

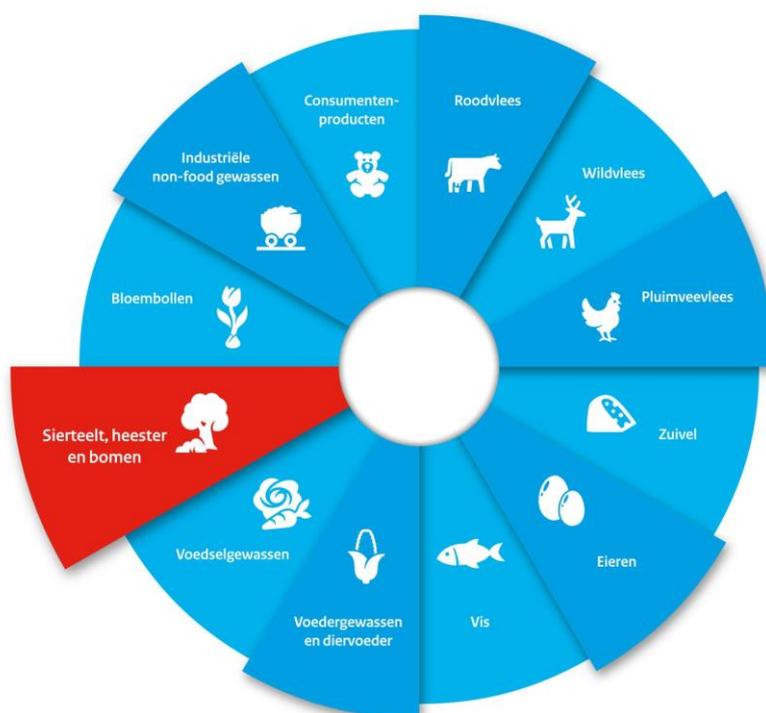


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**To the Inspector General of the Netherlands Food and
Consumer Product Safety Authority (NVWA)**

**From the Director of the Office for Risk Assessment &
Research**

**Advisory Report on the Risks of the Ornamental Horticulture
Production Chain**



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The Netherlands produces many ornamental horticultural products, and the country is an important player in the global trade in these products. Ornamental horticulture is extremely diverse and encompasses both plants grown in greenhouses, particularly pot plants and cut flowers, and plants grown outdoors, particularly trees, shrubs, perennials and cut flowers. In 2018, an estimated 9 billion euros worth of ornamental horticultural products were exported to third countries and EU Member States, and more than 2 billion euros worth were imported (WUR, 2019b). The ornamental horticulture sector supplies products that are valued by society, but it can also create risks for plants, nature, the environment, people and animals through the import, breeding, propagation, production and trade of ornamental horticultural products. The Office for Risk Assessment & Research (BuRO) has assessed these risks and compiled its key findings, conclusions and advice for the Inspector-General of the NVWA. The risk assessment of the ornamental horticulture production chain is part of a programme that develops systematic and periodic overviews and insights relating to the risks to people, animals, plants and nature that can occur in the production chains for food and consumer products.

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Introduction to the ornamental horticulture production chain

The ornamental horticulture production chain can be divided into four stages: breeding, propagation and production of propagation material (production of seeds, cuttings and other propagating material), production (production of plants, ornamental fruit, cut flowers and cut branches) and trade. The 'production stage' can be further divided into pretreatment, cultivation and post-harvest treatment including storage (Figure 1).

Ornamental horticulture encompasses a wide variety of plant species and production methods. For some plants, a major part of propagation and production takes place outside the Netherlands, after which the product or semi-finished product is imported. Ornamental horticultural products are imported from every continent except Antarctica. This means that many seeds, unrooted cuttings and cut flowers are imported, as well as larger plants, which are sold to the end user immediately after import or after a short growing period in the Netherlands. The import is characterised by a large volume and diversity. In 2017, plants¹ from over a thousand different genera and from 55 different countries were imported into the Netherlands or passed through the Netherlands on their way to other EU Member States (NVWA import database). Alongside the large, relatively constant import flows of species from specific countries, there are also smaller and highly variable imports of new species/origin combinations or species that are only imported occasionally (from certain countries). There is also a sizeable internal trade in ornamental horticultural products within the EU. For most species and genera, no public data on trade volumes can be found. The Directorate-General of Eurostat of the European Union provides import and export figures within the EU for a number of plant groups, but not at the species or genus level (with a few exceptions).

¹ In this document, 'plants' means 'plants for planting', other than seeds, where 'plants for planting' follows the definition given in Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC: "Plants intended to remain planted, to be planted or to be replanted"; this includes seeds, tissue culture plants, scions, unrooted cuttings, rooted cuttings, root cuttings, rhizomes, bulbs and tubers, plants with roots, plants with a root ball and plants in a pot; in this report, also referred to as 'plants and seeds', with cut flowers, branches, fruit and similar being considered 'plant products' rather than 'plants'.

There are harmful organisms in the Netherlands that threaten the cultivation, trade and export of ornamental horticultural products. In the EU, propagating material from ornamental plants that is placed on the market must be 'substantially free'² from harmful organisms (Council Directive 98/56/EC). The Netherlands has also introduced the 'Dutch Basic Standards for Ornamental horticulture', which state that ornamental horticultural products must be 'substantially free' from pests and diseases (NVWA, 2012). A number of organisms that are present in the Netherlands have EU quarantine status; a zero-tolerance policy applies for these organisms (products that are traded must be completely free from these organisms).

For many organisms, a zero-tolerance policy or a tolerance level applies for export to third countries as well, depending on the destination. Aside from the legal requirements, consumers also want a healthy product. For these reasons, growers take measures to prevent plants from becoming infested with harmful organisms. The use of plant protection products, biocides and biological pest control varies for different types of plants.

A detailed description of the ornamental horticulture production chain can be found in the Annex.

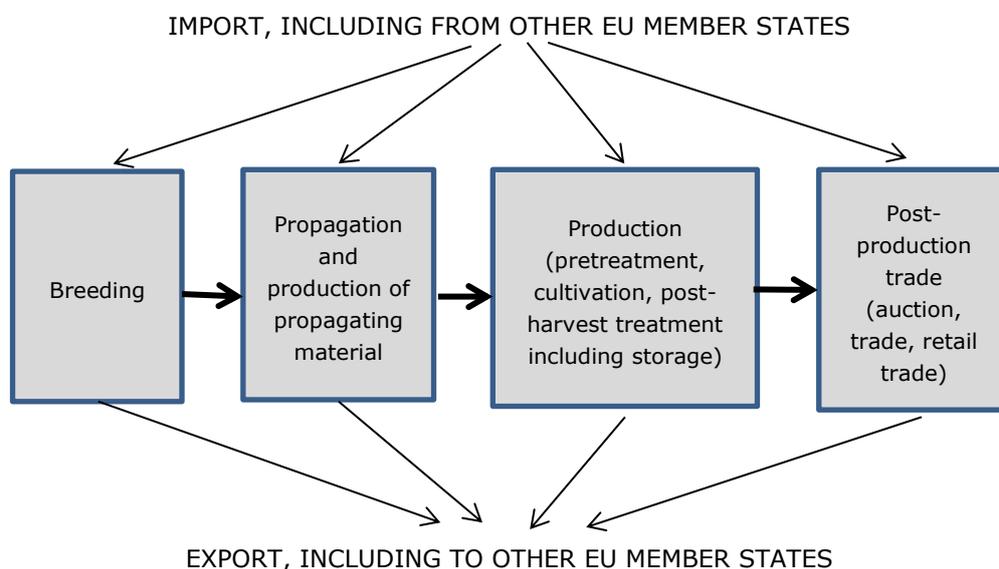


Figure 1. Diagram of the ornamental horticulture production chain

² "Substantially free from pests' means the extent of presence of pests, other than Union quarantine pests or protected zone quarantine pests, on the plants for planting or fruit plants, which is sufficiently low to ensure acceptable quality and usefulness of those plants" (Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019).

Investigation question and scope

The Office for Risk Assessment & Research (BuRO) formulated the following question for its investigation of the risks in the ornamental horticulture production chain:

What are the biggest risks in the ornamental horticulture production chain for plant health, nature and the environment, public health and animal health?

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The risk assessment of the ornamental horticulture production chain examines the risks arising from the import, breeding, propagation, production and trade of ornamental horticultural products in the Netherlands. BuRO has drafted a separate risk assessment for flower bulb cultivation³. Flower bulbs therefore do not form part of this ornamental horticulture production chain assessment. However, the cultivation of bulb flowers, in pots and as cut flowers, does fall within the scope of this risk assessment. Organisms harmful to plants⁴ and other invasive alien species⁵ may be introduced into the Netherlands through the ornamental horticulture production chain. The risks from these organisms have been assessed for ornamental horticulture, for nature⁶ and for plants in tropical greenhouses in the Netherlands (such as tropical greenhouses in zoos and botanical gardens). Risks associated with the import⁷ into the Netherlands of ornamental horticultural products produced abroad, including from other EU Member States, fall within the scope of this assessment. However, risks arising during phases in the ornamental horticulture production chain that take place outside of the Netherlands fall outside the scope. Consumer behaviour also falls outside the scope of this assessment, with the exception of the eating of plants and parts of plants.

Plant health

In terms of plant health, BuRO assessed the risks from organisms that are harmful to commercial ornamental horticulture, to plants in nature and to plants in tropical greenhouses (such as in zoos and arboretums). Harmful organisms are organisms (viroids, viruses, bacteria, fungi, pseudofungi, insects, mites, nematodes, gastropods and plants) that can infect or infest plants leading to a reduction in the quantity and/or quality of plants or harvested products. In the risk assessment, BuRO primarily looked at risks from organisms with quarantine status in the European Union (EU Q-pests) or that might be eligible for such a status under Regulation (EU) 2016/2031 (the Plant Health Regulation)⁸ (Table 1). An EU Q-pest is defined in the Plant Health Regulation as an organism with an established identity that is not present in the EU or, if present, is not widely

³ BuRO advisory report on risks from the flower bulb supply chain; see <https://www.nvwa.nl/documenten/plant/plantziekte-en-plaag/plantziekte-en-plaag-overig/risicobeoordelingen/advies-van-buro-over-de-risico%E2%80%99s-van-de-bloembollenketen>

⁴ Harmful organisms: viroids, viruses, bacteria, fungi, pseudofungi, insects, mites, nematodes, gastropods and plants that are harmful to plants.

⁵ A non-native species is a plant, animal or other organism that is not naturally present in the Netherlands and has been brought to our country through human activity. In this report, 'invasive alien species' are non-native species that establish themselves in the wild, multiply quickly and are harmful for native species.

⁶ For the purposes of this report, 'nature' have been broadly defined as all open areas of land with plants and/or water, whether public or private, where no commercial cultivation is taking place. This means 'nature' include public and private gardens, parks, open water and forests. However, for the assessment of the risk from invasive alien plants, plantings in parks and public and private gardens are excluded from the concept of 'nature'.

⁷ 'Import' refers to bringing products from third countries into the Netherlands. Where imports from other EU Member States are concerned, this will be explicitly mentioned.

⁸ Regulation (EU) 2016/2031 of the European Parliament and of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC. OJ L 317 23.11.2016, p. 4–104.

distributed, which could establish itself in the EU and would have unacceptable consequences after introduction, against which practicable and effective measures are available and which is listed in Annex II of Implementing Regulation (EU) 2019/2072 (Article 4 of the Plant Health Regulation). There is a zero-tolerance policy for EU Q-pests. Priority EU Q-pests form a special group within the wider category of EU Q-pests and are subject to additional requirements. In the rest of this report, EU Q-pests will simply be called Q-pests. In the risk assessment, in addition to the organisms listed in Annex II of the implementing regulation referred to above, organisms for which temporary measures apply via an implementing act (Article 30 of the Plant Health Regulation) are also treated as Q-pests, since these organisms are also subject to a European control obligation.

In this report, a 'new harmful organism' is defined as an organism that is not present in the EU or only in a limited area, and does not (yet) have quarantine status. A potential Q-pest is a 'new harmful organism' that meets all of the criteria for a Q-pest. Potential Q-pests are therefore harmful organisms that could possibly be given European quarantine status in the future. The Plant Health Regulation also states that, if a Member State finds an organism that, based on a preliminary risk assessment, meets the criteria for a Q-pest, that Member State must take measures to eradicate the organism (Article 29). In the Netherlands, these organisms are referred to as 'NL-provisional Q-pests'. Organisms can also be given the NL-provisional Q-pest status following a request from a company or institution to be allowed to import the organism for research purposes.

The following categories of organisms fall outside the scope of this risk assessment (see also Table 1):

- protected zone quarantine pests: pests that are only regulated in certain areas of the EU. The Netherlands has no PZ Q-pests, so this category will not be discussed further;
- EU regulated non-quarantine pests (RNQP);
- organisms with quarantine status in a third country, but not in the EU ('third-country quarantine pests');
- all other organisms.

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Table 1. Categories of harmful organisms that do/do not fall within the scope of this assessment (see the text and Annex 3 for complete definitions).

Category	Abbreviation	Brief definition	In scope
EU quarantine pest	(EU) Q	Organism in Annex II of Implementing Regulation (EU) 2019/2072	Yes
Priority pest	Priority (EU) Q	EU Q-pest with additional requirements under Article 6 of Regulation (EU) 2016/2031	Yes
Provisional EU quarantine pest	(EU) Q ¹	Organism for which temporary EU measures apply via an implementing act	Yes
Protected zone quarantine pest	PZ Q	Organism with quarantine status for specific areas within the EU	No
EU regulated non-quarantine pest	RNQP	Organism that is only regulated for certain plant material	No
New harmful organism	-	Harmful organism that is not present in the EU or is only present in limited numbers (one of the criteria for an EU Q-pest)	Yes ²
Potential EU quarantine pest	Potential (EU) Q	New harmful organism that meets all of the criteria for an EU Q	Yes
NL-provisional Q-pest	NL-provisional Q	Potential EU Q-pest for which official measures apply in the Netherlands	Yes
Third-country quarantine pest	Third-country Q	Organism that has quarantine status in a third country	No
Other organisms	-	Organisms that do not fall under any of the above definitions	No

¹ Note that, according to Regulation 2016/2031, only the organisms listed in Annex II of Implementing Regulation 2019/2072 are EU quarantine pests.

² An assessment is required of whether the organism meets all of the criteria for an EU Q-pest.

The presence of harmful organisms in a plant production chain may lead to reductions in yield, higher plant protection costs and the limitation of sales opportunities. These aspects are included in the assessment of risks from Q-pests and new harmful organisms. No estimate has been made of the effects on trade and export from any tightening of the phytosanitary laws and regulations. The economic risk from the rejection of an import consignment due to the presence of a Q-pest also falls outside the scope of this assessment.

The risks from known and potential Q-pests have been assessed taking into account the current laws and regulations and their implementation. Accordingly, the current import flows through which harmful organisms could enter the Netherlands, including import flows from other EU Member States, have been considered. Risks can change when regulations change and/or when import flows, including import flows from other EU Member States, change. The detection of a Q-pest or a potential Q-pest can have a significant impact for a company,

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landowner and/or other stakeholders, due to the cost of the measures that have to be taken to contain or eradicate the organism. No estimate has been made of the scale of these costs. However, the report does identify the Q-pests for which the likelihood of an infestation at a production site or in nature is assessed as relatively high.

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Nature and the environment

In addition to the risk of non-native plant pathogens and pests, the risk of the introduction of other invasive alien species has also been assessed for nature. Invasive alien species are non-native organisms that, if introduced, would constitute a threat to native flora and fauna. Both plants and animals (biological control agents) that are intentionally imported for the purposes of the ornamental horticulture industry, as well as organisms that are accidentally carried along on imported ornamental horticultural products, were examined.

