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Pest categorisation of *Plicosepalus acaciae*

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Plicosepalus acaciae* (Zuccarini) Wiens & Polhill), the acacia strap flower, a hemiparasitic plant of the family Loranthaceae parasitising woody plants. Host plants include several species of the genera *Vachellia, Tamarix* and *Ziziphus* and various fruit crops. *P. acaciae* is present in the Middle East and Eastern Africa and is not known to occur in the EU. *P. acaciae* has a long flowering period of about 10 months, from June to April the following year, during which flowers are pollinated by insects and birds. *P. acaciae* produces single seeded red berries that are eaten by birds, which then disseminate the seeds. The only known bird observed to disseminate the seeds of *P. acaciae* is *Pycnonotus xanthopygos*, which has been recorded just once (Spain) but it is not established in the EU. *P. acaciae* could enter into the EU with host plants for planting. Host plants are present and suitable climatic conditions occur in parts of the EU. If a suitable bird would adapt to transfer the seeds, establishment and spread of *P. acaciae* within the EU would be possible. If *P. acaciae* would be able to establish and spread, impacts on some crop plants (e.g. *Juglans regia*, *Ficus carica, Punica granatum, Pistacia vera*), ornamental plants, as well as native vegetation could occur. *P. acaciae* fulfils the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest. Uncertainty remains on bird species other than *P. xanthopygos* transferring *P. acaciae*, the magnitude of potential impacts and the host range.

Keywords: pest risk, plant health, plant pest, quarantine, hemiparasitic plant, Acacia Strap Flower, mistletoes

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1. Introduction

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

1.1.1. Background

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

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

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

1.1.2. Terms of Reference

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

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

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

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

1.2. Interpretation of the Terms of Reference

Plicosepalus acaciae is one of a number of pests listed in Annex 1 to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential Union quarantine pest for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores, and so inform EU decision-making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/ 2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *Plicosepalus acaciae* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name, synonyms and the common name of the pest as search term. Publications relevant for the pest categorisation were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), the CABI databases and scientific literature databases as referred above in Section 2.1.1.

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

The Europhyt and TRACES databases were consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

2.2. Methodologies

The Panel performed the pest categorisation for *Plicosepalus acaciae*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013).

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

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

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest clearly defined, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.

Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways for entry and spread.
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impacts?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.

The Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3 (d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes, the identity of the *Plicosepalus acaciae* is well established.

Plicosepalus acaciae ((Zuccarini) Wiens & Polhill), the acacia strap flower, synonym *Loranthus acaciae* (Zuccarini), is a hemiparasitic plant of the family Loranthaceae within the order of the Santalales. The order was revised by Nickrent (2020) to contain 20 families, most of them consisting entirely of parasitic plants. Loranthaceae is the largest family in the Santalales order, which contains stem parasitic plants commonly known as mistletoes (Nickrent and Musselman, 2004).

The EPPO code[1] (Griessinger and Roy, 2015; EPPO, 2019) for *P. acaciae* is: LOAAC (EPPO, online).

3.1.2. Biology of the pest

P. acaciae is a stem hemiparasitic evergreen plant starting its life cycle from the deposition of viable seeds by birds on branches of the woody host plant species. After germination and contact of the hypocotyl – radix complex with the host substrate a holdfast is formed, which develops into the haustorium establishing the structural and physiological continuity with the host tissue (Rödl and Ward, 2002). Secondary haustoria are produced on the runners of *Plicosepalus* spp., as they spread over the host branches (Qasem, 2009). *P. acaciae* accesses water as well as nutrients (through passive uptake) from the host. Indeed, the nitrogen status of *P. acaciae* was found to be dependent on that of its acacia host (Bowie and Ward, 2004). According to Qasem (2009), the life span of the species is 6–7 years. In its native areas, *P. acaciae* has a long flowering period of about 10 months, from June to April of the following year. During this period, some plant individuals flower twice while others are at the flowering stage for the entire period (Vaknin et al., 1996). Flowers are pollinated by a wide spectrum of insects, mainly bees, and birds, with the orange-tufted sunbird (*Nectarinia osea osea*)

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

being the main pollinator in the winter flowering time (Vaknin et al., 1996). *P. acaciae* produces single-seeded red berries that are eaten by birds, which then disperse the seeds. No other mechanisms of spread have been reported. An investigation in the Arava valley, Israel, found that *Pycnonotus xanthopygos* was the sole avian visitor being observed feeding on *P. acaciae* fruit (Green et al., 2009). These birds swallow the whole berries leaving the seeds viable, which are covered in a sticky substance (viscin). When the birds defecate perching on branches of trees and shrubs, the seeds become attached with the viscin (Green et al., 2009). The sticky seeds may also be dispersed by birds when they wipe their bills on branches (Qasem, 2009). *P. xanthopygos* is the only bird reported to distribute the seeds. If no other bird species present in the EU would disseminate *P. acaciae*, spread by natural means would not be possible. *P. acaciae* has also been found on halophytic host plants (e.g. *Atriplex halimus, Tamarix* spp.) growing in saline substrates and has been classified as a facultative euhalophyte, which increases its halo-succulence according to the host (Veste et al., 2015). *P. acaciae* is used in its native range as traditional medicine for treatment of variable diseases due to its antimicrobial activity (Elegami et al., 2001; Badr et al., 2013).

