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BEYOND XYLELLA

Practice abstracts Batch 2-RP2

Deliverable 9.5

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1. INTRODUCTION

The European Innovation Partnership for agricultural productivity and sustainability (EIP-AGRI) aims to stimulate innovation and improve the exchange of knowledge for agriculture, forestry, and rural areas.

EIP-AGRI projects are projects from across Europe that boost innovation and knowledge exchange. They are based on an 'interactive innovation' model, bringing together project partners to turn practical problems and creative ideas into innovative solutions. Co-creating solutions stimulates collaboration, knowledge exchange, and effective dissemination and take-up of knowledge and results.

The interactive innovation approach is used both in EIP-AGRI Operational Group projects, which are supported under the Common Agricultural Policy (CAP), and in multi-actor projects (including thematic and advisory networks) funded under EU Research and Innovation. While Operational Groups are implemented by EU countries, Horizon projects work on a transnational level.

EIP-AGRI Operational Groups and Horizon Europe projects are expected to share their knowledge and innovative solutions in the form of '**Practice Abstracts**', using the 'EIP-AGRI common format'.

Practice Abstracts deliver essential information, guidance, and/or best practices applicable in the daily operations of end-users. Essentially, **Practice Abstracts** are vital for broadcasting the main objectives and outcomes of European projects, crafted collectively by consortium partners and aimed at a diverse and extensive audience including farmers, foresters, advisers, plant health authorities, advisors, researchers, and all other actors across the EU interested in succinct and practical information.

Until April the 1st 2023, to upload a **Practice Abstract** (PA), the 'practice abstract format' was sent by email to the EIP-Agri team for uploading to the website (BeXyl project used this procedure for PA1 and PA2).

After this date, the EU CAP network created a procedure to upload the same information, but through a digital form. With this information, this forum is centralizing a collection of practical knowledge throughout the EU, facilitated by the EIP-AGRI projects database, which aids in spreading the findings from various interactive research and innovation projects.

All Horizon Europe Project Coordinators received the instructions for submitting the **Practice Abstracts** on December 2024. Consequently, for the submission of the 2nd batch of **Practice Abstracts** (PA3, PA4 and PA5) of BeXyl project we have followed this new procedure. The link to the BeXyl project in EU-CAP network website is:

https://eu-cap-network.ec.europa.eu/projects/beyond-xylella-integrated-management-strategies-mitigating-xylella-fastidiosa-impact_en

Additionally, due to the shortness of the text to be included in the **Practice Abstracts** an extended version of them have been produced for those readers that want to know more about their specific contents. Additionally, links to download short and extended versions have been also included in the description of each **Practice Abstract**.

As it was done in the reporting Period 1, for wider dissemination of these **Practice Abstracts**, WP9 worked on the elaboration of attractive visuals allowing a dissemination via different

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channels. All the **Practice Abstracts** already delivered in short and extended format are available on BeXyl's website in a dedicated tab (https://bexylproject.org/outcomes/documents/practice-abstracts/). Furthermore, they have been shared on social networks.

2. SECOND BATCH OF PRACTICE ABSTRACTS

Originally, for the second batch of Practise Abstracts it was planned to prepare three of them linked to different deliverables:

- **Practice Abstract 3:** It will illustrate the potential new host plants and pathogenicity of *Xylella fastidiosa* strains relevant for EU and the Mediterranean Basin (referring to the results from WP1 detailed in D1.3).
- **Practice Abstract 4:** It will illustrate the maps of relative risk to *Xylella fastidiosa* in EU based on the identified major biotic and abiotic factors that drives *Xylella fastidiosa* epidemics (referring to the results from WP1 detailed in D1.1).
- **Practice Abstract 5:** It will summarize the technical aspects of the applicability of TT therapy for *Xylella fastidiosa* on plant propagation material at commercial scale (referring to the results from WP3 detailed in D3.2).

However, these practice abstracts are linked to three deliverables which due date are at a later stage:

- **D1.1:** Due date 30/04/2026
- **D1.3:** Due date 28/02/2026
- **D3.2:** Due date 31/05/2026

Consequently, we have replaced those planned **Practice Abstracts** by these ones:

- **Practice Abstract 3:** It illustrates the innovative and environmentally friendly approach for controlling *Xylella fastidiosa* insect vectors using entomopathogenic fungi (referring to the results from WP5 detailed in D5.1).
- **Practice Abstract 4:** It illustrates the use of ground cover management as a sustainable strategy for *Philaenus spumarius* management (referring to the results from WP5).
- **Practice Abstract 5:** It illustrates the different tools that BeXyl is using to determine the potential new host plants and the pathogenicity of *Xylella fastidiosa* (Xf) strains relevant for EU and the Mediterranean Basin. Very similar to the originally planned one (PA 3) but not including results in the short version.

