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## Response to scientific and technical information provided by an NGO on *Xylella fastidiosa*

### European Food Safety Authority (EFSA)

#### Abstract

Following the publication of the Scientific Opinion by EFSA's PLH Panel which assessed the risk to plant health posed by *Xylella fastidiosa* in the EU territory and evaluated risk reduction options, EFSA received a request for an urgent response to scientific and technical information provided by an Italian non-governmental organisation (NGO). The NGO claimed that *X. fastidiosa* is not the cause of olive tree decline in Lecce Province in Southern Italy, but only an endogenous element present in the trees that is not active or aggressive unless a series of fungi infect the plants and create the right conditions for the development of *X. fastidiosa*. The NGO also claimed that treatment possibilities do exist to treat such fungi including pruning of infected plants and soil treatment. EFSA has reviewed the submitted documentation and held a hearing with an expert on tracheomycotic fungi associated with olive decline in Apulia. EFSA concluded that currently there is no scientific evidence that tracheomycotic fungi are the primary causal agents of olive quick decline syndrome. EFSA recommended further research – based on pest biology and using replicated and well-designed field experiments – to provide insight into the sustainable management of this complex problem.

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**Keywords:** *Xylella fastidiosa*, *Olea europea*, olive decline, tracheomycotic fungi, *Phaeoacremonium* spp., *Phaeomoniella* spp., *Pleurostomophora* spp.

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## 1. Introduction

### 1.1. Background

After the report in October 2013 of the outbreak of *Xylella fastidiosa* in Lecce province, Apulia, Italy EFSA provided the following scientific advice in response to requests from the European Commission:

- i. Statement of EFSA on host plants, entry and spread pathways and risk reduction options for *Xylella fastidiosa* Wells et al. (<http://www.efsa.europa.eu/en/efsajournal/pub/3468.htm>)
- ii. Scientific Opinion of the EFSA Plant Health Panel on the risks to plant health posed by *Xylella fastidiosa* in the EU territory, with the identification and evaluation of risk reduction options (<http://www.efsa.europa.eu/en/efsajournal/pub/3989.htm>)
- iii. Scientific Report of EFSA on categorisation of plants for planting, excluding seeds, according to the risk of introduction of *Xylella fastidiosa* (<http://www.efsa.europa.eu/en/efsajournal/pub/4061.htm>)

### 1.2. Terms of Reference

The European Commission recently received scientific and technical information from an Italian NGO, Peacelink, claiming that *Xylella fastidiosa* is not the cause of the olive tree decline in Southern Italy. Rather, the NGO claims that *X. fastidiosa* is only an endogenous element that is present in olive trees but is not active or aggressive unless a series of fungi, such as *Pleurostomophora richardsiae*, *Phaeoacremonium aleophilum* and *Neofusicoccum parvum* (see papers annexed to this letter), infect the plants and create the right conditions for the development of *X. fastidiosa*. At the same time, the NGO claims that treatment possibilities do exist to treat such fungi, including pruning of infected plants, and soil treatment (videos provided):

- <https://www.youtube.com/watch?v=ICHAvaelT30&noredirect=!>
- <https://www.youtube.com/watch?v=UhBI5Rd3dS4&feature=youtu.be>

This information calls into question the overall EU control strategy, which is based on the Pest Risk Assessment recently published by EFSA which recommends removal of infected plants, due to the lack of any effective treatment once the plant is infected. The information provided by the NGO has caught the attention of the media and some Members of the European Parliament. Moreover, it was made available at a very sensitive time, since the EU is currently in the review process of the EU emergency measures on *X. fastidiosa*, in view of a possible opinion of Member States at the next Standing Committee of 27-28 April 2015.

Consequently, EFSA was requested to prepare an urgent response by 17 April 2015 to the information provided and its relevance to the control of *X. fastidiosa* in Southern Italy.

### 1.3. Interpretation of the Terms of Reference

This statement of EFSA addresses the EC request for an urgent response (Ref. Ares(2015)1293668 - 24/03/2015) to two specific questions on the *X. fastidiosa* situation in Southern Italy.

