Biological stoichiometry of Daphnia growth: An ecophysiological test of the growth rate hypothesis

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ABSTRACT: The growth rate hypothesis (GRH) proposes that variation in organism C: P and N: P ratios reflects variation in P content associated with altered allocation to P-rich ribosomal RNA under different growth rates. We tested the GRH by examining the effects of food quantity and stoichiometric quality (differing carbon : nitrogen : phosphorus [C :N: P] ratios) on juvenile growth and chemical composition (C :N: P, RNA, and DNA contents) of two species of *Daphnia* (*D. galeata*, *D. pulicaria*). *Daphnia* in P-limited experiments were fed saturating and limiting concentrations of food (*Scenedesmus acutus*) of high P (C: P = 110 ± 7.3), medium P (456 ± 20.7), and low P (934 ± 23.6), and in an N-limited experiment *D. pulicaria* was fed saturating concentrations of high N (C:N = 6.31 ± 0.35), medium 1 and medium 2 (9.0 ± 0.42; 15.0 ± 0.49, respectively), and low N (18.22 ± 0.56) food. In P-limited experiments, both *Daphnia* species grew fastest under P-rich, high food conditions and grew slowest under P-deficient, low food conditions, showing effects of both food quality and quantity. *Daphnia* body percentage P, C: P, N: P, and percentage RNA were tightly correlated with growth rates, and RNA contributed a significant fraction of total body P (48.8% [62.0%]). This strong three-way (growth-RNA-P) set of correlations supports the GRH. In the N-limited experiment, food C:N had a moderate effect on *Daphnia* growth. While there was a good linear correlation between P and RNA, growth rate was uncorrelated with RNA content and P content, suggesting that the three-way coupling of growth, RNA, and P content is broken under N limitation of growth, but more data for these conditions are needed. These data help in delineating the physiological conditions under which the GRH holds and may be useful in interpreting variation in body stoichiometry of zooplankton from field and lab studies.