In relation to the environment, BuRO identified the risks from the use of plant protection products and biocides. Specifically, BuRO examined the risks from active substances in plant protection products and biocides (to the extent that such information was available), but any risks from adjuvants⁹ or basic substances¹⁰ were not examined. The Netherlands Food and Consumer Product Safety Authority (NVWA) does not perform measurements of plant protection products in surface water or groundwater, but it does monitor correct agricultural use of plant protection products. Incorrect use of these products can lead to environmental risks. These environmental risks are listed, but are not discussed in detail. The potential risks for nature and animal health resulting from the use of plant protection products have not been assessed. Likewise, the risks for nature and the environment resulting from the application of fertiliser to ornamental plants fall outside the scope of this risk assessment, as does the use of plant protection products by private individuals in ornamental gardens, on pot plants, etc. The risks to bees from the use of plant protection products are discussed briefly, but this will be further clarified in a subsequent advisory report.

Public health

For public health, BuRO looked at the risks from:

- the use of plant protection products and biocides in ornamental horticulture, for consumers and local residents. The risks for workers and processors are also discussed briefly. As with the risks for nature and the environment, BuRO only looked at the risks from active ingredients and did not examine any risks from adjuvants or basic substances;
- residues from plant protection products on ornamental horticultural products (including imported products);
- the dyeing and preserving of ornamental horticultural products (post-harvest treatment);
- deliberate or accidental consumption of ornamental plants;
- plant allergens;
- the ornamental horticulture production chain as a pathway for the introduction of organisms that are harmful to humans and animals.

⁹ An adjuvant may be added to a plant protection product to improve its effectiveness. Adjuvants require administrative registration; the legislation for the assessment of these substances needs to be more detailed.

¹⁰ A basic substance is a substance that is marketed for a different purpose, such as cosmetics or food. Any risks have therefore already been identified. Basic substances may be used for plant protection, but they cannot be sold as plant protection products. There is a list of 'permitted basic substances'.

Animal health

As with public health, BuRO looked at the risk to animal health from the introduction of harmful organisms via the import of ornamental horticultural products. The risks from the consumption of ornamental plants by animals are described.

A more extensive justification for the scope of the production chain is provided in Annex 1.

Approach

As the basis for this risk assessment, several BuRO experts performed a literature review. BuRO also used data collected by the NVWA. The hazards in the ornamental horticulture production chain have been identified and described. Finally, BuRO considered the extent to which these hazards could lead to risks for plant health, nature, the environment, public health and animal health.

A multidisciplinary team at BuRO produced a draft report, and the other departments of the NVWA were asked to provide additions and check for inaccuracies. The draft report was then submitted to external experts for comment. The industry was also given an opportunity to check a draft version of the report for inaccuracies.

The methodology used in the risk assessment of the ornamental horticulture production chain was largely based on the methodology of the Codex Alimentarius and EFSA and is in line with the systematic risk assessment procedure described in the General Food Law Regulation (GFLR)¹¹. Although this approach is specifically described in the Regulation for food safety risk assessments, its key elements are comparable with international methodologies used for risk assessments of animal health and plant health (EFSA-Scientific-Committee, 2012; FAO, 2017). Likewise, the methodology used to assess the risk to nature from invasive alien species is very similar to the methodology used for plant health (Roy et al., 2018).

The risk assessment method used consists of the following four elements. Taken together, these elements provide a comprehensive overview of the risks.

- 1 **Hazard identification:** identification of the hazards¹² (threats) to plant health, nature, the environment, public health and animal health in relation to the ornamental horticulture production chain that are described in the international scientific literature or other sources.
- 2 **hazard characterisation:** assessment of the relevance of these hazards for the Netherlands (for plant health and nature, this involves estimating the potential consequences of the presence of a harmful organism/non-native species in the Netherlands for crops, plants, plant products and nature);
- 3 **exposure assessment:** assessment of the likelihood of the hazards: for plant health and nature, this relates to the likelihood of a harmful organism/non-native species entering the Netherlands and becoming established and the extent to which the organism may spread in the Netherlands; for plant health

¹¹ Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, p. 1–24.

¹² A hazard is a biological, chemical or physical agent with potentially adverse effects for plant health, nature, the environment, public health and animal health (based on the definition in the General Food Law Regulation (Regulation (EC) No 178/2002)).

and nature, the exposure assessment was performed before the hazard characterisation step;

- 4 **risk characterisation**: the overall assessment of the nature and severity of each hazard or threat and its likelihood or prevalence in the Netherlands (conclusions of this risk assessment).

The risk assessments for A) Plant Health, B) Nature and the Environment and C) Public Health and Animal Health are described in the substantiation section, which follows the findings, conclusions and recommendations. A more extensive justification for the assessment framework is given in Annex 1.

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Findings of the risk assessment for the ornamental horticulture production chain

Plant health

1

Dutch companies import a large number of species of cut flowers, cut branches and ornamental plants¹³ from every continent except Antarctica. In addition to the large and fairly consistent import flows, there is significant variation in plant species/origin combinations from one year to the next. These imports create risks for plant health, nature (biodiversity), public health and animal health, because they could provide a pathway for the introduction of harmful organisms. Due to the global nature and diversity of the import flows, the number of new and existing harmful organisms that could be introduced is high. The risks for plant health are reduced by the European Union's phytosanitary legislation, which sets requirements for a large number of products, including official inspections and the issuing of a phytosanitary certificate by the country of origin. To protect nature, there is an import and trade ban in place throughout the EU with regard to a limited list of species (the Union List). There is no legislation providing for the rejection of consignments in relation to public health or animal health.

2

Plant pathogens and pests are a hazard for the production, quality, trade and export of ornamental horticultural products. In order to be placed on the market, ornamental horticultural products must be substantially free from harmful organisms and signs of disease. A zero-tolerance policy applies for certain organisms, depending on the country of destination. For optimal control of pests and diseases, plant protection products and biocides are used in various stages in the production chain. The use of these products can lead to risks for the environment and public health.

The introduction of a known or potential quarantine pests can cause significant damage to crops and plants, resulting in high costs for mandatory eradication and containment measures and costs of trade and export restrictions imposed by the EU and third countries. The import of ornamental plants is considered one of the most important potential pathways for introduction of known or potential quarantine pests. Most plant species can be imported into the EU without a prior

¹³ In this document, 'plants' refers to 'plants for planting, other than seeds', in accordance with the definition of 'plants for planting' given in Regulation 2016/2031 ("*plants intended to remain planted, to be planted or to be replanted*").

risk analysis, but they must comply with current phytosanitary legislation. A number of species is subject to an import ban from certain third countries.

3

The likelihood of the presence of known or potential quarantine pests in import consignments of plants is estimated to be relatively low if plants are grown in artificial growing media, and the plants are protected as much as possible from the influx of harmful organisms from the environment, or if the plants come from production sites from which the same plants have been imported for many years without any known or potential quarantine pests being detected on those plants.

4

Visual inspections of plant imports are of limited effectiveness for detecting infested units within a consignment and thus preventing the introduction of known or potential quarantine pests. Latent infections cannot be detected through visual inspections and certain stages of insects and mites, such as eggs, are difficult to detect. Furthermore, only a sample of the plants are inspected during inspections.

5

The NVWA conducts surveys¹⁴ for known and potential Q-pests. When an organism is detected shortly after its introduction, the likelihood of eradication is higher and the cost of eradication actions lower than if the organism is detected at a later stage. Using surveys based on a random selection of inspection locations, the likelihood of timely detection of an outbreak of many known and potential quarantine pests is small. By performing surveys at locations where the chance of introduction is highest, this likelihood can be increased.

6

The inspection of consignments a few weeks after import increases the chance of early detection of known or potential quarantine pests. The NVWA also conducts surveys at the sites of growers who import plants. It is not known what percentage of imported consignments are inspected through these surveys. Moreover, plants may be delivered to retailers immediately after import or only remain at the grower's site for a short period, which means they would be excluded from the survey.

7

Among the current quarantine pests, the longhorn beetles *Anoplophora glabripennis* and *A. chinensis*, the Japanese beetle *Popillia japonica* and the bacterium *Xylella fastidiosa* belong to the pests that pose the greatest risks to ornamental horticulture. The risks are especially high due to the effect on the trade and export of ornamental plants that would result from the detection or outbreak of these organisms. As most likely pathways for introduction have been identified for each of these organisms:

- *Anoplophora glabripennis*: the import of products with wood packing material from China;
- *Anoplophora chinensis*: the import of various woody plants, particularly *Acer*, from East Asia;

¹⁴ As part of a survey, inspections are performed in cultivated areas and/or nature to establish the presence or absence of a known or potential quarantine pest.

- *Popillia japonica*: hitchhiking in air or ground freight consignments from the north of Italy; the likelihood of elimination of an outbreak is assessed as low, and the expectation is that this organism will spread further within the EU; there are currently no specific EU regulations to prevent the spread;
- *Xylella fastidiosa*: EU internal trade in plants; it is possible that this organism has already arrived in the Netherlands on plants that were imported before the EU emergency measures came into force.

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Plants and products that do not comply with phytosanitary regulations (including products subject to an import ban or for which a mandatory phytosanitary certificate has not been obtained) have been intercepted in travellers' luggage and parcel post. Since Regulation (EU) 2016/2031 took effect on 14 December 2019, a phytosanitary certificate (PC) has been a requirement when bringing in virtually any plant, seed or plant product from a third country. "Member states, seaports, airports and international transport operators" are also required to inform travellers about phytosanitary legislation. Due to limited information about travellers' luggage and parcel post, the contribution to the risk relative to other introduction pathways cannot be properly assessed.

9

The quarantine nematodes *Meloidogyne chitwoodi* and *M. fallax* are established in the Netherlands and are suspected to be more widespread than is officially known. It is difficult to prevent the spread of these nematodes because both can infest a large number of plant species. Sites can become infested via infested propagation material and soil. Due to their quarantine status, *M. chitwoodi* and *M. fallax* constitute a risk for the trade and export of ornamental plants. These nematodes are not known to cause damage to ornamental plants.

10

The quarantine pest *Tobacco ringspot virus* (TRSV) has been found in ornamental plants several times over the past few decades. As far as is known, TRSV causes little or no damage to ornamental plants, but infected consignments must be destroyed. The virus can be eliminated relatively easily through the destruction of infected consignments, provided the natural vector (certain nematode species from the genus *Xiphinema*) is not present. The risk of TRSV would increase if the vector were introduced to the Netherlands. One vector species, *Xiphinema rivesi*, is already present in multiple EU Member States. European populations of this species are not regulated, and there is little information on their spread within Europe. Accordingly, the likelihood of the introduction of *X. rivesi* into the Netherlands is highly uncertain.

Nature and the environment

11

Imports of ornamental plants may harbour non-native plants and animals, which could thus be unintentionally introduced into the Netherlands. These plants and animals could have undesirable effects on nature, such as displacing native species and altering ecosystems.

12

In the Netherlands, 658 plant and animal species have been found in the wild that may have been unintentionally brought in with ornamental plant imports. This number is increasing. Of those species, 115 have become established and 41 are known to be (potentially) invasive. The chance that these hitchhikers become invasive is highest among imports from temperate climate zones.

13

In the Netherlands, a range of non-native organisms (including ticks, mosquitoes, slugs and snails) have been intercepted on ornamental horticultural products that can directly or indirectly (as a vector) harm the health of humans or animals. However, the likelihood of the introduction of such organisms through the import of ornamental horticultural products seems to be lower than for other pathways.

14

Ornamental plants that have escaped into the wild may have a negative effect on biodiversity, for example by displacing native plants through their overwhelming presence. In Natura 2000 areas, the ecological goals could be jeopardised if invasive plants become established. Invasive water plants can become so numerous that they impede the flow of the water. In addition, some plants can give rise to health problems, cause damage to buildings, pipes and infrastructure and jeopardise the security situation in the Netherlands, for example by affecting dykes.

15

The import of ornamental plants is seen as the most important pathway by which invasive plants have been introduced into the Netherlands. More than 60% of non-native plant species found in the wild in the Netherlands were introduced via the ornamental horticulture production chain. Only plants on the Union List (found in Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species) and a number of species that are banned under phytosanitary legislation may not be imported. On import applications, importers only have to give the genus names of plants. The absence of species names makes monitoring the import of banned species difficult. There is no national list in the Netherlands of non-native species of which the import and/or trade is banned.

16

The number of first sightings of ornamental plant species in the wild is showing a strong upward trend. Feral ornamental plants can behave like invasive species. In a horizon scan for the Netherlands (from 2014), several ornamental plant species were identified that were not yet present in nature and were considered to be 'potentially invasive'.

17

For species on the Union List, there is a requirement to take control measures. Non-established species must be eradicated. As of 1 September 2020, there were 36 plant species on the Union List. For newly identified and potentially invasive alien species that are not on the Union List, there are no regulations regarding control.

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Control of invasive alien plants is often expensive and not always successful. The likelihood of eradication is highest with early intervention. The Netherlands has an effective detection system that relies on volunteers who quickly report new sightings of ornamental plants in the wild. However, for many new non-native species that are not on the Union List it is unknown whether they are invasive or not because there is no reliable estimate of any possible negative long-term effects. As a result, it is difficult for land and/or water managers to assess whether new non-natives will become problem species and thus should be controlled as soon as possible. A number of invasive plant species that are controlled by land and/or water managers are simultaneously offered for sale to consumers. These sales mean that the species could be re-introduced into the wild. Examples include the rugosa rose (*Rosa rugosa*), Japanese knotweed (*Fallopia japonica*), swamp stonecrop (*Crassula helmsii*)¹⁵ and various cotoneaster species.

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20

The use of plant protection products in ornamental horticulture, particularly for ornamental plants grown in greenhouses, is high compared with other sectors (expressed in kilogrammes of active substance per hectare). Initiatives are taken to reduce the use and environmental impact of plant protection products.

21

Enforcement targets the trade and correct use of plant protection products. Inspections by the NVWA show that compliance with legislation on the use of plant protection products is low for a number of ornamental plants. A possible explanation for the low compliance is that the range of permitted products is too small. The NVWA does not perform any residue measurements on ornamental horticultural products, and no MRLs (maximum residue limits) have been set for plant protection products on ornamental horticultural products¹⁶.

22

Very little data are available on the use of biocides in the ornamental horticulture production chain or on residues from these products on ornamental horticultural products.

23

Although emissions of plant protection products into the environment are decreasing, surface water quality standards are still being exceeded, and the interim target from the Second Memorandum on Sustainable Plant Protection 2013–2023 (50% reduction by 2018, compared to the reference year 2013) has not been achieved. The use of plant protection products in ornamental horticulture is probably contributing to this failure to reach the target and leads to risks for nature and the environment.

¹⁵ Swamp stonecrop is often sold under the incorrect name *Crassula recurva*.

¹⁶ Since 1 January 2020, specific MRLs apply for pollen and bee products that will be included in the authorisation of plant protection products for ornamental plants.

24

In the cultivation of ornamental plants, organisms are released to combat pests. Some biological pest control organisms that have escaped or have been released in the past, such as the harlequin ladybird, have had undesirable effects on biodiversity. Since 2005, organisms may only be released for biological pest control purposes if they have been assessed and the risks for biodiversity are estimated to be very low. As far as is known, the organisms currently permitted to be used for biological pest control in the ornamental horticulture production chain do not have undesirable effects in nature. One possible exception is the bug *Orius laevigatus*, due to competition with native bugs.

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International guidelines regulate the import and release of organisms for biological pest control (International Standard of Phytosanitary Measures No. 3). In accordance with this standard, the release of organisms for biological pest control is regulated in the Netherlands, but Dutch legislation does not contain any guidelines for the import or transport of, or research with, new organisms. However, it is illegal in the Netherlands to release animals or their eggs into the wild (Nature Conservation Act (*Wet natuurbescherming*), Section 3.34(1)). Locations that are not contained provide an opportunity for animals to escape into the wild and are implicitly covered by this ban. Because there is no obligation for people to report that they are working with non-native species, there is no way of monitoring how well these species are contained.