All three practice abstracts have been submitted to the EU CAP Network web page of BeXyl Project:

https://eu-cap-network.ec.europa.eu/projects/beyond-xylella-integrated-management-strategies-mitigating-xylella-fastidiosa-impact_en

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2.1. Practice Abstract n. 3

The 3rd BeXyl Practice Abstract illustrates the innovative and environmentally friendly approach for controlling *Xylella fastidiosa* insect vectors using entomopathogenic fungi (referring to the results from WP5 detailed in D5.1).

The formatted Practice Abstract N.3 is available at this link and included in **Annex 1**. The extended version of Practice Abstract N.3 is available at this link and included in **Annex 2**.

Practice Abstract 3	
Short title in English	**Innovative and environmentally friendly approach for controlling *Xylella fastidiosa* insect vectors using entomopathogenic fungi**
Short summary for practitioners	BeXyl project is addressing the urgent need for sustainable alternatives to chemical insecticides to control *Xylella fastidiosa (Xf)* insect vectors. BeXyl solution is to harness entomopathogenic fungi—naturally occurring microorganisms- that target insect pests effectively and sustainably, and can easily be integrated into Integrated Pest Management (IPM) strategies. These fungi do more than just kill Xf insect vectors. They can also disrupt insect reproduction and behaviour, potentially reducing the spread of Xf. How will BeXyl make a difference? • ***Identifying Local Beneficial Fungi:*** BeXyl is exploring the olive agroecosystem—including olive plants, associated vegetation and cover crops, and insect communities—to discover native strains of entomopathogenic fungi naturally adapted to local environmental conditions. • ***Effective Pest Control:*** Selected fungal strains will be tested directly against both juvenile and adult forms of key insect vectors of *Xf* such as *Philaenus spumarius* and *Neophilenus campestris.* Furthermore, we will evaluate the potential of these entomopathogenic fungi to colonize olive plants internally, providing indirect pest control by impacting insect survival and reproduction when feeding. • ***Reducing Disease Transmission:*** These entomopathogenic fungi will also be assessed for their ability to modify insect feeding behaviours, thereby decreasing the transmission efficiency of *Xf* to olive trees. By thoroughly understanding and leveraging these natural control mechanisms, BeXyl aims to provide growers and stakeholders with practical, sustainable, and highly effective biocontrol tools (to be included in IPM programs) to protect olive crops from *Xf*.

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2.2. Practice Abstract n. 4

The 4th BeXyl Practice Abstract illustrates the use of ground cover management as a sustainable strategy for *Philaenus spumarius* management (referring to the results from WP5).

The formatted Practice Abstract N.4 is available at this link and included in **Annex 3**. The extended version of Practice Abstract N.4 is available at this link and included in **Annex 4**.

Practice Abstract 4	
Short title in English	**Ground cover management as a sustainable strategy for *Philaenus spumarius* management**
Short summary for practitioners	*Xylella fastidiosa (Xf)* spread is closely linked to insect vectors such as *Philaenus spumarius.* Traditional control methods targeting the vector often rely on chemical inputs, which pose environmental risks and lack long-term sustainability. How ground cover management can make a difference for *Xylella fastidiosa* management? ***Impact:*** Sustainable management of *Philaenus spumarius*, the primary vector of *Xf,* is critical to limit the spread of this devastating plant pathogen. As no cure exists for *Xf* -infected plants, controlling vector populations through eco-friendly practices is essential. Ground cover management - by modifying surrounding vegetation- offers a sustainable viable alternative to conventional management practices, minimizing pesticide use and drastic soil tillage while preserving biodiversity and supporting ecosystem health. ***Objective:*** A key of BeXyl's research is to identify and select plant species commonly used as ground covers that could contribute to the management and reduction of *P. spumarius* population densities. These species may support the development of a push-pull strategy by acting as trap plants, repellent plants, or non-preferred hosts of *Xf*, thereby serving as ecological infrastructures to suppress vector populations and limit *Xf* spread. ***Research outcomes:*** Our results suggest that *Sinapis alba* may be particularly effective in reducing *P. spumarius* nymph densities during critical periods, with also side effects lowering the population of *C. viridis*. Our research opens new ways to manage the vectors of *Xf* by using specific plant species as ground covers, which in turn will reduce the population density of vectors and reduce the spread and prevalence of *Xf* in susceptible crops.

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2.3. Practice Abstract n. 5

The 5th BeXyl Practice Abstract illustrates the different tools that BeXyl is using to determine the potential new host plants and the pathogenicity of *Xylella fastidiosa* (Xf) strains relevant for EU and the Mediterranean Basin.

