

Dehesa health starts from the ground up

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Holm oak from one of the places studied by the researchers. Credit: University of Córdoba

Holm oak decline threatens dehesa sustainability. Though the pseudofungus oomycete *Phytophthora cinnamomisería* is thought to be the main cause of holm oak decline, climate conditions have been shown to influence it, as well. Even so, this puzzle has yet to be solved.

In search of the last few pieces to understand how the disease develops, University of Cordoba Forest Engineering researchers Francisco Ruiz and Rafael M^a Navarro, in collaboration with researcher Alejandro Pérez de Luque from IFAPA (Agricultural and Fishing Training Research Institute of Andalusia, Alameda del Obispo center), and international researchers, carried out a study on microorganism biodiversity in soil using molecular techniques to analyze if and how interactions among soil microorganisms influence the seriousness of the disease.

The study focused on fungi and [oomycetes](#) that live in soil, and the interactions that occur among them. In addition, it confirms that changes in microbiota structure and biodiversity are fundamental for woodland health in two ways: On the one hand, interactions among soil microorganisms directly influence pathogens that affect holm oak, and on the other, the presence of some beneficial microorganisms helps to improve the trees' health.

A well-known biocontrol agent, *Trichoderma*, appeared to be related to the absence or scarcity of oomycete pathogens. Additionally, an abundance of mycorrhizae resulted in less defoliation of the woodland. These microorganisms are able to establish antagonistic relationships with the pathogens, and increase a tree's ability to absorb and stimulate an autoimmune response. In other words, a structure conducive to the fungi community and the presence of key beneficial species provides the oak with more resources to defend itself from the pathogen and improve the health of woodlands, even when root rot is present.

Turning the focus underground also unravels other mysteries. All of the areas that were studied had root rot (decline). Nevertheless, the pathogens that are considered to be the main causes of the disease were not relevant on many plots of land, even those teeming with dying holm oaks. The key to this mystery was the presence of a mixture of less aggressive individual species such as *Alternaria* and *Fusarium*, among

others. When these kinds of species synergize, they can cause the same symptomatology as do more aggressive species, even to the point that they cause the tree to die. So UCO and IFAPA researchers concluded that a diagnosis of oak decline should not only be limited to the presence of one single pathogen, but rather, a complete analysis of the present communities and the relationships among them is required in order to detect danger in a more precise way.

Advances in technology allowed the researchers to address the complexity of this study. The research group applied plant biotechnology methods to the study of forest pathology, which, along with data from the Environmental Damage Tracking Network, allowed them to understand the role of [soil microorganisms](#) in the decline of Andalusian dehesas. The diversity and structure of microbiota is a key piece of this puzzle. Considering the soil microbiome within the comprehensive management of holm oak and cork oak root rot on the dehesa is bringing the research community closer to finding the solution that will most effectively protect this ecosystem.

More information: Francisco J. Ruiz Gómez et al, Assessment of functional and structural changes of soil fungal and oomycete communities in holm oak declined dehesas through metabarcoding analysis, *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-41804-y](https://doi.org/10.1038/s41598-019-41804-y)

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