26

The European Union does not currently have a harmonised assessment and approval policy for organisms used for biological pest control. If such organisms are released in a country where they are not regulated, they could spread naturally or through human activity to a neighbouring country where their release may be banned due to the risk of undesirable side effects in nature.

Public health and animal health

27

There are no indications that dermal exposure of consumers to the residues of plant protection products as a result of the normal use of ornamental horticultural products poses a risk to public health. For those applying plant protection products, workers in the industry and processors of ornamental horticultural products (such as florists), health risks resulting from failure to follow the legal instructions for use or inadequate use of personal protection measures cannot be excluded.

28

Limited information is available on residues on imported ornamental horticultural products. The available literature reveals that imported cut flowers may contain high concentrations of many active ingredients, including substances that are not permitted in the EU. It is not known whether residues on imported products could pose a risk to public health or the environment. However, the available information shows that there are possible risks for workers.

29

A number of azole fungicides are permitted in ornamental horticulture. During composting of waste from the ornamental horticulture sector containing residues

of azoles, fungal strains with resistance to azoles can develop. This process is described for the fungus *Aspergillus fumigatus* after composting of flower bulb waste. This fungus is a conditional pathogen for humans. Resistance toazole drugs makes it difficult to treat fungal infections in humans. Due to the use of azoles in ornamental horticulture, the composting of waste from this production chain may contribute to this process; however, no studies focusing on this issue are available.

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30

Genetic modification is used in ornamental horticulture, for example to alter flower colour. The number of approvals is currently low, and genetically modified plants are assessed within a strict legal framework, so that any risks remain small. A study by the RIVM on the worldwide genetic modification of ornamental plants and the possible illegal import of these products revealed that the risks for public health and the environment in the Netherlands are indeed low.

31

Many ornamental plants contain toxic substances, which can lead to severe symptoms of poisoning when consumed by people or animals.

32

Plant protection products for ornamental plants are not assessed for risks that may arise from consumption of the plant. However, the limited available information about residues on ornamental horticultural products shows that consumption of these products may cause an increased risk for the consumer.

33

Within the ornamental horticulture sector, products are increasingly being grown and marketed that are intended for consumption. This primarily relates to herbs, cut flowers and plants with edible fruit. Flowers and other parts of plants that had not been used for human consumption to a significant degree before 15 May 1997 must be assessed by EFSA and approved by the European Commission for sale on the European market, pursuant to the Novel Food Regulation (Regulation (EU) 2015/2283).

34

For consumers, it is not always clear whether products from the ornamental horticulture sector are intended to be ornamental plants or whether they can be eaten. Dutch flower auctions advise their suppliers and customers to indicate on the packaging or on a stick-in or hanging label that the product is not intended for consumption. For a number of edible plants (herbs) that are often grown and marketed in the ornamental horticulture production chain, Regulation (EU) No 1308/2013 states that they fall within the fruit and vegetable sector. These herbs include fresh and chilled thyme, basil, lemon balm, mint, oregano/wild marjoram, rosemary and sage.

35

Ornamental plants may produce large quantities of pollen, which can cause allergic reactions, with hay fever being one of the most common. Within plant species, sterile varieties can occur that do not produce pollen. There are also allergy-free and low-allergen ornamental plants. These are usually not labelled as

such. The planting of sterile varieties could have harmful ecological effects, for example for insect populations.

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Conclusions

The ornamental horticulture sector can make a significant contribution to the protection of plants and nature against harmful organisms and invasive alien species¹⁷. In addition to the conventional trade in ornamental horticultural products, citizens can also play a role in the introduction of harmful organisms, for example via travellers' luggage and parcel post or through the purchase of invasive alien species as ornamental plants. The sector and government authorities can work together to contribute to the further protection of nature from invasive plants and species that were introduced accidentally by, for example, being selective about plantings or taking measures aimed at limiting or preventing spread. Likewise, the sector and government authorities can ensure citizens are informed about the risks in the ornamental horticulture production chain.

Risks for plant health

The risks from Q-pests and new harmful organisms for ornamental horticulture in heated greenhouses and outdoors (including unheated greenhouses and plastic tunnels) have been assessed, and the most significant risks for ornamental horticulture arise from:

- (i) the introduction of Q-pests and new harmful organisms via the import of ornamental plants, particularly the introduction of new harmful organisms that are little known or even unknown, as well as known harmful organisms via unknown host plants;
- (ii) the introduction of the longhorn beetles *A. glabripennis* and *A. chinensis*, the bacterium *X. fastidiosa* and the Japanese beetle *P. japonica*, for the trade and export of ornamental plants;
- (iii) too late detection of an outbreak of a known or potential Q-pest, meaning that eradication is no longer possible;
- (iv) the risk from the nematodes *M. chitwoodi* and *M. fallax* for the trade and export of ornamental plants;
- (v) the introduction of vectors of the *Tobacco ringspot virus*, the likelihood of which is uncertain. The virus itself has been found in cultivated areas several times in recent years. In the absence of natural vectors, the virus can be eliminated fairly easily by destroying the infected consignments. If a vector were to be introduced, the risk posed by the virus would increase.

Although the EU regulations are focused on limiting risks as much as possible, tightening the plant import regulations could help further limit the risks. In particular, this could help to exclude the presence of harmful organisms on these plants as much as possible, based on how they have been grown. Moreover, it is important that growers and cultivation consultants make timely reports about the detection of known or potential quarantine pests. The existing system of surveying

¹⁷ Text changed; 'public health and animal health' was unintentionally included in the original text (The ornamental horticulture sector can make a significant contribution to the protection of plant health, nature, public health and animal health against harmful organisms that appear in ornamental horticulture).

companies that import plants makes an important contribution to the NVWA's phytosanitary monitoring, but some aspects could be tightened.

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Risks for nature and the environment

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Risks for nature and the environment may arise through the deliberate or accidental introduction of non-native ornamental plants and other organisms and through the use of plant protection products and biocides. After becoming established in the wild, non-native ornamental plants can behave like invasive species and have a negative effect on biodiversity.

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The import of ornamental plants is the most important introduction pathway for invasive plants into the Netherlands. Current legislation in the area of invasive alien organisms offers insufficient possibilities for protecting nature from invasive plant species.

Biological pest control, plant protection products and biocides are used to prevent and control pests and diseases in ornamental horticulture. The release of non-native organisms for biological pest control purposes can have negative consequences for biodiversity. Since 2005, organisms may only be used for biological pest control purposes if the risks for nature are estimated to be low. There is no legal supervision of research on new biological control agents or the effectiveness of containment measures taken by institutions and companies in relation to such research. The EU does not currently have a harmonised assessment and approval policy for biological control agents, even though these organisms could become established in the wild after release and spread across national borders.

The use of plant protection products can have negative effects on the environment. Surface water measurements for plant protection products and their residues show that environmental standards are exceeded. In particular, there are risks related to incorrect use of products and from the use of unauthorised products in ornamental horticulture. The (illegal) use of plant protection products can for example result in harmful effects on bees. Integrated plant protection may contribute to reducing the risks related to the use of plant protection products.

Risks for people and animals

The use of plant protection products can lead to health risks, particularly for people who work in the ornamental horticulture production chain, for example if insufficient personal protective equipment is used and/or in the event of non-compliance with the legislation. The extent to which people and the environment are exposed to plant protection products via import from third countries is uncertain.

Organisms that are harmful for people and animals can enter the country with imports of ornamental horticultural products, including imports from other EU Member States, but the risk is relatively low compared to other pathways. Ornamental plants are not intended for consumption, and if they are ingested, health risks due to the presence of plant protection products and plant toxins cannot be excluded. It is not always easy for citizens to determine which plants and parts of plants are and are not suitable for consumption. Pollen from ornamental plants may lead to allergic reactions. Edible flowers, plants and parts of plants that have not previously been consumed in significant quantities must be assessed by EFSA as novel foods.

Recommendations

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1

Urge policymakers to tighten the EU regulations for the import of plants (plants for planting, other than seeds). Additional import requirements may include the following:

- The plants must have been at a nursery throughout the production period, with a clear distinction being made between the nursery and the surrounding environment.
- The plants must be unrooted or *in vitro* plants, or must have been grown exclusively in EU-authorized growing media (an exception could be made for bulbs, tubers and rhizomes (of specific origin) based on a risk assessment).
- The plants must have been irrigated using water free from harmful organisms.

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2

Work with policymakers to investigate what is required to ensure that growers and cultivation consultants report findings or suspicions of known or potential quarantine pests to the NVWA as quickly as possible.

3

Continue the current surveys of companies that import plants (and, where relevant, their surrounding environments) as part of the national phytosanitary monitoring programme. Pay special attention to plants that will be planted outdoors in the Netherlands and to new species-origin-combinations. Determine what percentage of imported consignments are inspected through these surveys and which consignments fall outside of these surveys.

4

Continue to pay particular attention to the following organisms (and locations/plant species) and introduction pathways in the phytosanitary survey program:

- *Anoplophora chinensis* (citrus longhorn beetle) at companies that import plants from countries, including EU Member States, where this organism is found;
- *Anoplophora glabripennis* (Asian longhorn beetle) in the vicinity of sites with wood packaging material from China;
- *Popillia japonica* (Japanese beetle) in the vicinity of airports;
- *Xylella fastidiosa* at companies that import host plants from southern Europe;
- *Tobacco ringspot virus* (TRSV) in ornamental plants with a history of TRSV infections;
- parcel post and travellers' luggage.

5

Investigate the effectiveness and efficiency of different surveillance methods, including the use of existing networks of volunteers and professionals who often visit green spaces, to detect known and potential quarantine pests and invasive alien organisms at an early stage when eradication is still feasible and/or eradication costs are still limited.

6

Urge policymakers to tighten the legislation on invasive alien plants. Risks can be reduced by proposing the inclusion of species that are invasive for the Netherlands in the Union List and by creating a national list of invasive species and banning

their sale; emergency measures can then be taken if species on the list are accidentally or deliberately imported.

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Urge the sector to take more responsibility for preventing the import of invasive plants and hitchhikers. They can do this by including the following in their quality systems:

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- an assessment of the invasiveness of the ornamental plant species to be imported;
- ending the import, cultivation, trade and planting of species that are proven to be invasive or are potentially invasive;
- taking measures to prevent undesirable species from entering the country with imports of non-native plants, cut flowers and raw materials;
- taking measures to prevent the spread of invasive organisms within the Netherlands, or via transit and export;
- providing information to consumers with regard to the risks of invasive plant species.

8

Urge local government authorities, such as provincial and municipal authorities, to help prevent the spread of invasive plants by:

- not planting these species;
- preventing unintentional spread, for example via work instructions for parks and gardens staff and tendering procedures for the design and management of public green spaces;
- informing individuals about the risks of invasive alien species.

9

Urge policymakers to legally establish that the import and transport of and research into new, not yet authorised non-native organisms for the purposes of biological pest control may only be done with a permit and under containment conditions, so that the organisms cannot escape. When issuing such permits, use the guidelines set out in the 'International Standard of Phytosanitary Measures No. 3'.

10

Urge policymakers to advocate within the European Union for a harmonised assessment and approval policy for organisms to be used for biological pest control.

11

Actively bring this BuRO advisory report to the attention of the Social Affairs and Employment Inspectorate and the Human Environment and Transport Inspectorate. Pursue a joint approach aimed at optimising knowledge-driven, risk-based compliance with the laws and regulations on the use of plant protection products in the ornamental horticulture production chain.

12

Conduct an exploratory study to discover the identity and quantities of plant protection product residues on ornamental horticultural products imported from third countries, which will allow risk assessment of these residues for people and the environment.

13

Investigate the need and possibilities for mandatory labelling of edible flowers, plants and parts of plants that are sold as food. Such labelling must make it clear that this is food that can be safely consumed and that can be monitored by the NVWA.

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Yours faithfully

Prof. Antoon Opperhuizen
Office for Risk Assessment & Research

Substantiation

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A. Plant health risk assessment

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Hazards for plant health

The hazards for plant health include viroids, viruses, bacteria, fungi, pseudofungi, nematodes, insects, mites, gastropods and plants that are injurious to plants. In this risk assessment, 'plant health' refers to the health of plants that are grown for their ornamental value and plants that grow in nature and in tropical greenhouses (in arboretums, zoos, etc.). Based on laws and regulations, harmful organisms can be categorized in various groups (Table 1). As indicated earlier, this risk assessment confines itself to the Q-pests and new harmful organisms that meet, or could meet, the criteria for a Q-pest. This report also gives examples of harmful organisms of which their presence have been reported in the Netherlands for the first time since 2000 and which at that time had not previously been reported in the EU before or had only recently been introduced into the EU, and which were not subject to any official measures at the time of first detection. These examples are illustrative of the risks posed by new harmful organisms.

Risks for cultivated areas and nature

Most Q-pests are not (yet) present in the Netherlands but could enter the country by various pathways, for example through the import of ornamental horticultural products, including from other EU Member States. The risks from known and potential Q-pests have been assessed taking into account existing phytosanitary laws and regulations. These laws and regulations are focused on preventing the introduction and spread of known and potential Q-pests. For example, specific requirements apply in relation to specific Q-pests for the import and – depending on the pest status¹⁸ of the organism in the EU – internal EU trade of certain plants and products. A number of general requirements also apply to the import of certain plants, plant products and materials, and some plants and products are subject to an import ban. A phytosanitary certificate is required for import consignments of plants, seeds and almost all plant products. Moreover, all import consignments of plants and of certain seeds, products and materials must be inspected on entry for the presence of known or potential Q-pests¹⁹. For other seeds and products for which a phytosanitary certificate is required, at least 1% of the consignments must be inspected on entry (Commission Implementing Regulation (EU) 2019/66, Article 5).

There are approximately 180 Q-pests (species and groups of organisms), a large number of which are relevant for ornamental horticulture and nature. In this risk assessment, a distinction has been made between Q-pests that are already present (established) in the Netherlands and non-established Q-pests. This is because, generally speaking, the likelihood of an infestation with an established Q-pest is higher than with a non-established Q-pest. This document lists all of the non-established Q-pests for which the likelihood of an infestation or the risk for ornamental horticulture and nature in the Netherlands is assessed as relatively high, as well as all established Q-pests that are relevant for ornamental

¹⁸ Pest status: the extent to which an organism is present in a given area.

¹⁹ For a number of product/origin combinations, 'reduced checks' apply, in which a certain percentage of the consignments must be inspected. See:

https://ec.europa.eu/food/plant/plant_health_biosecurity/non_eu_trade/less_frequent_checks_en

horticulture and nature. It should be noted that risks can quickly change: laws and regulations can be amended, trade flows can change, Q-pests can be added or an organism may be deregulated (so that it no longer has quarantine status).

The risks from established Q-pests, non-established Q-pests and new harmful organisms are discussed for three cultivation categories (cultivation in heated greenhouses, outdoor cultivation and cultivation of marsh and aquatic plants) and for nature. The various introduction pathways for known and potential Q-pests are discussed in a general way in a separate section. Because the import of ornamental plants is considered as (one of) the most important pathways, the effectiveness of the current phytosanitary legislation with regard to this pathway is discussed in more detail. Finally, specific attention is given to the risks from hand luggage and parcel post and the effectiveness of surveys. Details on the approach, the legislation and the risk assessments can be found in Annexes 3 to 5.

