You can have your cake and eat it, too: adaptation to a novel host does not cause strong selection when returned to the original host

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1Viruses exist in a world where they are constantly being exposed to potential hosts. The environment plays a critical role in avoiding or compensating for costs associated with host range expansion. Selection can filter costly mutations but only if they are costly in that environment, because selection is blind to costs not faced in the current environment. Most studies of host range expansion focus on the early stages of adaptation to a novel host, but little is known about how viruses respond when they return to their original host afterwards.

We performed a series of evolution experiments using the dsRNA bacteriophage phi6 to test how phage that had experienced selection on novel hosts for ~150 generations responded when subsequently adapted to the original host on which its ancestor specialized, Pseudomonas syringae pv phaseolicola (Pp). Specifically, we tested if these phage reverted back to their ancestral phenotype. To do this, we repeatedly evolved novel host-adapted phage to Pp for ~100 generations. We then tested if they contracted back to their ancestral phenotype. To do this, we repeatedly evolved novel host-adapted phage to Pp for ~100 generations. We then tested their host range to see if it contracted after exposure to a single host and found that host range remained broad despite never experiencing selection in many of the hosts. In fact, host range even expanded in a few cases. Furthermore, when we tested the fitness of the ancestors and the evolved populations, we found that experiencing selection on one or two novel hosts does not show evidence of strong selection on phi6. In future, we plan to use whole genome sequencing to identify mutations accumulated during evolution and whether they are new or reversions.

1. What is your pathogen? Multiple options possible (e.g. if working on coinfections)
   
   Other: bacteriophage phi6

2. On a scale of 1-5 is your work mostly eco/epidemiological or evolutionary? 3

3. On a scale of 1-5 is your work mostly theoretical or experimental/empirical?
   5 (100% empirical)