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The Food Plants and Distribution of the American Plum Borer (Lepidoptera: Pyralidae)

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THE FOOD PLANTS AND DISTRIBUTION OF THE AMERICAN PLUM BORER (LEPIDOPTERA: PYRALIDAE)[1]

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ABSTRACT

The North American geographical and host plant distributions for the American plum borer, *Euzophera semifuneralis*, are reported. Literature and curatorial surveys found the plum borer to be present in 34 states in the U. S. as well as parts of Canada, Mexico, and South America. Pheromone surveys and direct observation found it to be present in high numbers in most cherry and plum orchards in Michigan and in 28 counties of the lower peninsula. A very wide host range representing 15 plant families was found, with most host species in the Rosaceae.

The American plum borer, *Euzophera semifuneralis* (Walker) has been a major pest in cherry and plum orchards in Michigan only since the early 1970's (Brunner & Howitt 1981). The rapid spread of this moth from relative obscurity to economic importance in Michigan has been due almost entirely to the increase in tree wounding associated with the extensive use of mechanical harvesting of tart and sweet cherries in nearly all commercial plantings during this same period. The larva is a cambium feeder and is unusual among lepidopteran fruit tree borers in that it is a pyralid (Subfamily: Phycitinae) and not a sesiid clearwing borer (Fig. 1).

The American plum borer is presently a much more serious pest on cherry and plum in Michigan than the main sesiid pest, the lesser peachtree borer, *Synanthedon pictipes* (Grote & Robinson). Lesser peachtree borer larvae tend to feed randomly up and down the entire tree including the upper scaffold limbs, occasionally girdling individual limbs, but almost never completely girdling the trunks of older trees. Plum borer larvae concentrate around the damaged tissue where they enter and feed around the trunk or limb until it is completely girdled (Fig. 2). On trees that have been mechanically harvested, 90% of the larvae will be found in the trunk and lower scaffold limbs. Damage is most severe on young trees, but high populations of plum borer larvae are capable of girdling and killing full grown trees in less than 10 years (Biddinger 1989). Full-grown larvae of the plum borer are 18–25 mm long at normal distension and the color varies from a dusky, greenish-white to a grayish, red-purple with a head capsule, cervical shield and anal plate that are dark brown (Fig. 3). Most sesiids associated with the same hosts are more pure white with light yellowish-brown head capsules.

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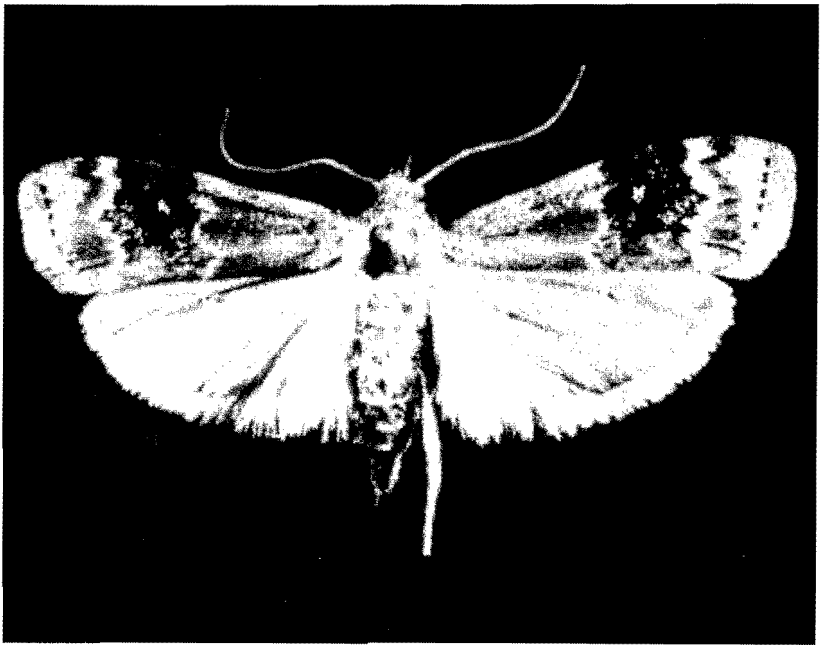

