SCIENTIFIC OPINION

efsa JOURNAL

ADOPTED: 12 December 2022

doi: 10.2903/j.efsa.2023.7769

Pest categorisation of *Resseliella maxima*

EFSA Panel on Plant Health (PLH),
Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe Lucien Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen, Lucia Zappalà, Jean-Claude Grégoire, Chris Malumphy, Virag Kertesz, Andrea Maiorano and Alan MacLeod

Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Resseliella maxima* (Diptera: Cecidomyiidae), the soybean gall midge, for the EU. This midge was first described in 2018 and is widespread in north-western United States. It is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072. Larvae feed on and develop in soybean (*Glycine max*, Fabaceae), and possibly in two other Fabaceae, sweet clover (*Melilotus officinalis*) and alfalfa/lucerne (*Medicago sativa*). Feeding damage results in dark brown or black areas on the stems which become weak and can break near the soil; heavy infestations can cause plant death. *R. maxima* adults live only a few days and adult females lay eggs within 24 h after emergence. Larvae of *R. maxima* overwinter in the soil as third instars in silken cocoons. The main natural dispersal stage is the adult, which can fly. Freshly cut host plants for animal feed contaminated with larvae provide a potential pathway for entry into the EU. However, there is great uncertainty as to whether such plants are imported from USA states where *R. maxima* occurs. Climatic conditions and host availability in central-western EU MS are favourable for outdoor establishment. Phytosanitary measures are available to reduce the likelihood of entry and spread. Except for the uncertainty concerning the likelihood of entry, *R. maxima* satisfies the other criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.

Keywords: soybean gall midge, Cecidomyiidae, Fabaceae, pest risk, plant health, plant pest, quarantine

Requestor: European Commission

Question number: EFSA-Q-2022-00760

Correspondence: plants@efsa.europa.eu

Panel members: Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen and Lucia Zappalà.

Declarations of interest: If you wish to access the declaration of interests of any expert contributing to an EFSA scientific assessment, please contact interestmanagement@efsa.europa.eu.

Acknowledgements: EFSA wishes to acknowledge the contribution of Oresteia Sfyra to this opinion

Suggested citation: EFSA PLH Panel (EFSA Panel on Plant Health PLH), Bragard C, Baptista P, Chatzivassiliou E, Di Serio F, Gonthier P, Jaques Miret JA, Justesen AF, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Stefani E, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Grégoire J-C, Malumphy C, Kertesz V, Maiorano A and MacLeod A, 2023. Scientific Opinion on the pest categorisation of *Resseliella maxima*. EFSA Journal 2023;21(1):7769, 20 pp. https://doi.org/10.2903/j.efsa.2023.7769

ISSN: 1831-4732

Table of contents

1. Introduction

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

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above-mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1 E (for more details see mandate M-2021-00027 on the Open.EFSA portal). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the Open.EFSA portal). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2. Interpretation of the Terms of Reference

Resseliella maxima is one of a number of pests listed in Annex 1D to the Terms of Reference (ToRs) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential Union quarantine pest for the area of the 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, and so inform EU decision making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

1.3. Additional information

This pest categorisation was initiated as a result of media monitoring, PeMoScoring and subsequent discussion in PAFF, resulting in it being included in the current mandate within the list of pests identified by horizon scanning and selected for pest categorisation.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *R. maxima* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as search term. Papers relevant for the pest categorisation 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), the CABI databases and scientific literature databases as referred above in Section 2.1.1.

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 and TRACES databases were 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 as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed 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 and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

GenBank was searched to determine whether it contained any nucleotide sequences for *Resseliella maxima* which could be used as reference material for molecular diagnosis. GenBank® (www.ncbi.nlm.nih.gov/genbank/) is a comprehensive publicly available database that as of August 2019 (release version 227) contained over 6.25 trillion base pairs from over 1.6 billion nucleotide sequences for 450,000 formally described species (Sayers et al., 2020).

2.2. Methodologies

The Panel performed the pest categorisation for *R. maxima*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2016).

The criteria to be considered when categorising a pest as a potential Union quarantine pest (QP) is given in Regulation (EU) 2016/2031 Article 3 and Annex I, Section 1 of the Regulation. Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee, 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

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, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the

EU. Whilet the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3 (d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as derived from 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 (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest clearly defined, 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 in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.
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 for entry and spread.
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impacts?
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.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes. The identity of the species is clearly defined and *Resseliella maxima* Gagné is the accepted name.

