A new resource for research and risk analysis: the updated European Food Safety Authority database of *Xylella* spp. host plant species

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Abstract

Following a series of requests for scientific advice from the European Commission starting in 2013, the European Food Safety Authority (EFSA) conducted pest risk assessment and created a comprehensive *Xylella fastidiosa* host plant database. The last update of the database, published in September 2018, includes information on host plants of both *X. fastidiosa* and *X. taiwanensis*, together with details on botanical classification, infection conditions, geographic location, pathogen taxonomy including information on subspecies, strain and sequence type, detection techniques and tolerant/resistant response of the plant. This updated database of host plants of *Xylella* spp. reported world-wide provides a key tool for risk management, risk assessment and research on this generalist bacterial plant pathogen.

Database announcement

Xylella fastidiosa is a generalist plant pathogenic bacterium (Almeida and Nunney, 2015) causing numerous plant diseases worldwide such as Pierce's disease of grapes, bacterial leaf scorch of shade trees and oleander leaf scorch in North America, and citrus variegated chlorosis in Brazil. In Taiwan, a leaf scorch disease of pear was described in association with a fastidious bacterium originally designated as a strain of *X. fastidiosa* (Leu and Su, 1993), which was later shown to be genetically distant from other *X. fastidiosa* strains and thus classified as a novel species, *X. taiwanensis* (Su *et al*., 2016). In 2013, the identification of olive trees affected by *X. fastidiosa* in southern Italy represented the first record of an outbreak of this pathogen under field conditions in the European Union (EU) (Saponari *et al*., 2013). This first report was then followed by additional outbreaks in France and Spain (Denancé *et al*., 2017; Olmo *et al*., 2017). The European Commission requested the European Food Safety Authority (EFSA) to provide scientific assistance on this matter. In January 2015, EFSA published a pest risk assessment of *X. fastidiosa* for the EU territory (EFSA PLH Panel, 2015) which included a list of the known host plant species of *X. fastidiosa* collected through a literature search. EFSA was then given the task to periodically update the database of *X. fastidiosa* host plants, and in 2016 an electronic version was published (EFSA, 2016). For the period 2016-2020, EFSA was requested to further update this database by taking into account the different subspecies, strains and European isolates of *X. fastidiosa*, together with information on tolerant/resistant plant varieties and negative results of diagnostic tests.

The process for updating the host plant database of *Xylella* spp., taking into account both *X. fastidiosa* and *X. taiwanensis*, was divided into the following steps: (1) an extensive

literature search to identify the relevant references; (2) the selection of the retrieved studies based on titles, abstracts and full-text; (3) the extraction of the relevant information from the selected references; (4) and data analysis and reporting.

The literature search was conducted in 2017 and 3595 references were obtained, supplemented by additional information provided by scientific experts and national authorities. On the whole, 853 publications were selected for data extraction and 8391 data extraction forms were filled with data covering botanical classification of the plant according to the updated taxonomy from the European and Mediterranean Plant Protection Organization (EPPO) global database (EPPO, 2018), infection conditions and location of the infected plant, geographic coordinates, isolate characterization (*Xylella* species, subspecies, disease, strain, multilocus sequence type), methods of detection, and information about the tolerant/resistant response of the plant.

Data reporting was designed to categorise *Xylella* host plant species based on the number and type of detection methods applied for each finding. Different combinations of detection methods were considered:

A. Plant species positive with at least two detection methods (out of: symptom observation on the test plant in experimental vector transmission, enzyme-linked immunosorbent assay (ELISA), other immunological techniques, polymerase chain reaction (PCR)-based methods, sequencing or culture) or positive with sequencing or culture.

B. The same as category A, but also including microscopy.

C. Plant species positive with at least one detection method (out of: symptom observation on the test plant in experimental vector transmission, ELISA, other immunological techniques, PCR-based methods, sequencing or culture).

D. The same as category C, but also including microscopy.

E. All plant species reported positive, regardless of the detection method (positive records but without the detection method specified, symptom observations, microscopy, symptom observation on the test plant in experimental vector transmission, ELISA, other immunological techniques, PCR-based methods, sequencing, or culturing).

An example of data reporting is presented in Table 1, in which the number of host plant species (according to categories A, B, C, D, E) reported infected by different *X. fastidiosa* subspecies in artificial, natural and unspecified conditions is shown. The complete lists of plant species are available in the database and scientific report (EFSA, 2018), both of which are open access.

Xylella taiwanensis is not included in Table 1 as up now it was reported only in naturally infected *Pyrus pyrifolia* in Taiwan.

A detailed genetic characterization of *Xylella* spp. (such as species, subspecies, strains and multilocus sequence type) as well as the tolerant/resistant host status of the plant species or variety are included in the current version of the database, with special categories and extensive comments.

This updated *Xylella* spp. host plant database was released in September 2018 together with a detailed report (EFSA, 2018). The raw data and related metadata are published in Zenodo

in the EFSA Knowledge Junction community: https://doi.org/10.5281/zenodo.1339344 . Interactive reports are available at the following link: https://www.efsa.europa.eu/en/microstrategy/xylella .

The EFSA database of *Xylella* spp host plant species reported world-wide is a key tool for risk management, risk assessment and research on this generalist bacterial plant pathogen, and is expected to be kept up-to-date as new relevant information becomes available.

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DISCLAIMER

The positions and opinions presented in this article are those of the authors alone and are not intended to represent the views or any official positions of their institutions.

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130 **Table**

131 Table 1: Number of host plant species reported infected by different subspecies of *Xylella*
132 *fastidiosa* under artificial, natural or unspecified conditions[a], according to confirmation
133 categories A, B, C, D, E[b].

Infection method	Artificial					Natural					Unspecified				
Category	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
***X. fastidiosa* subspecies**															
fastidiosa	35	35	41	41	42	32	32	32	32	32	3	3	3	3	3
fastidiosa/sandyi	0	0	0	0	0	2	2	2	2	2	0	0	0	0	0
morus	0	0	0	0	0	4	4	4	4	4	0	0	0	0	0
multiplex	8	8	11	11	11	108	108	116	116	116	10	10	11	11	11
pauca	7	7	13	13	13	41	41	43	43	43	1	1	1	1	1
sandyi	3	3	3	3	3	6	6	7	7	7	0	0	0	0	0
tashke	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0
unknown	93	96	191	195	204	144	148	326	333	338	15	15	15	15	16

134 [a] Artificial inoculation includes both mechanical inoculation and vector transmission; natural
135 infection includes all records of host plants found during survey or research activities; unspecified
136 infection includes all cases where no details on the type of infection methods were reported.

137 [b] Categories A through E represent progressively less stringent confirmation criteria as described in
138 detail in the text.