FACTORS THAT INFLUENCE ASIAN LONGHORNED BEETLE PUPATION

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ABSTRACT

The ability to rear Asian longhorned beetle in quarantine continues to be critical to progress in developing/evaluating techniques for the exclusion, detection, and eradication of this serious pest. Understanding factors that influence pupation makes predicting adult emergence more reliable, both in the laboratory and the field. Survival and development of larvae from three populations (Ravenswood, Chicago, Illinois;, Bayside, Queens, New York; and Hohhot, Inner Mongolia, China) were compared for a variety of temperatures and nutritional conditions. The following factors were evaluated: 1) timing of the larva chill period, 2) length and temperature of the larva chill period, 3) larva nutrition and moisture content of diet, and 4) effects of constant and varing temperatures on pupation.

There were marked differences among the three beetle populations observed. Individuals from the China and Illinois populations weighed more than those from New York. Larvae from the Illinois population began pupation sooner than those from New York or China and were least affected by the timing of the larva chill period. The Chinese population was the most sensitive to the timing of chill, possibly indicating that larvae from this population tend to pupate at a later instar, that more individuals may require a chill to complete development, or that some individuals may require more than one year to complete development under some conditions. A larva chill period was not required by all the larvae, an observation consistent with earlier findings. Larvae that had not reached their critical weight for pupation prior to the chill period sometimes required a second chill period before they initiated pupation. The critical weight for pupation appears to vary both within and among populations, which could indicate a high degree of plasticity or genetic variation for this trait. Overall survival decreased when the developmental time decreased before the chill period. Artificially manipulating the timing of the larva chill appeared to be effective in synchronizing adult emergence and increasing pupation.

When larvae were chilled at 15°C, they required a longer chill period to cue them to pupate and in general, it took them longer to initiate pupation after the chill than those held at lower temperatures. Larvae chilled at 5°C had a higher mortality rate than those chilled at 10°C and pupated less synchronously after chill. Poor larva nutrition also lengthened the time from the end of chill to pupation and increased mortality. Drier larva diets seemed to cause larvae to pupate sooner and reduce the need for a larva chill prior to pupation. This would be a necessary survival tactic as larvae that are either in a dying tree or cut infested wood need to pupate as quickly as possible to ensure their survival.

Larvae did not pupate at constant temperatures ≥ 30°C or ≤ 10°C. The number of instars larvae went through before pupation varied from a minimum of five to more than nine depending on the temperature regime and larva nutrition. It took about two years for larvae to complete development at a constant 15°C or if eggs hatched too late to allow larvae to reach the critical weight/instar for pupation before chill in a varying temperature regime.

It appears that there are several factors that can interact to affect Asian longhorned beetle pupation. In the laboratory, temperature and larva diet can be manipulated to make the timing of pupation very predictable. These results improve our understanding of and ability to predict pupation in wood, but also emphasize the complexity of the process. In addition, these results may help explain why insects other than Asian longhorned beetles also appear to require one or two years to complete development as it relates to their geographic location or host quality.

A CONTROLLED STUDY OF THE HEALING RESPONSE OF HOST TREES TO SIMULATED ASIAN LONGHORNED BEETLE DAMAGE

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ABSTRACT

This study was undertaken to examine the healing response of selected genera of trees to simulated damage by the Asian longhorned beetle (ALB), *Anoplophora glabripennis* (Coleoptera: Cerambycidae), while controlling certain key variables in the field. Results will be used to calibrate methods used to date actual ALB injury and to aid the survey program by documenting the appearance of damage inflicted at different times of the year after healing for various periods. Because tree bark is non-living and, in most species, is not shed, evidence of chewed oviposition pits and exit holes remains visible for years. However, over time, radial growth of the tree and the proliferation of callous tissue at the wound site usually distort the evidence of damage so that it becomes difficult to recognize. Exit holes grow completely closed and covered with new bark, sometimes within a year, leaving only a trace of the original injury on the bark surface. We see great variability in the rate of healing and the appearance of old damage, depending on the tree species and, apparently, on when and how long ago the damage occurred.