

Contrasting effects of acute heat shock on physiological and ecological performance of the fall armyworm

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Abstract

Temperature is a critical factor that influences the behavior, physiology, and development of ectothermic organisms. This has become even more important as acute temperature stress associated with global climate change becomes the new norm. Using the invasive fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), we assessed its physiological and ecological responses following acute heat stress, synonymous to heat waves associated with recent climate change. Specifically, we measured the effects of short-term exposure (for 2 h) to heat shock (at 32, 35, and 38 °C) on physiological responses, such as critical thermal minima (CT_{min}) and maxima (CT_{max}), and life-history traits, such as reproductive success (fecundity and hatching success) and longevity, using virgin adults. Our results showed that prior acute heat shock compromised cold tolerance (CT_{min}) while enhancing heat tolerance (CT_{max}). In addition, heat shock reduced fecundity and hatching success and had dramatic effects on adult longevity. We conclude that acute heat stress associated with shifting environmental conditions may generally offset key physiological traits, affect reproduction and thus population persistence, and simultaneously have complex effects on adult lifespan.

KEYWORDS: acute temperature stress, climate change, ectothermic organism, fall armyworm, heat shock, invasive species, Lepidoptera, life-history traits, longevity, Noctuidae, *Spodoptera frugiperda*, thermal plasticity