3.1.3. Host range/Species affected

P. acaciae has been observed on 44 host species (Appendix A) with 15 species in the Fabaceae family. In Jordan, *P. acaciae* was most common on the Anacardiaceae *Searsia tripartita,* the Casuarinaceae *Casuarina equisetifolia,* the Fabaceae *Vachellia farnesiana, Parkinsonia aculeata, Erythorstemon gilliesii,* and *Retama raetam,* the Moraceae *Ficus carica,* the Punicaceae *Punica granatum,* the Rhamnaceae *Ziziphus lotus* and *Z. spina-christi,* and the Tamaricaceae *Tamarix ramosissima* (Qasem, 2011). According to Qasem (2009), the host range of *P. acaciae* has expanded in Jordan from six host species reported in 1982 in the book 'Weeds of Jordan' by B. E. Abu-Irmaileh (cited in Qasem, 2009) to 26 hosts species reported in 2009 (Qasem, 2009, 2011). It is unclear if this observation reflects a true expansion of the host range or if some of the hosts were previously overlooked.

In Israel, the highest frequency of observations of *P. acaciae* in the Arava valley was reported for *Vachellia tortilis, V. tortilis* subsp. *raddiana* and *Tamarix nilotica* (Todt et al., 2000). Twenty of the hosts are cultivated in Israel and Jordan (Qasem, 2011; Veste et al., 2015) but, most likely, just *Ficus carica, Pistacia vera, Juglans regia* and *Punica granatum* are grown for commercial fruit production, while some others are grown for ornamental plantings. In Sudan, *P. acaciae* is known to infect *Vachellia seyal* (Elegami et al., 2001), but additional information about host plants outside Israel and Jordan has not been found. However, given the wider distribution of *P. acaciae* (Figures 1 and 2), the host plant range might also be wider than reported.

3.1.4. Intraspecific diversity

Intraspecific diversity of *P. acaciae* has not been reported.

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes. Detection and identification methods are available.

An identification key is provided in the general account of mistletoes in Africa by Polhill and Wiens (1998). Waly et al. (2012) provide a key for the identification of Loranthaceae species in Saudi Arabia, including *P. acaciae*. The genus Plicosepalus includes 12 accepted species with a native distribution throughout southern and eastern Africa, the Arabian Peninsula and the Middle East (https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:25317-1#children).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

P. acaciae is present in the Middle East (Jordan, Lebanon, Israel, Syria, Oman, Palestine, Saudi Arabia, Yemen, Egypt (Sinai)) and parts of Eastern Africa (Chad, Eritrea, Ethiopia, Somalia, Sudan, South Sudan) (Figure 1). According to the Plants of the World Online database, *P. acaciae* is native in this distributional range and alien occurrences outside this range are not known (POWO, 2019).

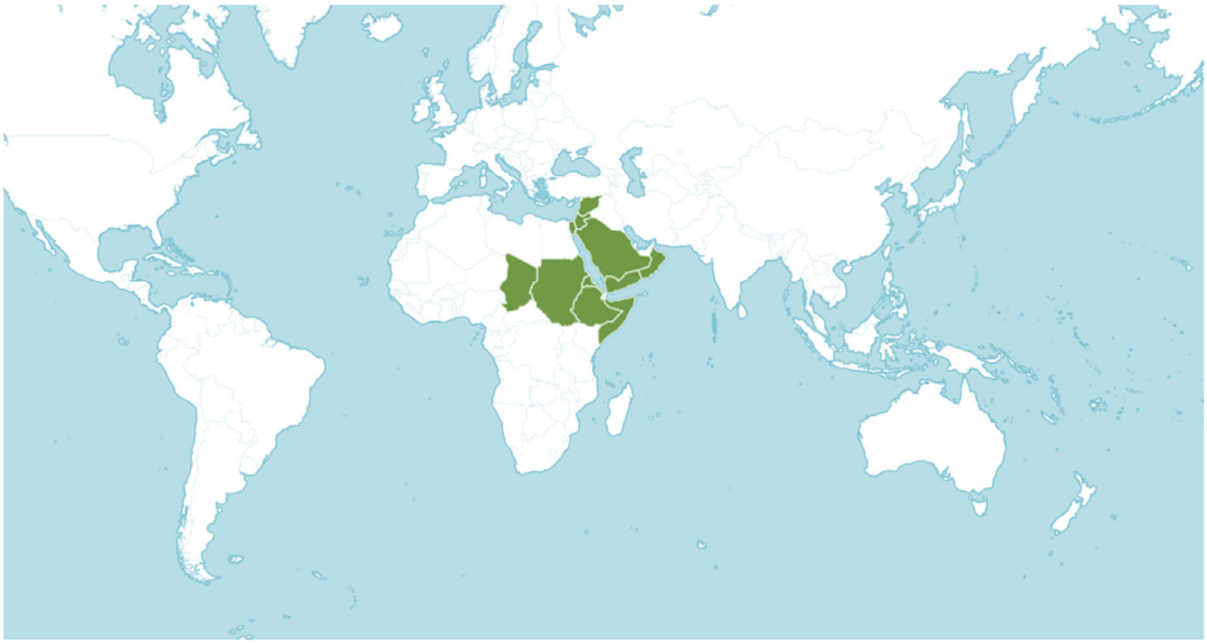

Figure 1: Global distribution of *Plicosepalus acaciae* (Source: Plants of the World Online, https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:915368-1#source-KB, accessed 6 November 2021)

The GBIF database has 181 records of *P. acaciae* (GBIF Secretariat, 2021a) which were considered reliable by the EFSA PLH Panel. The observations fall into the range reported in Plants of the World Online; however, most records (70%) are from Jordan and Israel (Figure 2), which is possibly related to higher recording efforts in these countries.