**Question 1:** EFSA is asked to analyse the scientific and technical information provided together with the request claiming that *X. fastidiosa* is not the cause of the olive tree decline in Southern Italy, but only an endogenous element present in the trees that is not active or aggressive unless a series of fungi, such as *Pleurostomophora richardsiae*, *Phaeoacremonium aleophilum* and *Neofusicoccum parvum* (see papers annexed to this letter), infect the plants and create the right conditions for the development of *X. fastidiosa*.

**Question 2:** EFSA is asked to evaluate if the provided information supports the claim that treatment possibilities exist to treat such fungi, including pruning of infected plants, and soil treatment.

#### 1.4. Scientific and technical information under assessment

Together with the request from the EC, EFSA was provided with additional scientific and technical information that were scrutinised to formulate this statement. Moreover, EFSA also considered in this document the recently published EFSA scientific advice on *X. fastidiosa* (see section 1.1) and other relevant recent scientific literature, when applicable. Due to the time scale and urgency of this request, a systematic or extensive review of all literature published on these topics was not conducted.

The material provided with the request refers to three distinct issues:

- i. Two scientific papers related to "Olive Decline" in Foggia and Barletta-Andria-Trani provinces, (Carlucci et al., 2013b, 1015)
- ii. A scientific paper discussing the potential establishment of *X. fastidiosa* in olive groves within the Mediterranean basin (Carlucci et al., 2013a)
- iii. Two videos and two certificates of soil analysis, that refer to agronomic and phytosanitary treatment on olive groves in Salento (Apulia)

In addition, a hearing of the first author of the cited papers, Prof. Antonia Carlucci of Università di Foggia, was held at EFSA in Parma on the 15<sup>th</sup> April 2015 with regard to the tracheomycotic fungal species associated with olive decline in Apulia.

## 2. Assessment

### 2.1. *Xylella fastidiosa* in Apulia

The outbreak of *X. fastidiosa* in Apulia was discussed in the Scientific Opinion of the EFSA Plant Health Panel (2015) some excerpts of which are presented below. In October 2013, "the occurrence of *X. fastidiosa* was reported in southern Italy in the province of Lecce, Apulia region, Italy, associated with quick decline symptoms on olive trees (*Olea europaea*), oleander (*Nerium oleander*) and almond (*Prunus dulcis*) (Saponari et al., 2013). Investigations showed that symptomatic olive trees were generally affected by a complex of pests, including *X. fastidiosa*, several fungal species belonging to the genera *Phaeoacremonium* and *Phaeomoniella* and the leopard moth *Zeuzera pyrina* (Nigro et al., 2013). Although the specific role of *X. fastidiosa* in the syndrome remains to be understood, and Koch's postulates are yet to be completely fulfilled, preliminary observations show that *X. fastidiosa* is also found in younger olive plants in the absence of the other organisms (Martelli, 2014). Reports on the association of *X. fastidiosa* with similar olive disease have been also recently published online from Argentina (<http://www.agromeat.com>, online reference, 2014). *X. fastidiosa* has been identified from olive plants based on PCR detection, ELISA, indirect immunofluorescence, electron microscopy and immunogold labelling (Cariddi et al., 2014), as well as by laboratory culture. The genotype of the strain of *X. fastidiosa* present in Italy is considered to be a new genetic variant within the subspecies *pauca* (Cariddi et al., 2014). It has been shown that the strain present in Italy is very homogeneous, and identical to a variant infecting oleander in Costa Rica. This also represents the first report of subspecies *pauca* in Costa Rica (Nunney et al., 2014). It was assigned a new sequence type (ST) profile, ST 53, and named CoDiRO for "Compleso del Disseccamento Rapido dell' Olivo" (complex of the olive quick decline). Concatenated sequences of the seven MLST genes showed that the CoDiRO strain is a "divergent" variant within the subspecies *pauca*. During the spring–summer period of 2014, further major spread was registered, with several tens of new outbreaks detected, mainly on the Ionian Sea coast of the central/southern part of the Lecce province, but also, to some extent, on the Adriatic Sea coast and on the central-northern part of the province". *X. fastidiosa* has been recently reported in 2015 also from few locations in Brindisi province. Up to now, the Apulian strain of *X. fastidiosa* has been found in olive, almond, cherry, rosemary, oleander, myrtle, Italian buckthorn (*Rhamnus alaternus*), Spanish broom (*Spartium junceum*) coastal rosemary (*Westringia fruticosa*), myrtle-leaf milkwort (*Polygala myrtifolia*), wattle (*Acacia saligna*), dwarf periwinkle (*Vinca minor*) and rosy periwinkle (*Catharanthus roseus*) (EFSA, 2015).