Resseliella maxima Gagné 2019 is an insect species within the order Diptera, family Cecidomyiidae. It is commonly known as the soybean gall midge. It was first described in 2019 (Gagné et al., 2019). However, its presence in the North Central region of the US was known for some time before (Mc Mechan et al., 2021; Sever, 2021).

The EPPO code[1] (Griessinger and Roy, 2015; EPPO, 2019) for this species is: RESSMA (EPPO, online).

3.1.2. Biology of the pest

As a recently described species, little is known about the biology of *R. maxima*. Adult emergence of the overwintering generation of *R. maxima* starts around early to mid-June in fields that grew soybean the previous year. The adults fly out of these fields to find current soybean fields where they can oviposit on soybean plants (McMechan et al., 2021; Montenegro Castro, 2022). Indeed, injured plants associated with the soybean gall midge were first observed in late June (McMechan et al., 2018b). The

[1] 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, 2019).

adult females lay their eggs in the cracks or crevices at the base of stems of hosts (Gagné et al., 2019; McMechan et al., 2021; Sever, 2021). Field observations reveal that soybean becomes susceptible at the second or third vegetative growth stage, V2 (see https://crops.extension.iastate.edu/soybean/production_growthstages.html for details on soybean development). Indeed, these developmental stages seem to coincide with the occurrence of crevices below the cotyledonary node where, under controlled greenhouse conditions, adults have been observed laying eggs (McMechan et al., 2021). After hatching larvae feed initially on the phloem before moving gradually towards the xylem and pith. Dissections of infested plant material revealed larvae feeding between dead and live plant tissue (McMechan et al., 2021). As larvae reach maturity, they drop to the soil and pupate.

Three periods of adult emergence, from mid-June to August, have been observed with each generation lasting 28–32 days (Montenegro Castro, 2022).

3.1.3. Host range/species affected

Soybean (*Glycine max* L.) is the main host plant affected (Gagné et al., 2019). *R. maxima* has also been collected from sweet clover (*Melilotus officinalis*) and alfalfa/lucerne (*Medicago sativa*) fields in Nebraska (Server, 2021); however, there is uncertainty whether these species are hosts of the pest.

3.1.4. Intraspecific diversity

No intraspecific diversity is up to now reported for this species. Studies are in progress to determine whether populations collected on different hosts are genetically different (Sever, 2021).

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, there are detection and identification methods for *R. maxima*.

Detection

R. maxima is a tiny fly (a midge), with adults being approximately 0.6 mm long, which makes them difficult to find (Sever, 2021). Nevertheless, visual examination of plants is presently the only way for detecting *R. maxima*, looking for dark discoloration at the base of the stem. Scouting of soybean plants should start after the V2 growth stage; infestations are most likely on field edges near fields that had soybean the previous year. Stems of infested plants become hard and can break near the soil. Larvae are rather easy to be detected being gregarious and orange and could be found peeling back the epidermis of the stem (Potter and Koch, 2022). Placing cages in *R. maxima* infested fields has allowed collection of adults that emerge from the soil to monitor adult activity (McMechan et al., 2021). Green sticky cards have also been used to follow the phenology of the midge (Varenhorst et al., 2020).

Identification

Morphological traits allow identification. A detailed description of the third instar larva and adult is provided by Gagné et al. (2019). Besides, a fragment of the mitochondrial gene cytochrome oxidase subunit I (COI) was sequenced and deposited in the DNA Data Bank of Japan (DDBJ), European Molecular Biology Laboratory (EMBL), and GenBank nucleotide sequence databases (Gagné et al., 2019).

Symptoms

Infested stems show a dark area and sometimes a swelling at the base. Plants with advanced *R. maxima* infestation are typically found wilted or dead. Besides, plant death appears to be more concentrated near the field edge and diminishes toward the field centre. In addition, heavily infested areas were often next to waterways and ditches with dense vegetation, probably serving as refugia for overwintering larvae (Gagné et al., 2019). However, some infested plants do not show noticeable symptoms, except possibly for some basal discoloration. In this case, the base of the stem near the soil surface needs to be carefully evaluated to confirm *R. maxima* infestation (McMechan et al., 2021; Montenegro Castro, 2022).

Description

Larva: larvae are legless maggots, 2 mm in length. Three instars of *R. maxima* larvae have been identified, first instar is clear to white, and third instar is orange (Gagné et al., 2019; Montenegro Castro, 2022).

