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A MATHEMATICAL MODEL FOR AN OLIVE TREE

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Olive tree (*Olea europaea* L.) has a great importance in the Mediterranean region. This plant is attacked by several diseases that can cause considerable economic losses in their production. The main diseases that affect olive trees are mostly caused by fungi and bacteria, which can infect several parts of the plant (roots, stem, fruits and leaves). Nowadays, olive diseases control programs rely mostly on chemical control by application of copper-based fungicides. Besides having limited efficacy, this control measure is not compatible with sustainable production systems. In olives production, plant protection strategy must follow the Guidelines for integrated production of olives, [1]. Thus, a need to develop novel and environmental-friendly control strategies for management of olive diseases is an important research topic. Phyllosphere-associated microorganisms may be explored, in an integrative perspective, for designing new strategies for the biological control of olive diseases. The aerial parts of the plants (phyllosphere) are colonized by a diverse microbial community (mostly bacteria and filamentuous fungi), which can grow both epiphytically on the surface of plant tissues and endophytically within the tissues, [2]. Those microorganisms interact with each other and with host plant, mediating several ecosystem processes by altering plant traits, [3], including disease resistance traits, [4].

In this work the potential role played by phyllosphere microorganisms in the protection of host olive tree to phytopathogen infection, as biological control agents or through their management in order to reduce phythopatogens, will be explored. A four dimensional nonlinear mathematical model is introduced and analysed. It describes the evolution in time of the phyllosphere of an olive tree and its interaction with two different microorganisms, a bad one, that affect the plant, and a beneficial one. Are found the analytical expressions of the five equilibria of the system and their stability is studied. The model has an interesting behaviour, the bistability of tree pairs of equilibria

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is shown, furthermore for one of them we have found the separatrix surface, [5]. Oscilation of an equilibrium point is found too.

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