### 2.2. Comments on the scientific papers

Several fungal pathogens, like e.g. *Verticillium dahliae*, have been reported to be associated with leaf scorch and dieback symptoms on olive (*Olea europea*) trees, with the possible formation of tyloses and aggregates that can block the xylem (Baidez et al., 2007). Malathrakis et al. (1979) and Rumbos (1988, 1993) reported olive cankers and dieback caused by *Phoma incompta*, *Cytospora oleina* and *Eutypa lata* in Greece. Later on, several Botryosphaeriaceae species were also associated with such symptoms (Kaliterna et al. 2012, Romero et al., 2005, Taylor et al., 2001). Recently, Urbes-Torres et al. (2013) have evidenced 18 different fungal species from olive trees with dieback symptoms: *Botryosphaeria dothidea*, *Diaporthe viticola*, *Diatrype oregonensis*, *Diatrype stigma*, *Diplodia mutila*, *Diplodia seriata*, *Dothiorella iberica*, *Eutypa lata*, *Lasiodiplodia theobromae*, *Neofusicoccum luteum*, *Neofusicoccum mediterraneum*, *Neofusicoccum vitifusiforme*, *Phaeoacremonium aleophilum*, *Phaeomoniella chlamydospora*, *Phomopsis* sp. group 1, *Phomopsis* sp. group 2, *Schizophyllum commune* and *Trametes versicolor*. They stated that the symptoms "were typically observed to affect only part of the tree, entire trees were occasionally observed to be affected in some of the orchards surveyed".

Carlucci et al. (2013a, 2013b, 2015) have investigated the association of olive decline and tracheomycotic fungi in Apulia. They found, that such fungi were often associated with an olive tree decline, including symptoms of leaf browning and leaf drop, wilting of apical shoots, twig and branch dieback, brown wood streaking and formation of cankers on the bark, and could be involved in the

quick decline syndrome of olive. These studies focused on the fungal species associated with decline of olive trees without inclusion of tests for detection of bacterial pathogens. The fungal species reported in these papers (Carlucci et al., 2013a, 2013b, 2015) were isolated from olive trees from the Foggia and Barletta-Andria-Trani provinces (Table 1), outside and north of the current outbreak area of *X. fastidiosa* (see section 2.1). However, according to a note on the olive decline in Lecce province of the Ufficio Osservatorio Fitosanitario of Regione Puglia (2013), as cited by Carlucci et al. (2013a), "the tracheomycotic pathogens *Phaeoacremonium parasiticum*, *P. rubrigenum*, *P. aleophilum*, *P. alvesii*, and *Phaeomoniella* spp. are a common occurrence in the olive wood". Evidence of the presence of tracheomycotic fungi in olive trees in locations of Salento can be found in other papers and conference proceedings previously published (Frisullo et al., 2002; Carlucci et al., 2008a; Carlucci et al., 2008b). Nigro et al. (2013) reported the presence of *Phaeoacremonium parasiticum* (the most frequently isolated species), *P. rubrigenum*, *P. aleophilum*, *P. alvesii* and of fungi belonging to the genus *Phaeomoniella* on olive trees in the outbreak area of *X. fastidiosa* in Lecce province, however no specific location is provided in the publication. Symptomatic olive trees were generally affected by a complex of pests, including *X. fastidiosa*, several fungal species belonging to the genera *Phaeoacremonium* and *Phaeomoniella*, the leopard moth *Zeuzera pyrina* and bark beetles (Nigro et al., 2013).

