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SCIENTIFIC OPINION

Risk assessment of *Retithrips syriacus* for the EU

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Abstract

Following a request from the European Commission, the EFSA Panel on Plant Health performed a quantitative risk assessment for the EU of *Retithrips syriacus* (Mayet) (Thysanoptera: Thripidae), a polyphagous thrips, regarded as a tropical/subtropical pest occurring in several countries of Africa, South America, Asia and in the EU in Cyprus. The current risk assessment focused on potential pathways for entry, the climatic conditions allowing establishment, the expected spread capacity and the impact considering a time horizon of 10 years (2023–2032). The Panel identified the import of cut roses, persimmons, table grapes, as well as plants for planting of the genera *Acalypha* and *Terminalia* from third countries and those of *Persea americana* (avocado) from Israel as the most relevant entry pathways to consider. Over the next 10 years, an annual median estimate of 95 (90% Certainty Range, CR, ranging from 13 to 1832) potential *R. syriacus* founder populations per year are expected to successfully transfer to a suitable host in the EU NUTS2 regions where the climatic conditions are predicted as suitable for establishment; this value drops to a median of 4.6 founder populations per year (90% CR: 1 every 1.9 years – 85.6 per year) after considering the actual probability of establishment of a potential founder population. The estimated number of founder population per year is mostly driven by the import of cut roses and plants for planting. If such founder populations were to establish, *R. syriacus* is estimated to spread at a median rate of 0.05 km/year (90% CR 0.02–2.30 km/year) after a median lag phase of 1.1 years (90% CR 0.3–3.3 years). The overall impact on yield (expressed as % of the total agricultural production) directly attributable to *R. syriacus* when considering: (i) the main *R. syriacus* hosts in the EU, (ii) the areas of the EU where establishment is possible, (iii) the current agricultural practices and (iv) the evidence of impact from the countries where the pest is established for a long time, was estimated at 0.065% as the median value of the uncertainty distribution (90% CR 0.001%–0.571%). Options for risk reduction are discussed, but the effectiveness was not quantified.

KEYWORDS

black vine thrips, pathway model, pest prevalence, phytosanitary measures, risk assessment, uncertainty, *Vitis vinifera*

CONTENTS

SUMMARY

Following a request from the European Commission, the EFSA Panel on Plant Health performed a quantitative risk assessment of *Retithrips syriacus* Mayet (Thysanoptera: Thripidae), for the EU. The assessment focused on potential pathways for entry, climatic conditions allowing establishment, spread and subsequent impact considering a time horizon of 10 years (2023–2032). Options for risk reduction are discussed, but their effectiveness has not been quantified.

Retithrips syriacus is regarded as a tropical/subtropical pest occurring in South America, different countries in Africa and Asia (particularly India) and Cyprus in the EU. With no interception data, the Panel identified the most relevant pathways for entry in the EU by considering the scientific evidence of association of *R. syriacus* with the host plants and the possible presence on the plant products for which there is evidence of trade from the third countries where *R. syriacus* is reported. The Panel identified the import of cut roses (*Rosa* spp.), persimmons (*Diospyros kaki*), table grapes (*Vitis vinifera*), as well as plants for planting of the genera *Acalypha* and *Terminalia*, and avocado (*Persea americana*) plants from Israel as the most relevant entry pathways.

Using expert knowledge elicitation (EKE) and pathway modelling, the Panel estimated that, considering all the entry pathways, in the order of hundreds of millions of units enter the EU every year from countries where *R. syriacus* is reported with 0.04% of the total imported units infested (considering all the entry pathways).

From the mapping and overlay of different climatic variables assumed to be indicative of the potential for *R. syriacus* establishment, the Panel identified areas in the southern EU Member States, especially in Spain (Comunitat Valenciana, Illes Balears, Andalucía and Región de Murcia), Portugal (Algarve, Centro (PT), Área Metropolitana de Lisboa and Alentejo), Italy (Puglia, Sicilia, Sardegna and Toscana), Greece (Attiki, Voreio Aigaio, Notio Aigaio, Kriti, Anatoliki Makedonia, Thraki, Kentriki Makedonia, Dytiki Makedonia, Ipeiros, Thessalia, Ionia Nisia, Dytiki Elláda, Sterea Elláda and Peloponnisos) and Cyprus (where *R. syriacus* is already established) as the NUTS2 regions where the climatic conditions are most suitable for establishment.

The number of potential founder populations estimated to successfully transfer to a suitable host in the NUTS2 regions of the EU is estimated to be 345 per year (90% CR: 40–10,761); however, when accounting for the actual probability of establishment, the number of founder populations drops to ~ 4.6 per year (90% CR: 1 every 1.9 years – 85.6 per year).

Should *R. syriacus* establish in the climatically suitable areas of the EU, the Panel estimates that it would take between 0.3 and 3.3 years (90% CR; median 1.1 years) for the populations to reach a steady rate of spread of ~ 0.05 km/year (90% CR 0.02–2.30 km/year).

In case *R. syriacus* population reaches an approximate equilibrium within suitable areas of the EU such that the thrips is considered as a naturalised species, the median yield losses directly attributable to *R. syriacus* are estimated to represent collectively the 0.0657% (90% CR 0.001%–0.571%) of the total agricultural production of affected crops. This estimate for the impact is supported by the substantial lack of evidence of yield losses, even in areas where the pest has been present for decades, such as Cyprus where this thrips was already reported in the 1960s.

Options for risk reduction are discussed, but effectiveness was not quantified. In conclusion, while it cannot be excluded the *R. syriacus* would reach suitable areas of the EU in the time horizon of the risk assessment, the species is expected to spread at a very low rate and in case it would reach an equilibrium, yield losses higher than 0.57% directly attributable to *R. syriacus* are not to be expected based on the available scientific evidence.

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 in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary.

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 50 pest categorisations for the pests listed in Annex 1A, 1B and 1D. 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). 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.

Annex 1 List of pests

A)

1. *Amyelois transitella*
2. *Citripestis sagittiferella*
3. *Colletotrichum fructicola*
4. *Elasmopalpus lignosellus*
5. *Phlyctinus callosus*
6. *Resseliella citrifrugis*
7. *Retithrips syriacus*
8. *Xylella taiwanensis*

1.2 | Interpretation of the Terms of Reference

The EFSA Panel on Plant Health (hereafter Panel) published a pest categorisation on *R. syriacus* (EFSA PLH Panel, 2021b), which concluded that the pest met the criteria for consideration as Union quarantine pest. The terms of reference relevant to *R. syriacus* specify that the requested opinion should address entry pathways, spread, establishment, impact and include a risk reduction options analysis. The Panel therefore undertook a quantitative pest risk assessment according to the principles laid down in its guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018).

2 | DATA AND METHODOLOGIES

The Panel performed this risk assessment following the Panel's guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018).

A literature search on *R. syriacus* was conducted at the beginning of the risk assessment (February 6th, 2023) in the ISI Web of Science and Scopus bibliographic databases using the scientific (*Retithrips syriacus*, *Retithrips aegyptiaca*, *Retithrips aegyptiacus*, *Stylothrips bondari*, *Dictyothrips zanoniana*, *Heliothrips syriacus*), and common (black vine thrips, castor thrips (English), tripes vermelho da maniçoba (Portuguese), trips negro de la vid (Spanish)) names of the pest as search terms. After removal of duplicates, 95 records were retained. Further references and documents ($N=19$) were obtained from experts, cross-referencing and grey literature for a total of 114 records. All the documents were uploaded on DistillerSR (https://www.distillersr.com/products/distillersr-systematic-review-software) and screened to extract data on: (i) geographical distribution, (ii) host(s), (iii) behavioural and biological parameters, (iv) spread, (v) symptoms and impact and (vi) control measures.

Data on interceptions and outbreaks of *R. syriacus* within the risk assessment area were searched in the Europhyt (1995 until May 2020) and TRACES (June 2020-ongoing database, last check 20th of December 2023) and no records of interceptions were found. However, considering that *R. syriacus* could have been intercepted but reported as 'Thripidae' or 'Thysanoptera', the Panel repeated the search for each of these terms. It is anticipated that although not specific for *R. syriacus*, these interceptions can provide a hypothetical upper bound of the potential number of interceptions of *R. syriacus* (see Section 3.1.1).

Information on the geographic distribution of the pest was used to inform the climate suitability analysis (Sections 2.2 and 3.2) while literature on the potential hosts of the pest and interception data were used to inform identification of the relevant entry pathways to be considered in the risk assessment when modelling the risk of entry (see Section 2.1.1).

The main features of the biology and life cycle of *R. syriacus* are summarised in the pest categorisation prepared by EFSA PLH Panel (2021b); however, the key biological aspects relevant for this assessment are reported in more detail in Appendix A (review of *Retithrips syriacus* biology).

Literature data on biology, spread, impact and control integrated with information collected during interviews of hearing experts were used to prepare evidence dossiers in support of expert knowledge elicitation (EKE) sessions aimed to estimate, by means of expert judgements, quantities that could not be well characterised from the literature alone (EFSA, 2014). EKE sessions involved Panel members, members of the working group and EFSA staff.

The estimation of the number of founder populations in the EU resulting from the import of plants for planting and plant products was assessed using pathway modelling in @Risk (https://www.palisade.com/risk/default.asp). The Excel implementation of the pathway model and the redistribution models described in Section 2.1.2.1 are available in the supplementary material of the Opinion.

Retithrips syriacus is a polyphagous, and therefore, in the assessment of entry, the Panel first identified the most relevant pathways for entry into the EU, and then systematically selected five of them as the most relevant for the assessment (see Section 3.1.1). For each pathway, the volume of trade to the EU from the countries where *R. syriacus* is reported was estimated together with the proportion of infested products (see Section 2.1.2) and the number of infested products delivered to each Member State and NUTS2 region according to a redistribution model (see Section 2.1.2.1). After the identification of the areas in the EU that are suitable for establishment should entry take place (see Sections 2.2.2 and 3.2.4), the number of founder populations was calculated considering three area-type specific probabilities of establishment as identified by the climate suitability analysis.

2.1 | Entry

2.1.1 | Identification of the relevant entry pathways

Due to the polyphagy of *R. syriacus*, many different hosts could provide a pathway for entry into the EU as plants for planting or plant products (EFSA PLH Panel, 2021b). Additionally, *R. syriacus* can be associated with soil, which could however be considered as a closed pathway according to the current regulation (EFSA PLH Panel, 2021b).

In agreement with the guidelines on quantitative pest risk assessment (EFSA PLH Panel, 2018) indicating that when multiple possible pathways are possible, the most relevant should be considered for estimating the probability of entry, the Panel identified the most relevant entry pathways following a three-step approach:

- Step 1. Identification of *R. syriacus* hosts and countries where *R. syriacus* has been reported. For this step, data on potential hosts and pest distribution were extracted from the papers retrieved by the systematic literature review. For the identification of the host plants in particular, a careful evaluation was made in distinguishing the references clearly reporting the observation of both adults and immature stages, which have been considered a sufficient indication that the pest is breeding and can complete the life cycle, from those where just adults were observed. Only the former was taken as evidence for the plant species or plant product to be considered as an actual *R. syriacus* host.
- Step 2. Identification of *R. syriacus* hosts that cannot be imported into the EU based on current regulations. From the list of hosts resulting from step 1, the Panel identified the plants and plant products whose imports are prohibited into the EU based on current regulations.

- Step 3. Identification of hosts that are imported from the countries where *R. syriacus* is reported but not posing a risk considering the biology of the pest. In this step, the Panel refined the list of hosts from step 2 by evaluating whether, based on EUROSTAT data, there is evidence of import into the EU as plants for planting and/or plant products from the countries where *R. syriacus* is reported. If there is evidence of trade, the Panel evaluated whether the products are imported at a stage that could plausibly act as a vehicle for entry considering the biology of the pest. Judgements were made considering the probable production practices such as whether plants were grown in open fields or greenhouses and the part of the plant imported. For instance, dormant plants without leaves were deemed not to provide a pathway because as a leaf-feeder, *R. syriacus* is found on leaves where it feeds and breeds, particularly mature fully developed leaves (Ananthakrishnan, 1985; Lima, O'donnell, & Miyasato, 2020; Prabhakar et al., 2008).

Trade import data for the plant products identified as relevant entry pathways for *R. syriacus* and from countries where the pest is reported were retrieved from EUROSTAT. For the entry pathway(s) involving plants for planting for which the EUROSTAT code and data for the specific plant species/genera is not available, import data were obtained from the NPPO of the Netherlands as this country is the major EU importer of plants for planting. The Dutch data provided the number of plants at the genus level imported into the Netherlands from 2010 to 2022 from the countries where *R. syriacus* is reported. Import data for plants for planting of *Persea americana* (from Israel) were obtained from the NPPO of Spain, because this country is the major producer of avocados in the EU. The dossier provided by the Plant Protection and Inspection Services (PPIS) of Israel for the EFSA commodity risk assessment of *P. americana* from Israel (EFSA PLH Panel, 2021a) was also used, as it specifically mentions that plants would be delivered to avocado growers at the export destination.

2.1.2 | Conceptual model

The entry pathway was modelled by estimating the number (per year) of potential founder populations of *R. syriacus* in the EU due to imports of plants for planting and plant products from countries where the pest is reported.

The outcome of the baseline entry model for both plants for planting and plant products entry pathways is the expected number of infested units entering the EU originating potential founder populations of *R. syriacus* after successful transfer to suitable hosts in each Member State *j* (MS) and NUTS2 region *i* ($NPFP_{NUTS2ji}$). The conceptual pathway model is used to estimate first the total number of infested transfer units imported into the EU ($NInf_{EU}$), and then, $NPFP_{NUTS2i}$ from the parameters reported in Table 1. These estimations are done for each type of plant product and plant for planting.

TABLE 1 Description, units and source of evidence of the parameters used to estimate the number or potential founder populations of *Retithrips syriacus* into the EU.

Parameter	Description	Unit	Data source
T_v	Yearly trade volume in the time horizon of the risk assessment (10 years)	Tons	EKE
Uw	Typical weight of a single transfer unit (commodity specific). – Cut roses = 50.72 g; – Persimmons = 154 g; – Table grapes (bunch) = 500 g	g	– Cut roses: EUROSTAT conversion factor for unit mass for the CN 06031100 – Persimmons and Table grapes (bunch): (EFSA PPR Panel, 2018)
P(Infested)	Prevalence of infested units before export at the point of departure in the country of origin	Proportion of units	EKE
Inf_{TU}	Number of infested units before departure from the countries of origin	N# units	Calculated (see Section 2.1.2)
$Pr(Tr_{OC})$, $Pr(Tr_{AC})$	Proportion of units transported by ocean cargo $Pr(Tr_{OC})$ and air cargo $Pr(Tr_{AC})$. – $Pr(Tr_{AC})$ for cut roses = 100% – $Pr(Tr_{AC})$ for persimmons = 10.6% – $Pr(Tr_{OC})$ for persimmons = 89.4% – $Pr(Tr_{AC})$ for table grapes = 2% – $Pr(Tr_{OC})$ for table grapes = 98%	Proportion of units	– Cut roses: (EFSA PLH Panel, 2023); – Persimmons: TRACES* – Table grapes: (DROPSA, 2016)
$P(Survival_{OC})$	Probability of survival of the pest during transport via ocean cargo from the country of origin to the EU according to the commodity and transportation characteristics (transport time, temperature, and treatments, if any)	Probability	EKE
$P(Survival_{AC})$	Probability of survival of the pest during transport via air cargo from the country of origin to the EU according to the commodity and transportation characteristics (transport time, temperature and treatments, if any)	Probability	EKE

(Continues)

TABLE 1 (Continued)

Parameter	Description	Unit	Data source
$NInf_{EU}$	Number of infested units imported into the EU from the countries where *R. syriacus* is reported	N# Units	Calculated (see Section 2.1.2)
$NInf_{NUTS2\_ji}$	Number of infested units delivered to each NUTS2 region '*i*' within each Member State (MS) '*j*'	N# Units	Redistribution model (see Section 2.1.2.1)
P(Transfer)	Probability of successful transfer to a suitable host	Probability	EKE

*Net weight of persimmons consignment delivered via airplane over the total net weight of persimmons consignments imported in the EU in the last 2 years TRACES database, accessed December 2023.

The total number of infested units before departure from the countries of origin per year (Inf_{TU}) is estimated as:

$$Inf_{TU} = \left(T_v / Uw\right) \text{P(Infested)}.$$

The model further considers that the infested units could arrive in the EU via ocean or air cargos. Different means of transportation entail different transport times, and therefore, depending on the commodity-specific transport temperature, a different probability of survival for *R. syriacus*. Consequently, for each imported product, with $Pr(Tr_{OC}) + Pr(Tr_{AC}) = 1$, the actual number of infested units imported into the EU per year ($NInf_{EU}$) is calculated as the cumulative output of the results of two sub-pathways:

$$NInf_{EU} = Inf_{TU}\left[Pr\left(Tr_{OC}\right) P\left(Survival_{OC}\right) + Pr\left(Tr_{AC}\right) P\left(Survival_{AC}\right)\right].$$

The cold resistance of *R. syriacus* is not known. However, *R. syriacus* is a tropical/sub-tropical pest and is likely to be less cold resistant than other thrips such as *Thrips palmi* Karny for which the thermal biology is known (Yadav & Chang, 2014). The Panel therefore considered the time necessary to kill 90% of a sample of *T. palmi* at 0°C (lethal time 90, LT_{90}) (McDonald et al., 2000) as a proxy to inform the EKE for P($Survival_{AC}$) and P($Survival_{OC}$).

The overall number of infested units imported in the EU, $NInf_{EU}$, is then redistributed across MSs and NUTS2 regions according to the redistribution model explained in Section 2.1.2.1 to obtain the number of infested units in each NUTS2 region *i* of each MS *j* ($NInf_{NUTS2\_ji}$). Finally, the number of potential founder populations (after transfer to suitable hosts) within each NUTS2 ($NPFP_{NUTS2\_ji}$) is calculated as:

$$NPFP_{NUTS2\_ji} = NInf_{NUTS2\_ji} \text{ P(Transfer)}.$$

For plant products (cut roses, persimmons and table grapes), the Panel assumed that the transfer to a suitable host is possible only after the infested units have reached the final destination (i.e. consumers). The distribution describing the uncertainty in the probability of transfer was fitted to values obtained by means of EKE after considering the factors facilitating or preventing successful transfer (see Appendix D.4). In case of the plants for planting entry pathways (*Acalypha* and *Terminalia* and *P. americana* from Israel), *R. syriacus* is already on a suitable host and the Panel assumed the probability of transfer is 1, as the event is certain to occur.

2.1.2.1 | *Redistribution model*

Plant products

The estimation of entry of possibly infested commodities into the EU relies on the international trade statistics of goods of EUROSTAT. From the ports of entry of the EU, the consignments are very often transferred to other Member States for consumption or further trading. The final destination of each consignment is difficult to ascertain, and therefore, the Panel implemented a redistribution model intended to provide, for each Member State, an estimate of the number of units imported from the countries where the pest is reported. Briefly, the commodity-specific inputs of the redistribution model are: (i) the weight of annually imported commodity from third countries with/without reported presence of the pest to the importing countries in the EU; (ii) the intra-EU trade flows, (iv) the export of the commodity from the EU countries to third countries and (iii) the commodity-specific production data of the Member States. With these data, the redistribution model returns, for each Member State, a distribution describing the estimated amount of commodity imported from third countries where the pest is present.

For the scope of the risk assessment, the median value of each Member State distribution was used to describe the relative proportion of product (and therefore infested products) from third countries where the pest is present that is allocated to each Member State. Within each Member State, the number of infested units is then redistributed across the NUTS2 regions according to the number of inhabitants (Pop_NUTS2_{ji}, EUROSTAT database: demo_r_d2jan downloaded on 24 January 2024), as an indicator of potential demand.

As an example, with $NInf_{EU}$ being the overall estimated number of infested units being imported in the EU, the number of infested units delivered to the NUTS2 region *i* of the MS *j*, ($NInf_{NUTS2\_ji}$) is equal to:

$$NInf_{NUTS2\_ji} = Ninf_{EU} \times MS_j \times Pr(Pop\_NUTS2_{ji}),$$

where $Ninf_{EU}$ is the number of infested units entering in the EU as estimated in Section 2.1.2, MS_j is the proportion of infested units delivered to Member State *j* as estimated by the redistribution model introduced above, and $Pr(Pop\_NUTS2_{ji})$ is the relative proportion of the number of inhabitants of Member State *j* residing in the NUTS2 region *i*. Readers are invited to refer to Appendix E for a detailed description of the model and the supplementary material for the working examples on cut roses, persimmons and table grapes.

Plants for planting

For the plants of the genera *Acalypha* and *Terminalia*, the Panel has no other simple and efficient basis to distribute imported plants other than assuming that the plants would be distributed across the Member States and NUTS2 regions according to their number of inhabitants (EUROSTAT database: demo_r_d2jan downloaded on 24 January 2024), as an indicator of potential demand. For the plants of *P. americana* (from Israel), the Panel considered that Spain is the major avocado producer in the EU (CBI, 2024) and identified the NUTS2 regions where avocado is grown (Plantae, 2023). While differences do exist in the avocado production of these NUTS2 (MAPA, 2021), there are not strong arguments to allocate the number of imports differently (e.g. proportional to the production could be misleading because regions with more plants could also be self-sufficient). Imports of *P. americana* plants from Israel were therefore equally distributed across these NUTS2 regions.

2.2 | Establishment

2.2.1 | Climate suitability analysis

To inform the assessment of establishment, information on the global distribution of *R. syriacus* was collected together with information on the climate requirements of the pest. The number of confirmed *R. syriacus* occurrences in precise georeferenced locations is rather restricted and sparse (49 points in total). Therefore, the use of comprehensive modelling approaches such as species distribution models or niche models were not considered appropriate in this case.

The full climate suitability methodology description is available in Golic et al. (2024). In summary, three climate indicators were considered for the analysis: the Köppen–Geiger climate classification, the hardiness zone map and the map with average maximum number of consecutive days below the lower development threshold (LDT) calculated in Section 2.2.1.1. Considering the areas identified by the different climate indicators, maps of union and intersection were developed and considered as the 'minimum impacted area' (the intersection map) and the 'maximum impacted area' (the union map) scenarios.

2.2.1.1 | *Lower development threshold*

The lower development thresholds (LDT) were computed based on development times (*Y* in days) estimated for different constant temperatures ranging from 15.25 and 36.0°C (Rivnay, 1939). Developmental rates ($R = Y - 1$, in days–1) were calculated for each tested temperature *T* and development stage (egg, larva and pupa). These rates *R* were plotted against temperatures for each development stage. Data showing an increasing linear trend were visually selected. Then, a linear regression model relating *R* to *T* was fitted to estimate the LDT (°C) (Logan et al., 1976), defined as the intercept of the fitted linear regression model. Based on the LDTs for different life stages, we calculated the thermal constants *K* (sum of temperatures, degree-day DD) required for completing each stage as follows (Varley et al., 1974): $K = \Sigma[Yi\,(Ti - \mathrm{LDT})]/n$, where *Yi* is the *i*th observed development time (in days) required to complete the stage considered, *Ti* is the *i*th temperature, LDT is lower development threshold obtained for the stage considered and *n* is the number of observations.

2.2.2 | Identification of the suitable NUTS2 regions for establishment

From the maps obtained as described in Section 2.2.1, the information at the grid level was summarised at NUTS2 level to identify the administrative units potentially suitable for establishment. The suitable NUTS2 regions were identified overlapping the union and intersection maps and, for each *i* NUTS2 region of each *j* MS, the actual percentage of area identified as 'Intersection (I)' $Pr(NUTS2_{jiI})$, 'Union (U)' $Pr(NUTS2_{jiU})$ or 'Null (N)' $Pr(NUTS2_{jiN})$ were calculated (Table 2).

2.2.3 | Estimation of the number of founder population for the EU

From the number of potential founder populations ($NPFP_{NUTS2i}$) resulting from the pathway model, the number of founder populations for each NUTS2 region (FP_{NUTS2i}) is estimated from the parameters reported in Table 2.

TABLE 2 Description and source of the evidence of the parameters used to estimate the number of founder population of *Retithrips syriacus* into the EU.

Parameter	Description	Source
$Pr(NUTS2_{jiI})$	Proportion of NUTS2 *i* (area) in Member State *j* where all the considered climate indicators coincide with those where the pest was observed in the countries of origin	Calculated (see Section 2.2.2)
$Pr(NUTS2_{jiU})$	Proportion of NUTS2 *i* (area) in Member State *j* where at least one of the considered climate indicators coincides with those where the pest was observed in the countries of origin	Calculated (see Section 2.2.2)
$Pr(NUTS2_{jiN})$	Proportion of NUTS2 *i* (area) in Member State *j* where none of the considered climate indicators coincides with those where the pest was observed in the countries of origin	Calculated (see Section 2.2.2)
$P(Establishment_I)$	Probability of establishment in the areas of the EU where all the considered climate indicators coincide with those where the pest was observed in the countries of origin	EKE
$P(Establishment_U)$	Probability of establishment in the areas of the EU where at least one of the considered climate indicators coincides with those where the pest was observed in the countries of origin	EKE
$P(Establishment_N)$	Probability of establishment in the areas of the EU where none of the considered climate indicators coincides with those where the pest was observed in the countries of origin	EKE

From the different probabilities of establishment in the three types of area identified by the Panel ('Intersection (I)', 'Union (U)' and 'Null (N)', see Section 2.2.2) and the proportions of these areas in each of the NUTS2 region *i* in Member State *j* ($Pr(NUTS2_{jiI})$, $Pr(NUTS2_{jiU})$, $Pr(NUTS2_{jiN})$), the number of founder populations for each NUTS2 region (FP_{NUTS2i}) is estimated as:

$$FP_{NUTS2ji} = NPFP_{NUTS2ji}\left[Pr\left(NUTS2_{jiI}\right) P\left(Establishment_I\right) + Pr\left(NUTS2_{jiU}\right) P\left(Establishment_U\right) + Pr\left(NUTS2_{jiN}\right) P\left(Establishment_N\right)\right],$$

$$\text{with } Pr\left(NUTS2_{jiI}\right) + Pr\left(NUTS2_{jiU}\right) + Pr\left(NUTS2_{jiN}\right) = 1.$$

As the last step, the total number of founder populations for the EU (FP_{EU}) is obtained as the sum of the founder populations in each NUTS2 regions ($FP_{NUTS2ji}$) resulting from all the entry pathways.

2.3 | Spread

In the assessment of potential spread after establishment, the Panel assumed that the founder populations of *R. syriacus* occupy a limited proportion of available habitat with a small local population size (i.e. a fraction of the habitat's carrying capacity). Similarly, it is assumed that the increase in population size of *R. syriacus* is limited due to the lack of fitness of the species in a new environment and to population size factors (i.e. Allee effects). Therefore, a lag phase parameter was considered to account for the average duration of the time period from establishment to subsequent spread.

At the end of this lag phase, the pest is expected to be better adapted to local conditions allowing it to survive, multiply and reach a population size large enough to spread. Both natural spread (i.e. hopping, flying) and human-assisted spread by common agricultural practices (i.e. movement of machinery) were considered. The average spread rate of pest was considered.

In the absence of specific data, the uncertainty distributions characterising the lag phase and spread rate of *R. syriacus* within the suitable regions of the EU were estimated considering the expected life span, number of generations, survival rate of the different life stages, flight capacity of the insect as described in the scientific literature and the behaviour of *R. syriacus* as reported by the experts (Dr. Élison Fabrício Bezerra Lima, Dr. Elleunorah Allsopp).

The distribution describing the uncertainty in the duration of the lag phase and the spread rate were fitted to values obtained by means of EKE after considering the factors facilitating or preventing successful spread.

2.4 | Impact

The scientific literature on *R. syriacus* was screened for information on impact of the pest on host plants and its potential role as vector of plant viruses (i.e. genera *Orthotospovirus*, *Ilarvirus*, *Carmovirus*, *Sobemovirus* and *Machlomovirus*, whose spread is commonly associated with or facilitated by thrips).

The main impacts reported in the literature are of qualitative nature with most of the records reporting only a description of the injuries on leaves following feeding or presence of faecal material. The quantitative evidence reporting yield loss attributed to *R. syriacus* is limited to three studies conducted in Andhra Pradesh (India) (Reddy, 2006; Reddy & Rao, 2002, 2003). Results reported on these papers are used to label this thrips as responsible for significant losses or even 'devastating' in grapevine (AGDA, 2016; DROPSA, 2016). However, since these results seemed in contradiction with:

- The mention of *R. syriacus* as a minor thrips for the Indian grape industry not causing any economic damage either to berries, flowers or leaves (NRCG, 2013).
- The lack of evidence of any significant economic damage in the countries where this pest is known to have been present for decades.
- The field experience of entomologists in the countries where the pest is reported on grapevines.

The Panel proceeded with a detailed examination of the evidence before using the quantitative data on reported yield loss to inform the EKE on the impact. In this assessment of potential impact of *R. syriacus*, the yield loss included both yield and quality losses altogether.

2.5 | Temporal and spatial scales of the risk assessment

The risk assessment area was the EU territory. The temporal horizon considered for the risk assessment was 10 years (2023–2032). This temporal horizon delimits the scope of the parameter elicitations done by the Panel. Entry was considered as a separate process for each year. No time-cumulative processes were accounted for in the entry model, but this was included in the spread model. The risk assessment was performed considering the current ecological factors and conditions for the host plants growing areas of the EU and countries of origin.

3 | ASSESSMENT

3.1 | Entry

3.1.1 | Identification of the most relevant entry pathways

Plant products

R. syriacus live and feed on fully developed mature leaves (Ananthakrishnan, 1985; Lima, O'donnell, & Miyasato, 2020; Prabhakar et al., 2008) but can be found on the fruit skin in case of severe infestation (Medina-Gaud & Franqui, 2001). For this reason, fruits of the plants identified as *R. syriacus* hosts were evaluated for the identification of the most relevant entry pathway(s). After considering the current regulatory framework for imports of plant products into the EU, the pest biology and the plausibility of the product to act as carrier for *R. syriacus* entry, the plant products identified as most relevant entry pathways for *R. syriacus* were cut roses, persimmons and table grapes. *R. syriacus* is not regarded as a quarantine pest in the EU and there is no evidence of *R. syriacus* interceptions at EU borders; this selection was driven by the evidence of association of the pest with the host plants *Rosa* spp., *Diospyros kaki* and *Vitis vinifera* (see Table B.1 in Appendix B) and the structural characteristics of the products as a factor offering the pest a refuge to remain undetected during inspection (i.e. in within the grape bunch for the table grapes, under the calyx for persimmons and in the flower in cut roses). The rationales for considering or not each of the plant products of known *R. syriacus* host plants as relevant entry pathways are outlined in Table B.3 of Appendix B.

Plants for planting

The selection of plant species was performed in three steps. From a scientific literature review (Step 1), 28 plant species in 21 genera were identified as *R. syriacus* hosts (Appendix B, Table B.1). Following further evaluation of the hosts under the current regulatory framework (Step 2), the list was reduced to 24 potentially relevant *R. syriacus* host species in 19 genera that could be imported from countries where *R. syriacus* is reported. However, when considering the import data (Appendix C, Tables C.1–C.13) and the plausibility for the host to act as a carrier for entry considering the pest biology (Step 3), the genera *Acalypha* and *Terminalia* were identified as relevant pathways for the entry of *R. syriacus* into the EU. In addition, in the light of the recent Commission Implementing Regulation (EU) 2021/1936, which allows the import under certain phytosanitary measures of plants for planting of *Persea americana* from Israel (*P. americana* is considered as a high-risk plant), the Panel also considered the entry import of *P. americana* plants from Israel as a relevant entry pathway.

The rationales for considering or not as relevant entry pathways the trade as plants for planting for each of the known *R. syriacus* host plants are outlined in Table B.4 of the Appendix B.

For *P. americana*, the Panel used the evidence and information provided by the PPIS of Israel as part of the dossier for the EFSA commodity risk assessment of *P. americana* from Israel (EFSA PLH Panel, 2021a). For the genera *Acalypha* and *Terminalia*, due to the absence of specific *R. syriacus* prevalence and infestation data that would justify separate modelling, the Panel considered a single 'Plants for planting' entry pathway by aggregating the import data of these two genera.

Interceptions

To the knowledge of the Panel, specific *R. syriacus* interception data are limited to two instances: In 1993, as part of a pre-departure inspection at San Juan (Puerto Rico) on a specimen of *Jatropha curcas* cuttings destined to Florida (Hamon & Edwards, 1994) and in 1998, with a juvenile intercepted at a port of entry in the Netherlands on *Achamera* from Israel (Vierbergen, 2008). As explained in Section 2, the Panel also searched for interceptions of 'Thripidae' or 'Thysanoptera' in the Europhyt (1995 until May 2020) and TRACES (June 2020-ongoing database). Interception records involving hosts of *R. syriacus* in countries where this pest is reported consisted of four interceptions recorded as Thripidae on roses (three from Israel and one from Kenya) and two interceptions recorded as Thysanoptera involving roses from Kenya (Table B.2, Appendix B). It is, however, uncertain whether these interceptions correspond to *R. syriacus*. Assuming this is the case, these interceptions suggest that roses from Israel and Kenya could be a plausible entry pathway.

3.1.2 | Parameters of the entry model

3.1.2.1 | *Trade volumes*

Plant products

Yearly trade data (2010–2022) for the plant products identified as relevant entry pathways for *R. syriacus* (cut roses, persimmons and table grapes) commercialised from countries where the pest is reported were retrieved from EUROSTAT (disaggregated country data are reported in detail for all the commodities in Appendix C.2, Tables C.14–C.16). To inform the EKE on the trade volume by year for cut roses, persimmon and table grapes, the Panel performed a trend analysis for each commodity finding that only the table grapes import data (2010–2022) showed a significant increasing ($p < 0.05$) trend (Figure 1).

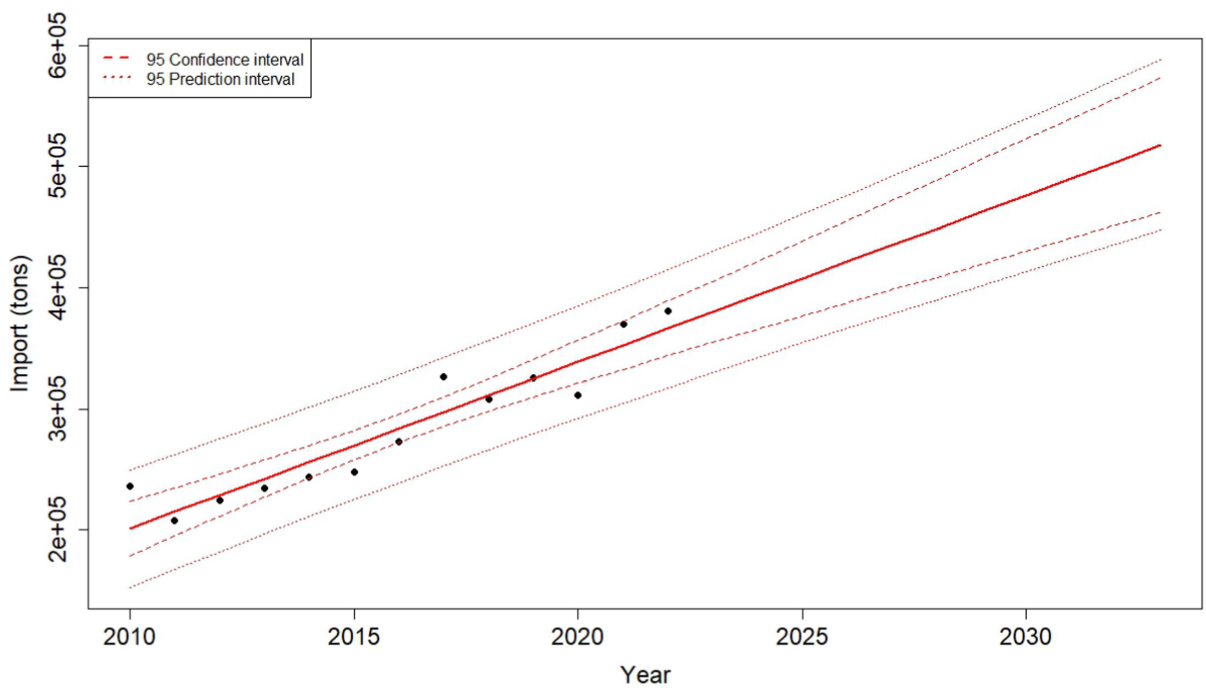


FIGURE 1 Trend analysis, based on 2010–2022 Eurostat data, of the import of table grapes (tons) into the EU from countries where *Retithrips syriacus* is reported. The fitted trend was projected over the 10 years of the PRA time horizon (2023–2032). Dashed and dotted lines indicate the 95% confidence and prediction intervals, respectively.