Figure 2: Georeferenced records of *Plicosepalus acaciae* in the GBIF database (GBIF Secretariat: GBIF Backbone Taxonomy. https://doi.org/10.15468/39omei Accessed via https://www.gbif.org/species/4001543 (6 December 2021))

3.2.2. Pest distribution in the EU

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

No. *P. acaciae* is not reported to be present in the EU.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

P. acaciae is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031.

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

None of the host plants, plant products and other objects that are *P. acaciae* hosts are listed in Annex VI of Regulation (EU) 2019/2072 and hence not prohibited from introduction into the EU from third countries. Some of the hosts which belong to the genera *Acacia*, *Albizia*, *Nerium, Juglans and Salix,* as well as *Ficus carica*, are included in the Commission Implementing Regulation (EU) 2018/2019 on high-risk plants. The panel noted that the scientific name of some hosts from the genus *Acacia* (*A. asak, A. farnesiana, A. nilotica, A. raddiana, A. tortilis, A. seyal*) to *Vachellia* (*V. farnesiana, V. nilotica, V. raddiana, V. tortilis)* and *Senegalia* (*S. asak*) has changed, and hence, it is different now from the nomenclature used in the Commission Implementing Regulation (EU) 2018/2019.

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

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

Comment on plants for planting as a pathway.

Yes. *P. acaciae* is able to enter the EU with plants for planting as the main entry pathway.

The PLH Panel identified the following main pathway for the entry of the pathogen into the EU territory:

1. Host plants for planting originating in infested third countries (see Section 3.2.1).

In principle, birds could be a pathway of entry. However, entry of *P. acaciae* with birds as dispersal vectors seems unlikely. According to Green et al. (2009), *Pycnonotus xanthopygos* was the only bird observed feeding on *P. acaciae* berries. The average transit times (the time from seed uptake to deposition) was about 20 min and the maximum distance from uptake to deposition was 270 m with 73.3% of seeds deposited within 100 m of the parent plant (Green et al., 2009). The increase in abundance of *P. acaciae* in Israel has been attributed to the increase of the population of *P. xanthopygos*, which has been linked to the increase in agricultural settlements in the area (Green et al., 2009).

The distributional range of the *P. xanthopygos* overlaps with the range of *P. acaciae*, but also extends to Turkey, according to the GBIF database (GBIF Secretariat, 2021b). Nevertheless, there are no reports of *P. acaciae* being present in Turkey.

Other potential pathways could be parasitised branches of host plants used for ornamental purpose and dried *P. acaciae* plants bearing fruits used for medicinal purpose (Elegami et al., 2001). However, these pathways are of minor importance as it is unlikely that seeds would be transferred from these pathways to potential host plants growing in the EU (Table 2).

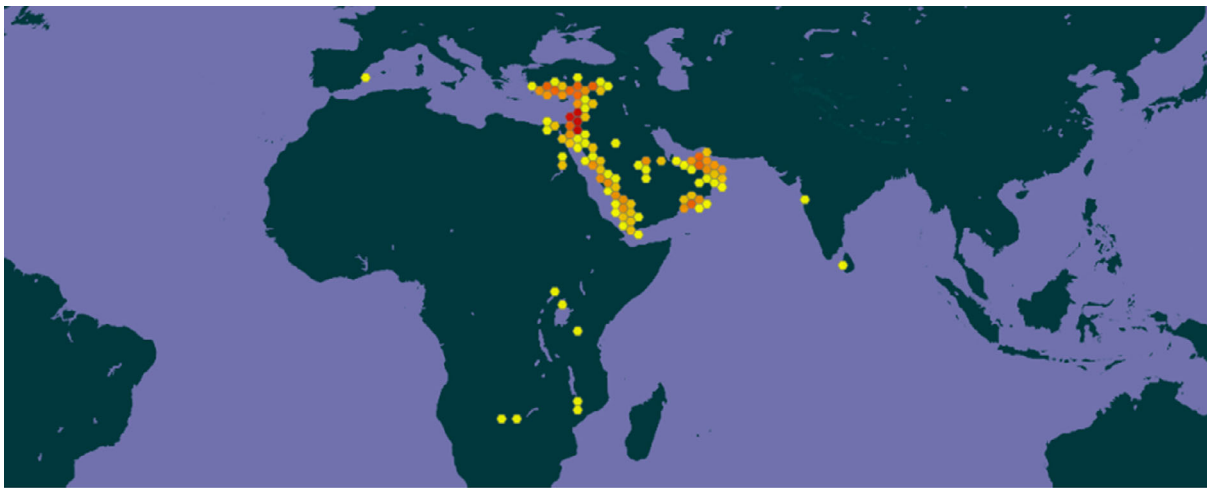

Figure 3: Distribution of *Pycnonotus xanthopygos* (GBIF Secretariat: GBIF Backbone Taxonomy. https://doi.org/10.15468/39omei Accessed via https://www.gbif.org/species/2486116 (6 December 2021))

Table 2: Potential pathways for *Plicosepalus acaciae* into the EU 27

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
Plants for planting	Seed or plant	No relevant mitigation available within Implementing Regulation 2019/2072 for any of the hosts originating from the countries where *P. acaciae* occurs (see Appendices A and B)
Trade of branches of host plants	Seed or plant	No relevant mitigation available within Implementing Regulation 2019/2072 for any of the hosts (see Appendices A and B)

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As at 29 November 2021, there were no records of interception of *P. acaciae* in the Europhyt and TRACES databases.

3.4.2. Establishment

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

Yes. Establishment of *P. acaciae* is possible if parasitised hosts are planted in the EU territory and a suitable vector bird would be able to transfer the seeds onto host plants growing in the EU.

