Beyond *Xylella*, Integrated Management Strategies for Mitigating *Xylella fastidiosa* impact in Europe

Practice abstract 4 - Extended Version

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

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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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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.

• Seasonal and Stage-Specific Density Patterns:

Philaenus spumarius exhibited its highest densities during spring, particularly at the nymph stage, marking this period as a critical window for intervention.

Cicadella viridis showed its highest densities toward the end of the season, 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.

BeXyl findings suggest that *Sinapis alba* may be particularly effective in reducing *Philaenus spumarius* nymph densities during critical developmental periods, with the additional benefit of also lowering populations of *Cicadella viridis*. Our research highlights the potential of using specific plant species as ground covers to manage *Xf* vectors. This approach could contribute to reducing vector population densities and, consequently, limiting the spread and prevalence of *Xf* in susceptible crops.

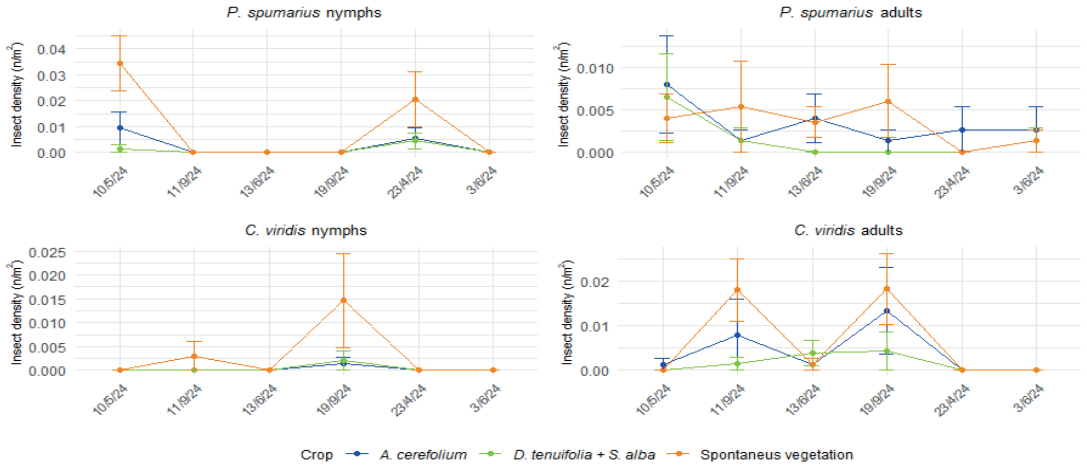


Figure 2. Seasonal changes in insect density (individuals/m²) of ***Philaenus spumarius*** and ***Cicadella viridis*** from April to September 2024. Each panel represents the mean number of individuals (nymphs and adults) for each species, with density plotted over time. The lines in different color indicate three ground cover treatments: 1) ***A. cerefolium***, 2) ***D. tenuifolia + S. alba*** mixture, and 3) **spontaneous vegetation**.

Further details: Check our published research here.

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