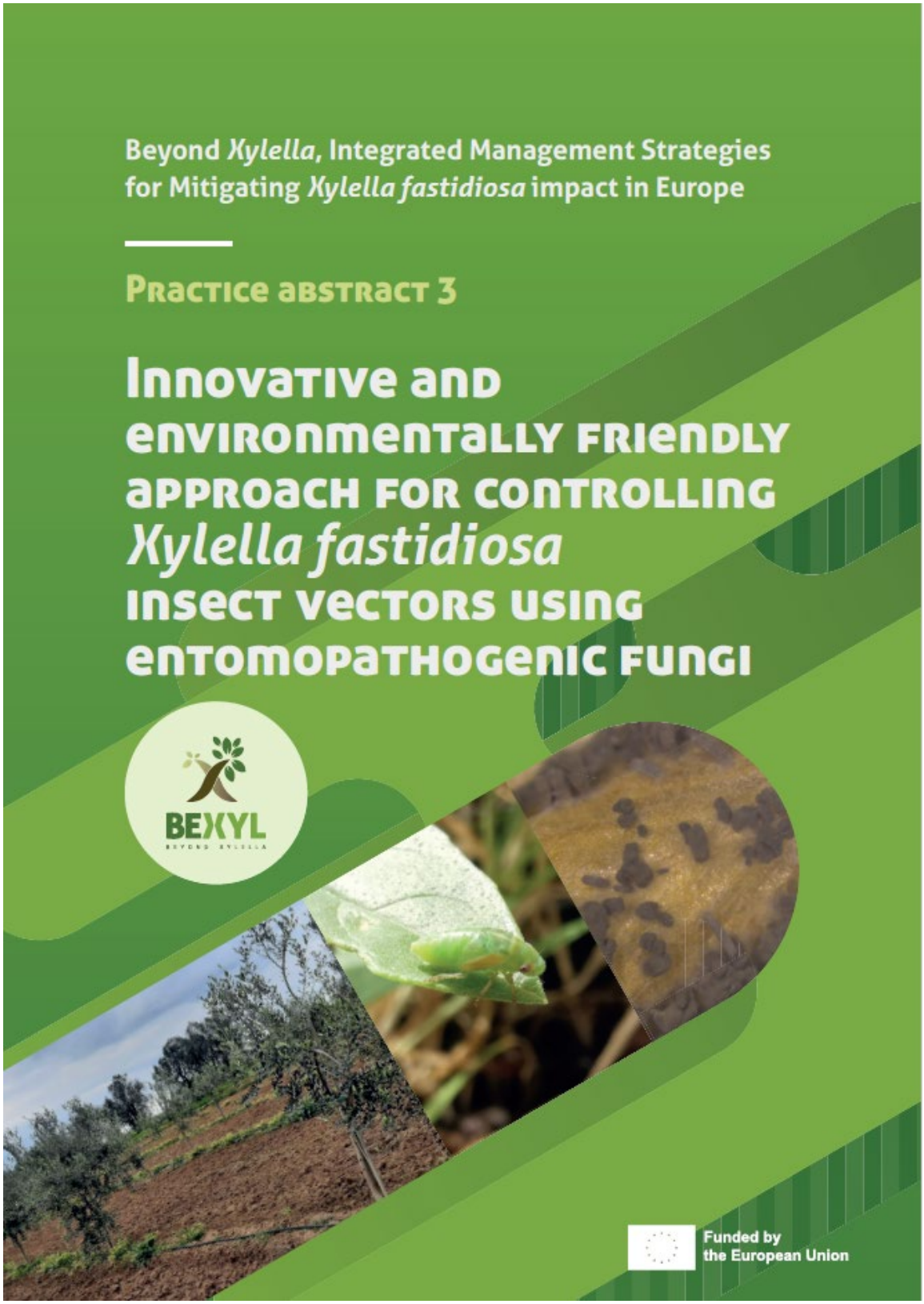
The formatted Practice Abstract N.5 is available at this link and included in **Annex 5**. The extended version of Practice Abstract N.5 will be available at this link once the final list of Botanical gardens participating in WP1-Task 1 is finished.

Practice Abstract 5	
Short title in English	**Tracking threats: Identifying new hosts and strains of *Xylella fastidiosa* relevant to European and Mediterranean plant health**
Short summary for practitioners	BeXyl project addresses the threat posed by *Xylella fastidiosa (Xf)* to agriculture and ecosystems in the European Union by identifying potential new host plants and assessing the pathogenicity of relevant *Xf* strains. How does BeXyl integrates information from diverse sources to strengthen the scientific basis for risk assessment and disease management? ***Pathogenicity testing:*** Inoculation experiments with selected *Xf* strains conducted under controlled conditions to assess their virulence on economically or ecologically important plant species relevant to the EU and Mediterranean region. ***Sentinel plots:*** Highly susceptible host plant species have planted in multiple countries, both in *Xf*-infected and *Xf*-free areas. These plots allow for real-time monitoring of natural infections and help assess disease dynamics under different environmental conditions. ***Botanical garden surveillance:*** Surveys in botanical gardens located in areas where *Xf* is native. These sites may harbor infected but asymptomatic plants of potential concern to European agriculture or natural environment, providing insights into long-term host–pathogen coexistence. ***Use of National Plant Protection Organizations (NPPOs) surveillance data:*** Official surveillance data from NPPOs across Europe are analysed to identify potential new host species and understand the distribution of different *Xf* strains under natural conditions. By integrating these complementary sources of information, BeXyl will contribute to a better understanding of Xf's biology, host range, and disease epidemiology. These insights will support EU-level preparedness, strengthen the scientific basis for risk assessment and targeted surveillance, supporting the development of sustainable plant health strategies.