Host plants are present in the EU and parts of the EU have suitable climatic conditions for the establishment of *P. acaciae*. The only bird documented to transfer the seeds is *P. xanthopygos*. It has only been recorded once in the EU in 2005 when it was caught in a trap (https://www.gbif.org/occurrence/1618349188). No further evidence of its presence in Europe was found. *P. xanthopygos* is not known to be established neither as breeding nor migratory bird in the EU (Figure 3). There is uncertainty if other birds present in the EU could transfer seeds to hosts grown in the EU. However, a large range of bird species occurring in Europe feed on berries of mistletoes e.g. on *Viscum album* (Mellado and Zamora, 2014) and blackbird (*Turdus merula*) and mistle thrush (*Turdus viscivorus*) feed on *Loranthus europeaus* (Krasylenko et al., 2019). Furthermore, it was noted that *P. acaciae* was also found outside of the documented distribution of *P. xanthopygos* suggesting that other birds could also act as vectors (see also Section 3.4.3)

3.4.2.1. EU distribution of main host plants

Several host plants of *P. acaciae* are present in the EU. The Plants of the World Online database (https://powo.science.kew.org/) classifies 12 of the host plants as native in parts of the EU territory, and 12 as alien to at least one EU MS. Host species considered absent (i.e. not recorded in the flora of any EU country) can still be used as ornamental plants in the EU. Host plants found to be more

frequently parasitised by *P. acaciae* in Jordan (Qasem, 2009) and present in the EU include *Vachellia farnesiana, Nerium oleander* and *Tamarix ramosissima,* which are frequently planted as ornamentals. Among crop plants more frequently parasitised, fig (*Ficus carica*), and pomegranate (*Punica granatum*) trees are frequently grown commercially in EU countries (Stover et al., 2007; Holland et al., 2009). *P. acaciae* was found rarely on walnuts (*Juglans regia*) and pistachios (*Pistacia vera*) (Qasem, 2009) that are also frequently grown as crops in the EU (Fabbri and Valenti, 1998, Barone and Marra, 2005) (see Table 3). As outlined in Section 3.4.1, successful establishment of *P. acaciae* depends on the availability of a suitable vector to transfer the seeds onto host plants. There is some uncertainty which bird species other than *P. xanthopygos* would be able to transfer the seeds (see Section 3.4.1). The reported expansion of the host range in Jordan (Qasem, 2009) and the observation of the species on cultivated hosts not native in the range of *P. acaciae*, also indicates the potential for establishment on plants not previously reported as hosts for *P. acaciae*.

Table 3: Harvested area of *Plicosepalus acaciae* hosts in EU 27, 2016–2020 (1,000 ha). Source EUROSTAT (accessed 9 November 2021) https://ec.europa.eu/eurostat/databrowser/view/apro_cpsh1/default/table?lang=e4

Crop	2016	2017	2018	2019	2020
Figs	477.86	495.80	469.39	410.79	451.14
Walnuts	831.18	962.39	955.40	907.91	939.80

3.4.2.2. Climatic conditions affecting establishment

The climatic zones in parts of the distributional range of *P. acaciae* are present within the EU (Figure 4). Based on the Köppen–Geiger climate classification, the most relevant climate zone is BSh, with few records of *P. acaciae* in the Csa zone. Areas in the EU climatically suitable for the establishment of *P. acaciae* therefore include in particular the Mediterranean coastal areas. In this area, the host plants mentioned in Section 3.4.2.1 are also frequently found.

