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Pest categorisation of *Nemorimyza maculosa*

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Nemorimyza maculosa* (Malloch) (Diptera: Agromyzidae) for the European Union (EU). *N. maculosa* is an oligophagous pest; cultivated hosts include *Chrysanthemum*, lettuce and other Asteraceae although there is little evidence of recent impacts. *N. maculosa* occurs widely in the Americas and is present on the island of Madeira (Portugal), where it is under official control. *N. maculosa* is not known to occur in mainland Portugal based on surveys. *N. maculosa* can have multiple overlapping generations per year. Eggs are inserted into the leaves of host plants. Developing larvae feed within leaves causing blotch mines. Pupation takes place in the soil or under debris on the ground. Immature stages on leafy host plant material such as *Chrysanthemum* cut flowers provide potential pathways for entry into the EU. Human-assisted movement of cut flowers, fresh leafy hosts for consumption and plants for planting with foliage are considered the main pathways for entry. Climatic conditions and the wide availability of cultivated and wild host plants provide conditions to support establishment in the EU in the open and in greenhouse. The extent of potential impacts on hosts such as ornamental Asteraceae and lettuce in the EU is uncertain. *N. maculosa* is regulated in the EU by Commission Implementing Regulation 2019/2072 (Annex IIA) where it appears using a synonym, *Amauromyza maculosa*. Within the Regulation, the import of soil or growing medium, from third countries other than Switzerland is regulated and therefore prevents the entry of *N. maculosa* pupae. All criteria assessed by EFSA above for consideration either as a potential union quarantine pest or as a potential regulated non-quarantine pest were met.

Keywords: Agromyzid, burdock leaf miner, chrysanthemum leaf miner, pest risk, plant health, plant pest, quarantine

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Table of Contents

1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background

Council Directive 2000/29/EC[1] on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community established the previous European Union plant health regime. The Directive laid down the phytosanitary provisions and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union. In the Directive's 2000/29/EC annexes, the list of harmful organisms (pests) whose introduction into or spread within the Union was prohibited, was detailed together with specific requirements for import or internal movement.

Following the evaluation of the plant health regime, the new basic plant health law, Regulation (EU) 2016/2031[2] on protective measures against pests of plants, was adopted on 26 October 2016 and applied from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest categorisations of the harmful organisms included in the annexes of Directive 2000/29/EC, in the cases where recent pest risk assessment/pest categorisation is not available.

1.1.2. Terms of reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002[3], to provide scientific opinion in the field of plant health.

EFSA is requested to prepare and deliver a pest categorisation (step 1 analysis) for each of the regulated pests included in the appendices of the annex to this mandate. The methodology and template of pest categorisation have already been developed in past mandates for the organisms listed in Annex II Part A Section II of Directive 2000/29/EC. The same methodology and outcome is expected for this work as well.

The list of the harmful organisms included in the annex to this mandate comprises 133 harmful organisms or groups. A pest categorisation is expected for these 133 pests or groups and the delivery of the work would be stepwise at regular intervals through the year as detailed below. First priority covers the harmful organisms included in Appendix 1, comprising pests from Annex II Part A Section I and Annex II Part B of Directive 2000/29/EC. The delivery of all pest categorisations for the pests included in Appendix 1 is June 2018. The second priority is the pests included in Appendix 2, comprising the group of *Cicadellidae* (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), the group of *Tephritidae* (non-EU), the group of potato viruses and virus-like organisms, the group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., and the group of *Margarodes* (non-EU species). The delivery of all pest categorisations for the pests included in Appendix 2 is end 2019. The pests included in Appendix 3 cover pests of Annex I part A section I and all pest categorisations should be delivered by end 2020.

For the above mentioned groups, each covering a large number of pests, the pest categorisation will be performed for the group and not the individual harmful organisms listed under "such as" notation in the Annexes of the Directive 2000/29/EC. The criteria to be taken particularly under consideration for these cases, is the analysis of host pest combination, investigation of pathways, the damages occurring and the relevant impact.

Finally, as indicated in the text above, all references to 'non-European' should be avoided and replaced by 'non-EU' and refer to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

[1] Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. OJ L 169/1, 10.7.2000, p. 1–112.

[2] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants. OJ L 317, 23.11.2016, p. 4–104.

[3] 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, 1.2.2002, p. 1–24.

1.1.2.1. Terms of Reference: Appendix 1

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

Aleurocantus spp.
Anthonomus bisignifer (Schenkling)
Anthonomus signatus (Say)
Aschistonyx eppoi Inouye
Carposina niponensis Walsingham
Enarmonia packardi (Zeller)
Enarmonia prunivora Walsh
Grapholita inopinata Heinrich
Hishomonus phycitis
Leucaspis japonica Ckll.
Listronotus bonariensis (Kuschel)
Numonia pyrivorella (Matsumura)
Oligonychus perditus Pritchard and Baker
Pissodes spp. (non-EU)
Scirtothrips aurantii Faure
Scirtothrips citri (Moultex)
Scolytidae spp. (non-EU)
Scrobipalpopsis solanivora Povolny
Tachypterellus quadrigibbus Say
Toxoptera citricida Kirk.
Unaspis citri Comstock

(b) Bacteria

Citrus variegated chlorosis
Erwinia stewartii (Smith) Dye
Xanthomonas campestris pv. *oryzae* (Ishiyama) Dye and pv. *oryzicola* (Fang. et al.) Dye

(c) Fungi

Alternaria alternata (Fr.) Keissler (non-EU pathogenic isolates)
Anisogramma anomala (Peck) E. Müller
Apiosporina morbosa (Schwein.) v. Arx
Ceratocystis virescens (Davidson) Moreau
Cercoseptoria pini-densiflorae (Hori and Nambu) Deighton
Cercospora angolensis Carv. and Mendes
Elsinoe spp. Bitanc. and Jenk. Mendes
Fusarium oxysporum f. sp. *albedinis* (Kilian and Maire) Gordon
Guignardia piricola (Nosa) Yamamoto
Puccinia pittieriana Hennings
Stegophora ulmea (Schweinitz: Fries) Sydow & Sydow
Venturia nashicola Tanaka and Yamamoto

(d) Virus and virus-like organisms

Beet curly top virus (non-EU isolates)
Black raspberry latent virus
Blight and blight-like
Cadang-Cadang viroid
Citrus tristeza virus (non-EU isolates)
Leprosis
Little cherry pathogen (non- EU isolates)
Naturally spreading psorosis
Palm lethal yellowing mycoplasm
Satsuma dwarf virus
Tatter leaf virus
Witches' broom (MLO)

Annex IIB

(a) Insect mites and nematodes, at all stages of their development

Anthonomus grandis (Boh.)
Cephalcia lariciphila (Klug)
Dendroctonus micans Kugelan
Gilphinia hercyniae (Hartig)
Gonipterus scutellatus Gyll.
Ips amitinus Eichhof
Ips cembrae Heer
Ips duplicatus Sahlberg
Ips sexdentatus Börner
Ips typographus Heer
Sternochetus mangiferae Fabricius

(b) Bacteria

Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton
Gremmeniella abietina (Lag.) Morelet
Hypoxylon mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

List of harmful organisms for which pest categorisation is requested per group. The list below follows the categorisation included in the annexes of Directive 2000/29/EC.