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3. ANNEXES

Annex 1: Practice Abstract 3 short



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Entomopathogenic fungi for controlling *Xylella fastidiosa* vectors



BeXyl project is addressing the urgent need for sustainable alternatives to chemical insecticides to control insect vectors of *Xylella fastidiosa* (***Xf***) .

BeXyl solution is to harness **entomopathogenic fungi** (naturally occurring microorganisms) that target insect pests effectively and sustainably, and can easily be integrated into Integrated Pest Management (IPM) strategies.

These **entomopathogenic fungi** do more than just kill ***Xf***-insect vectors; they can also disrupt insect reproduction and behaviour, potentially reducing the spread of ***Xf***.

How will BeXyl make a difference?

Identifying Local Beneficial Fungi: BeXyl is exploring the **olive agroecosystem**—including olive plants, associated vegetation and cover crops, and insect communities—to discover **native strains of entomopathogenic fungi** naturally adapted to local environmental conditions.

Effective Pest Control: Selected fungal strains will be tested directly against both juvenile and adult forms of key insect vectors of ***Xf***, such ***Philaenus spumarius*** and ***Neophilenus campestris***. Furthermore, we will evaluate the potential of these entomopathogenic fungi to colonize olive and other plants internally (as endophytes), providing indirect pest control by impacting insect survival and reproduction when feeding.

Reducing Disease Transmission: These entomopathogenic fungi will also be assessed for their ability to **modify insect feeding behaviour**; thereby, decreasing the transmission efficiency of ***Xf*** to olive trees.

By thoroughly understanding and harnessing these natural enthomopathogenic fungi, BeXyl aims to provide growers and stakeholders with practical, sustainable, and highly effective biocontrol tools (to be included in IPM programs) to protect olive crops from *Xylella fastidiosa*.

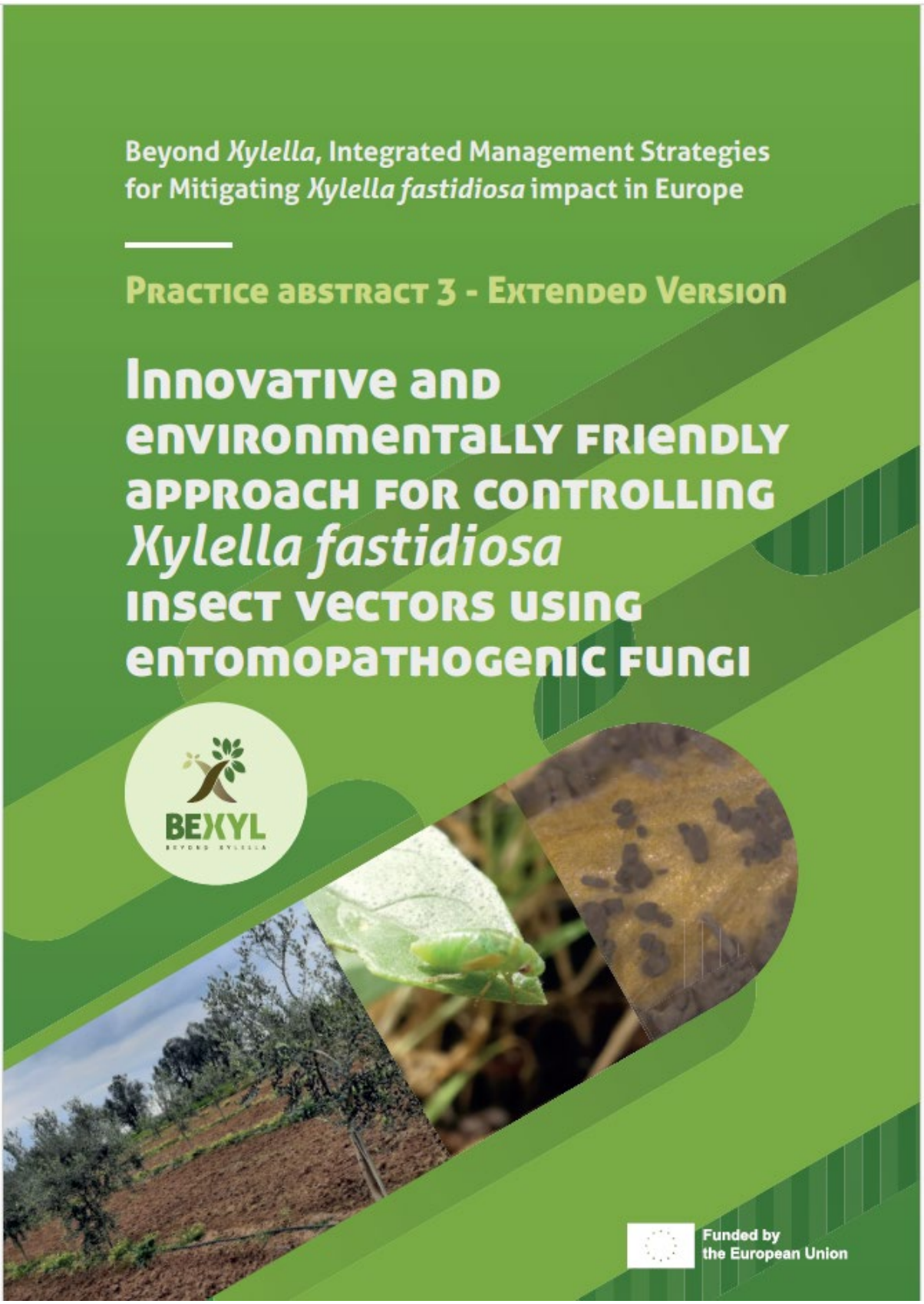
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Annex 2: Practice Abstract 3 extended