Pupa: it is found in the soil, in the first 2–4 cm from the surface (Montenegro Castro, 2022).

Adult: antennae with alternating dark and light bands; male with scape, pedicel, first flagellomere and first node and neck of each successive flagellomere dark, the remainder light, the female with basal third of each node and neck dark, remainder light; wing mottled and 2.0 (male) and 2.5 (female) mm in length; legs with alternating dark and light bands; orange abdomen (Gagné et al., 2019).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

R. maxima is only known to occur in the USA (Figure 1).

Figure 1: Global distribution of *Resseliella maxima* (Source: literature)

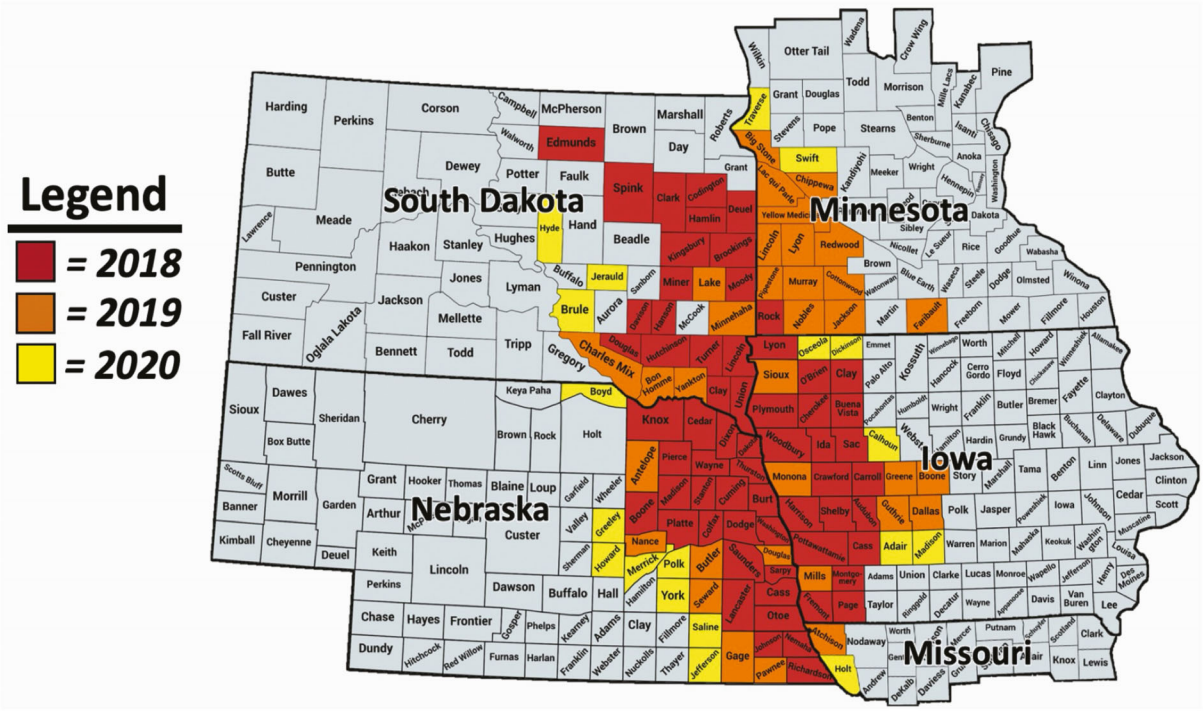

Figure 2: Distribution of *Resseliella maxima* in the Midwestern United States; Iowa, Nebraska, Minnesota, Missouri and South Dakota. Colour of countries indicates the year it was confirmed as infested by soybean hall midge (by McMechan et al., 2021; http://creativecommons.org/licenses/by-nc-nd/4.0)

R. maxima was identified in the autumn of 2019, in USA, feeding on stems of soybean (*G. max*), isolated from highly infested fields in Nebraska, Iowa, South Dakota and Minnesota (Figure 2). The larvae were initially found in 63 counties within the four states, which gradually became 114 counties, including some in the state of Missouri (McMechan et al., 2021). Although the species was identified only in 2019, it is likely to have been in the North Central region of the USA for some time. Indeed, in north-east Nebraska, orange larvae suspected to be the soybean gall midge were found in isolated soybean fields in 2011 (Hunt et al., 2011), but it was thought to be an opportunistic pest that fed on diseased or injured plants (Sever, 2021). Several anecdotal reports were known and converged in considering this species a secondary pest, attacking only hail-damaged or disease-compromised soybean plants (Gagné et al., 2019).