The EKE for the trade volume per year in the time horizon for cut roses, persimmons and table grapes was based on (i) the trend analysis of import data from countries where *R. syriacus* is reported and the trend projection in 2032 (ii) additional considerations concerning the market, such as the role of producers in the EU (e.g. Spain dominates the persimmon market), the expected competition with producers from other third countries where *R. syriacus* is not reported (e.g. Peru and Chile for table grapes) and the market shares of the countries where the pest is reported (e.g. the market of cut roses is dominated by Kenya). Results and justifications of the EKE process are reported in detail in Appendix D.1; Table 3 shows the percentiles of the probability distribution fitted to the consensus values of the EKE.

TABLE 3 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the trade volume parameter (T_V) for cut roses, persimmons and table grapes over 2023–2032.

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
Cut roses (tons)	35,261	75,663	98,800	126,252	213,285
Persimmons (tons)	140	502	837	1266	2364
Table grapes (tons)	321,160	400,544	449,187	500,658	602,793

Plants for planting of the genera Acalypha and Terminalia

Data on the import of plants (2010–2022) were obtained from a request to the Dutch NPPO. When considering entry of these two genera, the analysis of the last 10 years of plant import data from the countries where the pest is reported showed a significant ($p < 0.01$) increasing trend (disaggregated country data are reported in detail in Appendix C.1). Both the linear and quadratic trends fit the data well, with a small advantage to the quadratic (lower BIC). The two trends provided very different projected values over the next 10 years; higher values were forecasted with the quadratic compared to the linear trend (Figure 2).

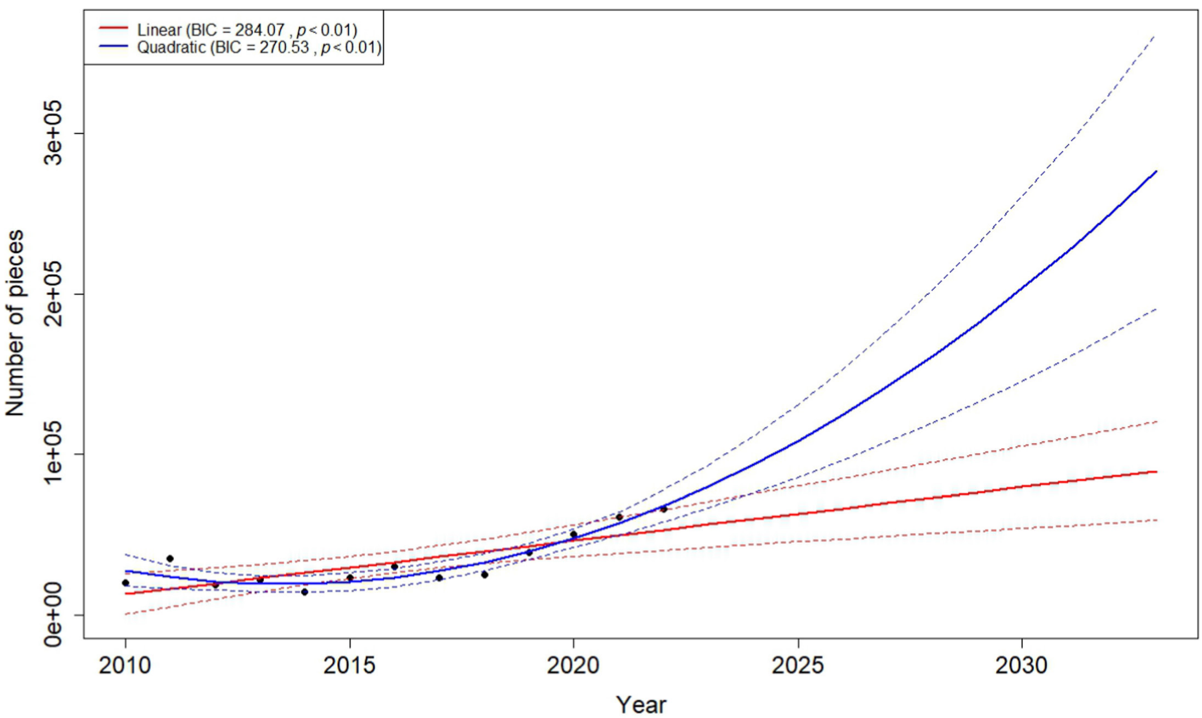


FIGURE 2 Trend analysis, based on 2010–2022 Dutch NPPO data, of the import of *Acalypha* and *Terminalia* into the EU from countries where the pest is reported. The fitted trend was projected over the 10 years of the PRA time horizon (2023–2032). Dashed lines indicate the 95% confidence intervals for both the linear (red) and quadratic (blue) fits, both significant at $p < 0.01$.

Persea americana plants from Israel

The dossier provided by the PPIS (Plant Protection and Inspection Services) of Israel indicated that plants of *P. americana* exported from that country would be delivered to avocado growers at export destination. Considering that Spain is the major producer of avocados in the EU, the Panel demanded import data to the Spanish NPPO who reported an import of 1360 pieces in 2023.

The EKE for the parameter T_V for the plants of the genera *Acalypha* and *Terminalia*, and for *P. americana* (from Israel) was informed based on the trend analysis of import data from countries where *R. syriacus* is reported and the trend projection in 2032 (for the plants of genera *Acalypha* and *Terminalia*, see above) and additional considerations on the market: (i) expected demand of avocado plants in the near future in the EU, (ii) interest and feasibility of avocado growers based in the

EU to fulfil the EU demand of avocado plants, (iii) capacity of Israel to fulfil the EU demand of avocado plants in the time horizon.

Results and justifications of the EKE process are reported in detail in Appendix D.1; Table 4 shows the percentiles of the probability distribution fitted to the consensus values of the EKE.

TABLE 4 Values (number of plants) at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the trade volume parameter (*Tv*) for plants of genera *Acalypha* and *Terminalia* and plants of *Persea americana* (from Israel) over 2023–2032.

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
Plants of genera *Acalypha* and *Terminalia*	20,044	34,138	72,173	143,097	321,731
Persea americana (from Israel)	453	2665	5683	9446	14,911

3.1.2.2 | *Infestation rate*

With very limited information regarding the *R. syriacus* infestation rate in the commodities intended for export to the EU, the aggregated infestation rate values for the different commodities at the point of departure from the countries of origin was elicited considering: (i) the biology of the pest, (ii) the harvest time in relation to the pest life cycle, (ii) the preharvest management (monitoring and control) and (iii) the expected pest response during harvesting and post-harvest processing. For plants for planting, the following elements were considered as well: (i) the actual species of *Acalypha* and *Terminalia* being imported, (ii) the presence of *R. syriacus* in the areas where *Acalypha* and *Terminalia* plants intended for export to the EU are produced in the countries of origin, (iii) the growing conditions, actual product being exported and transport conditions from the countries of origin until the final destination in the EU. Results and justifications are reported in detail in Appendix D.2; Table 5 shows the percentiles of the probability distribution fitted to the consensus values of the EKE.

TABLE 5 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the infestation rate for cut roses, persimmons, table grapes, plants of genera *Acalypha* and *Terminalia* and plants of *Persea americana* (from Israel).

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
Infestation rate of *R. syriacus* for cut roses (per 10,000 roses)	0.08	0.08	0.99	10.10	93.04
Infestation rate of *R. syriacus* for table grapes (per 10,000 bunches)	8.3×10^{-4}	10^{-3}	10^{-2}	0.10	0.93
Infestation rate of *R. syriacus* for persimmons (per 10,000 fruits)	8.3×10^{-6}	1.0×10^{-5}	9.9×10^{-5}	1.0×10^{-3}	9.3×10^{-3}
Infestation rate of *R. syriacus* for plants for planting of *Acalypha*, and *Terminalia* (per 10,000 plants)	4.1	5.0	10.0	25.0	108.7
Infestation rate of *R. syriacus* for plants for planting of *Persea americana* (from Israel) (per 10,000 plants)	10^{-2}	1.8	6.6	18.3	107.9

3.1.2.3 | *Probability of survival*

From the point of departure, the Panel considered that should *R. syriacus* be present in the exported units, the probability for the thrips to survive the transport from the country of origin would depend on the transport time, temperature and treatments (if any). Considering the very different transport time and temperature between air and sea cargo (DROPSA, 2016), and the lack of data on pest survival, the survival rate of *R. syriacus* was elicited separately for: (i) cut roses transported via air cargo, (ii) persimmons and table grapes transported via ocean cargo and (iii) persimmons and table grapes transported via air cargo. In the absence of specific data for *R. syriacus*, the elicitation was informed by the cold resistance data available for *Thrips palmi* Karny (Thysanoptera: Thripidae) together with the average transport time and temperature for the plant products. Results and justifications of the EKE process are reported in detail in Appendix D.3; Table 6 shows the percentiles of the probability distribution fitted to the consensus values of the EKE for P(Survival) of *R. syriacus* in cut roses when transported in the EU via air cargo and *R. syriacus* in table grapes and persimmons when transported in the EU via air and ocean cargo.

TABLE 6 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the *Retithrips syriacus* survival rate in cut roses transported to the EU via air cargo, and those of table grapes and persimmon via air and ocean cargo.

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
R. syriacus survival rate in cut roses when transported via air cargo (per 10,000 infested roses)	2060	5300	6739	7981	9659
R. syriacus survival rate in persimmons and table grapes when transported via air cargo (per 10,000 infested fruits or bunches)	1000	2500	4000	5500	7000
R. syriacus survival rate in persimmons and table grapes when transported via ocean cargo (per 10,000 infested fruits or bunches)	10^{-2}	13	68	194	529

3.1.2.4 | *Probability of transfer*

The total number of potential founder populations in the EU within the chosen time horizon is computed multiplying the number of infested units by the probability of transfer to hosts, given the intended use of the imported product within the EU territory and the expected prevalence of host plants. Results and justifications of the EKE process are reported in detail in Appendix D.4; Table 7 shows the percentiles of the probability distribution fitted to the consensus values of the EKE the results of the fitting of the consensus values for P(Transfer) of *R. syriacus* for cut roses, persimmons and grapes. For plants for planting of the genera *Acalypha* and *Terminalia* and those of *P. americana* from Israel, as pointed out in Section 2.1.2, P(Transfer) is 1.

TABLE 7 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the probability of *Retithrips syriacus* transfer rate for cut roses, persimmons, table grapes, plants of genera *Acalypha* and *Terminalia* and plants of *Persea americana* (from Israel).

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
R. syriacus transfer rate (per 10,000 infested units arriving in the EU)	0.30	3	7	19	181

3.1.3 | Redistribution model

The results of the redistribution model for cut roses, persimmons and table grapes are reported in Figure 3. Outputs of the redistribution model are the percentages of product (infested or not) imported into the EU (from the countries where the pest is reported) arriving in the different Member States. From the results, it can be appreciated that Germany alone accounts for more than 35% of table grapes, cut roses and persimmons imported from countries where *R. syriacus* is reported, and for all the commodities, it is anticipated that more than 80% of the imports are delivered to countries such as Austria, Belgium, Czechia, Denmark, Estonia, Finland, Germany, Lithuania, Northern Ireland, Poland or Sweden, where the probability of establishment is considered negligible due to the climatic conditions not matching *R. syriacus* requirements (see Section 3.2.4).

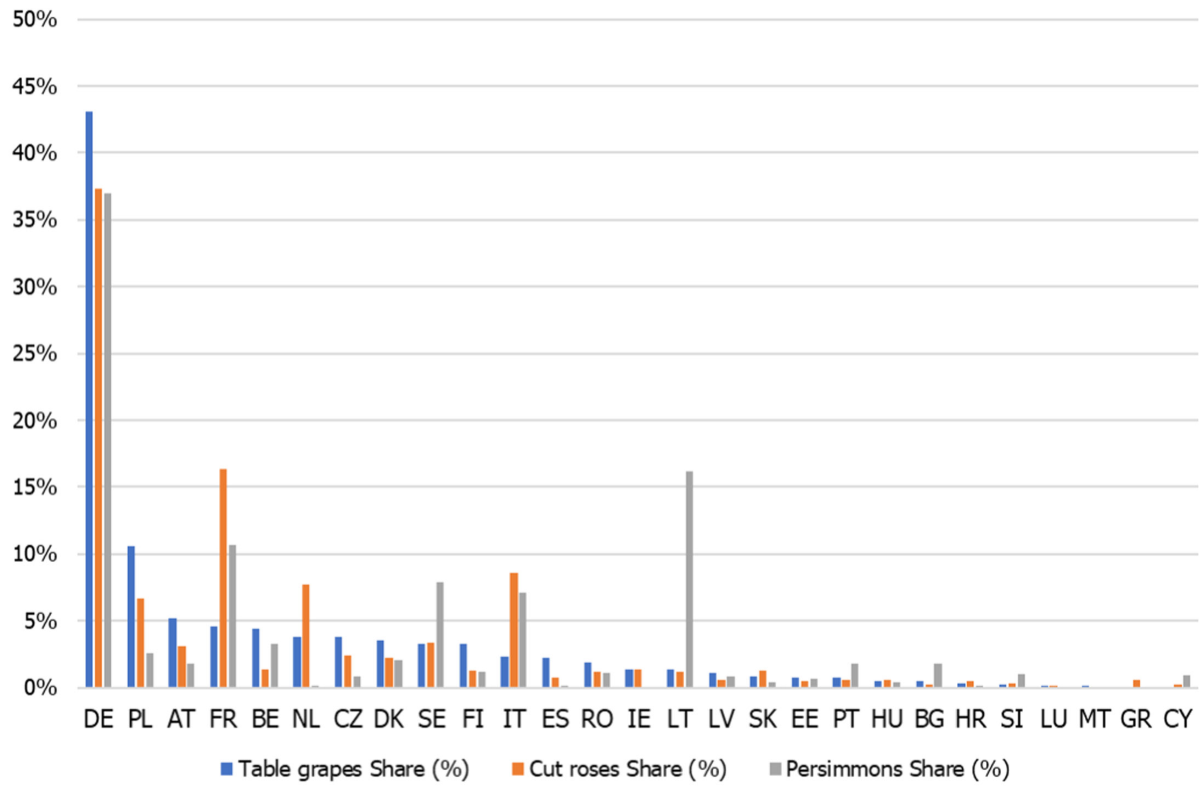


FIGURE 3 Percentage of product (cut roses, table grapes and persimmons) imported into the EU (from the countries where the pest is reported) that arrives in the Member States (median values of the redistribution model are reported).

For the scope of the assessment, it is assumed a perfect correlation between the proportion of infested units and the overall proportion of product arriving in each *j* Member State (i.e. if about 43% of the imported table grapes goes to Germany, 43% of the infested table grapes bunches is in Germany).

3.1.4 | Entry assessment results

The total number of potential founder populations per year in the EU estimated as the sum of all the infested units within each Member State and NUTS2 region ($NPFP_{NUTS2ji}$) as predicted by the entry pathway model are shown in Table 8. It is reminded to the readers that:

- Results for cut roses, persimmons and table grapes represent the model outputs with the imports distributed across Member States according to the results of the redistribution model (see Section 3.1.3); and then according to population size in the NUTS2 regions as an indicator of potential demand.
- Results for the plants of genera *Acalypha* and *Terminalia* represent the model output with the imports distributed across the Member States and NUTS2 regions according to their population, as an indicator of potential demand.
- Results for the plants for planting of *P. americana* (from Israel) represent the model output with the imports distributed across the avocado growing regions of Spain as explained in Section 2.1.2.1.

TABLE 8 Values at different percentiles of the output distribution for the total number of potential *Retithrips syriacus* founder populations per year in the EU ($NPFP_{EU}$).

	Percentile (%)						
Parameter	**1**	**5**	**25**	**50**	**75**	**95**	**99**
$NPFP_{EU}$ (TOTAL)	22	40	122	345	1285	10,761	41,985

From the contribution of all the considered entry pathways, the model estimated a median number of 345 potential founder populations of *R. syriacus* (90% CR: 40–10,761) per year in the EU. From the partial results of all the individual pathways, it can be appreciated how the risk of entry is driven by the cut roses and to a lesser extent, the import of *Acalypha* and *Terminalia* as plants for planting, and avocado plants from Israel (Table 9).

TABLE 9 Values at different percentiles of the output distribution for the total number of potential *Retithrips syriacus* founder population per year in the EU ($NPFP_{EU}$) as resulting from the individual entry pathways.

	Percentile (%)						
Entry pathway	**1**	**5**	**25**	**50**	**75**	**95**	**99**
Cut roses	0.5	1.6	12.2	89	899	10,551	41,921
Persimmons	7.4×10^{-9}	2.8×10^{-8}	2.5×10^{-7}	1.9×10^{-6}	1.8×10^{-5}	2.4×10^{-4}	10^{-3}
Table grapes	5×10^{-5}	1.8×10^{-4}	1.4×10^{-3}	0.01	0.11	1	6
Acalypha and *Terminalia*	11	14.5	38	89	214	815	1673
Persea americana (from Israel)	4.6×10^{-3}	0.05	0.7	3	10	39	85

The relative contribution of the table grapes and persimmons entry pathways to the total number of potential founder population is 1 entry event leading to transfer to a suitable host every 93 years for table grapes (90% CR ranging from 1 every 5579 years to about 1 per year) and 1 entry every about 950 years at the 99th percentile of the output distribution for persimmons. When looking at the actual location of the potential founder populations as a result of the redistribution model, it can be appreciated how most of the infested units originating a potential founder populations of *R. syriacus* are predicted in areas of the EU where the establishment is considered unlikely by the Panel based on their climatic requirements (Figures 4 and 6).

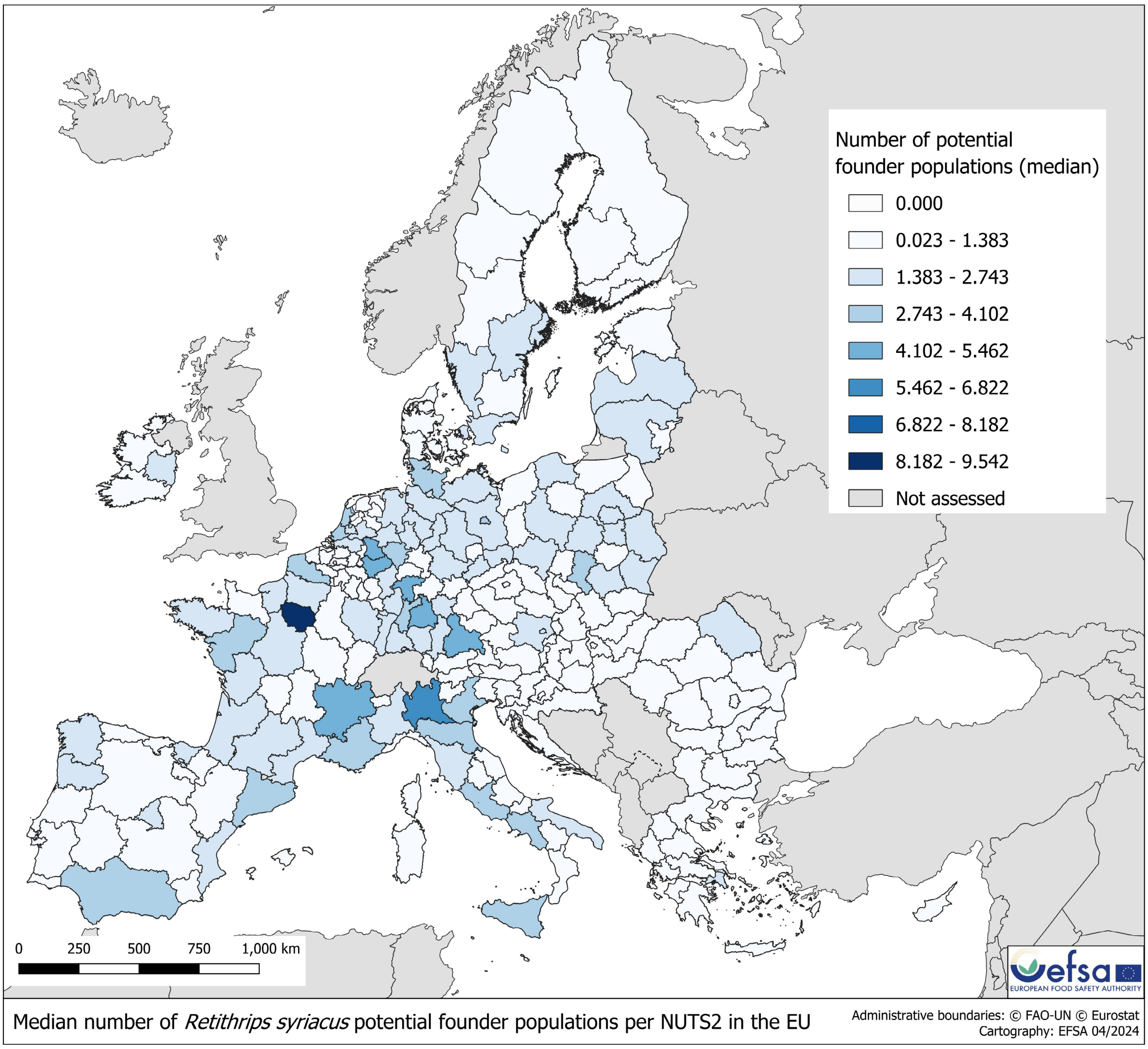


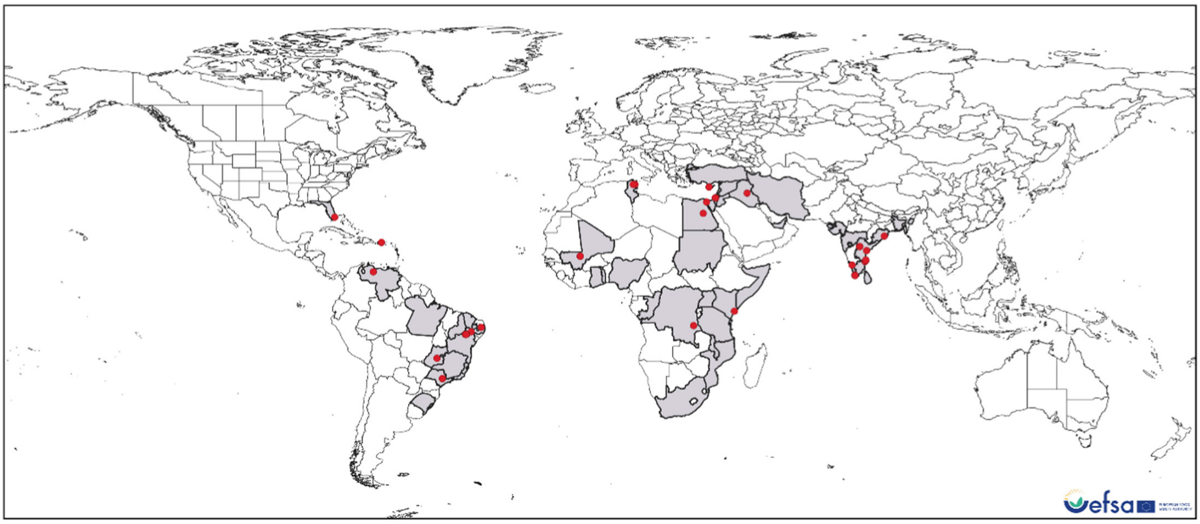
FIGURE 4 Graphical representation of the median number of potential founder populations per NUTS2 ($NPFP_{NUTS2ji}$) as a result of the redistribution model and probability of successful transfer to a suitable host.

When looking at the number of potential founder populations only for the areas of the EU where establishment would be possible, the model predicts 95 potential founder populations as the median value (90% CR ranging from 13 to 1832) representing about one-fourth of the number of potential founder populations predicted for the EU as a whole (Table 8).

3.2 | Establishment

3.2.1 | Background information and host distribution

The extensive literature search yielded only a limited number of specific geographic coordinates (directly reported or reporting enough information to obtain coordinates from Google Earth) (Golic et al., 2024). Most of the literature only mentioned the presence of *R. syriacus* in larger administrative units (Figure 5). As the Panel found evidence of the presence of the pest in Cyprus (Georghiou, 1977). For the scope of the Opinion, the Panel considered the distribution of the pest in the EU territory as restricted to Cyprus.



Administrative boundaries: © FAO-UN
Cartography: EFSA 02/2024

FIGURE 5 Map showing the location points (red) where precise coordinates for the presence of *Retithrips syriacus* could be obtained overlayed to the areas (grey background) where the presence of the pest was only reported at a FAO.GAUL Administrative 0, 1 or 2.

3.2.2 | Lower development thresholds

The lower development threshold and K for the different life stages of *R. syriacus* are reported in Table 10. Complete development from egg to adult required 313.7 DD, the minimum LDT was 12.4°C, which corresponded to pupae, the most robust stage to cold temperatures, whereas eggs were the most susceptible stage and required at least 14.9°C for development. The LDT of 14.9°C was used to map the average maximum number of consecutive days below the lower development threshold (see Section 3.2.3 and Appendix F.4) and identify areas where establishment is possible (the locations where the number of consecutive days below the LDT is lower or equal the highest value obtained from the pest observation point: 114.8 days in Tunisia).

TABLE 10 3 Lower development thresholds (LDT) and thermal constants (K) for the different life stages of *Retithrips syriacus* based on results from Rivnay (1939).

Stage	LDT (°C)	K (DD)
Egg	14.9	147.2
Larva	13.2	97.5
Pupa	12.4	69.0
Total	–	313.66

3.2.3 | Climate suitability analysis

With rather limited and sparse location data, the Panel identified the areas suitable for the establishment of *R. syriacus* in the EU by combining different climate indicators.

Köppen-Geiger climate comparison

The climate types present in the observed locations of *R. syriacus* were identified and mapped. For the climate matching, the Panel decided to use only the locations for which a point observation (indicated with red dots in Figure 5) was available.

This is because the use of larger administrative units (i.e. FAO GAUL 2 or 1) was judged of too low resolution and poor specificity for the purpose of climate matching. *R. syriacus* has been observed in the following Köppen–Geiger climate types that also occur in the EU: hot semiarid (BSh) and Mediterranean hot summer (Csa) (Appendix F.2, Figure F.2). Climate type BSh is relatively rare the UE but common in South America, India, Central and South Africa.

Hardiness zone

From worldwide distribution data, *R. syriacus* occurs in areas included in the 10a:13b cold-hardiness zones (Appendix F, Figure F.3). Therefore, by analogy, in the EU, the pest could occur in Cyprus (where it is indeed present), the coastal areas of Greece, France, Italy, Portugal and Spain and more extended areas in southwestern Andalusia (SW Spain) and the regions of Lisbon, Alentejo and Algarve in southern Portugal, where the same cold-hardiness zones are found.

Maximum number of consecutive days below the LDT

The map showing the maximum number of consecutive days below the LDT is the most restrictive as it shows the areas where the average number of consecutive days below the LDT is equal or lower the observed maximum (114.8 days in Tunisia). Under the assumption that longer period would not be suitable for the pest and according to this map alone, the areas suitable for *R. syriacus* in the EU are limited to few specific locations in the south of Spain, Portugal, Italy, Malta, Greece and Cyprus (Appendix F, Figure F.4).

3.2.4 | Identification of the suitable NUTS2 regions for establishment

As explained in Sections 2.2.1 and 2.2.2, the Panel identified the areas suitable for establishment by overlay the layers of Köppen–Geiger climate type, hardiness zone and maximum number of consecutive days below the LDT of 14.9°C, from this exercise, three area types (Figure 6) were identified:

1. 'Intersection (I)', areas of the EU where all the considered climate indicators (Maximum number of consecutive days below the LDT, hardiness zone and Köppen–Geiger climate type) coincide with those where the pest was observed in the countries of origin.
2. 'Union (U)', areas of the EU where at least one of the considered climate indicators coincide with those where the pest was observed in the countries of origin.
3. 'Null (N)', areas of the EU where none of the considered climate indicators coincide with those where the pest was observed in the countries of origin.

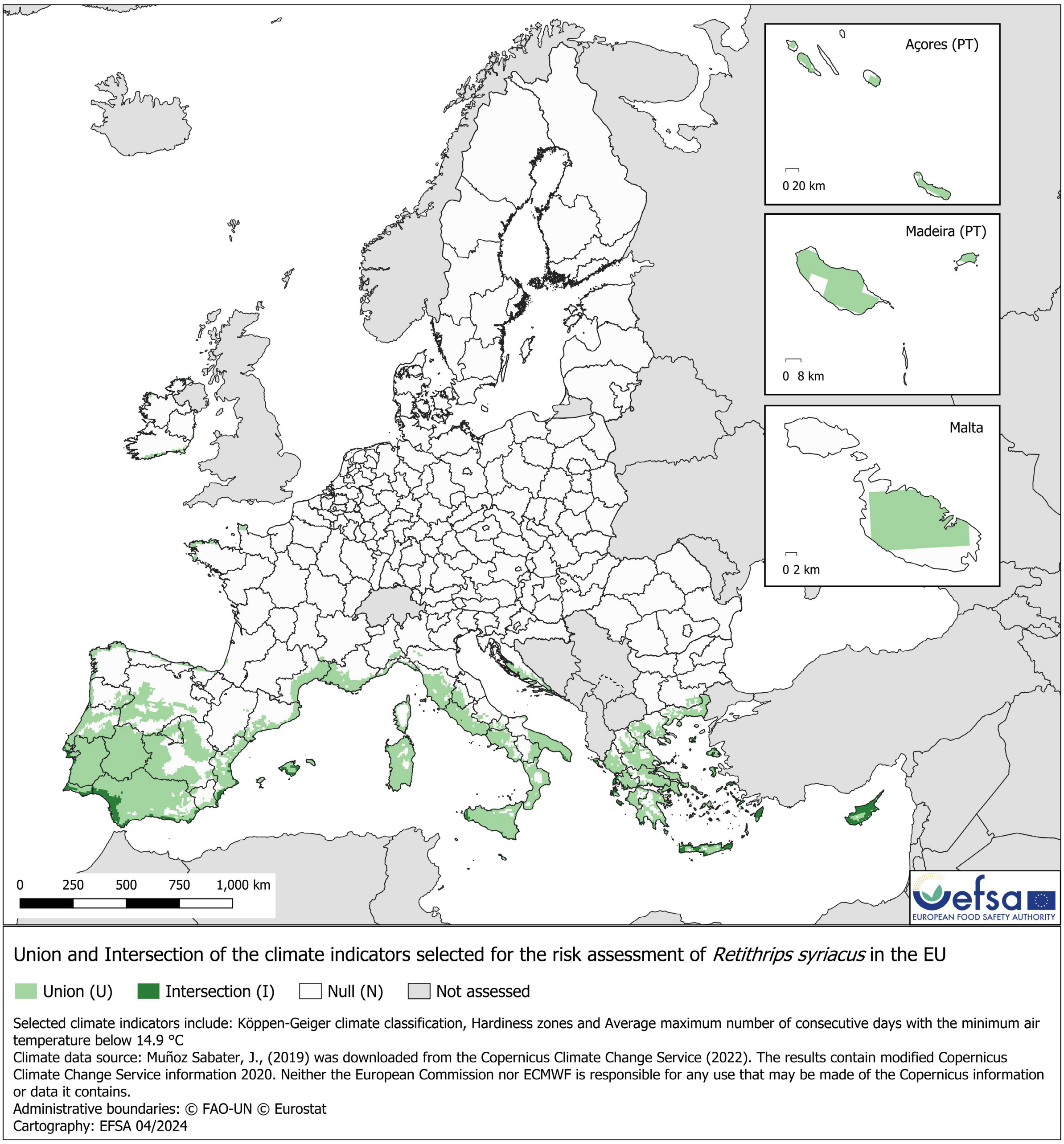


FIGURE 6 Map of the EU showing the result of overlapping Köppen–Geiger climate type, hardiness zone and average maximum number of consecutive days below the LDT. In white areas where the probability of establishment was assumed to be negligible. In light green ('Union'), the areas of the EU where at least one of the considered climate indicators coincide with those where *Retithrips syriacus* was observed in the countries of origin. In dark green ('Intersection'), the areas of the EU where all the considered climate indicators coincide with those where the pest was observed in the countries of origin.

A probability of establishment was elicited for each of these two areas (i.e. Union and Intersection) by considering Allee effects, the expected continuous availability of suitable hosts in the areas where the establishment would be possible, and the expected importance that the fulfilment of all climate indicators has for establishment. Results and justifications are reported in detail in Appendix D.5; the results of the fitting of the consensus values are summarised in Table 11.

TABLE 11 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the *Retithrips syriacus* establishment rate (out of 10,000 potential founder populations) in the 'Intersection' and 'Union' areas of the EU as defined in Section 3.2.4.

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
Establishment rate ('Intersection')	498	2135	3684	5254	6986
Establishment rate ('Union')	64	515	968	1529	2674
Establishment rate ('Null')	0 (Negligible)				

3.2.5 | Number of founder populations

From the contribution of all the considered entry pathways, the median number of *R. syriacus* founder populations for the EU (FP_{EU}) as estimated by the model was 4.6 per year (90% CR: 1 every 1.9 years to 85.6 per year).

The location of the founder populations as a result of: (i) the redistribution model (see Section 2.1.2.1), (ii) the probabilities of establishment in the three types of area identified by the Panel ('Intersection (I)', 'Union (U)' and 'Null (N)', see Section 3.2.4) and the proportions of these areas in each of the NUTS2 regions (see Section 2.2.2) is graphically shown with the map in Figure 7 where the median values of the $FP_{NUTS2ji}$ regions are reported.