Figure 1. American plum borer, *Euzophera semifuneralis*, adult

The wide geographical distribution and extreme diversity in foodplants of the American plum borer has allowed it to take advantage of relatively recent horticultural practices such as the pruning and grafting of fruit, nut and ornamental trees and the use of clonal rootstocks. The larvae are unable to bore into the cambium without some sort of existing wound. In nature, this generally consists of sun-scald, winter injury, cankers and blacknot growths from diseases (Biddinger 1989, Blackslee 1915). Horticultural practices such as those already mentioned, have greatly increased wounds on trees and thereby provide a means of entry to the cambium. Other means of entry to the cambium include scrapes on trunks from orchard mowers, adventitious root growths or burr knots on the trunks of some dwarfing rootstocks, and physiological incompatibilities at the union of a rootstock and its scion (Biddinger 1989). Mechanical trunk or limb shakers used for harvesting cherries have hydraulic clamps that may exert pressures of over 1,000 psi which crack the bark and crush underlying cambium, thus creating ideal entry sites for plum borer larvae.

Little work was done on the biology of this pest until 1985, when populations were reaching epidemic proportions in some of the cherry growing areas of Michigan. A survey of cherry orchards in western Michigan found this borer to be present in most cherry orchards, averaging as high as 5 to 12 borers per tree in some commercial orchards in Oceana and Leelenau Counties (Biddinger 1989). An estimated statewide reduction in the life of cherry orchards of about a third has been largely attributed to direct girdling damage and indirect damage such as disease introduction from this borer (Biddinger

Figure 2. Tart cherry tree with bark peeled away to reveal underlying American plum borer girdling damage to the cambium.

1989). Weiner and Norris (1983) also found the plum borer to be a serious widespread pest of tart cherries in Wisconsin, but they worked only on control methods and not the biology of the borer. Little was known about the biology and distribution of the plum borer until recently, and the following study is the most comprehensive listing of hostplants and geographical distribution to date.

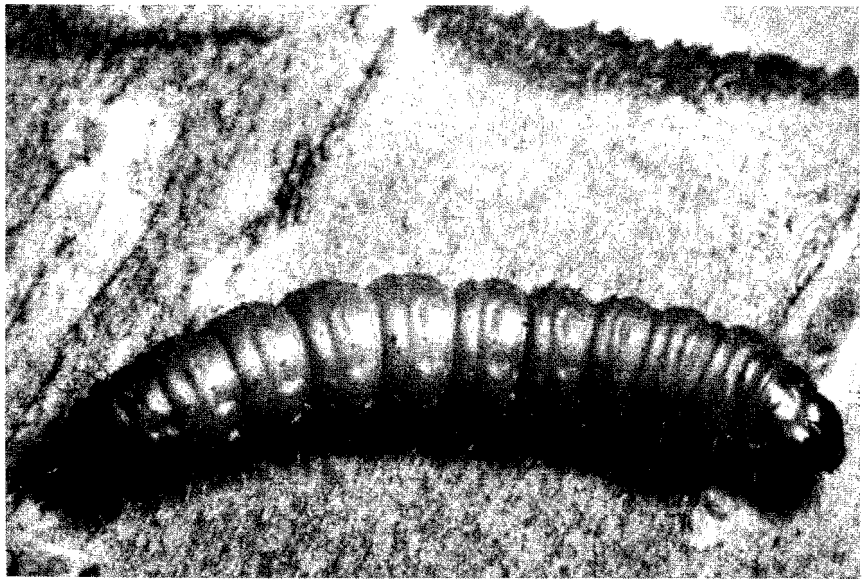

Figure 3. American plum borer larva.

MATERIALS AND METHODS

The literature, especially economic, was reviewed to determine host and North American distribution records for the American plum borer. The last major review was by Heinrich (1956) and several foodplants and localities not previously recorded were found by the authors. These additional records on fruit and ornamental trees were taken in Michigan by excavating larvae and pupae from the cambium of borer infested trees. Additional distribution records for North America were found in a general review of the more recent literature and from a survey of curators of entomological collections from selected states.

