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Xylella fastidiosa and its role in the Olive Quick Decline Syndrome

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The Olive Quick Decline Syndrome (OQDS) appeared suddenly some years ago in the municipality of Gallipoli, Puglia region (southeast Italy) and its spread was very fast through the heavily olive-grown countryside. Search for the causal agent(s) of this new olive disease disclosed the consistent presence of *Xylella fastidiosa* (*Xf*) in the diseased olive trees, as well as in other hosts exhibiting leaf scorching symptoms (Saponari *et al*., 2013). *X. fastidiosa* is a xylem-restricted pathogenic bacterium native to the Americas, where it has been confined for long time. Following the report of its finding in Italy, monitoring and surveys have been intensified throughout the European Union and the Mediterranean Countries. Currently, confirmed records of its presence come from Iran, Italy, France, Germany and Spain, with epidemic field outbreaks occurring only in Iran (Amanifar *et al*., 2014), southern Italy (Salento peninsula, southern Puglia) (Martelli *et al*., 2016) and in insular (Corsica) and continental (French Riviera) France (Anonymous, 2016). Thus, *Xf* has no longer a geographical distribution limited to the Americas and these novel records demonstrate that the bacterium continues to conquer new areas (Almeida and Nunney, 2015). *Xf* infections to olive were first reported by Krugner *et al.* (2014) in trees exhibiting leaf scorch and dieback symptoms in California (USA). In the Salentinian olive groves, *Xf* outbreaks were consistently associated to the olive groves affected by OQDS, consisting in leaf scorching and scattered desiccation of twigs and small branches, which, in the early stages of the infection, prevail on the upper part of the canopy. Over time, symptoms become increasingly severe and extend to the rest of the crown, which acquires a blighted appearance. Desiccated leaves and mummified drupes remain attached to the shoots. The most severely and impressively affected olives are the centuries-old trees of the locally grown highly susceptible cultivars Cellina di Nardò and Ogliarola salentina, which the growers unsuccessfully try to save through a drastic rejuvenation pruning to stimulate new growth. In fact, the new vegetation pushed by these skeletal-looking trees will soon wither and desiccate. These trees show also a variously extended browning of the sapwood of branches and trunks associated with the presence of fungal species of the genera *Phaeoacremonium*, *Phaemoniella*, *Pleumostomophora* and *Neofusicoccum* whose penetration is favored by the leopard moth galleries and which are thought to act as disease aggravators (Nigro *et al*., 2013). The overall aspect of OQDS and the modality of its spreading recalled very much the outcome of *Xf* infections to grapes, fruit and shade trees as described in the North American literature.

Interestingly, olive diseases strikingly resembling the Puglia OQDS have been described from Argentina (Haelterman *et al*., 2015) and Brazil (Coletta-Filho *et al.,* 2016). In both cases, symptomatic plants are infected by *Xf* strains closely genetically related to the subspecies *pauca*. Although belonging to the same subspecies occurring in Puglia, the Argentinean and Brazilian *Xf* strains differ from the Salentinian isolate, known as CoDiRO, whose genome, a DNA molecule of *ca.* 2,500,000 bp in size, has been sequenced (Giampetruzzi *et al*., 2015) and found to be molecularly identical to a bacterial isolate from Costa Rica, recently reported in an outbreak in France (Menton) along with the isolates of the subsp. *multiplex* commonly identified in the French outbreaks.

In early 2016, symptoms resembling those observed in the infected olive groves were recovered under experimental conditions in two independent experiments of mechanical inoculation (needle

inoculation) of potted olive plants with a bacterial suspension of the CoDiRO strains (Saponari *et al*., 2016 and unpublished). Twig dieback starting from the apexes and progressing with the desiccation of the entire branches were observed 8-14 months after the inoculation. Indeed, similarly to the field conditions, sprouts from the rootstocks (seedlings) of the inoculated grafted plants remained symptomless for a longer period, with few starting to become symptomatic 2 years after the inoculations. This study provided also evidence that the bacterium is capable to move downstream and to invade and colonize efficiently the olive roots.

In addition to mechanical inoculations, successful vector-mediated infection of the olive trees was achieved using field-collected adults of *Philaenus spumarius.* The experiments conducted using the vectors demonstrated that the natural infectivity rates of *P. spumarius* collected from olive orchards in Puglia were reasonably high (at least 25%), and that these individuals transmit the bacterium to host plants from May to October (Cornara *et al*., 2016).

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