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Entomopathogenic fungi for controlling *Xylella fastidiosa* vectors

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Impacts achieved:



Harnessing Nature's Own Pest Control Agents: Recent **BeXyl** research results has shown that different elements within olive orchards—including olive trees, ground cover plants, and insects living in these ecosystems—host naturally occurring beneficial fungi (fungal strains) that can infect and kill insect pests. Furthermore, they have environmental competence in their respective isolation habitats.

Fungal Warriors Against Insect Vectors: Several strains of these beneficial fungi (*Beauveria* sp., *Metarhizium* sp., and *Lecanicillium* sp.) collected from olive groves have demonstrated a high ability to infect and kill young (nymphs) and adult stages of key insect pests that transmit ***Xf*** such as *Philaenus spumarius* and *Neophilenus campestris*. These specific strains are called entomopathogenic fungi.

Fungi That Protect From Within: Selected strains of these fungi have the ability to live harmlessly inside certain plants (endophytic strains) that are commonly used in experiments for ***Xf***-insect vector studies, such as sowthistle (*Sonchus oleraceus*). Additionally, due to this plant endophytic activity these fungi indirectly caused increased mortality in insects feeding on these plants both of nymph and adults of the vector.

Disrupting Insect Feeding to Reduce Disease Spread: These fungal strains also alter the feeding behaviour of insect pests. When insects feed on plants colonized by these beneficial entomopathogenic fungi—particularly olive trees—they spend less time feeding from the plant's internal vessels (xylem), potentially reducing the risk of spreading the harmful bacterium ***Xf***.

BeXyl's final aim is to harness naturally occurring beneficial entomopathogenic fungi to sustainably control insect vectors and reduce the spread of *Xylella fastidiosa* in olive orchards and other important crops. This beneficial fungal strains will be used to implement tailored Integrated Pest Management (IPM) strategies to mitigate the impacts of current *Xylella fastidiosa* outbreaks, helping the agricultural/forestry sectors to remain productive and sustainable at long-term.

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Annex 3: Practice Abstract 4 short



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Ground cover management as a sustainable strategy for *Philaenus spumarius* management

Xylella fastidiosa (***Xf***) is a serious plant pathogen in Europe, with its spread closely linked to insect vectors like ***Philaenus spumarius***. Traditional control methods targeting the insect vector often rely on chemical inputs, which pose environmental risks and offer limited long-term sustainability. Ground cover management has emerged as a promising agroecological strategy that not only reduces vector populations but also enhances biodiversity and soil health. BeXyl consortium is exploring how strategic management of ground vegetation can contribute significantly to the integrated management of ***Xf***, with a focus on disrupting the life cycle or feding habits of ***Philaenus spumarius*** in a sustainable and environmentally friendly way.

How ground cover management can make a difference for *Xylella fastidiosa* control?

Impact: Sustainable management of ***Philaenus spumarius***, the primary vector of ***Xf***, is critical to limit the spread of this devastating plant pathogen. As no cure exists for ***Xf*** -infected plants, controlling vector populations through eco-friendly practices is essential. **Ground cover management** - by modifying surrounding vegetation- offers a sustainable viable alternative to conventional management practices, minimizing pesticide use and drastic soil tillage while preserving biodiversity and supporting ecosystem health.

Objective: A key objective of BeXyl's research is to identify and select plant species commonly used as ground covers that could contribute to the management and reduction of ***P. spumarius*** population densities. These species may support the development of a **push-pull strategy** by acting as trap plants, repellent plants, or non-preferred hosts of ***Xf***, thereby serving as ecological infrastructures to suppress vector populations and limit ***Xf*** spread.