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Ornamental horticulture in heated greenhouses

Established Q-pests

No Q-pests have been identified that are relevant for ornamental plants and that are established in greenhouse ornamental horticulture. It is possible that the quarantine nematodes *Meloidogyne chitwoodi* and *M. fallax* are present in soil-grown crops in greenhouses, but there are no official records. The quarantine bacterium *Ralstonia solanacearum* is established in surface water in the Netherlands. This organism is primarily known as the cause of brown rot in potatoes, but it is also relevant for ornamental horticulture. In the past, the bacterium has been found in the cultivation of *Pelargonium*, most likely introduced through the import of infected cuttings (Janse et al., 2004). It is possible that other ornamental plants could act as host plants for this bacterium. If propagating material is free from the bacteria, growers do not use surface water and take hygiene measures, the chance of an infection with *R. solanacearum* is low. There have been other outbreaks of *R. solanacearum* in ornamental plants grown in greenhouses, including *Anthurium*, *Curcuma* and roses. However, these involved a different variant of *Ralstonia*, which has been reclassified under the species *R. pseudosolanacearum*. *R. pseudosolanacearum* is not established in the Netherlands.

Non-established Q-pests

- In total, 16 Q-pests have been identified that are not established in the Netherlands and for which the likelihood of an infestation is assessed as relatively high:
 - *Aleurocanthus spiniferus*;
 - *Anoplophora chinensis*;
 - *Chrysanthemum stem necrosis virus*;
 - *Eotetranychus lewisi*;
 - *Liriomyza sativae*;
 - *Ralstonia pseudosolanacearum*;
 - *Ripersiella hibisci*;
 - *Spodoptera eridania*;
 - *Spodoptera frugiperda*;
 - *Spodoptera litura*;

- *Tetranychus mexicanus*;
 - *Thrips palmi*;
 - *Tobacco ringspot virus*;
 - *Tomato ringspot virus*;
 - *Tomato brown rugose fruit virus*;
 - *Xylella fastidiosa*.
- Infestations with these organisms can especially occur through the import, including from other EU Member States, of plants from areas where these organisms are present. Most of these organisms are polyphagous and can infest plant species from multiple genera or families.
 - Infestations with *Tomato brown rugose fruit virus* (ToBRFV) may also occur through spread within the Netherlands. ToBRFV was found at several sites growing fruiting vegetables in the second half of 2019 and in 2020 and can easily be mechanically transferred on contaminated materials, hands and so on.
 - One organism that is frequently found in ornamental horticulture (both protected and open-field cultivation) is *Tobacco ringspot virus* (TRSV). This virus will be discussed under 'Outdoor ornamental horticulture', since the most recent findings were at sites with open-field cultivation.
 - The bacterium *Xylella fastidiosa* constitutes one of the biggest risks for the trade in and export of ornamental plants, particularly for the tree nursery industry, and will be discussed under 'Outdoor ornamental horticulture'.

New harmful organisms, including potential Q-pests

- Since the year 2000, several new harmful organisms have been found in the Netherlands that, at the time they were first detected, did not have an EU quarantine status nor a NL-provisional quarantine status.
- A number of these were given the NL-provisional quarantine status, which was later withdrawn following a comprehensive risk analysis. Out of these organisms, only the mite *Tetranychus mexicanus* currently still has the NL-provisional quarantine status.
- The import of propagating material (plants) was the most likely introduction pathway for most of these organisms.
- For a number of these organisms, the initial finding concerned a yet undescribed species: the fungus *Fusarium foetens* in *Begonia* and the gall midge *Contarinia jongi* in *Alstroemeria*. *Fusarium foetens* in particular caused a major damage after its introduction. As far as is known, *C. jongi* has been eradicated.
- A number of these organisms have become established in the Netherlands and are significant pest species for certain plants. Examples include *Thrips setosus* in the cultivation of hydrangea, *Plantago asiatica mosaic virus* (PIAMV) in the cultivation of lilies as cut flowers and the previously discussed *F. foetens*. Since eradication of these organisms is no longer considered feasible, no official measures have been taken or the official measures were lifted after a certain period. PIAMV and *T. setosus* were well-known species, but PIAMV was not known to affect lilies when it was first detected in the Netherlands. *T. setosus* was only known to be present in Japan and South Korea. In Japan, it was considered a 'minor pest'.

Outdoor ornamental horticulture (including cultivation in unheated greenhouses and plastic tunnels)

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Established Q-pests

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- Seven Q-pests have been identified that are established in the Netherlands and are relevant for outdoor ornamental horticulture: the pseudofungus *Phytophthora ramorum*, the nematodes *Globodera pallida*, *G. rostochiensis*, *Meloidogyne chitwoodi* and *M. fallax*, the bacterium *Ralstonia solanacearum* and the fungus *Synchytrium endobioticum*.
- *P. ramorum* affects many plants at tree nurseries. The yield loss from infestations appears so far to be limited, and the organism seems to primarily be a risk for the trade and export of plants at tree nurseries. In the period 2015–2017, the organism was intercepted 39 times on plants from the Netherlands. The problem is that this organism can be present but asymptomatic for an extended period, making it difficult to detect. The organism is present in multiple EU Member States. At present, only the non-EU isolates of *P. ramorum* are listed in Annex II of Implementing Regulation (EU) 2019/2072, but emergency measures apply for all isolates (Commission Decision 2002/757/EC). The EU isolates may eventually be given RNQP status.
- *R. solanacearum* is primarily known as a bacterium that affects potatoes, but it can affect other species; to date, there have been no known infections of ornamental plants grown outdoors.
- *G. pallida*, *G. rostochiensis* and *S. endobioticum* are also primarily known for affecting potatoes. As far as is known, they do not affect ornamental plants, but their presence in soil (including attached soil) may lead to the rejection of consignments due to their quarantine status. *G. rostochiensis* and *G. pallida* are widespread in the Netherlands, with the exception of the 'potato cultivation prohibition areas'. Since 2010, there have been three new findings of *S. endobioticum*, and the risk posed by this organism for the ornamental horticulture sector seems low.
- *M. chitwoodi* and *M. fallax* have a broad range of host plants, including ornamental plants. No information has been found on damage to ornamental plants, and for ornamental horticulture the nematodes primarily pose a risk for the trade and export of plants. To date, the number of official findings of these nematodes in ornamental horticulture is small, but the likelihood of an infestation of these nematodes appears to be increasing. The spread of these nematodes is difficult to control due to the large number of host plants. Plants may be infested without showing any clear symptoms. Inspection of plants is usually visual; if other methods of detection were to be used, the number of findings might increase.

Non-established quarantine pests

- Nine Q-pests have been identified that are not established in the Netherlands and for which the likelihood of an infestation in the ornamental horticulture sector is assessed as relatively high (Figure 2). These organisms are briefly discussed below.
- The bacterium *Xylella fastidiosa*, the longhorn beetles *Anoplophora glabripennis* (ALB: Asian longhorn beetle) and *A. chinensis* (CLB: Citrus longhorn beetle) and the Japanese beetle *Popillia japonica* constitute high risks for the trade and export of ornamental plants, partly due to the large number of plant species they affect. The anticipated direct damage for the ornamental horticulture sector is limited. Greater damage would be expected in nature if ALB would

become established, and in the fruit-growing industry if *P. japonica* would become established. As the climate continues to heat up, the potential damage from all four organisms will increase. These four organisms are included in the EU list of priority pests²⁰ (Commission Delegated Regulation (EU) 2019/1702). EU emergency measures also apply to these organisms, with the exception of *P. japonica*. If an outbreak of *X. fastidiosa*, ALB or CLB occurs, there is an obligation to demarcate an area around the infestation. The effect on trade of such a measure could be huge. For ALB and CLB, no demarcation is required for isolated cases, provided measures are taken to ensure the organism is immediately eliminated. For *X. fastidiosa*, exceptions to the demarcation requirement apply only in very specific situations. There must be proof that the bacterium “was recently brought into the area with the plants on which it was found” or that the bacteria was found at a location that “is physically protected from vectors” (Commission Implementing Decision (EU) 2015/789). In addition, an investigation must uncover no indications of natural spread. (Note: the regulations relating to *X. fastidiosa* have been regularly updated.)

- The most important introduction pathway for *X. fastidiosa* and CLB is the import of ornamental plants, including from other EU Member States. It is possible that *X. fastidiosa* is already present in a small number of locations in the Netherlands, in plants that were imported before the EU emergency measures against *X. fastidiosa* were introduced.
- The most important introduction pathway for ALB is the import of products with wood packaging material from China. International agreements state that wood packaging material must be treated in such a way as to prevent harmful organisms from accidentally being transported in it²¹, but these agreements have proven to be inadequate. Due to the risk from wood packaging material, from 1 April 2013 to 30 June 2020, EU emergency measures were in place for wood packaging material in certain consignments²². These emergency measures have now expired, but the EU requirements to draw up a monitoring plan for wood packaging material and to implement risk-based checks still apply²³. In addition, the NVWA has for many years carried out inspections at sites where materials with wood packaging material arrive, as part of its annual phytosanitary monitoring programme. In these inspections, each site and the surrounding area are inspected for the presence of known and potential Q-pests.
- At present, the most important introduction pathway for *P. japonica* seems to be hitchhiking with air and road transport. The organism may also be spread through trade in plants with attached soil and possibly through fruit. The organism is present on the European continent in the north of Italy, where the infested area is expanding. The likelihood of it spreading to other Member States is considered high. There are currently no specific EU

²⁰ Priority pests are the Q-pests with the “most serious economic, social or environmental consequences” (Article 6, Regulation 2016/2031). These are organisms to which special provisions apply, “including public information, investigation, contingency planning, simulation exercises, action plans focused on eradication, and co-financing of measures by the EU”.

²¹ ISPM (International Standard for Phytosanitary Measures) No. 15, Regulation of wood packaging material in international trade. Food and Agriculture Organisation of the United Nations. See: <http://www.fao.org/3/a-mb160e.pdf>

²² Commission Implementing Decision (EU) 2018/1137 of 10 August 2018 on the supervision, plant health checks and measures to be taken on wood packaging material for the transport of commodities originating in certain third countries. OJ L 205, 14.8.2018, p. 54–61.

²³ Commission Delegated Regulation (EU) 2019/2125 of 10 October 2019 supplementing Regulation (EU) 2017/625 of the European Parliament and of the Council as regards rules concerning the performance of specific official controls of wood packaging material, notification of certain consignments and measures to be taken in cases of non-compliance.

- requirements for measures against this organism. The pathway 'hitchhiking with transportation' is difficult to regulate.
- Outbreaks of ALB and CLB have been successfully eliminated in the Netherlands in the past. The likelihood of timely detection of an outbreak of *P. japonica* when it is still possible to eliminate the beetle seems low. For *X. fastidiosa*, the likelihood of elimination of an outbreak is uncertain. As long as no natural spread has taken place, the bacteria can be eradicated relatively easily by destroying the infected plants.
 - Over the past few years, the Q-pest *Tobacco ringspot virus* (TRSV) has been detected several times in the ornamental horticulture sector, and it is suspected that the virus has spread more widely in the Netherlands and other EU Member States than is officially known. As far as is known, TRSV causes few or no symptoms in ornamental plants, which means the virus can enter the country and survive unnoticed. The virus is subject to regulation primarily due to its harmful effect on a number of fruit crops. No special requirements apply in the EU for this virus in ornamental plants. The virus can spread via vegetative propagation. As far as is known, its natural vectors – species in the nematode group complex *Xiphinema americanum* s.l. – are not present in the Netherlands. However, *X. rivesi* is present in Europe, and this species is known to be a vector for TRSV and three other quarantine viruses. To date, no natural spread in Europe of the TRSV or the other three quarantine viruses has been reported. European populations of *X. rivesi* are not regulated, and there is little information on its spread within Europe. Accordingly, the likelihood of introduction into the Netherlands is highly uncertain.
 - *Tomato ringspot virus* (ToRSV) is related to TRSV. ToRSV is found in the Netherlands less frequently than TRSV, but like TRSV, it can be present asymptomatic. For this virus, specific EU requirements apply for *Pelargonium*, *Malus*, *Prunus* and *Rubus* for third countries where the virus is known to be present. However, the virus can infect other plant species and is suspected to be present in more countries than are currently known about, which means these regulations only reduce the risk from the virus to a limited extent.
 - The fungus *Fusarium circinatum* affects pine trees (*Pinus* spp.) and Douglas firs (*Pseudotsuga menziesii*) and can be transmitted via seeds. Within the EU, the fungus is present in Spain and Portugal. The risk from this organism for the Netherlands seems to be low, due to the Netherlands' unfavourable climate.
 - The bacterium *Pseudomonas syringae* pv. *actinidiae* affects kiwifruit (*Actinidia* spp.) and is present in multiple EU Member States. The acreage where host plants grow is limited in the Netherlands, but at a local level, the impact of introduction could be major, due to the mandatory quarantine measures.
 - The fruit fly *Strauzia longipennis* affects sunflowers (*Helianthus* spp.). The species was first found in Europe in 2010 in the vicinity of Berlin (Germany) and is expected to spread further within Europe.

New harmful organisms, including potential Q-pests

- Since the year 2000, several new harmful organisms have been found in the Netherlands that did not have quarantine status at the time they were detected, but which have the potential to cause considerable damage to plants in outdoor cultivation. Examples include: *Cylindrocladium buxicola* (a fungus that causes twig blight in *Buxus* spp.) and *Cydalima perspectalis* (box tree moth). Eradication of these organisms was not considered feasible at the time of initial detection (and following a survey), and these organisms were not given the NL-provisional Q-status. *C. buxicola* was previously recorded in

Europe in the 1990s, in the United Kingdom. At that time, it was an undescribed species.

- A small-scale literature survey was conducted of potential Q-pests, which led to a large number of organisms being identified. These organisms can mainly enter via imports of plants and wood (including wood packaging material) (Table 2). For many of these organisms, no risk assessment is yet available. A risk assessment is required to determine whether the organism meets all of the criteria of a Q-pest.

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Aquatic and marsh plants

There are no known examples of the introduction into the Netherlands of known or potential Q-pests that cause problems in the cultivation of aquatic plants. There are also no known 'pest alerts' for new harmful organisms specific to aquatic and marsh plants. However, in 2017, the NVWA intercepted the quarantine nematode *Hirschmanniella caudacrena* in a large number of consignments. Since 14 December 2019, special requirements have been in place for certain host plants in relation to harmful nematodes. It is expected that these requirements should reduce the number of infested consignments. The risk to the EU from *Hirschmanniella caudacrena* seems, however, to be low (Jeger et al., 2018).

