The visual ecology of selective predation: Are unhealthy hosts less stealthy hosts?

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Abstract

Predators can strongly influence disease transmission and evolution, particularly when they prey selectively on infected hosts. Although selective predation has been observed in numerous systems, why predators select infected prey remains poorly understood. Here, we use a model of predator vision to test a longstanding hypothesis as to the mechanistic basis of selective predation in a *Daphnia*-microparasite system, which serves as a model for the ecology and evolution of infectious diseases. Bluegill sunfish feed selectively on *Daphnia* with a variety of parasites, particularly in water uncolored by dissolved organic carbon. The leading hypothesis for selective predation in this system is that infection-induced changes in the appearance of *Daphnia* render them more visible to bluegill. Rigorously evaluating this hypothesis requires that we quantify the effect of infection on the visibility of prey from the predator's perspective, rather than our own. Using a model of the bluegill visual system, we show that the three common parasites, *Metschnikowia bicuspidata, Pasteuria ramosa and Spirobacillus cienkowskii*, increase the opacity of *Daphnia*, rendering infected *Daphnia* darker against the background of downwelling light. As a result of this increased brightness contrast, bluegill can see infected *Daphnia* at greater distances than uninfected *Daphnia* – between 19-33% further, depending on the parasite. *Pasteuria* and *Spirobacillus* also increase the chromatic contrast of *Daphnia*. Contrary to expectations, the visibility *Daphnia* was not strongly impacted by water color in our model. Our work generates hypotheses about which parasites are most likely affected by selective predation in this important model system and establishes visual models as a valuable tool for understanding ecological interactions that impact disease transmission.

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