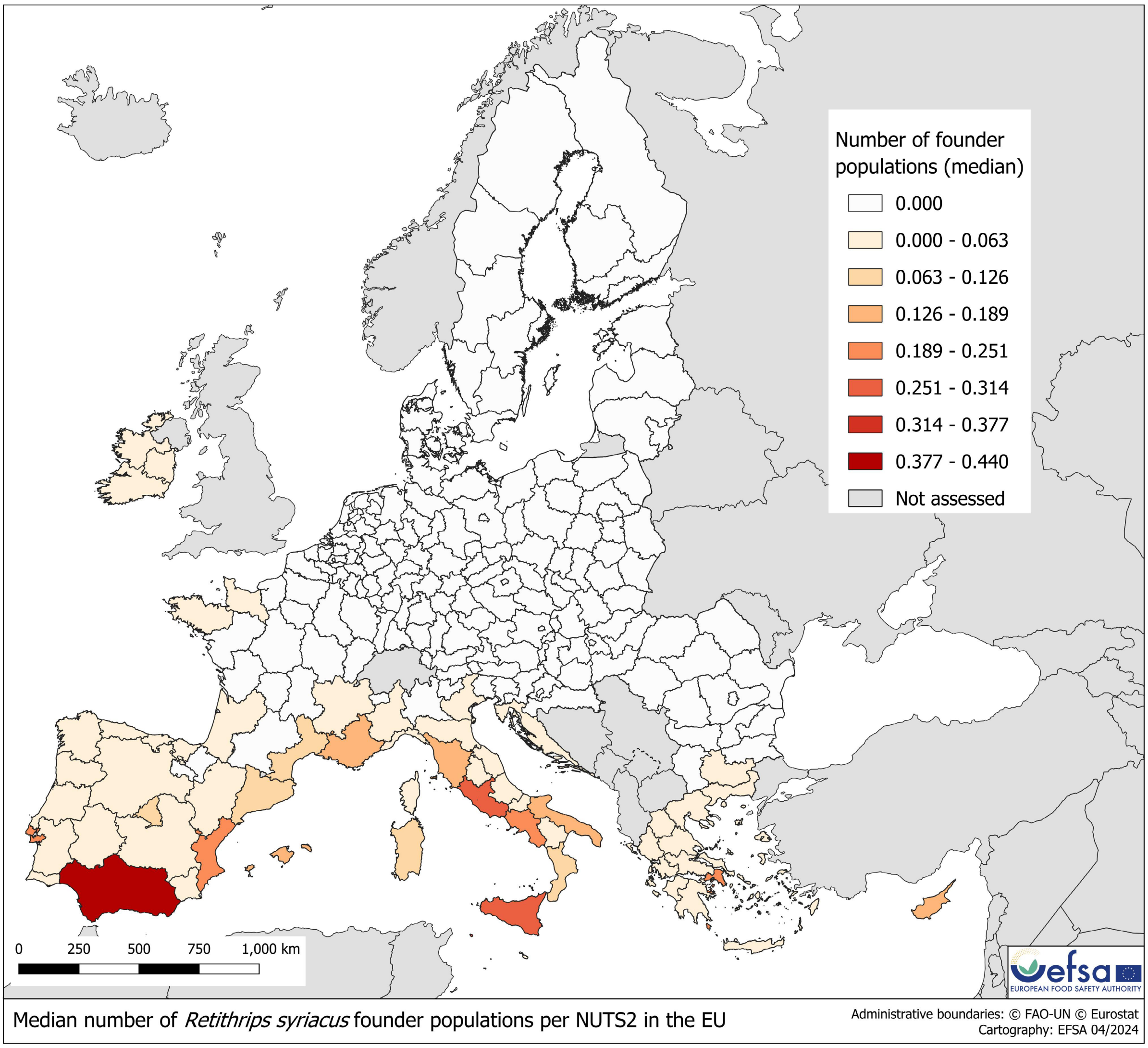


FIGURE 7 Graphical representation of the median number of founder populations of *R. syriacus* per NUTS2 ($FP_{NUTS2ji}$) as a result of the redistribution model and probability of establishment.

3.2.5.1 | *Sensitivity analysis*

A sensitivity analysis was conducted to estimate the correlations between the output variable (FP_{EU}) and the parameters of the entry pathway model. Correlations were computed using the Spearman rank coefficient which is nonparametric and able to compute both linear and nonlinear relationships between parameters and outputs. Results (Figure 8) show that the highest correlations were obtained for the following parameters:

- The infestation rate in cut roses;
- The probability of establishment in the areas of the EU where all the considered climate indicators coincide with those where the pest was observed in the countries of origin;
- The probability of transfer to suitable host;
- The trade volume and infestation rate on plants for planting of *Acalypha* and *Terminalia*.

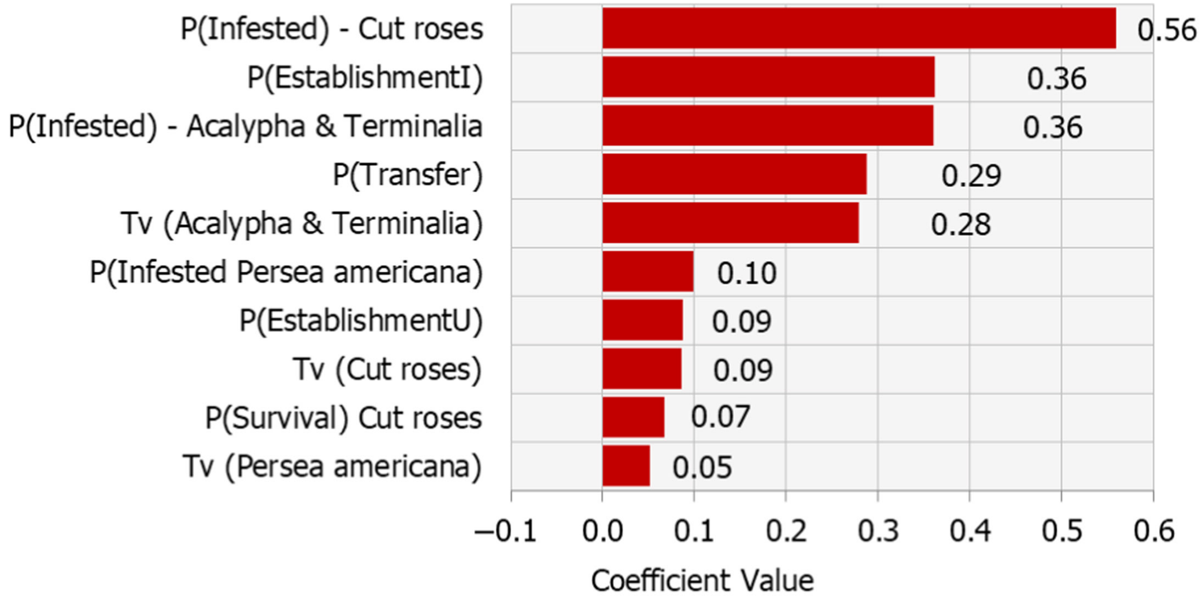


FIGURE 8 Correlations between the output variable (FP_{EU}) and the parameters of the entry pathway model. Only the 10 highest correlations are shown.

To reduce uncertainty regarding entry risk, it would therefore be a priority to collect more information on these parameters.

3.2.5.2 | *Unquantified uncertainties affecting the assessment of entry and establishment*

- For consignments arriving in the EU, there is uncertainty on the chance of *R. syriacus* detection in case of infestation; in addition, there is no obligation to notify interceptions of non-quarantine pests. With no indication of interceptions, the identification of the most relevant entry pathways was based on the fulfilment of a set of logical criteria. This led the Panel to consider five entry pathways for *R. syriacus* in the EU (import of: cut roses, persimmons, table grapes, plants for planting of the genera *Acalypha* and *Terminalia* and those of *P. americana* from Israel). While *R. syriacus* has been observed on a range of other host plants, by the set of criteria considered for the identification of the entry pathways (including the trade volume and the strength of association of the pest with the commodity from the literature), the Panel reckons not having ignored entry pathways that could have affected the outcome.
- The survival rates of *R. syriacus* as a function of time and temperature were largely informed on the cold resistance data for *T. palmi*, believed to be more cold-tolerant than *R. syriacus* based on the differences in the LDTs between the two thrips. However, the actual cold tolerance of *R. syriacus* is uncertain.
- Trying to model accurately the very final destination of goods imported from third countries is extremely challenging due to lack of tracking of the intra-EU trade at a sufficient level of resolution. For the commodities where data allow (cut roses, persimmons, table grapes) the panel elaborated a redistribution model that tries to capture the general trends emerging from the combination of the import, export and production data of each Member State. While representing a source of uncertainty itself, the Panel considered that for these commodities, this modelling approach would provide a more representative figure of the real flows as compared to the distribution based on population size of the Member States.
- The Canary Islands are not part of the PRA area, but avocados are grown in that region. Whether the destination of some of the *P. americana* plants delivered to Spain from Israel is in fact the Canary Island is uncertain. Having redistributed the trade over the NUTS2 regions of mainland Spain and Balearic Islands the number of plants distributed on these NUTS2 could be slightly overestimated.

4 | SPREAD

4.1 | Assessment of lag phase and spread

For the duration of the lag phase, it was considered that the life cycle of *R. syriacus* is completed, under laboratory conditions, within 42.1 ± 2.4 days at 20°C, 27.3 ± 2.0 days at 25°C and 19.8 ± 1.7 days at 30°C on rose leaves (Khan et al., 1997). The insect can produce about seven generations per year under most suitable field conditions. Under favourable climatic conditions, adults can live from 10 to 20 days, whereas at lower temperatures, longevity may reach 40 days (Avidov & Harpaz, 1969). Khan and colleagues recorded the highest longevity of females to be 50 days at 25°C (Khan et al., 1997). Those conditions are easily meet during the Mediterranean hot summer months. *R. syriacus* can overwinter at the adult stage in debris on the soil (Ben-Yakir, 2012), so it can withstand the relatively cold winters in the Mediterranean Basin.

For the spread rate, it was considered that the flying capacity of *R. syriacus* is relatively low, and adults hop and fly short distances only when disturbed (Dr. Élison Fabrício Bezerra Lima, personal communication). Nevertheless, individuals can be also dispersed by wind to relatively longer distances. Human-assisted spread with common agricultural practices was also considered. *R. syriacus* may spread with infested leaves, flowers and fruits attached to farm machinery moving within and between plots.

The median duration of the lag period in the regions where *R. syriacus* could potentially establish in the EU was estimated to be ~ 1.1 years (90% CR 0.3–3.3 years) (Table 12). After the lag period, *R. syriacus* is estimated to spread in those areas at a rate of 0.05 km/year (90% CR 0.02–2.3 km/year). More details are available in Appendix D.6.

TABLE 12 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the duration lag phase and spread rate of *Retithrips syriacus*.

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
Lag phase (years)	0.26	0.61	1.10	1.90	4.50
Spread rate (km/year)	0.02	0.025	0.05	0.20	13

For the first percentile of the lag phase, it was considered that infested plants may be introduced under protected conditions in a garden centre or greenhouse, where temperatures would be favourable all year around. Likewise, typically hot summer months in the Mediterranean Basin would provide favourable temperatures for *R. syriacus* even under open-field conditions. The 99th percentile was set considering that *R. syriacus* has a relatively low reproduction rate and it may take several growing seasons to build up a population high enough to start spreading. Also, the introduction may take place in a particular agricultural setting where insecticide sprays are regularly applied or where natural enemies are effective. For the median, it was considered that one summer season would be enough for *R. syriacus* to complete two to three generations.

For the first percentile of the spread rate, it was considered that *R. syriacus* typically shows an aggregated behaviour, as well as the low potential of the pest for natural spread. The value of the 99th percentile was set considering wind dispersal and human-assisted spread by infested plant organs carried by farm machinery. For the median and inter-quartile range, the main evidence considered was that *R. syriacus* is present in Cyprus for decades. Although there is evidence for *R. syriacus* presence in two different locations about 60 km apart (Nicosia in 1990 and Doğancı in 2005) (Natural History Museum (2024); Senckenberg Naturmuseum (2024), there is no evidence of how movement occurred. Likewise, *R. syriacus* was first reported in Tunisia in two host plants in 2009 (Elimem et al., 2011) but no further reports of its geographical range in the north of Africa have been published. These areas in Cyprus and Tunisia have similar climatic and host characteristics to the risk assessment area. *R. syriacus* is more widespread in Israel, but it is likely that this region falls within the pest's native range.

4.2 | Conclusions

The median duration of the lag period between establishment and spread, defined as the time needed for a founder population to build up to a population size enabling the colonisation of neighbouring hosts in the regions where *R. syriacus* could potentially establish in the EU was estimated to be ~ 1.1 years (90% CR 0.3–3.3 years). After the lag period, the median spread rate of *R. syriacus* by natural means (i.e. hopping, flying), wind dispersal and human-assisted spread by plant organs carried with farm machinery in the areas the pest could establish in the EU is estimated at a rate of 0.05 km/year (90% CR 0.02–2.30 km/year).

4.3 | Uncertainties affecting the assessment of the lag period and spread

The main uncertainties affecting the assessment of the lag period include:

- The extent to which natural enemies (other arthropods, entomopathogens, etc.) could hamper the build-up of the population, as adaptation to a new host can take time.
- The agronomic characteristics of the area of pest introduction (i.e. protected cultivation vs. open field).
- Climatic events that may disrupt or delay population build-up in new areas.
- Unknown effect of pesticide applications in the field that may decrease the rate of population build-up.
- Unknown differences in the preference of *R. syriacus* for different host species and cultivars.

The main uncertainties affecting the assessment of the spread rate include:

- Quantitative data on the spread rate of *R. syriacus* are not available.
- Whether *R. syriacus* has not spread in Cyprus and Tunisia or this perception is driven by the lack of systematic surveys.

- Whether *R. syriacus* is more widespread in Israel due to higher dispersal potential or because this region falls within the native range of the pest.
- The potential of wind and farm machinery for an effective spread of *R. syriacus*.

5 | IMPACT

5.1 | Evidence of impact

Retithrips syriacus prefers to oviposit in mature leaves and a severe infestation causes the leaves to dry out and fall off. This thrips species is not known to transmit any plant virus and its damage results from the ovipositing and feeding activities of the individuals, which impact the epidermal cells of the plant tissue and creates grey-silver scars on the leaves and fruits (Ben-Yakir, 2012; Rivnay, 1939; Zanuncio-Junior et al., 2016). Within its native range in Israel, it is reported to infest various crops of economic importance, causing puncture marks on the leaves which turn grey by the reduction of chlorophyll. If high temperatures are reached during summer, the thrips only appear in autumn, in which case the plant damage is insignificant. Leaf tissue injury is caused by the mechanical action of its ovipositor and piercing sucking mouthparts (Elimem et al., 2011; Rivnay, 1939). In case of heavy infestations, the deposition of faecal droplets on the leaves may cause cosmetic injury (Khan et al., 1997; Vijayan Nair, 1989). In Israel, Izhar (1992) reported discoloration on avocado and persimmons fruits by *R. syriacus*, which turn silvery grey at the feeding sites with some varieties recognised as more susceptible than others, but no quantitative assessment of the damage is provided (Izhar et al., 1992). *R. syriacus* normally feed on mature leaves, in fact, when infesting grapevines, the population is expected to build up at the end of the growing season. Avidov (1969), who lists grapevine as one of the hosts in Israel, states that irrigated vineyards do not require any control treatment against the pest, as late irrigation prevents or reduces leaf drop (Avidov & Harpaz, 1969).

In South Africa, *R. syriacus* has never been reported on grape bunches (Dr. Elleunorah Allsopp, personal communication). Pest infestations are observed on leaves and mostly after harvest. Similar observations were carried out by Rivnay (1939), who mentioned that the injuries caused by *R. syriacus* on grapevines and walnut trees occur after fruit picking and before the leaf fall, thus without substantial impact on yield. Similarly, *R. syriacus* is observed on table grapes in Maharashtra, India, but remains only on old leaves and does not cause any economic damage either to berries, flowers or leaves (NRCG, 2013).

In southern India, Malawi and Tanzania, larvae of this thrips were reported to damage leaves and bolls of cotton under hot and dry conditions (Anonymous, 1967), but the actual yield losses were not indicated. In India, *R. syriacus* was not able to infest cotton varieties with high gossypol content and dense trichomes, not even with artificial infestation (Gopichandran et al., 1992). Mallamaire (1949) has described the injuries caused in cotton plantations in Siango, Mali (Mallamaire, 1949). The pest was considered of some importance since it affected the photosynthetic ability of the plant but did not trigger any serious concern. Adequate fertilisation and irrigation were suggested to counteract the effects of the pest, which was also controlled by native predators (ladybirds and dipteran larvae).

In Venezuela, *R. syriacus* was observed on *Eucalyptus urophylla* trees, but population built up coincided with the dry season and natural dropping of leaves. Subsequent rains drastically reduced the population and trees recovered their foliage. No control measures were necessary and no damage in greenhouse crops was expected by the authors because of high relative humidity conditions (Rosales, 2000).

Cosmetic damage to leaves of *Rosa* sp. is reported by Khan et al. (1997) in Bangladesh, including silvering and curling of leaves, in some cases leading to defoliation and a reduction in production of flowers. In urban household gardens of Kerala, India, Vijayan Nair (1989) observed combined infestations of *R. syriacus* and *Rhipiphorothrips crueantatus* Hood (Thysanoptera: Thripidae) on rose plants which resulted in bleached leaves filled with excreta. Bondar (1924) gives a similar description of injuries caused by *R. syriacus* on rose plants in Brazil (Bahia) but stresses the correlation with extended dry weather conditions and notices that pest abundance and associated damages are reduced during the rainy season (Bondar, 1924). Similar injuries in the Brazil were also reported by Lima et al. (2016) on roses and *Terminalia catappa*.

In the region of Antakya (Türkiye), Doganlar and Yigit (2002) observed *R. syriacus* infestations at home gardens and described scarring caused by the pest both on leaves and bunches of grapevines (Doganlar & Yigit, 2002). However, there are no reports of *R. syriacus* damage in commercial vineyards in Türkiye. Likewise, no crop damage has been reported in Cyprus, where *R. syriacus* was introduced in 1960s (Georghiou, 1977).

In Tunisia, Elimem et al. (2011) reported damages of *R. syriacus* in two host plants, a grapevine from a private garden and persimmon from an orchard. No quantitative assessment of the damage was provided, and these authors indicated that additional studies are required to determine the impact of this thrips species in vineyards and persimmon orchards. All the literature noted above is mainly descriptive of the injuries caused by *R. syriacus* during its feeding activity, but without reporting actual impacts on yield or quality in a qualitative or quantitative way. The only studies available which report data on yield losses associated with *R. syriacus* are (Reddy & Rao, 2002, 2003) and (Reddy, 2006) from India, which are described and scrutinised below.

Reddy and Rao (2002) report the results of an experimental trial conducted in one vineyard plot at Bolaram, India, in 1995–1996 and 1996–1997 (Thompson seedless grape cultivar). The main purpose of this study was to assess and compare the efficacy of various insecticides to control three pests, namely flea beetle (*Scelodonta strigicollis* Motschulsky (Coleoptera: Chrysomelidae)), thrips (*R. syriacus*) and pod borer (*Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae)). Treatment efficacy was assessed by estimating the mean reduction in pest population in treated vs. untreated plots (which consisted of one single plant), and by comparing mean damages, for each pest separately. According to this study, 100% of grape berries were damaged by *R. syriacus*, and the tested insecticides were able to strongly reduce these damages, down to 0%–9% depending on the treatment considered. Yield loss data were not reported systematically in this paper, but some yield values were given in the text: 933 kg ha^{-1} in untreated control and from 18,509 to 27,331 kg ha^{-1} in treated plots. However, the yield difference cannot be attributed to *R. syriacus* alone as 100% of the plants were infested by the three different pest species simultaneously according to the authors. The results reported in this paper are uncertain because:

- The protocol used to measure the damages caused by the thrips is not presented in detail, and it is thus unsure whether the damages were due to thrips only;
- Although percentages of population reduction in treated vs. untreated plots are presented, no information on the initial densities of the pest populations (before treatment) were reported;
- The yield data are not presented systematically, and yield losses could not be attributed to thrips only as the plants were infested by three different pest species.

Reddy and Rao (2003) report results of a field trial which is most likely related to the trial reported in Reddy and Rao (2002); the same site name (Bolaram), same years, same cultivar are mentioned in both papers. However, the study of Reddy and Rao (2003) focused on the impact of *R. syriacus* and its reduction using three types of pesticide treatment and did not study the impact of flea beetle and pod borer contrary to Reddy and Rao (2002). Moreover, different treatments are considered here compared to Reddy and Rao (2002). The efficacy of the three pesticide treatments was assessed by comparing the population of *R. syriacus*, the damages of *R. syriacus* on berries, the yield loss and the economic margin between control and treated plots.

In Reddy and Rao (2003), the flea beetle was controlled using pesticide treatments, but it is unclear whether this control was fully effective. Moreover, pod borer infestation is not mentioned in Reddy and Rao (2003) while this pest was present in Bolaram during the same years according to Reddy and Rao (2002).

According to Reddy and Rao (2003), the thrips population ranged from 22.58 individuals per 10 canes to 62.13 individuals per 10 canes in untreated plots. These numbers correspond to about three to six thrips individuals per (untreated) cane, which seems to be very low as *R. syriacus* is known to live in clusters including many individuals (usually around 50 individuals per grape leaf according to Dr. Eleunorah Allsopp, personal communication). Nevertheless, the authors indicated that 100% of the berries were damaged by *R. syriacus* and that the yield loss reached 77% in the untreated plot when expressed relative to the most effective pesticide treatment. These results are uncertain because:

- The low numbers of thrips per cane do not seem consistent with 100% damaged berries. It is unclear how such a high level of damage could be induced by so few individuals.
- The protocol used to measure the thrips damage is not clearly presented and it is unsure whether the damage should be attributed to *R. syriacus* only.
- As Reddy and Rao (2002) reported high levels of infestation by two other pests in same site and years, it is unclear how the yield loss could be attributed to *R. syriacus* only.

Reddy (2006) reports the results of a field trial conducted on 'Thompson' seedless grape in Bolaram (the same site as in the two previous studies), but the specific years when the trial was conducted are not indicated. The author aimed to assess pesticide treatments to control flea beetle (*S. strigicollis*), thrips (*R. syriacus*) and gram caterpillar (named pod borer in Reddy & Rao, 2002, *H. armigera*). The spray schedules were different in Reddy (2006) when compared with the two previous studies. Treatment efficacy was assessed by comparing mean damage and yield values between treated and untreated plots (which same as with previous studies consisted of one single plant), for each pest separately. Reddy (2006) reports 98.61% of berries damaged by *R. syriacus* in the untreated plot and a yield loss of 94.52% compared to the most effective pesticide treatment. However, as the damage attributed to the two other pests is also very high (93%–98% of damage), yield loss cannot be attributed only to *R. syriacus*. No information on pest population is reported. The results are uncertain because:

- The protocol used to measure the damage caused by thrips is not presented;
- No information on the initial densities of the pest populations (before treatment) is reported;
- Yield losses could not be attributed to thrips only as the plants were infested by three different pest species.

Altogether, the three studies by Reddy and Rao (2002, 2003) and Reddy (2006) do no provide robust evidence of yield losses caused by *R. syriacus* on grapevine. The poor experimental design (factorial design with up to 8 replicates consisting of one single plant per treatment, with no control/untreated plants separating treatments) and result reporting in those papers present serious limitations and the damage attributed to *R. syriacus* cannot be disentangled from the two other grapevine pests present in the experimental site.

In areas of Israel within the native range of *R. syriacus*, Ben-Yakir (2012) indicated that the pest can affect persimmon, avocado, mango, quince and guava, but usually it does not cause economic damage in grapevines; moreover, in a publication issued by the Indian National Research Centre for Grapes (NRCG), the significance of thrips species for table grapes production is discussed. While reporting *Scirtothrips dorsalis* Hood and *Rhipiphorothrips cruentatus* Hood (Thysanoptera: Thripidae) as causing damage to growing shoots, flowers and berries of table grapes in India, this publication indicates that *R. syriacus* '*remains only on old leaves and does not cause any economic damage either to berries, flowers, or leaves*' (NRCG, 2013), which is in contrast with Reddy and Rao (2002, 2003) and Reddy (2006).

5.2 | Assessment of the impact

For the assessment of the impact, the Panel considered the fact that several reports qualitatively describe a certain level of damage to various hosts of economic importance to EU agriculture. Since these reports were mostly descriptive and did not provide any quantitative evidence of damage, we have assumed that it is very likely that *R. syriacus* does not cause any substantial yield losses although this may not have been within the scope of these studies. The lack of detailed research in the countries where the pest was reported present is another indication of a low level of damage. As indicated in Section 5.1, there are only three references reporting in a quantitative way some negative impacts of *R. syriacus* on yield. However, as mentioned above, those studies were conducted in one single grapevine plot in India, had serious limitations in the experimental design, data reporting and interpretation and were thus not included in the evidence dossier for EKE.

For the first percentile of the elicited probability distribution, it was considered that experts from Brazil and South Africa reported that the pest was not a major source of concern for farmers and particularly viticulturists (Dr. Élison Fabrício Bezerra Lima, Dr. Elleunorah Allsopp, personal communications). It was also considered that table grape crops in the EU are generally irrigated and mostly covered with nets, which may reduce the level of pest infestation and damage due to higher relative humidity. Overall, *R. syriacus* is not considered as a source of concern in grapes (both table and wine grapes) and other major crops by the experts from Brazil and South Africa. Based on the available evidence, the hypothesis of the absence of yield and/or quality losses is considered possible. Moreover, insecticide sprays and other pest control measures, including natural biological control, are a component of the general cropping practices in the risk assessment area and could further decrease pest populations and therefore pest damage.

For the 99th percentile, qualitative assessments of impact elsewhere were considered. Although some impacts on yield may be plausible, high uncertainty exists about its levels, since mostly injury descriptive qualitative data are available. It was considered that if yield losses were higher than 1%, more research would have been triggered on *R. syriacus* in countries where the pest has been present for decades.

For the median and the inter-quartile range, it was considered that reports describing high pest populations and associated plant damage date back to several decades and were either observed in very specific conditions (such as specific plant variety and prolonged dry periods), or outside commercial crop-growing areas like home or urban gardens. Assuming that *R. syriacus* reached its maximum distribution in the EU, the median yield reduction of plant products under general cropping practices was estimated to be 0.06% (90% CR 0.001%–0.57%) (Table 13) assuming that *R. syriacus* reached its maximum distribution. More details are available in Appendix D.7.

TABLE 13 Values at different percentiles of the distributions fitted to EKE values and describing the uncertainty in the impact of *Retithrips syriacus* on yield reduction (%).

	Percentile (%)				
Parameter	**1**	**25**	**50**	**75**	**99**
% yield reduction	0.0001	0.02	0.06	0.18	1.1

5.3 | Conclusions on impact

Assuming that *R. syriacus* reached its maximum distribution in the EU, the median yield reduction of plant products was estimated to be 0.06% (90% CR 0.001%–0.57%). Furthermore, the extent of the area where the pest could establish and spread in the EU is very limited, restricted to some areas in the south of the EU.

5.4 | Uncertainties affecting the impact

The main uncertainties affecting the assessment of impact include:

- Only qualitative information on damage is reported in the literature (insect injury description) and there is no sufficient evidence supporting potential yield losses attributed to *R. syriacus*, specifically. quantitative data on yield losses are not considered reliable.
- Limited scientific research on the pest even in countries where the pest was reported injuring on crops.
- Reports about damage to ornamental plants are based on observations collected in home or urban gardens, not in crop fields. There is uncertainty about the cosmetic damage *R. syriacus* could cause to greenhouse commercial cultivations of ornamental plants.

- Tolerance of cosmetic damage of fruits depends on the market and this tolerance may change in the future and depending on the actual production (higher cosmetic standards when production is high).
- High pest population and related crop damage are reported in very specific environmental conditions and plant varieties.
- Some records of injuries to crops were observed in association with other thrips species, and it was uncertain whether *R. syriacus* was the actual causal agent.
- Crops with sufficient water and nutrient input will probably not suffer any damage by the pest's feeding activity.
- Plant protection products currently applied to cultivated hosts targeting similar pests may have an effect on *R. syriacus*.

6 | POTENTIAL RISK REDUCTION OPTIONS

Specific import requirements for relevant host commodities can be identified as risk reduction options (RROs) for countries or areas where *R. syriacus* is present. This may be stand-alone RROs or may be combined in a system approach, which according to ISPM 14 requires two or more measures that are independent of each other and may include any number of measures that are dependent on each other.

– Pest-free places of production

A pest-free place of production is defined by ISPM 10 as a place of production in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period. In the case of *R. syriacus*, effective insecticide treatments and biological control agents (see Appendix A) are available. Chemical control may be applied to the plants to prevent the entry of the pest into the place of production. Conservation biological control (i.e. use of banker plants) may be applied to have generalist natural enemies ready to attack the pest upon entry. Soil treatments (physical, chemical) may be used to mitigate the likelihood of the presence of buried *R. syriacus* pupae. Likewise, the use of plastic covers for the production of plants in greenhouses of screenhouses can also avoid the entry of *R. syriacus* into the place of production. Growing under protected conditions may be particularly adequate for the production of plants for planting. Pest freedom in places of production should be substantiated by surveys and/or growing season inspections. All the operations need to be supported by appropriate documentation.

– Treatments on consignments

Chemical and physical treatments can be used to mitigate the likelihood of infestation of plants or plant products during transport. Effective insecticide treatments are available and may be applied to the plants to minimise infestation. These treatments may be more adequate for plants for planting, which are not for direct human consumption and so not subjected to the same maximum residue levels that apply to plant products. Physical treatments consisting of low temperatures and high relative humidities are known to be detrimental for *R. syriacus*. The effectiveness of chemical and physical treatments on consignments can be verified by official inspections.

As *R. syriacus* is already present in the EU territory in Cyprus, additional RROs to slow spread and facilitate eradication may be identified. Being the pest present in Cyprus since the 1960s, eradication in this island would be extremely challenging. Recognition of a protected zone as laid down by Regulation (EU) 2016/2031 might be considered.

– Protected zone quarantine pest

As established by Regulation (EU) 2016/2031, where a quarantine pest is present in the EU territory but not in the territory of a Member State or a part thereof, and is not a Union quarantine pest, such territory may be recognised as a protected zone. A protected zone quarantine pest shall not be introduced into, moved within or held, multiplied or released in, the respective protected zone. A plant, plant product or other object originating in a demarcated area established in a protected zone for the protected zone quarantine pest concerned shall not be moved from that demarcated area into the remaining part of that protected zone or into any other protected zone established for that protected zone quarantine pest. The competent authority shall carry out annual surveys of each protected zone as regards the presence of the protected zone quarantine pest concerned.

Based on the expected limited spread capacity and estimated low potential impact of *R. syriacus* in the relatively small areas of the EU that were considered suitable for pest establishment, (see Section 3.2.4), the Panel did not proceed with the quantitative assessment of potential RROs.

7 | CONCLUSIONS OF THE PRA

Following the previous pest categorisation conducted on *R. syriacus* (EFSA PLH Panel, 2021a, 2021b), this quantitative PRA confirms the potential of this pest for entry, establishment and spread in the EU, but with a potential geographical range limited to areas in the southern EU Member States and an estimated relatively low impact.

Due to the polyphagy of *R. syriacus*, many different hosts could provide potential pathways for entry into the EU as plants for planting or plant products. Following a prioritisation approach, the Panel considered the five most relevant entry pathways for *R. syriacus* in the EU: import of cut roses (*Rosa* spp.), persimmons (*Diospyros kaki*), table grapes (*Vitis vinifera*), plants for planting of the genera *Acalypha* and *Terminalia* and those of avocado (*Persea americana*) from Israel.

The risk of entry for table grapes and persimmons is lower than the risk driven by the cut roses, *Acalypha* and *Terminalia* as plants for planting, and avocado plants from Israel. From the contribution of all the considered entry pathways, the model estimated a median number of 345 potential founder populations of *R. syriacus* (90% CR: 40–10,761) per year in the EU.

With the rather limited and sparse available location data, by combining different climate indicators the Panel was able to identify the areas suitable for the establishment of *R. syriacus* in the southern EU Member States. From the contribution of all the considered entry pathways and the probabilities of establishment, the model estimated a median number of 4.6 founder populations of *R. syriacus* per year in the EU (90% CR: 1 every 1.9 years to 85.6 per year). The main uncertainties affecting the assessment of entry and establishment are the actual cold tolerance of *R. syriacus* as well as the precise final destinations of the imported commodities.

After establishment of *R. syriacus* in the risk assessment area, the median duration of the lag period between establishment and spread, defined as the time needed for a founder population to build up to a population size enabling the colonisation of neighbouring hosts, was estimated to be ~ 1.1 years (90% CR 0.3–3.3 years). After the lag period, the median spread rate of *R. syriacus* by natural means (i.e. hopping, flying), wind dispersal and human-assisted spread by plant organs carried with farm machinery in the areas where the pest could potentially establish in the EU is estimated at a rate of 0.05 km/year (90% CR 0.02–2.30 km/year).

The main uncertainties affecting the assessment of the lag phase are the extent to which natural enemies, agroclimatic characteristics and crop management practices could hamper the build-up of the population. For the spread rate, the main uncertainties are that quantitative data about the dispersal range of *R. syriacus* are not available, whether the pest has spread in Cyprus and Tunisia, as well as the potential of wind and farm machinery for effectively spreading of the pest.

Damage caused by *R. syriacus* is reported in qualitative terms, mostly just describing the injuries caused during the feeding activity of the pest. The evidence supporting potential yield losses attributed to *R. syriacus* only is not conclusive. Assuming *R. syriacus* has reached its maximum geographical range in the EU, the median yield reduction of plant products under general cropping practices was estimated to be 0.06% (90% CR 0.001%–0.57%). Furthermore, the estimated potential geographical range of the pest in the EU is relatively limited, restricted to some areas in the southern EU Member States.

Potential risk reduction options for *R. syriacus* were described. Nevertheless, based on the expected limited spread capacity and subsequent estimated low impact of the pest in the relatively small areas of the EU that were considered suitable for pest establishment, the Panel did not proceed with the quantitative assessment of potential RROs.

ABBREVIATIONS

BIC	Bayesian Information Criteria
CR	Certainty Range
DD	Degree Days
EKE	Expert Knowledge Elicitation
HRP	High Risk Plant
ISI	Institute for Scientific Information
ISPM	International Standards for Phytosanitary Measures
K	Thermal constant
LDT	Lower Developmental Threshold
MS	Member State (of the EU)
NPPO	National Plant Protection Organisation
NUTS	Nomenclature Units for Territorial Statistics
PPIS	Plant Protection and Inspection Services
PT	Portugal
RRO	Risk Reduction Option
ToR	Terms of Reference

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CONFLICT 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.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX A

Review of *Retithrips syriacus* biology

The life cycle of *Retithrips syriacus* is completed, under laboratory conditions, within 42.1 ± 2.4 days at 20°C, 27.3 ± 2.0 days at 25°C and 19.8 ± 1.7 days at 30°C on rose leaves (Khan et al., 1997). This insect can produce up to seven generations per year. Under favourable climatic conditions, adults can live from 10 to 20 days, whereas at lower temperatures, longevity may reach 40 days (Avidov & Harpaz, 1969). Khan et al. (1997) recorded the highest longevity of females to be 50 days at 25°C.

Pre-oviposition period could range from 8 to 13 days at 17°C to 3–5 days at higher temperatures (Rivnay, 1939). The mean daily fecundity of *R. syriacus* on rose plants at 20, 25, 30 and 35°C was 1.75, 3.25, 4.25 and 5.75 eggs/female/day, respectively. The highest value was recorded at 35°C (6 eggs/female/day) (Khan et al., 1997). Population numbers peak with high temperatures and low RH (Lal, 1982).

As all thrips within the suborder Terebrantia, eggs of *R. syriacus* are primarily laid under the dorsal epidermal layer of leaves with an ovipositor (=terebra). Often the texture of the leaf determines the oviposition site. The immatures and adults live on both the abaxial and adaxial sides of the host leaf (Majumder, 2001). After two larval instars, the larva is ready to pupate and retires into a corner or along the vein of the leaf, where it moults into the pre-pupal stage. Usually, several pre-pupae, pupae and larvae are found in groups, side by side, in a circle, head directed towards the centre (Rivnay, 1939). The second-instar larvae, pre-pupae and pupae usually remain in an aggregation of five to seven individuals in close proximity. Majumder (2004) mentions that pupation occurs on the underside of the rose leaf (Majumder, 2004). On the other hand, Sujatha et al. (2011) stated that on *Ricinus communis* in Andhra Pradesh, India, the larvae pupate in the soil (Sujatha et al., 2011). However, soil pupation is not mentioned for the other hosts. In northeastern Brazil, the pest pupates on the leaves on *Jatropha* plants, which have leaves similar to *R. communis* (Dr. Élison Fabrício Bezerra Lima, personal communication). In South African vineyards, pupation may occur in the crevices of the bark (Dr. Elleunorah Allsopp, personal communication).

