Quantitative resistance differences between and within natural populations of Solanum chilense against the oomycete pathogen Phytophthora infestans

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Abstract

The wild tomato species Solanum chilense is divided in geographically and genetically distinct populations that show signs of defense gene selection and differential phenotypes when challenged with several phytopathogens, including the oomycete causal agent of late blight Phytophthora infestans. To better understand the phenotypic diversity of this disease resistance in S. chilense and to assess the effect of plant genotype vs. pathogen isolate, respectively, we evaluated infection frequency in a systematic approach and with large sample sizes. We studied 85 genetically distinct individuals representing nine geographically separated populations of S. chilense. This showed that differences in quantitative resistance properties can be observed between but also within populations at the level of individual plants. Data also did not reveal clear indications for complete immunity in any of the genotypes. We further evaluated the resistance of a subset of the plants against P. infestans isolates with diverse virulence properties. This confirmed that the relative differences in resistance phenotypes between individuals were mainly determined by the plant genotype under consideration with modest effects of pathogen isolate used in the study. Thus, our report suggest that quantitative resistance against P. infestans in natural populations of a wild tomato species S. chilense is likely not the result of specific adaptations of hosts to the pathogen but of basal defence responses that depend on the host genotype and are pathogen isolate-unspecific.

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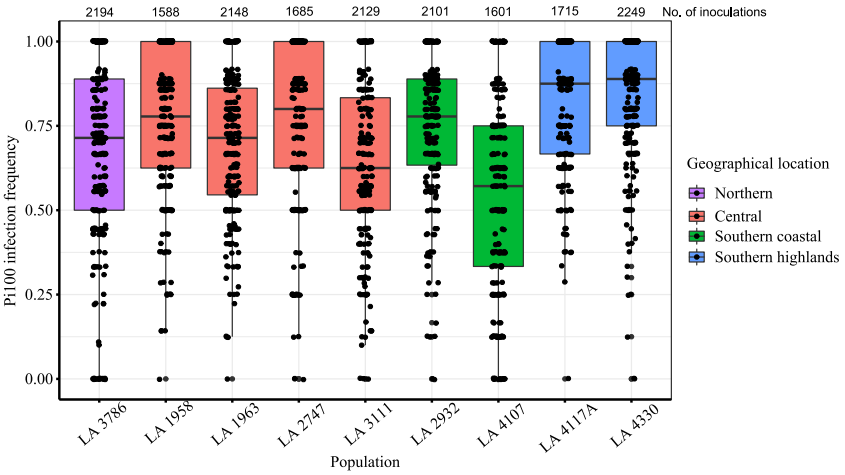

Figure 1: Infection frequencies in different populations upon inoculation with *P. infestans* isolate Pi100.
The box plots show the median of the infection frequency of a leaf which is the ratio of infected leaflets over total inoculated leaflets. Each population consisted of 9-10 plants. The assay was performed on three separate dates, each time with seven to eight leaves for each individual plant. Each data point indicates the infection frequency of an individual leaf obtained from inoculations616 of up to 14 leaflets per leaf. The Y-axis shows infection frequency ranging from 0 (no infected617 leaflets on a leaf) to 1 (all leaflets show infection). The colors represent the geographic regions of the population.