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.

No, *R. maxima* is not known to be present in the EU territory.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

Resseliella maxima is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031, or in any emergency plant health legislation.

3.3.2. Hosts or species affected that are prohibited from entering the union from third countries

Table 2: List of plants, plant products and other objects that are *Resseliella maxima* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI)

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	**CN Code**	**Third country, group of third countries or specific area of third country**
19.	Soil as such consisting in part of solid organic substances	ex 2,530 90 00 ex 3,824 99 93	Third countries other than Switzerland
20.	Growing medium as such, other than soil, consisting in whole or in part of solid organic substances, other than that composed entirely of peat or fibre of *Cocos nucifera* L., previously not used for growing of plants or for any agricultural purposes	ex 2,530 10 00 ex 2,530 90 00 ex 2,703 00 00 ex 3,101 00 00 ex 3,824 99 93	Third countries other than Switzerland

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways.

Yes, possible but unlikely (much uncertainty). If soybean plants were imported fresh for animal feed, they could provide an entry pathway for this species. However, there is no evidence that such trade exists. Soil could also provide a pathway.

Comment on plants for planting as a pathway.

Plants for planting includes seed and on a commercial scale host plants are planted only as seed. However, seed does not provide a pathway for this pest.

R. maxima could spread over long distances through the movement of freshly cut host plants, soil and soil on machinery (Table 3).

Table 3: Potential pathways for *Resseliella maxima* into the EU

Pathways (e.g. host/ intended use/source)	**Life stage**	**Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]**
Freshly cut host plants (e.g. fresh forage, fodder)	Eggs, larvae	No prohibitions nor special requirements are in place
Soil	Larvae, pupae	Annex VI (19. and 20.) bans the introduction of soil and growing media as such into the Union from third countries other than Switzerland
Soil on machinery	Larvae, pupae	Annex VII (2.) Official statement that machinery or vehicles are cleaned and free from soil and plant debris

The EU does import fodder from the USA. Between 2017 and 2021 between 283 and 700 t of fodder of different species (Table 4) were imported annually from the USA by the EU 27 (Table 4). However, it is not possible to determine whether any of these imports contained alfalfa/lucerne or clover that are unconfirmed hosts of *R. maxima*, nor is it possible to determine whether any of this material came from states or counties in the USA where *R. maxima* occurs. It is possible that fodder from USA did not come from any states in the Mid-west and if it did it is still possible that none of it was alfalfa/lucerne or clover.

Table 4: EU 27 imports of fodder from USA, 2017–2021 (tonnes) Source: Eurostat

Commodity	2017	2018	2019	2020	2021
Hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches and similar forage products, excluding swedes, mangolds and other fodder roots and lucerne meal) (CN 1214 9,090)	440	283	600	700	621

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As at 02/12/2022, there were no records of interception of *Resseliella maxima* in the Europhyt and TRACES databases.

3.4.2. Establishment

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

Yes, the pest is able to become established in the EU territory. The known host plants are grown in the EU and there are areas, especially in some of the EU countries of central-western Europe where climate is suitable.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest taking key abiotic factors into account (Baker, 2002). Availability of hosts is considered in Section 3.4.2.1. Climatic factors are considered in Section 3.4.2.2.

3.4.2.1. EU distribution of main host plants

The main host of *R. maxima* is soybean (Table 5), infestations were also reported from alfalfa and sweet clover (Appendix A).

Table 5: Soybean cultivated area*, main host of Resseliella maxima, in EU 27 countries, in ha* (*FAOSTAT accessed on 27/4/2022*)

Soybean	2016	2017	2018	2019	2020
EU 27	829,166	960,640	955,400	907,900	947,680
Austria	49,791	64,467	67,620	69,210	68,500
Bulgaria	14,162	11,530	2,320	3,860	4,510
Croatia	78,614	85,133	77,090	78,330	86,190
Czech Republic	10,608	15,344	15,230	12,240	14,150
France	136,518	141,829	153,850	163,800	186,720
Germany	16,000	19,000	24,100	28,900	33,800
Greece	3,261	2,796	610	1,030	990
Hungary	61,029	75,667	62,120	58,230	58,670
Italy	288,060	322,417	326,590	273,330	256,130
Lithuania	:	:	1,920	1,820	2,070
Netherlands	:	:	540	480	:
Poland	7,642	9,333	5,450	7,920	7,170
Romania	125,148	164,624	169,420	158,150	174,610
Slovakia	34,872	43,900	45,300	47,600	51,070
Slovenia	2,466	2,908	1,760	1,430	1,640
Spain	995	1,692	1,480	1,570	1,450

':' Data not available.