Recently hatched first- and second-instar larvae of *R. syriacus* are hyaline, but quickly turn in yellow-orange and vermilion red. Pre-pupae and pupae are bright reddish with a yellowish head and legs, the wing pads are pale brown. Adults are black and up to 1.3–1.5 mm long (Figure A.1).

FIGURE A.1 *Retithrips syriacus* adult female (A), slide-mounted female (B), prepupa (left) and second instar larva (right) (C), prepupae (D). Photos © Dr. Élison Fabrício Bezerra Lima.

Males and females can be easily distinguished by their size and form, with males slender and smaller than females. Mating may take place shortly after adult emergence, even on the same day. Newly emerged adults are capable of creeping or flying short distances and disperse on not infested leaves.

In the area of Rehovot, the observed sex ratio was 80:20 (female: male) from winter until summer. The number of males gradually increased to reach a 50:50 ratio in autumn (Rivnay, 1939). Similar observations were made by Ananthakrishnan (1955), with the general observed sex ratio usually between 1:4 and 1:5, with the females always predominating (Ananthakrishnan, 1955). In Brazil, however, no males have been observed in nature and the populations reproduce by thelytoky (Dr. Élison Fabrício Bezerra Lima, personal observation, personal communication). Both sexes are present in African populations of *R. syriacus* (Dr Elleunorah Allsopp, personal communication).

Overwintering

Retithrips syriacus was observed to overwinter in Israel at the adult stage in debris on the soil (Ben-Yakir, 2012). However, in tropical countries, this species can be found on plants all year long. Larvae show great resistance to low humidities as long as the host leaf is turgent. Pupae are resistant to low air humidities, but are susceptible to high humidities, near 100%. Cold air (5°C or less) and high temperatures (37°C or more) are lethal to most of the pupae. The species does not oviposit and fails to moult into adult from pupae at 10°C. Eggs do not hatch at 35°C. The larva is less sensitive than the egg to extremes in climatic conditions, though mortality increases when the temperature rises above 33°C. Above 37°C, no larvae attain pupation. The majority of larvae also die when the temperature drops below 14°C. When temperatures drop below 17°C or rise above 37°C, oviposition is arrested (Avidov & Harpaz, 1969).

Behaviour

Females usually cover the oviposition place with an opaque fluid, possibly their faeces. Larvae are usually found in groups and usually on the underside of the leaf. After hatching, they do not wander about in search of food but begin to feed immediately on the hatching site. During the feeding period, the larva carries a droplet of faeces on the tip of the abdomen. When it becomes too heavy, it is deposited on the leaf. When the larva is mature and ready to pupate, these droplets become smaller (Rivnay, 1939). As the individuals live on exposed surfaces, these droplets may be used to protect the larva from natural enemies and to prevent it from being blown away (Lima et al., 2021; Majumder, 2004). It can also be used as a defence mechanism against predators (Dr. Elleunorah Allsopp, personal communication).

Feeding habits

Retithrips syriacus larvae and adults feed on mature leaves of hosts, therefore, are present at later stages of crop-growing season. The pest does not feed on the twigs of hosts (like *Rosa* spp.) or inside rose flowers (Majumder, 2004). It can feed on the fruit skin of avocado, persimmon, grapes and cotton (Avidov & Harpaz, 1969; Doganlar & Yigit, 2002; Izhar et al., 1992; Medina-Gaud & Franqui, 2001). It has never been observed on bunches of grapes in South Africa (Dr. Elleunorah Allsopp, personal communication). The proportion of adults to larvae in older leaves is very small, namely, about 8%, whereas in younger leaves, the adults are found in greater numbers than the immatures. The fact that adults are more numerous on the upper, younger leaves of the plant, could be attributed to these leaves being a mating and oviposition site (Ananthakrishnan, 1955).

Trapping

Attractive semiochemicals remain largely unknown for *R. syriacus*, which makes specific trap monitoring difficult for this species. Because their flying capacity is very limited, and adults hop and fly short distances only when disturbed, sticky traps would not be very useful as an early warning tool (Dr. A. Loomans, personal communication).

Similar species in EU and natural enemies

Heliothrips haemorrhoidalis (Bouché) and *Hercinothrips femoralis* (Reuter) (Thysanoptera: Thripidae) are thrips species found in Europe that belong to the same subfamily (Panchaetothripinae) and have behaviour and lifestyle similar to *R. syriacus*.

Parasitoids

Megaphragna priesneri Timberlake (Hymenoptera: Trichogrammatidae) was found parasitising the eggs of *R. syriacus* in Egypt and Israel (Polaszek et al., 2022). *Thripobius hirticornis* Ferrière and *Thripoctenus javae* Girault (Hymenoptera: Eulophidae) parasitise the larvae of *R. syriacus* and can efficiently control the pest populations on *Bucida buceras* and *Lagestroemia speciosa* (Etienne et al., 2015).

Predators

Franklinothrips vespiformis Crawford (Thysanoptera: Aeolothripidae) can prey on the eggs of *R. syriacus* (Loomans & Vierbergen, 1999). Pirate bugs (Anthocoridae) and phytoseiid mites (Phytoseiidae) could potentially be used for the biological control of *R. syriacus*.

APPENDIX B

Retithrips syriacus hosts potentially posing a risk for pest introduction into the EU

B.1 | CHECKLIST OF *RETITHRIPS SYRIACUS* HOSTS (AMENDED FROM THE EFSA PEST CATEGORISATION [EFSA PLH PANEL, 2021B])

To be considered a host, the insect must be able to complete its development and produce viable progeny following mating by feeding only on the plant regarded as a host. The Panel considered reports of immature stages of ***R. syriacus*** on a plant as a sufficient indication that the pest could complete the life cycle on that host. The list of identified ***R. syriacus*** hosts together with the supporting reference is reported in Table B.1.

TABLE B.1 Scientific name (as reported in the original reference) and reference(s) supporting the plant species/genera as a *Retithrips syriacus* host.

Scientific name	Reference supporting the plant as an actual host for *R. syriacus* based on immature stages observed or reported as observed by cross-referencing to other evidence
Acalypha	Ananthakrishnan (1955)
Ampelopsis orientale	Doganlar and Yigit (2002)
Coffea canephora	Kumar et al. (1984)
Coffea dewevrei	Kumar et al. (1984)
Coffea liberica	Kumar et al. (1984)
Diospyros kaki	Doganlar and Yigit (2002), Elimem et al. (2011), Ibrahim (2017)
Eucalyptus globulus	Ananthakrishnan et al. (1992)
Eucalyptus spp.	Monteiro et al. (1999) in Lima, O'donnell, & Miyasato (2020), Mound and Marullo (1996), Monteiro (2002)
Eucalyptus urophylla	Rosales (2000)
Gossypium spp.	Mallamaire (1949), Ananthakrishnan (1955), Gopichandran et al. (1992), Silva et al. (2022)
Jatropha curcas	da Silva et al. (2008) in Lima, O'donnell, & Miyasato (2020), Prabhakar et al. (2008), Patel et al. (2009), Patel et al. (2013), Ibrahim (2017)
Juglans regia	Doganlar and Yigit (2002)
Lagerstroemia speciosa	Etienne et al. (2015)
Leucaena leucocephala	Ibrahim (2017)
Manihot esculenta	Lal and Pillai (1981), Lal (1982), Lal and Pillai (1982)
Manihot glaziovii	Bastos and Alves (1981) in Lima, O'donnell, & Miyasato (2020), Bastos and Figueiredo (1979a, 1979b), Bastos and Figueiredo (1981), Bastos and Alves (1983)
Manihot utilissima	Ananthakrishnan et al. (1992)
Melaleuca quinquenervia	Medina-Gaud and Franqui (2001)
Myrtus communis	Rivnay (1939), Doganlar and Yigit (2002)
Persea americana	Izhar et al. (1992)
Punica granatum	Ananthakrishnan (1955)
Pyrus communis	Ibrahim (2017)
Ricinus communis	Ananthakrishnan (1955, 1956), Ananthakrishnan et al. (1992), Sujatha et al. (2011)
Rosa spp.	Lima et al. (2016) in Lima, O'donnell, & Miyasato (2020), Bondar (1924), Vijayan Nair (1989), Khan et al. (1997), Majumder (2001), Doganlar and Yigit (2002), Majumder (2004)
Schinus molle	Doganlar and Yigit (2002)

(Continues)

TABLE B.1 (Continued)

Scientific name	Reference supporting the plant as an actual host for *R. syriacus* based on immature stages observed or reported as observed by cross-referencing to other evidence
Schinus terebinthifolius	Ibrahim (2017)
Terminalia catappa	Etienne et al. (2015), Lima et al. (2016), Lima, O'donnell, & Miyasato (2020)
Vitis vinifera	Monteiro et al. (1999) in Lima, O'donnell, & Miyasato (2020), Ananthakrishnan (1955), De Vasconcelos et al. (1976), Doganlar and Yigit (2002), Reddy and Rao (2003), Al-Zyoud and Elmosa (2007), Haji et al. (2009), Brito et al. (2010), Elimem et al. (2011), Mannaa et al. (2012), Moreira et al. (2012), Ibrahim (2017)

The interception records labelled either 'Thripidae' or 'Thysanoptera' from countries where ***R. syriacus*** is present are listed in Table B.2 highlighted are the commodities known as a ***R. syriacus*** host.

TABLE B.2 Results when searching for interceptions of Thripidae and Thysanoptera from countries where *Retithrips syriacus* is present Europhyt (1995 until May 2020) and TRACES (June 2020-ongoing database).

Consignor	Commodity	Harmful_Organism	*n*
Bangladesh	*Amaranthus* sp.	Thripidae	25
Bangladesh	*Amaranthus tricolor*	Thripidae	16
Bangladesh	*Amaranthus viridis*	Thripidae	2
Bangladesh	*Citrus aurantifolia*	Thripidae	2
Bangladesh	*Corchorus* sp.	Thripidae	1
Bangladesh	*Leucocasia gigantea*	Thripidae	1
Bangladesh	*Luffa acutangula*	Thripidae	2
Bangladesh	*Momordica*	Thripidae	6
Bangladesh	*Momordica*	Thysanoptera	1
Bangladesh	*Momordica charantia*	Thripidae	3
Bangladesh	*Momordica cochinchinensis*	Thripidae	6
Bangladesh	*Momordica* sp.	Thripidae	42
Bangladesh	*Musa* sp.	Thripidae	1
Bangladesh	*Piper betle*	Thripidae	1
Bangladesh	*Solanum melongena*	Thripidae	54
Bangladesh	*Solanum melongena*	Thysanoptera	2
Bangladesh	*Solanum* sp.	Thripidae	1
Egypt	*Asparagus* sp.	Thripidae	1
Egypt	*Chrysanthemum* sp.	Thripidae	1
Egypt	*Dianthus* sp.	Thripidae	2
Egypt	*Gladiolus* sp.	Thripidae	5
Egypt	*Gypsophila* sp.	Thripidae	4
Egypt	*Solanum melongena*	Thripidae	2

TABLE B.2 (Continued)

Consignor	Commodity	Harmful_Organism	*n*
Ghana	*Abelmoschus esculentus*	Thripidae	3
Ghana	*Capsicum*	Thripidae	1
Ghana	*Capsicum*	Thysanoptera	1
Ghana	*Citrullus lanatus*	Thysanoptera	1
Ghana	*Luffa*	Thripidae	3
Ghana	*Luffa acutangula*	Thripidae	224
Ghana	*Luffa* sp.	Thripidae	35
Ghana	*Momordica charantia*	Thripidae	6
Ghana	*Momordica* sp.	Thripidae	11
Ghana	*Moringa oleifera*	Thripidae	1
Ghana	*Solanum*	Thripidae	1
Ghana	*Solanum aethiopicum*	Thripidae	2
Ghana	*Solanum gilo*	Thripidae	8
Ghana	*Solanum melongena*	Thripidae	201
Ghana	*Solanum melongena*	Thysanoptera	10
Ghana	*Solanum melongena* var. *serpentinum*	Thripidae	1
Ghana	*Solanum* sp.	Thripidae	1
India	*Abelmoschus esculentus*	Thripidae	37
India	*Abelmoschus* sp.	Thripidae	2
India	*Amaranthus*	Thripidae	1
India	*Amaranthus* sp.	Thripidae	2
India	*Amaranthus viridis*	Thripidae	1
India	*Capsicum*	Thripidae	3
India	*Capsicum annuum*	Thripidae	1
India	*Capsicum* sp.	Thripidae	1
India	*Citrus aurantifolia*	Thripidae	2
India	*Citrus hystrix*	Thripidae	1
India	*Citrus* sp.	Thripidae	1
India	*Citrus* sp.	Thysanoptera	1
India	*Colocasia esculenta*	Thripidae	1
India	*Corchorus* sp.	Thripidae	3
India	*Luffa acutangula*	Thripidae	8
India	*Luffa aegyptiaca*	Thripidae	1

(Continues)

TABLE B.2 (Continued)

Consignor	Commodity	Harmful_Organism	*n*
India	*Luffa* sp.	Thripidae	3
India	*Mangifera indica*	Thripidae	1
India	*Momordica*	Thripidae	1
India	*Momordica charantia*	Thripidae	29
India	*Momordica charantia*	Thysanoptera	43
India	*Momordica cochinchinensis*	Thripidae	3
India	*Momordica* sp.	Thripidae	85
India	*Momordica* sp.	Thysanoptera	4
India	*Moringa oleifera*	Thripidae	5
India	*Ocimum basilicum*	Thripidae	1
India	*Psidium guajava*	Thysanoptera	1
India	*Solanum melongena*	Thripidae	28
India	*Solanum melongena*	Thysanoptera	24
India	*Trigonella* sp.	Thysanoptera	1
Israel	*Argyranthemum frutescens*	Thripidae	1
Israel	*Artemisia* sp.	Thysanoptera	1
Israel	*Bidens ferulifolia*	Thripidae	1
Israel	*Chrysanthemum*	Thripidae	3
Israel	*Cleome hassleriana*	Thripidae	1
Israel	*Dianthus*	Thripidae	4
Israel	*Dianthus* sp.	Thripidae	1
Israel	*Eustoma* sp.	Thripidae	2
Israel	*Eustoma* sp.	Thysanoptera	4
Israel	*Gaura* sp.	Thysanoptera	1
Israel	*Gypsophila*	Thysanoptera	1
Israel	*Gypsophila* sp.	Thripidae	1
Israel	*Impatiens* sp.	Thysanoptera	1
Israel	*Ipomoea batatas*	Thripidae	1
Israel	*Lantana montevidensis*	Thripidae	1
Israel	*Lavandula angustifolia*	Thysanoptera	1
Israel	*Lisianthius* sp.	Thripidae	2
Israel	*Lisianthius* sp.	Thysanoptera	1
Israel	*Lithodora*	Thripidae	1

TABLE B.2 (Continued)

Consignor	Commodity	Harmful_Organism	*n*
Israel	*Lithospermum* sp.	Thysanoptera	1
Israel	*Lobelia* sp.	Thysanoptera	1
Israel	*Nemesia fruticans*	Thripidae	1
Israel	*Ocimum basilicum*	Thripidae	1
Israel	*Ocimum basilicum*	Thysanoptera	2
Israel	*Penstemon* sp.	Thysanoptera	1
Israel	*Rosa*	Thripidae	3
Israel	*Rosmarinus* sp.	Thysanoptera	1
Israel	*Salvia*	Thripidae	1
Israel	*Salvia* sp.	Thysanoptera	1
Israel	*Santolina* sp.	Thysanoptera	1
Israel	*Satureja* sp.	Thysanoptera	1
Israel	*Thymus* sp.	Thysanoptera	1
Jordan	*Gerbera jamesonii*	Thysanoptera	1
Kenya	*Alstroemeria* sp.	Thripidae	1
Kenya	*Alstroemeria* sp.	Thysanoptera	1
Kenya	*Artemisia dracunculus*	Thripidae	4
Kenya	*Artemisia dracunculus*	Thysanoptera	3
Kenya	*Chrysanthemum* sp.	Thripidae	1
Kenya	*Chrysanthemum* sp.	Thysanoptera	1
Kenya	*Dianthus caryophyllus*	Thysanoptera	1
Kenya	*Gypsophila*	Thripidae	1
Kenya	*Gypsophila paniculata*	Thysanoptera	1
Kenya	*Limonium* sp.	Thripidae	2
Kenya	*Lisianthius* sp.	Thripidae	1
Kenya	*Momordica charantia*	Thripidae	6
Kenya	*Momordica* sp.	Thripidae	2
Kenya	*Momordica* sp.	Thysanoptera	1
Kenya	*Ocimum basilicum*	Thripidae	33
Kenya	*Ocimum basilicum*	Thysanoptera	16
Kenya	*Rosa* sp.	Thripidae	1
Kenya	*Rosa* sp.	Thysanoptera	2
Kenya	*Solanum melongena*	Thripidae	2

(Continues)

TABLE B.2 (Continued)

Consignor	Commodity	Harmful_Organism	*n*
Kenya	*Solanum melongena*	Thysanoptera	1
Kenya	*Solidago* sp.	Thysanoptera	1
Lebanon	*Allium cepa*	Thripidae	1
Lebanon	*Chrysanthemum* sp.	Thripidae	1
Lebanon	*Coriandrum sativum*	Thripidae	1
Lebanon	*Lactuca sativa*	Thripidae	1
Lebanon	*Rosa hybrid rugosa*	Thripidae	1
Nigeria	*Amaranthus*	Thripidae	2
Nigeria	*Amaranthus viridis*	Thripidae	4
Nigeria	*Celosia argentea*	Thripidae	2
Nigeria	*Corchorus*	Thripidae	2
Nigeria	*Corchorus olitorius*	Thripidae	4
Nigeria	*Rumex acetosa*	Thripidae	1
Nigeria	*Solanum melongena*	Thripidae	1
Nigeria	*Telfairia*	Thripidae	1
Nigeria	*Telfairia occidentalis*	Thripidae	40
South Africa	*Chrysanthemum*	Thysanoptera	1
South Africa	*Dianthus*	Thysanoptera	2
South Africa	*Solanum melongena*	Thripidae	1
Sri Lanka	*Ipomoea aquatica*	Thripidae	1
Sri Lanka	*Mangifera* sp.	Thripidae	1
Sri Lanka	*Momordica charantia*	Thripidae	5
Sri Lanka	*Momordica charantia*	Thysanoptera	9
Sri Lanka	*Momordica cochinchinensis*	Thripidae	1
Sri Lanka	*Momordica* sp.	Thripidae	12
Sri Lanka	*Momordica* sp.	Thysanoptera	1
Sri Lanka	*Murraya koenigii*	Thripidae	1
Sri Lanka	*Solanum macrocarpon*	Thripidae	1
Sri Lanka	*Solanum melongena*	Thripidae	3
Sri Lanka	*Solanum melongena*	Thysanoptera	8
Sri Lanka	*Solanum* sp.	Thripidae	1
Sri Lanka	*Trichosanthes* sp.	Thripidae	1

TABLE B.2 (Continued)

Consignor	Commodity	Harmful_Organism	*n*
Tanzania	*Asteriscus* sp.	Thysanoptera	1
Tanzania	*Begonia* sp.	Thysanoptera	1
Tanzania	*Brachyscome* sp.	Thysanoptera	1
Tanzania	*Cestrum nocturnum*	Thysanoptera	1
Tanzania	*Felicia amelloides*	Thysanoptera	1
Tanzania	*Fuchsia* sp.	Thysanoptera	1
Tanzania	*Leucanthemum* sp.	Thysanoptera	1
Tanzania	*Pelargonium* sp.	Thysanoptera	1
Tanzania	*Sutera* sp.	Thysanoptera	1
Togo	*Solanum aethiopicum*	Thysanoptera	2
Togo	*Solanum melongena*	Thysanoptera	5
Türkiye	*Punica granatum*	Thysanoptera	1
Uganda	*Momordica charantia*	Thripidae	1
Uganda	*Solanum melongena*	Thripidae	1
Uganda	*Sutera* sp.	Thripidae	1
United states	*Phlox drummondii*	Thripidae	1

B.2 | IDENTIFICATION OF PRIORITY ENTRY PATHWAYS

For plants for planting and plant products whose plant is a known ***R. syriacus*** host, the rationale for having considered or not the plant genera or plant product as a priority entry pathway are reported in Tables B.3 and B.4.

TABLE B.3 Summary table outlining, for each of the plant product, the HS Code and whether the Panel considers the import of the product into the EU a relevant entry pathway for *Retithrips syriacus*.

Genus	HS code	Comment	Relevant entry pathway?
Coffea	0901 90 10 (Coffee husks and skins)	*R. syriacus* is not known to feed on *Coffea* beans. Pathway not considered based on the pest biology	No
Diospyros	0810 70 00 (Persimmons)	*R. syriacus* could be present on mature persimmons of infested plants as the calyx could offer *R. syriacus* a niche to hide (for pupation, for instance) and remain undetected. For this reason, the Panel considered persimmons as relevant entry pathway	Yes
Juglans	0802 31 00//0802 32 00 (Walnut, In shell//Shelled)	*R. syriacus* does not feed on shelled or in-shell walnut. Pathway not considered based on the pest biology	No
Manihot	0714 10 00 Manioc (Cassava)	*R. syriacus* does not feed on roots, which constitute the imported commodity. Pathway not considered based on the pest biology	No
Punica	Pomegranates do not have an individual Harmonised System (HS) code and are included in the code for the fresh fruit not mentioned elsewhere: 08109075 Precise trade statistics are therefore unavailable	Trade data for pomegranate fruits are not available; however, special requirements are applied to pomegranates imported from countries of the African continent and Israel (Annex VI of Regulation (EU) 2019/2072). Import of pomegranate fruits was not considered as relevant entry pathway for *R. syriacus*	No
Persea	0804 40 00 (Avocados)	Although *R. syriacus* could be present on the peel of mature avocados of heavily infested plants, harvesting and the post-harvest processing (washing and waxing in particular) makes the presence of the pest on the peel of avocados for export unlikely as compared to other commodities	No
Pyrus	0808 30 (Pears)	Although *R. syriacus* could be present on the peel of mature pears of highly infested plants, harvesting and the post-harvest processing (washing and waxing in particular) makes the presence of the pest on the peel of the pears for export unlikely as compared to other commodities	No
Rosa	0602 40 00//0603 11 00 (Roses, grafted or not//fresh cut flowers roses)	Although *R. syriacus* is primarily found on the leaves of infested roses, the flower could offer a niche for the pest to hide and remain undetected. For this reason, the Panel considered cut roses as relevant entry pathway	Yes
Vitis	0806 10 10 (Table grapes)	*R. syriacus* could be present on the grapes of infested plants and the structure of the grape bunch could offer a niche for the pest to hide and remain undetected. For this reason, the Panel considered table grapes as relevant entry pathway	Yes

TABLE B.4 Summary table outlining, for each of the plant genera identified as *Retithrips syriacus* host, whether there is evidence of import of plants for planting (from the Dutch NPPO data) and whether the Panel considers their import as a relevant entry pathway for *Retithrips syriacus* in the EU based on the available evidence.

Genera	Comment	Evidence of import (Dutch NPPO)	Relevant entry pathway?
Acalypha	Regular imports from countries where *R. syriacus* is reported, particularly Israel and Kenya with more than 10,000 pieces/year since 2019	Yes	Yes
Ampelopsis	*Ampelopsis orientalis* was identified as a *R. syriacus* host following identification of immature stages on a plant located in a private garden in Türkiye. The Panel could not find any further evidence of import for plants of this genus from countries where *R. syriacus* is reported	No	No
Coffea	The evidence of plants of this genus identified as *R. syriacus* host can be traced back to (Kumar et al., 1984) who reported the thrips on *Coffea canephora, C. liberica and C. dewevrei*. *Coffea* plants can be imported from countries free from *Xylella fastidiosa*. However, the evidence from the Dutch NPPO showed that import of *Coffea* plants in the last 10 years is limited to consignments of very few plants (see Table C.2). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. extremely low numbers, if any, imported in the past decade, with no imports in recent years. Based on the available information, import of *Coffea* plants for planting was not considered as a relevant entry pathway for *R. syriacus*	Yes	No
Diospyros	Import prohibited under Regulation (EU) 2018/2019	No	No
Eucalyptus	Evidence from the Dutch NPPO showed no imports of *Eucalyptus* plants since 2017 (see Table B.1). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years. Based on the available information, import of *Eucalyptus* plants for planting was not considered as a relevant entry pathway for *R. syriacus*	Yes	No
Gossypium	Evidence from the Dutch NPPO showed no imports of *Gossypium* plants since 2015 (see Table C.4). The panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years. Based on the available information, import of *Gossypium* plants for planting was not considered as a relevant entry pathway for *R. syriacus*	No	No
Jatropha	Evidence from the NPPO of the Netherlands showed that import of *Jatropha* plants is limited to consignments of very few plants since 2015 (see Table C.5). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. very low numbers, if any, imported in the past decade. Based on the available information, import of *Jatropha* plants for planting was not considered as a relevant entry pathway for *R. syriacus*	Yes	No
Juglans	Import prohibited under Regulation (EU) 2018/2019	No	No
Lagerstroemia	The evidence identifying a plant of the genus *Lagerstroemia* as a *R. syriacus* host is limited to one study (Etienne et al., 2015) reporting the presence of the thrips on *Lagerstroemia speciosa*. While there is evidence of import of plants of this genus from countries where the pest is present (see Table C.6), as a deciduous plant imported as dormant, it would not represent a relevant entry pathway for *R. syriacus*	Yes	No
Leucaena	The evidence identifying *Leucaena* as a *R. syriacus* host is limited to one study reporting the presence of the thrips on *Leucaena leucocephala* (Ibrahim, 2017). However, the Panel could not find evidence of import of plants of this genus from countries with reported presence of *R. syriacus*	No	No
Manihot	The evidence of import from countries where *R. syriacus* was reported by the NPPO of the Netherlands is limited to 2 specimens in 2010 (see Table C.7). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years	No	No
Malaleuca	The evidence of import from countries where *R. syriacus* was reported by the NPPO of the Netherlands is limited to 29 specimens in 2010 (see Table C.8). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years	Yes	No
Myrtus	Evidence from the NPPO of the Netherlands showed no imports of *Myrtus* plants since 2016 (see Table C.9). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years	Yes	No

(Continues)

TABLE B.4 (Continued)

Genera	Comment	Evidence of import (Dutch NPPO)	Relevant entry pathway?
Persea	The import of this genus is prohibited under Regulation (EU) 2018/2019. The pathway is however open from Israel according to derogation (EU) 2021/1936. Plants for planting of *P. americana* Mill. from Israel must be accompanied by an official statement that, among other things, ensures that: *'immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of …[R. syriacus]… with such a sample size as to enable at least the detection of 1% level of infestation with a level of confidence of 99%'*	Yes*	Yes
Pyrus	The pathway is open for plants for planting from Türkiye, but there is no evidence of trade from available data. For other third countries where *R. syriacus* was reported, import of plants for planting of *Pyrus* L. other than dormant plants free from leaves, flowers and fruits is prohibited under Annex VI of Regulation (EU 2019/2072)	Yes	No
Punica	While there is evidence of import of plants for planting of this genus from countries (i.e. Egypt and Israel) where the pest is present (see Table C.10), as a deciduous plant imported as dormant, it would not represent a relevant entry pathway for *R. syriacus*	Yes	No
Ricinus	The evidence of import from countries where *R. syriacus* was reported is limited to 3 and 2 specimens in 2010 and 2011 (see Table C.11). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years	No	No
Rosa	The pathway is open for plants with leaves from Türkiye, but there is no evidence of trade from available data. For other third countries where *R. syriacus* was reported, import of plants for planting of *Rosa* L. other than dormant plants free from leaves, flowers and fruits is prohibited under Annex VI of Regulation (EU) 2019/2072	Yes	No
Schinus	Evidence from the NPPO of the Netherlands showed no imports of *Schinus* plants since 2016 (see Table C.12). The Panel assumed that imports to other EU MSs have followed the same pattern, i.e. no imports in recent years	Yes	No
Terminalia	There is evidence of regular imports from countries where the pest is reported to occur, particularly Indonesia (see Table C.13)	Yes	Yes
Vitis	The import of this genus is prohibited under Regulation (EU) 2018/2019 and Annex VI of Regulation (EU) 2019/2072	No	No

*Evidence of import from EFSA commodity risk assessment.

APPENDIX C

Trade data

C.1 | IMPORT OF PLANTS FROM COUNTRIES WITH REPORTED PRESENCE OF *RETITHRIPS SYRIACUS*

Import data for the years from 2010 to 2022 obtained by the NPPO of the Netherlands for the plants identified as hosts of ***R. syriacus*** are reported from Tables C.1–C.13.

TABLE C.1 Import data (2010–2022) for the plants of genus *Acalypha* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Brazil	1500	10											
Indonesia									150				
Israel	4803	8500	11,000	12,700	4900	5300	20,250	18,500	20,150	23,350	14,300	29,400	36,300
Kenya	13,500	10,810	6440	8930	4300	17,050	9712	4820	4715	15,265	18,715	20,300	18,700
Sri Lanka	40						50					400	
United States	19		6	34			20	45	11	45	20	19	

TABLE C.2 Import data (2010–2022) for the plants of genus *Coffea* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indonesia	4		14	15	19	5	9	24	19				
Brazil		1000											
United states		17	4										
Sri Lanka						10							
Uganda								40					

TABLE C.3 Import data (2010–2022) for the plants of genus *Eucalyptus* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
India	800												
Israel		3016											
Kenya				1280									
Brazil							300						
South Africa								160					
United states								6					

TABLE C.4 Import data (2010–2022) for the plants of genus *Gossypium* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Israel		3008											
Sri Lanka			100		510	275							

TABLE C.5 Import data (2010–2022) for the plants of genus *Jatropha* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Brazil	40												
Sri Lanka	74	1715											
Tanzania, united republic of	1000												
United states	2	20	40		40			15	20		30		
Egypt		40											
Israel			104	728	312								

TABLE C.6 Import data (2010–2022) for the plants of genus *Lagerstroemia* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indonesia	12	9	3										
Israel	9009	9127	5233	4433	2928	556	3537	3001	4429	13,788	7761	21,056	21,148
United states	174	1227	540	270	665	2346	6400					75	45
Türkiye					8920		600	8580	5800	10,700	6200	9520	9200
Kenya							33,640						
Uganda								4350	650	3600	71,450	129,250	115,300

TABLE C.7 Import data (2010–2022) for the plants of genus *Manihot* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
United states		2								360			

TABLE C.8 Import data (2010–2022) for the plants of genus *Malaleuca* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
South Africa												29	

TABLE C.9 Import data (2010–2022) for the plants of genus *Myrtus* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indonesia	1				17	15		8					
Israel	9348	48,896	18,220	29,604	720	7110	1890						

TABLE C.10 Import data (2010–2022) for the plants of genus *Punica* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Egypt											21,455	3850	
Israel											500	520	1575

TABLE C.11 Import data (2010–2022) for the plants of genus *Ricinus* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indonesia	3	2											

TABLE C.12 Import data (2010–2022) for the plants of genus *Schinus* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Uganda						14,650							

TABLE C.13 Import data (2010–2022) for the plants of genus *Terminalia* recorded by the NPPO of the Netherlands.

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indonesia		15,564	1009		4850	50					16,860	10,400	11,000
Sri Lanka					510	860				125	250	625	130
United States	2	2				2	1	1					

C.2 | EXPORT OF PLANT PRODUCTS FROM COUNTRIES WITH REPORTED PRESENCE OF *RETITHRIPS SYRIACUS*

EUROSTAT import data for the years from 2010 to 2022 were used to estimate the amounts of cut roses (Table C.14) and table grapes (Table C.16) imported into the EU from countries where *R. syriacus* was reported. For persimmons, data for the time period 2012–2022 were available (Table C.15).

TABLE C.14 Import of roses from countries with reported presence of *Retithrips syriacus* into the EU [×100 kg] (Eurostat, EU trade since 1988 by HS2-4-6 and CN8, CN 06031100, online, accessed on 16 August 2023).

Partner	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Brazil	794.31	207.66	51.8	33.18	37.48	32.38	27.39	30.34	18.04	14.78	0.00	0.00	0.00
Egypt	0.21	0.00	0.40	0.00	0.00	1.07	0.00	0.00	0.05	0.00	4.18	0.00	0.00
Ghana	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.0	0.00	0.00	0.00
India	1096.08	770.7	895.73	844.44	1362.13	350.53	1119.35	609.78	780.52	359.09	314.69	114.74	291.30
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00
Iran	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.03	10	1.26	7.34	1.42	22.09
Israel	323.42	132.1	21.6	11.18	9.25	15.54	9.41	9.91	7.96	2.21	0.04	21.99	32.73
Jordan	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.15
Kenya	659,451.38	714,437.16	691,683.48	1,065,378.37	1,142,489.78	1,208,399.62	1,223,993.51	1,192,113.19	1,127,273.08	1,197,531.96	1,031,716.73	1,079,599.06	672,067.78
Lebanon	0.00	3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.40	0.00	4.90	0.00
Malawi	236.07	38.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nigeria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.11	0.5	1.77	0.00	0.00
South Africa	86.91	83.78	12.91	159.11	3.69	804.84	1.61	12.9	306.07	530.01	582.44	527.72	2104.61
Sri Lanka	0.00	1.17	0.00	0.00	39.98	0.00	6.66	0.61	0.00	0.00	0.00	0.00	0.02
Tanzania	15,304.76	14,937.97	14,199.78	30,396.39	23,421.33	12,992.08	29,879.13	30,331.78	23,222.62	20,556.23	7701.49	0.00	0.00
Tunisia	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Türkiye	19.24	58.46	3.94	0.45	21.94	198.90	6.73	14.20	12.30	179.89	490.02	525.54	52.62
Uganda	35,872.16	37,649.92	37,626.19	139,306.8	128,191.5	118,519.1	133,375.4	124,050.2	116,312.8	90,409.64	101,631.4	125,029	39,215.2
United Arab Emirates	0.00	0.00	0.00	0.00	0.00	0.18	2.3	0.00	0.01	0.00	0.00	0.00	0.01
United States	136.91	26.81	1.35	1.73	4.28	2.78	0.13	2.02	0.3	3.31	3.91	4.6	26.89

TABLE C.15 Import of persimmons from countries with reported presence of *Retithrips syriacus* into the EU [×100 kg] (Eurostat, EU trade since 1988 by HS2-4-6 and CN8, CN 08107000, online, accessed on 16 August 2023).

Partner	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bangladesh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	0.00
Brazil	457.61	405.88	395.12	342.61	33.63	315.72	337.6	974.78	428.63	859.52	1657.61
Congo	0.00	0.00	0.00	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indonesia	6.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iran	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Israel	14,634.19	11,278.85	11,196.82	5506.8	2404.45	3231.29	1158.64	181.58	3211.13	1831.29	1539.87
Kenya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25

TABLE C.15 (Continued)

Partner	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Lebanon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00
South Africa	416.4	199.8	279.88	832.42	823.16	817.79	206.08	7857.42	4974.49	5551	11,143.58
Syria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.86	0.02
Türkiye	141.77	18.94	7.5	0.00	62.88	10.29	1.5	0.00	52.88	155.23	1120.69
Uganda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.82
United Arab Emirates	0.00	0.00	0.00	0.00	169.14	0.00	0.00	0.00	0.00	0.00	0.00
United States	331.94	156.2	460.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE C.16 Import of table grape from countries with reported presence of *Retithrips syriacus* into the EU [×100 kg] (Eurostat, EU trade since 1988 by HS2-4-6 and CN8, CN 08061010, online, accessed on 16 August 2023).