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

Group of Cicadellidae (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), such as:

1) *Carneocephala fulgida* Nottingham
2) *Draeculacephala minerva* Ball
3) *Graphocephala atropunctata* (Signoret)

Group of Tephritidae (non-EU) such as:

1) *Anastrepha fraterculus* (Wiedemann)
2) *Anastrepha ludens* (Loew)
3) *Anastrepha obliqua* Macquart
4) *Anastrepha suspensa* (Loew)
5) *Dacus ciliatus* Loew
6) *Dacus curcurbitae* Coquillet
7) *Dacus dorsalis* Hendel
8) *Dacus tryoni* (Froggatt)
9) *Dacus tsuneonis* Miyake
10) *Dacus zonatus* Saund.
11) *Epochra canadensis* (Loew)
12) *Pardalaspis cyanescens* Bezzi
13) *Pardalaspis quinaria* Bezzi
14) *Pterandrus rosa* (Karsch)
15) *Rhacochlaena japonica* Ito
16) *Rhagoletis completa* Cresson
17) *Rhagoletis fausta* (Osten-Sacken)
18) *Rhagoletis indifferens* Curran
19) *Rhagoletis mendax* Curran
20) *Rhagoletis pomonella* Walsh
21) *Rhagoletis suavis* (Loew)

(c) Viruses and virus-like organisms

Group of potato viruses and virus-like organisms such as:

1) Andean potato latent virus
2) Andean potato mottle virus
3) Arracacha virus B, oca strain
4) Potato black ringspot virus
5) Potato virus T
6) non-EU isolates of potato viruses A, M, S, V, X and Y (including Yo, Yn and Yc) and Potato leafroll virus

Group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., such as:

1) Blueberry leaf mottle virus
2) Cherry rasp leaf virus (American)
3) Peach mosaic virus (American)
4) Peach phony rickettsia
5) Peach rosette mosaic virus
6) Peach rosette mycoplasm
7) Peach X-disease mycoplasm
8) Peach yellows mycoplasm
9) Plum line pattern virus (American)
10) Raspberry leaf curl virus (American)
11) Strawberry witches' broom mycoplasma
12) Non-EU viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

Group of *Margarodes* (non-EU species) such as:

1) *Margarodes vitis* (Phillipi)
2) *Margarodes vredendalensis* de Klerk
3) *Margarodes prieskaensis* Jakubski

1.1.2.3. *Terms of Reference: Appendix 3*

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

Acleris spp. (non-EU)
Amauromyza maculosa (Malloch)
Anomala orientalis Waterhouse
Arrhenodes minutus Drury
Choristoneura spp. (non-EU)
Conotrachelus nenuphar (Herbst)
Dendrolimus sibiricus Tschetverikov
Diabrotica barberi Smith and Lawrence
Diabrotica undecimpunctata howardi Barber
Diabrotica undecimpunctata undecimpunctata Mannerheim
Diabrotica virgifera zeae Krysan & Smith
Diaphorina citri Kuway
Heliothis zea (Boddie)
Hirschmanniella spp., other than *Hirschmanniella gracilis* (de Man) Luc and Goodey
Liriomyza sativae Blanchard
Longidorus diadecturus Eveleigh and Allen
Monochamus spp. (non-EU)
Myndus crudus Van Duzee
Nacobbus aberrans (Thorne) Thorne and Allen
Naupactus leucoloma Boheman
Premnotrypes spp. (non-EU)
Pseudopityophthorus minutissimus (Zimmermann)
Pseudopityophthorus pruinosus (Eichhoff)
Scaphoideus luteolus (Van Duzee)
Spodoptera eridania (Cramer)
Spodoptera frugiperda (Smith)
Spodoptera litura (Fabricus)
Thrips palmi Karny
Xiphinema americanum Cobb *sensu* lato (non-EU populations)
Xiphinema californicum Lamberti and Bleve-Zacheo

(b) Fungi

Ceratocystis fagacearum (Bretz) Hunt
Chrysomyxa arctostaphyli Dietel
Cronartium spp. (non-EU)
Endocronartium spp. (non-EU)
Guignardia laricina (Saw.) Yamamoto and Ito
Gymnosporangium spp. (non-EU)
Inonotus weirii (Murril) Kotlaba and Pouzar
Melampsora farlowii (Arthur) Davis
Mycosphaerella larici-leptolepis Ito et al.
Mycosphaerella populorum G. E. Thompson
Phoma andina Turkensteen
Phyllosticta solitaria Ell. and Ev.
Septoria lycopersici Speg. var. *malagutii* Ciccarone and Boerema
Thecaphora solani Barrus
Trechispora brinkmannii (Bresad.) Rogers

(c) Viruses and virus-like organisms

Tobacco ringspot virus
Tomato ringspot virus
Bean golden mosaic virus
Cowpea mild mottle virus
Lettuce infectious yellows virus
Pepper mild tigré virus
Squash leaf curl virus
Euphorbia mosaic virus
Florida tomato virus

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAII

(a) Insects, mites and nematodes, at all stages of their development

Meloidogyne fallax Karssen
Popillia japonica Newman
Rhizoecus hibisci Kawai and Takagi

(b) Bacteria

Clavibacter michiganensis (Smith) Davis et al. ssp. *sepedonicus* (Spieckermann and Kotthoff) Davis et al.
Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen
Synchytrium endobioticum (Schilbersky) Percival

Annex I B

(a) Insects, mites and nematodes, at all stages of their development

Leptinotarsa decemlineata Say
Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Amauromyza maculosa (Malloch) is one of a number of pests listed in the Appendices to the Terms of Reference (ToRs) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential quarantine pest or those of a regulated non-quarantine pest for the area of the European Union (EU) excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

A taxonomic revision now places *Amauromyza maculosa* in the genus *Nemorimyza* (Zlobin, 1996; Scheffer et al., 2007). The current valid senior synonym is therefore *Nemorimyza maculosa* (Malloch).

Following the adoption of Regulation (EU) 2016/2031[2] on 14 December 2019 and the Commission Implementing Regulation (EU) 2019/2072 for the listing of EU regulated pests, the Plant Health Panel interpreted the original request (ToR in Section 1.1.2) as a request to provide pest categorisations for the pests in the Annexes of Commission Implementing Regulation (EU) 2019/2072.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *N. maculosa* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name *Nemorimyza maculosa* and the synonyms *Amauromyza maculosa, Agromyza maculosa, Agromyza guaranitica, Dizygomyza maculosa, Phytobia maculosa,* and the common names 'burdock leaf miner' and 'chrysanthemum leaf miner' as search terms. Relevant papers were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online) and relevant publications.

Data about the import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States (MSs) and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for *Nemorimyza maculosa*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018) and in the International Standard for Phytosanitary Measures No 11 (FAO, 2013) and No 21 (FAO, 2004).

This work was initiated following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union regulated non-quarantine pest (RNQP) in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific ToRs received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. All relevant criteria have to be met for the pest to potentially qualify either as a quarantine pest or as a RNQP. If one of the criteria is not met, the pest will not qualify. A pest that does not qualify as a quarantine pest may still qualify as an RNQP that needs to be addressed in the opinion. For the pests regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone; thus, the criteria refer to the protected zone instead of the EU territory.

