Rates of biotic interactions scale predictably with temperature despite variation

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Abstract:
Most biological processes are temperature dependent. To quantify the temperature dependence of biotic interactions and evaluate predictions of metabolic theory, we: 1) compiled a database of 81 studies that provided 112 measures of rates of herbivory, predation, parasitism, parasitoidy, or competition between two species at two or more temperatures; and 2) analyzed the temperature dependence of these rates in the framework of metabolic ecology to test our prediction that the “activation energy,” $E$, centers around 0.65 eV. We focused on studies that assessed rates or associated times of entire biotic interactions, such as time to consumption of all prey, rather than rates of components of these interactions, such as prey encounter rate. Results were: 1) the frequency distribution of $E$ for each interaction type was typically peaked and right skewed; 2) the overall mean is $E = 0.96$ eV and median $E = 0.78$ eV; 3) there was significant variation in $E$ within but not across interaction types; but 4) average values of $E$ were not significantly different from 0.65 eV by interaction type and 5) studies with measurements at more temperatures were more consistent with $E = 0.65$ eV. These synthetic findings suggest that, despite the many complicating factors, the temperature-dependence of rates of biotic interactions broadly reflect of rates of metabolism, a relationship with important implications for a warming world.

Read the full article in *Oikos* [1].

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