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SUGAR MAPLE BORER (COLEOPTERA: CERAMBYCIDAE) ACTIVITY ASSOCIATED WITH PERIODS OF SEVERE DEFOLIATION

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ABSTRACT

A perusal of previous research on sugar maple borer, *Glycobius speciosus*, in northern New York State strongly associates severe early and late season defoliation with increased borer damage. This re-examination of earlier work suggests foliage protection may be necessary when forest management objectives are concerned with wood volume and quality.

The sugar maple borer (SMB), *Glycobius speciosus* (Say), is an economically important sub-cortical pest of sugar maple, *Acer saccharum* Marsh. Sugar maples are rarely killed by this insect; however, large diameter holes in the sapwood resulting from gallery excavation can reduce lumber grade (Hoffard and McCreery 1977). Additionally, SMB activity often stains the sapwood as a result of mineral streak (Shigo et al. 1973, Shigo 1976). This discoloration is a physiological response of maple to stem injury and occurs when anti-fungal phenolic compounds accumulate in the region of injury (Manville and Levitin 1974). Stained maple lumber often checks during drying and both imperfections can render it unusable for visible surfaces in furniture (Levitin 1976). Also, the callous that forms around wounds created by the borer results in twisted grain, which is problematic during wood milling (Shigo 1976; Hesterberg et al. 1976).

Sugar maple borer – host relations. SMB has been implicated as a contributing factor in maple decline (Giese et al. 1964; Bauce and Allen 1992a), yet little is known concerning its population dynamics. Host condition plays a significant role in determining the susceptibility of a tree to SMB attack, with low vigor trees being the most susceptible (Britton 1923; Talerico 1962; Newton and Allen 1982; Bauce and Allen 1992a). Thus, to avoid significant economic losses due to SMB, it is essential to understand the nature of the factors affecting the susceptibility of sugar maple.

In 1978, Newton and Allen (1982) investigated the role that host condition plays in the attack ecology of SMB. The study was conducted in a second growth northern hardwood stand in northern New York State near Wanakena (St. Lawrence County) which originated following extensive fires between 1905 and 1910. In that study, dendrochronological methods were used to evaluate periodic growth prior to attack and to determine the year that each of 78 sugar maples were infested by SMB. This cohort represented 100% of the sugar maples damaged by SMB in a 1.9 ha portion of the stand. They found that annual SMB attack frequencies peaked during two periods; 1958-1963 and 1973-1975, suggesting that increased SMB activity may be triggered by specific environmental conditions. Newton and Allen (1982) also noted that trees that were attacked had experienced growth reductions during the preceding decade. They investigated the possibilities that low precipitation or unfavorable temperatures were associated with peak episodes of SMB attack, but were unable to demonstrate either relationship.

In the late 1980s, a separate study to understand the etiology of a sugar maple decline (Bauce and Allen 1991) was conducted in another second growth

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northern hardwood stand. It also originated following fires between 1905 and 1910 and is located approximately 2.8 km from the stand used by Newton and Allen (1982). In this subsequent project growth studies were conducted on 120 dominant sugar maples. Growth patterns were determined from increment cores taken at breast height (1.4 m). The width of growth rings was measured to the nearest 0.5mm and converted to volume estimates. Results indicated that episodes of severe defoliation by the forest tent caterpillar from 1953 through 1954 and the saddled prominent during 1967 and 1968, as documented in forest management compartment records, significantly reduced growth. Furthermore, they suggested that both defoliation events were important inciting factors in the etiology of the maple decline being studied. The impact of these defoliations likely explain the growth losses reported by Newton and Allen (1982) that occurred 5-10 years prior to SMB attack. Neither study, however, made the connection between these defoliation events and increased SMB damage.

Sugar maple borer incidence and insect defoliation. When we combined the temporal patterns of growth loss due to defoliation (Bauce and Allen 1991) and incidence of SMB damage (Newton and Allen 1982), we uncovered a likely association (Fig. 1). The first period of increased SMB activity (1958-1963) began three years and peaked six to eight years following cessation of the forest tent caterpillar outbreak in 1953 and 1954. Likewise, the second period of increased SMB activity (1973-1975) began four years and peaked six to eight years following cessation of the saddled prominent outbreak during 1967 and 1968.