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, whereas addressing social impacts is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/ presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism.	Is the pest present in the EU territory? If not, it cannot be an RNQP. (A regulated non-quarantine pest must be present in the risk assessment area).

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future.	The protected zone system aligns with the pest-free area system under the International Plant Protection Convention (IPPC). The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone).	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential RNQP were met, and (2) if not, which one (s) were not met.

The Panel will not indicate in its conclusions of the pest categorisation whether to continue the risk assessment process, but following the agreed two-step approach, will continue only if requested by the risk managers. However, during the categorisation process, experts may identify key elements and knowledge gaps that could contribute significant uncertainty to a future assessment of risk. It would be useful to identify and highlight such gaps so that potential future requests can specifically target the major elements of uncertainty, perhaps suggesting specific scenarios to examine.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?

Yes. The identity is established and taxonomic keys are available for its identification.

Nemorimyza maculosa (Malloch, 1913) is an insect of the order Diptera, family Agromyzidae. Junior synonyms include *Agromyza maculosa* Malloch, 1913*, Amauromyza maculosa* (Malloch, 1913), *Agromyza guaranitica* Brethes, 1920*; Dizygomyza maculosa* Blanchard, 1938 and *Phytobia* (*Amauromyza*) *maculosa* Frick, 1952*;* (CABI, 2019; EPPO, 2019a,b). The common names are chrysanthemum leaf miner and burdock leaf miner. The EPPO code[4] (Griessinger and Roy, 2015; EPPO, 2019a,b) for this species is AMAZMA.

3.1.2. Biology of the pest

Biology and life history data are available for *N. maculosa* from laboratory experiments (Ota and Nishida, 1966). Adults mostly emerge during the morning and reproduce sexually. Female adults puncture leaves and feed on the exudates. This causes whitish or brown stipples on the leaves. Eggs are inserted within host leaves. Egg laying occurs during the daytime beginning soon after sunrise with a peak between mid-morning and noon then decreases gradually until sunset. Females prefer young leaf tissue for oviposition (Hudson and Stiling, 1997). Two to four eggs are laid in groups in quick succession forming 'egg-groups' along the lateral margins and tips of leaves. The average number of eggs laid by 27 females was 367 ± 344 eggs/fly. Egg hatching was 65% during the first days of egg laying and increased to 90–98% after day 5. Egg laying starts on day 1 after adult emergence and reaches a maximum at day 6 and continues at a similar rate until a few days before the fly dies. Adult females live for approximately 14 days; adult males for 7 days. Eggs hatch then larvae feed within the leaf. Three larval stages feed internally on the natal leaf forming blotch mines. The mines have a short linear portion where the mine was initiated and an expanded fan like portion with irregular margins. When eggs are laid in close proximity, the mines unite and several larvae feed within one mine. The last larval stage bites through the upper epidermis and exits the mine through this opening. Pupae are formed one hour after larvae have left the mine and can be found under debris including dead leaves and in the soil.

The duration of the egg stage, larval stages and pupae was investigated in the laboratory at mean temperatures of 25.9°C and 26.4°C. No significant difference in development time was observed under the two temperature regimes and the data were pooled. The observed development time was 3–4 days for eggs, 6–8 days for larvae stage and 13–16 days for pupae (Ota and Nishida, 1966).

3.1.3. Intraspecific diversity

No intraspecific diversity is reported in the literature.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes. Damage symptoms (stippling caused by females piercing host leaves and blotch mines in host leaves) can be detected when scouting amongst hosts; morphological keys for adults are available to identify the species (e.g. Spencer, 1963).

[4] An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed, the EPPO code remains the same. This provides a harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (Griessinger and Roy, 2015; EPPO, 2019a,b). EPPO codes are used in EU Regulation 2016/2031.

Feeding and oviposition punctures on host leaves by females appear as white speckles between 0.15 and 0.13 mm in diameter (Smith et al., 1997; CABI, 2019). A larval mine is usually a large blotch with white and dampened black and dried brown areas. Three to six larvae are common in a single leaf, frequently forming a large community mine (Weems and Dekle, 1999).

A detailed morphological description is provided by Ota and Nishida (1966). Smith et al. (1997) and CABI (2019) provide the following description of life stages:

Eggs: 0.2–0.3 mm × 0.10–0.15 mm, off white and lightly translucent with a smooth chorion devoid of any external markings.

Larva and puparium: headless maggot, posterior spiracles of larva (and puparium) paired, each with three pores. The puparium is oval, slightly flattened ventrally, 1.2–2.3 × 0.5–0.75 mm, with variable colour.

Adult: small, greyish-black, compact bodied, about 2.3 mm in body length, 2.3–2.5 mm in wing length, scutellum black. Halteres white with characteristic dark spot on upper part of the knob. Females are generally larger than males.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

N. maculosa occurs in South, Central and North America including the Caribbean and Hawaii (Figure 1). Its origin is most likely from subtropical and temperate regions of South America (Spencer, 1990; Smith et al., 1997; Valladares et al., 2011; Valenzuela-Escoboza et al., 2017; CABI 2019). Note that CABI (2019) suggest that N. maculosa is more widespread in the Americas than is currently indicated in the CABI datasheet (Table 2).

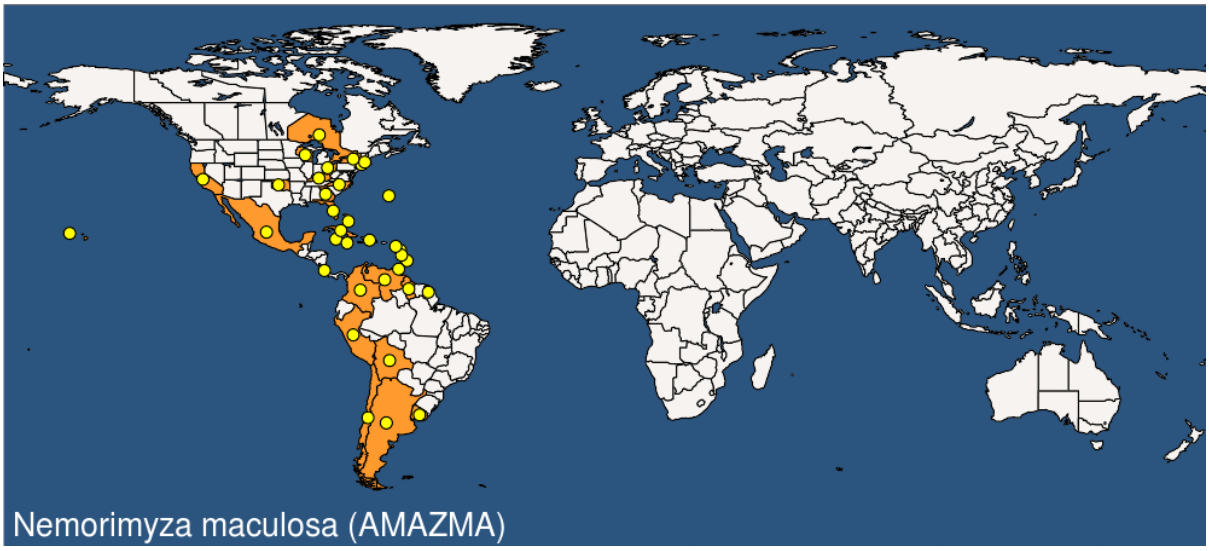


Figure 1: Global distribution map for *Nemorimyza maculosa* (extracted from the EPPO Global Database accessed on 29 January 2020 and updated with the latest version from 18 February 2020)