Partner	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bangladesh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84
Brazil	266,838.92	258,667.28	261,904.84	239,425.89	147,617.84	199,278.12	194,152.79	249,279.81	271,987.56	196,465.22	228,091.31	360,790.68	239,268.42
Egypt	243,319.08	249,734.40	276,664.55	274,141.96	308,484.03	296,033.72	330,040.63	404,015.02	428,993.01	440,776.12	461,383.25	487,973.17	451,501.10
Ghana	7.65	0.00	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
India	292,322.38	160,253.92	274,749.35	402,875.33	451,442.25	295,704.32	640,933.67	827,331.17	722,649.04	950,246.40	733,534.40	837,519.74	881,040.10
Indonesia	0.00	349	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iran	0.00	0.00	2.61	3.34	0.00	0.00	0.00	0.00	1969.60	186	399.80	305.77	302.98
Israel	31,807.09	16,563.27	23,070.8	16,029.59	9299.46	9912.57	13,164.66	7041.42	6397.33	318.24	1080.9	0.00	0.00
Jordan	205.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kenya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	186.96	0.00	0.00	0.00	0.00
Lebanon	625.72	1726.04	3323.12	4549.87	4131.94	3287.69	3965.32	431.18	1329.00	1389.21	1426.11	6001.45	6747.28
West Bank (incl. East Jerusalem) and Gaza strip	43	343	194.40	0.00	0.00	290.70	0.00	153	328.95	0.00	61.20	0.00	0.00
South Africa	1,287,530.58	1,095,932.13	1,180,228.72	1,226,597.27	1,240,843.74	1,441,705.75	1,244,196.24	1,388,338.79	1,418,505.53	1,395,775.68	1,397,162.80	1,672,887.18	1,995,888.68
Syria	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tunisia	3212.79	3346.29	877.49	1511.81	826.76	358.45	657.82	0	239.62	40.6	192	0	140
Türkiye	232,774.34	286,377.21	221,359.10	178,145.64	265,522.47	231,698.21	297,498.44	375,141.07	226,426.06	272,090.16	287,310.41	329,639.80	231,423.74
United Arab Emirates	0.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
United States	2948.06	2108.31	976.24	1312.16	6149.28	1915.64	1713.67	8868.68	4409.92	1858.29	1072.48	4.59	3.13

APPENDIX D

Model Input parameters

D.1 | TRADE VOLUME (T_V)

Cut roses

When considering the countries where *R. syriacus* is reported, and collectively accounting for at least 99.99% of the imports, the EU import of cut roses is dominated by African countries, particularly Kenya, followed by Uganda and the United Republic of Tanzania (Figure D.1).

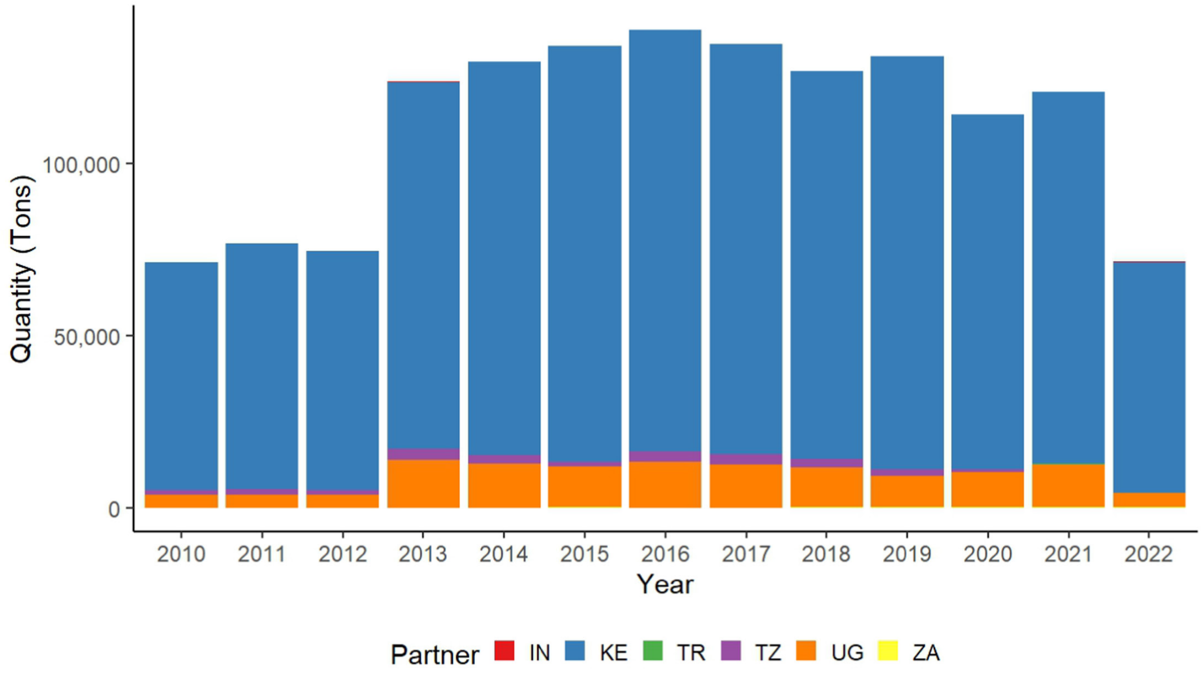


FIGURE D.1 Total quantity (2010–2022) imported from the countries collectively accounting for 99.99% of the total cut roses imported into the EU from countries where *Retithrips syriacus* is recorded. IN, India; KE, Kenya; TR, Türkiye; TZ, United Republic of Tanzania; UG, Uganda; ZA, South Africa.

The market share of these key partners has been quite stable since 2010 and represents about half of the cut roses imported in the EU (Figure D.2).

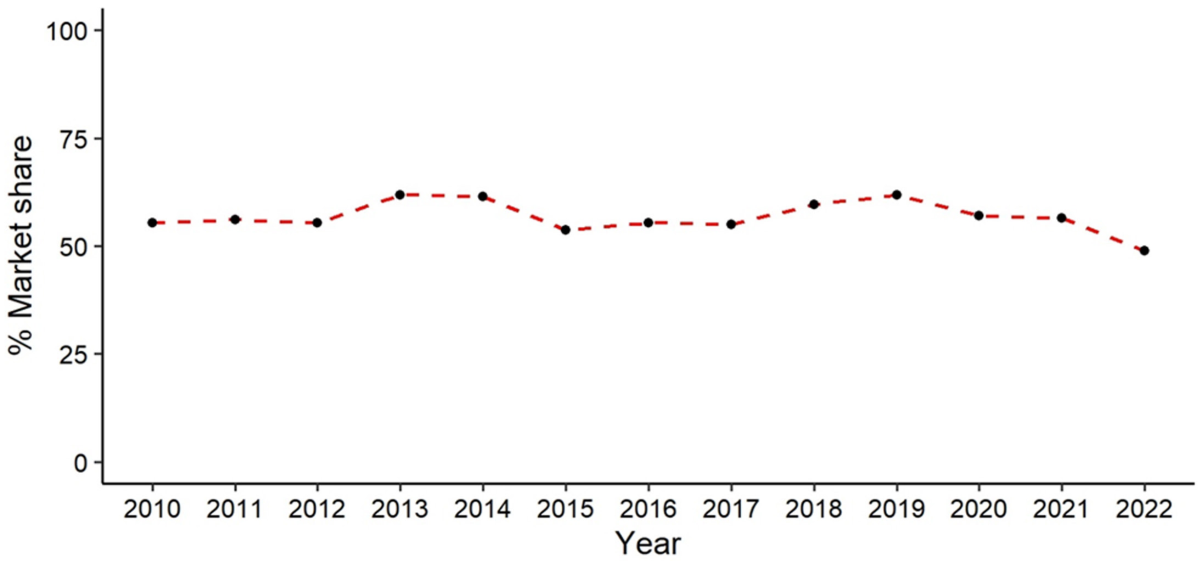


FIGURE D.2 Share of the cut roses market from countries collectively accounting for 99.99% of the cut roses imports from where *Retithrips syriacus* is recorded (India, Kenya, Türkiye, United Republic of Tanzania, Uganda and South Africa) as compared to other third countries where *R. syriacus* is not known to occur.

When the average import data are disaggregated by month (Figure D.3), it can be noticed that the EU demand of cut roses from the African countries remains between 5000 and 10,000 tons per month throughout the year, with a slight decline in the demand between June and October.

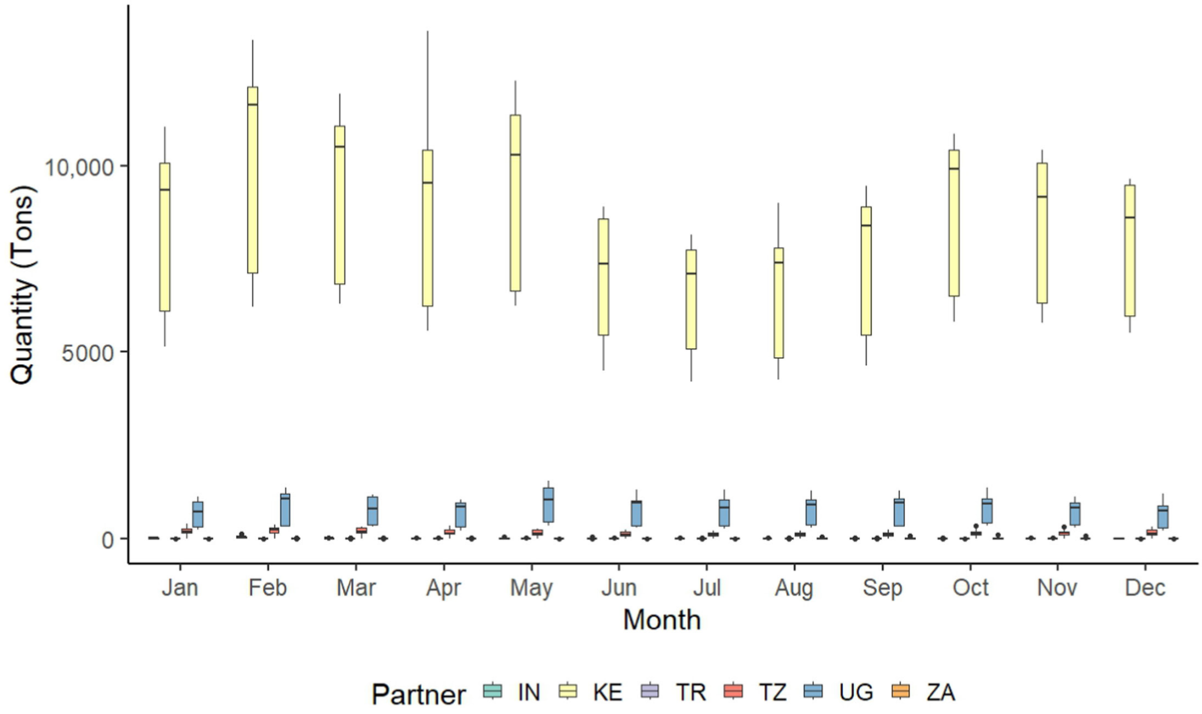


FIGURE D.3 Monthly import data of cut roses into the EU from commercial partners collectively accounting for 99.99% of the total cut roses imports from where *Retithrips syriacus* is recorded. IN, India; KE, Kenya; TR, Türkiye; TZ, United Republic of Tanzania; UG, Uganda; ZA, South Africa.

The trend analysis for the cut roses showed no indication of any significant trend along time (Figure D.4).

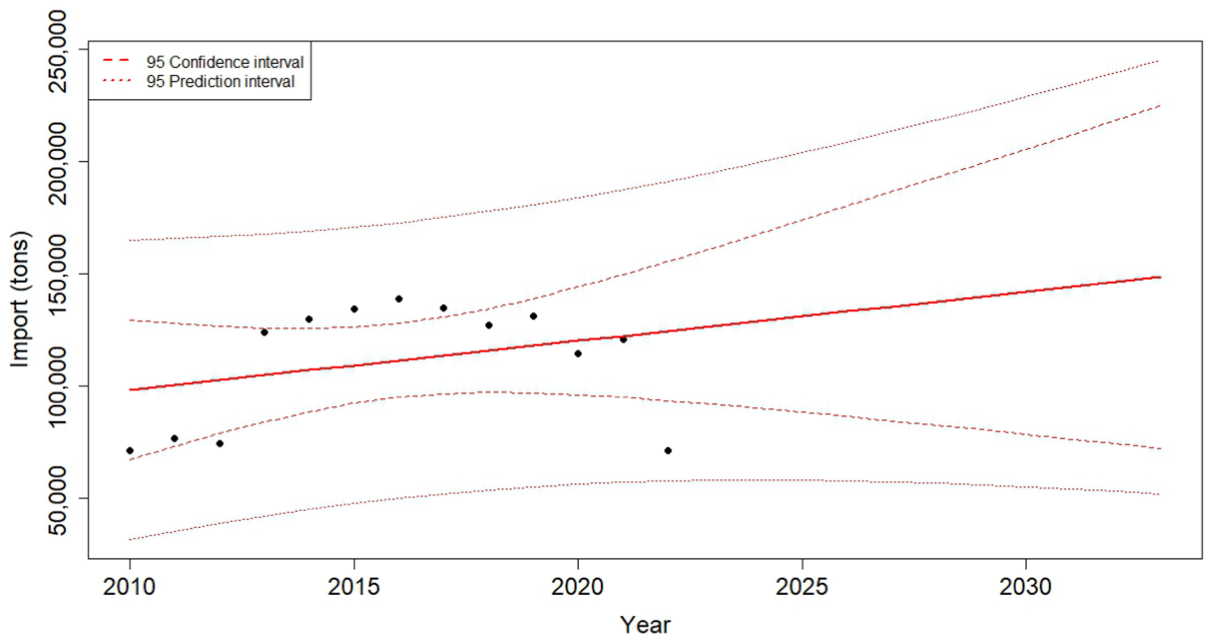


FIGURE D.4 Trend analysis based on 2010–2022 EUROSTAT data of cut roses import (tons) into the EU from countries where *Retithrips syriacus* was reported, and projection over the 10 years of the PRA time horizon (2023–2032). Dashed and dotted lines indicate the 95% confidence and prediction intervals, respectively.

The elicited values for the trade flow of cut roses per year in the time horizon are reported in Table D.1, along with the fitted probability distributions in Figure D.5. EKE values are the values proposed by the expert working group as consensus estimates.

TABLE D.1 Elicitation of the cut roses trade flow in metric tons (1000 kg) per year over the time horizon period 2023–2032.

Question	What is the expected total amount of cut roses imported into the EU per year from countries where *R. syriacus* is known to occur at the end of the time horizon?						
Results	Trade volume (tons)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	25,000		75,000	100,000	125,000		225,000
Fitted values	35,261	49,337	75,663	98,800	126,252	173,841	213,285
Distribution	= Gamma (7.2405, 14,298)						

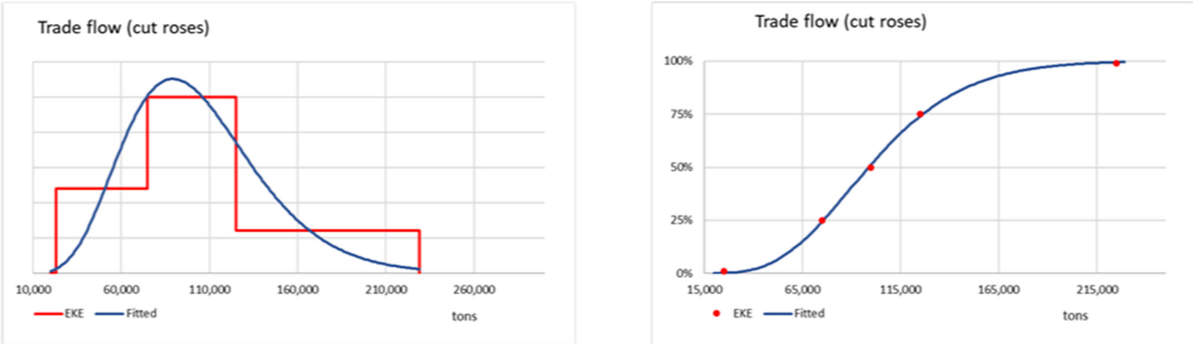


FIGURE D.5 Distribution of the estimated trade flow (T_V) for cut roses as tons per year fitted to EKE estimates.

The 99th percentile for the trade volume was mostly driven by the upper bound of the confidence interval of the trend analysis and the fact that to reach and exceed that value, not only the import from Kenya but also imports from other commercial partners would need to increase substantially.

The first percentile was set considering that the import of cut roses is dominated by a single commercial partner (Kenya), and as such, any event affecting the production of this country would have an important effect on the import of cut roses into the EU (as also evidenced by the variation in the imports between 2010 and 2022). The Panel considered that, except for catastrophic events (not considered in the estimation), any phenomenon severely affecting the production would lead to a collapse but not a complete elimination of the export of cut roses from the major player, reflected by the first percentile. The median, 25th and 75th quartiles were set considering that the demand has 50% chance to remain relatively close to the median value and stay within the range described by inter-quartile.

Persimmons

When considering the countries where *R. syriacus* is reported, the EU import of persimmons is mostly driven by South Africa and to a lesser extent by Brazil, Israel and United States (Figure D.6).

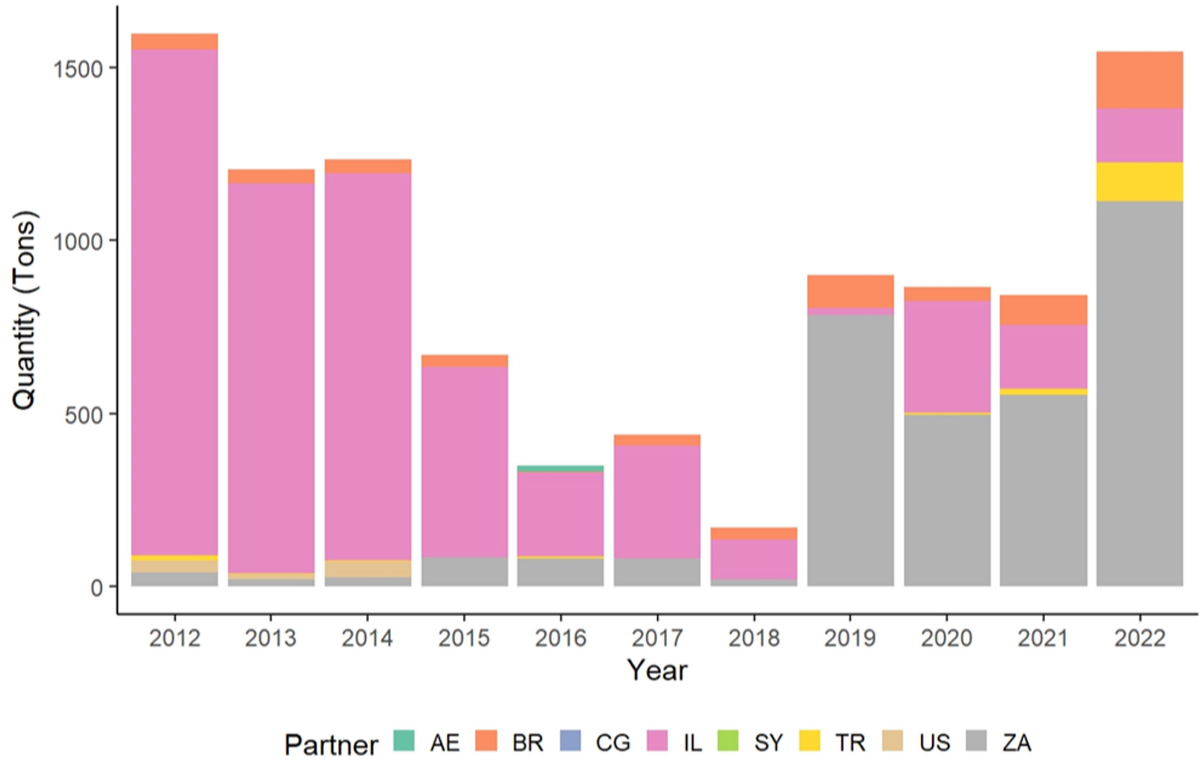


FIGURE D.6 Total import quantity (2012–2022) of the commercial partners collectively accounting for 99.99% of the total persimmons imports into the EU from where *Retithrips syriacus* is recorded (AE, United Arab Emirates; BR, Brazil; CG, Congo; IL, Israel; SY, Syrian Arab Republic, TR, Türkiye, US, United States, ZA, South Africa).

The total imports from these countries collectively represent about 32% of the persimmons imported into the EU in 2022. Over the 10-year time frame considered here, the market share of these commercial partners has been increasing since the minimum of about 12% in 2018, when a drastic decrease in imports from Israel and the emergence of South Africa as a major exporting country for the EU has been observed (Figure D.7).

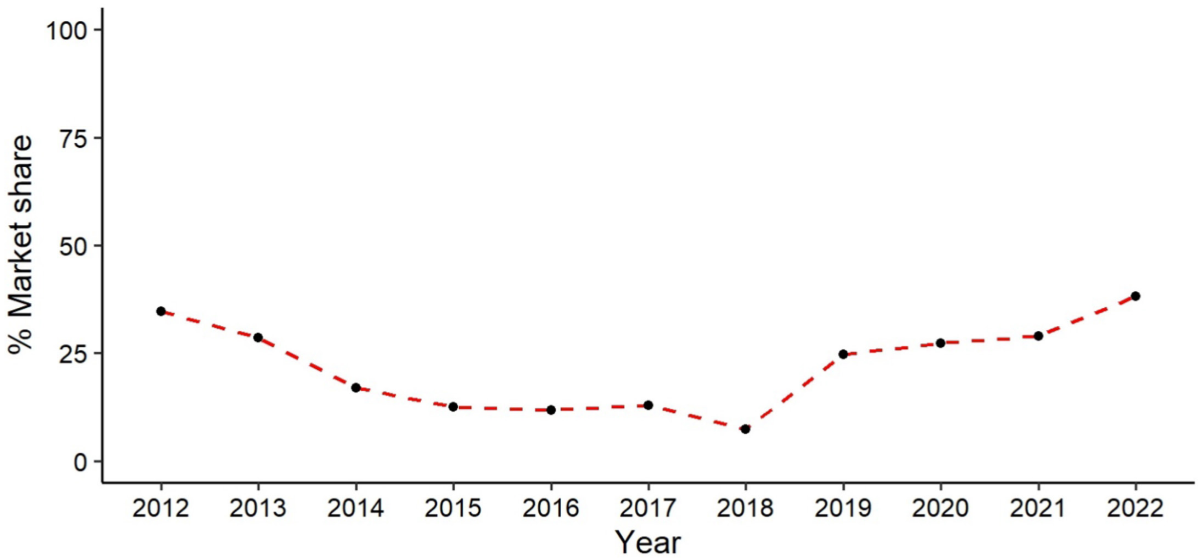


FIGURE D.7 Share of the persimmons market from countries collectively accounting for 99.99% of the imports of persimmons from where *Retithrips syriacus* is present (United Arab Emirates, Brazil, Congo, Israel, Syrian Arab Republic, Türkiye, United States, South Africa) as compared to other third countries where *R. syriacus* is not known to occur.

The EU market of persimmons remains dominated by Spain, one of the largest producers worldwide. For non-European exporters, the best opportunity remains to not overlap with the Spanish-producing season but to focus on supplying Europe with persimmons during spring and summer (CBI, 2019). In fact, looking at the average import data disaggregated by month (Figure D.8), it can be noticed how most of the persimmons are imported into the EU from South Africa during a narrow window form May to July.

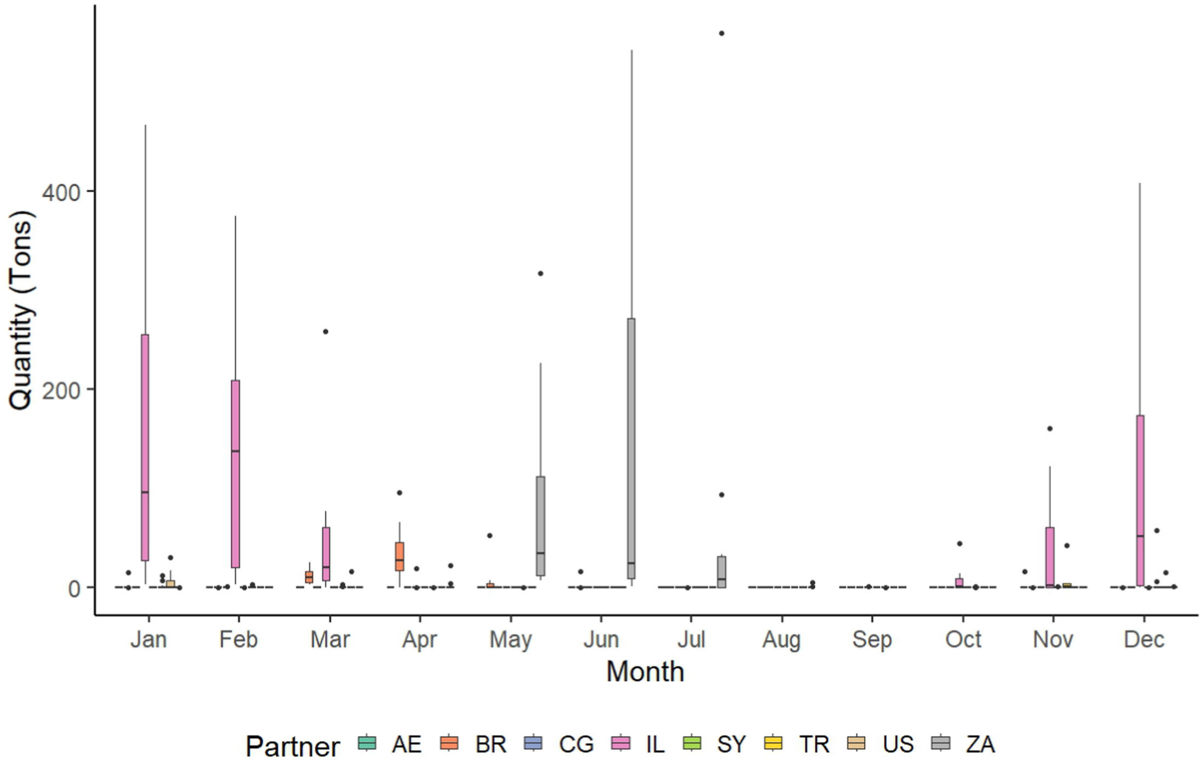


FIGURE D.8 Monthly persimmons import data into the EU from the commercial partners collectively accounting for 99.99% of the total persimmons imports from where *Retithrips syriacus* is present (AE, United Arab Emirates; BR, Brazil; CG, Congo; IL, Israel; SY, Syrian Arab Republic; TR, Türkiye; US, United States; ZA, South Africa).

The trend analysis for the persimmons showed no indication of significant ($p > 0.05$) trend (Figure D.9).

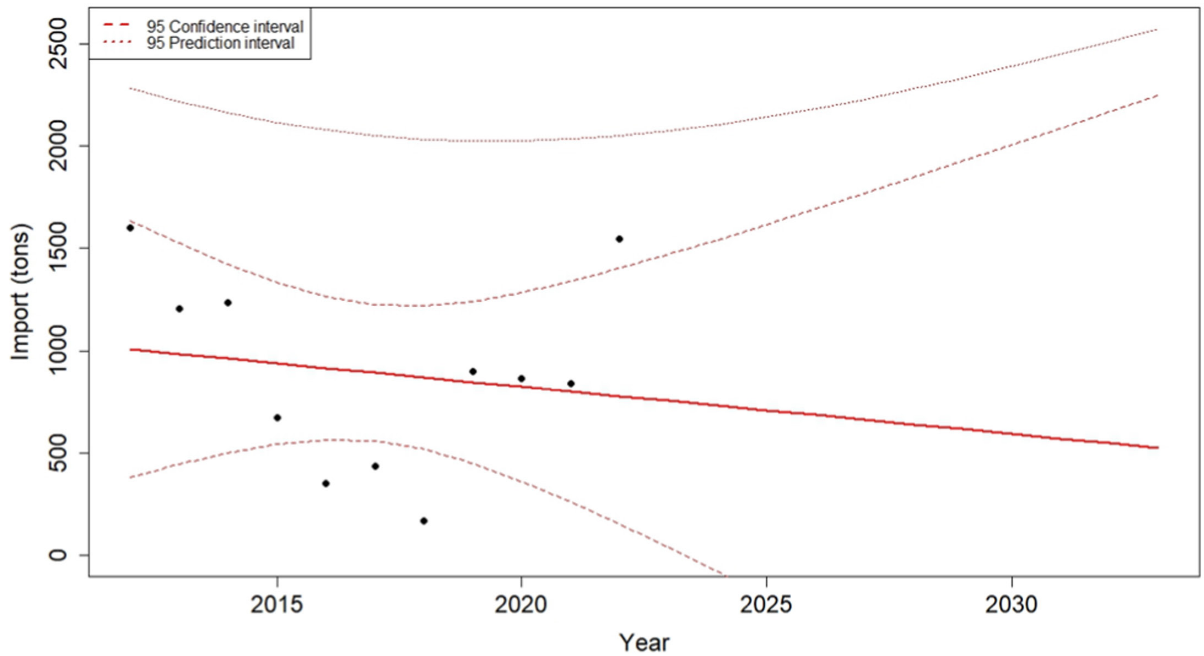


FIGURE D.9 Trend analysis based on 2012–2022 EUROSTAT data on the persimmons import (tons) into the EU from countries where *Retithrips syriacus* was reported, and projection over the 10 years of the PRA time horizon (2023–2032). Dashed and dotted lines indicate the 95% confidence and prediction intervals, respectively.

The elicited values for the trade flow of persimmons per year in the time horizon are reported in Table D.2, together with the fitted probability distributions in Figure D.10. EKE values are the values proposed by the expert working group as consensus estimates.

TABLE D.2 Elicitation of trade flow in metric tons (1000 kg) of persimmons per year over the time horizon period 2023–2032.

Question	What is the expected total amount of persimmons imported into the EU per year from countries where *R. syriacus* is known to occur at the end of the time horizon?					
Results	Trade volume (tons)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	150		475	900	1200		2500
Fitted values	140	222	502	837	1266	1940	2364
Distribution	= BetaGeneral (1.4947, 4.111, 100, 3200)						

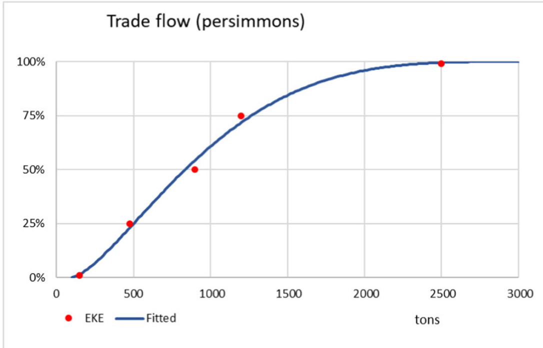


FIGURE D.10 Distribution of the estimated trade flow (*Tv*) for persimmons as tons per year fitted to EKE estimates.

The 99th percentile for T_V was set considering that the demand of persimmons is expected to increase but the Spanish production represents an important barrier towards a substantial increase in the import of persimmons from third countries.

The first percentile was set considering the strong decrease in the imports observed in the recent past and the possible increasing role of Spain and/or other big producers (e.g. China) in the EU market. The median, 25th and 75th quartiles were set considering that the demand at EU level is expected to increase but slowly (consumption of persimmon is common in the south of the EU but is still relatively limited in northern EU).

Table grapes

When considering the countries where *R. syriacus* is recorded, the EU import of table grapes is driven by South Africa and India, followed by Egypt, Türkiye and Brazil (Figure D.11).

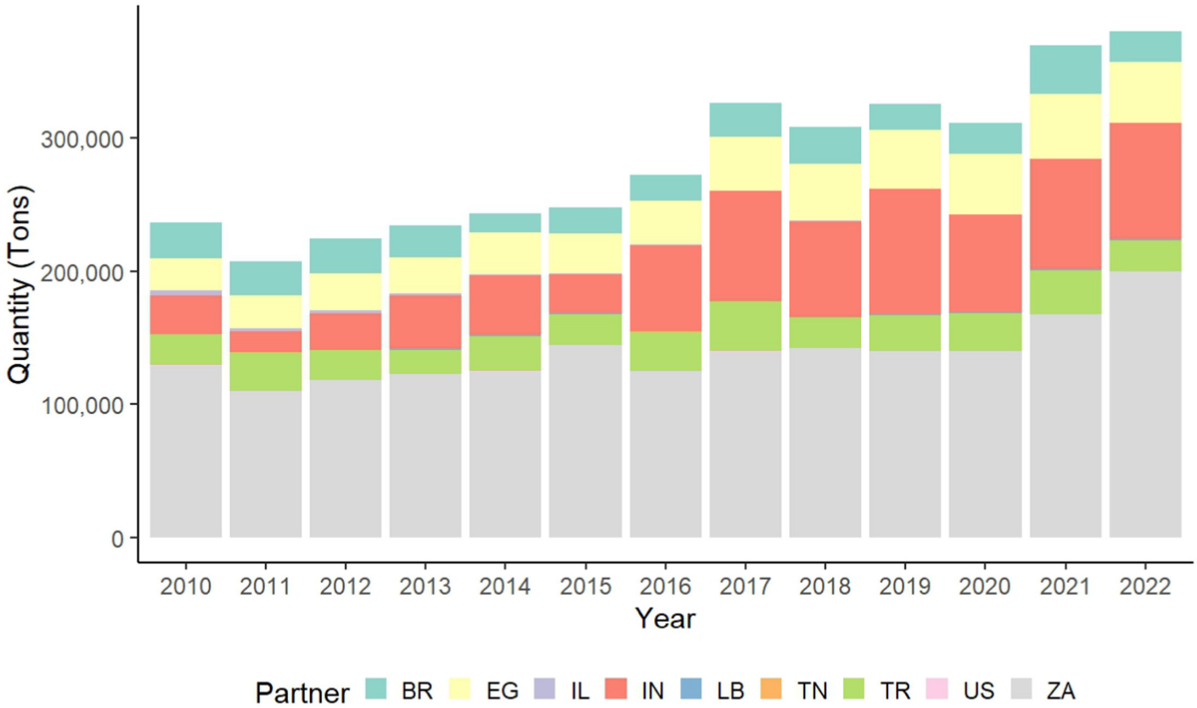


FIGURE D.11 Total import (2010–2022) of the commercial partners collectively accounting for 99.99% of the total table grapes imports into the EU from where *Retithrips syriacus* is present. BR, Brazil; EG, Egypt; IL, Israel; IN, India; LB, Lebanon; TN, Tunisia; TR, Türkiye; US, United States; ZA, South Africa.

The total imports from these countries collectively represent about 60% of the table grapes imported into the EU. Although in absolute terms imports have increased over the last years, the market share of these key commercial partners showed little variation, ranging between 50% and 60% since 2010 (Figure D.12).