Table 2. Harmful organisms that are not yet subject to regulations in the EU^a and, as far as is known, are not present in the EU, but are a potential hazard for ornamental horticulture and/or nature in the Netherlands.^b

Organism	Host plants	Area of spread (continents/regions)
Insects and mites		
Buprestidae (jewel beetles)		
<i>Agrilus auroguttatus</i>	<i>Quercus</i> (oak)	North America
<i>Agrilus coxalis</i>	<i>Quercus</i> (oak)	North America
<i>Agrilus fleischeri</i>	<i>Populus</i> spp. (poplar)	Asia
<i>Chrysobothris femorata</i>	Polyphagous on hardwoods	North America
Cerambycidae (longhorn beetles)		
<i>Aeolesthes sarta</i>	Polyphagous on hardwoods	Asia
<i>Batocera lineolata</i>	Polyphagous on hardwoods	Asia
<i>Massicus raddei</i>	<i>Quercus</i> spp. (oak), <i>Castanea</i> (chestnut)	Asia
Hemiptera (true bugs)		
<i>Lepidosaphes ussuriensis</i>	Polyphagous on hardwoods	Asia
Hymenoptera (membrane-winged insects)		
<i>Neodiprion abietis</i>	<i>Abies balsamea</i> (balsam fir)	North America
<i>Zapatella davisae</i>	<i>Quercus</i> (oak)	North America
Lepidoptera (moths and butterflies)		
<i>Cydia latiferreana</i>	<i>Quercus</i> (oak), <i>Castanea</i> (sweet chestnut), <i>Corylus avellana</i> (hazelnut)	North America
<i>Lambdina fiscellaria</i>	Polyphagous, but <i>Abies balsamea</i> (balsam fir) and <i>Tsuga canadensis</i> (Canadian hemlock) in particular	North America
<i>Lymantria mathura</i>	Polyphagous on hardwoods	Asia
<i>Lymantria obfuscata</i>	Polyphagous on hardwoods	Asia
<i>Malacosoma americanum</i>	Woody plants in Rosaceae	North America
<i>Malacosoma disstria</i>	Polyphagous on hardwoods	North America
<i>Phyllonorycter crataegella</i>	Woody plants in Rosaceae	North America
<i>Thyridopteryx ephemeraeformis</i>	Polyphagous on hardwoods and softwoods	Asia, North America
Fungi and pseudofungi		
<i>Fusarium euwallaceae</i> and the vector <i>Euwallacea</i> spp. (bark beetles) ^c	Polyphagous on hardwoods	California (USA), Mexico, Israel, South Africa
<i>Pucciniastrum coryli</i>	<i>Corylus</i> (hazel)	Asia
<i>Phytophthora castaneae</i> (Fungi; syn. <i>P. katsurae</i>)	<i>Castanea</i> (sweet chestnut)	Africa, Asia, Caribbean region, Oceania
<i>Phytophthora quercetorum</i>	<i>Quercus</i> (oak)	North America
<i>Phytophthora</i> spp.	Various (little is known about these species)	East Asia
Disease of unknown origin		
Beech leaf disease	<i>Fagus</i> spp. (beech)	North America

^a For a number of organisms for which a risk assessment for the EU or the EPPO (European and Mediterranean Plant Protection Organisation) area is available, there is an ongoing debate about regulation at the EU level.

^b The organisms are known to be harmful, but for many of the organisms, no risk assessment is available for the EU or the Netherlands.

^c Non-European bark beetles (Scolytinae) including *Euwallacea* spp. are regulated as Q-pests..

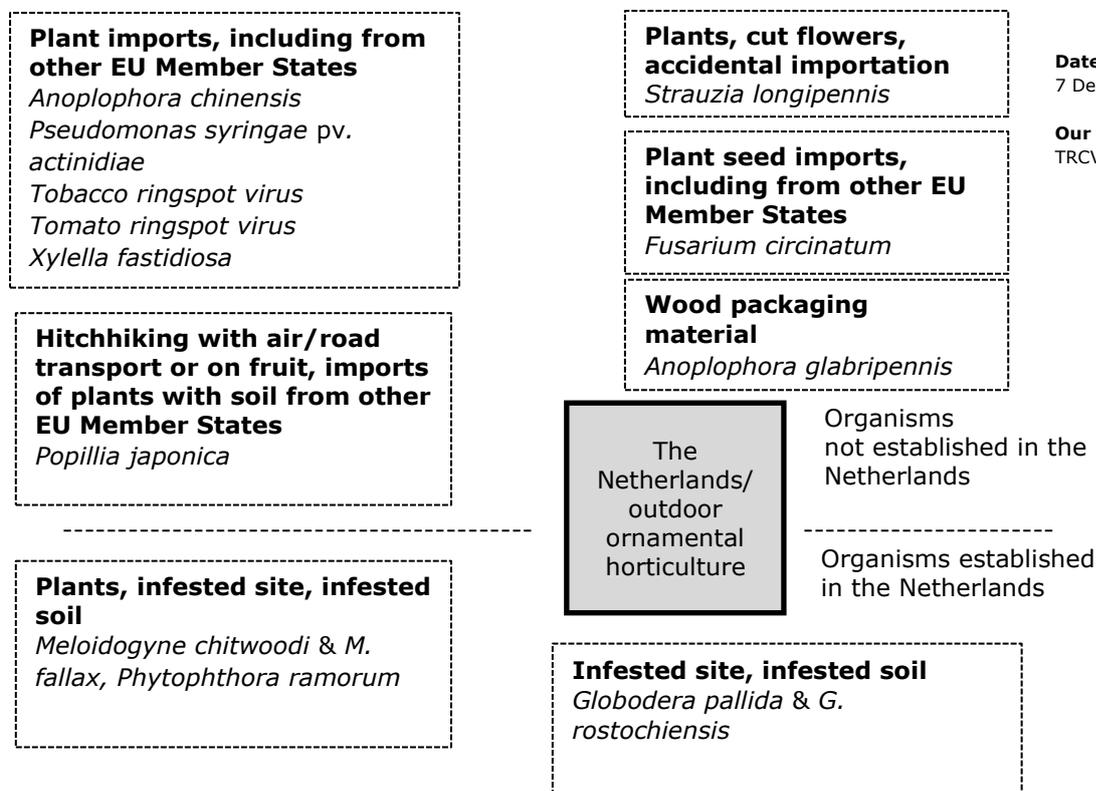


Figure 2. Summary of Q-pests that have a relatively high chance of an infestation and are relevant for outdoor ornamental horticulture. The organisms are categorised based on the most likely pathway(s)/products by which they may be introduced (Note: organisms may enter the country via other pathways/products). Organisms that are not yet present in the Netherlands may be introduced to the ornamental horticulture sector directly or may initially appear in other crops or in nature and then reach ornamental plants via natural spread or other means.

Plant health and nature

- Organisms whose host plants are widespread in nature and that are expected to be very harmful in the Dutch climate are obviously a hazard for nature. Such organisms include the Asian longhorn beetle (*Anoplophora glabripennis*), the emerald ash borer (*Agrilus planipennis*) and the bronze birch borer (*A. anxius*). The Asian longhorn beetle affects a large number of hardwood species, including a number of widespread species such as *Acer* (maple), *Betula* (birch), *Populus* (poplar) and *Salix* (willow). The likelihood of an outbreak of this beetle is relatively high via infested wood packaging material, but two previous outbreaks have been eradicated (see also 'Outdoor ornamental horticulture'). The emerald ash borer and the bronze birch borer affect ash and birch trees respectively; the trees can die within a few years of an infestation. Strict regulations apply to imports of plants and wood from specified countries (countries where the organism is known to be present), so that the likelihood of introduction from these countries is low. However, the emerald ash borer is present in western Russia and has recently become established in the Ukraine; it appears to be expanding its distribution area westward, which means the likelihood of introduction into the Netherlands is increasing. If an outbreak occurs in the EU, official measures will probably only serve to slow down the spread.
- Other Q-pests with a relatively high risk for nature include the longhorn beetle species *Anoplophora chinensis*, *Aromia bungii* and *Saperda candida*, the fungi *Ceratocystis platani* and *Sphaerulina musiva* and the *Rose rosette virus*. The likelihood of an outbreak of these species is assessed as relatively low, with the exception of *Anoplophora chinensis*. Like *A. chinensis*, *A. bungii* and *C. platani* are established in the EU, and further spread of these organisms within the EU may increase the likelihood of an outbreak in the Netherlands. Furthermore, findings of the bacterium *Xylella fastidiosa* and the pine wood nematode *Bursaphelenchus xylophilus* could have an impact at a local level due to the mandatory clear-cut zones (removal of all known host plants) around the site found infested.
- New harmful organisms and potential Q-pests:
 - since 2000, several new harmful organisms have been found in nature, of which a number have caused significant damage, such as *Cydalima perspectalis* (box tree moth) and *Hymenoscyphus pseudoalbidus*, a fungus that causes ash dieback. At the time of their initial finding, these organisms did not have quarantine status, and no official measures were taken because elimination was no longer considered feasible. At the time of the initial detection of *H. pseudoalbidus* in Europe (in the 1990s), the species was still undescribed.
 - Several organisms have been identified that are not yet present in the EU and do not have quarantine status but are known to be harmful in various types of trees and shrubs in their current distribution area (Table 2). For many of these organisms, no risk assessment is yet available. A risk assessment is required to determine whether the organisms meet the criteria of a Q-pest and are thus potential Q-pests.

Pathways for the introduction of known and potential quarantine pests

Ornamental horticulture covers a vast range of plant species, which are associated with a large number of harmful organisms. Harmful organisms, including known and potential Q-pests, may be accidentally introduced via regular imports of various products such as plants, wood and wood products, seeds, fruit and vegetables, cut flowers and cut branches. Harmful organisms may also enter the country in travellers' luggage, through parcel post or as 'hitchhikers' in air and ground freight consignments. Of these pathways, the global trade in ornamental plants is considered to be one of the most important pathways by which harmful organisms are spread around the world (Liebhold et al., 2012). Plant imports have been identified as the most likely pathway for many harmful organisms that have been introduced into the Netherlands. Dutch companies import a large number of ornamental plants, in terms of both volume and number of species, from every continent except Antarctica. In import inspections, more Q-pests are intercepted on cut flowers than on plants, but plants are still considered as a more important introduction pathway, since the chance that the organism will actually become established is much higher with an infested plant than with an infested cut flower. The import of products with wood packaging material is a pathway for a range of organisms that pose a risk to arboriculture and nature (Figure 2). Wood packaging material is subject to international requirements (the wood must be treated), which, if compliance is adequate, should reduce the risk to virtually zero (see 'Outdoor ornamental horticulture'). The numerous interceptions of harmful organisms indicate that wood packaging material is not always adequately treated. EU Member States are also required to draw up a monitoring plan for wood packaging material and carry out risk-based checks (see also 'Outdoor ornamental horticulture – non-established Q-pests').

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Importation of ornamental plants and phytosanitary legislation

Most plant species can be imported into the EU without a prior risk analysis, but they must comply with current phytosanitary legislation. Current phytosanitary legislation specifies a number of general phytosanitary requirements that certain plants must meet in order to be imported. These general requirements, which include visual inspections and requirements for attached soil, limit introductions of new harmful organisms, but they cannot entirely prevent them. For certain plant species (from specific countries or areas), additional requirements relating to specific Q-pests apply. Latent infections cannot be detected through visual inspections and certain stages of insects and mites, such as eggs, are difficult to detect. Furthermore, only a sample of the plants is inspected. The requirements for attached soil are insufficient to entirely prevent the introduction of soil pathogens. For example, plants that were grown in natural soil may be imported, provided the soil is removed. However, removing the soil does not eliminate any root pathogens that are already in the roots. Plants that were grown in natural soil are therefore a greater risk for the introduction of soil pathogens than plants that were grown in clean artificial growing media, with contact with the soil being prevented and clean (pathogen-free) water being used. Furthermore, the likelihood of introduction of new harmful organisms via plant imports is generally considered to be higher for species-origin-combinations that have not previously or have only occasionally been imported than for species-origin-combinations that have been imported for many years without any new harmful organisms being detected. For plants that have been imported for many years from the same production sites without any indications of accidental importation of known or

potential quarantine pests, the risk seems to be relatively low. However, for this to be true, the plants must always come from the same production site and must always be grown under the same conditions, and no new harmful organisms must be introduced into the area where the production site is located.

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A number of plant species are subject to an import ban from certain third countries. The Plant Health Regulation (Regulation (EU) 2016/2031) that came into effect on 14 December 2019 also provides for the possibility of an import ban on plants and products that, on the basis of a preliminary assessment, “present a pest risk of an unacceptable level” (Article 42). Based on this legislation, the import of plants from 35 plant genera and species has been (temporarily) banned since 14 December 2019. Seeds, naturally and artificially dwarfed plants and in-vitro material are exempt from this ban (Commission Implementing Regulation (EU) 2018/2019)²⁴. The import ban on a genus or species from a specific source can be lifted based on a risk assessment. Because many more plant genera and species are imported than the 35 currently listed in the implementation regulation and new harmful organisms have been found on many other genera and species, the likelihood of introduction of new harmful organisms via plant imports remains relatively high.

The risks from new harmful organisms may be reduced by making greater efforts to identify new hazards (horizon scanning) and then putting timely measures in place (regulating to reduce the likelihood of introduction). Alerts for new hazards in Europe are issued via the alert systems of the European and Mediterranean Plant Protection Organisation (EPPO) and the European Food Safety Authority (EFSA). Each month, EFSA publishes the results of its horizon scanning, in which it conducts daily scans of the media and scientific literature for new and emerging risks for plant health. The EPPO publishes monthly reports via the EPPO Reporting Service. These reports are discussed in a European context. Because some organisms have not yet been described or are not well known as harmful organisms, such an approach has its limitations. For example, an organism may cause very little damage in its area of origin, perhaps because the host plants are not particularly susceptible and/or due to the presence of natural predators, whereas the same organism could cause considerable damage if it were introduced elsewhere. Examples of past introductions indicate that some new harmful organisms cause considerable damage after introduction, even though little or nothing was known about those organisms previously (Annex 5).

Introduction of harmful organisms via luggage and parcel post

Plants, seeds, plant products and other objects may be imported in travellers’ luggage and through parcel post, which can result in the accidental importation of harmful organisms (Caton & Griffin, 2006; Ramasodi, 2008; Giltrap et al., 2009; Kaminski et al., 2012). The NVWA monitors travellers’ luggage in conjunction with Customs; it also monitors parcel post in collaboration with Customs and courier services (NVWA, 2018). These checks show that compliance with European phytosanitary requirements is often lacking; this is evident from interceptions of products that are subject to an import ban. Limited information is available about the percentage of luggage that is checked and the species and quantities of plants

²⁴ Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018 establishing a provisional list of high risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031 and a list of plants for which phytosanitary certificates are not required for introduction into the Union, within the meaning of Article 73 of that Regulation. OJ L 323, 19.12.2018, p. 10–15.

and plant products that passengers bring into the country, which makes it difficult to estimate the risk posed by travellers' luggage. The fact is that many deficiencies have been observed with these checks (NVWA, 2016;2018). EU legislation regarding travellers' luggage and parcel post was tightened on 14 December 2019 (Regulation (EU) 2016/2031). A phytosanitary certificate is now required for plants, seeds and virtually all plant products imported in travellers' luggage, the same as for the mainstream trade in such products. A list of "*plants, plant products and other objects*" may be drawn up showing the maximum quantities that may be carried in travellers' luggage without a phytosanitary certificate (Article 75, Regulation (EU) 2016/2031), but for the time being, the EU has not made any exceptions for travellers' luggage. Harmful organisms can also be brought into the country via small quantities of plants and products. Exceptions for travellers' luggage should be permitted only if a risk assessment shows that the risk is low. Regulation (EU) 2016/2031 also requires "*Member States, seaports, airports and international transport operators*" to inform travellers about the phytosanitary requirements for their luggage. Due to limited information and the fairly recent tightening of the legislation, the risk from travellers' luggage and parcel post relative to the risk from other introduction pathways cannot be properly assessed.

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Surveillance and timely detection of known and potential Q-pests

It is important for an outbreak of a known or potential Q-pest to be detected at a point when the organism has not yet spread far and eradication is still feasible. For many organisms, the likelihood of timely detection of an outbreak through surveys based on a random selection of inspection sites is low. After all, the organism would have to be found while the infested area is still small, whereas in many cases the organism is able to establish itself across a large area. In addition, several harmful organisms have been introduced into the EU for which, following the initial official finding (and a survey), eradication was considered to be unfeasible or was found to no longer be feasible. To increase the likelihood of timely detection, the NVWA partially targets sites where the chance of introduction is relatively high with its surveys. For example, as part of its annual phytosanitary monitoring programme, the NVWA conducts surveys at the sites of companies that import plants. It is not known what percentage of imported consignments are inspected during these surveys. For example, plants may be delivered to retailers immediately after import or only remain at a cultivation site for a short period, which means they would be excluded from the survey.