This pattern of severe defoliation followed by increased activity of a wood boring insect has been documented for members of the Buprestidae. For example, severe defoliation of oaks (*Quercus* spp.) by the gypsy moth often results in increased populations of two-lined chestnut borer, *Agrilus bilineatus* (Weber) (Dunn et al. 1987). Similarly, infestations of bronze birch borer, *Agrilus anxius* Gory, are associated with severe defoliation of birch (Barter 1957). In both examples, severe defoliation created favorable conditions for the borers by reducing host resistance to attack. Defoliation apparently provides an increased number of potential hosts, which in turn leads to an increase in successful attacks and, presumably, higher populations of these borers. Many subcortical cerambycids and buprestids prefer exposed stems for oviposition (Solomon 1995). It is reasonable therefore to speculate that the diurnally active adults of SMB may follow this same strategy. Infestations of many cerambycid species have been associated with host stress due to events like suppression, drought, fire, poor site conditions (clay soils), tree disease and physical injury, either singly or in combination (Hanks 1999). To the best of our knowledge, *Saperda tridentata* Olivier is the only other member of this family that has been associated with insect defoliation (Solomon 1995).

Conclusions. Our observations suggest the three to four-year lag between the cessation of defoliation and the beginning of increased SMB attacks simply reflects an increase of available (i.e., stressed) hosts. It typically takes 4 to 6 years for growth rates of surviving sugar maples to recover following defoliation episodes (Bauce and Allen 1991; Wink 2002). During this period of recovery, trees are presumably more susceptible to attack by SMB. Also, the borer's two-year life cycle is partly responsible for the lag in response. It may simply take time for SMB populations to respond to the favorable conditions provided by defoliation. Although our conclusions are based on only two events, we believe the evidence strongly suggests severe defoliation often precedes increased damage by SMB.

Forest management implications. When a forest owner's management objectives include income from sawtimber or syrup production, there should be strong incentive to undertake direct pest control measures to prevent repeated, severe (e.g., > 75%) defoliation. The value of quality sugar maple sawtimber has increased substantially during the past decade or so. The growth impact associated with this level of defoliation can be significant. Also, defoliated trees often are more susceptible to a variety for secondary events, such as SMB (e.g., Hesterberg et al. 1976, Bauce and Allen 1992a,b). Crown size plays a major role in sap production.