According to Carlucci et al. (2013a), *Pleurostomophora richardsiae* is the main pathogen involved in the decline of olive trees reported in the olive groves in the Canosa di Puglia, Cerignola and Foggia areas of southern Italy (outside of the *X. fastidiosa* outbreak area), however the interaction between *P. richardsiae* and the other fungi is yet to be studied. According to Carlucci (EFSA hearing minutes, 2015), these fungi are associated with a decline of olive trees showing symptoms similar to those observed in the Lecce province, but not with the same distribution, spread pattern and intensity. Prof. Carlucci also stated that in the Salento area the symptoms of olive decline were already observed before 2000, however the frequency of desiccation is now much higher and more diffuse on the plants; she also noted however that during the last decade the care and management of olive trees has reduced drastically in Salento and that damage by other agents such as the leopard moth *Zeuzera pyrina* has also been very frequently observed in declining olives in Salento. These observations do not imply however that *X. fastidiosa* is not responsible for the olive tree mortality observed in the Lecce province area, as the faster spread can also be indicative of a disease vectored by insects.

*Phaeoacremonium* species are also associated with esca and esca-like diseases on grapevine (*Vitis vinifera*), apricot (*Prunus armeniaca*), kiwifruit (*Actinidia deliciosa*), and hazel (*Corylus avellana*). Bertch et al. (2014) states that such diseases are complex and still poorly understood. The above-mentioned fungi are characterized by aerial dispersal. Based on studies on grapevine, it was shown that *P. aleophilum* can enter the plant through pruning wounds (Larignon and Dubos, 2000, Serra et al., 2008).

A disease called "Brusca" was reported in Southern Italy since the 18<sup>th</sup> century, and associated to both abiotic and biotic causes (Frisullo et al., 2014). Frisullo et al. (2014), based on several circumstantial evidences, differentiate the biotic "Brusca" caused by the fungus *Stictis panizzei* from the olive quick decline syndrome reported in Apulia. In addition, the symptoms of the biotic "Brusca" disease are different from those caused by tracheomycotic fungi in olive (Carlucci A., personal communication at EFSA technical hearing, 2015). Frisullo et al. (2014) also discussed and confuted the hypothesis that the outbreak of *X. fastidiosa* in Apulia could be the consequence of a century-old introduction and identified *X. fastidiosa* as a recent and major cause of decline.

In California, Krugner et al. (2014) could not reproduce leaf scorch symptoms in olives inoculated with *X. fastidiosa* under greenhouse conditions. However it has to be noted that the olive strains from California belong to a different subspecies, *X. fastidiosa* subsp. *multiplex*, and the vectors involved have shown in these studies a low transmission efficiency.

In conclusion, in all the scientific papers provided in this request and in the other literature reviewed, there is no scientific demonstration or statement that could support the claim that *X. fastidiosa* is not the cause of the olive tree decline in Lecce Province, Southern Italy, but only an endogenous element present in the trees, which is not active or aggressive unless a series of fungi, such as *Pleurostomophora richardsiae*, *Phaeoacremonium aleophilum* and *Neofusicoccum parvum*, infect the plants and create the right conditions for the development of *X. fastidiosa*. This does not rule out that such fungi are able to produce leaf scorch and dieback symptoms on olive trees and that they can

play a role together with other agents, such as *X. fastidiosa* and the leopard moth, in the olive quick decline complex. This has to be investigated by ongoing and future research in Apulia.

