

Janzen-Connell effects in a broadcast-spawning Caribbean coral: Distance-dependent survival of larvae and settlers

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The Janzen-Connell hypothesis states that host-specific biotic enemies (pathogens and predators) promote the coexistence of tree species in tropical forests by causing distance- or density-dependent mortality of seeds and seedlings. Although coral reefs are the aquatic analogues of tropical forests, the Janzen-Connell model has never been proposed as an explanation for high diversity in these ecosystems. We tested the central predictions of the Janzen-Connell model in a coral reef, using swimming larvae and settled polyps of the common Caribbean coral *Montastraea faveolata*. In a field experiment to test for distance- or density-dependent mortality, coral settler mortality was higher and more strongly density-dependent in locations down-current from adult corals. Survival did not increase monotonically with distance, however, revealing the influence of fluid dynamics around adult corals in structuring spatial patterns of mortality. Complementary microbial profiles around adult coral heads revealed that one potential cause of settler mortality, marine microbial communities, are structured at the same spatial scale. In a field experiment to test whether factors causing juvenile mortality are host-specific, settler mortality was 2.3-3.0 times higher near conspecific adults versus near adult corals of other genera or in open reef areas. In four laboratory experiments to test for distance-dependent, host-specific mortality, swimming coral larvae were exposed to water collected near conspecific adult corals, near other coral genera, and in open areas of the reef. Microbial abundance in these water samples was manipulated with filters and antibiotics to test whether the cause of mortality was biotic (i.e., microbial). Juvenile survivorship was lowest in unfiltered water collected near conspecifics and survivorship increased when this water was filter-sterilized, collected further away, or collected near other adult coral genera. Together these results demonstrate for the first time that the diversity-promoting mechanisms embodied in the Janzen-Connell model can operate in a marine ecosystem and in an animal. The distribution of adult corals across a reef will thus influence the spatial pattern of juvenile survival. When rare coral species have a survival advantage, coral species diversity per se becomes increasingly important for the persistence and recovery of coral cover on tropical reefs.

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