Araliaceae | 92 855 074 |
| 7. Dianthus | Caryophyllaceae | 64 962 749 |
| 8. Impatiens | Balsaminaceae | 57 577 388 |
| 9. Osteospermum | Asteraceae | 56 669 852 |
| 10. Petunia | Solanaceae | 56 567 234 |
| 11. Fuchsia | Onagraceae | 55 057 340 |
| 12. Begonia | Begoniaceae | 52 956 529 |
| 13. Phalaenopsis | Orchidaceae | 46 950 064 |
| 14. Allium | Amaryllidaceae | 44 153 714 |
| 15. Saintpaulia | Gesneriaceae | 36 025 647 |
| 16. Verbena | Verbenaceae | 35 575 819 |
| 17. Dracaena | Asparagaceae | 32 413 216 |
| 18. Calibrachoa | Solanaceae | 27 907 849 |
| 19. Dahlia | Asteraceae | 27 592 609 |
| 20. Lavandula | Lamiaceae | 27 399 701 |
| 21. Aster | Asteraceae | 25 591 487 |
| 22. Argyranthemum | Asteraceae | 22 382 623 |
| 23. Ranunculus | Ranunculaceae | 20 358 201 |
| 24. Sutera | Scrophulariaceae | 19 599 175 |
| 25. Sanvitalia | Asteraceae | 16 123 800 |
| 26. Lobelia | Campanulaceae | 14 162 206 |
| 27. Schlumbergera | Cactaceae | 13 730 472 |
| 28. Freesia | Iridaceae | 13 188 619 |
| 29. Aubrieta | Brassicaceae | 12 653 854 |
| 30. Bidens | Asteraceae | 11 230 163 |
| 31. Hydrangea | Hydrangeaceae | 10 915 058 |
| 32. Phlox | Polemoniaceae | 10 535 177 |
| 33. Lilium | Liliaceae | 9 938 190 |
| 34. Calocephalus | Asteraceae | 9 365 966 |
| 35. Gerbera | Asteraceae | 9 306 323 |
| 36. Scaevola | Goodeniaceae | 9 303 033 |
| 37. Spathiphyllum | Araceae | 9 066 512 |

| Genus | Family | Units in 2010* |
|---|---|---|
| 38. Campanula | Campanulaceae | 9 055 399 |
| 39. Echinodorus | Cactaceae | 8 551 045 |
| 40. Salvia | Lamiaceae | 8 174 851 |
| 41. Hibiscus | Malvaceae | 8 164 123 |
| 42. Vinca | Apocynaceae | 8 124 093 |
| 43. Guzmania | Bromeliaceae | 7 916 569 |
| 44. Celosia | Amaranthaceae | 7 568 116 |
| 45. Brachyscome | Asteraceae | 7 545 848 |
| 46. Peperomia | Piperaceae | 7 394 043 |
| 47. Saxifraga | Saxifragaceae | 7 071 805 |
| 48. Bacopa | Scrophulariaceae | 6 946 351 |
| 49. Cynodon | Poaceae | 6 572 200 |
| 50. Cabomba | Cabombaceae | 6 533 344 |
| 51. Diascia | Scrophulariaceae | 6 488 731 |
| 52. Zantedeschia | Araceae | 6 477 406 |
| 53. Chlorophytum | Asparagaceae | 6 475 593 |
| 54. Nemesia | Scrophulariaceae | 6 467 946 |
| 55. Euonymus | Celastraceae | 6 022 042 |
| 56. Tillandsia | Bromeliaceae | 5 641 883 |
| 57. Helichrysum | Asteraceae | 5 598 534 |
| 58. Mandevilla + Dipladenia | Apocynaceae | 5 347 531 |
| 59. Rosa | Rosaceae | 5 282 859 |
| 60. Codiaeum | Euphorbiaceae | 5 275 910 |
| 61. Ajania | Asteraceae | 5 139 856 |
| 62. Yucca | Asparagaceae | 4 870 809 |
| 63. Thymus | Lamiaceae | 4 713 503 |
| 64. Asteriscus | Asteraceae | 4 441 320 |
| 65. Ornithogalum | Asparagaceae | 4 435 980 |
| 66. Ficus | Moraceae | 4 372 278 |
| 67. Vriesea | Bromeliaceae | 4 048 366 |
| 68. Sedum | Crassulaceae | 3 999 060 |
| 69. Pennisetum | Poaceae | 3 931 496 |
| 70. Crassula | Crassulaceae | 3 922 840 |
| 71. Lantana | Verbenaceae | 3 739 660 |
| 72. Portulaca | Portulacaceae | 3 729 209 |
| 73. Cuphea | Lythraceae | 3 671 457 |
| 74. Dendrobium | Orchidaceae | 3 611 476 |