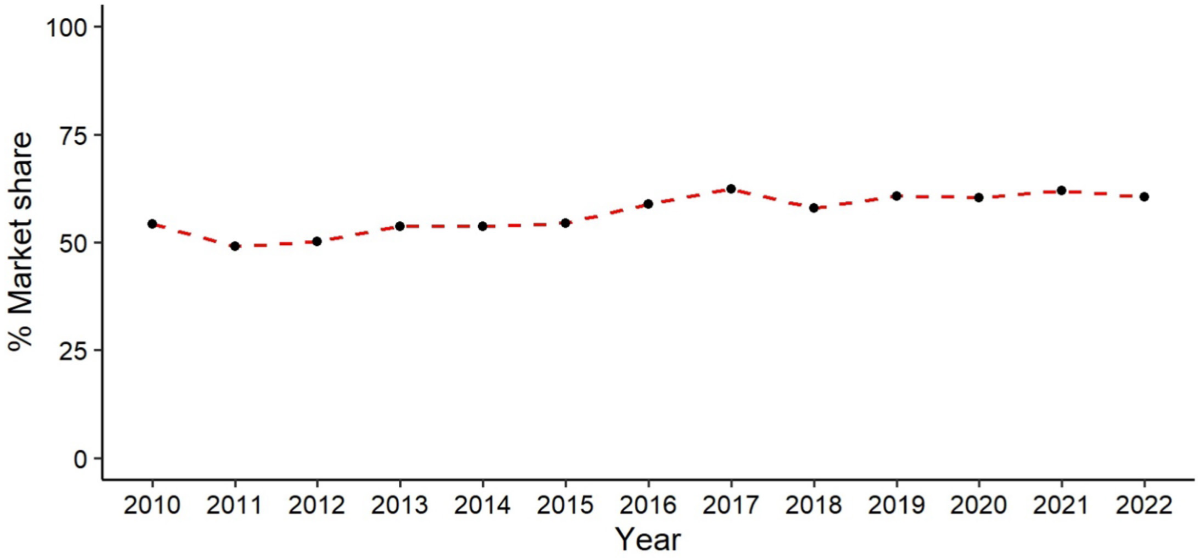


FIGURE D.12 Share of the table grapes market from countries collectively accounting for 99.99% of the table grapes imports from where *Retithrips syriacus* is present (Brazil, Egypt, Israel, India, Lebanon, Tunisia, Türkiye, United States and South Africa) as compared to other third countries where *R. syriacus* is not known to occur.

When the average import data are disaggregated by month (Figure D.13), some specific trade windows can be identified: considering the three major countries by volume, table grapes are imported into the EU from South Africa from December to May, with a peak in February; the trade window of India overlaps with that of South Africa but is slightly shifted towards spring, with a peak in March, while the trade window of Egypt is shorter and shifted between May and July.

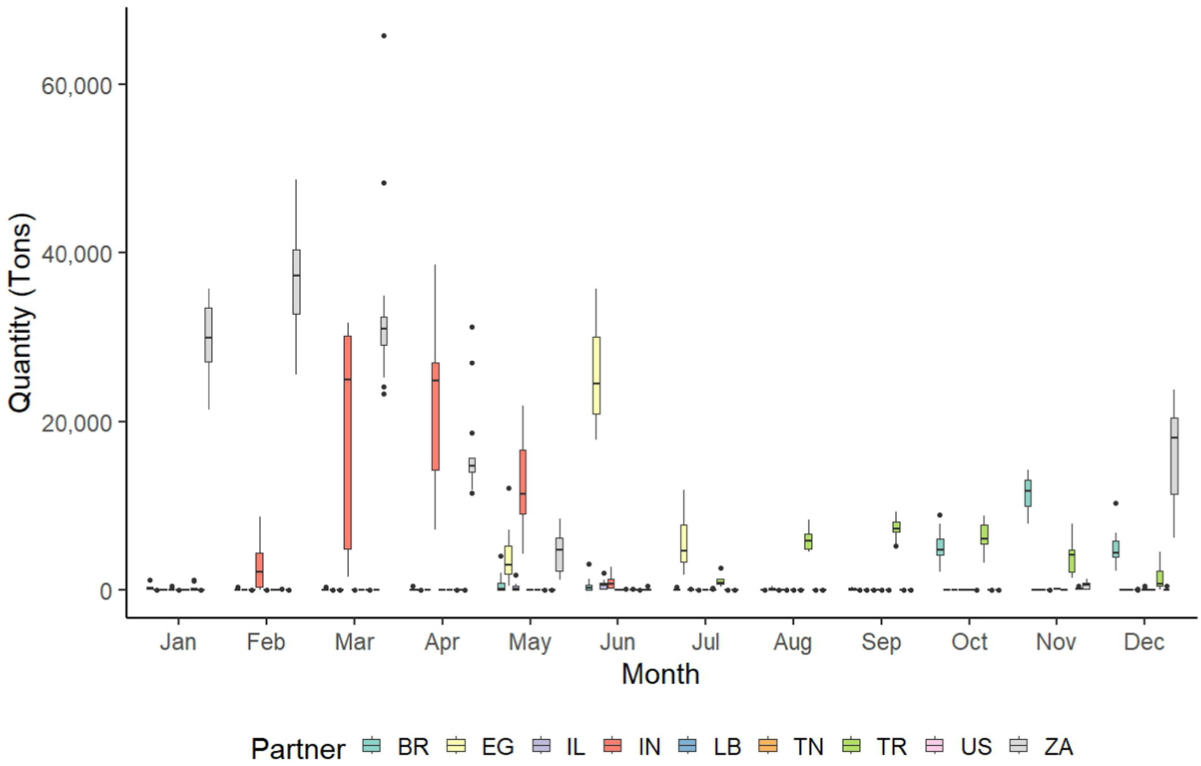


FIGURE D.13 Monthly table grapes import data into the EU from commercial partners collectively accounting for 99.99% of the total table grapes imports from where *Retithrips syriacus* is present (BR, Brazil; EG, Egypt; IL, Israel; IN, India; LB, Lebanon; TN, Tunisia; TR, Türkiye; US, United States; ZA, South Africa).

The elicited values for the table grapes trade flow per year in the time horizon are reported in Table D.3, along with the fitted probability distributions in Figure D.14. EKE values are the values proposed by the expert working group as consensus estimates.

TABLE D.3 Elicitation of the table grapes trade flow in metric tons (1000 kg) per year over the time horizon period 2023–2032.

Question	What is the expected total amount of table grapes imported into the EU per year from countries where *R. syriacus* is known to occur at the end of the time horizon?						
Results	Trade volume (tons)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	300,000		400,000	450,000	500,000		650,000
Fitted values	321,160	345,798	400,544	449,187	500,658	567,392	602,793
Distribution	= BetaGeneral (2.6162, 3.3862, 295,000, 655,000)						

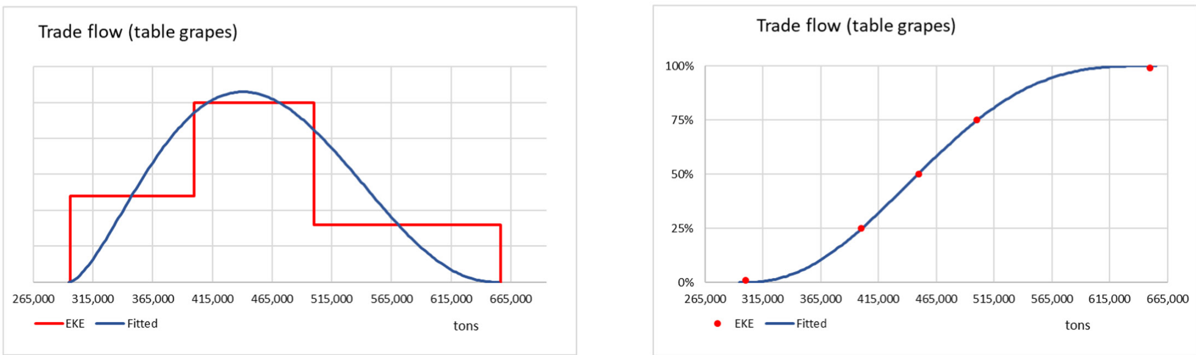


FIGURE D.14 Distribution of the estimated trade flow (*Tv*) for table grapes as tons per year fitted to EKE estimates.

The upper boundary was mostly driven by the trend analysis but set a bit higher not to exclude the possibility of a change in the trend into a more exponential shape. The lower boundary was set around the value of the prediction interval for 2023 under the reasoning that a plateau in the demand is still possible and might happen in the near future. Even if a plateau is possible, the trend is robust, and therefore, the median value was set slightly lower than the mean. The Panel was confident about the estimate for the median value and the 25th and 75th quartiles were set closer and equidistant from the median rather than the extremes.

Plants for planting

The elicitation of the expected plants for planting trade flows for the plants for planting of genera *Acalypha* and *Terminalia* was largely informed by the trend analysis showing that both the linear and quadratic trends are significant (Figure 2, Section 3.1.2.1, $p < 0.01$) and by the import data of other plants (e.g. *Lagerstroemia* from Uganda in Table B.1) demonstrating that sudden significant increases are possible. The elicited values for the trade flow of *Acalypha* and *Terminalia* plants for planting are reported in Table D.4, together with the fitted probability distributions in Figure D.15. EKE values are the values proposed by the expert working group as consensus estimates.

TABLE D.4 Elicitation of trade flow in number of pieces of plants of genera *Acalypha* and *Terminalia* over the time horizon period 2023–2032.

Question	What is the expected number of plants for planting of the genera *Acalypha* and *Terminalia* imported into the EU per year from countries where *R. syriacus* is known to occur at the end of the time horizon?						
Results	Trade volume (number of plants)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	25,000		40,000	75,000	150,000		350,000
Fitted values	20,044	20,779	34,138	72,173	143,097	262,444	321,731
Distribution	=BetaGeneral (0.55979, 1.934, 24,958, 375,646)						

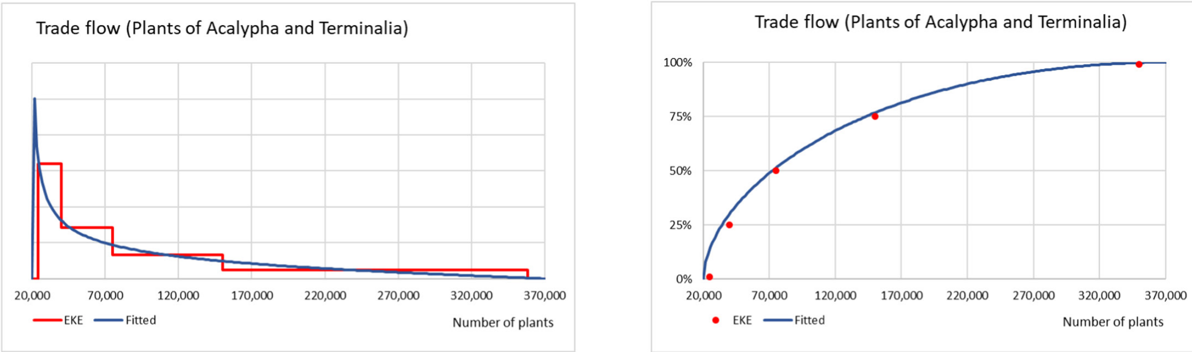


FIGURE D.15 Distribution of the estimated trade flow (*Tv*) plants for planting of the genera *Acalypha* and *Terminalia* as number of pieces per year fitted to EKE estimates.

For the import of plants for planting the 99th percentile of the probability distribution was mostly driven by the upper bound of the confidence interval of the quadratic trend, to reflect the possibility of a sudden increase in the import of both plant genera in the near future. When looking at the import data of other plant genera, this event was considered unlikely but not impossible. The values for the first percentile and the median were set to reflect an expected increase in the trade more aligned to that shown by the linear trend. The inter-quartile range was set to reflect more uncertainty in the upper values.

Persea americana (from Israel)

The elicitation of the expected trade flows in the plants for planting of *Persea americana* (from Israel) was largely informed by (i) the import data provided by the Spanish NPPO (as most avocado orchards within the EU are located in Spain) for the last 2 years (2022 and 2023), (ii) the number of avocado plants per year Israel is expected to export to the EU when submitted the dossier to EFSA (i.e. '*from thousands to dozens of thousands*') and (iii) the expected capacity of Israel to fulfil the demand or avocado plants in the EU and the role of European nurseries. The elicited values for the trade flow of plants for planting of *P. americana* (from Israel) are reported in Table D.5, along with the fitted probability distributions in Figure D.16. EKE values are the values proposed by the expert working group as consensus estimates.

TABLE D.5 Elicitation of trade flow in number of pieces of *P. americana* plants from Israel over the time horizon period 2023–2032.

Question	What is the expected number of *Persea americana* plants imported from Israel per year at the end of the time horizon?						
Results	Trade volume (number of plants)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	500		2500	6000	9000		15,000
Fitted values	453	744	2665	5683	9446	13,599	14,911
Distribution	= BetaGeneral (0.55979, 1.934, 24,958, 375,646)						

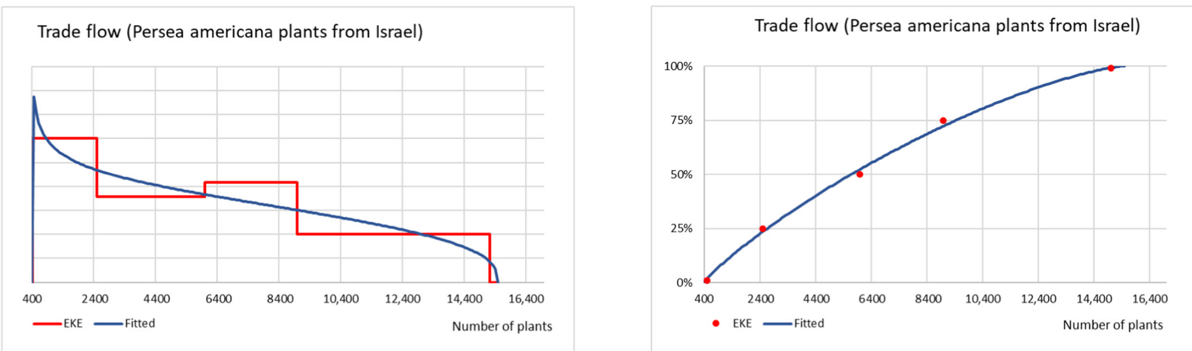


FIGURE D.16 Distribution of the estimated *Persea americana* plants trade flow (*Tv*) from Israel as number of pieces per year fitted to EKE estimates.

The 99th percentile of the probability distribution was set considering that according to the dossier submitted by Israel, the estimated number for exported avocado plants was between '*thousands and dozens of thousands*', as mentioned in this dossier. Since Israel has applied for derogation, an expansion of the production was expected in this country. Furthermore, although the current geopolitical situation could pose some difficulties for the keeping up of the expected production, it is possible that the plants exported to Europe are produced in few nurseries, not or only slightly affected by the ongoing conflict.

The 1st percentile was set in consideration of the evidence that import data from the NPPO of Spain show a very limited number of plants being actually imported. Israel was expecting to export up to dozens of thousands of plants per year to avocado growers in the EU but Spain, the leading country regarding production of avocados in the EU imported only 500 plants in 2023. These lower exports than expected, might reflect some difficulty in achieving the export volumes expected by Israel. In addition, if the European demand of *P. americana* plants is as high as predicted by Israel, it is possible that nurseries in Europe will try to fulfil this demand internally. However, it is uncertain whether the demand of plants of planting will actually increase as the continuous drought during the last few years would not encourage the establishment of new avocado plantations.

The consensus value for the median was set considering that Israel was planning to accomplish the export of up to dozens of thousands of plants in 2019 and will try to catch up with the demand. The inter-quartile range was set to reflect reduce the probability of the extreme values.

D.2 | INFESTATION RATE

The elicited mean annual rates of infestation per 10,000 units of cut roses, table grape bunches and persimmons are reported in Tables D.6, D.7 and D.8 together with the fitted probability distributions in Figure D.17, D.18 and D.20. EKE values are the values proposed by the expert working group as consensus estimates.

Cut roses

The association between *Rosa* sp. (rose) and *R. syriacus* is well known and supported by a number of direct observations in flower gardens (Bodenheimer, 1926; Bondar, 1924; Dash & Naik, 1998; Doganlar & Yigit, 2002; Halperin & Zur Strassen, 1981; Khan et al., 1997; Majumder, 2004; Nair et al., 1990) and nurseries (Oda et al., 1997). Given the reported presence of the pest in some of the major exporting countries of cut roses including Kenya and Uganda (Elimem et al., 2011), the Panel considered the import of cut roses as a relevant entry pathway for *R. syriacus*. Except for some evidence about occasional interception of thrips in cut roses from third countries (including Kenya), *R. syriacus* infestation data for cut roses intended for export to the EU are not available. The EKE for the *R. syriacus* infestation rate in cut roses at the point of departure from the country of origin was largely based on the information concerning the requirements for growers producing roses for export, the level of compliance to biosecurity requirements, inspection scheme and audit reports collected as part of the recent EFSA Opinion on the risk of introduction of *Thaumatotibia leucotreta* into the European Union with the import of cut roses (EFSA PLH Panel, 2023). The results of the elicitation for cut roses are reported in Table D.6 and Figure D.17.

TABLE D.6 Estimated mean number of cut roses infested with *R. syriacus* when leaving the packing house in the country of origin (per 10,000 cut roses).

Question	How many out of 10,000 cut roses coming from greenhouses producing cut roses for export to EU, are on average infested with living individuals of *R. syriacus* at the point of departure from the country of origin?						
Results	Infestation rate before export at the point of departure (per 10,000 cut roses)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	0.000		0.1	1	10		100
Fitted values	0.08	0.08	0.1	1	10	55	93
Distribution	= BetaGeneral (0.17396, 2.2271, 0.083213, 139.11)						

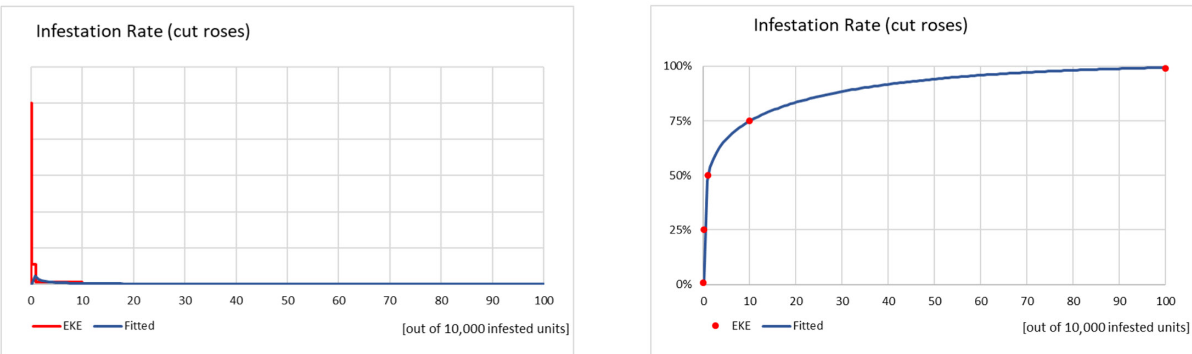


FIGURE D.17 Distribution of the estimated infestation rate of *Retithrips syriacus* in cut roses (per 10,000 units) when leaving the packing house fitted to EKE estimates.

The 1st percentile was supported by the following reasonings:

- Exporters of cut flowers and roses, with particular reference to the major exporter (Kenya), are required to register and a pre-approval audit is carried out to ensure product traceability, pest management in general, calibration of sprayers and scouting, hygiene of the produce and adoption of internal controls and procedures for addressing nonconformities.
- All roses destined for export are cultivated in greenhouses which are covered with polyethylene; roses grown outside are not intended for export.
- Cut roses are produced in greenhouses with a level of isolation in collaboration with industry, and growers are encouraged to set insect-proof nets on the sides of greenhouses, so that the cultivation is not exposed when the sides are open for ventilation.
- The commodity is considered as a high-risk category, growers and inspectors look carefully for the presence of pests (e.g. *Thaumatotibia leucotreta*) and it is reasonable to assume that the presence of thrips would be reported and addressed.

For the 99th percentile value, it was considered that although only reported at genus or order level, there is evidence of interceptions of thrips/Thysanoptera in cut roses from countries where the pest is recorded. Although an infestation rate higher than 1 in 100 units would be highly concerning for the producers given the preventive measures in place and the value of the market, a relatively low infestation rate could sporadically occur from the following reasonings:

- While it is true that growers are encouraged to improve the structure of greenhouses with a double-door system and insect-proof nets, especially for those that open the sides for ventilation, not all the growers have already made these structural improvements.
- Because of the challenges related to high humidity and grey mould caused by *Botrytis*, not all the greenhouses have insect-proof nets on the sides.
- The humidity management requires growers to compromise the isolation after heavy rains (i.e. the isolation nets on the sidewalls are lowered for a certain period to reduce the humidity).
- The sensitivity of detection at inspection at the point of departure is uncertain given the high numbers of units that should be inspected (700) in a limited time (about 10 min).

The consensus median value was set to 1 out of 10,000; the probability for *R. syriacus* to be present in the units intended for export is expected to be very low. *R. syriacus* is a leaf-feeder, and infestation normally involves more than one plant. Injuries on the leaves are visible, and the insect itself, particularly the pupae, is brilliant red. An infestation on the leaves would be noticed during inspection (for thrips or other pests) and during packaging.

Table grapes

Vitis vinifera is one of the plants most often associated with *R. syriacus*, and table grapes are a commodity already identified by an EU project as one of the most relevant entry pathways for this insect (DROPSA, 2016). For the estimation of the infestation rate, the Panel considered (i) the quality standards normally required for the EU market, (ii) the pre- and post-harvest processing agricultural practices – expected either to favour or to prevent the occurrence of the pest on table grapes intended for export (OECD, 2007; NRCG, 2013; CBI, 2023; PPECB, 2023), and (iii) the fact that *R. syriacus* tend to feed on mature leaves. In fact, in the countries where the pest is recorded on vineyards, like South Africa, the thrips often appear after the harvesting of early ripening cultivars (Dr. Elleunorah Allsopp, personal communication and NRCG, 2013). Indeed, this South African expert confirmed that she had never seen a *R. syriacus*-infested bunch of grapes and that this insect was not considered a problem in table grapes in South Africa. The results of the elicitation for table grapes are reported in Table D.7 and Figure D.18.

TABLE D.7 Estimated mean number of table grapes bunches infested with *Retithrips syriacus* when leaving the packing house from the country of origin (per 10,000 table grapes bunches).

Question	How many out of 10,000 table grape bunches will be on average infested with *R. syriacus* before export at the point of departure?						
Results	Infestation rate before export at the point of departure (per 10,000 table grape bunches)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	0.000		0.001	0.01	0.1		1
Fitted values	0.0008	0.0008	0.001	0.01	0.1	0.55	0.93
Distribution	= BetaGeneral (0.17396, 2.2271, 0.083213, 139.11)						

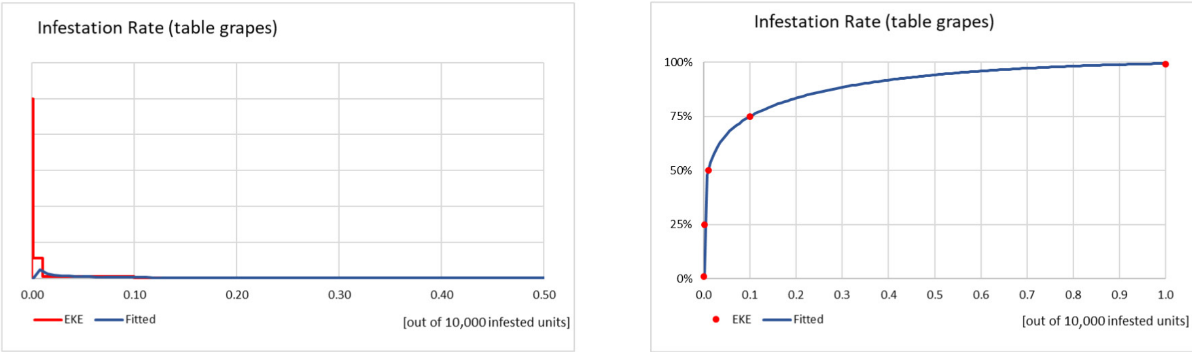


FIGURE D.18 Distribution of the estimated infestation rate of *Retithrips syriacus* in table grapes bunches (per 10,000 units) when leaving the packing house fitted to EKE estimates.

The first percentile was supported by the following reasonings:

- Because *R syriacus* is a leaf-feeder, the presence on the berries at harvest is plausible only in case of high infestation of the plants, but during preharvest, it is usual to monitor for the presence of pests, particularly if table grapes are intended for export.
- For the European market, grade 'A' or above is normally required, and table grapes for fresh consumption are harvested by hand and carefully treated to ensure high product quality.
- Sorting and shaping (cutting bunchers in right shape) is done manually and the operators are trained to look for damaged (sunburn, disease, wind, insect) berries.

For the 99th percentile value, the points above are still valid in justifying the overall low probability of occurrence; however, it was considered that the structure itself of the grape bunch would offer *R. syriacus* a place to hide and remain undetected during sorting and inspection at the point of departure.

The consensus median value was set to 1 infested table grape bunch out of 1,000,000; the probability of *R. syriacus* being present in the units intended for export, is expected to be extremely low. As *R. syriacus* is a leaf-feeder, the presence of adult thrips in the grape bunches is expected to occur only by chance in case of highly infested plants; however, the symptoms, in case of heavily infested plants are evident and normally more than one plant is involved. Such a situation is unlikely to remain unnoticed and not managed in vineyards producing table grapes intended for export.

Persimmons

As with the table grapes, the estimation of the infestation rate of persimmons was based on (i) the quality standards normally required for the EU market, (ii) the pre- and postharvest processing agricultural practices expected either to favour or to prevent the occurrence of the pest in the table grapes intended for export (Bignell et al., 2017; CBI, 2019; UNECE, 2020), and (iii) the fact that *R. syriacus* tend to feed on mature leaves. For persimmons, the Panel evaluated that the reasonings followed for table grape are still valid. However, it was considered that persimmon fruits do not offer the same level of protection to the thrips as table grape bunches; *R. syriacus* is much more exposed to the external environment with the only place available for hiding being under the dry sepals of the calyx. In addition, it should be considered that, for persimmons, the post-harvesting process involves polishing, washing and sometimes waxing (Bignell et al., 2017). All these operations are expected to be highly effective in mechanically removing the thrips from the skin. Under this reasonings, the Panel accepted the estimates for table grapes but applied a correction factor of 0.01. The results of the elicitation for persimmons are reported in Table D.8.

TABLE D.8 Estimated mean number of persimmons infested with *Retithrips syriacus* when leaving the packing house from the country of origin (per 10,000 fruits).

Question	How many out of 10,000 persimmons will be on average infested with *R. syriacus* before export at the point of departure?						
Results	Infestation rate before export at the point of departure (per 10,000 fruits)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	0		1.0×10^{-5}	1×10^{-4}	0.001		0.01
Fitted values	8.3×10^{-6}	8.3×10^{-6}	1.0×10^{-5}	9.9×10^{-5}	0.001	0.005	0.009
Distribution	= BetaGeneral (0.17396, 2.2271, 0.00000832129, 0.013911)						

Plants for planting

To estimate the infestation rate, the Panel considered the following sources of uncertainty for the plants of genera *Acalypha* and *Terminalia*:

- The evidence supporting plants of the genus *Acalypha* as a *R. syriacus* host is limited to one study intended to ascertain the factors determining *R. syriacus* host preference and having observed the thrips on *Acalypha* in lower numbers as compared to other plants. To explain that, the authors hypothesized the low stomal frequency of the leaves makes *Acalypha* plants a less preferable host (Ananthakrishnan, 1955).
- While there is evidence of import of *Acalypha* plants from countries where the pest is recorded (mostly from Israel and Kenya, see Table B.1) this genus includes 442 accepted species (POWO, 2024) and whether the species of the plants grown and imported into the EU from Israel and Kenya is the same of that identified as *R. syriacus* host is unknown.
- Where and how *Acalypha* plants intended for export as plants for planting are grown in Israel and Kenya is unknown.
- Whether the greenhouses of *Acalypha* plants in Kenya and Israel are located in areas that are suitable for the presence of *R. syriacus* is unknown.
- The evidence identifying a plant of the genus *Terminalia* as a *R. syriacus* host is limited to studies reporting the presence of the thrips on plants of *Terminalia catappa* in Guadeloupe and Martinique (Etienne et al., 2015).
- While there is evidence of import of plants of genera *Terminalia* from countries where the pest is recorded (Indonesia, Sri Lanka and United States, see Table B.14), the genus *Terminalia* includes 279 accepted species (POWO, 2024) and whether the species of the plants grown and imported into the EU is the same of that identified as *R. syriacus* host is unknown.
- The major exporter is Indonesia but within that country, *R. syriacus* is reported from the isle of Java, only.
- Where and how the plants of *Terminalia* intended for export as plants for planting are grown in Indonesia and Sri Lanka is unknown.
- Whether the greenhouses of *Terminalia* plants in Indonesia and Sri Lanka are in areas that are suitable for the presence of *R. syriacus* is unknown.

The results of the elicitation for the plants of genera *Acalypha* and *Terminalia* are reported in Table D.9 and Figure D.19.

TABLE D.9 Estimated mean number plants of the genera *Acalypha* and *Terminalia* intended for export as plants for planting infested with *Retithrips syriacus* when arriving in the EU (per 10,000 plants).

Question	How many out of 10,000 plants of the genera *Acalypha* and *Terminalia* intended for export as plants for planting to the EU, are infested with living individuals of *R. syriacus* when arriving in the EU?					
Results	Infestation rate before export at the point of departure (per 10,000 plants)					
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	0.00		5.00	10.00	25.00		200.00
Fitted values	4.12	4.14	5.00	10.00	25.01	68.40	108.73
Distribution	= BetaGeneral (0.37742, 5.6457, 4.1247, 252.78)						

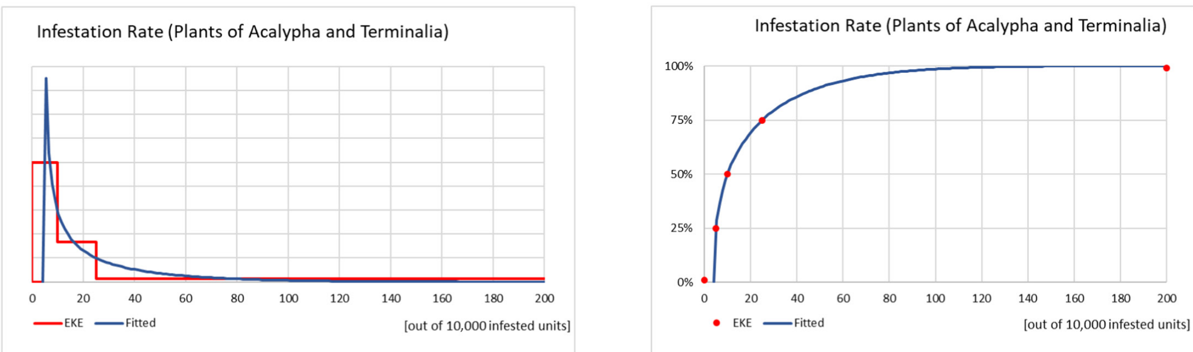


FIGURE D.19 Distribution of the estimated infestation rate of *Retithrips syriacus* in plants of the genera *Acalypha* and *Terminalia* (per 10,000 units) when arriving in the EU fitted to EKE estimates.

The 1st percentile was supported by the following reasonings: Since *R. syriacus* is polyphagous, it is expected to be observed at various hosts within its native range, and *Acalypha* and *Terminalia* are part of the natural flora of tropical and subtropical countries. However, these genera include hundreds of very different species, and whether those are equally likely to be hosts of the pest is unknown. Similarly, the actual species being imported in the EU is uncertain.

Observation on *R. syriacus on Acalypha* plants was made only in early July (beginning of the rainy season) at Chennai, India. There is uncertainty about the population dynamics of the pest on this host during different season periods. Observation of *R. syriacus* individuals on *Terminalia catappa* plants was made on spontaneous vegetation in Guadeloupe, but no feeding damage was reported, indicating to low infestation level on this host. In Brazil, however, it produced minor injuries in a few leaves.

Imported plants for planting would come from a greenhouse or nursery which are protected with thrips-proof nets. Furthermore, *R. syriacus* can easily be spotted on the plants, and imported plants are likely coming from greenhouses where they are monitored and treated for pests.

The 99th percentile was set considering that there is no track record of interceptions and an infestation rate greater than 2% would most likely be noticed and addressed.

The median value was set to reflect an expected overall very low infestation rate motivated by the substantial lack of evidence of association of the pest with plants for planting intended for export and the lack of even sporadic interception records. The inter-quartile range was set to reflect the consensus of more certainty of the lower values and less confidence towards the high value.

For the elicitation of *P. americana* plants infestation rate from Israel, the Panel considered that:

- The pest is present in the avocado growing areas of Israel.
- *R. syriacus* is a known issue and pesticides are applied as a preventive measure.
- The inspection method enables at least the detection of 1% level infestation with a level of confidence of 99%
- Plants are transported for few days at low temperature (2–4°C)
- Even if monitoring and inspection are systematically applied, some infestations may remain undetected.

The results of the elicitation for the plants for planting of *P. americana* (from Israel) are reported in Table D.10 and Figure D.20.

TABLE D.10 Estimated mean number of *Persea americana* plants from Israel intended for export as plants for planting infested with *Retithrips syriacus* when arriving in the EU (per 10,000 plants).

Question	How many out of 10,000 plants *Persea americana* (from Israel) intended for export as plants for planting to the EU, are infested with living individuals of *R. syriacus* when arriving in the EU?					
Results	Infestation rate before export at the point of departure (per 10,000 plants)					
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	0.00		2.50	5.00	20.00		100.00
Fitted values	0.01	0.14	1.79	6.57	18.30	57.17	107.94
Distribution	Weibull (0.67646, 11.291)						

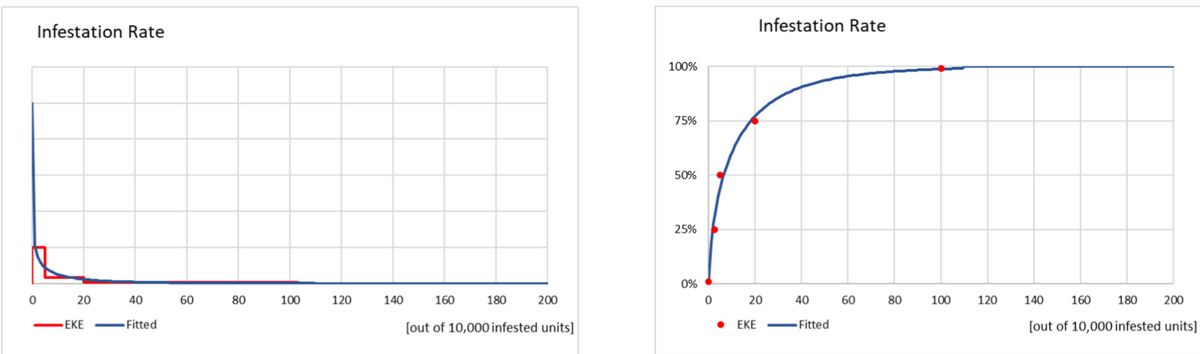


FIGURE D.20 Distribution of the estimated infestation rate of *Retithrips syriacus* in *P. americana* plants from Israel (per 10,000 units) when arriving in the EU fitted to EKE estimates.

For the 1st percentile, an infestation rate equal to 0 per 10,000 plants could not be excluded after the monitoring and inspection measures.

The 99th percentile was set to 1% after considering the specifics of the inspection requirements.

The median value was supported by the following reasonings:

- As the pest is present in the country and on the crop, it cannot be excluded that some plants could be infested.
- If the pest is present, it will probably involve more than one plant; however, visual inspection is likely to spot the infestation at the nursery and the plants will be treated with insecticide.
- Inspectors are trained to detect this pest.