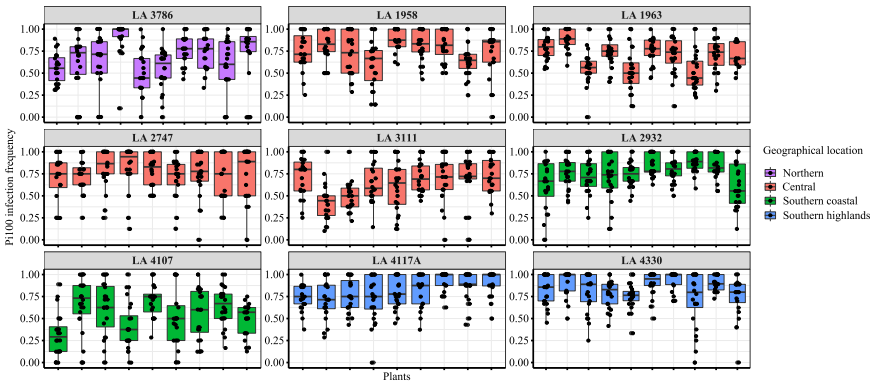

Figure 2: Evaluation of infection frequency in individual plants from different populations.
Each individual facet shows different populations (as tested in Figure 1) each box plot shows a single plant tested for infection phenotype. Experiments were performed on three separate dates (with an exception for 1 plant only on two dates), each time with 8 leaves per plant (with an exception in 2 plants with 7 leaves per plant). Y-axis represents infection frequency and X-axis represents different plants; color shows the geographical region of the population (as in Figure 1).

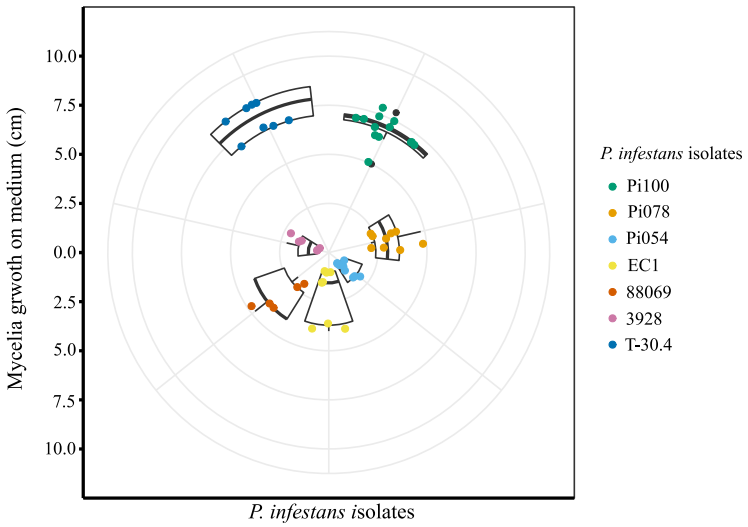

Figure 3: Growth of different isolates of *P. infestans* on culture medium.
The radial plot shows the outgrowth of mycelia (in cm) of different isolates of *P. infestans* 10 days post drop inoculation on Rye B agar medium. Different colors indicate different isolates of *P. infestans*.

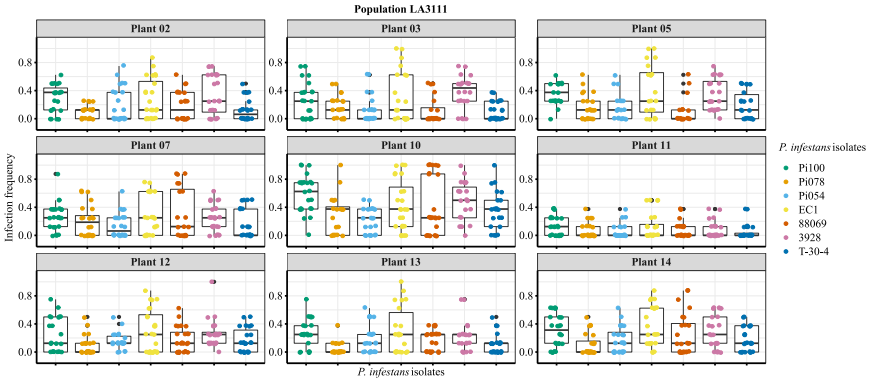

Figure 4: Infection frequency of 7 different isolates of *P. infestans* on plants within population LA3111.
Each facet shows an individual plant of the population LA3111, the box plot represents the infection fraction of plants when inoculated with seven isolates of *P. infestans* depicted in different colors. Y-axis represents infection frequency (0-1 as in Figures 1 and 2) and X-axis represents different *P. infestans* isolates.