| Genus | Family | Units in 2010* |
|---|---|---|
| 75. Heliotropium | Boraginaceae | 3 437 219 |
| 76. Lithodora | Boraginaceae | 2 906 667 |
| 77. Heuchera | Saxifragaceae | 2 772 527 |
| 78. Rosmarinus | Lamiaceae | 2 753 909 |
| 79. Rhipsalis | Cactaceae | 2 750 538 |
| 80. Geranium | Geraniaceae | 2 745 980 |
| 81. Gaura | Onagraceae | 2 719 500 |
| 82. Cordyline | Asparagaceae | 2 685 176 |
| 83. Mentha | Lamiaceae | 2 670 187 |
| 84. Echeveria | Crassulaceae | 2 660 799 |
| 85. Epipremnum | Araceae | 2 637 352 |
| 86. Limonium | Plumbaginaceae | 2 630 682 |
| 87. Sansevieria | Asparagaceae | 2 587 931 |
| 88. Glechoma | Lamiaceae | 2 573 318 |
| 89. Ajuga | Lamiaceae | 2 521 572 |
| 90. Dieffenbachia | Araceae | 2 396 981 |
| 91. Ageratum | Asteraceae | 2 390 971 |

| Genus | Family | Units in 2010* |
|---|---|---|
| 92. Alocasia | Araceae | 2 367 004 |
| 93. Coreopsis | Asteraceae | 2 314 545 |
| 94. Bracteantha | Asteraceae | 2 313 997 |
| 95. Pilea | Urticaceae | 2 309 501 |
| 96. Galanthus | Amaryllidaceae | 2 290 230 |
| 97. Lysimachia | Primulaceae | 2 284 549 |
| 98. Plectranthus | Lamiaceae | 2 276 980 |
| 99. Musa | Musaceae | 2 276 043 |
| 100. Egeria | Hydrocharitaceae | 2 248 775 |
| 101. Aloe | Xanthorroeaceae | 2 223 244 |
| 102. Fragaria | Rosaceae | 2 204 929 |
| 103. Pachira | Malvaceae | 2 163 966 |
| 104. Erysimum | Brassicaceae | 2 089 283 |
| 105. Philodendron | Araceae | 2 024 564 |

* NL, DE, IT (some regions, not accounting for mixed consignments), FR (propagation material only). See details in 5.13.

Table 6. Plant families with over 50 million units imported in 2010, and percentage of total imports of plants for planting (over 4 241 049 766 units)

| Family | Units | % of total |
|---|---|---|
| Asteraceae | 2 314 613 783 | 54.58 |
| Geraniaceae | 495 945 654 | 11.69 |
| Crassulaceae | 170 963 569 | 4.03 |
| Euphorbiaceae | 124 419 188 | 2.93 |
| Araliaceae | 96 111 516 | 2.27 |
| Solanaceae? | 85 139 944 | 2.01 |
| Caryophyllaceae | 66 726 521 | 1.57 |
| Lamiaceae | 58 990 042 | 1.39 |
| Onagraceae | 58 048 940 | 1.37 |
| Balsaminaceae | 57 675 288 | 1.36 |
| Asparagaceae | 56 798 105 | 1.34 |
| Orchidae | 56 118 695 | 1.32 |
| Begoniaceae | 52 956 529 | 1.25 |
| Amaryllidaceae | 52 092 515 | 1.23 |
|  | **Total** | **88.34** |