Generally speaking, the number of sites that can be visited and the number of inspection opportunities during the annual survey are limited. Rapid reporting by growers and cultivation consultants of a suspected infestation with a new harmful organism may increase the chance of timely detection. However, generally speaking, growers seem reluctant to inform the NVWA at an early stage about the suspected presence of a new harmful organism. Eradication measures can have a significant impact for growers. For the detection of known and potential quarantine pests in nature, existing networks of volunteers and professionals who often visit nature can play a role. The same applies to private individuals who are not directly involved in such networks.

A recent review provided an overview of the various methods that could be used in surveillance for non-native insects in forests (Poland & Rassati, 2019). Every method has advantages and disadvantages, and the development of a cost-

effective surveillance programme for timely detection of outbreaks of known and potential quarantine pests would require a thorough analysis of the “trade-offs between surveillance effort and management costs” (Poland & Rassati, 2019).

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B. Risk assessment for nature and environment

Hazards for nature and the environment

A range of hazards for nature and the environment may be present in or introduced through the ornamental horticulture production chain. This section discusses the hazards and assesses the risks posed by:

- the introduction of invasive alien species through the import of ornamental horticultural products (with the exception of the harmful organisms already discussed in Section A 'Plant health risk assessment');
- the introduction of non-native biological control agents;
- the use of plant protection products and biocides, for the environment.

More information can be found in Annexes 6 and 8.

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Risks from the import of ornamental plants

Escape of ornamental plants into the wild

The import of ornamental plants is considered the most important pathway for introduction of non-native plant species into the Netherlands. More than 60% of non-native plant species found in the wild were introduced via the ornamental horticulture production chain.

To determine whether a plant is non-native or native, BuRO used the Standard List of the Flora of the Netherlands 2003 (Tamis et al., 2004). Non-natives are all plants for which the 'indigenous indicator code' is not 'i' (= indigenous origin). The list of non-native species was supplemented with all known non-native species that have since been found in the wild in the Netherlands and included in the Dutch National Database of Flora and Fauna (NDFF, 2018).

In the Netherlands, 2,438 non-native plant species have been found in the wild, of which at least 1,529 species are or have been traded in the Netherlands or are related to the trade of ornamental plants in another way. Of these 1,529 species, 158 are reproducing and have thus become established in the wild. Ornamental plant species can escape into the wild if their seeds spread from gardens, if people dump plants and garden waste in nature areas or if they are deliberately released into nature areas.

Approximately 40% of the 158 established species (63 species) have been assessed as invasive or potentially invasive. Examples of established ornamental plant species that behave like invasive species include:

- Himalayan balsam (*Impatiens glandulifera*);
- tree of heaven (*Ailanthus altissima*);
- water primrose (*Ludwigia grandiflora*);
- black cherry (*Prunus serotina*);
- parrot's feather (*Myriophyllum aquaticum*);
- swamp stonecrop (*Crassula helmsii*);
- giant hogweed (*Heracleum mantegazzianum*); and
- Japanese knotweed (*Fallopia japonica*).

Ornamental plant species that have become established in the wild can have a range of effects. They may have an impact on biodiversity, for example by

displacing native plants through their overwhelming presence. In nature protection areas, such as Natura 2000 areas, the ecological goals could be jeopardised if invasive plants become established, native species disappear and the vegetation composition becomes less diverse. Invasive plants can also give rise to health problems and cause damage to buildings, pipes and infrastructure.

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The effects of different plant species are interrelated and can have an impact on the entire ecosystem. For example, when invasive aquatic plants become abundant, they displace other aquatic plants. If the plant mass dies, it leads to a lack of oxygen in the water. This has a negative impact on the animals that live in the water and on the animals that feed on these animals.

Established ornamental plant species can also have an impact on ecosystem services²⁵. Ditches can become overgrown with invasive aquatic plants. The plant mass can become detached and accumulate in pumping stations, dams and other pieces of water infrastructure. This impedes the flow of the water. It is, therefore, possible that after heavy rain, the water cannot drain away and flooding occurs. This can cause damage to homes and agricultural crops, for example. Invasive aquatic plants grow in areas where recreational boats are used. A thick layer of aquatic plants can cause significant problems for these boats, because they can wrap themselves around the propeller. In risk assessments of invasive alien species, the impact on ecosystem services is often not quantified or is only partially quantified.

Under the EU Invasive Species Regulation (Regulation (EU) 1143/2014), an import ban, including from other EU Member States, applies for 36 plant species (as at 1 September 2020); these species appear on the Union List. The Union List applies to all Member States, which means the import, cultivation, trade, possession and transport of these species is banned in all EU Member States. There is no national list in the Netherlands of invasive alien species of which the import, including from other EU Member States, is banned. However, for a number of plant families and genera, an import ban is in place under European phytosanitary legislation (Regulation (EU) 2016/2031) for plants from certain third countries. When importing plants, importers only have to specify the genus names of the plants. The absence of species names makes monitoring the import of banned species difficult. Most plant species may be imported without a prior assessment for potential invasiveness.

On average in the period 2005–2014, around 850 different plant genera per year were imported into or via the Netherlands from more than 50 non-EU countries. New species for new markets are often sought on a 'trial and error' basis. In 2012, 20% of all unique genus-origin-combinations of non-native plants imported in the four years prior were no longer being imported. The volume represented by this 20% amounted to only 0.2% of the total imports of non-native plants. Due to the significant variation in imported ornamental plant species, the likelihood of the introduction of invasive species is high. The likelihood that planted species may escape into the wild, become established and ultimately become a nuisance depends in part on introduction pressure and species characteristics such as winter hardiness.

²⁵ Ecosystem services are services for the benefit of humans that arise from natural resources in ecosystems or that are related to the functioning of ecosystems. Examples include pollination, water supply and recreation in nature areas.

The number of first sightings of ornamental plant species in the wild has shown a strong upward trend over the years (Figure 4). If government policy remains unchanged, it is expected that this trend will continue. One explanation for the sharp increase in first sightings of new ornamental plant species over the past few decades is the globalisation of the trade in ornamental plants. Moreover, a first sighting does not necessarily mean that a species will become established. In 2014, BuRO commissioned a horizon scanning project to identify invasive alien species that could potentially affect the Netherlands (Matthews et al., 2014). This scan and other horizon scans revealed a range of species in areas with comparable climates to the Netherlands that could be harmful for biodiversity if introduced into the Netherlands.

Invasive alien species also have economic consequences. In addition to the costs of control and eradication, there are also costs that arise directly from the effects on nature, public health, security and infrastructure. These costs have not been quantified for non-native ornamental plant species in the Netherlands. For species on the Union List that are present in the Netherlands, there is a legal requirement to take control measures. Non-established species must be eradicated. For newly identified and potentially invasive alien species that are not on the Union List, there are no regulations regarding control.

Control of invasive alien plants is often difficult and not always successful. Little information is available about the cost of controlling invasive ornamental plant species. However, some data are available for aquatic plants. To preserve biodiversity and water flow, aquatic plants have to be removed from various locations. This means higher costs for water boards and other public authorities. The extra maintenance costs for waterways that have become overgrown with non-native aquatic plants amount to around €2 million per year (UVW, 2017). Control of the small water primrose on Tiengemeten island cost around €150,000 (Withage et al., 2017), but the plant was not yet fully established there.

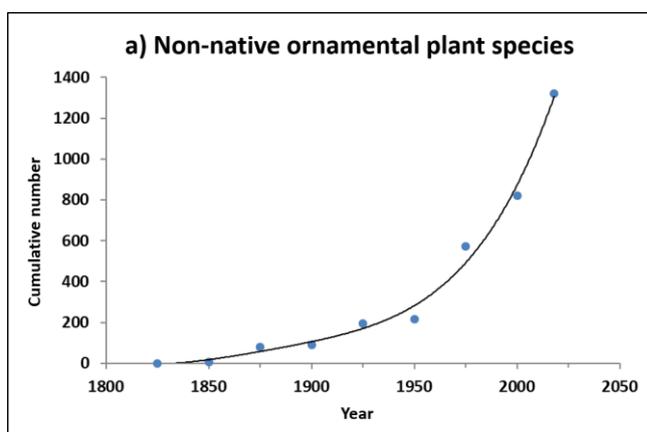


Figure 4. Cumulative number of known first sightings of new non-native ornamental plants in the wild (n=1321). For 208 of the 1,529 species, there is no information about the year of the first sighting. (Source: (Pieters et al., 2018))

The likelihood of inexpensive eradication is highest with early intervention. The Netherlands has an effective detection system that relies on volunteers who quickly report new sightings of ornamental plants in the wild. However, for many new non-native species not on the Union List, whether they will turn out to be a problem species is unknown, because there is no reliable estimate of any possible negative long-term effects. As a result, it is difficult for landowners to assess whether a new non-native species will become a problem species and should therefore be controlled as soon as possible. After all, most species are not invasive. By the time it becomes clear that a non-native species is having a negative impact on biodiversity, control may have already become a difficult and expensive task.

Although the government and public authorities have expended significant effort and money over many years to control invasive plant species, a number of these same species are still available for sale. Examples include the rugosa rose (*Rosa rugosa*), Japanese knotweed (*Fallopia japonica*), swamp stonecrop (*Crassula helmsii*) and various cotoneaster species.

Species that were imported accidentally

Non-native species that can potentially be harmful for native flora and fauna may be accidentally introduced with plant imports, from both third countries and other EU Member States. Such species may include plants (weeds), insects, mites, gastropods, etc. In the Netherlands, 658 species have been found in the wild that are known to have been accidentally imported via the ornamental horticultural production chain. Of these species, 115 have become established in the Netherlands, and 41 are invasive or considered potentially invasive (Pieters et al., 2018). Most of these species are insects.

The impact of these species on biodiversity is usually considered to be small, but with a high degree of uncertainty. The impact on ecosystems is known for 12 of the 41 species; the impact is small to moderate, with a high degree of uncertainty. Species that were imported accidentally may also have a negative impact on human health and cause nuisance.

Examples of organisms that were probably introduced into the Netherlands via the ornamental horticulture production chain and that have an impact on biodiversity include the Portuguese slug (*Arion lusitanicus*) and the Argentine ant (*Linepithema humile*). The Portuguese slug is considered to be a potentially invasive alien species due to its rapid spread and its potential impact on the native red slug (*Arion rufus*). In a number of countries in Europe, it has been observed that the native slug has been displaced in urban areas. Both species were observed in a study in Wageningen in 2009. The Argentine ant displaces other ant species, such as the native common black ant (*Lasius niger*). Because the Argentine ant is not as good at spreading plant seeds as native ants, the Argentine ant is also an indirect threat to flora. Common ragweed (*Ambrosia artemisiifolia*) is an example of a species that has an impact on human health. Common ragweed produces allergenic pollen in autumn. The Asian tiger mosquito (*Aedes albopictus*) can transmit a range of diseases. The invasive garden ant (*Lasius neglectus*) causes nuisance in houses, and its burrowing also causes damage to paving.

An example of an invasive alien species that may be accidentally imported with pot plants and that is not yet established in the Netherlands is the New Zealand

flatworm (*Arthurdendyus triangulatus*). This worm feeds on earthworms and has the potential to cause their near-total disappearance. Because earthworms are an important source of food for a range of animals, this has a significant impact on biodiversity. The absence of earthworms also has a negative impact on pasture yield levels. In Northern Ireland, the yield reduction from 0.8 New Zealand flatworms per m² has been estimated at 7.4%. Like the control of ornamental plants that have escaped into the wild, the control of organisms that were imported accidentally is often difficult and expensive. In 2019, the species was placed on the Union List²⁶.

For several organisms that could potentially be imported by accident, it is estimated that, if they were to become established in the wild, they could cause harmful effects. However, there is no European or national legislation that could provide a basis for imposing measures if such an organism is intercepted or found. No enforcement action can be taken when the presence of these organisms is detected, with the exception of species that are banned under phytosanitary legislation or are on the Union List.

The number of first sightings in the wild of species that have been accidentally imported via the ornamental horticulture production chain is increasing (Figure 5). Here, too, it should be remembered that a first sighting does not mean that a species will become established. The likelihood that species will become established and invasive is highest for imports from temperate climate zones.

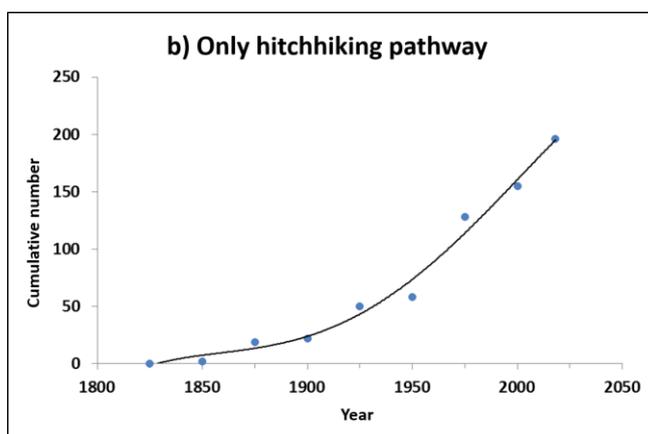


Figure 5. Cumulative number of known first sightings in the wild of species that were exclusively imported accidentally²⁷ in the ornamental horticulture production chain (n=196). For 462 of the 658 species, there is no information about the year of the first sighting. Source: (Pieters et al., 2018).

Knowledge of invasive alien species and their impact is still insufficient among various actors such as citizens and professional gardeners. A survey²⁸ conducted in 2015 revealed that at secondary schools and vocational schools few learning

²⁶ Commission Implementing Regulation (EU) 2019/1262 of 25 July 2019 amending Implementing Regulation (EU) 2016/1141 to update the list of invasive alien species of Union concern.

²⁷ A species counts as being exclusively imported accidentally if it has only ever been imported accidentally.

²⁸ See: <https://www.nvwa.nl/onderwerpen/invasieve-exoten/documenten/dier/dieren-in-de-natuur/exoten/publicaties/inventarisatie-en-uitkomsten-lesmateriaal-invasieve-exoten>

resources about invasive alien species were available, even though it is highly likely that the students will encounter these pest species in their future careers (Verbrugge & Rutenfrans, 2015). In 2014, invasive alien species were mentioned rarely or not at all in Natura 2000 management plans, even though invasive alien species represent a growing threat to biodiversity and the cost of controlling them continues to rise (Siebel & Reichgelt, 2014).

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Risks from non-native organisms used for biological pest control purposes

In recent years, the agriculture and horticulture industries have seen not only a rise in the numbers of organisms being used for biological pest control, but also a rise in the range of species used (Loomans, 2015). One key reason for this is the desire to use fewer plant protection products. Research by Radboud University shows that there are currently 38 species authorised and offered for use in biological pest control in open-field and/or greenhouse cultivation in the food crop and ornamental horticulture production chains (Pieters et al., 2018). The 38 species comprise 11 parasitic wasps, 11 predatory mites, 5 nematodes, 4 beetles, 4 flies, 2 bugs and 1 net-winged insect. It is not always clear whether a species is native or non-native. Of these 38 species, 20 are most likely native (including 2 with cosmopolitan distribution). Of the 18 non-native species, 9 are listed in the Dutch Species Register (NSR) as 'non-native species observed in the wild in the Netherlands' or as 'expected non-native species', and 9 are not listed in the NSR. A first sighting is described for seven of the nine species listed in the NSR.

