

Effects of Temperature on the Life History Parameters of *Anoplophora glabripennis* (Coleoptera: Cerambycidae)

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Abstract

There is a critical need for information on the basic biology of the Asian longhorned beetle, *Anoplophora glabripennis* (Motschulsky), to provide the biological basis for predicting developmental phenology in order to optimize the timing of exclusion and eradication treatments and to predict attack rates under different environmental conditions. In these studies, we used individuals from Bayside, NY and Ravenswood, IL to assess temperature effects on developmental rates and survival at 10°C (larvae only), 15°C, 20°C, 25°C, 30°C (egg and larvae only) and 35°C (larvae only).

There were no significant differences in female longevity between populations or temperatures. Males tended to live longer than females at all temperatures and lived longer at 20°C than 15°C or 25°C. The time the females began laying eggs and the order of average number of eggs laid was significant: 25°C > 20°C > 15°C. Bayside females laid fewer eggs at both 20°C and 25°C than Chicago females. The order of mating success, as measured by the percentage of females that laid eggs that hatched, was: 25°C > 20°C > 15°C for both strains. The percentage of eggs that were viable did not vary between temperatures or strains, but the percentage that hatched at 15°C was significantly less than at the other temperatures. Some of the eggs laid at 15°C did not hatch until moved to 25°C. A nearly linear relationship existed between developmental rate of eggs and temperatures between 15°C and 30°C. Using this relationship, we would predict that eggs would not hatch at temperatures of 10°C or less. Based on the lower percentage hatch of viable eggs at 30°C compared to 25°C, the upper temperature at which egg development ceases and eggs die is at or above 35°C.

The minimum developmental threshold for instars 1 to 8 is projected to be close to 10°C. There is some development at 10°C, at least for early instars; about 20 percent of the larvae will molt to the second instar after about 5 months. The upper threshold for larval development, the temperature at which development stops and death occurs, is probably between 35 and 40°C. Larval survival was higher at 25°C than at lower temperatures and was zero for 35°C by the beginning of the fifth instar. Larvae held at 15°C, 30°C, and 35°C had narrower head capsules and weighed less than those held at 20°C or 25°C from the third instar. This might indicate that these temperatures are less than optimal for growth. The Chicago larvae gained weight faster than those from Bayside in the later instars.