**Table 1:** Summary of the fungal species and sampled locations reported in Carlucci et al. (2013a, b, 2015)

Fungal species	Locations	Province	Reference
<i>Phaeoacremonium alvesii</i>	Canosa di Puglia, Cerignola, Ortanova	Barletta-Andria-Trani / Foggia	Carlucci et al. 2015
<i>Phaeoacremonium italicum</i>	Cerignola, Ortanova	Foggia	Carlucci et al. 2015
<i>Phaeoacremonium scolyti</i>	Canosa di Puglia, Cerignola, Foggia, Stornara,	Barletta-Andria-Trani / Foggia	Carlucci et al. 2015
<i>Phaeoacremonium sicilianum</i>	Canosa di Puglia, Cerignola	Barletta-Andria-Trani / Foggia	Carlucci et al. 2015
<i>Phaeoacremonium aleophilum</i>	Canosa di Puglia, Cerignola, Corato, Monte Sant'Angelo, Stornara, Terlizzi	Barletta-Andria-Trani / Foggia	Carlucci et al. 2015
<i>Phaeoacremonium parasiticum</i>	Cerignola, Corato, Monte Sant'Angelo, Stornara, Terlizzi,	Barletta-Andria-Trani / Foggia	Carlucci et al. 2015
<i>Neofusicoccum parvum</i>	Canosa di Puglia, Cerignola, Foggia areas	Barletta-Andria-Trani / Foggia	Carlucci et al. 2013b
<i>Phaeoacremonium aleophilum</i>	Canosa di Puglia, Cerignola, Foggia areas	Barletta-Andria-Trani / Foggia	Carlucci et al. 2013b
<i>Pleurostomophora richardsiae</i>	Canosa di Puglia, Cerignola, Foggia areas	Barletta-Andria-Trani / Foggia	Carlucci et al. 2013b
<i>Neofusicoccum parvum</i>	Andria, Canosa di Puglia, Cerignola, Foggia areas	Barletta-Andria-Trani / Foggia	Carlucci et al. 2013a
<i>Phaeoacremonium aleophilum</i>	Andria, Canosa di Puglia, Cerignola, Foggia areas	Barletta-Andria-Trani / Foggia	Carlucci et al. 2013a
<i>Pleurostomophora richardsiae</i>	Andria, Canosa di Puglia, Cerignola, Foggia areas	Barletta-Andria-Trani / Foggia	Carlucci et al. 2013a

### 2.3. Comments on the videos and the soil analyses

**First video:** <https://www.youtube.com/watch?v=ICHAvaeIT30&noredirect=1>

- Area: Between Alezio and Taviano (close to Gallipoli), Lecce Province, Apulia, Italy. Close to the first occurrence of *X. fastidiosa*
- Infection: No specific mention of *X. fastidiosa* or detection methods were cited in the video
- Management:
  - 5 ha olive groves (young olive trees)
  - 3 treatments to the plants with Bordeaux mixture (1%) copper sulphate + calcium hydroxide
  - pruning to remove the dead branches, disinfection of the branches
  - 1 treatment to the soil with sulphur and calcium hydroxide
  - grass was mowed, but no tillage operation was carried out

**Second video:** <https://www.youtube.com/watch?v=UhBI5Rd3dS4&feature=youtu.be>

- Area: Between Alezio and Taviano (close to Gallipoli), Lecce Province, Apulia, Italy. Close to the first occurrence of *X. fastidiosa*.
- Infection: No specific mention of *X. fastidiosa* or detection methods was made in the video
- Management:

- olive groves with 100 olive trees (old olive trees)
- 3 treatments to the plant with Bordeaux mixture (1%) copper sulphate + calcium hydroxide
- pruning to remove the dead branches, disinfection of the branches
- disinfection of the trunk and branches using iron sulphate and calcium hydroxide
- 1 soil treatment with sulphur and calcium hydroxide

Although the two videos claim the effectiveness of the treatments applied on the recovery of the trees from the disease, no specific mention of *X. fastidiosa* or detection methods was made in the video and no additional information of the experimental design was provided. With regard to pruning, it should be noted that in the case of fungal pathogens associated with olive decline, an excessive pruning might enhance the contamination by tracheomycotic agents since they can infect the plant through wounds if the wounds are unprotected.

The chemical and physical analyses of soil were provided (possibly to illustrate the edaphic conditions/types of orchard soil on which the treatments were applied), without indicating the scope for the analyses. It is not clear from the request for which reasons EFSA is expected to take them into account.

