Cover Crops	Border Hedges	
	Shrub and Arboreal	**Herbaceous**
Trifolium Subterraneum	Arbutus unedo	Mentha suaveolens
Trifolium Incarnatum	Crataegus monogyna	Pastinaca Sativa
Trifolium Vesiculosum	Viburnum tinus	Chrysanthemum
Trifolium Resupinatum	Punica glutinosa	Hypericum perforatum
Trifolium Michelianum		Centaurea cyanus
Trifolium Alexandrinum		Borago officinalis
Phacelia tanacetifolia		Helianthus Annuus
Sinapis alba		
Matricaria Chamomila		
Calendula officinalis		
Lupinus Luteus		
Raphanus sativus		

Parameters to be measured for monitoring of the impact of the Project actions

Factor	Parameter
(I) Tree Health	(1) Nutritional State (Foliar Analysis) (2) Tree Temperature (3) *Vegetative development* (NDVI, NDWI)
(II) Soil Quality	(4) Soil microbiological activity (5) Available Water Capacity (AWC) (6) Physicochemical analysis (SOM/SOC)
(III) Disease prevalence	(7) *Xylella fastidiosa* disease control (8) Insect vector trap
(IV) Weather	(9) Climatic and atmospheric data
(V) Quality	(10) Olive Oil (organoleptic characteristics) (11) *Almond (size and USDA grades)*
(VI) Water use	(12) Water Use Efficiency (WUE) (13) Irrigation Water Productivity (IWP) (14) Stem Water Potential (SWP)
(VII) Carbon Footprint	(15) CO_2 emitted (agricultural processes)
(VIII) Biodiversity	(16) Auxiliary fauna (insect populations)
(IX) Production Value	(17) Money saved
(X) *Xf* Resilience	(18) Resilient Rate

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Sustainable agricultural practices to prevent *Xylella fastidiosa* in intensive olive and almond systems

Training
course material

liferesilience.eu

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Xylella fastidiosa (Xf) is a quarantine bacterium found in the European Union (EU) since 2000 and considered as a serious risk that threatens several crops and agricultural products of great strategic importance all over the world.

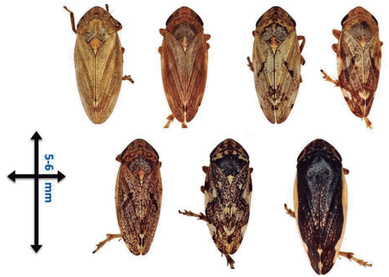
About the subspecies and associated diseases

Xf subspecies *(fastidiosa, pauca, multiplex, sandyi, tashke and morus)* cause important diseases in crops different from olive trees (olive quick decline syndrome, OQDS): almond leaf scorch disease (ALSD), citrus variegated chlorosis (CVC), phony peach disease (PPD), and Pierce's disease of grapevine.

About the host plants

The list of *Xf* host plants is extremely wide, including 563 plant species identified [European Food Safety Authority (EFSA), 2018].

Its database is increasing, suggesting that *Xf* could affect other susceptible hosts (crop, ornamental, forestry or wild species) that are found in the new European outbreaks.



Source: Instituto Valenciano de Investigaciones Agrarias (IVIA), Generalitat Valenciana (GV).

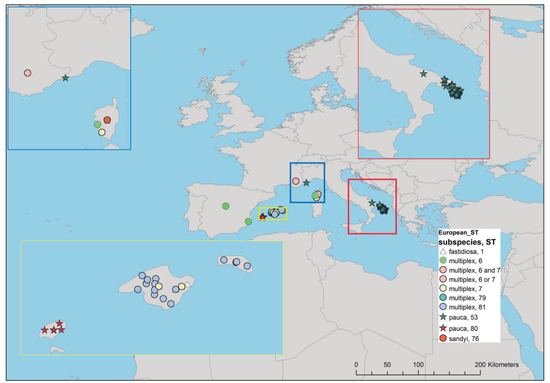
Philaenus spumarius

About the insect vectors

Xf is adapted to subsist into arthropods, being most of these sucking insects, which behave as vectors carrying the bacterium. Pathogen transmission occurs since insect vectors are able to achieve the xylem in the infected tissues of the plant and to suck the raw sap containing the bacteria. In Apulia (Italy), *Xf* is transmitted by the meadow spittlebug *Philaenus spumarius*, which is an extremely efficient and abundant vector.

