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ECOPHYSIOLOGICAL MODELLING OF PLANT-NEMATODE INTERACTIONS TO UNDERSTAND PLANT TOLERANCE

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Root-knot nematodes (RKN) of the *genus Meloidogyne spp.* cause considerable yield losses in numerous crops worldwide. The dynamics and outcome of plant-pathogen interactions depend on the ecological conditions, including the phenotypes of the interacting species, their physiology and the abiotic environment in which the interaction takes place. In theoretical ecology a broad literature exists on interactions between plants and different pest species (e.g. predation, competition, etc.). These studies investigate temporal and spatial dynamics in plant-pest systems. Yet they usually describe plants in a very simple way, neglecting their physiological response. For instance, most mathematical models that describe crop-nematode interactions either focus on plant physiology and do not consider pest dynamics, or conversely are based on the pest life cycle but neglect plant physiology and defense response [1].

We exploit methods from dynamic system modelling to build a mechanistic model of plant-RKN interactions that explicitly links plant physiology and pest demography, including both the effect of these pests on the crops and the effect of the plants on the pests.

The model is used to study the variability of plant response to pest attacks and to analyse the complex interplay among plant physiological and architectural traits, abiotic conditions and nematode biology that affects the infection dynamics. A particular attention will be devoted to the identification of key plant traits, that characterize susceptible and tolerant plants, a key challenge for varietal selection and pest management.

Understanding the origin of these phenotypic differences is a key challenge to design, improve and assess pest control strategies, including the selection of new tolerant cultivars.

References

[1] Nilusmas, S., Mercat, M., Perrot, T., Djian-Caporalino, C., Castagnone-Sereno, P., Touzeau, S., Mailleret, L. (2020). Multi-seasonal modelling of plant-nematode interactions reveals efficient plant resistance deployment strategies. *Evolutionary applications*, 13(9), 2206-2221.

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