The distribution of the American plum borer throughout the state of Michigan was determined through the use of a newly developed pheromone and through direct observation of larvae in suspected hosts. In 1985–86, a direct damage survey of 30 cherry and plum orchards in 12 Michigan counties was undertaken. Larvae were excavated from the cambium using long-handled screwdrivers and hammers to pry away the overlying areas of dead bark. Black light trap records by Mr. John Newman and specimens from the holdings of the Michigan State University Entomological collection were noted. In 1985, the pheromone for the American plum borer was isolated by Dr. Wendell Roeloffs at Cornell University (Biddinger 1989) and became commercially available the following year. From 1985–86, the plum borer pheromone was used in Phercon II sticky traps to survey most of the counties of the Michigan's lower peninsula.

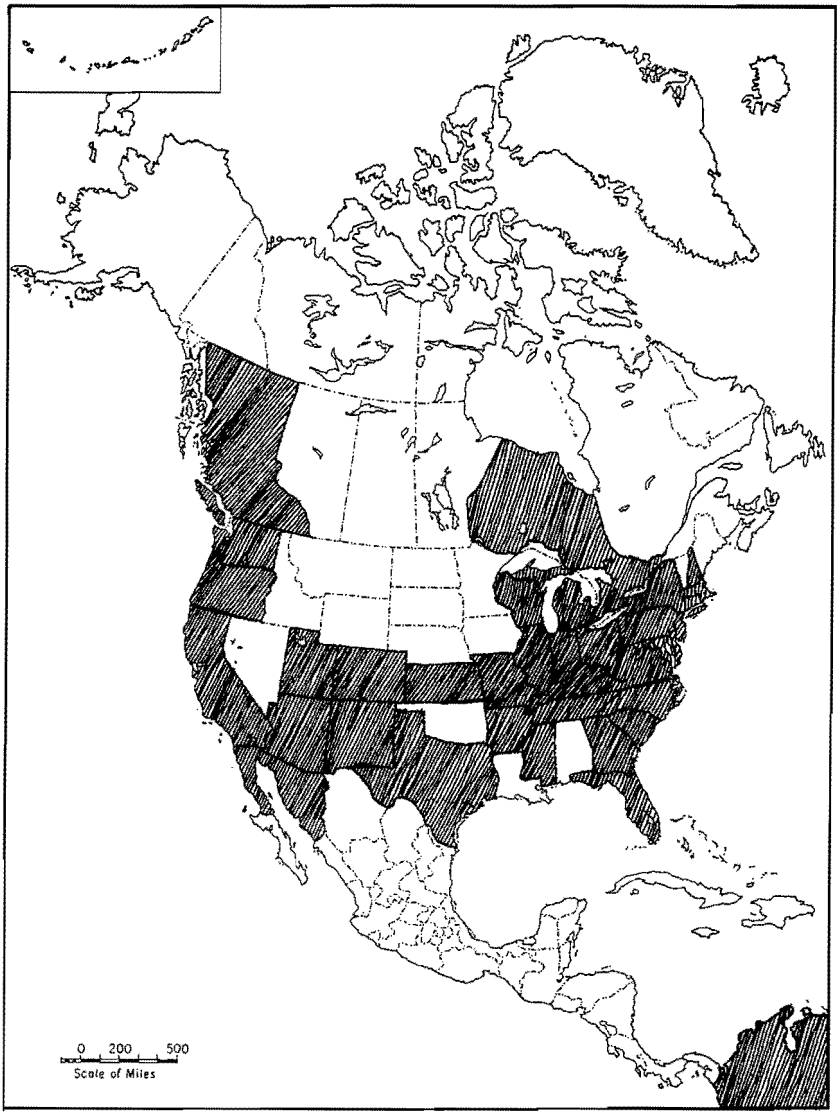

Figure 4. North American distribution of the American plum borer, *Euzophera semifuneralis*.