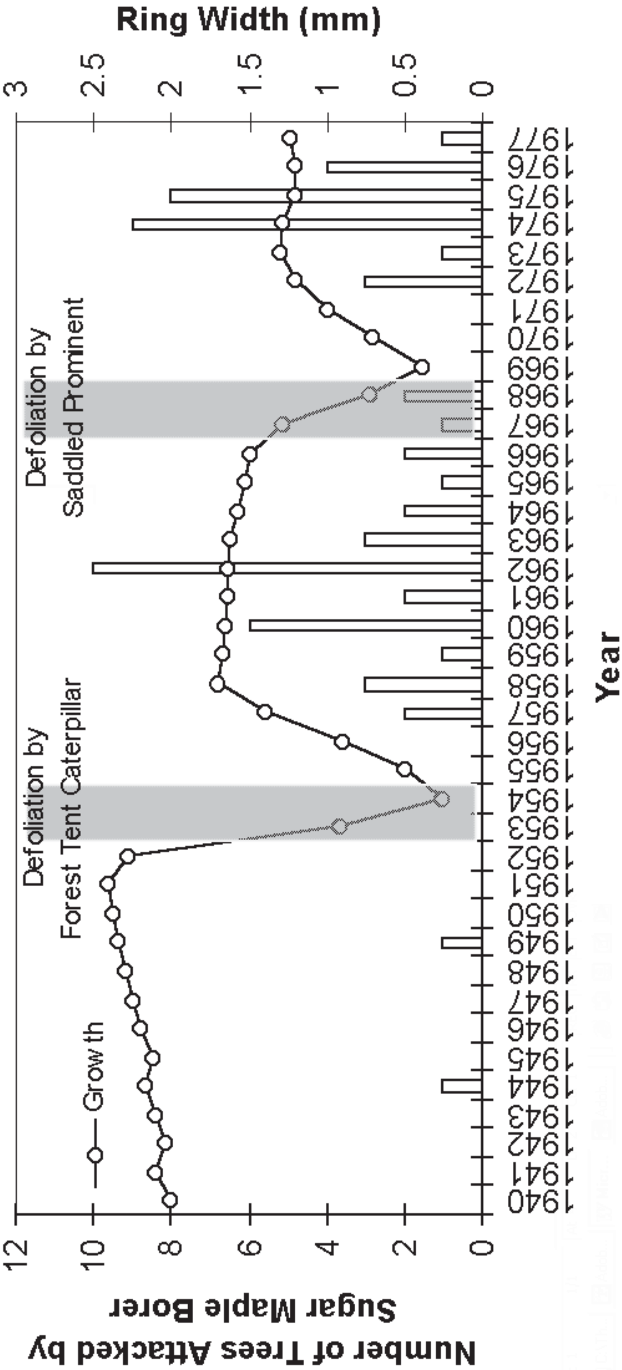

Figure 1. The relationship between the occurrence of outbreaks of forest tent caterpillar (1953-1954) and saddled prominent (1967-1968) as evidenced by annual ring increments (ring width) and annual attack frequency of sugar maple borer (vertical bars).

Loss of foliage can significantly reduce both the quality (sugar content) and quantity of sap a tree produces (e.g., Sippell and Rose 1977). Though sugar maple rarely succumbs to SMB attack, the insect girdles portions of the main stem, resulting in large branches immediately above the damaged region often being killed. This branch loss reduces crown volume. Forest owners not only have to be concerned about the impact of defoliation but a likely subsequent increase in damage by SMB.

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LITERATURE CITED

Barter, G.W. 1957. Studies of the bronze birch borer, *Agrilus anxius*, Gory in New Brunswick. Can. Entomol. 89: 12-36.

Bauce, E., and Allen, D.C. 1991. Etiology of a maple decline. Can. J. For. Res. 21: 686-693.

Bauce, E. and Allen, D.C. 1992a. Role of *Armillaria calvescens* and *Glycobius speciosus* in a sugar maple decline. Can. J. For. Res. 22: 549-552.

Bauce, E., and Allen, D.C. 1992b. Condition of the fine roots of sugar maple in different stages of decline. Can. J. For. Res. 22: 264-266.

Britton, W.E. 1923. Twenty-second report of the state entomologist of Connecticut for the year 1922. Bull. Conn. Agric. Exp. Stn., New Haven. 247: 269-281.

Dunn, J.P., Kimmerer, T.W., and Nordin, G.L. 1987. The role of host tree condition in attack of white oaks by the two-lined chestnut borer, *Agrilus biliniatus* (Weber) (Coleoptera: Buprestidae). Oecologia 70(4): 596-600.

Giese, R.L., Houston, D.R., Benjamin, D.M., Kuntz, J.E., Kaplan, J.E. and Skilling, D.D. 1964. Studies of maple blight. University of Wisconsin, Madison Res. Bull. 250. 128p.

Hanks, L.M. 1999. Influence of the larval host plant on reproductive strategies of cerambycid beetles, Annu. Rev Entomol. 44: 483-505.

Hesterberg, G.A., Wright, C.J., and Frederick, D.J. 1976. Decay risk for sugar maple borer scars. J. For. 74: 443-445.

Hoffard, W.H and McCreery, L. 1977. Evaluation of a sugar maple borer survey technique. USDA For. Serv. For. Ins. Dis. Eval. Rep. D17-77.

Levitin, N. 1976. Bleaching mineral stains out of maple. Can. For. Industry 96: 45-47.

Manville, J.F. and N. Levitin. 1974. Anti-fungal coumarins from mineral-stained maple. Can. For. Service. Bi-mon. Res. Notes 30: 3-4.

Newton, W.G., and Allen, D.C. 1982. Characteristics of trees damaged by sugar maple borer, *Glycobius speciosis* (Say). Can. J. For. Res. 12: 738-744.

Shigo, A.L., Leak, W.B., and Filip, S.M. 1973 Sugar maple borer injury in four northern hardwood stands in New Hampshire. Can. J. For. Res. 3: 512-515.

Shigo, A.L. 1976. Mineral stain. Northern Logger Timber Processing. 24: 18-19.

Solomon, J.D. 1995. Guide to insect borers of North American broadleaf trees and shrubs. Agric. Handbk. 706. Washington, DC: U.S. Department of Agriculture, Forest Service.

Sippell, W.L. and A.H. Rose. 1977. Another plague of forest tent caterpillar. Can. For. Service, FIDS, Sault Ste. Marie, Ontario.

Talerico, R.L. 1962. A study of damage caused by the sugar maple borer. J. For. 60: 178-180.

Wink, R.A. 2002. The combined effects of defoliation and partial cutting on Tug Hill hardwoods. PhD. thesis. SUNY Coll. Environ. Sci. and For., Syracuse, NY.