Worldwide distribution

Xf is wide distributed throughout the American continent (Canada, Mexico, United States, Costa Rica, Argentina, Brazil, Ecuador, Paraguay and Venezuela). Official surveys carried out by EU Member States confirm so far that its presence is limited to Italy, Germany, France, Spain and Portugal. Outside of America and Europe, *Xf* has been detected in Iran and Israel.



Source: EFSA 2018

Soil and plant health

The living organisms that inhabit the soil are called soil biota. The soil biota is composed of soil flora and fauna. Among the organisms that inhabit the soil, we find soil bacteria.

Soil bacteria are the smallest and most numerous microorganisms and participate in the recycling processes of energy and nutrients.

The plant growth promoting bacteria (PGPR) are those bacteria that inhabit the rhizosphere and are able to benefit the plant through an increase in growth or stimulating plant's immune system.

Stimulation of plant's immune system activates its resistance mechanism, where defense compounds, such as phenolic compounds and antioxidants, are produced.

The production of this type of compounds not only protects the plant from possible diseases, but also increases its nutraceutical value.

Images: Symptoms of OQDS caused by Xf subsp. pauca ST53; Landa B.B. and Navas-Cortés, J.A. (2017).

Efficient use of water

Efficient irrigation is a crucial water management objective under scare water supply, as well as under climate uncertainty and variability. The main goal of irrigation scheduling is to define the adequate amounts of water to apply to cropped fields with the proper irrigation timing, frequency and time duration to avoid the occurrence of water stress during the crop cycle.

There are three main **irrigation scheduling** methods to achieve an efficient use of water and the production optimization.

a) Crop Evapotranspiration (ET) Scheduling
b) Soil Based Method
c) Plant-Based Irrigation Scheduling

The **irrigation scheduling approach** most frequently used aims at full satisfaction of the crop water requirements, however Partial irrigation strategies may be considered and pursued during periods of limited water supply or to achieve specific production quality targets. Regulated (which will be tested in this project) and Sustained Deficit Irrigation are common scheduling approaches for partial irrigation that could be used to achieve specific targets for crop production or to maximize water-use efficiency and water productivity.

Plants and animal life

In order for the auxiliary fauna to be established in agricultural holdings, it is fundamental to proportionate the basic conditions for its development and proliferation, through the creation of Ecological Continuity Structures.

Without good maintenance of these super-structures, it is not possible to have functional biodiversity, which can limit and control the potential XF vectors.

It is important select and use varieties that have a high level of rusticity, are also improving and add ecological benefits (attractive potential of auxiliary fauna).

The cover crops and Border Hedges are an important aid to the management and maintenance of XF vector insect predator insects.

Image:
Philaenus spumarius.
Source: RSPB, UK

Advantages in Using Ecological Continuity Structures

For Soil:
Weed Control
Protection against soil erosion
Increase in the level of organic matter
Carbon Sequestration
Best soil structure
Best agriculture machine work

For Plant:
Increased root depth
Decrease of damage to plant roots
Increase Biodiversity
Increase of Auxiliary Insects

Xylella Fastidiosa Vector Auxiliary Insects

XF Vectors	Auxiliary Insects	
Adults	Order Araneae:	Family Lycosidae Family Araneidae
	Order Opiliones:	Family Phalangiidae (Platybunustriangularis)
	Order Coleoptera:	Family Carabidae (Nebriabrevicollis) Family Coccinelidea
	Order Díptera:	Sub-order Nematocera
	Order Formicidae (Myrmicasp)	
	Order Hymenoptera:	Family Sphecidae
Nymphs	Order Araneae:	Family Lycosidae Family Araneidae
	Order Hemiptera:	Family Nabidae
	Order Coleoptera:	Family Staphylinidae (Tachinusrufipes) Family Cantharidae (Cantharissp.)
Adults/Nymphs/Eggs	Order Hymenoptera (Parasitóides):	Family Mymaridae Family Dryinidae Family Aphelinidae