The inter-quartile range was set to reflect more certainty around the median value and an overall low level of confidence for the upper value.

D.3 | PROBABILITY OF *RETITHRIPS SYRIACUS* SURVIVAL DURING TRANSPORT

Elicited mean rates of survival during transport to the EU per 10,000 infested units of cut roses, table grape bunches and persimmons are reported in Tables D.11, D.12 and D.13 together with the fitted probability distributions in Figures D.21, D.22 and D.23. EKE estimates are values proposed by the expert working group as consensus estimates.

The cold resistance of *R. syriacus* is unknown. However, *R. syriacus* is a tropical pest and can be less cold resistant than other thrips species such as *Thrips palmi* Karny (Thysanoptera: Thripidae) for which cold resistance data are available (lethal time killing 90% of the population at different low temperatures, LT_{90} (McDonald et al., 2000)) and could be used as proxy taking into account that the LDT for the most susceptible stage of *T. palmi* (Yadav & Chang, 2014) is about 2°C lower than that for *R. syriacus* (Rivnay, 1939) (i.e. *T. palmi* more cold resistant). For example, when considering acclimated *T. palmi* adults at 0°C, an average LT_{90} of 8.8 days (95% fiducial limit: 10.4–13.8) was reported.

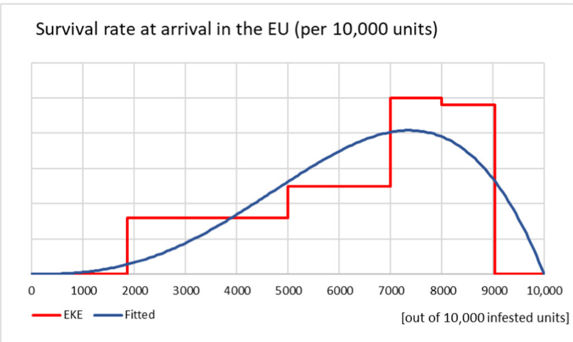
Considering the very different transport time and temperature for the plant products considered in the pathway model and the lack of data to try the fitting of a survival function, the survival rate of *R. syriacus* was elicited separately for: (i) cut roses transported via air cargo, (ii) table grapes and persimmons transported via ocean cargo and (iii) table grapes and persimmons transported via air cargo. The Panel considered:

- The duration of transport via air cargo for all the commodities is assumed to be adequately described by the distribution used for the cut roses in the recent EFSA opinion on *Thaumatotibia leucotreta*: triangular distribution with parameters minimum, most likely, and maximum equal to 1.0, 4.5 and 8.0 days (EFSA PLH Panel, 2023).
- The duration of transport via ocean cargo takes from 2 to 3 weeks (DROPSA, 2016).
- The optimal storage temperature for cut roses is 4°C ± 1; however, temperatures might fluctuate for short periods during handling (up to 8°C) and reloading (up to 16°C) (EFSA PLH Panel, 2023).
- The storage temperature for persimmons and table grapes is assumed to be −0.5 ± 0.5°C (https://www.cargohandbook.com/Grapes, https://cargohandbook.com/Persimmons, [PPECB, 2017, 2023]).

The results of the elicitation for cut roses transported via air cargo are reported in Table D.11 and Figure D.21.

TABLE D.11 Estimated survival rate of *Retithrips syriacus* in cut roses transported via air cargo (per 10,000 *R. syriacus* specimens).

Question	How many out of 10,000 *R. syriacus* specimens would survive in cut roses when transported to the EU via air cargo?					
Results	Survival rate					
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	2000		5000	7000	8000		9000
Fitted values	2059	3249	5300	6739	7981	9202	9659
Distribution	= BetaGeneral (3.7911, 1.9963, 0, 10,000)						



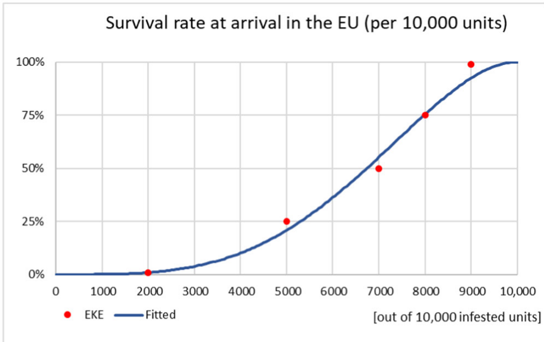


FIGURE D.21 Distribution of the estimated survival rate of *Retithrips syriacus* in cut roses (per 10,000 units) when transported to the EU via air cargo fitted to EKE estimates.

The reasoning in support of the elicited values for the survival rate in cut roses transported via air cargo is listed below.
1st percentile:

- The total turnover time from the grower up to and including the arrival at point of retail can take up to 8 days.
- During transport a constant temperature of 4 ± 1°C should be maintained to deliver the flowers to destinations in optimal conditions.
- If considering the non-acclimated *T. palmi* adults (the most unfavourable assumption given it is the condition for which the lower LT_{90} was recorded), the lower limit of the 95 CI of the LT_{90} for *T. palmi* indicates that 90% of the population was eliminated after 6.3 days at 0°C. Although the cut roses are transported at temperature that is higher than 0°C and for fewer days, *T. palmi* is expected to be more cold-resistant than *R. syriacus*.

99th percentile:

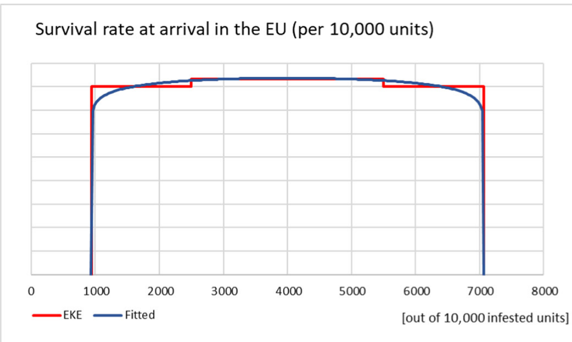
- The total turnover time from the grower up to and including the arrival at point of retail can take as little as one day.
- During transport, temperatures might fluctuate for short periods during handling (up to 8°C) and reloading (up to 16°C) from storage into transport and from trucks to aircraft cabin.
- If considering the acclimated *T. palmi* adults (i.e. the most favourable assumption given it is the condition for which the higher LT_{90} was recorded), the higher limit of the 95 CI of the LT_{90} for *T. palmi* indicates up to 13.8 days are needed for a reduction of 90% of the population at 0°C. In the case of cut roses, the transport time could be considerably less than 13.8 days and the temperature is higher than 0°C. Nonetheless, *T. palmi* is expected to be more cold resistant that *R. syriacus* and some reduction is still expected.

Median and inter-quartile range: The consensus value for the median was driven by the fact that *R. syriacus* in cut roses would be exposed to low (but not 0°C) temperatures for a relatively short time (~4 days on average considered). If the LT_{90} of *T. palmi* is to be used as a proxy for *R. syriacus*, then the values for the non-acclimated specimens would probably be more appropriate to consider. The inter-quartile range was set to reflect the consensus of lower likelihood on the lower values and higher likelihood on the higher values.

The results of the elicitation for table grapes and persimmons transported via air cargo are reported in Table D.12 and Figure D.22.

TABLE D.12 Estimated survival rate of *Retithrips syriacus* in table grapes and persimmons (per 10,000 *R. syriacus* specimens) when transported to the EU via air cargo fitted to EKE estimates.

Question	How many out of 10,000 *R. syriacus* specimens would survive in table grapes and persimmons when transported to the EU via air cargo?					
Results	Survival rate					
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE values	1000		2500	4000	5500		7000
Fitted values	1000	1263	2500	4000	5499	6736	7000
Distribution	BetaGeneral (3.7911, 1.9963, 0, 10,000)						



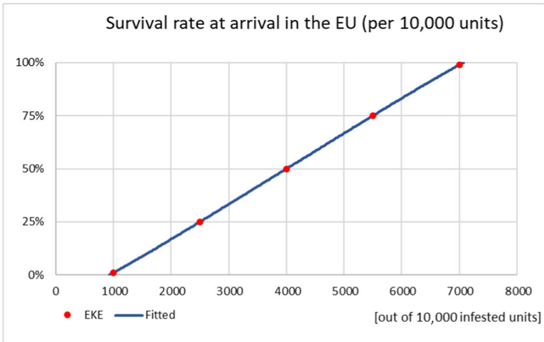


FIGURE D.22 Distribution of the estimated survival rate of *Retithrips syriacus* in table grapes and persimmons (per 10,000 units) when transported to the EU via air cargo fitted to EKE estimates.

The reasoning in support of the elicited values for the survival rate in table grapes and persimmons transported via air cargo are listed below.

1st percentile:

- The transport time can take up to 8 days, and the recommended transport temperature is about −0.5°C; in addition, the table grapes are delivered from the countries of origin with pads of SO_2 to control grey mould and deastringency treatments (CO_2) can be applied to some cultivars of persimmons. Contingent effects on other pests including *R. syriacus* can be expected from both SO_2 and CO_2.
- If considering the non-acclimated *T. palmi* adults (i.e. the most unfavourable assumption given it is the condition for which the lower LT_{90} was recorded), the lower limit of the 95 CI of the LT_{90} for *T. palmi* indicates that 90% of the population was eliminated after 6.3 days at 0°C. Although *T. palmi* is expected to be more resistant that *R. syriacus*, the transport time could be considerably less than 6 days and the temperature slightly higher than 0°C.

99th percentile:

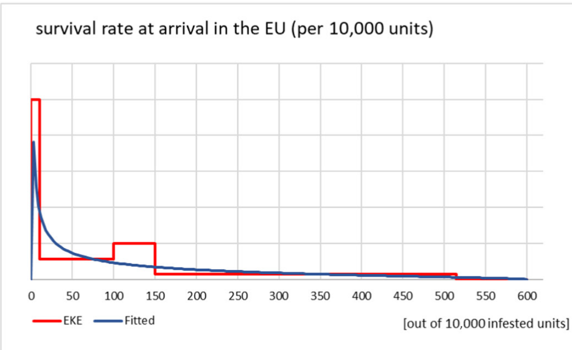
- The transport time until the destination by can be as short as 2–3 days, but the transport temperature is very low; in

addition, table grapes are delivered from the countries of origin with pads of SO_2 to control grey mould and deastringency treatments (CO_2) can be applied to some cultivars of persimmons. Contingent effects on other pests including *R. syriacus* can be expected from both SO_2 and CO_2.
- There is uncertainty in the variability of the temperature during transport via air cargo.
- If considering the acclimated *T. palmi* adults (i.e. most favourable assumption given *R. syriacus* was not acclimated before transport and it is the condition for which the lower LT_{90} was recorded for *T. palmi*), the higher limit of the 95 CI of the LT_{90} for *T. palmi* indicates that up to 13.8 days at 0°C could be needed to reach 90% reduction of the population.
- As for the cut roses, the transport time by air cargo can be considerably shorter than 13.8 days and the transport temperature could be slightly higher than 0°C; however, *T. palmi* is expected to be more cold resistant that *R. syriacus* and therefore some reduction effect is still expected.

Median and inter-quartile range: The consensus values for the median and the interquartile range were set as to reflect the maximum level of uncertainty in relation to actual length of the journey and the extent to which *R. syriacus* is expected to be less cold resistant than *T. palmi*. The results of the elicitation for table grapes and persimmons transported via ocean cargo are reported in Table D.13 and Figure D.23.

TABLE D.13 Estimated survival rate of *Retithrips syriacus* in table grapes and persimmons (per 10,000 *R. syriacus* specimens) when transported to the EU via ocean cargo fitted to EKE estimates.

Question	How many out of 10,000 *R. syriacus* specimens would survive in table grapes and persimmons when transported to the EU via ocean cargo?						
Results	Survival rate (per 10,000 infested units)						
Percentiles (%)	1%	5%	25%	50%	75%	95%	99%
EKE values	0.00		10.00	100.00	150.00		500.00
Fitted values	0.01	0.31	13.01	67.87	193.77	421.63	528.64
Distribution	BetaGeneral (1.0464, 1.0464, 927.92, 7072.1)						



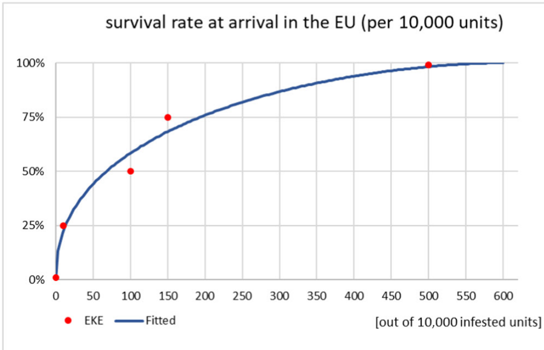


FIGURE D.23 Distribution of the estimated survival rate of *Retithrips syriacus* in table grapes and persimmons (per 10,000 units) when transported to the EU via ocean cargo fitted to EKE estimates.

The reasoning in support of the elicited values for the survival rate in table grapes and persimmons transported via ocean cargo are listed below.

1st percentile:

- The transport time until the final destination can take up to 3 weeks.
- The transport temperature is very low and for table grapes SO_2 pads are used to control grey mould and deastringency treatments (CO_2) can be applied to some cultivars of persimmons. Contingent effects on other pests including *R. syriacus* can be expected from both SO_2 and CO_2.
- The cold resistance of *R. syriacus* is unknown. However, *R. syriacus* is a tropical pest and can be expected to be less cold resistant than other thrips that have a lower LDT such as *T. palmi*; the lower limit of the 95 CI of the LT_{90} for *T. palmi* at 0°C was 6.3 days for non-acclimated adults.

99th percentile limit:

- The cold resistance of *R. syriacus* is unknown. However, *R. syriacus* is a tropical pest and can be expected to be less cold resistant than other thrips that have a lower LDT such as *T. palmi* for which cold resistance data (LT_{90}) are available and can be used as a proxy.
- Most of the table grapes and persimmons are transported via ocean cargo and the journey could take less 14 days.

- For both the commodities, the storage temperature is close to 0°C and the upper limit of the LT_{90} for adults of *T. palmi* (acclimated adults) exposed to 0°C was 13.8 days.
- The cold resistance of *R. syriacus* is unknown and could be similar to that of other tropical thrips that have adapted to European climate.

Median and inter-quartile range: The consensus value for the median was driven by the expected lower cold resistance of *R. syriacus* when compared that of a thrips with lower LDT, the length of the transport time via ocean cargo and the expected low variability in the storage temperature. the inter-quartile range was set to reflect the consensus of lower likelihood on the lower values and higher likelihood on the higher values.

D.4 | PROBABILITY OF TRANSFER

The elicited probability of *R. syriacus* being in the conditions of moving from the consumers' house to a suitable host and surviving along the way to the host until egg laying was informed by the expected time of pest arrival in the EU (see trade windows in Figures D.3, D.8 and D.13) and the corresponding temperature (see maps in Appendix E) to evaluate whether, at the time of pest arrival, the environmental conditions are expected to be favourable for movement and egg laying. The Panel also considered the expected fitness of the arriving thrips in relation to their travel history. For example, *R. syriacus* specimens surviving a journey of 2 weeks at a T° −0.5°C (transport time and temperature for table grapes) are expected to be in overall worse fit if compared to *R. syriacus* specimens surviving a journey of few days at a T° of about 4°C (transport time and temperature for cut roses). The final destination of the cut roses, persimmons and table grapes is the consumers' house, and considering that the flight capability of *R. syriacus* is very limited, the probability of transfer was also considered to be affected by the consumers' behaviour (detection and disposal of the infested product or elimination of the insect) and the characteristics of the surrounding environment in terms of: (i) landscape (urban vs. rural environment) affecting accessibility and availability of suitable hosts and (ii) presence of barriers/predators along the way to the suitable host. The results of the elicitation are reported in Table D.14 and Figure D.24.

TABLE D.14 Estimated transfer rate of *Retithrips syriacus*.

Question	10,000 transfer units are purchased by consumers and all units are infested with at least 1 mated female of *R. syriacus*. How many of the 10,000 mated female *R. syriacus* will be in the conditions of moving from the consumers house to a suitable host and survive along the way to the host until egg laying?						
Results	Successful transfer rate (per 10,000 units)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE estimates	0	–	3.00	7.00	20.00	–	100.00
Fitted values	0.30	0.77	2.91	7.37	18.63	70.75	180.63
Fitted distribution	Lognorm (18.967, 45.002)						

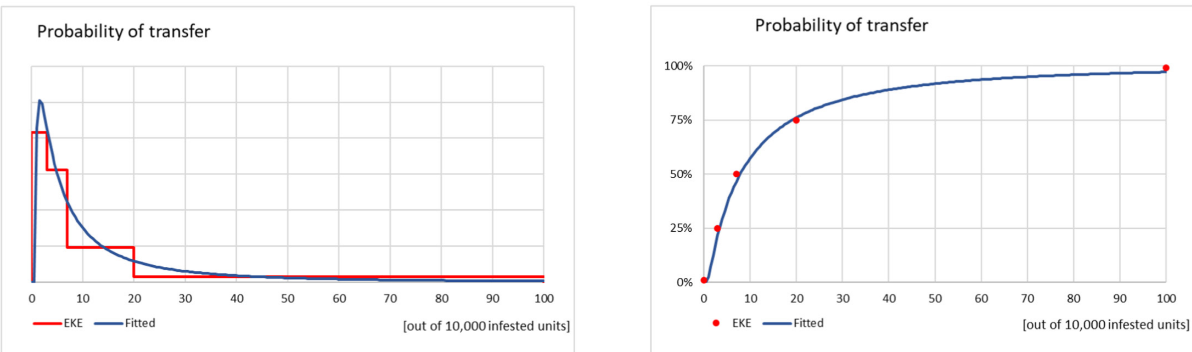


FIGURE D.24 Distribution of the estimated transfer rate of *Retithrips syriacus* fitted to EKE estimates.

The reasoning in support of the elicited values for the transfer rate is listed below.

1st percentile:

- Many of the mated *R. syriacus* specimens would arrive in the EU via ocean cargo, a journey that takes at about 2 weeks with the fruit stored at a temperature of about −0.5°C. These conditions are expected to affect the fitness of the surviving specimens.
- Adult *R. syriacus* are winged, but are not regarded as a good flyer, so it would need to end up close to a suitable host for successful transfer to occur.

- The pest will need to find the way out of the consumer's house and likely need to overcome several physical barriers to reach the nearest suitable host in the external environment.
- If detected by the consumers, it is likely that *R. syriacus* will simply be eliminated.
- The events for the transfer to take place (leaving the house, host plants being available, safe reaching of the nearest host, making successful contact with suitable host) are all characterised by a low probability of occurrence.

99th percentile:

- The most favourable condition for *R. syriacus* is represented by the entry through cut roses delivered via air cargo (short journey) at a time of the year when the temperature is favourable for egg laying.
- Consumption of cut roses is expected to be proportional to the population size and therefore also concentrated in the urban areas where the availability of the suitable hosts and pest survival during the translocation to the first available host for egg laying is expected to be lower as compared to rural areas.
- The flying distance could be up to few hundred metres or wind-assisted.
- If *R. syriacus* is detected on the fruit/on the cut roses by the consumers, the pest might be thrown into the external environment resulting in a sort of human-assisted transfer.

Median:

- *R. syriacus* is more likely to arrive in winter with table grapes and cut roses when temperatures are not favourable for egg-laying and fewer hosts are expected to be available.
- Most of the imported table grapes is imported via ocean cargo (long journey at a temperature around −0.5°C).
- A consistent proportion of cut roses imported via air cargo (short journey at low temperature) is redistributed across the urban areas of the EU.
- Very likely the infested units will end up in a closed environment and the pest will need to find the way out to reach the host.
- *R. syriacus* adults are winged, but regarded as poor flyers.

The inter-quartile range was set to reflect the consensus of lower likelihood on the higher values and higher likelihood on the lower values.

D.5 | PROBABILITY OF ESTABLISHMENT

The elicited probability of a reproductive female *R. syriacus* initiating a founder population that persists in areas of the EU where **all the climate indicators** are consistent with those where the insect was observed in its origin countries (see intersection of climatic indicators map) is reported in Table D.15.

TABLE D.15 Estimated establishment rate in the areas of the EU where ALL the climate indicators are consistent with those where the pest was observed in the countries of origin.

Question	10,000 reproductive female of *R. syriacus* have laid eggs in the climatic areas of the EU where ALL the climate indicators: • Hardiness zone • Max N# of consecutive days < 14.9°C (LDT) • KG in the EU are consistent with those where the pest was observed in the countries of origin. How many of these females will be able to start a founder population?						
Results	Proportion of founder populations successfully establishing (out of 10,000 females)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE estimates	500	–	2000	4000	5000	–	7000
Fitted values	498	810	2135	3684	5254	6643	6986
Fitted distribution	BetaGeneral (1.1291, 1.1628, 400, 7100)						

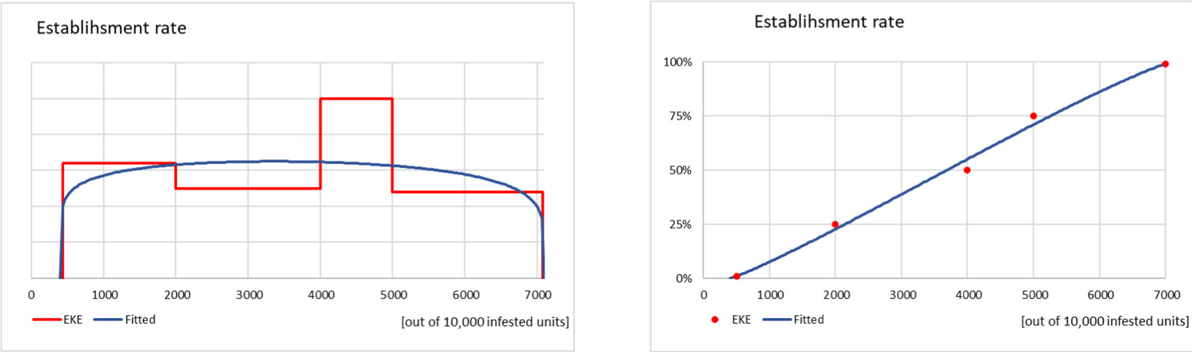


FIGURE D.25 Distribution fitted to EKE estimates of *Retithrips syriacus* establishment rate in the areas of the EU where ALL the climate indicators are consistent with those where the pest was observed in the countries of origin.

The reasoning in support of the elicited values for the establishment rate of *R. syriacus* in the EU area where all climate conditions are satisfied (intersection of climatic indicators) are listed below.

1st percentile:

- Even at the best conditions, successful establishment is very difficult, as it is necessary for the offspring generation to survive during the winter.
- Low ability for adaptation to new environment because of narrow gene pool of the offspring generation.
- Although *R. syriacus* is established in areas around the Mediterranean, there is uncertainty under which conditions this entry and establishment happened.

99th percentile

- *R. syriacus* is already present in climates similar to the risk assessment area.
- The driving factor for the establishment of *R. syriacus* populations is the infested cut roses that arrive throughout the year by air cargo, and have not suffered cold stress.
- It is probable that the strain of *R. syriacus* is parthenogenetic and new populations can build up quickly.
- If a female *R. syriacus* ends up in an urban environment, conditions for establishment are favourable because of limited numbers of predators and no application of pesticides.
- Even if the conditions for establishment are optimal, there is still a rate of natural mortality.
- Allee effects will have a negative effect on the establishment.

Median:

- The insect is present for many decades in the Mediterranean basin, even in countries with intensive agricultural production and extensive use of pest control measures.
- A thrips species is easily hiding and can survive insecticide applications to the host plant.
- Establishment is a process depending on many random factors and success is difficult even when all the conditions are optimal.

The inter-quartile range was set to reflect the consensus of higher likelihood on the lower than the higher values.

The elicited probability of a reproductive female *R. syriacus* initiating a founder population that persists in areas of the EU where **at least one of the climate indicators** is consistent with those where the insect was observed in its origin countries (see union map but excluding the areas covered by the intersection map) is reported in Table D.16.

TABLE D.16 Estimated establishment rate in the areas of the EU where AT LEAST ONE of the climate indicators is consistent with those where the pest was observed in the countries of origin.

Question	10,000 reproductive female of *R. syriacus* have laid eggs in the climatic areas of the EU where AT LEAST one of the climate indicators: • Hardiness zone • Max N# of consecutive days < 14.9°C (LDT) • KG in the EU are consistent with those where the pest was observed in the countries of origin. How many of these females will be able to start a founder population?						
Results	Proportion of founder populations successfully establishing (out of 10,000 females)						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE estimates	50	-	500	1000	1500	-	3000
Fitted values	64	154	515	968	1529	2295	2674
Fitted distribution	BetaGeneral (1.2539, 2.4347, 30, 3070)						

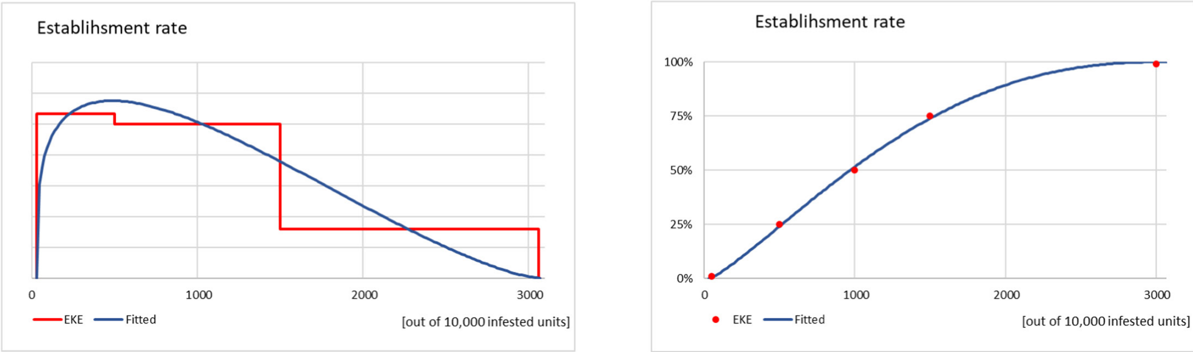


FIGURE D.26 Distribution fitted to EKE estimates of *Retithrips syriacus* establishment rate in the areas of the EU where AT LEAST ONE of the climate indicators is consistent with those where the pest was observed in the countries of origin.

The reasoning in support of the elicited values for the establishment rate of *R. syriacus* at the union of climatic indicators areas of EU (excluding the intersection areas) are listed below.

1st percentile:

- Even if the temperature is favourable for the establishment, there are still other factors, like relative humidity and precipitation that are not considered in the climatic maps.
- Grapevine, which is a favourite host for *R. syriacus* is cultivated in southern Europe for centuries, but still the insect is not present in these areas probably because they are at the limits of climatic suitability.

99th percentile:

- Although the climatic conditions may not be perfectly aligned with the conditions in the origin country, the risk assessment area is still in the Mediterranean.
- There is uncertainty about the lower temperature survival threshold.
- The borders between the union and intersection areas will have favourable enough conditions for the establishment of *R. syriacus*.

Median:

- The offspring generation must survive during the winter, which may be harsh, for example in areas of Spain.
- Presence of *R. syriacus* remains confined to a specific area, while its hosts are widely distributed, so median value is closer to the lower limit.

The inter-quartile range was set to reflect the consensus of higher likelihood on the lower than the higher values.

D.6 | PROBABILITY OF LAG PHASE AND SPREAD RATE

For the elicitation of the spread parameters, the Panel considered the lag phase as the period where the pest is reproducing and increasing in numbers until it reaches a population level to be able to spread to non-infested areas. The spread as the spatial expansion of a population either due to the natural spread capacity of the pest or human-assisted spread (human-assisted spread is limited to the spread of the pest facilitated by common agricultural practices).

For the duration of the lag phase, it was considered that the life cycle of *R. syriacus* is completed, under laboratory conditions, within 42.1 ± 2.4 days at 20°C, 27.3 ± 2.0 days at 25°C and 19.8 ± 1.7 days at 30°C on rose leaves (Khan et al., 1997). The pest can produce about seven generations per year. Under favourable climatic conditions, adults can live from 10 to 20 days, whereas at lower temperatures longevity may reach 40 days (Avidov & Harpaz, 1969). Khan et al. (1997) recorded the highest longevity of females to be 50 days at 25°C. Those conditions are easily meet during the Mediterranean hot summer months. *R. syriacus* can overwinter at the adult stage in debris on the soil (Ben-Yakir, 2012), so it can withstand the relatively cold winters in the Mediterranean Basin.

For the spread rate, it was considered that the flying capacity of *R. syriacus* is relatively low, and adults hop and fly short distances only when disturbed (Dr. Élison Fabrício Bezerra Lima, personal communication). Nevertheless, individuals can be also dispersed by wind to relatively longer distances. Human-assisted spread with common agricultural practices was also considered. *R. syriacus* may spread with infested leaves, flowers and fruits attached to farm machinery moving within and between plots.

The elicited probability for the lag phase and spread sate of *R. syriacus* is reported in Tables D.17 and D.18. together with the fitted probability distributions in Figures D.27 and D.28.

TABLE D.17 Estimated *Retithrips syriacus* lag phase in years.

Question	How long is the average duration of the lag phase, defined as the time from the first entry and establishment of the pest (founder population) to its spread with constant rate in pest free areas (constant expansion)?						
Results	Year						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE estimates	0.30	–	0.65	1.00	2.00	–	5.00
Fitted values	0.26	0.31	0.61	1.11	1.88	3.32	4.35
Fitted distribution	BetaGeneral (0.91906, 3.2348, 0.25, 5.2)						

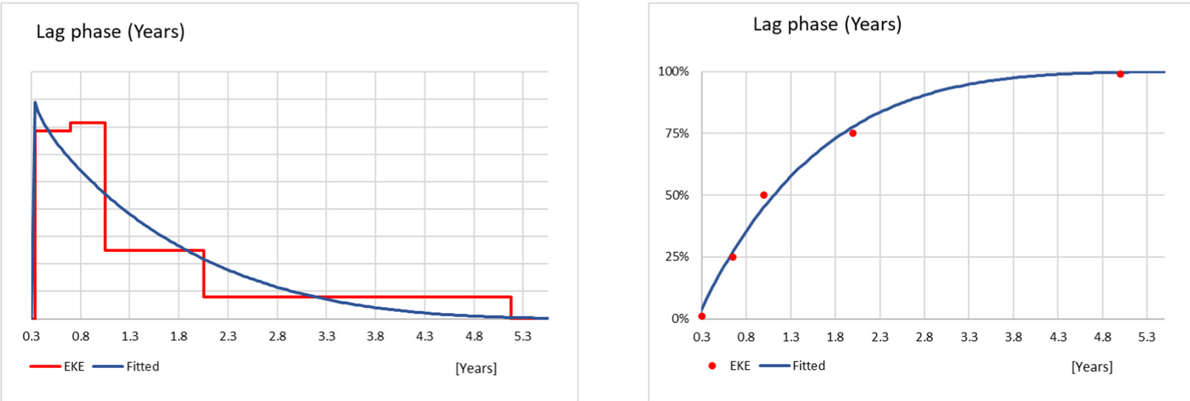


FIGURE D.27 Distribution fitted to EKE estimates of *Retithrips syriacus* lag phase (in years).

The reasoning in support of the elicited values for the lag phase of *R. syriacus* is listed below.

1st percentile:

- The scenario resulting in the shortest lag phase for *R. syriacus* would be when plants for planting infested with eggs may be transferred to a greenhouse in the risk assessment area, where environmental conditions allow maximum survival rate for all subsequent life stages of the pest. Therefore, fast population build-up of the pest will be favoured.
- When the introduction of *R. syriacus* in the risk assessment area will take place under open field conditions, optimal temperatures for pest development could be present for four consecutive months during the typical Mediterranean summer months. Considering the biological traits of *R. syriacus*, it was estimated that during this period at least three generations of the pest can be completed.

99th percentile:

- Since the assumption for the lag phase is that *R. syriacus* is already established in a climatic suitable area, the process of population built-up will only be restricted by the pest's biology.
- The scenario resulting in the longest lag phase for *R. syriacus* would be when infested plant products may land in a wine-producing vineyard in the risk assessment area, where the common crop management practices include insecticide applications which are detrimental for population build-up of the pest.
- Considering that *R. syriacus* has a relatively low reproduction rate, under the conditions of this scenario it will take several years to reach population levels high enough to trigger spread. Nevertheless, it was considered very unlikely that *R. syriacus* will not build up its population after three growing seasons.

Median:

- The scenario for the median lag phase duration considered that one summer season in the Mediterranean Basin would be enough for two to three generations of *R. syriacus* to be completed, which would be sufficient for population build-up and trigger spread.
- Although assessing climate change is outside the remit of this PRA, for the median duration of the lag phase, it was considered that summer conditions in the risk assessment area become longer each year.

Inter-quartile range:

- For the uncertainty around the median duration of the lag phase, it was considered that random mortality factors will affect the survival of *R. syriacus*.

- It was also considered that very likely that it will take more than one growing season for *R. syriacus* to reproduce to high levels allowing successful spread to other areas.

TABLE D.18 Estimated spread of *Retithrips syriacus* in km/year.

Question	Assuming that human-assisted spread between infested hosts is excluded by perfect sanitary measures or prohibited exchange of tools, but considering the common agricultural practices, what is the spread rate after the lag phase in the areas where establishment is possible? [km/year]						
Results	Km/Year						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE estimates	0.001	–	0.025	0.05	0.20	–	10.00
Fitted values	0.02	0.02	0.025	0.05	0.19	2.28	13.55
Fitted distribution	Lognorm (0.94447, 29.346) + Shift (0.01981)						

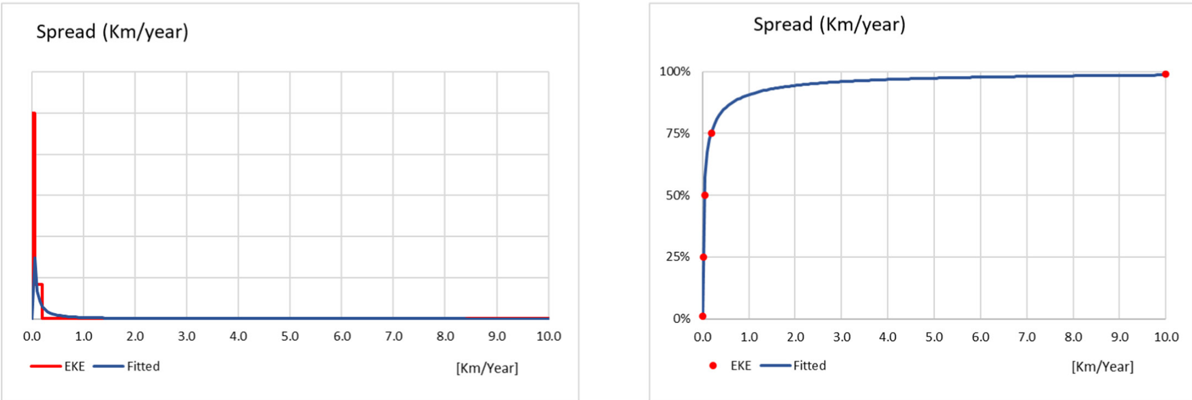


FIGURE D.28 Distribution fitted to EKE estimates of *Retithrips syriacus* spread rate (in km/years).

The reasoning in support of the elicited values for the spread of *R. syriacus* is listed below.

1st percentile:

- Considering the limited flying capacity of the *R. syriacus*, zero spread after establishment was considered as a plausible – though unlikely – scenario.
- Despite the low potential of the pest for natural spread, transfer to the neighbouring plants would still be possible by chance factors.
- Field observations indicate that *R. syriacus* shows an aggregated behaviour, supporting the scenario for low spread potential. Observations from South Africa show that even in the same vineyard row, it is possible that the pest is not found on every vine or on every leaf of an infested vine.

