

CELLULOSE DIGESTION IN THE LARVAE OF THE ASIAN LONGHORNED BEETLE (*ANOPLOPHORA GLABRIPENNIS*)

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Abstract

In order for the Asian longhorned beetle (*Anoplophora glabripennis*) (ALB) to feed on the nutrient poor, inner wood of a host tree, we suspect that larvae have a cellulose digestion system. Cellulose digestion involves three enzyme components: (1) exoglucanases; (2) endoglucanases; and (3) beta-glucosidases. In other insect species, cellulolytic enzymes are either endogenous or exogenous, either produced from symbiotic microbes maintained in the gut, or ingested through feeding.

The ability to digest cellulose was investigated in ALB larvae fed on artificial diet, a preferred host (*Acer sac*), and a resistant tree species (*Pyrus calleryana* var. Aristocrat). By incubating a gut homogenate with different cellulose substrates and measuring glucose production through a reducing sugar assay, enzyme activity of the three main enzyme components of the cellulase complex was identified in larvae fed sugar maple and callery pear, while reduced cellulase activity was detected in diet fed larvae. Based on the reducing

sugar assay, the complete suite of cellulolytic enzymes was found in ALB fed on the preferred host (*A. sac*) with an average activity level of 0.65 μ M glucose released/g gut/hr from crystalline cellulose. Larvae fed on the non-host (*P. calleryana* var. Aristocrat) retained the active cellulase enzyme complex. Enzyme activity levels showed no significant difference from maple-fed insects. This suggests that larval mortality in larvae fed on callery pear is not due to a disruption of the digestion system in the beetle. Larvae fed on artificial diet had a significant reduction in both beta-glucosidase and exoglucanase activities. This disruption in the cellulase complex was most likely due to the high level of simple sugar in the artificial diet (sucrose), suggesting that these cellulolytic enzymes are induced as needed during feeding. We also concluded that rearing on an artificial diet is not suitable to study digestion in this beetle. To our knowledge, this is the first report of the presence of a complete cellulase system in a cerambycid species that feeds on healthy trees.