Table 2: Distribution of *Nemorimyza maculosa*, excluding EU (Source: EPPO Global Database, CABI (2019), accessed 30 January 2020)

Region	Country	Sub-national distribution	Status
Central America & Caribbean	Antigua and Barbuda*		Present, few occurrences
	Bahamas		Present, restricted distribution
	Barbados		Present, restricted distribution
	Cayman Islands		Present, restricted distribution

Region	Country	Sub-national distribution	Status
	Costa Rica		Present, widespread
	Cuba		Present, restricted distribution
	Dominican Republic		Present, no details
	Guadeloupe		Present, no details
	Jamaica		Present, no details
	Martinique		Present, no details
	St Kitts & Nevis		Present, no details
	Trinidad and Tobago		Present, few occurrences
North America	Bermuda		Present, no details
	Canada	Ontario	Present, no details
	Mexico		Present, few occurrences
	United States of America	California, Connecticut, Florida, Georgia, Hawaii, Indiana*, Kentucky, Massachusetts*, New YorkWashington*, Wisconsin	Present, restricted distribution
South America	Argentina		Present, restricted distribution
	Bolivia		Present, no details
	Brazil	Pernambuco*, Rio de Janeiro*, Sao Paulo*	Absent, unreliable record*
	Chile		Present, restricted distribution
	Colombia		Present, no details
	French Guiana		Present, no details
	Guyana		Present, no details
	Peru		Present, restricted distribution
	Uruguay		Present, few occurrences
	Venezuela		Present, restricted distribution

*: Included in CABI 2019 and not in EPPO GD2020.

3.2.2. Pest distribution in the EU

Source: EPPO GD.

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?

N. maculosa is not known to occur in the EU, other than in Madeira (PT) where it is under official control.

Status of Nemorimyza maculosa in the EU (Source: EPPO Global Database, CABI (2019), accessed 24 December 2019)

Region	Country	Sub-national distribution	Status
EU	Portugal	Madeira	Present, restricted distribution, under official control
	Netherlands		Absent, confirmed by survey
	Slovenia		Absent, confirmed by survey

N. maculosa is also reported in La Palma (Canary Islands, ES) (Černý et al., 2018). Recall that for phytosanitary purposes the territory of the Canary Islands are not included as part of the EU (Article 1 of 2016/2031)

N. maculosa was reported in Portugal on the island of Madeira (Europhyt database) with the notification date of 20 September 2016.

N. maculosa is under control as it was notified to Commission in September 2016. Since 2017, an official survey was put in place in Portugal mainland and the Azores. The results of 3-year survey were negative for the rest of the Portuguese territory (personal communication Portuguese Directorate for Plant Health).

3.3. Regulatory status

3.3.1. Commission Implementing Regulation (EU) 2019/2072

The pest is listed using the synonym *Amauromyza maculosa* in Annex II A of Commission Implementing Regulation (EU) 2019/2072.[5] Details are presented in Table 3.

Table 3: *Nemorimyza maculosa* (as *Amauromyza maculosa*) in Commission Implementing Regulation (EU) 2019/2072

Annex II	**List of Union quarantine pests and their respective codes**
Part A:	Pests not known to occur in the Union territory
	Quarantine Pests and their codes assigned by EPPO
	C. Insects and mites
	7. *Amauromyza maculosa* (Malloch) [AMAZMA]

3.3.2. Legislation addressing the hosts of *Nemorimyza maculosa* (Tables 4 and 5)

Table 4: List of plants, plant products and other objects, originating from third countries and the corresponding special requirements for their introduction into the Union territory in Commission Implementing Regulation (EU) 2019/2072

Annex VII	List of plants, plant products and other objects, originating from third countries and the corresponding special requirements for their introduction into the Union territory			
	Plants, plant products and other objects	**CN codes***	**Origin**	**Special requirements**
8.	Plants for planting of herbaceous species, other than bulbs, corms, plants of the family *Poaceae*, rhizomes, seeds, tubers and plants in tissue culture	ex 0602 10 90 0602 90 20 ex 0602 90 30 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99 ex 0704 10 00 ex 0704 90 10 ex 0704 90 90 ex 0705 11 00 ex 0705 19 00 ex 0705 21 00 ex 0709 99 10 ex 0910 99 31 ex 0910 99 33 ex 0705 29 00 ex 0706 90 10 ex 0709 40 00	Third countries where [. . .] and *Amauromyza maculosa* (Malloch) are known to occur	Official statement that the plants have been grown in nurseries and: (a) originate in an area established by the national plant protection organisation in the country of origin as being free from [. . .] and *Amauromyza maculosa* (Malloch) in accordance with relevant International Standards for Phytosanitary Measures which is mentioned on the phytosanitary certificate referred to in Article 71 of Regulation (EU) No 2016/2031, under the rubric 'Additional declaration', or (b) originate in a place of production, established by the national plant protection organisation of the country of origin as being free from [. . .] and *Amauromyza maculosa* (Malloch) in accordance with the relevant International Standards for Phytosanitary Measures, and which is mentioned on the phytosanitary certificate referred to in Article 71 of Regulation (EU) No 2016/2031, under the rubric 'Additional declaration', and declared free from [. . .] and

[5] 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. OJ L 319, 10.12.2019, p. 1–279.

				Amauromyza maculosa (Malloch) on official inspections carried out at least monthly during the three months prior to export, or (c) immediately prior to export, have been subjected to an appropriate treatment against [...] and *Amauromyza maculosa* (Malloch) and have been officially inspected and found free from [...] and *Amauromyza maculosa* (Malloch). Details of the treatment referred in point (c) shall be mentioned on the phytosanitary certificate referred to in Article 71 of Regulation (EU) No 2016/2031.
28	Cut flowers of *Chrysanthemum* L., *Dianthus* L., *Gypsophila* L. and *Solidago* L., and leafy vegetables of *Apium graveolens* L. and *Ocimum* L.	0603 12 00 0603 14 00 ex 0603 19 70 0709 40 00 ex 0709 99 90	Third countries	Official statement that the cut flowers and the leafy vegetables: (a) originate in a country free from [...]and *Amauromyza maculosa* (Malloch), or (b) immediately prior to their export, have been officially inspected and found free from [...] and *Amauromyza maculosa* (Malloch).

*: Further details on the CN codes are provided in Annex XI of Commission Implementing Regulation (EU) 2019/2072.

