PHENOLOGY OF THE ASIAN LONGHORNED BEETLE UNDER SIMULATED ANNUAL ENVIRONMENTAL FLUCTUATIONS

Melody A. Keena

U.S. Forest Service, Northern Research Station
51 Mill Pond Rd., Hamden, CT 06514-1703

ABSTRACT

The Asian longhorned beetle (ALB) (*Anoplophora glabripennis* Motschulsky [Coleoptera: Cerambycidae]) is an introduced insect with the potential to devastate urban hardwood forests, especially maple species (*Acer* spp.) commonly found in North America. Consequently, there is a critical need for biological information that can be used for phenological models that will enable the development of exclusion and eradication methodologies. In China, ALB completes development in 1 or 2 years. Later, emerging adults lay eggs that may not hatch until the following spring, and some full-size larvae require cold temperatures before they pupate. In this paper, I document the phenology of this beetle in the laboratory over a 3-year period using simulated seasonal variations.

Thirty-one pairs of laboratory-reared adults from the Chicago, IL, strain (emerged end of June to middle of August) were used to initiate this study. Forty-year (1961-2000) weekly average temperature, humidity, and day length for Central Park in New York City were used as climatic variables. A total of 1,989 eggs were laid by the original 31 adult females; 1,193 of these hatched and we followed the development of 406 larvae placed on artificial diet. The first egg was laid on June 28 and the last on October 30 when the temperature was 12 °C during the first year of the study. Egg hatch continued until the temperature went down to 6 °C and resumed the following year when temperatures reached 12 °C. The last larval molt in the first year occurred at 13 °C on October 19, and the first molt the next year occurred on May 8 at 16 °C. Larvae continued to molt through the year until temperatures dropped below 5 °C. During the first simulated winter, eggs and larvae through the 7th instar overwintered, and during the second winter, 6th through 13th instars overwintered. At the onset of the simulated winter, larvae that pupated during the second year weighed 0.568 + 0.037 g and those that pupated during the third year weighed 1.883 + 0.022 g. Pupation of 6th through 13th instars occurred from July 3 to August 29 in the second year and from June 3 to August 6 in the third year. Adults emerged from July 22 to September 24 during the second year and from June 27 to August 26 during the third year. ALB phenology allows the species to easily adapt to ambient environmental conditions. Larvae that have not reached the critical weight for pupation, either by the beginning of winter or when they resume feeding in the spring (before temperatures approach 25 °C), will not proceed to pupation but instead will continue to grow and molt until they reach their maximal weight or temperatures drop below about 15 °C. This can force part or all the individuals in a population into a 2-year life cycle, especially larvae that hatch too late to grow large enough the first year or where the growing season is short. ALB eggs and larvae of all sizes overwinter and can survive low temperatures of at least 0 °C for 3 weeks, thus enhancing the ability of this insect to adapt. This dataset will be used to validate a phenology model developed using previously collected data on the effects of temperature on the development of all the life stages.