Experimental evolution of a plant RNA virus: a warning about spurious correlations when studying fitness changes

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Experimental evolution of a plant RNA virus: a warning about spurious correlations when studying fitness changes

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Several authors proposed to fight against pathogens by manipulating the evolutionary forces imposed by the host on the pathogen, like genetic drift and selection. However, this approach has never been tested in a plant-pathogen system.

We analysed the impact of pepper (*Capsicum annuum*) DH lines showing contrasted genetic backgrounds on *Potato virus Y* (PVY) evolution. The lines exerted different level of selection and genetic drift (N_e) on the virus, and the initial PVY fitness (W_i) differed between lines. We serially passaged 64 PVY populations every month on 6 lines during 7 months and we assessed their final fitness (W_f).

Contrasted evolutionary trajectories occurred, including virus extinctions and fitness gains linked to parallel nonsynonymous mutations in the VPg cistron. These trajectories were well explained by the evolutionary forces imposed by the host on PVY. Firstly, when N_e was high, the fitness change (W_f/W_i) decreased with W_i, while, when N_e was low, no fitness change occurred. The faster evolution of low-fitness compared to high-fitness populations is frequently observed in microbial experimental evolutions. However, since W_i appears in both variables, a problem of "spurious correlation" arises. Consequently, we reexamined the link between W_f/W_i and W_i in our data and in published datasets, and we provide solutions to avoid this bias. Secondly, we considered W_f and obtained similar results: when N_e was high, W_f was high whatever W_i, while, when N_e was low, W_f was close to W_i. Therefore, combining a high resistance efficiency (low W_i) and a low N_e could prevent virus adaptation.