Table 5: List of *Nemorimyza maculosa* hosts regulated in Annex XI of Commission Implementing Regulation (EU) 2019/2074

Annex XI	List of plants, plant products and other objects subject to phytosanitary certificates and those for which such certificates are not required for their introduction into the Union territory	
Part A	List of plants, plant products and other objects, as well as the respective third countries of origin or dispatch, for which, pursuant to Article 72(1) of Regulation (EU) 2016/2031 phytosanitary certificates are required for their introduction into the Union territory	
Plants, plant products and other objects	CN code and its respective description under Council Regulation (EEC) No.2658/87	Country of origin or dispatch
2. General categories		
Plants for planting, other than seeds	Lettuce (*Lactuca sativa*) and [...] fresh, planted in a growing substrate: ex 0705 11 00 ex 0705 19 00 ex 0705 21 00 ex 0705 29 00	Third countries other than Switzerland
Part B	List of the respective CN codes of plants, as well as the respective third countries of their origin or dispatch, for which, pursuant to Article 73 of Regulation (EU) 2016/2031, phytosanitary certificates are required for their introduction into the Union territory	
Plants	CN code and its respective description under Council Regulation (EEC) No.2658/87	Country of origin or dispatch
All plants, within the meaning of point 1 of Article 2 of Regulation (EU) 2016/2031, other than those specified in parts A and C of this Annex	[...] Lettuce (*Lactuca sativa*) [...], fresh or chilled, other than planted in a growing substrate: ex 0705 11 00 ex 0705 19 00 ex 0705 21 00 ex 0705 29 00 [...]	Third countries other than Switzerland

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

Nemorimyza maculosa is found most commonly on genera of Asteraceae. Spencer (1990) reports *N. maculosa* feeding on 17 genera of Asteraceae (*Bidens, Calendula, Chrysanthemum, Conyza, Dahlia, Emilia, Erigeron, Eupatorium, Gaillardia, Helenium, Helianthus, Melanthera, Porophyllum, Pterocaulon, Solidago, Tagetes* and *Zinnia*). EPPO lists the following plant species as major hosts: *Dendranthema x grandiflorum*, *Gerbera jamesonii*, *Pericallis x hybrida* and *Lactuca sativa*. CABI (2019) lists also the following main host species: *Arctium lappa*, *Aster* spp., *Chrysanthemum* spp., *Tagetes* spp. (CABI, 2019; EPPO GD, 2019).

The Asteraceae *Mikania micrantha* and *Baccharis halimifolia* are also attacked by *N. maculosa* (Hudson and Stiling, 1997; Diaz et al., 2015).

In addition to the species/genera listed above, *N. maculosa* was found in a more recent study in the United states on the following Asteraceae: *Artemisia vulgaris*, *Chromolaena odorata*, *Erechtites hieraciifolius*, *Gamochaeta pensylvanica*, *Grindelia squarrosa*, *Packera glabella*, *Sonchus asper* (Eiseman and Lonsdale, 2018).

Annex VII of Commission Implementing Regulation (EU) 2019/2072 lists the special requirements necessary for the introduction of plants in 19 CN codes which are hosts to *N. maculosa*.

Some additional host species to the ones above are listed by CABI 2019 and EPPO GD, however, most of them are considered doubtful e.g. CABI refers to unconfirmed reports where *N. maculosa* was found to attack Solanaceae (Sanabri di Arévalo, 1994) and Brassicaceae (Spencer et al., 1992).

3.4.2. Entry

Is the pest able to enter into the EU territory? (Yes or No) If yes, identify and list the pathways.

Yes, *Nemorimyza maculosa* could enter the EU via infested host plants or with soil (closed pathway).

Nemorimyza maculosa is an oligophagous species and its different life stages could use different pathways to enter the EU, as noted in Table 6.

Table 6: Potential pathways for *Nemorimyza macuolsa* and existing mitigations

Pathways	Life stage	Relevant mitigations
Plants for planting with foliage	Eggs and larvae	Many herbaceous plants are covered by the CN codes listed in Annex VII of Commission Implementing Regulation (EU) 2019/2072 (see Table 4 above)
Fresh leafy hosts for consumption	Eggs and larvae	Annex IX Part A of Commission Implementing Regulation (EU) 2019/2072 requires a phytosanitary certificate for *Lactuca sativa.*
Cut flowers and branches with foliage	Eggs and larvae	Annex VII of Commission Implementing Regulation (EU) 2019/2072 applies only to *Chrysanthemum*, *Dianthus*, *Gypsophila* and *Solidago* although other ornamental hosts exist
Soil & growing media	Pupae	Annex VI of Commission Implementing Regulation (EU) 2019/2072 regulates the introduction of soil and growing medium as such into the Union from third countries other than Switzerland

The import of soil or growing medium as such, from third countries other than Switzerland is prohibited. Growing medium, attached to or associated with plants, intended to sustain the vitality of the plants, with the exception of sterile medium of *in vitro* plants is subjected to special requirements from third countries other than Switzerland. Machinery and vehicles which have been operated for agricultural or forestry purposes are also subject to special requirements. Therefore, the entry of *N. maculosa* pupae is prevented.

There are no records of interceptions of *N. maculosa* in the Europhyt database.

3.4.3. Establishment

Is the pest able to become established in the EU territory?

Yes, *N. maculosa* hosts grow widely across the EU and there are suitable climates that would enable *N. maculosa* to establish outdoors in the EU and also in protected cultivation, such as in greenhouses or polytunnels

3.4.3.1. EU distribution of main host plants

Many potential hosts of *N. maculosa* are available to this insect in the EU. Because of the oligophagy of this Dipteran, a wide range of host plant species within the Asteraceae family including crops such as lettuce and ornamental plants widely grown in the EU, including those grown in glasshouses, could support the development and reproduction of this insect (Table 7).

Table 7: EU 28 crop production of example hosts (area × 1000 ha) (cultivation/harvested/production) in the years 2014–2018

Crop	Eurostat code	Year				
		2014	2015	2016	2017	2018
Lettuces	V2300	96.03	93.95	91.19	91.00	88.33
Sunflower seeds	I1120	4,266.12	4,196.97	4,137.65	4,311.63	4,025.65

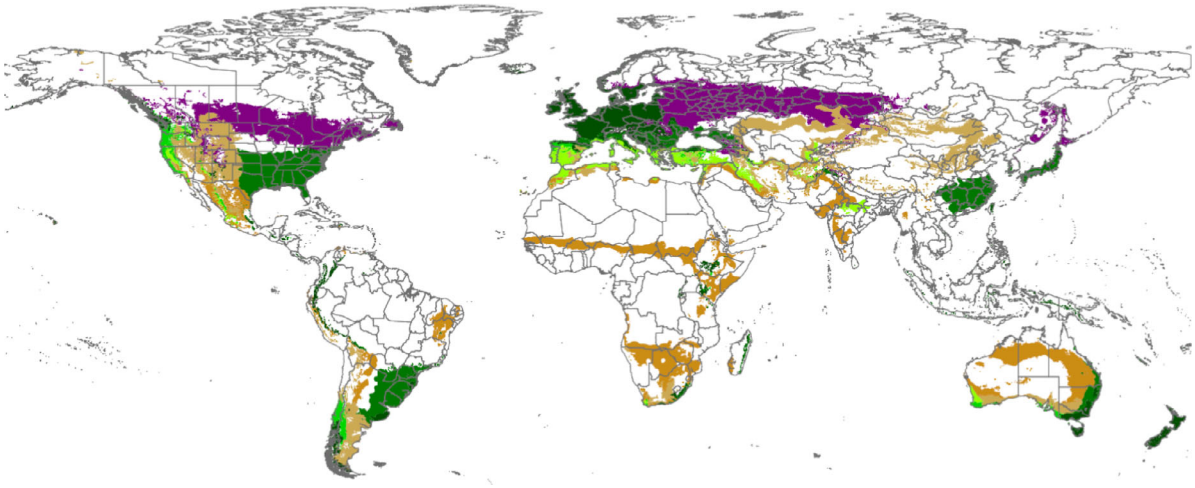
There are no recent detailed statistics regarding the area used to grow specific species of ornamental plants in the EU. Nevertheless, Table 8 shows data from a European Commission working document on horticultural products prepared in 2017 that included estimates of the area used to grow flowers and ornamental plants (excluding nurseries) in EU member states (European Commission, 2017). A proportion of the area would have been used to grow ornamental Asteraceae such as chrysanthemums which could host *N. maculosa.*