Research outcomes: Our results suggest that ***Sinapis alba*** may be particularly effective in reducing ***P. spumarius*** nymph densities during critical periods, with also side effects lowering the population of ***Cicadella viridis***. Our research opens new ways to manage the vectors of ***Xf*** by using specific plant species as ground covers, which in turn will reduce the population density of vectors and reduce the spread and prevalence of ***Xf*** in susceptible crops.

Further details: Check our published research here

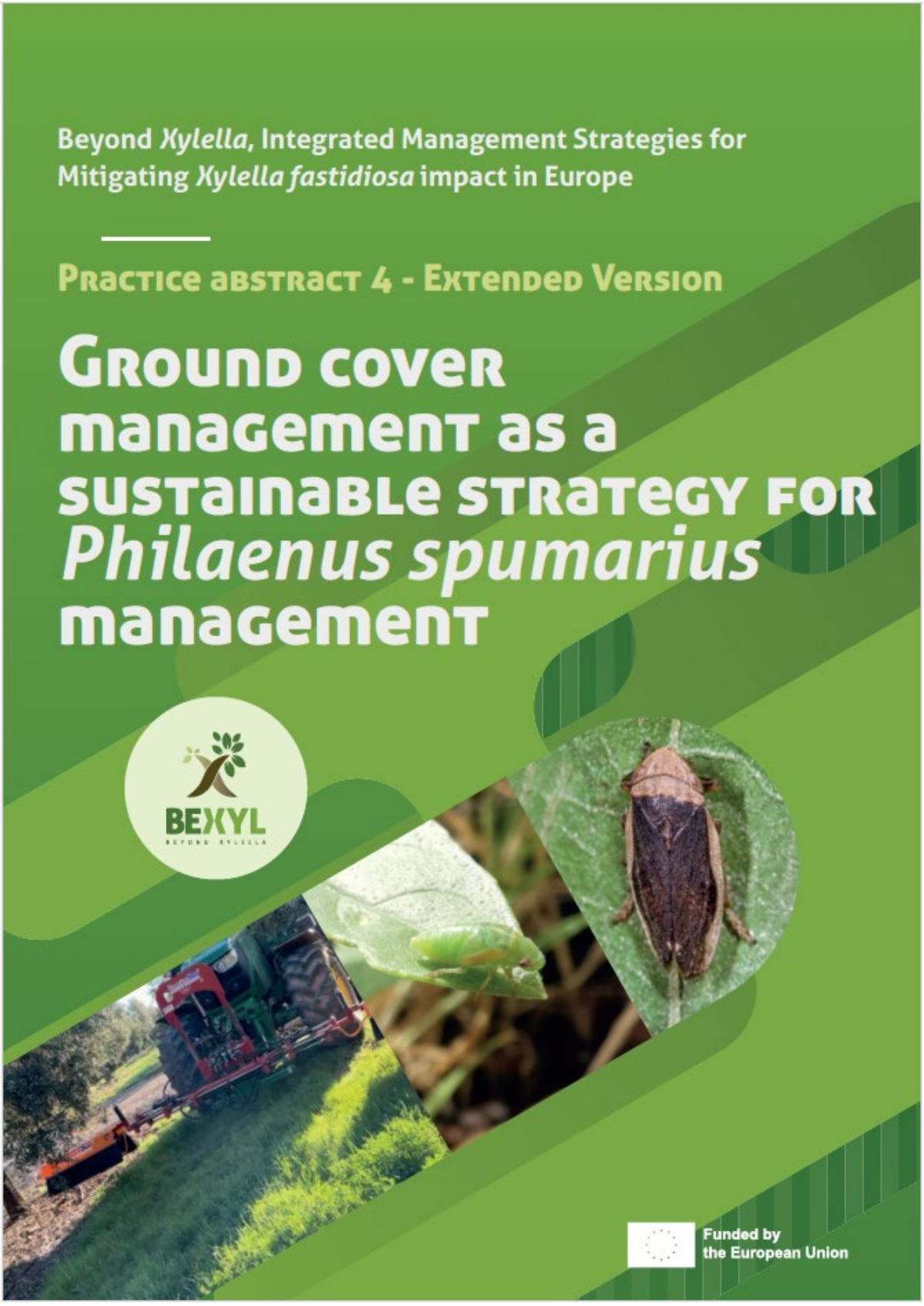
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Annex 4: Practice Abstract 4 extended



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Ground cover management as a sustainable strategy for *Philaenus spumarius* management

Xylella fastidiosa (***Xf***) is a serious plant pathogen in Europe, with its spread closely linked to insect vectors like ***Philaenus spumarius***. Traditional control methods targeting the insect vector often rely on chemical inputs, which pose environmental risks and offer limited long-term sustainability. Ground cover management has emerged as a promising agroecological strategy that not only reduces vector populations but also enhances biodiversity and soil health. BeXyl consortium is exploring how strategic management of ground vegetation can contribute significantly to the integrated management of ***Xf***, with a focus on disrupting the life cycle or feeding habits of ***P. spumarius*** in a sustainable and environmentally friendly way.