Table 7. Plant families imported in 2010

| Family |
|---|
| 1. Acanthaceae |
| 2. Achariaceae |
| 3. Acoraceae |
| 4. Actinidiaceae |
| 5. Adoxaceae |
| 6. Aizoaeceae |
| 7. Alismataceae |
| 8. Alstroemeriaceae |
| 9. Altingiaceae |
| 10. Amaranthaceae |
| 11. Amaryllidaceae |
| 12. Anacardiaceae |
| 13. Annonaceae |
| 14. Anthocerotaceae |
| 15. Apiaceae |
| 16. Apocynaceae |
| 17. Aponogetonaceae |
| 18. Aquifoliaceae |
| 19. Araceae |
| 20. Araliaceae |
| 21. Araucariaceae |
| 22. Arecaceae |
| 23. Argophyllaceae |
| 24. Aristolochiaceae |
| 25. Asparagaceae |
| 26. Aspleniaceae |
| 27. Asteliaceae |
| 28. Asteraceae |
| 29. Atherospermataceae |
| 30. Auriculariaceae |
| 31. Balsaminaceae |
| 32. Basellaceae |
| 33. Begoniaceae |
| 34. Berberidaceae |
| 35. Betulaceae |

| Family |
|---|
| 36. Bignoniaceae |
| 37. Bixaceae |
| 38. Blechnaceae |
| 39. Boraginaceae |
| 40. Brassicaceae |
| 41. Bromeliaceae |
| 42. Bruniaceae |
| 43. Butomaceae |
| 44. Buxaceae |
| 45. Cabombaceae |
| 46. Cactaceae |
| 47. Calophyllaceae |
| 48. Calycanthaceae |
| 49. Campanulaceae |
| 50. Cannaceae |
| 51. Capparaceae |
| 52. Caprifoliaceae |
| 53. Caricaceae |
| 54. Caryophyllaceae |
| 55. Casuarinaceae |
| 56. Celastraceae |
| 57. Ceratophyllaceae |
| 58. Cercidiphyllaceae |
| 59. Chloranthaceae |
| 60. Cistaceae |
| 61. Cleomaceae |
| 62. Clethraceae |
| 63. Clusiaceae |
| 64. Colchicaceae |
| 65. Combretaceae |
| 66. Commelinaceae |
| 67. Convolvulaceae |
| 68. Cornaceae |
| 69. Corylaceae |
| 70. Costaceae |

| Family |
|---|
| 71. Crassulaceae |
| 72. Cratoneuronaceae |
| 73. Cucurbitaceae |
| 74. Cunoniaceae |
| 75. Cupressaceae |
| 76. Cyatheaceae |
| 77. Cycadaceae |
| 78. Cyclanthaceae |
| 79. Cyperaceae |
| 80. Davalliaceae |
| 81. Dicksoniaceae |
| 82. Dioscoreaceae |
| 83. Dipterocarpaceae |
| 84. Droseraceae |
| 85. Dryopteridaceae |
| 86. Ebenaceae |
| 87. Elaeagnaceae |
| 88. Elaeocarpaceae |
| 89. Equisetaceae |
| 90. Ericaceae |
| 91. Escalloniaceae |
| 92. Euphorbiaceae |
| 93. Fabaceae |
| 94. Fagaceae |
| 95. Fontinalaceae |
| 96. Fouquieriaceae |
| 97. Garryaceaea |
| 98. Gentianaceae |
| 99. Geraniaceae |
| 100. Gesneriaceae |
| 101. Ginkgoaceae |
| 102. Goodeniaceae |
| 103. Grammitidaceae |
| 104. Griseliniaceae |
| 105. Grossulariaceae |