Table 8: Estimates of area used to grow flowers and ornamental plants (excluding nursery plants) in key EU member states (ha) (Source: extract from European Commission 2017, Table 2.1a)

Member state	2014	2015	2016
Netherlands	26,300	27,600	32,600
France	8,800	8,800	8,900
Germany	7,300	7,500	7,300
Spain	7,100	6,300	6,400
UK	6,000	6,000	6,000
Belgium	5,100	5,400	5,300
Poland	3,500	3,500	4,900
Portugal	2,900	2,900	3,500

3.4.3.2. Climatic conditions affecting establishment

The origin of *N. maculosa* is most probably subtropical/temperate areas of South America. It is also widespread in the Caribbean and North America. In the eastern states of the USA, it occurs outdoors while in the most northern states and in Canada, it occurs in greenhouses. European climate types occur in regions of the Americas where *N. maculosa* can be found (Figure 2).



Köppen-Geiger climate		% of EU	Description
BSh		0.1	Dry, hot, semi-arid steppe
BSk		1.5	Dry, cold, semi-arid steppe
Cfa		6.3	Temperate, uniform precipitation, humid sub- tropical
Cfb		48.6	Temperate, uniform precipitation, oceanic
Cfc		0.5	Temperate, uniform precipitation, sub-polar oceanic
Csa		10.1	Temperate, dry, hot summer / Mediterranean hot summer
Csb		3.9	Temperate, dry, warm summer / Mediterranean warm or cool summer
Dfb		8.7	Continental, uniform precipitation, warm summer

Figure 2: Köppen–Geiger climate type zones occurring in the EU and around the world (Note that CSc, Dsb and DSc, each occupying < 0.05% of EU are not shown, nor is Dfc which in the EU occurs in Scandinavia). In its native range in the Americas, *N. maculosa* is established from South America (Argentina to Venezuela), Central America and Caribbean, North America (USA and Canada – in northern US states *N. maculosa* occurs in greenhouses). (Map based on data in MacLeod and Korycinska (2019)).

3.4.4. Spread

Is the pest able to spread within the EU territory following establishment?

Yes, adults can fly. However, *N. maculosa* seems not to be a good flyer. It can be passively dispersed by wind currents.

RNQPs: Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects?

Yes, wide-scale and international spread of *N. maculosa* seems to be mostly dependent on human-mediated movement of plants.

Agromyzid flies are not considered strong fliers and tend to remain close to their host plants, only moving short distances between plants. However, they can be passively dispersed over long distances by the wind (Malipatil et al., 2016). International spread can be attributed to human-assisted movement of infested host plant material and infested cut flowers can be a means of such dispersal (Shewell, 1967). It is noted that the vase life of chrysanthemums is sufficiently long to allow completion of the life cycle of *N. maculosa* (Smith et al., 1997; CABI, 2019).

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, the introduction of *N. maculosa* could have an economic impact in the EU through qualitative and quantitative effects on horticultural production (e.g. ornamental Asteraceae such as chrysanthemums).

RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?

Yes, should *N. maculosa* be present in plants for planting, an economic impact on their intended use would be expected.

Damage is caused to hosts by females puncturing leaves during oviposition and by subsequent larval mining within leaves. The photosynthetic ability of plants is often greatly reduced as the chlorophyll-containing cells are destroyed. Severely infested leaves may fall, exposing plant stems to wind action, and flower buds and developing fruit to scald (Musgrave et al. 1975). In young plants and seedlings, mining may cause considerable delay in plant development leading to plant loss.

CABI (2019) reports that there are very few reports of serious outbreaks. A US report from 1962 notes the pest was 'medium' on chrysanthemums in a greenhouse in Pennsylvania (USDA, 1962). It is assumed this means the pest was causing a 'medium' amount of damage. Leaf miner damage to ornamentals can reduce quality and marketability and even slight damage in the flower industry can cause concern. In California (USA), ornamental growers monitor for low-level damage to young plants (Smith et al., 1997) and then presumably intervene to avoid losses.

Although *N. maculosa* occurs in Florida, Weems and Dekle (1999) report that it is not an important pest of commercial chrysanthemums in the principal commercial growing areas. It can, however, be problematic in domestic gardens (i.e. non-commercial sites).

Damage to lettuce has been reported from Trinidad and Venezuela, where a small field was totally destroyed (Spencer, 1973).

There is no information regarding impacts in Madeira or La Palma.

3.6. Availability and limits of mitigation measures

Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?

Yes, the existing measures (see sections 3.3 and 3.4.2) can mitigate the risks of entry into the EU.

RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?

Yes, sourcing plants for planting from pest free areas or pest free places of production would mitigate the risk.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to many host plants which are regulated and require a phytosanitary certificate for EU entry. Cut flowers of *Chrysanthemum*, *Dianthus*, *Gypsophila* and *Solidago* are regulated specifically for *N. maculosa* in Annex VII of Commission Implementing Regulation (EU) 2019/2072 (see Sections 3.3 and 3.4.2).

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 9.

Table 9: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/ establishment/ spread/impact)
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses.	Entry, spread
Crop rotation, associations and density, weed/ volunteer control	Crop rotation, associations and density, weed/volunteer control are used to prevent problems related to pests and are usually applied in various combinations to make the habitat less favourable for pests. The measures deal with (1) allocation of crops to field (over time and space) (multicrop, diversity cropping) and (2) to control weeds and volunteers as hosts of pests/vectors. Nitrogen level and reflective mulches are sometimes said to influence leaf miner populations, but responses have not been consistent (Chalfant et al., 1977; Hanna et al. 1987).	Impact
Heat and cold treatments	Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself. All stages are killed within a few weeks by cold storage at 0°C. Newly laid eggs are, however, the most resistant stage and it is recommended that cuttings of infested ornamental plants be maintained under normal greenhouse conditions for 3–4 days after lifting to allow eggs to hatch. Subsequent storage of the plants at 0°C for 1–2 weeks should then kill off the larvae of leaf miner species (Webb and Smith, 1970)	Entry
Chemical treatments on crops including reproductive material	Some insecticides, particularly pyrethroids, are effective against leaf miners but resistance makes control difficult (Parrella et al., 1984). Foliar application of insecticides is often frequent in susceptible crops. Insecticide susceptibility varies greatly both spatially and temporally. Many insecticides are no longer effective. Insecticides are disruptive to naturally occurring biological control agents, and leaf miner outbreaks are sometimes reported to follow chemical insecticide treatment for other insects (Capinera, 2017)	Impact
Biological control and behavioural manipulation	Natural enemies sometimes suppress leaf miner populations (Spencer, 1973). Some parasitic wasps may be useful against *Chrysanthemum* leaf miners in greenhouse conditions (Harris, 1976)	Impact

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 10.

