

Life History Patterns of Longhorned Beetles (Cerambycidae): A Worldwide Perspective

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There are more than 35,000 cerambycid species in the world (Švácha and Lawrence 2014), with over 1000 species, representing over 300 genera, in North America. Adult cerambycids vary greatly in size, from as short as 1.5 mm in length (*Decarthria stephensi*) to as long as 167 mm (*Titanus giganteus*) (Haack 2016).

Nearly all cerambycids feed on plant tissue as both adults and larvae, but cerambycids in the genus *Elytroleptus* are one exception whereby they mimic and subsequently prey on adult lycid beetles (Eisner et al. 2008). Most cerambycids develop in woody plants such as trees, shrubs, and woody vines, but some species develop in herbaceous plants, as well as bamboo, cacti, palms, and yucca (Haack 2016). Some species are agricultural pests on crops such as soybeans in U.S. (*Dectes texanus*), bamboo in Asia (*Chlorophorus annularis*), and sugarcane in Asia (*Dorystenes buqueti*). Nearly every part of a tree is attacked by one or more cerambycid species, especially the twigs, branches,

trunks, and roots, but a few develop in cones, fruit, and seed, and at least one species in New Zealand is a leaf miner *Microlamia pygmaea* (Martin 2000).

Cerambycid larvae develop in a variety of host tissues within woody plants, including outer bark, inner bark, cambium, sapwood, heartwood, and pith. Given that these tissues vary in nutritional quality and defenses (with the inner bark and cambium being the most nutritious, and the outer bark and heartwood being the least), voltinism patterns are affected greatly. In general, most temperate cerambycid species that develop primarily in the inner bark can complete development in 1 year, whereas those that develop primarily in the outer bark require 2-3 years, and those that develop mostly in the sapwood and heartwood require 2-5 years (Haack and Slansky 1987). But there are exceptions, such as the wood-infesting Asian longhorned beetle (*Anoplophora glabripennis*) and the citrus longhorned beetle (*A. chinensis*), which are often univoltine (Haack et al. 2010). By contrast, when infested trees are later converted to lumber and used in products such as flooring and furniture, the typical generation time can be greatly protracted, such as when an *Eburia quadrigeminata* emerged from a bookcase that was constructed over 40 years earlier (Jaques 1918).

The host breadth of cerambycids varies greatly with some species being monophagous (e.g., the locust borer, *Megacyllene robiniae*, develops in 1 genus of plants) while others are highly polyphagous (e.g., the redheaded ash borer, *Neoclytus acumi-*

natus, develops in at least 26 genera of woody plants). A few species that have highly restricted host ranges have been used in biocontrol programs of weeds, such as the European species *Oberea erythrocephala* that was introduced into western North America to control leafy spurge, *Euphorbia esula* (Hansen et al.



1997).

Some cerambycids do not feed as adults while others feed on flowers, bark, foliage, cones, sap, fruit, roots, and fungi (Linsley 1959). Adult females usually lay eggs on or in their larval host plants. Many species oviposit under bark scales or in bark crevices, while others, especially the Lamiinae species, first chew a pit through the outer bark with their mandibles and then deposit eggs in the underlying plant tissues. Adult females of a few species first girdle a branch or twig before ovipositing in it. Species in the genus *Oberea*, typically oviposit below the girdle (i.e., on the side toward the trunk) while in *Oncideres*, females oviposit above the girdle (i.e., toward the branch tip) (Solomon 1995).

Most cerambycid species overwinter in the larval stage. Pupation usually occurs at the end of their larval galleries in cells (where the pupa is in direct contact with the host tissues) or in cocoons (where the larva secretes a calcareous or gum-like substance over the chamber walls) (Duffy 1953, Linsley 1961). Prior to pupation, larvae often plug their galleries with wood shavings. Some species exit the host plant prior to pupation and pupate in the soil.

There are several species of exotic cerambycids in the U.S. but only the Asian longhorned beetle (ALB), *Anoplophora glabripennis*, is currently the target of a federal quarantine and eradication effort. The first ALB infestation in the U.S. was found in New York City in 1996 and several more have followed. A few have been successfully eradicated, such as the infestations in Chicago and Boston, but three are still ongoing eradication efforts in the states of Massachusetts, New York, and Ohio. The two largest infestations in the U.S. were the last two discovered: in 2008 in Worcester, MA, and in 2011 to the east of Cincinnati, OH. As of early



Adult male Asian longhorned beetle, *Anoplophora glabripennis*
Photo by Franck Herard

October 2015, more than 24,000 ALB-infested trees have been detected around Worcester and over 17,000 in Ohio. This large-scale survey and eradication effort is justified because ALB can infest and kill apparently healthy trees in just a few years, and because it has a very wide host range, infesting especially maples, but also many other hardwoods such as birch, elm, horsechestnut, poplar, and willow (Haack et al. 2010).

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