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Be strong in a single host or be versatile in a multitude of hosts ?

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► To cite this version:

Elise Lepage, Julien Papaix, Benoît Moury, Loup Rimbaud. Be strong in a single host or be versatile in a multitude of hosts ?. Conférences Jacques Monod, Oct 2023, Roscoff, France. hal-04608145

HAL Id: hal-04608145

<https://hal.inrae.fr/hal-04608145>

Submitted on 11 Jun 2024

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Be strong in a single host or be versatile in a multitude of hosts ?

The pathosystem

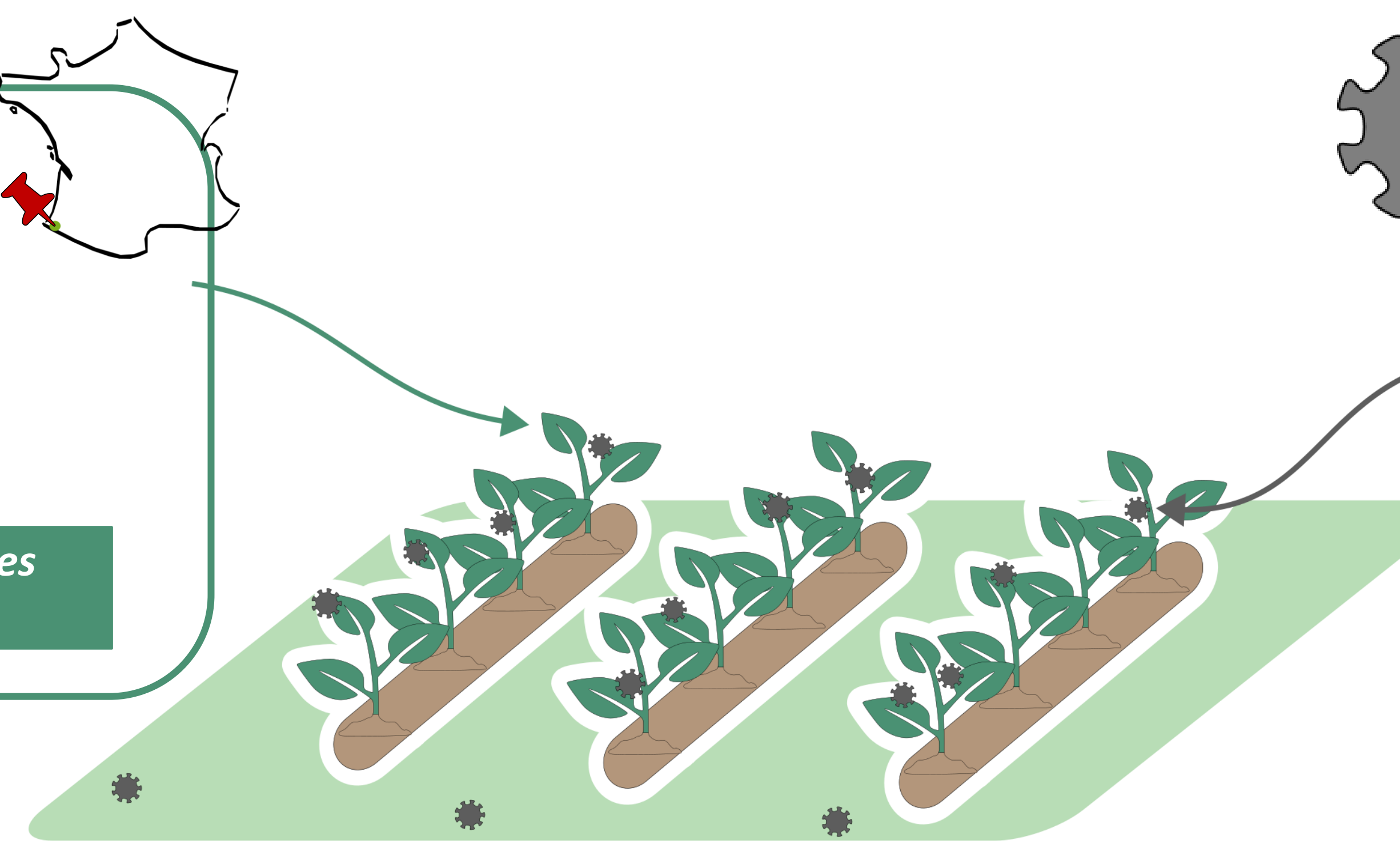
The crop : Espelette pepper

Capsicum annuum var. Gorria

~200 plots, in a 15x15km² PDO zone

Open field crop, from May to December

Sept. 2021 : 89 % infected plants (samples from 23 plots, 60 samples by plot)



The pathogen : cucumber mosaic virus

- Generalist pathogen: > 1000 host species
- Vector transmitted, >80 aphid species
- Present worldwide, France : subgroups IA and II

Isolates found in Espelette : mainly from subgr. IB, low genetic diversity, a few isolates from gr. II

Phylogenetic tree of CMV genetic diversity.