Table 10: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/ establishment/ spread/impact)
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5). The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques.	Entry
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols. Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests.	Entry
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by a National Plant Protection Organization in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries.	Entry
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing. For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology.	Entry
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import) b) plant passport (EU internal trade) To avoid the introduction of *N. maculosa* EPPO (EPPO, 1990) recommends that propagating material (except seeds) of *Capsicum*, carnations, celery, chrysanthemums, *Cucumis*, *Gerbera*, *Gypsophila*, lettuces, *Senecio hybridus* and tomatoes from countries where the pest occurs must have been inspected at least every month during the previous 3 months and found free from the pests. A phytosanitary certificate should be required for cut flowers and for vegetables with leaves.	Entry
Certification of reproductive material (voluntary/ official)	–	Entry
Surveillance	–	Entry

3.6.1.3. Biological or technical factors limiting the effectiveness of measures to prevent the entry, establishment and spread of the pest

- Minute size of all developmental stages of *N. maculosa*
- Mobility of adults
- Egg and larval stages within and protected by plant tissue
- Pupal stage occurring in the soil
- Control with insecticides is usually complicated by the insect's biology, including the ability of Agromyzidae flies to develop resistance to insecticides (Parrella, 1987).

3.6.1.4. Biological or technical factors limiting the ability to prevent the presence of the pest on plants for planting

- Fast development time
- High reproductive capability

3.7 Uncertainty

CABI (2019) suggests that *N. maculosa* is more widespread in the Americas than is currently indicated, e.g. distribution in USA and Brazil is unclear. The magnitude of potential impact in the EU is also uncertain. Some of the literature reporting impacts in CABI (2019) and cited in Smith et al. (1997) is from the 1930s.

4. Conclusions

N. maculosa satisfies the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest and also the criteria that are within the remit of EFSA to assess for it to be regarded as a potential regulated non-quarantine pest (given its limited presence in the EU and main means of spread being plants for planting). The pest is regulated as a quarantine pest, there are no grounds to consider that its status could be revoked (Table 11).

Table 11: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pests (Section 3.1)	The identity of *Nemorimyza maculosa* is well established and there are taxonomic keys available for its identification to species level.	The identity of *Nemorimyza maculosa* is well established and there are taxonomic keys available for its identification to species level.	
Absence/presence of the pest in the EU territory (Section 3.2)	*N. maculosa* is present on the island of Madeira (PT) but is not known to occur in mainland Portugal	*N. maculosa* present on the island of Madeira (PT) but is not known to occur in mainland Portugal	
Regulatory status (Section 3.3)	The pest is listed in as a Union quarantine pest in Annex IIA of Commission Implementing Regulation (EU) 2019/2072. Although present in the EU its distribution is limited and it is under official control.	The pest is regulated as a quarantine pest, there are no grounds to consider that its status could be revoked.	

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	*N. maculosa* could enter into, become established in, and spread within, the EU territory. The main pathways are: Cut flowers or branches with foliage, fresh leafy hosts for consumption, leafy plants for planting.	Although adults can fly, natural spread is not considered its main mode for long distance dispersal. Instead human-assisted transport via cut flowers or leafy plants for planting are likely the main means of spread.	
Potential for consequences in the EU territory (section 3.5)	The pests' introduction would most probably have an economic impact in the EU.	Should *N. maculosa* be present on plants for planting, an economic impact on their intended use would be expected.	The magnitude of potential impact is uncertain. Some of the literature reporting impacts in CABI (2019) and cited in Smith et al. (1997) is from the 1930s, pre agrochemicals
Available measures (Section 3.6)	There are measures available to prevent the entry into, establishment within or spread of the pest within the EU (i.e. sourcing plants from PFA).	There are measures available to prevent the entry into, establishment within or spread of the pest within the EU (i.e. sourcing plants from PFA).	
Conclusion on pest categorisation (Section 4)	Although *N. maculosa* occurs in a limited area of the EU, where it is under official control, all criteria assessed by EFSA above for consideration as a potential quarantine pest are met	The criteria for consideration as a potential RNQP are met although *N. maculosa* occurs only in a limited area of the EU where it is under official control.	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	A future assessment could consider the impact of *N. maculosa* in Madeira, and the likelihood of *N. maculosa* spread from Madeira to the rest of the EU.		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
RNQP	Regulated non-quarantine pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)

Greenhouse	The term 'greenhouse' is used in the current opinion as defined by EPPO (https://gd.eppo.int/taxon/3GREEL) as a walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment. A similar definition is also given in EFSA Guidance Document on protected crops (2014) https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2014.3615.
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)
Measures	Control (of a pest) is defined in ISPM 5 (FAO, 2017) as "Suppression, containment or eradication of a pest population" (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance.
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017)
Protected zones (PZ)	A Protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union.
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017)
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2017)

Appendix A – Host plants for *Nemorimyza maculosa*.

Host category	Host	Common name	Family	Reference
Main	*Lactuca sativa*	lettuce	Asteraceae	EPPO GD (2019)
Major	*Dendranthema x grandiflorum*	chrysanthemum	Asteraceae	EPPO GD (2019)
Major	*Gerbera jamesonii*	African daisy	Asteraceae	EPPO GD (2019)
Major	*Pericallis x hybrida*	cineraria	Asteraceae	EPPO GD (2019)
Main	*Aster*	–	Asteraceae	CABI (2019)
Main	*Arctium lappa*	burdock	Asteraceae	CABI (2019)
Main	*Chrysanthemum*	chrysanthemum	Asteraceae	CABI (2019)
Main	*Tagetes*	marigold	Asteraceae	CABI (2019)
Minor	*Dahlia*	dahlia	Asteraceae	EPPO GD (2019)
Minor	*Symphyotrichum novi-belgii*	New York Aster	Asteraceae	EPPO GD (2019)
Wild host	*Baccharis halimifolia*	groundsel-bush	Asteraceae	CABI (2019)
Wild host	*Conyza*	butterweed	Asteraceae	CABI (2019)
Wild host	*Sonchus*	sow thistle	Asteraceae	CABI (2019)
Unclassified	*Argyranthemum frutescens*	marguerite daisy	Asteraceae	EPPO GD (2019)
Unclassified	*Leucanthemum vulgare*	ox-eye daisy	Asteraceae	EPPO GD (2019)
Unclassified	*Leucanthemum x superbum*	Shasta daisy	Asteraceae	EPPO GD (2019)
Unclassified	*Tanacetum parthenium*	feverfew	Asteraceae	EPPO GD (2019)
Unclassified	*Tanacetum vulgare*	golden buttons	Asteraceae	EPPO GD (2019)
Other	*Ageratum*	–	Asteraceae	CABI (2019)
Other	*Arctium minus*	common burdock	Asteraceae	CABI (2019)
Other	*Bidens*	burmarigold	Asteraceae	CABI (2019)
Other	*Calendula*	marigolds	Asteraceae	CABI (2019)
Other	*Emilia sonchifolia*	red tasselflower	Asteraceae	CABI (2019)
Other	*Erigeron*	fleabane	Asteraceae	CABI (2019)
Other	*Eupatorium*	–	Asteraceae	CABI (2019)
Other	*Gaillardia*	blanket flower	Asteraceae	CABI (2019)
Other	*Helenium*	sneezeweeds	Asteraceae	CABI (2019)
Other	*Helianthus annuus*	sunflower	Asteraceae	CABI (2019)
Other	*Ipomoea batatas*	sweet potato	Convolvulaceae	CABI (2019)
Other	*Parthenium hysterophorus*	parthenium weed	Asteraceae	CABI (2019)
Other	*Raphanus*	radish	Brassicaceae	CABI (2019)
Other	*Senecio*	groundsel	Asteraceae	CABI (2019)
Other	*Solanum dulcamara*	nightshade	Solanaceae	CABI (2019)
Other	*Solidago*	goldenrod	Asteraceae	CABI (2019)
Other	*Taraxacum*	dandelion	Asteraceae	CABI (2019)
Other	*Zinnia*	–	Asteraceae	CABI (2019)