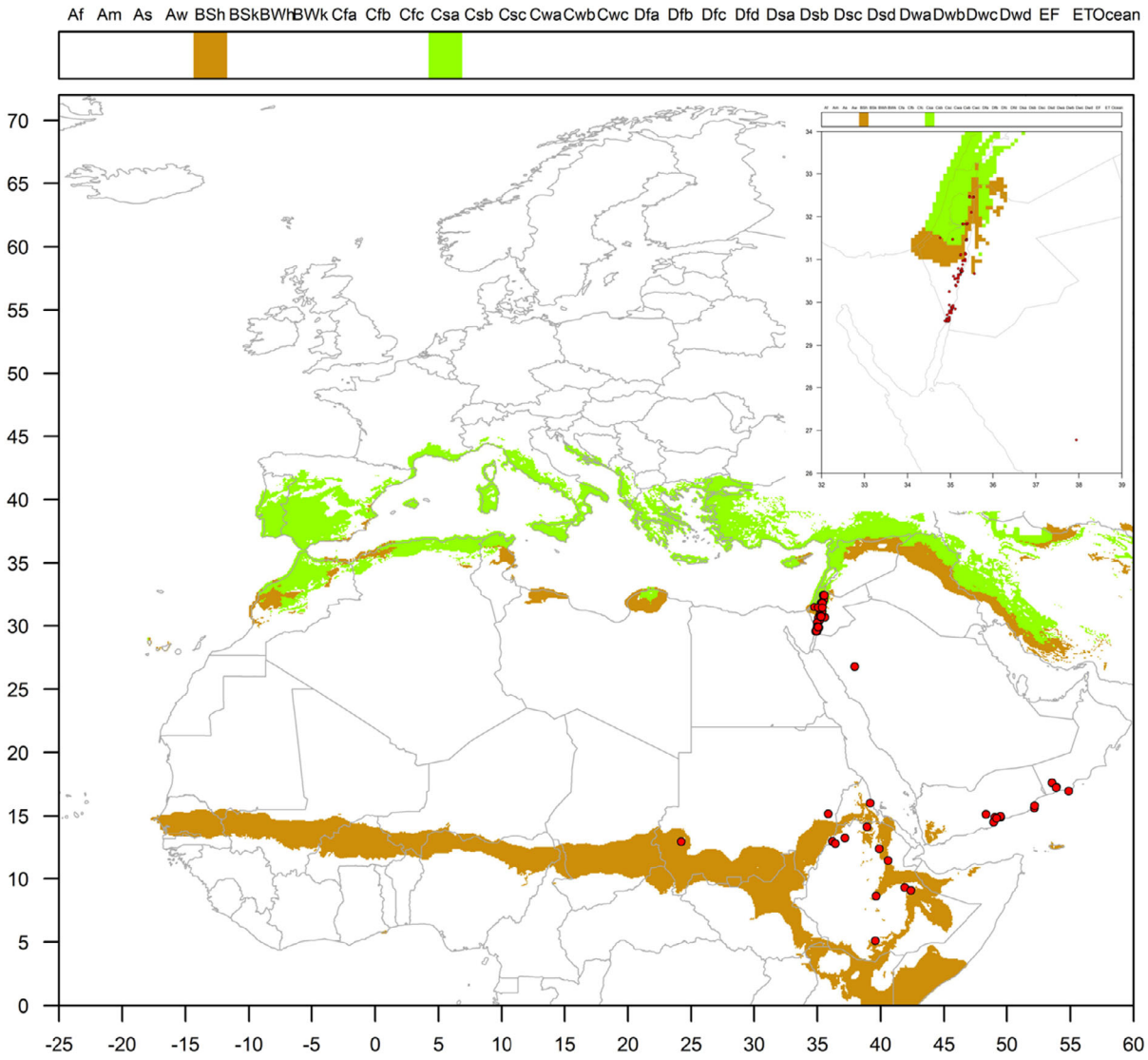

Figure 4: Distribution of two Köppen-Geiger climate types, BSh, Csa that occur in the EU and in countries where *Plicosepalus acaciae* has been reported. Red dots indicate point locations where *P. acaciae* was found according to the GBIF database (GBIF Secretariat, 2021a). The inset map provides more detail for Israel, Jordan and Palestine. The legend shows the list of Köppen–Geiger climates.

3.4.3. Spread

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

Yes, the pest would be able to spread if birds present in the EU adapt to feed on the fruits and vector the seeds or if *P. xanthopygos* invades and establishes in the EU. Plants for planting is another possible mechanism of spread.

P. acaciae, as most aerial mistletoe species, is disseminated by birds (Vidal-Russell and Nickrent, 2008; Green et al., 2009). Loranthaceae are characterised by a high degree of affinity between the parasitic plants and their dispersal vectors, which are almost always birds, and are highly dependent on their dispersers for reaching a suitable host (Vidal-Russell and Nickrent, 2008; Green et al., 2009). In Israel, *P. acaciae* dispersal is dependent on *P. xanthopygos* (Green et al., 2009).

P. xanthopygos is considered not available as a vector in Europe (see Section 3.4.2). If no other bird species present in the EU would disseminate *P. acaciae*, spread by natural means would not be possible. However, the distribution of *P. acaciae* includes regions where no occurrence records of

P. xanthopygos have been reported (e.g. Ethiopia, Yemen). This provides an indication that *P. acaciae* can be distributed also by other bird species (unless *P. xanthopygos* is present but not recorded in these countries). A large range of bird species occurring in Europe feed on berries of mistletoes (see Section 3.4.2). If one of those bird species would adapt to transfer the seeds of *P. acaciae*, spread of *P. acaciae* within the EU would be possible.

Movement of plants for planting is another possible mechanism of spread.

3.5. Impacts

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

Yes. If *P. acaciae* would be able to establish and spread, impacts on some crop plants (*Ficus carica, Punica granatum, Pistacia vera, Juglans regia*), plants used as ornamentals as well as native vegetation could occur.

There is little information on potential negative impacts of *P. acaciae* on parasitised host species.

A survey performed in Jordan found 26 woody host plants of *P. acaciae*, of which eight (*Casuarina equisetifolia, Melia azedarach, Nerium oleander, Pistacia atlantica, Poinciana gilliesii, Retama raetam, Searsia tripartita, Tamarix ramosissima*) were found to be severely affected (Qasem, 2011). It was destructive to *Ziziphus* spp., killing *Ziziphus spina-christi* in many places (Qasem, 2011). In Israel, *P. acaciae* was found to infect up to 80% of the *Ziziphus spina-christi* trees, with infected plants having dead branches and reduced fruit production (Ward et al., 2006). *P. acaciae* is therefore considered to have significant negative impacts on this endangered species and to contribute to its decline (Ward et al., 2006). *Ziziphus spina-christi* is not native in the EU, but is used as an ornamental plant. Another *Ziziphus* species, *Z. jujuba*, is traditionally and locally cultivated in Italy as a fruit crop (Veneto, Romagna, Tuscany and Campania), although it growing area is very limited.[2]

Bowie and Ward (2004) investigated *P. acaciae* infections of *Vachellia tortilis* subsp. *raddiana* (Syn. *Acacia raddiana*) in the Negev Desert, but concluded they were not causing high acacia mortality in the area. Similarly, Stavi et al. (2014) investigating reasons for the mortality of acacia species in the Negev desert and Arava valley concluded that despite the fact that about 8% of the trees in their study were parasitised by *P. acaciae,* this was presumed to have no effect on tree viability because just one of the 162 infected trees was dead.

