

Threshold temperatures and degree-day estimates for development of post-dormancy larvae of *Monochamus galloprovincialis* (Coleoptera: Cerambycidae)

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Abstract Developmental thresholds and thermal requirements for development of post-dormancy larvae of *Monochamus galloprovincialis* (Olivier) (Cerambycidae; Monochamini) were studied at ten constant temperatures ranging from 7 to 35°C. The relationship between temperature and development duration in days was linear between 15 and 30°C ($r^2 = 0.98$). The lower threshold for development was determined to be $12.2 \pm 0.8^\circ\text{C}$ and an average of 822 degree-days (DD) above that value was required for 50% adult emergence under laboratory conditions. The rate of larval development decreased above 30°C and the lethal upper threshold was between 32 and 35°C. Degree-day rate summation was initiated in the first of March and model predictions were validated with records of field emergence for the years 2001 to 2004. The modified sine wave predicted median emergence with an average error of 3.8 days from emergences in the field and a zero-day difference for two of the years. Model predictions were always within 10% of actual observed emergences. Predictions for early emergences (cumulative percentiles 1 and 10) were less accurate than predictions for median and late emergences. The results suggest that a simple linear method driven by air temperatures can predict the emergence of *M. galloprovincialis* with sufficient accuracy to improve the pest management programmes currently implemented on the pine wilt disease affected zone in Portugal.

Keywords Cerambycidae · Sine wave · Temperature thresholds · Larval development

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