| Family |
|---|
| 106. Haemodoraceae |
| 107. Haloragaceae |
| 108. Hamamelidaceae |
| 109. Heliconiaceae |
| 110. Hydrangeaceae |
| 111. Hydrocharitaceae |
| 112. Hypericaceae |
| 113. Hypoxidaceae |
| 114. Iridaceae |
| 115. Juglandaceae |
| 116. Juncaceae |
| 117. Lamiaceae |
| 118. Lardizabalaceae |
| 119. Lauraceae |
| 120. Lecythidaceae |
| 121. Lentibulariaceae |
| 122. Liliaceae |
| 123. Linaceae |
| 124. Lomariopsidaceae |
| 125. Lycopodiaceae |
| 126. Lythraceae |
| 127. Magnoliaceae |
| 128. Malpighiaceae |
| 129. Malvaceae |
| 130. Marantaceae |
| 131. Mayacaceae |
| 132. Melanthiaceae |
| 133. Melastomataceae |
| 134. Meliaceae |
| 135. Menyanthaceae |
| 136. Montiaceae |
| 137. Moraceae |
| 138. Moringaceae |
| 139. Musaceae |
| 140. Myrtaceae |

| Family |
|---|
| 141. Nelumbonaceae |
| 142. Nepenthaceae |
| 143. Nothofagaceae |
| 144. Nyctaginaceae |
| 145. Nymphaeaceae |
| 146. Oleaceae |
| 147. Onagraceae |
| 148. Ophioglossaceae |
| 149. Orchidaceae |
| 150. Orobanchaceae |
| 151. Oxalidaceae |
| 152. Paeoniaceae |
| 153. Pandanaceae |
| 154. Papaveraceae |
| 155. Passifloraceae |
| 156. Paulowniaceae |
| 157. Phrymaceae |
| 158. Phyllanthaceae |
| 159. Pinaceae |

| Family |
|---|
| 160. Piperaceae |
| 161. Pittosporaceae |
| 162. Plagiotheciaceae |
| 163. Plantaginaceae |
| 164. Plumbaginaceae |
| 165. Poaceae |
| 166. Podocarpaceae |
| 167. Polemoniaceae |
| 168. Polygalaceae |
| 169. Polygonaceae |
| 170. Polypodiaceae |
| 171. Pontederiaceae |
| 172. Portulacaceae |
| 173. Primulaceae |
| 174. Proteaceae |
| 175. Pteridaceae |
| 176. Ranunculaceae |
| 177. Resedaceae |
| 178. Restionaceae |

| Family |
|---|
| 179. Rhamnaceae |
| 180. Rhizophoraceae |
| 181. Ricciaceae |
| 182. Rosaceae |
| 183. Rubiaceae |
| 184. Rutaceae |
| 185. Salicaceae |
| 186. Salviniaceae |
| 187. Sapindaceae |
| 188. Sapotaceae |
| 189. Sarraceniaceae |
| 190. Saururaceae |
| 191. Saxifragaceae |
| 192. Schisandraceae |
| 193. Scrophulariaceae |
| 194. Selaginellaceae |
| 195. Solanaceae |
| 196. Strelitziaceae |
| 197. Styracaceae |

| Family |
|---|
| 198. Talinaceae |
| 199. Tamaricaceae |
| 200. Taxaceae |
| 201. Taxodiaceae |
| 202. Theaceae |
| 203. Thymelaeaceae |
| 204. Tropaeolaceae |
| 205. Typhaceae |
| 206. Ulmaceae |
| 207. Urticaceae |
| 208. Verbenaceae |
| 209. Violaceae |
| 210. Vitaceae |
| 211. Woodsiaceae |
| 212. Xanthorrhoeaceae |
| 213. Zamiaceae |
| 214. Zingiberaceae |

## ATTACHMENT 10. CRITERIA CONSIDERED BUT DISCARDED

The criteria below were envisaged when identifying possible criteria that could be used to evaluate the risk linked to the import of given plants or groups of plants. However, it was felt that they could not be used for this purpose and they were discarded.

**Linked to the origin**

- **Experience with trade: confidence in trade.** Although North America is identified in the literature as one major source of introductions of pests over time, none of the examples above relate to North America. On the other hand, some trades from Asia, Africa and South America have recently led to cases of introduction, incursions or interceptions (e.g. *Diaphania perspectalis* and *Anoplophora chinensis* from China, *Rhynchophorus ferrugineus* from Africa, *Paysandisia archon* from South America). Trade within Europe also led to spread of recently introduced pests (e.g. *Diaphania perspectalis*, *Dryocosmus kuriphilus*). Considering together the experience with non-compliance and the experience with introductions might give an indication of risk.