Qasem (2009, 2011), in a survey for mistletoe infections in Jordan including fruit tree orchards, found evidence of moderate severity of impacts on fig trees (*Ficus carica*) and pomegranate (*Punica granatum*), and light severity of impacts on walnuts (*Juglans regia*) and pistachios (*Pistacia vera*). These assessments were made by visual observation of the level of infestations (Qasem, 2011) and did not involve quantifications of the impacts on crops. Furthermore, several crop trees surveyed (and reported to be parasitised by other mistletoes species) were not observed to be infected by *P. acaciae* including apricot (*Prunus armeniaca*), cherry (*Prunus cerasifera*), plum (*Prunus domestica*), olive (*Olea europaea*), *Citrus* spp., apple (*Malus domestica*) and grapevine (*Vitis vinifera*) (Qasem, 2011). Mathiasen et al. (2008), in a review of mistletoes, did not include *Plicosepalus* spp. in their list of pathogenic genera of mistletoes, but also pointed out, that there was a lack of data quantifying the economic damage caused by most mistletoe species.

There is high uncertainty on the magnitude of impacts due to the lack of data on the severity and possible extent of impacts on crop species, native vegetation, as well as ornamental plants. It is also unclear, how impacts on ornamental plants would be perceived, as *P. acaciae* has a long flowering period and produces flowers that could be considered beneficial from an ornamental gardeners' perspective. There is also a lack of information on possible impacts of *P. acaciae* in other areas of its distribution outside Israel and Jordan.

3.6. Available measures and their limitations

Are there measures available to prevent the entry into the EU (and spread for pests already present) such that the risk becomes mitigated?

[2] https://www.ortodacoltivare.it/frutti/giuggiolo.html, https://www.agraria.org/coltivazioniarboree/giuggiolo.htm

No phytosanitary measures specific to *P. acaciae* exist that would mitigate the likelihood of entry, establishment and spread. However, potential additional risk reduction options exist to mitigate the risk of entry, establishment and spread of *P. acaciae* (see Section 3.6.1).

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some host plants for planting (see Section 3.3.2). Additional potential risk reduction options and supporting measures are shown in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1. Additional potential risk reduction options

Potential control measures on hosts that are imported are listed in Table 4.

Table 4: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Require pest freedom	Plants and branches of host plants must come from a country officially free from *P. acaciae* or from a pest free area or from a pest free place of production.	Entry/Spread
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses. Growing plants in isolation could be an effective control measure	Entry/Spread/Impact
Roguing and pruning	Roguing is defined as the removal of infested plants and/or uninfested host plants in a delimited area, whereas pruning is defined as the removal of infested plant parts only without affecting the viability of the plant. Pruning the host branch is an efficient measure to remove the parasitic plant. The branch should be pruned at least 30–40 cm from the mistletoe, since roots may easily extend 30 cm in either direction into the branch of its host plant.	Entry/Establishment/Spread/Impact
Biological control and behavioural manipulation	Scaring birds away or preventing them from entering sites where hosts are grown	Establishment/Spread/Impact

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 5.

Table 5: Selected supporting measures (a full list is available in EFSA PLH Panel et al., 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Supporting measure	Summary	Risk element targeted (entry/ establishment/ spread/impact)
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5). Inspection is an efficient supporting measure to detect *P. acaciae*. However, very small parasitic plants might not be noticed.	Entry/ Establishment/ Spread
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing. For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology.	Entry/Spread
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import) b) plant passport (EU internal trade) A phytosanitary certification confirming that the plant originates outside of the range of occurrence of *P. acaciae* is an efficient measure.	Entry/Spread
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by the NPPO in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries. The risk is reduced if the plants are from approved premises free of *P. acaciae*.	Entry/Spread
Delimitation of Buffer zones	ISPM 5 defines a buffer zone as 'an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate' (ISPM 5). The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place (PFPP), site (PFPS) or area (PFA). Buffer zones would need to be sufficiently large in order to avoid spreading of seeds by birds. *P. xanthopygos* has been observed to spread seeds to a distance of up to 270 m (Green et al., 2009), which could be considered as a minimum distance. Additionally, *P. xanthopygos* is mainly resident, although local movement occur in search of fruit sources. Altitudinal migration may occur (Fishpool and Tobias, 2005).	Spread

Supporting measure	Summary	Risk element targeted (entry/ establishment/ spread/impact)
Surveillance	*P. acaciae* is not reported to be present in the EU. Surveillance would be an efficient supporting measure.	Establishment/ Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures to prevent the entry (and spread when applicable) of the pest

No biological or technical factors were identified which could limit the effectiveness of measures to prevent the entry and spread of the pest.

3.7. Uncertainty

Uncertainty exists on the potential transfer of *P. acaciae* seeds to host plants grown in the EU because data are lacking on the dispersal of seeds of *P. acaciae* by birds other than *P. xanthopygos*, and if bird species present in the EU would potentially distribute the seeds and over which distances.

Uncertainties also exist on the severity and possible extent of impacts on crop species, native vegetation as well as ornamental plants.

Uncertainties exist regarding the host range since the available evidence of the host range is from Israel and Jordan only. One host species has been reported from outside this area from Sudan and observations from Jordan indicate the ability of *P. acaciae* to expand its host range.

4. Conclusions

P. acaciae has not been reported to be present in the EU territory. The parasitic plant fulfils the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest (Table 6).