Although the soil analyses and videos provided do not show that fungal disease management, or orchard management more generally, will prevent or reduce the impact of *X. fastidiosa* infection, EFSA performed a preliminary literature search in the ISI Web of Knowledge database to identify the published scientific literature on methods applied to or researched for olive cultivation to control *Phaeoacremonium* spp and *Phaeomoniella* spp. supposedly involved in the olive decline in southern Italy. A very limited number of articles were found and these did not directly address the topics in question. Therefore, as the tracheomycotic complex was studied more extensively in relation to the control of ECAS disease in vineyards, EFSA recommends that similar control measures could be explored and tested in further research on olive tree decline, through the implementation of replicated and well-designed field experiments.

### 3. Conclusions

This EFSA statement addresses the following two questions of the European Commission request:

#### **Question 1:**

In the recently published scientific opinion, EFSA was requested to perform a pest risk assessment for *X. fastidiosa* and to identify and evaluate risk reduction options. In this document, following the outbreak of *X. fastidiosa* in Lecce province, EFSA did not address the general decline of olive trees in southern Italy but assessed the probability of entry, the potential establishment and spread of the quarantine bacterium in the EU and its potential consequences. There is no evidence that *Xylella* is an "endogenous element" or endophytic bacterium that is and has been present in olives for a considerable time. There is also currently no scientific demonstration that tracheomycotic fungi are the primary causal agents of the olive quick decline syndrome observed in Southern Italy.

In its scientific opinion, EFSA's Panel on Plant Health Panel (PLH) noted: "In 2013, the occurrence of *X. fastidiosa* was reported in southern Italy (near Lecce, in the Salento peninsula, Apulia region), associated with quick decline symptoms on olive trees (*Olea europea*), oleander (*Nerium oleander*) and almond (*Prunus dulcis*) (Saponari et al., 2013). Investigations showed that symptomatic olive trees were generally affected by a complex of pests, including *X. fastidiosa*, several fungal species belonging to the genera *Phaeoacremonium* and *Phaeomoniella* and *Zeuzera pyrina* (leopard moth) (Nigro et al., 2013). Investigations are still ongoing to delimit the outbreak area and the biological characterisation of the Apulian *X. fastidiosa* strain".

The three scientific publications provided together with this request and other literature have been thoroughly analysed and support the statement above, as already reported in the Scientific Opinion on *X. fastidiosa* published earlier this year.

More insights on the relative importance of the various agents associated with olive decline in Apulia can be expected when the research inoculation studies currently ongoing will be completed.

**Question 2:**

On the request of the European Commission, in the recently published scientific opinion on the risk assessment of *X. fastidiosa* for the EU territory, EFSA's PLH Panel identified and evaluated the risk reduction options in terms of effectiveness and technical feasibility and analysed the associated uncertainties for each option. In virtue of the separation of risk management and risk assessment in the EU as laid down in EFSA's founding regulation (178/2002/EC), the Panel did not recommend a specific control strategy: that is in the remit of European and national authorities. There is no published evidence that fungal disease management will reduce establishment, spread and impact of *X. fastidiosa*, other than the observation that improved orchard management more generally is beneficial for plant health.

However, EFSA shares the concerns over the situation in olive trees in the affected areas, and fully understands the need for further research on potential options to reduce the risk and damage caused by *X. fastidiosa*. In the context of the identification of new options that could reduce the risk to plant health caused by a pest (EFSA PLH Panel 2012), EFSA provides guidance on evaluation of risk reduction options. In this guidance document, the PLH Panel describes in detail the types of information, supporting evidence and the methods that may be used when evaluating the risk reduction options. Moreover, the guidance document includes a checklist to ensure that all data required for an EFSA evaluation are made available. The checklist can be used to verify whether all required information is provided in support of a risk reduction option, to quickly describe information supplied to EFSA and to identify major gaps in the data.

EFSA also stresses the need for research to address current gaps of knowledge. As mentioned in this statement, there is a need to understand the contribution of the different agents that are suspected to be involved in the olive quick decline syndrome, the leopard moth *Zeuzera pyrina*, the tracheomycotic fungi, as well as *X. fastidiosa* and its insect vectors. Besides, research based on the pest biology should also provide insights on how to sustainably manage such complex problems, through the implementation of replicated and well-designed field experiments.

