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Exploring plant tolerance to viruses as a sustainable means of disease control

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As it is expected to exert a weaker selection pressure on parasite populations, plant tolerance to parasites - the mechanisms that reduce the negative impact of infection on host fitness, health or yield, despite elevated parasite concentrations - appears as an interesting alternative to resistance *sensu stricto* - mechanisms that reduce parasite accumulation. However, the durability of tolerance has seldom been experimentally tested. Moreover, little is known about the genetic determinants controlling tolerance to parasites.

We have chosen the interaction between pepper and *Cucumber mosaic virus* (CMV) as a model to study plant tolerance to viral pathogens and evaluate the durability of tolerance. We have recently initiated a screen using a pepper doubled haploid (DH) mapping population to map CMV tolerance and resistance QTLs. Both virus titer and plant health were simultaneously evaluated for each DH line. Virus accumulation was quantified using serological methods (DAS-ELISA, Double Antibody Sandwich Enzyme Linked Immunosorbent Assay). The impact of infection on plant health was measured using different methods. These methods included calculating the AUDPC (Area Under the Disease Progress Curve) index, which combines time of symptom emergence and symptom intensity; measuring plant growth parameters, such as the reduction in fresh weight of infected plants compared to mock-inoculated plants and measuring chlorophyll fluorescence parameters.

Our preliminary screening efforts have (i) shown that plant health and virus load are not correlated and (ii) allowed the identification of lines displaying contrasted levels of tolerance and resistance to CMV. Screening of additional DH lines will allow us to map QTLs controlling tolerance or resistance *s.s.*, and to compare the genetic architecture of these two defense mechanisms. Further efforts will aim at confirming tolerance and resistance levels of a small subset of DH lines with contrasted levels of tolerance and resistance to CMV, testing their response to a set of isolates representative of CMV diversity, and evaluating their tolerance and resistance levels at the adult stage and in fruit. Tolerant DH lines will be exploited in experimental evolution assays, through serial virus inoculations, in order to evaluate the durability of this defense mechanism in controlled conditions. These assays should indicate whether tolerance is evolutionarily more stable than resistance *s.s.* and whether breeding tolerant crops may contribute to sustainable control of plant viruses.

Mots-clés : Tolerance, resistance, QTL, durability, *Capsicum annuum*, Cucumber mosaic virus.



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