Since 2005, the Netherlands has had a 'white list' – a list of species that are already being used for biological pest control. New native and non-native organisms may only be used for biological pest control if permission is granted by the competent authority (Loomans, 2015), which in this case is the Netherlands Enterprise Agency (RVO) on behalf of the Ministry of Agriculture, Nature and Food Quality. The list of approved organisms is set out in the Nature Conservation Regulation (*Regeling natuurbescherming*) (Ministerie van Economische Zaken, 2016). For approval to be granted, the organism must undergo an environment-focused risk assessment, as described by Van Lenteren et al. (2006). Factors that determine the risk of damage to native flora and fauna by organisms used for biological pest control include the capacity of the organisms to become established and to spread, the range of the host plants/prey and the direct and indirect impact on species that are not the target of the pest control (Van Lenteren et al., 2003; Van Lenteren et al., 2006). Exemptions may be requested from the Netherlands Enterprise Agency (RVO) for the use of organisms that are not on the 'white list' (RVO, 2019), after which the NVWA will assess the risks. The release of organisms for biological pest control in the Netherlands is therefore regulated.

There are also international guidelines (written by the International Plant Protection Convention (IPPC)) aimed at preventing harmful effects on the environment, including on non-target organisms, from organisms used for biological pest control (IPPC, 2005, aangepast in 2017). In accordance with these guidelines, it is also prohibited in the Netherlands to release animals into the wild (Nature Conservation Act (*Wet natuurbescherming*), Section 3.34(1)), but the guidelines on importing, transport and research are not enshrined in legal frameworks in the Netherlands. Locations that are not contained provide an opportunity for animals to escape into the wild and are implicitly covered by this

ban. However, because there is no obligation for people to report that they are working with non-native species, there is no way of monitoring how well contained these species are.

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Of the organisms currently permitted to be used for biological pest control, only a few species have become established in the Netherlands. As far as is known, the non-native organisms permitted to be used for biological pest control in the food crop and ornamental horticulture production chains do not currently have an undesirable impact. The only possible exception is the predatory bug *Orius laevigatus*. It is on the list of permitted species, but it has also been identified as potentially invasive, because it competes with native bugs from the same genus and thus could have a negative impact on biodiversity (Pieters et al., 2018). Since the *Orius laevigatus* is from southern Europe, it could also reach the Netherlands through natural expansion (Aukema & Loomans, 2005) or through internal EU traffic.

An example of a non-native organism that has been used for biological pest control in the past and that has had undesirable consequences for biodiversity is the harlequin ladybird (*Harmonia axyridis*). This ladybird was released to control a range of aphid species in both greenhouse and open-field cultivation. It appears to be able to survive Dutch winters and displace native ladybird species. Its use for biological pest control is no longer permitted.

Although the risks from the use of organisms for biological pest control transcend national borders, the European Union does not currently have a harmonised assessment and approval policy for organisms to be used for biological pest control (Hunt et al., 2008; Mason et al., 2017). If such organisms are released in a country where they are not regulated, they could spread naturally or through human actions to a neighbouring country where they are banned due to the risk of undesirable side effects in nature.

Plant protection products and biocides

The majority of the non-plant-based substances found on ornamental plants are intentionally introduced into the production chain as plant protection products. Plant protection products are products that are intended to protect plants from harmful organisms, to influence their growth (not including nutrients), to preserve plant products, to destroy unwanted plants or parts of plants or to restrict or prevent the undesirable growth of plants (Ctgb, 2019b). Biocides are also used in the ornamental horticulture sector. Biocides are products that are used to destroy, repel, render harmless or prevent harmful or unwanted organisms (such as bacteria, viruses, fungi and rats) (Ctgb, 2019a). Biocides for use in the agriculture industry are approved for general hygiene purposes and may not contain claims about the protection of plants or plant products, or they will be classified as plant protection products (Ctgb, 2017). Disinfectants (plant protection products and biocides) are primarily used for the decontamination of tools, floors, machinery, etc. and are not applied to the plants themselves. Furthermore, after the harvest of cut flowers, bactericides are applied to the harvesting water, flower barrels (buckets, etc.) and growing medium for use in vases to prevent bacterial growth and extend the life of the flowers. Plant protection products and biocides are thus

used throughout the entire cultivation process for a wide range of purposes, depending on the type of cultivation.

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Legislation and authorisation of plant protection products and biocides

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Plant protection products and biocides may be used only if they have received authorisation or an exemption under the Plant Protection Products and Biocides Act (Wgb). This legislation is based on European regulations and directives. In the Netherlands, the Board for the Authorisation of Plant Protection Products and Biocides (Ctgb) assesses whether plant protection products and biocides are safe for people, animals and the environment. When used according to the legal instructions for use, the risks for people and the environment have been assessed as acceptable by the Ctgb. The effects of combinations of products are not systematically taken into account in the assessment, but cumulative effects are currently considered at the European level.

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Dutch plant protection products and biocides policy is determined by the European Plant Protection Products Regulation (Regulation (EC) No 1107/2009)²⁹ and the European Biocidal Products Regulation (528/2012)³⁰. There is also the Sustainable Use Directive (Directive 2009/128/EC)³¹, which provides a framework for the sustainable use of plant protection products, including by promoting integrated plant protection. Dutch policy with regard to plant protection is described in the Second Memorandum on Sustainable Plant Protection 2013–2023, Healthy Growth, Sustainable Harvest (Ministry of Economic Affairs, 2013). Integrated plant protection is an important approach within this policy. Integrated plant protection is about preventing and controlling weeds, pests and diseases through a combination of products and measures, thereby minimising the risks for human health and the environment³². The goal is to prevent or control the presence of harmful organisms through the use of mechanical or biological control methods and low-risk products. The interim evaluation of the policy memorandum was released by the Netherlands Environmental Assessment Agency (PBL) in June 2019 (PBL, 2019).

The active substances in plant protection products and biocides are assessed at a European level, based on a harmonised European assessment framework. EFSA (European Food Safety Authority) conducts this assessment for plant protection products, and the ECHA (European Chemicals Agency) for biocides. Authorisation of specific products containing those active substances is done by the Member States. For authorisation assessments of plant protection products, Europe is divided into three zones (northern, central and southern). For each zone, the authorisation assessment is conducted by one of the Member States in accordance with the European assessment framework. The assessment then applies to the other Member States in the same zone; they can simply adopt the authorisation.

²⁹ Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. OJ L 309, 24.11.2009, p. 1–50.

³⁰ Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (Text with EEA relevance). OJ L 167, 27.6.2012, p. 1–123.

³¹ Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (Text with EEA relevance). OJ L 309, 24.11.2009, p. 71–86.

³² There are various definitions of 'integrated plant protection'; some people talk about 'using as few chemical products as possible' instead of 'having the least possible impact on the environment'. This is not the same thing, since one product may have a much higher environmental impact than another product (see also Annex 10: Glossary).

Member States may set additional risk-reducing measures if warranted by specific national circumstances.

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For biocides, individual Member States assess the products and their applications. If a product is authorised by one Member State, other Member States may adopt this authorisation via mutual recognition. Producers can also apply directly for EU-wide authorisation for a product. Products are approved for a period of 10 of 15 years, after which a reassessment is necessary.

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It is possible, under certain conditions, to extend an authorisation for 'minor uses' (Article 51 of Regulation (EC) No 1107/2009). Since 2018, due to a reclassification of crop groups, most ornamental plants fall into the 'minor crops' group, which means the possibility of an extension for permitted products has increased. Furthermore, if no other method of pest control is possible and if certain conditions are met, an exemption for an unapproved product for a maximum of 120 days may be granted under Article 53 of Regulation (EC) No 1107/2009 (Section 38 of the Plant Protection Products and Biocides Act). Several exemptions are granted for ornamental horticulture each year.

Use of plant protection products and biocides

Approximately 390 plant protection products are authorised for the 'ornamental horticulture' area of application. In total, these products contain around 170 unique active substances or unique combinations of active substances. As well as chemical active substances, authorised products contain 150 microbiological preparations, consisting of fungi or bacteria, as the active component. Most products contain a single active substance, but in a number of cases, products contain a combination of two active substances. In total, these products are authorised for over 2,200 applications, of which most act as a fungicide (35%), herbicide (29%) or insecticide (21%). Data of 2016 from Statistics Netherlands (CBS) show that the use of plant protection products, in kilogrammes of active substance per hectare, is higher for the greenhouse cultivation of flowers than for other types of cultivation, despite the fact that the use per hectare declined by 25% between 2012 and 2016. The use of such products is particularly high in the cultivation of roses (81.8 kg/ha), chrysanthemums (76 kg/ha) and gerberas (40.5 kg/ha). The use of plant protection products among tree nurseries and flower breeders is significantly lower, at 7.4 kg active substance per hectare. Given the relatively small acreage used for greenhouse flower cultivation and for tree nurseries and flower breeders (0.4% and 2.2% respectively of the total acreage for all cultivation sectors), these sectors' contribution to the total plant protection product use in the agriculture and horticulture industries is small. To reduce the use of and dependence on chemical plant protection products, integrated plant protection is applied and encouraged through research and information campaigns. Application of this methodology in practice can be seen in the greenhouse cultivation of flowers, in which the use of biological control increased between 2012 and 2016 from 45% to 70% of the cultivated acreage (PBL, 2019). Very little data are available on the use of biocides in the ornamental horticulture sector.

NVWA inspections have revealed significant differences between different types of cultivation in terms of compliance with laws and regulations. Compliance for greenhouse cultivation of ornamental crops was lowest in the ornamental horticulture sector. In the open-field cultivation sector, compliance with regard to

the use of chemicals was higher for plants at tree nurseries and perennials than for floristry plants. Two possible explanations for low compliance have been suggested by field experts: there are insufficient products to control certain pests and diseases or control is only possible by using large quantities of plant protection products (NVWA, 2017). The PBL's interim evaluation of the Policy Memorandum also showed that growers' assessment of the range of products available between 2010 and 2017 remained poor (PBL, 2019). For growers, an effective set of plant protection products and measures is important to prevent yield loss and to comply with trade and export requirements. Adjustments to the crop group classifications and the 'extrapolation document for effectiveness and phytotoxicity in ornamental horticulture' published by the Ctgb in 2018 mean that there are now more possibilities to broaden the range of authorised products. The possible impact of the recent changes in authorisation guidelines on the product range is not yet known.

In its monitoring programmes, the NVWA does not inspect ornamental horticultural products for residues of plant protection products. Nor does such an inspection take place for imported ornamental horticultural products. The limited data available for residues on Dutch and imported ornamental horticultural products indicate that cut flowers are intensively treated with many different plant protection products. Substances have also been found that are not authorised in Europe (Toumi et al., 2016; EC, 2019). Consumers, workers and processors in the sector may come in contact with (persistent) residues of these products. In theory, the residues may also enter the environment. The use of plant protection products by Dutch ornamental horticulture companies in third countries is being closely examined, and measures are being taken to limit the use of hazardous products (NOS, 2019; WUR, 2019a) (IMVO, 2019).

Risks from plant protection products for nature and the environment

Although the Ctgb, in its authorisation procedure for plant protection products, establishes the risks from the use of the individual products for nature and the environment based on a risk assessment, measurements (including instances of surface water standards being exceeded) show that the risks are not always negligible (Deltares, 2018b; 2018a). Despite a decrease in emissions to surface water, in its interim evaluation of the Policy Memorandum, the PBL concluded that the interim target of a 50% reduction in the number of instances in which surface water quality standards were exceeded in 2018 had not been achieved. The majority of exceedances were recorded in ditches near tree nurseries, flower bulbs, fruit orchards and greenhouses. Standards may be exceeded because the legal instructions for use were not followed when the chemicals were applied, but there may be other causes, such as insufficient harmonisation between the plant protection product authorisation procedure and water quality standards (PBL, 2019; RIVM, 2019a). When the standards are exceeded, negative effects on the environment cannot be excluded. Most of the residues found in groundwater are related to products that are no longer authorised. Three active substances found in groundwater are an exception to this rule and are still authorised. These are bentazon, glyphosate and mecoprop-P, although the latter is not authorised for use in ornamental horticulture (Ctgb, 2018a; PBL, 2019). Of course, authorisation does not mean that the products are actually used in ornamental horticulture.

According to emission calculations for greenhouse horticulture for the period 2004–2016, the burden on aquatic life in this period decreased by up to 90%. The

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vast majority of the environmental impact from this type of cultivation (ornamental plants and vegetables grown in greenhouses) was caused by the use of insecticides (WUR, 2018a). According to the study, active substance use (in kg/ha) in cut flower cultivation in the period 2004–2016 decreased by 60% (WUR, 2018b). Measurements also showed a decrease, although exceedance of water quality standards were observed throughout the period (Deltares, 2018b;2018a). An earlier study, focusing on the monitoring of imidacloprid in surface water in a number of bulb, greenhouse and arboriculture regions in the Netherlands, found that no decrease, or only a slight decrease, in levels was detected after additional treatment measures (of discharged water) were implemented for this product on 1 May 2014 (CML, 2015). Given the obligation to filter discharged water, which took effect on 1 January 2018, it is expected that emissions of plant protection products to surface water will decrease.

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Plant protection products may also enter the environment through the composting of ornamental horticultural products that contain residues of plant protection products. This may be important for ornamental horticultural products originating in third countries, where persistent chemicals are still being used. However, it is unclear to what extent the composting of ornamental horticultural products contributes to organic pollutants in fertilisers.

In addition to their intended purpose, insecticides may also have harmful effects on useful insects. For example, neonicotinoids have raised awareness in recent years due to their harmful effects on bees. In 2013, EFSA issued a specific guideline for assessing the risks to bees from plant protection products (EFSA, 2013). This guideline has not yet been adopted at a European level. A number of elements of the draft guideline are currently being updated. In April 2018, the EU Member States endorsed the proposal of the European Commission to ban the outdoor use of three neonicotinoids (clothianidin, imidacloprid and thiamethoxam).

A 2014 risk assessment by BuRO, which included 25 plant protection products detected on ornamental plants from Dutch garden centres, described the uncertainty about the hazards for bees from specific systemic pesticides³³ (neonicotinoids). Bees are exposed to plant protection products primarily via nectar and pollen from flowering plants that are grown in greenhouses before being planted in gardens (BuRO, 2014). A 2017 study showed that the number of products that are harmful to bees and are applied to ornamental plants is decreasing (Greenpeace, 2017).

The illegal use of products can also lead to harmful effects for bees. In 2016 and 2019, the NVWA reported incidents of mass mortality of honey bees caused by the use of the unauthorised plant protection product fipronil in the cultivation of cherry laurel trees (RIVM-WFSR, 2017;2019).

³³ "A product of which the active substance is absorbed by the plant and transported via the vascular bundle system in an upwards direction."

C. Public health and animal health risk assessment

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Hazards for public health and animal health

A range of hazards for public health and animal health may be present in or introduced through the ornamental horticulture production chain. This section discusses each of the hazards in turn and assesses the risks posed by:

- the introduction of harmful organisms through the importing of ornamental horticultural products;
- the use of plant protection products and biocides, for workers, surrounding residents and consumers;
- the development of fungicide resistance by opportunistic human pathogens as a result of the application of plant protection products;
- post-harvest treatment of ornamental horticultural products (dyeing and preserving);
- plant toxins in ornamental horticultural products; and
- plant allergens.

More details on these topics can be found in Annexes 7, 8 and 9.

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Introduction of harmful organisms through the import of ornamental horticultural products

Organisms that are harmful to people and/or animals may be accidentally introduced with ornamental horticultural product imports. There are several known cases of organisms being intercepted on import consignments of ornamental plants, where the organisms are harmful for people and/or animals (ticks, slugs, snails, mosquitoes, etc.), whether directly or indirectly (as a vector). The findings of the Asian tiger mosquito (*Aedes albopictus*) in consignments of 'lucky bamboo' are probably the best-known example of this. The Asian tiger mosquito could enter the Netherlands in several different ways; at present, other pathways such as the import of car and aircraft tyres are seen as more important pathways (lucky bamboo used to be transported in a layer of water, but that no longer happens). For many other organisms, too, the likelihood of introduction via other pathways is considered greater than via the ornamental horticulture production chain. The findings of the Asian tiger mosquito in import consignments of lucky bamboo show that the introduction of an organism that is harmful to people and/or animals can happen via the ornamental horticulture production chain. At present, however, there is no legislation that could provide a basis for the NVWA to reject an import consignment after the detection of such an organism, although the owner can be required to implement control measures with the aim of eliminating the organism under the Public Health Act (*Wet publieke gezondheid*). For this to happen, the organism must first be designated by a general administrative order or ministerial regulation.