3.4.2.2. Climatic conditions affecting establishment

R. maxima occurs only in Midwestern USA. It was described from material collected in Nebraska and it was proved to be present in Iowa, Minnesota, South Dakota and Missouri (see Section 3.2.1). Figure 3 shows the world distribution of Köppen–Geiger climate types (Kottek et al., 2006) that occur in the EU (e.g. in northern Italy and south-eastern Europe) and which occur in the USA states where *R. maxima* has been reported.

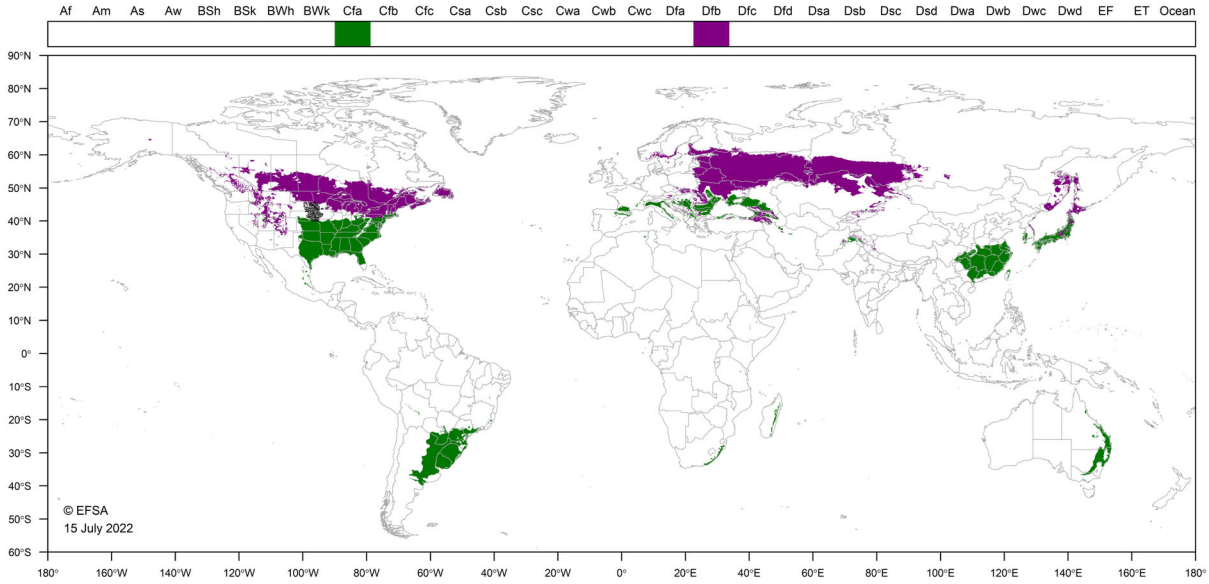

Figure 3: World distribution of Köppen-Geiger climate types that occur in the EU and which occur in sites where *Resseliella maxima* has been reported

3.4.3. Spread

Describe how the pest would be able to spread within the EU territory following establishment?

Even though adults are poor flyers – and thus only fly to the next row or so of soybeans – they can be wind-carried from one field to the next, spreading infestations locally (Sever, 2021). The pest could also spread by movement of freshly cut host plants.

Comment on plants for planting as a mechanism of spread.

Plants for planting are not a realistic pathway for this pest because hosts are planted as seed.

3.5. Impacts

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

Yes, if *R. maxima* established in the EU, it could have an economic impact, although the magnitude of impact is uncertain.

The distribution of plant injury in the field, larval feeding within the stem, and timing of infestation indicate that *R. maxima* is likely an important pest of soybean with yield losses that can reach 100% for the first 30 m from the field edge, and 17–31% further into the field (McMechan et al., 2021). However, there is still some uncertainty regarding the significance of this species as a primary pest of healthy, undamaged plants. There may be factors, such as disease, that predispose plants to infestation (Varenhorst et al., 2020; California Department of Food and Agriculture, 2021). Alfalfa and sweet clover are known hosts though very few larvae have been observed on these crops and their ecological role in soybean gall midge infestations as well as impacts have not been reported (Dean & Hogdson, 2022). Besides there is some uncertainty regarding if the midge that feeds on soybean is the same as the midge that feeds on sweet clover and alfalfa. Research is currently underway that may help answer this question (Sever, 2021).