Another component of experience in trade cannot be rated precisely in this study. It is the 'good' or 'bad' experience of trading with partners, including how the plant health system functions, how problems are resolved when they arise, and how instances of non-compliance are corrected. Within the same continent or within the EPPO region, many countries have longstanding and positive experiences of trading with each other. Similarly countries might have good experiences with certain countries on other continents. This can be taken into account by individual countries when evaluating risk, but cannot be considered as a criterion as part of the pre-screening process. Consequently, the only component of experience with trade that can be covered in a pre-screening process is the instances of non-compliance for the origin considered, which has been covered under C8.

- **Origin on the same continent as the country of destination**

At the level of the plant and of pests, if the country of origin is on the same continent, pests are more likely to have already spread within the continent, either by natural spread or through 'historical' trade, and to have reached areas where conditions (climatic, growing etc.) are suitable for their establishment. For this reason, the risk could be considered to be lower than if the origin is on another continent.

However, numerous introductions between European countries are documented and there might still be different pests in two countries on the same continent. This is especially the case if pests have been introduced in the country of origin (e.g. *Paysandisia archon*, which still has a limited distribution in the EPPO region) and are not yet present at the destination. If such introductions have already been documented, e.g. via appropriate reporting in the EU and in the EPPO region and would be covered under C7 (documented evidence of spreading latent pests or pests that are difficult to detect). However, the pest might not be detected immediately after introduction, and such information might be reported a long time after introduction actually happened. It also takes time to implement reliable control systems at origin to ensure that plants for planting are free from the pest. These factors would increase the risk posed by the plant from that origin. In many of the examples considered, a series of introductions of a pest occurred within a relatively short time after the initial introduction in the EPPO region (e.g. *Dryocosmus kuriphilus*, *Diaphania perspectalis*, *Rhynchophorus ferrugineus*). The country of destination might need to consider information on recent incursions, interceptions and introductions.

If origin on the same continent is considered as a criterion, it would therefore have two components:
- is the country of origin on the same continent as the country of destination?
- if so, are there recent introductions involving the plant in the country of origin?

Answering the second question seems to be beyond a simple pre-screening process, as there might be no information yet, or this would involve more research or direct contact with the origin. It has been considered that this cannot be covered under the pre-screening process, which applies whether the origin is on the same continent or not). The whole criterion has been discarded on the ground that origin on the same continent would present a lower risk, but recent introductions involving the plant at origin cannot be assessed properly in a pre-screening process

**Linked to availability of information**

- **Existence of a previous commodity PRA**

A previous commodity PRA might be a useful source of information to consider the risk linked to a pathway. However, existence of a previous commodity PRA is not considered as a criterion for classifying the pathway in a pre-screening process. If a pathway is identified for commodity PRA at pre-screening, one step of the commodity PRA will be to see if there is a previous commodity PRA. In any case, a commodity PRA will not necessarily be relevant to the risk for the country of destination, in relation to climatic conditions, practices in the importing country, importance of the host plant etc.

- **Accessibility of information allowing a proper risk assessment**

Risk assessment relies on information available on the plant, the range of pests at origin, the possible spread of these pests in other regions. Information may be lacking for several reasons:

- Lack of published or other information on the pest range of the plant at origin, for example because the plant is grown in the wild, or it is a new crop, or there are no research being conducted, or the information is not circulated.
- Language. Countries might have difficulties in understanding/accessing publications in some languages.
- Lack of knowledge on the international spread of pests due to the lack of reporting of incursions or introductions.

However, accessibility of information is not considered as a criterion for classifying the pathway in a pre-screening process. Firstly the lack of information will appear only when carrying out a commodity PRA, i.e. after having decided that the pathway should be subject to PRA. Secondly, even if information is not available from the origin (e.g. because of lack of data or language barriers), there might be information available from other countries where a major pest of the plant at origin has established, giving sufficient substantiated information on the risk of the plant from that origin (e.g. USA was a good source of information to assess, at least partially, the risk of import of plants for planting of fuchsia from Brazil).