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# Field estimates of fitness costs of the pace-of-life in an endangered damselfly

Rassim Khelifa[1,2] | Rabah Zebsa[3] | Hichem Amari[3] | Mohammed Khalil Mellal[3] | Hayat Mahdjoub[4]

[1]Biodiversity Research Center, University of British Columbia, Vancouver, British Columbia, Canada

[2]Botany Department, University of British Columbia, Vancouver, British Columbia, Canada

[3]Laboratoire Biologie, Eau et Environnement (LBEE), Université 8 Mai 1945 Guelma, Guelma, Algeria

[4]Department of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland

**Correspondence**
Rassim Khelifa, Biodiversity Research Center, University of British Columbia, 2212 Main Mall, Vancouver. B.C. V6T1Z4, Canada.
Email: rassimkhelifa@gmail.com

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## Abstract

Theory predicts that within-population differences in the pace-of-life can lead to cohort splitting and produce marked intraspecific variation in body size. Although many studies showed that body size is positively correlated with fitness, many argue that selection for the larger body is counterbalanced by opposing physiological and ecological selective mechanisms that favour smaller body. When a population split into cohorts with different paces of life (slow or fast cohort), one would expect to detect the fitness–size relationship among and within cohorts, that is, (a) slower-developing cohort has larger body size and higher fitness than faster-developing cohort, and (b) larger individuals within each cohort show higher fitness than smaller individuals. Here, we test these hypotheses in capture–mark–recapture field surveys that assess body size, lifespan, survival and lifetime mating success in two consecutive generations of a partially bivoltine aquatic insect, *Coenagrion mercuriale*, where the spring cohort is slower-developing than the autumn cohort. As expected, body size was larger in the slow-developing cohort, which is consistent with the temperature-size rule and also with the duration of development. Body size seasonal variation was greater in slow-developing cohort most likely because of the higher variation in age at maturity. Concordant with theory, survival probability, lifespan and lifetime mating success were higher in the slow-developing cohort. Moreover, individual body size was positively correlated with survival and mating success in both cohorts. Our study confirms the fitness costs of fast pace-of-life and the benefits of larger body size to adult fitness.

KEYWORDS

life history, mating success, odonate, plasticity, survival, temperature-size rule

## 1 | INTRODUCTION

Several studies agree that there is a trade-off between development rate and size at maturity in ectotherms (Stearns, 1992). Individuals that develop slowly will have larger body size at maturity whereas those that develop quickly will have a smaller body size (Ashton, 2004; Blackburn et al., 1999). As one consequence of this pattern, plasticity in development rate and body size occurs across a species range where individuals from southern populations are smaller than individuals from northern populations (Angilletta, Steury, & Sears, 2004; Partridge & Coyne, 1997; Pincheira-Donoso et al., 2008; Van Voorhies, 1996). Although laboratory studies have documented the trade-off between development rate and fitness (Angilletta et al., 2004), the results derived from the laboratory are not often similar to those observed in the field (Irschick et al., 2008; Warner & Andrews, 2002).

  