Table 6: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of *P. acaciae* is well-established.	None
Absence/presence of the pest in the EU (Section 3.2)	No. *P. acaciae* has not been reported from the EU	None
Regulatory status (Section 3.3)	*P. acaciae* is not regulated in the EU.	None
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*P. acaciae* could enter the EU with plants for planting. Climatic conditions are suitable for establishment in parts of the EU. If a suitable bird-vector species would adapt to transfer the seeds, spread of *P. acaciae* within the EU would be possible. Spread would be also possible by human-assisted means, e.g. movement of parasitized host plants for planting.	It is unknown, if birds which are present in the EU may transfer the seeds of *P. acaciae*. The host range could be wider than documented.
Potential for consequences in the EU (Section 3.5)	If *P. acaciae* would be able to establish, impacts on some crop plants (e.g. *Ficus carica, Punica granatum, Pistacia vera, Juglans regia*), native vegetation as well as plants used as ornamentals could occur.	Uncertainty on the magnitude of impacts in the EU.
Available measures (Section 3.6)	Phytosanitary measures (prohibitions) are currently applied to some host plants for planting (see Section 3.3.2) Additional measures exist to prevent entry into, establishment or spread of the pest within the EU.	None

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Conclusion (Section 4)	*P. acaciae* fulfils the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest.	None
Aspects of assessment to focus on/scenarios to address in future if appropriate:	Information on potential vectors of seeds and impacts on host plants is required.	

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Abbreviations

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

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2018)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2018)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2018)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2018)

Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2018)
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Hitchhiker	An organism sheltering or transported accidentally via inanimate pathways including with machinery, shipping containers and vehicles; such organisms are also known as contaminating pests or stowaways (Toy and Newfield, 2010).
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2018)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2018)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2018)
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2018)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2018)

Appendix A – Plicosepalus acaciae host plants/species affected

Host status	Host name	Plant family	Common name	Reference[A]
	Acacia saligna (=Acacia cyanophylla)	Fabaceae		Qasem (2011)
	Acacia tortilis subsp. raddiana (=Acacia raddiana)	Fabaceae		Rödl and Ward (2002), Green et al. (2009), Todt et al. (2000)
	Albizia lebbeck	Fabaceae		Todt et al. (2000)
	Anagyris foetida	Fabaceae		Qasem (2011)
	Atriplex halimus	Chenopodiaceae		Todt et al. (2000)
	Balanites aegyptiaca	Zygophyllaceae		Todt et al. (2000)
	Casuarina cunninghamiana	Casuarinaceae		Todt et al. (2000)
	Casuarina equisetifolia	Casuarinaceae		Qasem (2011)
	Calligonum comosum	Polygonaceae		Todt et al. (2000)
	Capparis spinosa	Capparidaceae		Qasem (2011)
	Ceratonia siliqua	Fabaceae		Qasem (2011)
	Delonix regia	Caesalpiniaceae		Todt et al. (2000)
	Elaeagnus angustifolia	Elaeagnaceae		Veste et al. (2015)
	Erythorstemon gilliesii (=Poinciana gilliesii)	Fabaceae		Qasem (2011)
	Ficus carica	Moraceae		Qasem (2011)
	Haloxylon persicum	Chenopodiaceae		Todt et al. (2000)
	Juglans regia	Juglandaceae		Qasem (2011)
	Melia azedarach	Meliaceae		Qasem (2011)
	Nerium oleander	Apocynaceae		Qasem (2011)
	Nitraria retusa	Zygophyllaceae		Todt et al. (2000)
	Ochradenus baccatus	Resedaceae		Todt et al. (2000)
	Parkinsonia aculeata	Fabaceae		Qasem (2011)
	Pistacia vera	Anacardiaceae		Qasem (2011)
	Pistacia atlantica	Anacardiaceae		Qasem (2011)
	Prosopis chilensis	Fabaceae		Qasem, 2011
	Prosopis farcta	Fabaceae		Qasem (2011), Todt et al. (2000)
	Punica granatum	Punicaceae		Qasem (2011), Todt et al. (2000)
	Retama raetam	Fabaceae		Qasem (2011), Veste et al. (2015)
	Rhamnus spec.	Rhamnaceae		Todt et al. (2000)
	Rhus spec.	Anacardiaceae		Todt et al. (2000)
	Searsia tripartita (=Rhus tripartita)	Anacardiaceae		Qasem (2011)
	Salix alba	Salicaceae		Qasem (2011)
	Senegalia asak (= Acacia asak)	Fabaceae		Qasem (2011)
	Tamarix aphylla	Tamaricaceae		Todt et al. (2000), Veste et al. (2015)
	Tamarix jordanis	Tamaricaceae		Todt et al. (2000), Veste et al. (2015)
	Tamarix nilotica	Tamaricaceae		Todt et al. (2000), Veste et al. (2015)

Host status	Host name	Plant family	Common name	Reference[A]
	Tamarix ramoissima (=Tamarix pentandra)	Tamaricaceae		Qasem (2011)
	Vachellia seyal (= Acacia seyal)	Fabaceae		Elegami et al. (2001)
	Vachellia farnesiana (= Acacia farnesiana)	Fabaceae		Qasem (2011)
	Vachellia nilotica (=Acacia nilotica)	Fabaceae		Qasem (2011)
	Vachelia tortilis (=Acacia tortilis)	Fabaceae		Green et al. (2009), Todt et al. (2000)
	Ziziphus jujuba	Rhamnaceae		Qasem (2011)
	Ziziphus lotus	Rhamnaceae		Qasem (2011)
	Ziziphus spina-christi	Rhamnaceae		Qasem (2011), Todt et al. (2000)

Appendix B – Distribution of Plicosepalus acaciae

Distribution records based on Plants of the World Online, https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:915368-1, accessed 6 December 2021).