A model to predict the potential yield loss at a given level of injury severity, and an injury rating system in order to express the relationship between season-long injury severity and yield loss, were developed by Helton et al. (2022). This research does not detail relations between pest population density and yield loss.

3.6. Available measures and their limitations

Are there measures available to prevent pest entry, establishment, spread or impacts such that the risk becomes mitigated?

Yes. Although the existing phytosanitary measures identified in Section 3.3.2 do not specifically target *R. maxima*, they mitigate the likelihood of its entry into, establishment and spread within the EU (see also Section 3.6.1).

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some host plants for planting (see Section 3.3.2).

Additional potential risk reduction options and supporting measures are shown in Sections 3.6.1.1. and 3.6.1.2.

3.6.1.1. Additional potential risk reduction options

Potential additional control measures are listed in Table 6.

Table 6: Selected control measures (a full list is available in EFSA PLH Panel et al., 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

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/ spread/impact)
Require pest freedom	The presence of the pest is rather limited to North Central region of the US, therefore the origin of plants or plant products from pest free areas could be effective in preventing pest entry.	Entry
Managed growing conditions	Tilling fields to try to destroy pupae, planting fields 20 ft in from the edges, changing planting dates (both earlier and later) are solutions applied by the growers (Sever, 2021).	Entry/Impact/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) (multi-crop, diversity cropping) and (2) to control weeds and volunteers as hosts of pests/vectors. Surveys in the US highlighted that infested soybean fields were often next to a field that had been planted to soybean the previous year (McMechan et al., 2021).	Entry/Establishment/ Impact
Use of resistant and tolerant plant species/varieties	Germplasm screening is currently being performed in order to find tolerant/resistance varieties (Sever, 2021).	Establishment/Spread/ Impact
Timing of planting and harvesting	The objective is to produce phenological asynchrony in pest/crop interactions by acting on or benefiting from specific cropping factors such as: cultivars, climatic conditions, timing of the sowing or planting, and level of maturity/age of the plant seasonal timing of planting and harvesting. The late planting dates corresponded to lower infestation (McMechan et al., 2018a).	Spread/Impact

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/ spread/impact)
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage e.g., fumigation; spraying/dipping pesticides; surface disinfectants	Entry/Spread/Impact
Limits on soil	Prohibitions to import soil or any kind of growing substrate avoid the transportation of last instar larvae and pupae.	Entry/Spread
Soil treatment	The control of the instars living in the soil by chemical and physical methods listed below: a) Fumigation; b) Heating; c) Solarisation; d) Flooding; e) Soil suppression; f) Augmentative Biological control; g) Biofumigation	Entry/Establishment/ Impact
Waste management	The destruction of infested crop residues could help in reducing pest pressure and therefore Establishment, Spread and Impact (Montenegro Castro, 2022).	Establishment/Spread/ Impact
Controlled atmosphere	Treatment of plants by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure).	Entry/Spread (via commodity)

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 7.

Table 7: Selected supporting measures (a full list is available in EFSA PLH Panel et al., 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

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (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/Establishment/ Spread
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/Spread
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

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (entry/establishment/ spread/impact)
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)	Entry/Spread
Delimitation of Buffer zones	ISPM 5 defines a buffer zone as "an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimise the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate" (ISPM 5). The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place (PFPP), site (PFPS) or area (PFA).	Spread
Surveillance	Surveillance to guarantee that plants and produce originate from a Pest Free Area could be an option.	Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

Eggs and larvae may not be easily detectable as eggs are laid into stem crevices and larvae develop inside stem tissues.

3.7. Uncertainty

There is uncertainty as to the likelihood of entry via freshly cut plants for animal feed.

4. Conclusions

There is doubt regarding whether imports of freshly cut plants for animal feed from USA really provide a likely pathway and whether *M. sativa* and *M. officinalis* are *R. maxima* hosts, nevertheless economic impacts could still be expected in soybeans if *R. maxima* established in the EU. Except for the uncertainty concerning the likelihood of entry, *R. maxima* satisfies the other criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union QP. (Table 8).

Table 8: 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	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the species is established and *Resseliella maxima* Gagné is the accepted name. Morphological and molecular identification methods are available.	None
Absence/presence of the pest in the EU (Section 3.2)	*R. maxima* is not known to occur in the EU territory.	None
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*R. maxima* could potentially enter, become established and spread within the EU territory. The potential pathway is import of freshly cut plants for animal feed. Soil is a potential pathway but is prohibited.	Whether freshly cut plants (soybean) are imported is unknown.

