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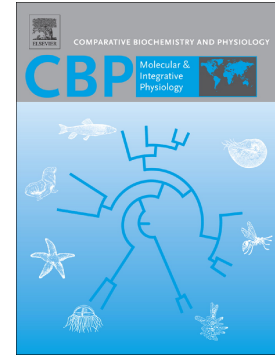
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Respiration-based monitoring of metabolic rate following cold-exposure in two invasive *Anoplophora* species depending on acclimation regime

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Abstract

The Asian and Citrus longhorned beetles, *Anoplophora glabripennis* (ALB) and *A. chinensis* (CLB) respectively, are two closely related invasive species with overlapping native ranges. Although both species have rather similar biological characteristics, they differ in their invasion patterns. ALB shows numerous, but local, outbreaks in urban areas of North-East America, Western and Central Europe, whereas CLB has colonized a large part of Northern Italy. Temperature is pivotal in setting distribution limits of ectotherms. Low temperature may be limiting for larvae since they are the main overwintering stage for both species. To investigate whether differential cold tolerance may contribute to setting the respective limits of the range invaded by each species, we monitored larval metabolic rate before and after exposure to a one-week ecologically relevant moderate cold stress (-2/+2 °C, 14/10 hours). We tested two distinctive fluctuating regimes before the cold exposure to check whether larval acclimation significantly altered their cold tolerance. Survival was high in all conditions for both species. Visual examination showed temporary locomotor inactivity during the stress but respiration rates were not altered after the stress suggesting that larvae could rapidly resume their initial metabolic activity. The respiration rate was globally higher in ALB than in CLB. Together, these results tend to indicate that both species have similar tolerance to the moderate cold stress tested, but also that ALB may be better at maintaining metabolic activity at cold than CLB. These observed differences could affect phenology in both species and in turn their establishment potential.

Key words: *Anoplophora*, invasion, resting metabolic rate, cold stress, acclimation

Introduction

Life histories and geographical distribution of ectotherms are largely shaped by temperature and associated constraints (Addo-Bediako et al., 2000). Temperature can affect their survival, developmental rate, reproduction (Angilletta, 2009), as well as their locomotor activity and ability to access resources (Košťál et al., 2006). Cold stress is often reported as one of the main climatic barriers setting the distribution of temperate insects (Addo-Bediako et al., 2000; Battisti et al., 2005), and cold tolerance is therefore central to the successful completion of their life cycle. Thermal fluctuations are a common factor they have to mitigate in their natural environment on different time scales, and the associated adaptive responses are crucial to overcome variations that are stressful enough to threaten survival and reproduction. This is critical for alien organisms whose invasive success depends on their

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