Region	Country	Subnational (e.g. State)	Status
Africa	Chad		
	Sudan		
	Eritrea		
	Ethiopia		
	Somalia		
	Egypt		
Asia	Israel		
	Lebanon		
	Syria		
	Jordan		
	Saudi Arabia		
	Yemen		
	Oman		

In addition to the overview distribution in Plant of the World Online, there were 181 georeferenced observations which were considered reliable by the panel in the gbif database https://www.gbif.org/species/4001543 (accessed on 6 December 2021).

Appendix C – EU 27 annual imports of fresh produce of hosts from countries where Plicosepalus acaciae is present, 2016–2020 (in 100 kg)

Source: Eurostat accessed on 10 December 2021

		2016	2017	2018	2019	2020
Edible fruit or nut trees, shrubs and bushes, whether or not grafted	Ethiopia	–	0.00	–	–	–
	Lebanon	–	0.00	–	–	–
	Syria	–	–	–	–	–
	Oman	–	–	–	–	0.05
	Saudi Arabia	–	0.30	18.34	–	–
	Jordan	–	0.00	8.96	–	–
	Egypt	–	32.73	–	0.11	–
	Sudan	–	0.00	–	–	–
	Israel	634.17	1755.41	1350.76	1758.56	55.42
	Sum	634.17	1788.44	1378.06	1758.67	55.47

		2016	2017	2018	2019	2020
Conifer and evergreen outdoor trees, shrubs and bushes, incl. their roots	Ethiopia					
	Lebanon					
	(Syria)					
	Oman					
	Saudi Arabia			128.36		
	Jordan					
	Egypt					
	Sudan					
	Israel	4,959.63	2,124.22	74.23	2.40	
	Sum	4,959.63	2,124.22	202.59	2.4	0

		2016	2017	2018	2019	2020
Outdoor trees, shrubs and bushes, incl. their roots, with bare roots (excl. cuttings, slips and young plants, and fruit, nut and forest trees)	Ethiopia					
	Lebanon					
	Syria					
	Oman					
	Saudi Arabia					
	Jordan					
	Egypt		525.00		840.50	
	Sudan					
	Israel	93.45				
	Sum	93.45	525	0	840.50	0

		2016	2017	2018	2019	2020
Outdoor trees, shrubs and bushes, incl. their roots (excl. with bare roots, cuttings, slips, young plants, conifers, evergreens and fruit, nut and forest trees)	Ethiopia				0.00	0.00
	Lebanon					
	Syria				0.25	
	Oman					
	Saudi Arabia			7.72		
	Jordan					
	Egypt				30.00	
	Sudan					
	Israel	70.25	289.18	64.14	358.51	0.60
	Sum	70.25	289.18	71.86	388.76	0.6

		2016	2017	2018	2019	2020
Live outdoor plants, incl. their roots*	Ethiopia	195.43	36.36	102.53	212.72	1809.82
	Lebanon	4.30	2.90	2.10	1.50	0.10
	Syria					
	Oman		0.00			
	Saudi Arabia		0.00			
	Jordan					0.08
	Egypt	95.43	1.97	0.42	586.76	5.70
	Sudan					
	Israel	2,768.08	1,959.35	2,190.75	3,758.35	2,292.20
	Sum	3,063.24	2,000.58	2,295.80	4,559.33	4,107.90

*: (Excl. bulbs, tubers, tuberous roots, corms, crowns and rhizomes, incl. chicory plants and roots, unrooted cuttings, slips, rhododendrons, azaleas, roses, mushroom spawn, pineapple plants, vegetable and strawberry plants, trees, shrubs and bushes).

Appendix D – EU 27 and member state cultivation/harvested/production area of Plicosepalus acaciae hosts (in 1,000 ha)

Source EUROSTAT (accessed 9 December 2021).

Figs	2016	2017	2018	2019	2020
EU 27	23.74	24.63	24.99	25.59	27.20
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.01	0.03
Czechia	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	3.79	3.82	3.77	3.99	4.40
Spain	12.61	13.56	13.98	14.60	15.72
France	0.38	0.40	0.44	0.44	0.44
Croatia	0.35	0.27	0.27	0.42	0.57
Italy	2.39	2.26	2.23	2.15	2.06
Cyprus	0.10	0.16	0.14	0.16	0.17
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	4.10	4.13	4.13	3.81	3.81
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	0.01	0.01	0.01	0.02	0.02
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00

Walnuts	2016	2017	2018	2019	2020
EU 27	72.61	74.15	80.60	87.62	96.69
Belgium	0.05	0.05	0.08	0.10	0.10
Bulgaria	6.28	5.05	6.18	6.36	7.10
Czechia	0.18	0.19	0.17	0.13	0.16
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.29	0.29	0.29	0.29
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	12.04	13.19	15.27	14.82	20.27
Spain	9.63	10.37	11.00	11.44	12.29
France	21.36	21.63	22.17	25.88	24.99
Croatia	5.40	5.55	6.70	7.21	8.11
Italy	4.54	4.35	4.50	4.67	4.93
Cyprus	0.21	0.19	0.18	0.21	0.21
Latvia	0.00	0.00	0.00	0.00	0.00

Walnuts	2016	2017	2018	2019	2020
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.01	0.01	0.01	0.01	0.01
Hungary	4.85	5.08	5.40	6.00	6.40
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.14	0.14	0.17	0.17	0.18
Poland	2.47	2.38	2.31	2.27	2.70
Portugal	3.32	3.54	3.85	5.37	5.40
Romania	1.67	1.60	1.59	1.62	1.91
Slovenia	0.27	0.34	0.38	0.44	0.47
Slovakia	0.19	0.21	0.36	0.63	1.17
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00