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Potential for consequences in the EU (Section 3.5)	The pest introduction in the EU territory would most likely have an impact. Indeed, while initially *R. maxima* was reported occurring only on previously damaged or disease-comprised soybean plants, subsequent records report yield losses.	None
Available measures (Section 3.6)	There are measures available to prevent entry, establishment and spread of *R. maxima* within the EU. Risk reduction options include inspections, chemical treatments on the crop and on consignments of fresh plant material from infested countries and the production of plants for import in the EU in pest free area.	None
Conclusion (Section 4)	Except for having uncertain pathway of introduction, *R. maxima* satisfies the other criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union QP.	
Aspects of assessment to focus on/scenarios to address in future if appropriate:		

References

Baker RHA, 2002. Predicting the limits to the potential distribution of alien crop pests. In: GJ Hallman and CP Schwalbe (eds). Invasive Arthropods in Agriculture: problems and solutions. Science Publishers Inc, Enfield, USA. pp. 207–241.

Dean A and Hodgson E. 2022. Soybean Gall Midge. Iowa State University, USA. Available online: https://crops.extension.iastate.edu/encyclopedia/soybean-gall-midge, [Accessed on 15/11/22].

California Department of Food and Agriculture: California Pest Rating Proposal Resseliella maxima Gagné: Soybean gall midge, 2021.

EFSA PLH Panel (EFSA Panel on Plant Health), Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gregoire J-C, Jaques Miret JA, MacLeod A, Navajas Navarro M, Niere B, Parnell S, Potting R, Rafoss T, Rossi V, Urek G, Van Bruggen A, Van Der Werf W, West J, Winter S, Hart A, Schans J, Schrader G, Suffert M, Kertesz V, Kozelska S, Mannino MR, Mosbach-Schulz O, Pautasso M, Stancanelli G, Tramontini S, Vos S and Gilioli G, 2018. Guidance on quantitative pest risk assessment. EFSA Journal 2018;16(8):5350, 86 pp. https://doi.org/10.2903/j.efsa.2018.5350

EFSA Scientific Committee, Hardy A, Benford D, Halldorsson T, Jeger MJ, Knutsen HK, More S, Naegeli H, Noteborn H, Ockleford C, Ricci A, Rychen G, Schlatter JR, Silano V, Solecki R, Turck D, Benfenati E, Chaudhry QM, Craig P, Frampton G, Greiner M, Hart A, Hogstrand C, Lambre C, Luttik R, Makowski D, Siani A, Wahlstroem H, Aguilera J, Dorne J-L, Fernandez Dumont A, Hempen M, ValtueñaMartınez S, Martino L, Smeraldi C, Terron A, Georgiadis N and Younes M, 2017. Scientific Opinion on the guidance on the use of the weight of evidence approach in scientific assessments. EFSA Journal 2017;15(8):4971, 69 pp. https://doi.org/10.2903/j.efsa.2017.4971

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: https://gd.eppo.int [Accessed 24/10/2022].

EPPO (European and Mediterranean Plant Protection Organization), 2019. EPPO codes. https://www.eppo.int/RESOURCES/eppo_databases/eppo_codes

FAO (Food and Agriculture Organization of the United Nations), 2016. ISPM (International Standards for Phytosanitary Measures) 31. Methodologies for sampling of consignments. FAO: Rome, Italy, p. 31. Available online: https://www.ippc.int/en/publications/83473/

FAO (Food and Agriculture Organization of the United Nations), 2021. International Standards for Phytosanitary Measures. ISPM 5 Glossary of phytosanitary terms, FAO, Rome. https://www.fao.org/3/mc891e/mc891e.pdf

Griessinger D and Roy A-S, 2015. EPPO codes: a brief description. https://www.eppo.int/media/uploaded_images/RESOURCES/eppo_databases/A4_EPPO_Codes_2018.pdf

Gagné RJ, Yukawa J, Elsayed AK and McMechan AJ, 2019. A new pest species of *Resseliella* (Diptera: Cecidomyiidae) on soybean (Fabaceae) in North America, with a description of the genus. Proceedings of the Entomological Society of Washington, 121, 168–177.

