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► **To cite this version:**

Elise Lepage, Julien Papaïx, Loup Rimbaud, Benoît Moury. Thesis in progress : Understanding the role of natural reservoirs in the epidemic and evolutionary dynamics of generalist agricultural pathogens. 19èmes Rencontres de Virologie Végétale, Jan 2023, Aussois, France. hal-04195544

HAL Id: hal-04195544

<https://hal.inrae.fr/hal-04195544>

Submitted on 4 Sep 2023

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Thesis in progress : Understanding the role of natural reservoirs in the epidemic and evolutionary dynamics of generalist agricultural pathogens

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Diversification of the plant community in space and time is a fundamental component of disease management in agroecological landscapes. However, such strategies seldomly account for the complex and ambivalent role of wild hosts in the vicinity of crops. Moreover, many landscape strategies can be undermined by generalist pathogens (able to infect a large range of plant species, and likely to be present in many wild plants). This thesis, started in September 2022, aims at tackling the following questions : What roles do natural reservoirs play in the epidemic and evolutionary dynamics of generalist agricultural pathogens, and what are the consequences for management strategies?

This work is motivated by the current epidemic of cucumber mosaic virus (CMV) on peppers in the Espelette region, whose causes are still unknown. Here, a systemic approach, combining field sampling, laboratory experiments and simulation modeling, in collaboration with the ‘Syndicat du Piment d’Espelette AOP’, will allow the study of the spatio-temporal genetic structure of the virus in the Espelette area. Our first campaigns led to the shortlisting of ‘ideal suspects’ - that is, abundant and often infected CMV alternative hosts in the wild reservoir during the offseason. To further understand their role on CMV epidemics on pepper in summer, the level of adaptation of the virus to these alternative hosts is to be explored through both genetic and phenotypic approaches.

This investigation will eventually lead to the identification of key factors of epidemics, which will help prioritize control strategies and test them via a simulation modeling approach.