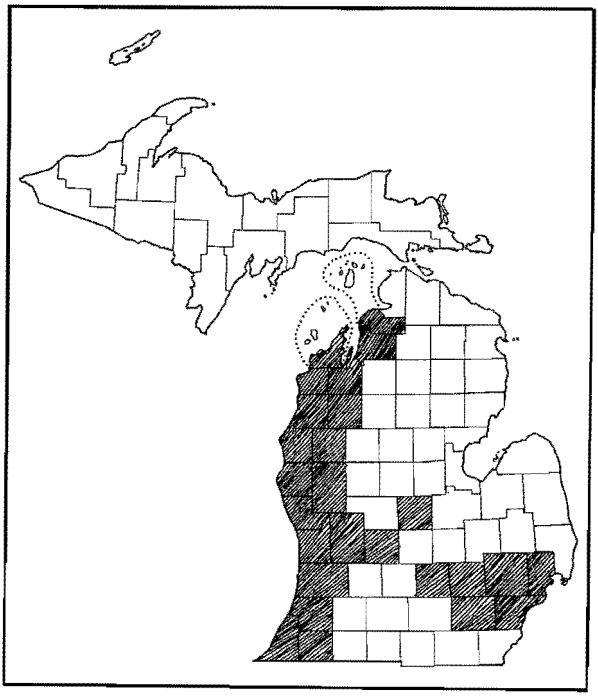

Figure 5. Distribution of the American plum borer, *Euzophera semifuneralis*, in Michigan

RESULTS

Euzophera semifuneralis was first noted as a pest of plum by S. A. Forbes in 1890 and was given its now accepted common name. It was noted as a serious pest in the pruning wounds of pecans (Pierce & Nichols 1941), and has been known as a pest of walnut under the synonym of *Euzophera aglaella* which was commonly known as the "Walnut Girdler" (Essig 1929). The plum borer has been noted as a minor pest of apple, pear, and peach (Blackslee 1915, Kelsey & Stearns 1957, Sanderson 1901, Slingerland & Crosby 1914, Brunner & Howitt 1981), almonds (Van Steenwyk 1986, Anonymous 1985, Moller & DeVay 1968), mountain ash (Kellicot 1891), olive (Essig 1917), London plane trees and sycamore (Johnson & Lyon 1988).

As noted in the economic literature, *E. semifuneralis* has been found on a very diverse range of forest, ornamental, and fruit trees across Canada and the United States. Although a native insect, it clearly prefers the imported varieties of plum and cherry as its favorite hosts over the native species (Lockhead 1918). Originally described from specimens from Columbia, South America (Walker 1863), records for its foodplants in the Mexican and South American part of its range are lacking. While generally a cambium feeder, it can be found feeding in various growths such as cankers, callouses, and burr knots caused by diseases and physiological disorders of trees as previously noted. Although it has been found in dead wood and stumps of its various

foodplants (Rhoads 1924, Biddinger 1989), the plum borer cannot live in dry materials. It can also be found in stored materials such as sweet potatoes (Westicott 1973). It has infrequently been found in stems of plants such as cotton and cornstalks in the southern part of its range (Bottimer 1926, Heinrich 1956). A list of foodplants compiled from the literature and personal observations for *E. semifuneralis* in various regions of the U. S. can be found in Table 1. Most of the host species reside in the family Rosaceae, but 15 families are represented. Larvae were reared on a pinto bean diet under laboratory conditions (Biddinger 1989).

The American plum borer is widely distributed throughout the North American continent (Heinrich 1956, Blackslee 1915, Kimball 1915, Van Steenwyk et al. 1986, Forbes 1891, Hulst 1890, Forbes 1923, Leonard 1926, Kellicot 1891, Brimley 1938, Pierce and Nichols 1941, Weiner and Norris 1983, Bottimer 1926). It has been recorded on the west coast of Canada and there have been unpublished reports of this moth from areas of southern Canada adjacent to the Great Lakes and southern Quebec. It appears to be absent in the northern and central provinces. A survey of selected state entomological collections, as well as reports in the literature, place *E. semifuneralis* in 34 states (Fig. 4). Its range does not seem to reach into some of the north-central states such as the Dakotas and Montana or the far north-eastern states such as Vermont and Maine. Other states which lack records such as Alabama, Iowa, Louisiana, Oklahoma, and Rhode Island are most probably included in its geographical range considering records from surrounding states, but specimens haven't yet been identified. Other states such as Idaho, Minnesota, and Nevada in which the plum borer has not been recorded, may also be part of its range, but seem less likely. It has not been found in Hawaii or Alaska.