Helton ML, Tinsley NA, McMechan AJ and Hodgson EW 2022. Developing an Injury Severity to Yield Loss Relationship for Soybean Gall Midge (Diptera: Cecidomyiidae). Journal of Economic Entomology, 115, 767–772.
Hodgson EW and Helton M, 2021. Soybean Gall Midge Efficacy, 2020. Arthropod Management Tests, 46, 2021, 1–2.
Hunt T, Jarvi K, and Wright R, 2011. Gall midge larvae found in soybeans. University of Nebraska-Lincoln, CropWatch. https://cropwatch.unl.edu/gall-midge-larvae-found-soybeans-unl-cropwatch-aug-17–2011
Kottek M, Grieser J, Beck C, Rudolf B and Rubel F, 2006. World map of the Köppen_Geiger climate classification updated. Meteorologische Zeitschrift, 15, 259–263. https://doi.org/10.1127/0941-2948/2006/0130
McMechan AJ, Hodgson EW, Varenhorst AJ, Hunt T, Wright R and Potter B, 2021. Soybean gall midge (Diptera: Cecidomyiidae), a new species causing injury to soybean in the United States. Journal of Integrated Pest Management, 12, 8.
McMechan J, Hunt T. and Wright R, 2018a. Soybean Gall Midge: Adult Stage Identified. University of Nebraska Extension Crop Watch, USA. Available online: https://cropwatch.unl.edu/2018/soybean-gall-midge-adult-stage-identified [Accessed on 24 October 2022].
McMechan AJ, Hunt T and Wright R, 2018b. Survey of orange gall midge in Nebraska: a potential pest of soybeans. University of Nebraska-Lincoln, Crop Watch. USA. https://cropwatch.unl.edu/2018/survey-orange-gall-midge
Montenegro Castro and Maria V, 2022. Soybean Gall Midge (*Resseliella maxima* Gagné): Insecticide Efficacy and Seasonal Larval Abundance. Dissertations and Student Research in Entomology, 78, 172 pp. https://digitalcommons.unl.edu/entomologydiss/78
Potter B. and Koch R., 2022. Soybean gall midge in Minnesota soybean, Available online: https://extension.umn.edu/soybean-pest-management/soybean-gall-midge-minnesota-soybean [Accessed on 24 October 2022].
Sayers EW, Cavanaugh M, Clark K, Ostell J, Pruitt KD and Karsch-Mizrachi I, 2020. Genbank. Nucleic Acids Research, 48, Database issue, D84–D86. https://doi.org/10.1093/nar/gkz956
Sever M, 2021. Soybean gall midge: how do you solve a problem you know little about? Crops and Soils, 54, 38–43.
Toy SJ and Newfield MJ, 2010. The accidental introduction of invasive animals as hitchhikers through inanimate pathways: a New Zealand perspective. Revue scientifique et technique (International Office of Epizootics), 29, 123–133.
Varenhorst A, Rozeboom P, Bachmann A, Wagner P. 2020. Soybean Gall Midge Larvae Found in South Dakota, South Dakota State University Extension, USA. Available online: https://extension.sdstate.edu/soybean-gall-midge-larvae-found-south-dakota, Last update: 25 August 2020, [Accessed on 24 October 2022].

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
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, 2021).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2021).
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, 2021).
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2021).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2021).
Greenhouse	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.
Hitchhiker	An organism sheltering or transported accidentally via inanimate pathways including with machinery, shipping containers and vehicles; such

	organisms are also known as contaminating pests or stowaways (Toy and Newfield, 2010).
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, 2021).
Pathway	Any means that allows the entry or spread of a pest (FAO, 2021).
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, 2021).
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, 2021).
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, 2021).

Appendix A – *Resseliella maxima* host plants/species affected

Source: literature as indicated

Host status	Host name	Plant family	Common name	References
Cultivated hosts	*Medicago sativa*	Fabaceae	Alfalfa/lucerne	California Department of Food and Agriculture, 2021
	Glycine max	Fabaceae	Soybean	Gagne et al., 2019
	Melilotus officinalis	Fabaceae	Sweet clover	California Department of Food and Agriculture, 2021

Appendix B – Distribution of *Resseliella maxima*

Distribution records based on literature.

Region	Country	Sub-national (e.g. State)	Status	References
North America	USA	Iowa	Present	Gagne et al., 2019
		Minnesota	Present	Gagne et al., 2019
		Missouri	Present	Hodgson & Helton, 2021
		Nebraska	Present	Gagne et al., 2019
		South Dakota	Present	Gagne et al., 2019