Appendix B – EU Member State production area of example hosts 2014–2018

Lettuce area (cultivation/harvested/production) (1000 ha) (Source: Eurostat)

Member state/Year	2014	2015	2016	2017	2018	% of EU lettuce area	Cumulative %
Spain	33.87	34.31	35.65	34.51	33.67	37.4	37.4
Italy	19.78	18.58	15.67	15.66	14.92	18.4	55.7
France	8.96	8.84	8.86	8.60	8.43	9.5	65.2
Germany	6.70	6.56	6.50	7.09	6.93	7.3	72.5
United Kingdom	6.00	6.43	4.70	4.80	4.80	5.8	78.4
Greece	4.76	3.67	3.56	3.29	3.31	4.0	82.4
Netherlands	3.51	3.48	3.52	3.45	3.35	3.8	86.1
Poland	1.70	1.80	2.31	2.78	2.53	2.4	88.6
Portugal	2.42	2.15	2.18	2.28	1.93	2.4	90.9
Sweden	1.85	1.71	1.63	1.70	1.81	1.9	92.8
Austria	1.41	1.32	1.45	1.39	1.31	1.5	94.3
Belgium	1.25	1.33	1.29	1.28	1.18	1.4	95.7
Slovenia	0.67	0.73	0.75	0.74	0.71	0.8	96.5
Finland	0.65	0.65	0.70	0.59	0.67	0.7	97.2
Denmark	0.67	0.61	0.42	0.56	0.53	0.6	97.8
Hungary	0.31	0.37	0.40	0.34	0.28	0.4	98.2
Czechia	0.18	0.14	0.15	0.59	0.62	0.4	98.5
Ireland	0.30	0.30	0.31	0.26	0.26	0.3	98.8
Lithuania	0.22	0.24	0.27	0.24	0.25	0.3	99.1
Bulgaria	0.29	0.18	0.12	0.29	0.24	0.2	99.4
Croatia	0.10	0.20	0.28	0.20	0.25	0.2	99.6
Cyprus	0.08	0.15	0.28	0.19	0.18	0.2	99.8
Romania	0.15	0.16	0.15	0.14	0.15	0.2	99.9
Slovakia	0.20	0.04	0.02	0.02	0.01	0.1	100.0
Luxembourg	0.01	0.01	0.02	0.02	0.02	0.0	100.0
Estonia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Latvia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Malta	0.00	0.00	0.00	0.00	0.00	0.0	100.0

Lettuce area under glass or high accessible cover (1000 ha) (Source: Eurostat)

Member state/Year	2014	2015	2016	2017	2018	% of EU lettuce area	Cumulative %
Italy	4.27	3.84	4.55	4.52	4.31	35.2	35.2
France	2.62	2.39	2.39	2.32	2.28	19.7	54.9
Belgium	0.95	1.01	1.00	1.00	0.90	8.0	62.8
Spain	0.98	1.04	1.05	0.95	0.84	8.0	70.8
Portugal	0.98	0.96	0.90	1.10	0.75	7.7	78.5
Greece	0.62	0.65	0.49	0.52	0.53	4.6	83.1
Poland	0.40	0.40	0.35	0.38	0.38	3.1	86.2
United Kingdom	0.30	0.35	0.30	0.40	0.40	2.9	89.1
Finland	0.32	0.29	0.37	0.27	0.41	2.7	91.8
Netherlands	0.38	0.35	0.35	0.05	0.05	1.9	93.7
Bulgaria	0.18	0.10	0.10	0.18	0.19	1.2	95.0
Ireland	0.12	0.12	0.12	0.12	0.12	1.0	95.9
Hungary	:	0.10	:	:	:	0.8	96.8
Lithuania	0.09	0.13	0.09	0.09	0.09	0.8	97.6

Member state/Year	2014	2015	2016	2017	2018	% of EU lettuce area	Cumulative %
Austria	0.10	0.09	0.06	0.06	0.06	0.6	98.2
Romania	0.07	0.06	0.07	0.07	0.09	0.6	98.8
Germany	0.08	0.07	0.06	0.07	0.07	0.6	99.3
Sweden	0.07	0.06	0.05	0.05	0.06	0.5	99.8
Croatia	0.01	0.04	0.01	0.01	0.02	0.1	100.0
Denmark	0.01	0.00	0.00	0.01	0.01	0.0	100.0
Czechia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Estonia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Cyprus	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Latvia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Luxembourg	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Malta	:	0.00	0.00	0.00	0.00	0.0	100.0
Slovenia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Slovakia	0.00	0.00	0.00	0.00	0.00	0.0	100.0

Sunflower seeds (cultivation/harvested/production) (1000 ha) (Source: Eurostat)

Member state	2014	2015	Year 2016	2017	2018	% of EU sunflower seed area	Cumulative %
Romania	1,001.02	1,011.53	1,039.82	998.42	1,006.99	24.2	24.2
Bulgaria	843.64	810.84	817.51	898.84	788.66	19.9	44.0
Spain	783.43	738.85	717.67	724.63	691.28	17.5	61.5
Hungary	593.73	611.64	629.68	694.54	616.95	15.0	76.5
France	657.36	618.16	541.48	586.23	552.07	14.1	90.6
Italy	111.35	114.45	110.72	114.45	103.87	2.6	93.3
Greece	87.81	107.23	85.10	90.61	82.50	2.2	95.4
Slovakia	76.59	75.41	83.79	87.35	68.80	1.9	97.3
Croatia	34.87	34.49	40.25	37.15	37.13	0.9	98.2
Austria	20.54	19.06	18.19	22.02	21.50	0.5	98.7
Germany	20.00	18.40	16.70	18.00	19.50	0.4	99.1
Czechia	18.61	15.45	15.65	21.60	20.20	0.4	99.6
Portugal	15.55	19.93	18.21	13.46	9.49	0.4	99.9
Poland	1.36	1.30	2.00	3.24	5.67	0.1	100.0
Netherlands	0.00	0.00	0.64	0.80	0.75	0.0	100.0
Slovenia	0.25	0.23	0.24	0.30	0.29	0.0	100.0
Ireland	0.00	0.01	0.00	0.00	0.00	0.0	100.0
Belgium	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Denmark	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Estonia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Cyprus	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Latvia	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Lithuania	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Luxembourg	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Malta	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Finland	0.00	0.00	0.00	0.00	0.00	0.0	100.0
Sweden	0.00	0.00	0.00	0.00	0.00	0.0	100.0
UK	0.00	0.00	0.00	0.00	0.00	0.0	100.0