The Role of Memory in Patch Exploitation Dynamics of Caenorhabditis elegans

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Abstract

Foraging behavior in animals is shaped by the balance between exploiting known resources and exploring new areas. In *Caenorhabditis elegans*, understanding how memory influences this tradeoff is crucial for understanding how search-related behaviors are shaped. Here, we investigate the effects of short- and medium-term memory on patch-leaving behavior, focusing on how prior food conditions impact the decision to remain within a resource patch or explore the surrounding environment. Through a series of controlled foraging experiments, we measure the probability of *C. elegans* leaving food patches under different conditions defined by three key factors: (i) patch quality; (ii) conditioning time; and (iii) conditioning density, indicating the bacterial density experienced before release into the test environment. Our results suggest that both the quality of the current patch and the nematode's recent exposure to food significantly affect the likelihood of switching from local exploitation (remaining in the patch) to broader exploration (leaving the patch). Furthermore, we find that higher-quality patches reduce the propensity for *C. elegans* to leave, while longer conditioning under poor resource conditions increases exploratory tendencies. These findings provide valuable insights into the cognitive mechanisms guiding foraging strategies in *C. elegans* and contribute to a broader understanding of how organisms adapt search behaviors based on memory of past experiences.

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