A survey of the distribution of *E. semifuneralis* in the state of Michigan has shown it to be present in about 85% of all plum and cherry orchards in western Michigan (Biddinger 1989). Damage surveys in these areas have shown Allegan, Atrim, Benzie, Cass, Charlevoix, Grand Traverse, Leelenau, Manistee, Mason, and Oceana counties to be the most heavily infested. Holdings from the Michigan State University entomology museum, black light traps records from Dr. John Newman, and recent pheromone trappings surveys, indicate *E. semifuneralis* is found in 29 counties in the lower peninsula (Fig. 5). Because of its wide host plant distribution, however, it is probably found in all counties of the lower peninsula with its range extending up into parts of the upper peninsula.

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Table 1. — Foodplants of the American Plum Borer in North America

CONVOLVULACEAE		
Sweet potato (stored tubers only)	*Ipomoea batatas* Lam.	North Carolina
EBENACEAE		
Persimmon	*Diospyros virginiana* L.	Ohio
FAGACEAE		
Pin Oak	*Quercus palustris* Muenchh.	Texas
Southern Live Oak	*Quercus virginiana* Mill	Texas
GINKGOACEAE		
Ginkgo	*Ginkgo biloba* L.	
GRAMINEAE		
Corn stalks	*Zea mays* L.	Texas
HAMAMELIDACEAE		
Sweetgum	*Liquidambar styraciflua* L.	
JUGLANDACEAE		
Pecan	*Carya illinoensis* C. Koch	California, Texas
Hickory	*Carya* sp.	New York
Black Walnut	*Juglans nigra* L.	
River Walnut	*Juglans microcarpa* Berland	New Mexico, Arizona, Utah
MALVACEAE		
Cotton stems	*Gossypium hirsutum* L.	Mississippi
MORACEAE		
Mulberry	*Morus alba* L. *Morus* spp.	
OLEACEAE		
Olive	*Olea europea* L.	California
PLATANACEAE		
Sycamore	*Platanus occidentalis* L.	
London Plane Tree	*Platanus acerifolia* Willd	Eastern U.S.
ROSACEAE		
Almonds	*Prunus dulcis* (Mill)	California
Apple	*Malus domestica* L.	Delaware, Michigan, New York, Virginia
Apricot	*Prunus armeniaca* L.	Michigan, California
Flowering Crab	*Malus* spp.	Michigan
Common Pear	*Pyrus communis* L.	Delaware
Mountain Ash	*Sorbus americana* Marsh.	Michigan
Peach	*Prunus persica* Batsch	Michigan, New York
Plum	*Prunus domestica* L.	Michigan, Wisconsin, California, British Columbia, Ontario, New York
Sweet Cherry	*Prunus avium* L.	Michigan, Wisconsin, California

Table 1.—Foodplants of the American Plum Borer in North America *(Continued)*

Tart Cherry	*Prunus cerasus* L.	Michigan, Wisconson, California
Pin & Wild Cherries	*Prunus* spp.	Michigan, Ontario
Wild Plums	*Prunus* spp.	British Columbia, Ontario, Michigan
"June Drop" Apple fruit	*Malus domestica* L.	Pennsylvania
SALICACEAE		
Willow	*Salix* spp.	
Poplar	*Populus* spp.	Illinois
TILIACEAE		
Basswood	*Tilia* spp.	New Jersey
ULMACEAE		
Elm	*Ulmus* spp.	Texas
CANKERS ON HOSTS		
Black-knot of plum	*Dibotryon morbosum*	Michigan, California
Olive-knot	*Pseudomonas savastanoi*	California

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