How ground cover management can make a difference for *Xylella fastidiosa* control?

Effective disease management based on vector control: To date, there is no cure for plants infected by ***Xf***. Thus, management of vector populations is key to contain the spread of ***Xf*** in infected areas.

Side effects of conventional agriculture practices: The widespread use of **pesticides and drastic tillage** can pose serious risks to biodiversity, ecosystem services and human health.

Alternative agriculture practices: **Cover crops**, reduce erosion, increase biodiversity and enhance populations of beneficial arthropods. Additionally, cover crops may also serve as hosts (reservoir) for crop pests and plant pathogens including spittlebugs and other vectors of ***Xf***.

Push-pull strategies for pest management: Plants attractive to pests can be used as a trap for concentrating insects (**pull**), while repellent plant species could be used to keep pests away from the crop (**push**). Combination of attractive trap and repellent plants (**push-pull strategy**) is a sustainable strategy that has been proved to be effective under an integrated pest management (**IPM**) framework.

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Research on *Philaenus spumarius* host preference: greenhouse experiments

BeXyl's work has shown that, under greenhouse conditions, ***Anthriscus cerefolium*** is a suitable plant to attract adults and enhance oviposition, but has a lethal effect on the first nymphal instars of ***Philaenus spumarius***, making it highly suitable for use as a trap plant. ***Diplotaxis tenuifolia*** is not suitable for oviposition or nymphal development and may function effectively as a repellent plant. ***Sinapis alba*** does not enhance oviposition but support nymphal development, although it is aassocaited with moderate to high cumulative nymphs mortality, suggestig its potential use in a push-pull strategy to disrupt spittlebug development. Both, ***Moricandia moricandioides*** and ***Papaver rhoeas*** induced high nymphal mortality rates (60% within 24h, reaching 90-100%), indicating strong insecticidal properties.

Impact: The sustainable management of ***Philaenus spumarius***, the primary vector of ***Xf***, is critical to reduce the spread of this devastating plant pathogen in agricultural systems. Since there is currently no cure for plants infected with ***Xf***, controlling vector populations through sustainable practices is essential for limiting the disease's impact. **Ground cover management**, which involves manipulating the natural vegetation surrounding crops, offers a sustainable alternative to conventional management practices, minimizing pesticide use and drastic soil tillage and preserve biodiversity and enhance ecosystem health while targeting vectors.

Objectives: Our research aim to identify and select plant species commonly used as ground cover that could be used to manage and reduce the density of ***Philaenus spumarius*** populations. Such plants could be used to deploy a **push-pull strategy** based on a combination of trap and repellent plants, as well as nonpreferred hosts for ***Xf***, which will provide ecological infrastructures to reduce the population density of ***Philaenus spumarius***.

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Research on *Philaenus spumarius* host preference: Field experiments

A field experiment was conducted in a vineyard field located in Areeiro, Pontevedra, Galicia, northern Spain, which is a ***Xf***-free area. Three different plant covers were tested: ***Diplotaxis tenuifolia*** with ***Sinapis alba***, ***Anthriscus cerefolium***, and spontaneous vegetation as a control (Figure 1). The groundcovers where sown in autumn 2023. Systematic samplings of potential vectors (both nymphs and adults) were carried out during spring 2024.



Figure 1. Field site in a vineyard located in Areeiro, Pontevedra, Galicia, northern Spain.

• Impact of Ground Cover on vectors Density:

Sinapis alba significantly reduced the density of Philaenus spumarius nymphs in spring compared to other ground covers, indicating effective suppression of early-stage ***Philaenus spumarius*** populations in these sites.

Philaenus spumarius adults increased in S. alba rows, while they were lowest in spontaneous vegetation plots, suggesting a potential shift in adult habitat preference. Results should be interpreted with caution due to the low numbers of insect vectors in the experimental plots.

The lowest adult densities of Cicadella viridis were observed in ***Diplotaxis tenuifolia*** and ***Sinapis alba*** mixture, indicating that this cover may also limit adult population of this potential vector of ***Xf***.

