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Appendix A from S. R. Hall et al., "Resource Ecology of Virulence in a Planktonic Host-Parasite System: An Explanation Using Dynamic Energy Budgets"

(Am. Nat., vol. 174, no. 2, p. 149)

Additional Results from the Life-Table Experiment

In this appendix, we provide additional yet germane data from the life-table experiment comparing fitness components of hosts (*Daphnia dentifera*) and parasites (*Metschnikowia bicuspidata*). First, when examining survivorship curves, we see that almost all uninfected animals survived the duration of the experiment (see fig. A1 for more details). Thus, infection considerably curtails survivorship of parasitized *Daphnia*. Additionally, in the text we show that reproductive rate remains lower for infected hosts than for uninfected hosts. However, it increases with food supply for both classes of hosts, but at a slower rate for infected hosts. Here, we dissect this virulent effect on fecundity into two components: reproductive turnover and clutch size. Regarding reproductive turnover, *Daphnia* release offspring in clutches while molting. The rate at which hosts produce clutches increases with more food supply (food effect, ANOVA: $F_{3,73} = 20.3$, $P < .0001$) but decreases overall when hosts are infected (infection effect, $F_{1,73} = 95.6$, $P < .0001$; fig. A2*A*). Meanwhile, the number of offspring produced per clutch (clutch size; fig. A2*B*) also increases with food supply ($F_{3,73} = 238.0$, $P < .0001$). However, as food supply increases, clutch size begins to drop for infected hosts relative to healthy ones (food × infection interaction: $F_{3,73} = 18.4$, $P < .0001$; infection effect: $F_{1,73} = 73.8$, $P < .0001$). Thus, lower fecundity of infected hosts at a high food supply involves both reduced reproductive turnover and clutch size; however, at a low food supply, the compromised fecundity signal reflects slower reproductive turnover only (fig. A2). Such details might be accounted for in a dynamic energy budget (DEB) model tailored more specifically to molting dynamics of *Daphnia*.

The DEB model assumes that parasitized hosts die sometime after a critical threshold is crossed (i.e., the $N = \rho W$ threshold, where N is parasite mass, W is host structural mass, and ρ is a proportional constant). Above this mechanical threshold, parasite burden becomes so intense that the host ceases to eat (and therefore starves and dies). We estimated dry mass of this clone of hosts, using a length-weight regression, $L = \alpha W^3$. Spore weights were estimated by counting densities of spores in solution and then weighing them on preweighed filters. This procedure may have overestimated spore density, but it still yielded a rough estimate of 174 pg spore^{-1}. On the bases of these estimates and fits using major-axis regression, a reasonable value for ρ is ~1.86 (unitless; fig. A3). That is, at time of death, infected hosts carried a spore mass that was about twice as much as their own structural body mass.

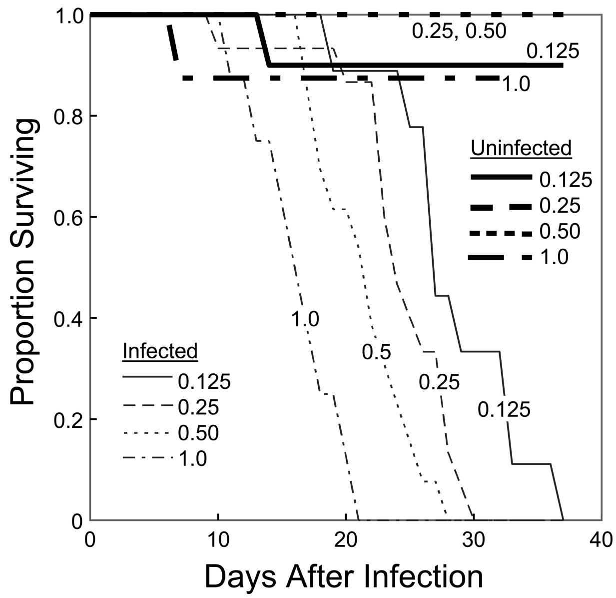

Figure A1: Survivorship curves for infected and uninfected *Daphnia* hosts from the life-table experiment, with varying food supply (four levels: 0.125, 0.25, 0.50, and 1.0 mg C L^{-1} of algal *Ankistrodesmus*). By the end of the experiment, all uninfected animals had survived in the moderate-food treatments (0.25 and 0.50), and one animal had died in the low-food (0.125) and high-food (1.0) treatments each. Note that data from uninfected animals in the high treatment are censored at day 31 (because of an accident). Suffice it to say that uninfected animals had a much longer life span than did infected animals.

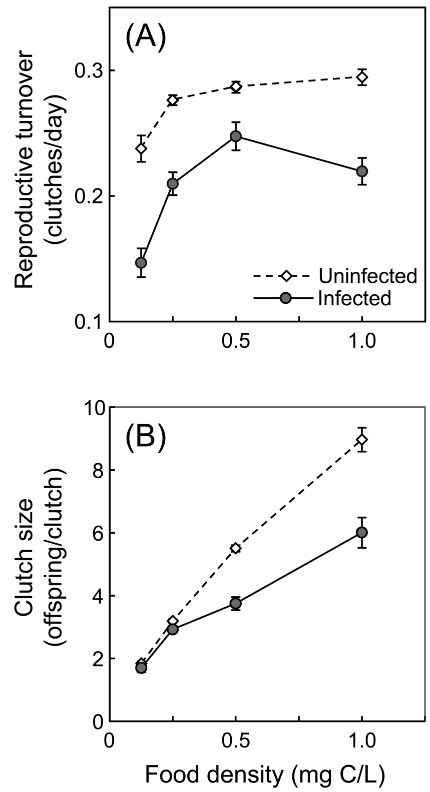

Figure A2: Breakdown of virulence of a fungal parasite (*Metschnikowia bicuspidata*) on reproduction of a zooplankton host (*Daphnia dentifera*). Mean reproductive rate can be separated into reproductive turnover (or number of clutches per unit time; *A*) and clutch size (or number of offspring produced per clutch; *B*). Here, in the turnover component, sick hosts (infection effect) and hosts that were fed low amounts of food (food effect) produced clutches more slowly. Meanwhile, clutch size increased with food (food effect), but at higher levels of food supply, infected hosts began to produce fewer offspring per clutch (food × infection interaction).

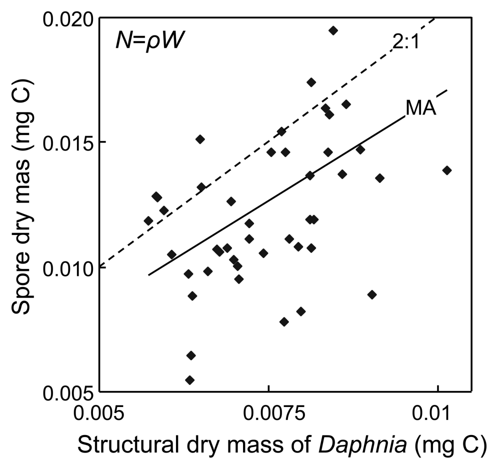

Figure A3: Relationship between estimates of biomass (in carbon) of *Daphnia* hosts and those of fungal parasite spores at the time of host death. *Daphnia* mass is calculated from a length–structural mass regression for the clone used in this experiment, which is itself built on the assumptions that structural mass is half of total mass in well-fed hosts and that carbon content equals half of dry mass. The regression line reflects fits of a reduced major-axis (MA) regression model; the slope is approximately 1 ($\rho = 1.86$ in the $N = \rho W$ relationship for the mechanical threshold; compare with the $2:1$ line), meaning that infected hosts support approximately twice their structural mass of spores at time of death.