Hirsch, J., & Moury, B. (2021). Cucumber Mosaic Virus (Bromoviridae). *Encyclopedia of Virology*

Exploring the vicinity of plots : the wild reservoir

2021 : broad exploration
more than 240 species sampled
infected plants detected in **36 species**

Number of fields where CMV-infected wild plants were detected, out of the 23 fields sampled

March (interseason) : 17/23 Sept. (crop season) : 22/23

Focus on 5 wild plant species :

Species	Abundance	CMV prevalence	isolates group
<i>Hyacinthoides non-scripta</i>	High	High	Gr. II
<i>Nicandra physalodes</i>	High	High	Sub. Gr. IB
<i>Capsella bursa-pastoris</i>	High	High	Sub. Gr. IB
<i>Stellaria media</i>	High	High	Sub. Gr. IB
<i>Trifolium repens</i>	High	High	Sub. Gr. IB
<i>Cerastium glomeratum</i>	High	High	Sub. Gr. IB

Is generalism the sum of specialized subpopulations, or is it truly *one genotype to infect them all*?

Is there a cost to generalism?

A cross-inoculation experiment to tackle down these questions :

Isolate / group	CMV									Mock
	CMV ^{gor}	CMV ^{hya}	CMV ^{i17f}	CMV ^{nic}	CMV ^{caps}	CMV ^{stel}	CMV ^{tri}	CMV ^{cer}	CMV ^{ref}	
Plant	IB	II	IA	IB	IB	IB	IB	IB	IB	Ø
Gorria pepper	X15									
<i>Hyacinthoides</i>										
<i>Nicandra physalodes</i>										
<i>Capsella bursa-pastoris</i>										
<i>Stellaria media</i>										
<i>Trifolium repens</i>										
<i>Cerastium tomentosum</i>										
Ref. pepper (Yolo Wonder)										

For each combination plant species x isolates, we measure :

- Infection rate (number of successful inoculation)
- Viral load (quantitative ELISA)
- Virulence (reduction of mass)

- Results :**
- Plant species matters and isolate doesn't when it comes to infection rate
 - An interaction between plant species and viral isolates can exist when it comes to virulence (ongoing analysis)

- Discussion :**
- Difficulty to evaluate species that naturally live in different ecological conditions (ex : *Hyacinthoides* = winter plant).
 - Impossible to implement such an experiment with aphid-transmission.
 - Ongoing development of a quantitative ELISA protocol to measure viral load in different species with different viral strains.

Number of successful inoculations

Plants	CMV	20 plants inoc.							15 plants inoculated							Mock		
		Gor.	Hya.	i17f	Nic.	Caps.	Stel.	Tri.	Cer.	Gor.	Hya.	i17f	Nic.	Caps.	Stel.		Tri.	Cer.
		Gor.	20	20	20	15	15	15	15	15	0	Gor.	20	20	20		15	15
Nic.	19	20	20	20	14	15	15	15	0	Nic.	19	20	20	14	15	15	15	0
Caps.	20	20	20	20	15	15	15	15	0	Caps.	20	20	20	15	15	15	15	0
Stell.	18	20	20	20	15	15	15	15	0	Stell.	18	20	20	15	15	15	15	0
Tri.	1	0	2	0	0	0	0	0	0	Tri.	1	0	2	0	0	0	0	0
Cer.	1	0	2	1	0	0	0	0	0	Cer.	1	0	2	1	0	0	0	0
ref. (YW)	20	20	20	20	15	15	15	15	0	ref. (YW)	20	20	20	15	15	15	15	0

Unexpected result : group II isolate is seldomly found on the field, but it effectively infects pepper and wild plants

Be strong in a single host or be versatile in a multitude of hosts: what is the strategy of cucumber mosaic virus in the Espelette landscape?

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