REARING CLIMATE CAN ALTER PREDATOR FORAGING RATES IN NOVEL ENVIRONMENTS

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Abstract

Predicting the net effect of climate change on communities requires understanding how increasing temperatures alter trophic interactions. Most warming experiments proceed by increasing temperature to a constant level (24 hours) or disproportionately during the daytime. However, the global trend of increasing mean temperatures has been driven largely by warming during the nighttime rather than daytime. This asymmetric warming could have important ecological implications, and challenge the utility of experiments that disproportionately warm during the daytime. We investigated the impacts of four different temperature regimes (ambient, constant, day, night) to test the hypothesis that the timing of warming has ecologically-relevant effects. Specifically, we examined the effects of warming regimes on development and predation rates of a lady beetle on pea aphids grown in plant growth chambers. For predator development, eggs were reared in each treatment to determine the effect of temperature on hatching success and development. In a complementary experiment, temperature effects on lady beetle predation rates were measured during the daytime (6:00-18:00) and nighttime (18:00-600). Finally, we evaluated the effects of temperature regime on aphid populations in a factorial experiment that crossed food chain lengths (plants; plants and aphids; plants, aphids, and predators) within each of the environmental chambers.

Our results show that the timing of warming influences predators and their interactions with prey in several ways. Daytime warming reduced hatching success by approximately 45% relative to other treatments. Lady beetles in the day warming and night warming treatments consumed similar numbers of aphids during foraging trials. Aphid population growth rate in the absence of predators was significantly higher in the night warming treatment relative to daytime warming. The interaction between predator presence and warming treatment (day vs. night) was marginally significant, but the data suggest that the night warming treatment predators were more efficient foragers, potentially due to a change in prey behavior. While preliminary, our results corroborate previous work demonstrating that predators mediate the net effects of warming and that nuances in warming treatments may produce different conclusions about the net effects of climate warming.