Use of plant protection products and biocides

Plant protection products and biocides can potentially constitute a hazard to public health. Consequently, plant protection products and biocides may only be used if they have received authorisation or an exemption under the Plant Protection Products and Biocides Act (Wgb) (see also 'Nature and the environment risk assessment').

Risks for consumers from dermal exposure

In the authorisation procedure for plant protection products, for the safety of consumers, it is assumed that, if the 'transferrable residue' does not constitute a risk for workers, the risk for consumers who purchase the ornamental plants must be negligible. This assumption is based on the fact that consumers' contact with the substance will occur later and be much less intensive (Ctgb, 2018b). If products are used in accordance with the legal instructions for use, residues on ornamental plants are therefore considered safe for consumers. A previous study on the risks for consumers from residues of plant protection products on ornamental plants showed that there were no anticipated risks for consumers who came into contact with these residues (BuRO, 2009;2014). In the conservative (worst-case) assumptions, such as complete dermal absorption of all residue present on the plant, the 'acceptable daily intakes' (ADIs) of the assessed plant protection products was not exceeded.

No systematic data are available on residues of plant protection products on imported ornamental horticultural products, so a risk assessment for these products is not possible. A limited study on the use of plant protection products in Ethiopia and Kenya, two countries that export large quantities of ornamental horticultural products to the Netherlands, shows that hazardous products are used in these countries, monitoring is limited and, due to a lower level of knowledge, the chance of incorrect use of the products is higher. In July 2019, 12 parties from the flower sector and the Ministers of Agriculture, Nature and Food Quality and Foreign Trade and Development Cooperation signed an agreement to make the cultivation of ornamental plants by Dutch companies in third countries such as Kenya and Ethiopia more sustainable (IMVO, 2019).

Risks for consumers from oral exposure

Ornamental horticultural products are not intended for consumption. Accordingly, no maximum residue limits (MRLs) have been set for ornamental horticultural products³⁴. However, consumers may deliberately or unintentionally consume an ornamental horticultural product, or part of one, thus being exposed via the mouth (orally) to plant protection product residues. A BuRO risk assessment on the consumption of rose petals (the worst-case scenario, due to the high use of plant protection products in rose cultivation), based on measured residues on roses from the Belgian market (Toumi et al., 2017), showed that only a small number of rose petals were needed for the health limit values to be exceeded. For children, acute health risks cannot be excluded from the consumption of 10 rose petals. In terms of long-term consumption, chronic health effects cannot be excluded from daily consumption of more than two petals. Given that petals make up only a small portion of the overall diet, their contribution to chronic health effects is probably low. This calculation was based on procymidone, the active substance with the highest ratio between the measured residue concentration and the ADI or ARfD (acute reference dose). Procymidone has not had European approval as an active substance since 2008, but it may still be in use outside of Europe. The calculations did not take account of any synergy or addition (strengthening or accumulation of effects) of the various residues.

³⁴ With effect from 1 January 2020, specific MRLs apply for plant protection products in pollen and bee products. These MRLs will be taken into account in the authorisation of plant protection products for ornamental plants.

If roses are grown specifically for consumption, the maximum residue limits for food crops apply, which must be taken into account when using plant protection products. These products must therefore be suitable for consumption. In theory, oral exposure to plant protection products applied to ornamental plants can also occur via the previous plants grown on the same site. This route of exposure is particularly important for substances (or degradation products) that remain in the soil for a long time. Most ornamental plants are not rotated with food crops, or only very rarely, but there are examples in outdoor cultivation where such rotation takes place. The authorisation requirements for plant protection products take into account the possibility that a food crop may be a subsequent crop, and provided the laws and regulations are followed, the risks for public health should be negligible, according to current standards. Compliance percentages are particularly low in specific types of protected cultivation. In these types of cultivation, crop rotation does not usually include crops for consumption (and if so, probably only after replacement of the substrate), and the public health risks via the 'cultivation of a food crop after ornamental plants' pathway appear to be limited.

Consumers may also be exposed to plant protection product residues from ornamental plants through the consumption of honey. Bees can collect nectar from ornamental plants to which plant protection products have been applied. Due to the absence of a suitable methodology, the standard MRL of 0.05 mg/kg was used until recently. On 1 January 2020, specific MRLs for pollen and bee products came into force. These MRLs are now being taken into account in the authorisation of plant protection products for ornamental plants (Ctgb, 2019c). Given that honey consumption is only a small part of the overall diet, an evaluation of MRLs is primarily important in terms of acute effects. Honey consumption's contribution to chronic health effects is likely to be negligible.

Risks for people working in the ornamental horticulture sector (including the retail trade)

Occupational exposure to plant protection products can occur during application of the products and for workers who come into contact with the treated plants. Occupational exposure is typically higher than consumer exposure. In its authorisation assessment of plant protection products and biocides, the Ctgb evaluates the risks for those applying plant protection products and for workers. However, the Health Council of the Netherlands concluded in 2014 that, in practice, safety in relation to occupational exposure is not always sufficient (Gezondheidsraad, 2014). One possible cause may be a failure to follow the legal instructions for use, meaning that actual exposure is higher than the levels taken into account during the authorisation procedure. In addition, the possible cumulative effects of products are not taken into account in the product authorisation assessment. The PBL also concluded, in its interim evaluation of the Policy Memorandum, that occupational safety is not always adequate. Issues that impede the training of staff and the recording of agreements include language barriers and short employment periods. According to the PBL's analysis, working safely with plant protection products is not given a sufficiently high priority. However, the number of companies engaged in greenhouse ornamental horticulture that did not give their staff any training on plant protection products decreased from over 20% to around 15% between 2010 and 2018 (PBL, 2019). BuRO risk assessments (BuRO, 2009) and academic studies (Toumi et al., 2017) show that, for workers in the sector and processors of ornamental horticultural

products (such as florists), negative effects on health cannot be excluded if sufficient personal protection measures (such as the wearing of gloves by florists) are not taken. Since not enough is known about which biocides are used in ornamental horticulture, the risks cannot be assessed.

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Risks for neighbouring residents

Before 2014, the risk to neighbouring residents was not separately assessed in the Ctgb's authorisation assessment, with the exception of residents in the vicinity of greenhouses. It was implicitly assumed that the assessment of the occupational exposure risks was sufficient to protect neighbouring residents. Nevertheless, there was societal concern about the use of large quantities of plant protection products on agricultural land. In 2014, the Health Council of the Netherlands issued a report that recommended further research into exposure to plant protection products of residents in the vicinity of agricultural land (Giltrap et al., 2009; Gezondheidsraad, 2014). This was due to the independent nature of neighbouring residents as a risk group. Differences in the risk assessments for neighbouring residents and for workers may arise due to the length of exposure, the level of exposure (peak exposure versus long-term exposure to lower concentrations), the presence of sensitive groups such as children and pregnant women and the use of personal protective equipment by workers. Since 2014, in response to the Health Council's report, the Ctgb has explicitly assessed the exposure of neighbouring residents using two available models. In addition, based on a new EFSA model, it has conducted a reassessment of existing authorisations to identify the risks for neighbouring residents and bystanders including children. This reassessment did not reveal any risks from existing authorisations. Since January 2016, an EFSA model has been applied (after adoption by the European Commission in late 2015) in the assessment of new substances and products. In response to the Health Council's report, the RIVM coordinated a study on the exposure and health risks for residents in the vicinity of agriculture land. An exploratory study showed that there was no clear correlation between health and the proximity of agricultural land (RIVM, 2018). In the study into the exposure of neighbouring residents, residues of applied plant protection products were found in and around homes and in urine samples taken from residents; the measured concentrations were below the health limit values. The study showed that the current authorisation frameworks do not underestimate the exposure of neighbouring residents. However, there was scope for further refinement of the model (RIVM, 2019b). The RIVM therefore recommended a follow-up study and further refinement of the authorisation framework (for example, by assessing combined exposure).

Fungicide resistance

Aspergillus fumigatus is a fungus that generally appears on rotting plant material and produces numerous spores. These spores are present everywhere in both indoor and outdoor air, and people inhale them continually. This fungus is an opportunistic pathogen for humans that can cause a severe burden of disease in immunocompromised individuals (Verweij et al., 2009). Infections can be controlled with the help of azole antifungal drugs. However, resistance to this treatment as a consequence of exposure of the fungus to azole fungicides is a significant problem, because cross-resistance between the various azoles is very common (Azevedo et al., 2015). An increase in *A. fumigatus* resistance has been related to the storage of wood waste and with compost heaps containing

remnants of flower bulbs and other plant material. Given the use of azole fungicides in ornamental horticulture, the development of azole resistance by *A. fumigatus* through the composting of plant waste from the ornamental horticulture production chain is a possible scenario; however, not enough data are available to test this hypothesis. The identification of possible sources of this development of resistance is now on the political agenda (Minister van LNV, 2019).

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Genetic modification

Genetic modification is permitted in ornamental horticulture, for example to alter flower colour. The number of approvals for genetically modified plants is currently limited, and any risks are assessed within a strict legal framework, which means they are very low. In 2014, on behalf of the Human Environment and Transport Inspectorate of the Ministry of Infrastructure and Water Management, the RIVM conducted a survey of global developments of successfully genetically modified ornamental plants and the possible illegal import of these products. In general, the risk to public health and the environment from the products identified was small. One modified (glyphosate-resistant) plant (*A. stolonifera*) was identified that could potentially be a risk to biodiversity, but illegal imports of this plant are unlikely (RIVM, 2014).

Post-harvest treatment of ornamental horticultural products

Cut flowers and indoor plants (such as orchids) may be dyed and processed by being dipped in a container of dye or being placed in a vase containing dye. Ornamental horticultural products may also be sprayed or treated with glitter. Preserving flowers also seems to be a growing trend. Roses in particular, but increasingly also other flowers, plants and mosses, are being treated to make them keep for more than a year without requiring water. Flowers can be preserved using a variety of methods. The most common commercial form is dehydration (drying), followed by dyeing the flower or applying a pigment. Flowers can be dehydrated in a number of different ways. The water in the flower (with or without the stem and leaves) is replaced with another liquid, usually an oil such as glycols or glycerine. The flowers are not intended for consumption, nor is it expected that the flowers (which are usually brightly coloured) will be eaten accidentally. Dehydrated, coloured, dyed, sprayed or treated flowers and plants are unfit for consumption. It is not known, and cannot currently be assessed due to a lack of information, whether there are health risks if, for example, children put preserved ornamental horticultural products in their mouths or even eat them.

Plant toxins in ornamental plants

Ornamental plants may contain toxic substances that cause harmful health effects after ingestion by people or animals. If substances from certain ornamental plants come into contact with skin or eyes, health problems may arise such as redness, pain, inflammation and blistering of the skin, eye irritation, eye infection, corneal damage and temporary blindness. Data from the Dutch Poisons Information Centre (NVIC) give an indication of the number of cases of poisoning and the plant species that lead to poisoning. Medical professionals can obtain information from the NVIC about poisoning cases and how to treat them. In 2017, NVIC was consulted about 1,846 cases of exposure of people and 1,624 cases of exposure of animals to plants. In general, the reports involved mild symptoms such as nausea

and diarrhoea. In poisoning cases involving plants, it is usually young children who have eaten the plants out of curiosity. Poisoning may also occur when one plant is mistaken for another, or out of ignorance, where people eat a poisonous plant instead of an edible plant. Serious health effects primarily occur following deliberate ingestion by an adult; this may be intentional or it may be due to the supposed medicinal properties of the plant.

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Edible ornamental plants

Within the ornamental horticulture sector, flowers, plants and parts of plants that are intended for consumption are increasingly being grown and traded. This includes edible herbs, cut flowers and plants with edible fruit. There is an increasing trend to use flowers as decorations for meals or to use them in salads and soups. For this purpose, people use ornamental plants that are edible but are probably classified as novel foods. In other words, if these flowers, leaves, herbs and cresses (freshly-sprouted seedlings) were not used for human consumption to a significant degree before 15 May 1997, they are classified as novel foods and must be assessed for safety by EFSA and be approved by the European Commission for sale on the European market (Regulation (EU) No 2015/2283). Edible plants that are already on the European market or have been admitted to the European market must comply with the legislation for food.

A 2016 Danish investigation into the use of flowers from wild and cultivated plants in restaurants and by local food producers revealed that 9 of the 23 flowers investigated (including woodruff and nasturtium, which are also grown as ornamental plants) contained substances with toxic or potentially toxic effects. The substances in question were plant-based substances. Two plants contained unidentified toxic substances and four were flowers from plants with potentially toxic substances in parts other than the flower or in related species (Egebjerg et al., 2018). The safe intake levels of the toxic substances were exceeded even with small quantities.

Labelling

The Association of Dutch Flower Auctions (VBN) indicates that producers of ornamental horticultural products must specify the intended purpose of the product. When trading a product that has both edible and non-edible variants, it must be clearly indicated whether or not it is intended for consumption. The VBN's labelling guidelines are not covered by any statute, and it is not known what percentage of ornamental horticultural products in the Netherlands carry a label indicating that the product is or is not intended for consumption. A number of edible plants that are often grown and marketed in the ornamental horticulture production chain are legally classified in the fruit and vegetable sector (Regulation (EU) No 1308/2013). These plants are subject to a legal European obligation to be labelled as edible plants. The plants in question include fresh and chilled thyme, basil, lemon balm, mint, oregano/wild marjoram, rosemary and sage.

Plant allergens

A large number of ornamental plants (including ornamental trees) produce pollen with allergenic³⁵ properties and thus constitute a potential risk to human health. Pollen allergy or hay fever, also known as allergic rhinitis³⁶, is one of the most

³⁵ An allergen is a substance that triggers an allergic reaction.

³⁶ Rhinitis is the scientific term for inflammation of the nose and nasal mucosa.

common allergies. The symptoms of hay fever may include sneezing, a runny nose, red eyes with an itchy or burning sensation, a swollen throat, watery eyes, swollen eyelids, poor sleep, headaches and concentration problems. Hay fever can have a significant impact on quality of life due to sleep issues and restrictions on daily activities and sport, and there is no cure. Around 5 to 30% of people suffer from hay fever. People with a pollen allergy may also develop an allergy to certain types of fruit (food allergy). As well as the inhalation of pollen, eating ornamental plants can cause allergies, and contact with ornamental plants can trigger allergic reactions. Little is known about the extent to which this occurs or the severity of the symptoms.

Nature and ornamental horticultural products contribute to citizens' well-being and quality of life. However, when their presence causes allergic reactions and symptoms in susceptible people, this has a detrimental effect on their quality of life. The number and types of pollen to which people are exposed determines the allergenic effect. The main allergens are pollen from tree species, grasses and a number of herbaceous weeds in green spaces (such as *Ambrosia artemisiifolia*). In terms of trees, basically all flowering tree species produce pollen. There are differences in allergenicity between plant species and between varieties within certain species. There are also sterile varieties that produce no pollen at all. This makes it possible to think more carefully about allergy-free or allergy-friendly green spaces with non-allergenic or low-allergy alternatives and measures to control pollen emissions. Any negative ecological effects of such plantings, such as effects on insect populations, will have to be considered.

Climate change may have an impact on plant growth. Pollen may be produced during different periods, and the flowering period of plants may change. This may lead to a longer or shorter exposure period and an increase or decrease, depending on the situation and individual susceptibility, of the health problems experienced by individuals.

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