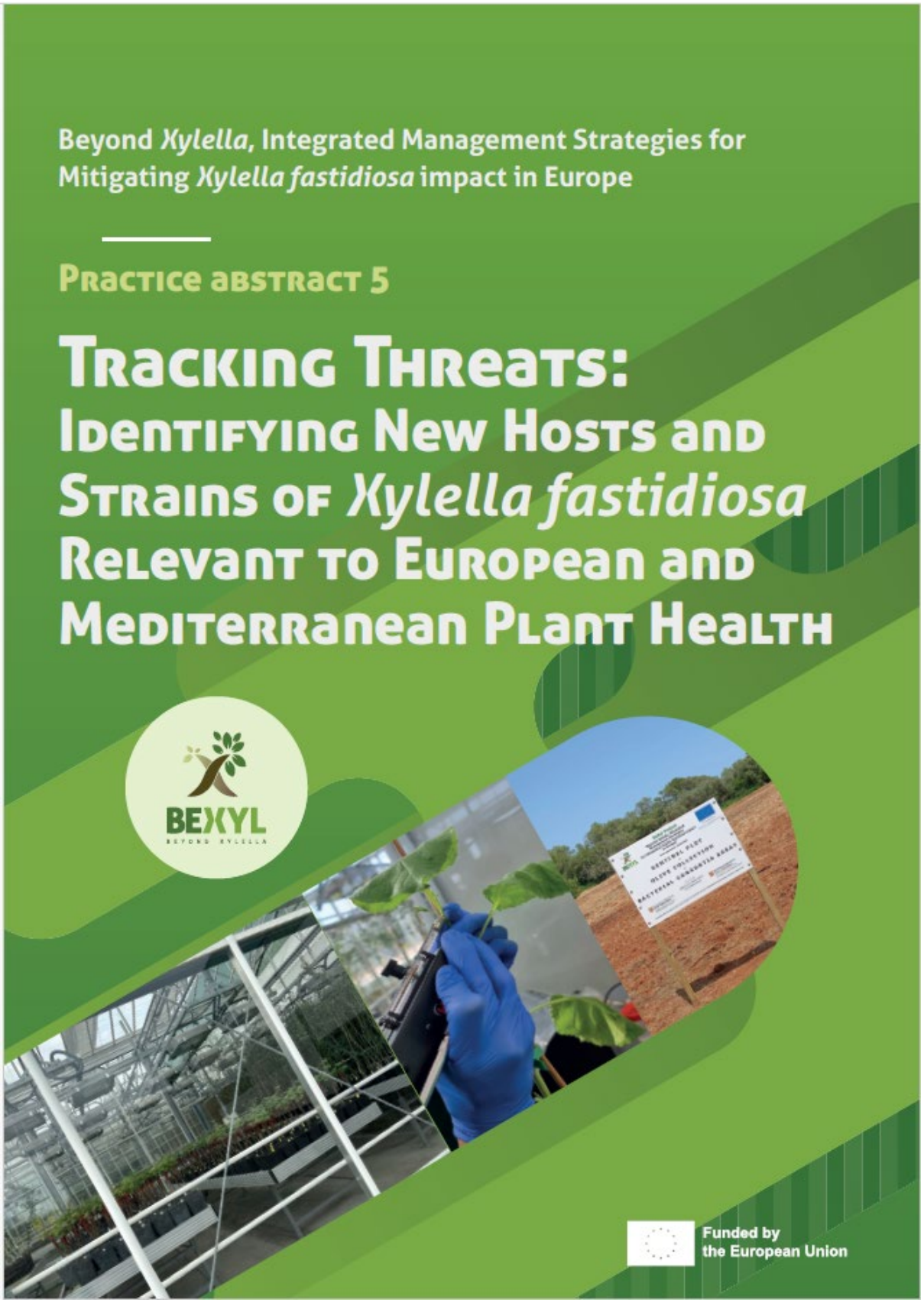
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Annex 5: Practice Abstract 5 short



Tracking Threats: Identifying New Hosts and Strains of *Xylella fastidiosa* Relevant to European and Mediterranean Plant Health

BeXyl project addresses the threat posed by *Xylella fastidiosa* (***Xf***) to agriculture and ecosystems in the European Union by identifying potential new host plants and assessing the pathogenicity of relevant ***Xf*** strains.

How does BeXyl integrates information from diverse sources to strengthen the scientific basis for risk assessment and disease management?

Pathogenicity testing: Inoculation experiments with **selected *Xf* strains** conducted under controlled conditions to assess their virulence on economically or ecologically important plant species relevant to the EU and Mediterranean region.

Sentinel plots: Highly susceptible host plant species have planted in multiple countries, both in ***Xf***-infected and ***Xf***-free areas. These plots allow for real-time monitoring of natural infections and help assess disease dynamics under different environmental conditions.

Botanical garden surveillance: Surveys in botanical gardens located in **areas where *Xf* is native**. These sites may harbor infected but asymptomatic plants of potential concern to European agriculture or natural environment, providing insights into long-term host–pathogen coexistence.

Use of National Plant Protection Organizations (NPPOs) surveillance data: **Official surveillance data** from NPPOs across Europe are analysed to identify potential new host species and understand the distribution of different ***Xf*** strains under natural conditions.

By integrating these complementary sources of information, BeXyl will contribute to a better understanding of *Xf*'s biology, host range, and disease epidemiology. These insights will support EU-level preparedness, strengthen the scientific basis for risk assessment and targeted surveillance, supporting the development of sustainable plant health strategies.

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