99th percentile:

- This scenario for relatively long-distance spread of *R. syriacus* considers that spread assisted by human activity and by wind occurs in the risk assessment area.
- Under these assumptions, with 1–2 days of continuous wind the dispersal of *R. syriacus* would be possible resulting in a radial expansion of the geographical distribution by several kilometres.
- Likewise, relatively long-distance spread of *R. syriacus* would be possible by farm workers and/or machinery moving from one position of the crop/vineyard to another may inadvertently transfer infested plant organs.

Median

- For the median spread rate, it was considered that *R. syriacus* is present in Cyprus since the 1960's but, based on the available information, it might not have expanded to the entire territory of the island.
- Likewise, the pest was first reported in Tunisia in two host plants in 2009, but further reports of its geographical range in the north of Africa are not available. Thus, evidence for long range spread in the region was not substantiated.
- No spread of *R. syriacus* from Cyprus and Tunisia to continental EU countries has been documented, but these areas are geographically restricted by the Mediterranean Sea limiting long-distance spread.
- The pest is more widespread in Israel, which is a continental country, but it is possible that Israel is part of the native range of *R. syriacus* and so it had much more time to complete its maximum spread potential.

- Passive dispersal by wind is considered the most contributing factor for the long-distance dispersal of *R. syriacus* reaching not infested areas, but it is very unlikely that this will result in a successful expansion of its geographical distribution.

Inter-quartile range:

- Higher likelihood was put on the lower values of the spread rate, since even 100 m is a long distance for a thrip species to spread naturally.

D.7 | IMPACT ASSESSMENT

The elicited probability for the expected impact that is directly attributable to *R. syriacus* should the thrips successfully establish in the suitable areas of the EU is reported in Table D.19 and Figure D.27.

TABLE D.19 Estimated yield loss by *Retithrips syriacus*.

Question	What is the likely mean reduction in yield of plant products when the pest has reached its maximum distribution range in the EU and farmers are managing the pest as a component of the general cropping practices?						
Results	% yield reduction						
Percentiles	1%	5%	25%	50%	75%	95%	99%
EKE estimates	0%	–	0.025%	0.05%	0.20%	–	1.0%
Fitted values	0.0001%	0.001%	0.02%	0.06%	0.18%	0.57%	1.1%
Fitted distribution	RiskWeibull (0.67646, 0.11291)						

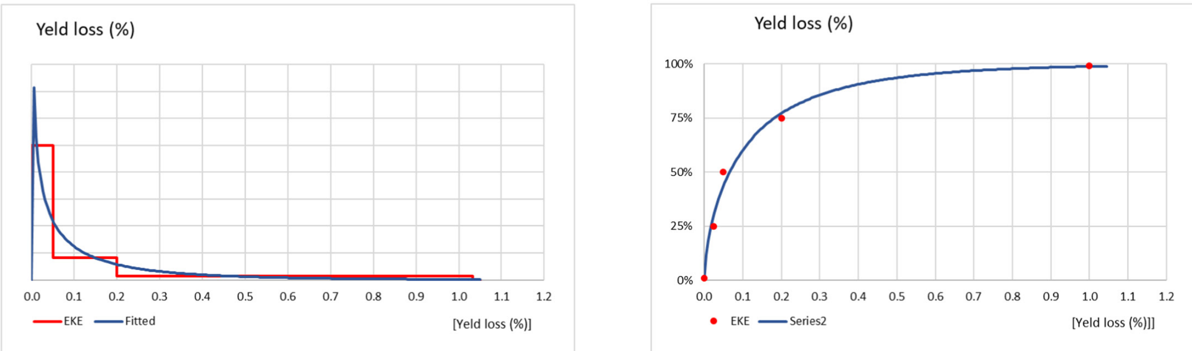


FIGURE D.29 Distribution fitted to EKE estimates of the expected yield loss directly attributed to *Retithrips syriacus* in the areas of the EU where establishment is possible (% plant products).

The reasoning in support of the elicited values for the yield loss directly attributable to *R. syriacus* in the areas of the EU where establishment is possible is reported below.

1st percentile:

- It was considered that experts from Brazil and South Africa indicated the low concern that farmers and particularly table grape growers show for *R. syriacus*.
- Table grape crops in the EU are irrigated and mostly covered with nets, which may reduce the level of pest infestation and damage.
- Insecticide sprays and other pest control measures are a component of the general cropping practices in the risk assessment area, including treatments targeting another pestiferous thrips, *Frankliniella occidentalis* Pergande (Thysanoptera: Thripidae).

Under this scenario, the available evidence up to now can support the hypothesis that zero damage by *R. syriacus* would be possible.

99th percentile:

- Qualitative assessments of impact elsewhere were considered. Although some impacts on yield may be plausible, high uncertainty exists about its levels, since mostly descriptive qualitative data of crop damage are available.
- It was considered that with yield losses above 1%, more research would have been triggered on *R. syriacus* in the countries where the pest is present for decades.

Median:

- Reports describing high pest populations and inflicted plant damage were considered, but they date back to several decades and were observed when a set of conditions applied such as specific plant variety and prolonged dry periods, or outside commercial crop settings like home or urban gardens.
- No substantial yield losses by *R. syriacus* were reported from Cyprus and Tunisia, where the pest is present for decades, and share similar climatic and hosts characteristics with the risk assessment area.
- Qualitative statements of impacts by *R. syriacus* are available from Israel, a region also with similar climatic and host characteristics to the risk assessment area. Nevertheless, despite these statements of impact, quantitative yield losses have not been reported and the pest has not triggered scientific research either.

Inter-quartile range: the inter-quartile range was set to reflect the consensus towards more likelihood was put on the low levels of impact.

APPENDIX E

Redistribution model

The estimation of entry of possibly infested commodities into the EU relies on the international trade statistics in goods of EUROSTAT (2022). The data set (EUROSTAT/International trade in goods – detailed data(ext_go_detail)/EU trade since 1988 by HS2-4-6 and CN8) reports the weight of annually imported commodities from third countries with/without reported presence of the pest to the importing countries in the EU, the intra-EU trade and the export of the commodity from the EU countries to outside the EU. Also, for perishable commodities, it is likely that parts of the imported commodities are re-distributed within the EU or further exported to third countries, but the exact proportions are unknown. Therefore, the final allocation of the imported commodities from third countries between the consuming EU countries is modelled (Figure E.1).

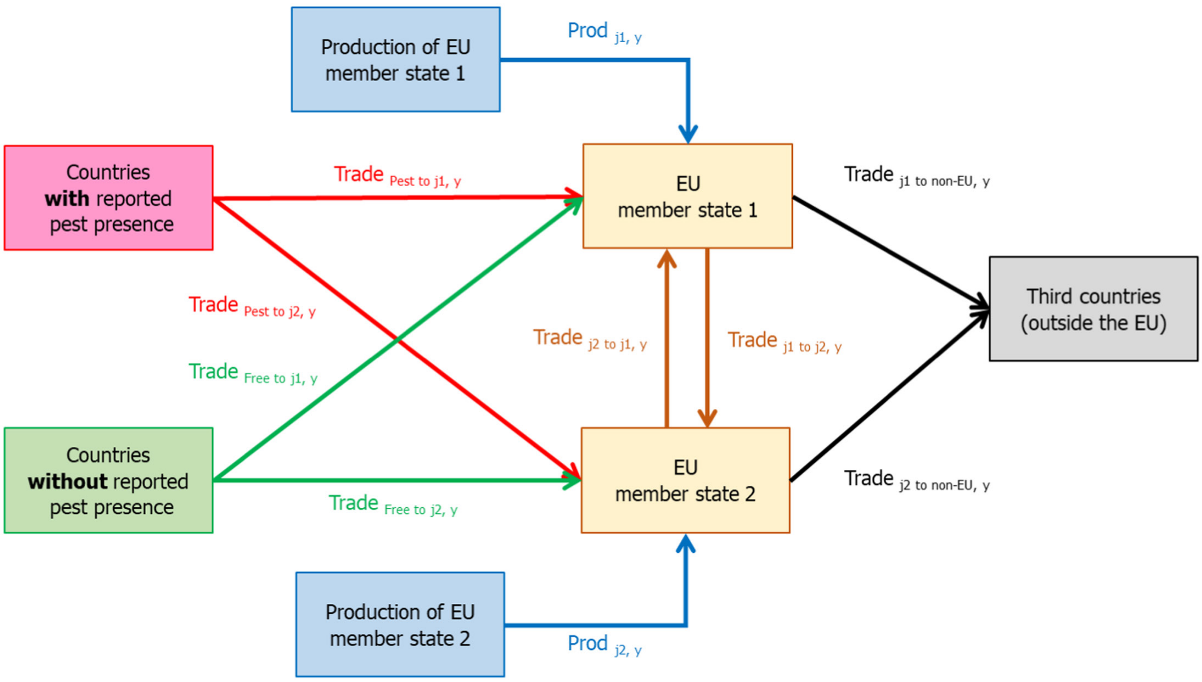


FIGURE E.1 Structure of the redistribution model (with 2 EU Member States).

Additionally, the annual production of the commodities within each EU Member State is taken from the EUROSTAT statistics on agricultural production of crops (EUROSTAT/Crop production in EU standard humidity (apro_cpsh1)) or similar sources (e.g. FAO statistics). A summary of the inputs needed for the re-distribution model is outlined in Table E.1.

TABLE E.1 Inputs for the redistribution model.

Abbreviation	Description	Data source
j, *j*1, *j*2	Index for one of the 27 Member States of the current EU (EU-27)	
Y	Index for the year	
$Trade_{Pest\ to\ j,\ y}$	Import of the commodity from countries outside the EU with reported presence of the pest to the Member State '*j*' in the year '*y*'	EUROSTAT table: ext_go_detail
$Trade_{Free\ to\ j,\ y}$	Import of the commodity from pest-free countries outside the EU to the Member State '*j*' in the year '*y*'	EUROSTAT table: ext_go_detail
$Prod_{j,\ y}$	Production of the commodity in the Member State '*j*' in the year '*y*'	EUROSTAT table: apro_cpsh1 or similar
$Trade_{j1\ to\ j2}$	Trade of the commodity from Member State '*j*1' to Member State '*j*2' in the year '*y*'	EUROSTAT table: ext_go_detail
$Trade_{j1\ to\ non\text{-}EU,\ y}$	Export of the commodity from Member States '*j*1' to third countries (outside the EU) in the year '*y*'	EUROSTAT table: ext_go_detail

The modelling is done year by year (Figure E.2).

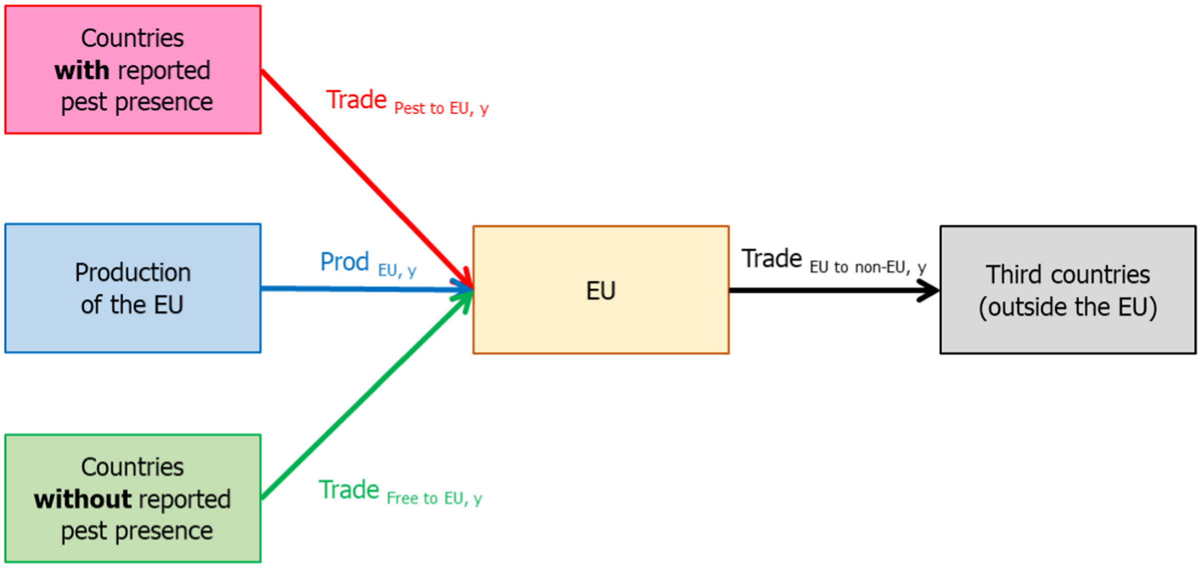


FIGURE E.2 Structure of the annual commodity balance on EU level.

As a first iteration the proportion of possibly infested material on the EU level is estimated, from the inputs described in Table E.2, as:

$$\text{Prob}_{\text{Pest,EU},y} = \text{Trade}_{\text{Pest to EU},y} / \left(\text{Trade}_{\text{Pest to EU},y} + \text{Trade}_{\text{Free to EU},y} + \text{Prod}_{\text{EU},y}\right).$$

TABLE E.2 Inputs for the calculation of the proportion of possibly infested material on an EU-level.

Abbreviation	Calculation	Description
y		Index for the year
$\text{Prob}_{\text{Pest, EU}, y}$	See above	Proportion of possibly infested material on the EU-level in the year '*y*'
$\text{Trade}_{\text{Pest to EU}, y}$	$\Sigma_{\text{EU members}}\ \text{Trade}_{\text{Pest to } m, y}$	Total import of the commodity from countries outside the EU with reported presence of the pest to the EU in the year '*y*'
$\text{Trade}_{\text{Free to EU}}$	$\Sigma_{\text{EU members}}\ \text{Trade}_{\text{Free to } m, y}$	Total import of the commodity from pest-free countries outside the EU to the EU in the year '*y*'
$\text{Prod}_{\text{EU}, y}$	$\Sigma_{\text{EU members}}\ \text{Prod}_{m, y}$	Total production of the commodity in the EU in the year '*y*'
$\text{Trade}_{\text{EU to non-EU}, y}$	$\Sigma_{\text{EU members}}\ \text{Trade}_{m \text{ to non-EU}, y}$	Total export of the commodity from the EU to third countries (outside the EU) in the year '*y*'

This proportion describes how the possibly contaminated material is diluted in the EU with pest-free commodities. In the second iteration, the proportion is calculated for each Member State using the proportion on the EU level for the intra-EU trade (Table E.3).

Three scenarios are made to explore the uncertainty related to the proportion of the possibly infested material, which is redistributed.

The low-risk scenario assumes that commodities imported from countries with reported pest presence stay in the first country of entry and are not re-distributed within the EU:

$$\text{Prob}_{\text{Low,Pest},j,y} = \text{Trade}_{\text{Pest to } j,y} / \left(\text{Trade}_{\text{Pest to } j,y} + \text{Trade}_{\text{Free to } j,y} + \text{Trade}_{\text{EU to } j,y} + \text{Prod}_{j,y}\right).$$

The **medium-risk scenario** assumes that the re-distributed material from other Member States is diluted with the EU average (proportion of the EU level):

$$\text{Prob}_{\text{Medium,Pest},j,y} = \left(\text{Trade}_{\text{Pest to } j,y} + \text{Prob}_{\text{Pest,EU},y} \times \text{Trade}_{\text{EU to } j,y}\right) / \left(\text{Trade}_{\text{Pest to } j,y} + \text{Trade}_{\text{Free to } j,y} + \text{Trade}_{\text{EU to } j,y} + \text{Prod}_{j,y}\right).$$

Finally, the **high-risk scenario** assumes that commodities exported are pest-free (from pest-free countries or EU production) and reduces the dilution in the Member State:

$$\text{Prob}_{\text{High,Pest},j,y} = \left(\text{Trade}_{\text{Pest to } j,y} + \text{Prob}_{\text{Pest,EU},y} \times \text{Trade}_{\text{EU to } j,y}\right) / \left(\text{Trade}_{\text{Pest to } j,y} + \text{Trade}_{\text{Free to } j,y} + \text{Trade}_{\text{EU to } j,y} + \text{Prod}_{j,y} - \text{Trade}_{j \text{ to EU},y} - \text{Trade}_{j \text{ to non-EU},y}\right).$$

TABLE E.3 Additional inputs for the calculation of the proportion of possibly infested material on a Member State level.

Abbreviation	Calculation	Description
j		Index for one of the 27 Member States of the current EU (EU-27)
Y		Index for the year
$\text{Prob}_{\text{Low, Pest}, j, y}$	See above	Proportion of possibly infested material in the Member State 'j' in the year 'y' under the low-risk scenario
$\text{Prob}_{\text{Medium, Pest}, j, y}$	See above	Proportion of possibly infested material in the Member State 'j' in the year 'y' under the medium-risk scenario
$\text{Prob}_{\text{High, Pest}, j, y}$	See above	Proportion of possibly infested material in the Member State 'j' in the year 'y" under the high-risk scenario
$\text{Trade}_{\text{EU to } j, y}$	$\Sigma_{\text{EU members } k \neq j} \text{Trade}_{k \text{ to } j, y}$	Total import of the commodity from all other countries in the EU to the Member State 'j' in the year 'y'
$\text{Trade}_{j \text{ to EU}, y}$	$\Sigma_{\text{EU members } k \neq j} \text{Trade}_{j \text{ to } k, y}$	Total export of the commodity to all other countries in the EU from the Member State 'j' in the year 'y'

In the model, the proportion of possibly infested material in the Member State 'j' in the year 'y' is included as uncertainty distribution:

$$\text{Prob}_{\text{Pest},j,y} = \text{TRIANGULAR}\left(\text{Prob}_{\text{Low,Pest},j,y}, \text{Prob}_{\text{Medium,Pest},j,y}, \text{Prob}_{\text{High,Pest},j,y}\right).$$

The final allocation of the commodities imported from countries with reported pest presence is done using one step of re-exporting (inputs described in Table E.4). This reflects the fact that the commodities are fresh and stay only few weeks on the market.

$$\text{Comm}_{\text{Pest},j,y} = \text{Trade}_{\text{Pest to } j,y} + \text{S}_{\text{EU members } k \neq j} \left[\text{Prob}_{\text{Pest},k,y} \times \text{Trade}_{k \text{ to } j,y}\right]_{-} \text{Prob}_{\text{Pest},j,y} \times \text{Trade}_{j \text{ to EU},y-} \text{Prob}_{\text{Pest},j,y} \times \text{Trade}_{j \text{ to non-EU},y}.$$

At the end the average over all years in the specified period is taken.

$$\text{Comm}_{\text{Pest},j} = \text{Mean}_y \left(\text{Comm}_{\text{Pest},j,y}\right).$$

TABLE E.4 Calculation of finally allocated possibly infested material in a Member State.

Abbreviation	Calculation	Description
j		Index for one of the 27 Member States of the current EU (EU-27)
y		Index for the year
$\text{Comm}_{\text{Pest, j, y}}$	See above	Allocated weight of the possibly infested material in the Member State 'j' in the year 'y'
$\text{Comm}_{\text{Pest, j}}$	See above	Allocated weight of the possibly infested material in the Member State 'j' in the year 'y'

The median gives a single value neither over- or underestimating the amount regarding the uncertainties. The profile over all Member States is used as input to the entry model.

APPENDIX F

Climate suitability maps

F.1 | MONTHLY AVERAGE TEMPERATURE FOR THE EU

The monthly average temperature for the EU is shown in Figure F.1. These maps were used in combination with the trade windows to evaluate the likely temperature encountered by the pest at arrival in the EU.

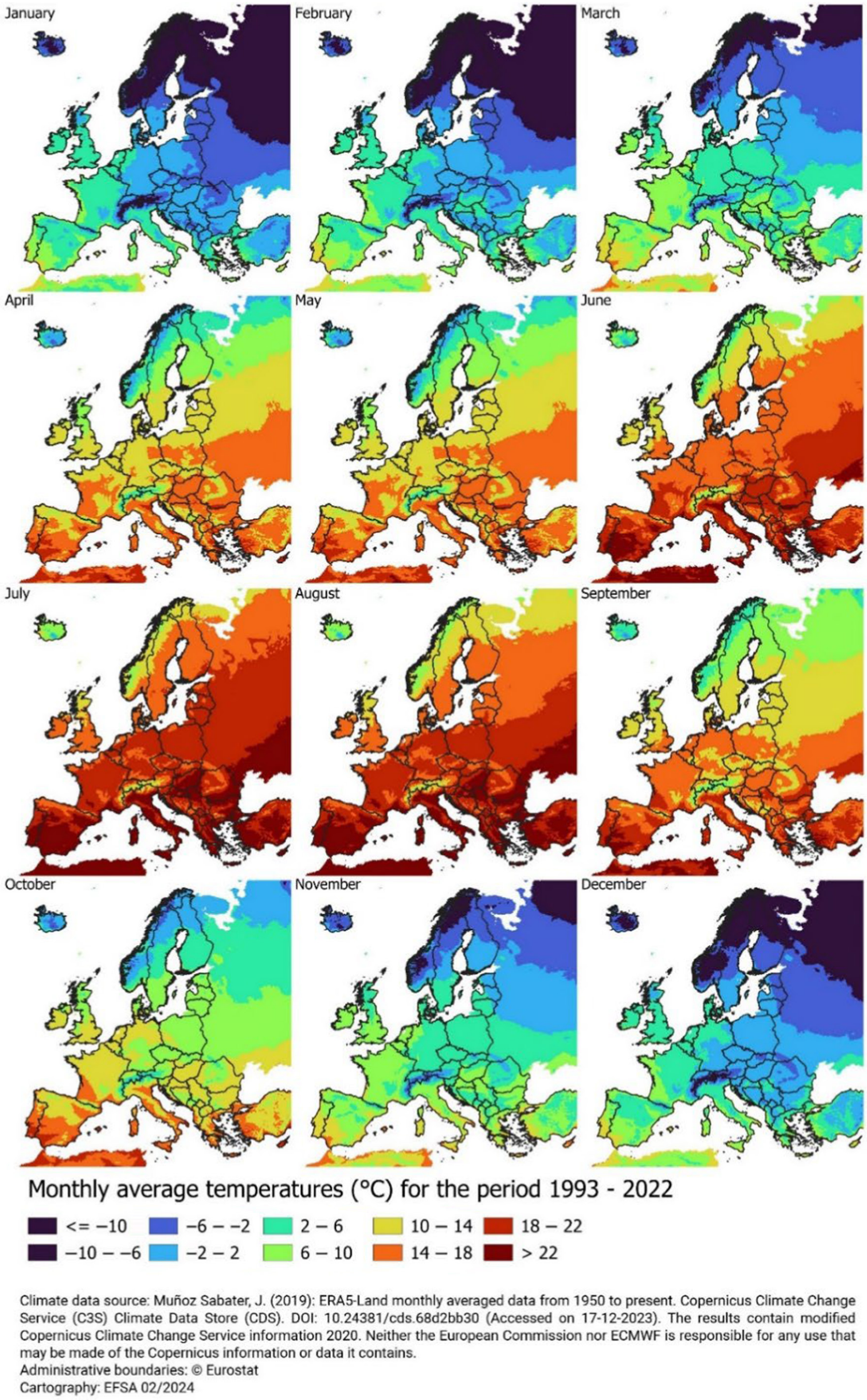


FIGURE F.1 Monthly average temperature for the EU.

F.2 | KÖPPEN–GEIGER

Since the area of the assessment is the EU, the Köppen–Geiger climate matching map shows only climate types that are present in this area. If *R. syriacus* was reported occurring in a climate type that does not occur in the EU, this climate is not mapped as a relevant climate for the assessment.

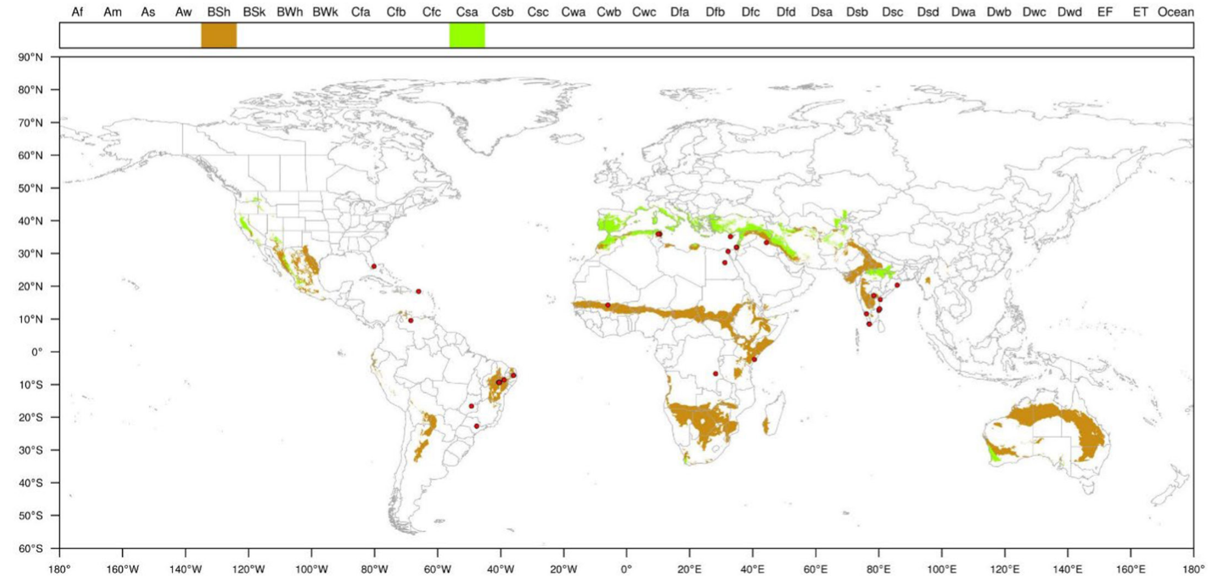


FIGURE F.2 Köppen–Geiger climate types occurring in places where *Retithrips syriacus* has been reported and in the EU.

F.3 | HARDINESS ZONE

The observed pest distribution was used to sample the average annual minimum temperature raster layer, corresponding to a specific hardiness zone, where the pest was observed. All the areas in EU having an equal or higher hardiness zone corresponding to the sampled minimum temperature were mapped. The hardiness zones map implemented for this analysis was based on the updated version of the USDA Plant Hardiness Zones (2023) which identifies 13 main zones, each divided into two subzones, for a total of 26 hardiness zones.

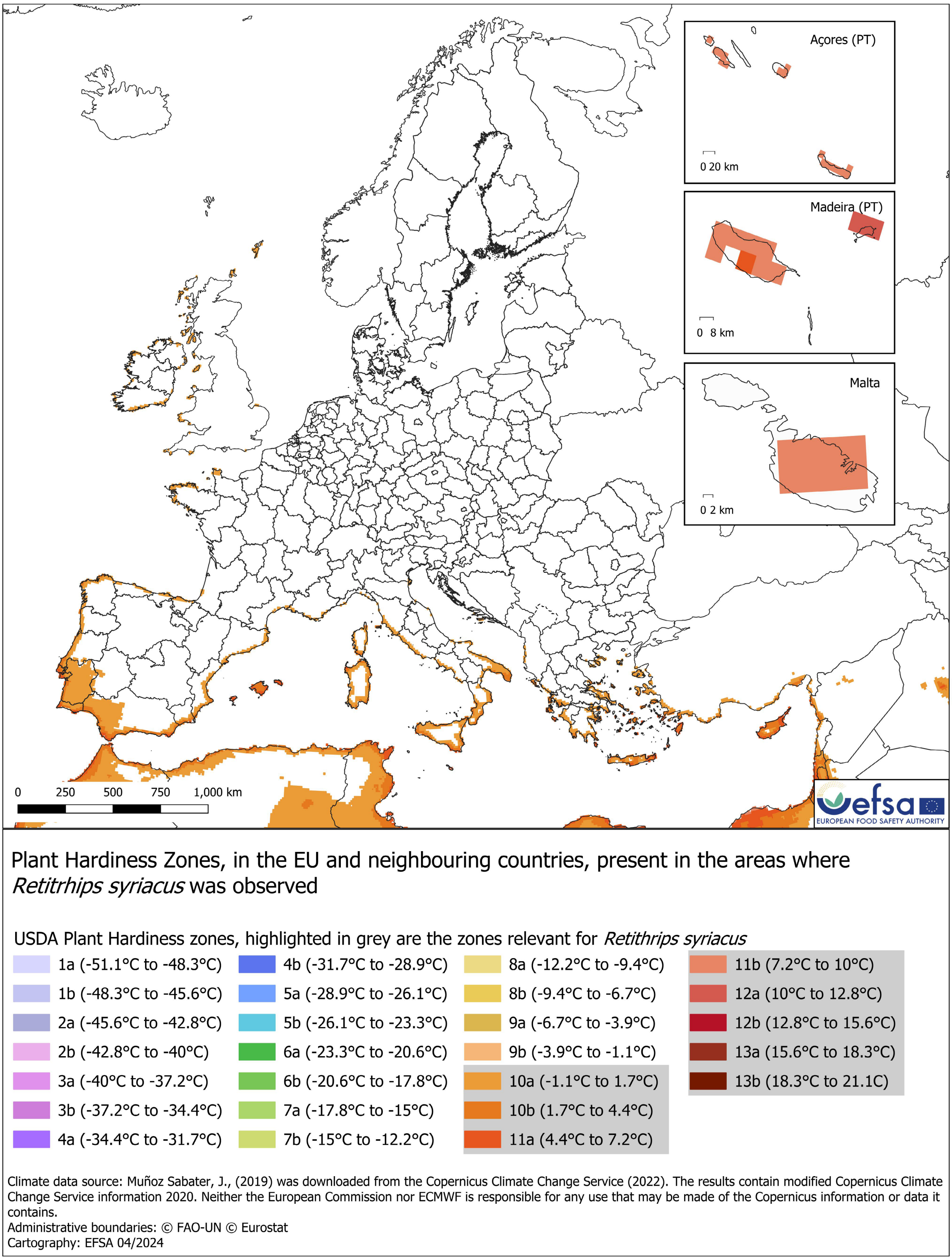
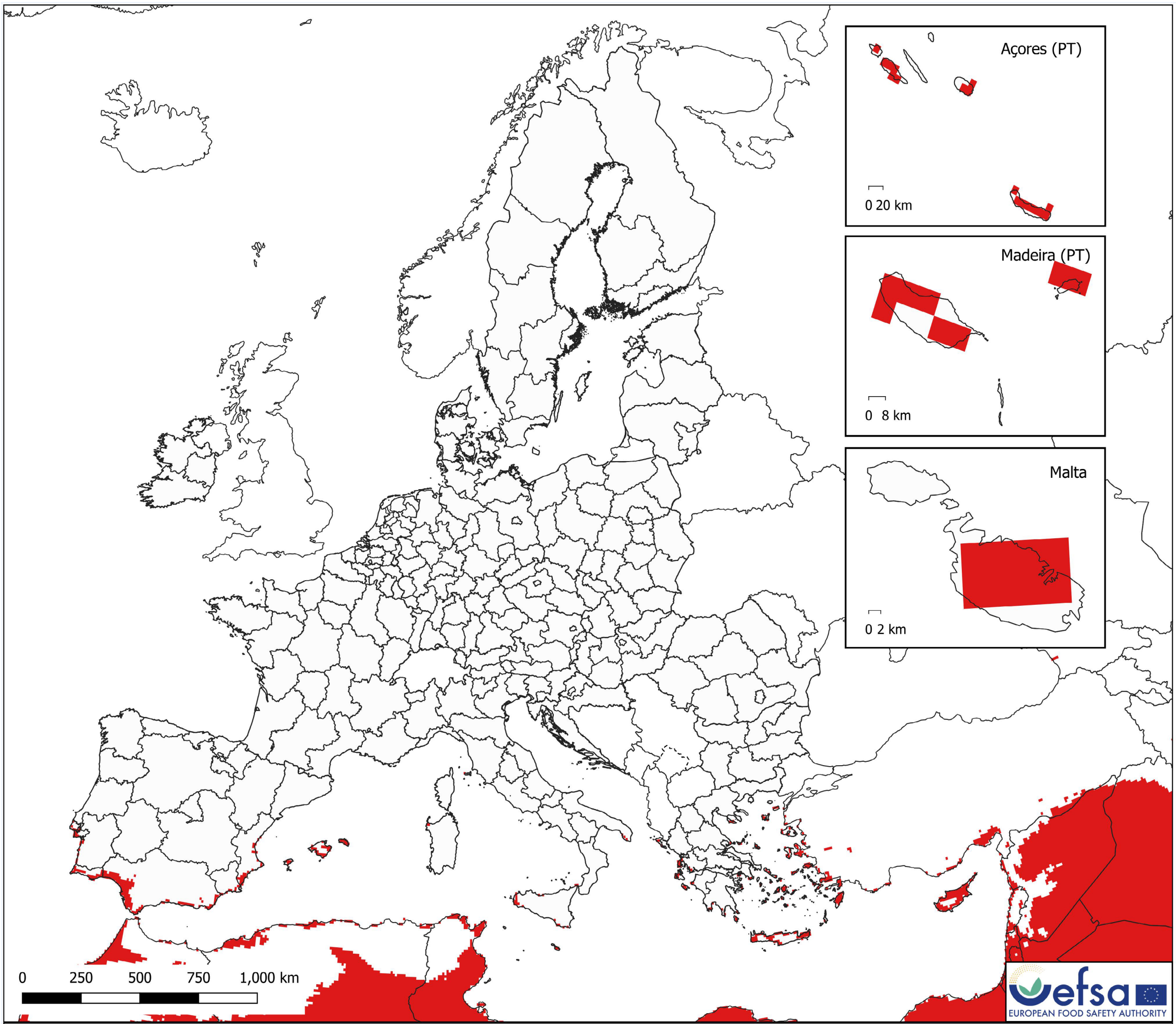


FIGURE F.3 Hardiness zone map based on the average annual minimum temperature for the period 1993–2022. The map highlights the hardiness zones (highlighted in grey in the legend) in the EU where the average minimum temperature is higher or equal to the minimum value sampled using *Retithrips syriacus* occurrences. The Hardiness zone map is based on the recent implementation of the USDA Plant Hardiness Zones (2023).

F.4 | MAXIMUM NUMBER OF CONSECUTIVE DAYS BELOW THE LDT

The average maximum number of consecutive days below the lower development threshold was used as an indicator of climate conditions particularly unfavourable to the organism. The LDT for *R. syriacus* was obtained by extracting the average maximum number of consecutive days (period 1993–2022) below the lower development threshold (14.9°C) for each pest observation point. The highest value obtained (114.8 days in Tunisia) was used as a threshold assuming longer period would not be suitable for the pest. The map below shows in red the areas in EU having an equal or lower average maximum number of consecutive days below the LDT.



Average maximum number of consecutive days with the minimum air temperature below 14.9 °C in the EU and neighbouring countries

Highlighted in red are areas with the average maximum number of consecutive days ≤ 114.83 days
Climate data source: Muñoz Sabater, J., (2019) was downloaded from the Copernicus Climate Change Service (2022). The results contain modified Copernicus Climate Change Service information 2020. Neither the European Commission nor ECMWF is responsible for any use that may be made of the Copernicus information or data it contains.
Administrative boundaries: © FAO-UN © Eurostat
Cartography: EFSA 04/2024

FIGURE F.4 Areas in EU where the average maximum number of consecutive days with temperature below lower development threshold (14.9°C) is equal or below the maximum value (114.8 days in Tunisia) derived from the *Retithrips syriacus* distribution occurrences.