## Documentation provided to EFSA

1. Carlucci A, Lops F, Cibelli F & Raimondo ML (2015) *Phaeoacremonium* species associated with olive wilt and decline in southern Italy. *European Journal of Plant Pathology* 141(4): 717-729.
2. Carlucci A., M. L. Raimondo, F. Cibelli, A.J.L. Phillips, F. Lops (2013). *Pleurostomophora richardsiae*, *Neofusicoccum parvum* and *Phaeoacremonium aleophilum* associated with a decline of olives in southern Italy. *Phytopathologia Mediterranea* 52, 3, 517-527.
3. Carlucci A., F. Lops, G. Marchi, L. Mugna, and G. Surico (2013). Has *Xylella fastidiosa* "chosen" olive trees to establish in the Mediterranean basin? *Phytopathologia Mediterranea* 52, 3, 541-544.
4. Results of laboratory analyses performed on soil in Italy.

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- EFSA (European Food Safety Authority), 2015. Categorisation of plants for planting, excluding seeds, according to the risk of introduction of *Xylella fastidiosa*. *EFSA Journal* 2015;13(3):4061, 31 pp. Annex A - Electronic Excel database on *Xylella fastidiosa* host plants (downloadable from <http://www.efsa.europa.eu/en/efsajournal/doc/4061ax1.xls>)
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## Appendix: Literature search

The literature search was performed on 15/04/2015.

### 1. Information sources

The information sources used to produce a set of relevant evidence that were consulted for performing the assessment:

ISI Web of Knowledge (Web of Science™ Core Collection (1975–present); BIOSIS Citation Index<sup>SM</sup> (1926–present); CABI: CAB Abstracts® (1910–present); Chinese Science Citation Database<sup>SM</sup> (1989–present); Current Contents Connect® (1998–present); Data Citation Index<sup>SM</sup> (1900–present); FSTA®—the food science resource (1969–present); MEDLINE® (1950–present); SciELO Citation Index (1997–present); Zoological Record® (1864–present)).

### 2. Search strategy on olive tracheomycotic fungi

The search equation used to search ISI Web of Knowledge was articulated as follows:

```
TOPIC: (Phaeoacremonium OR Phaemoniella) AND TOPIC: (Olive OR olea)
Timespan: 1970-2015.
Search language=Auto
```

As a result, 7 relevant publications were obtained running the search equation.

- Carlucci, A., F. Lops, et al. (2015). "Phaeoacremonium species associated with olive wilt and decline in southern Italy." *European Journal of Plant Pathology* 141(4): 717-729.
- Carlucci, A., F. Lops, et al. (2009). "Olive trees as a potential source of inoculum of esca-associated fungi of grapevine in southern Italy." *Phytopathologia Mediterranea* 48(1): 182-182.
- Carlucci, A., F. Lops, et al. (2013). "Has *Xylella fastidiosa* "chosen" olive trees to establish in the Mediterranean basin?" *Phytopathologia Mediterranea* 52(3): 541-544.
- Carlucci, A., M. L. Raimondo, et al. (2013). "Pleurostomophora richardsiae, Neofusicoccum parvum and Phaeoacremonium aleophilum associated with a decline of olives in southern Italy." *Phytopathologia Mediterranea* 52(3): 517-527.
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- Nigro, F., D. Boscia, et al. (2013). "Fungal species associated with a severe decline of olive in Southern Italy." *Journal of Plant Pathology* 95(3): 668-668.
- Urbez-Torres, J. R., F. Peduto, et al. (2013). "Olive Twig and Branch Dieback: Etiology, Incidence, and Distribution in California." *Plant Disease* 97(2): 231-244.

### 3. Search strategy on control of tracheomycotic fungi

The search equation used to search ISI Web of Knowledge was articulated on as follows:

```
TOPIC: (Phaeoacremonium OR Phaemoniella) AND TOPIC: (plant) AND TOPIC: (control)
Timespan=1970-2015
Search language=Auto
```

As a result, 138 hits were obtained running the search equation.