Euphresco

Success story

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Study on the diversity of phytoplasmas detected in European forests

Phytoplasmas are wall-less bacteria, responsible for many diseases of plants that severely reduce agricultural production (*e.g.* in vineyards and fruit tree orchards) and impact natural ecosystems. Insects can vector phytoplasmas and plant species in agroecosystems surrounding cultivated areas can act as sources of inoculum. Knowledge on the host plants and on the insect vectors of phytoplasmas can help understanding and mitigating the risks, and allows the development of better management strategies. A number of plants that are part of the wild forest flora can host phytoplasmas, and insects that occur in forests can vector them. A thorough knowledge of these can be used to develop measures to reduce outbreaks in cultivated crops and maintain environmental biodiversity.

The Euphresco project PhyFor aimed to broaden the knowledge on the epidemiology of phytoplasmas with a particular focus on phytoplasmas present in forests. The project partners developed common protocols for the monitoring and detection/identification of phytoplasmas and monitored forests to detect decline syndromes associated with the presence of phytoplasmas, especially those of exotic origins.

Wild areas surrounding grapevine, fruit trees and other cultivated crops were investigated in Austria, Bosnia & Herzegovina, France, Germany, Italy, Serbia and Slovenia. The insects and plant samples collected produced a preliminary picture of the presence and diversity of phytoplasmas.

Several phytoplasmas were identified in *Scaphoideus titanus*, the insect vector of grapevine "flavescence dorée". Of these, '*Candidatus* Phytoplasma asteris', was shown to be transmitted to plant species, however the ability of *Scaphoideus titanus* to transmit the other phytoplasmas should be studied more thoroughly. Other insects were shown to host phytoplasmas such as *Anaplotettix fuscovenosus*, *Arboridia*

ribauti, *Euscelis incisus*, *Hyalesthes obsoletus, Neoaliturus fenestratus, Orientus ishidae, Philaenus spumarius* and *Synophropsis lauri*, but their ability to vector the phytoplasmas still has to be demonstrated. More information is provided in Table 1.

Table 1. Phytoplasma detected in insect species during the survey. In red insects that were demonstrated to vector the detected phytoplasma, in blue phytoplasmas associated with economically relevant diseases in EU.

'*Candidatus* Phytoplasma' species (ribosomal group/subgroup)	**Insect species**	**Country**
'*Candidatus* Phytoplasma asteris' (16SrI)	*Scaphoideus titanus, Hyalesthes obsoletus, Orientus ishidae, Neoaliturus fenestratus, Euscelis incisus*	Italy
(16SrII)	*Anaplotettix fuscovenosus*	
(16SrIII)	*Anaplotettix fuscovenosus*	
(16SrV-C)	*Scaphoideus titanus, Orientus ishidae*	Italy, Slovenia, Bosnia & Erzegovina
(16SrVI)	*Scaphoideus titanus, Orientus ishidae*	Italy
'*Candidatus* Phytoplasma fraxini' (16SrVII-A)	*Scaphoideus titanus, Orientus ishidae*	
(16SrIX)	*Arboridia ribauti, Synophropsis lauri*	
(16SrX)	*Philaenus spumarius*	
'*Candidatus* Phytoplasma prunorum' (16SrX-B)	*Scaphoideus titanus*	
'*Candidatus* Phytoplasma solani' (16SrXII-A)	*Scaphoideus titanus, Hyalestes obsoletus, Orientus ishidae, Neoaliturus fenestratus*	

Surveys conducted in plants collected in forest areas that surround cultivated fields provided information on the presence of phytoplasmas. In Germany about 5 000 elm trees of diverse species in forests were tested and 1/3 of the trees tested positive for the presence of '*Candidatus* Phytoplasma ulmi'. Phytoplasmas were identified in several plant species such as: *Acer campestre, Ailanthus altissima*, *Alnus glutinosa, Alnus incana, Carpinus betulus*, *Celtis orientalis*, *Clematis vitalba, Cirsium arvense,*

Convolvulus arvensis, Crataegus laevigata, Fraxinus spp., *Morus* spp., *Parthenocissus quinquefolia*, *Quercus petraea*, *Rubus* spp., *Salix* spp., *Skimmia* spp., *Sorghum halepense, Ulmus glabra*, *Ulmus laevis*, and *Ulmus minor* (Table 2). In some cases, such as in Slovenia, phytoplasmas were also detected in cultivated plantations of *Corylus avellana*. The trees did not always show symptoms typical of phytoplasma presence.

Table 2. Phytoplasmas detected in plants collected in forest areas surrounding cultivated fields.

'*Candidatus* Phytoplasma' species (ribosomal group/subgroup)	**Plant species**	**Country**
'*Candidatus* Phytoplasma asteris' (16SrI)	*Sorghum halepense*, *Clematis vitalba*, *Rubus* sp., *Morus* sp.	Italy
'*Candidatus* Phytoplasma ulmi' (16SrV-A)	*Ulmus* spp.	
	Ulmus minor, Ulmus glabra, Ulmus laevis	Slovenia, Germany
(16SrV-C)	*Clematis vitalba, Salix* spp., *Alnus glutinosa*	Italy
	Ailanthus altissima, Alnus glutinosa, Alnus incana, Clematis vitalba	Slovenia
	Ulmus, Clematis	Bosnia & Erzegovina
	Alnus glutinosa	Serbia
(16SrIX)	*Celtis orientalis*	Italy
(16SrX)	*Convolvulus arvensis, Cirsium arvense, Celtis orientalis, Sorghum halepense*	
'*Candidatus* Phytoplasma solani' (16SrXII-A)	*Skimmia* sp., *Parthenocissus quinquefolia*	
'*Candidatus* Phytoplasma fragariae' (16SrXII-E)	*Fraxinus* sp.	France
	Acer campestre, Carpinus betulus, Crataegus laevigata, Fraxinus ornus, Quercus petraea	Slovenia

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