United States Department
of Agriculture
Forest Service
Agriculture Handbook
AH-706

Guide to Insect Borers in North American Broadleaf Trees and Shrubs

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Pesticide Precautionary Statement

Pesticides used improperly can be injurious to humans, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key–out of the reach of children and animals–and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat, drink, or smoke until you have washed them thoroughly. If you swallow a pesticide or get it in your eyes, follow the first-aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing and wash skin thoroughly.

Do not clean spray equipment, or dump excess spray material, near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

Note: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the United States Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

Contents

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. 735 p.

This manual describes 300 species of insect borers and includes 244 photographic plates.

KEYWORDS: Wood borers; bark beetles; wood defects; decline; mortality; damage to forests, plantations, nurseries, shelterbelts, and urban plantings.

Issued June 1995.

Acknowledgments

I acknowledge with deep gratitude the contributions made by a large number of individuals in the preparation of this publication. I am deeply indebted to those specialists who reviewed sections of the manuscript on the different families of insect borers and to those who provided photographs and/or infested wood samples for photographs. Courtesy lines presented with figure captions contain only the contributor's name. Their affiliations and contributions are listed here:

Abgrall, J.F., Protection Phytosanitaire de la Foret Cemagref, Grenoble, France, provided photographs.

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My deep appreciation also goes to F.T. Hovore, Placerita Canyon Nature Center, Newhall, CA, and R.L. Penrose, California Department of Food and Agriculture, Sacramento, CA, for hosting a study trip in southern California; to the College of Environmental Science and Forestry, State University of New York, Syracuse, NY, for making its borer-damaged wood collection available to me for photographs; to W.T. Johnson, Cornell University, Ithaca, NY, for making his photographic museum available; to R.L. Brown, Mississippi State University, Mississippi State, MS, for making the entomology museum available for photographs; and to D.M. Anderson, D.R. Davis, D.C. Ferguson, R.W. Hodges, J.M. Kingsolver, R.V. Peterson, D.R. Smith, T.J. Spilman, D.W. Weisman, and D.R. Whitehead, U.S. Department of Agriculture, Agricultural Research Service, Systematic Entomology Laboratory, Washington, DC, and W.D. Duckworth, Department of Entomology, Smithsonian Institution, for making museum specimens and damaged wood samples available to me for photographs.

I also give special thanks to T.H. Filer, retired, U.S. Department of Agriculture, Forest Service, Stoneville, MS, for his technical and administrative advice in preparation of the manuscript; to L. Newsome, W.N. McDuff, and A.S. Risner, U.S. Department of Agriculture, Forest Service, Stoneville, MS, for printing and mounting the photographic plates, dissecting the infested wood samples for study, and typing the manuscript; to E.P. Merkel, retired, U.S. Department of Agriculture, Forest Service, Olustee, FL, for first-draft write-ups of a number of borers; and to C.L. Dunaway, artist, Leland, MS, and T.C. Lockley, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Gulfport, MS, for sketch-illustrations of some borer species. I also would like to express my appreciation to C.A. Lowe, U.S. Department of Agriculture, Forest Service, New Orleans, LA, and D.A. Swords and S.J. Branham, freelance editors, New Orleans, LA, for editing the manuscript. R.G. Nisley, U.S. Department of Agriculture, Forest Service, Hamden, CT, was managing editor.

INFOSOUTH, Athens, GA, provided invaluable assistance in locating articles in the old literature, especially those in little-known or discontinued periodicals. I also wish to thank the staff at the Southern Hardwoods Laboratory, U.S. Department of Agriculture, Forest Service, Stoneville, MS, and members of the Southern Hardwood Forestry Group, Stoneville, MS, for helping to locate insect borer populations for study and for technical advice during the progress of this study.

How to Use This Book

This book is an illustrated guide to 300 species of insect borers that attack hardwood trees, shrubs, and other woody angiosperms in North America. The major purposes of this guide are to identify insect borers and their damage and to provide information for controlling them. Readers most likely to find this guide useful are practicing foresters, entomologists, and others responsible for preventing or minimizing losses caused by these insects in forests, plantations, nurseries, urban plantings, and other settings where trees and shrubs grow. This book should also be a useful reference for extension agents, pest control specialists, arboriculturists, horticulturists, nursery managers, urban managers, forestry technicians, forest owners, homeowners, and teachers and students of forestry and entomology.

Although *Insects of Eastern Forests* (USDA FS 1985), *Western Forest Insects* (Furniss and Carolin 1977), *Insects That Feed on Trees and Shrubs* (Johnson and Lyon 1988), and other major references contain sections on insect borers, the information in these sources is brief and limited to the most-common species. This guide, on the other hand, focuses entirely on the insect borers of living North American broadleaf hardwood tree and shrub species (most of which are deciduous), including those used for timber, windbreaks, ornament, nut and fruit production, and other purposes.

The insects are arranged taxonomically by order and family, generally following the protocol and classification scheme used in other major texts, catalogs, and checklists (Arnett 1968, Borror and others 1981, Furniss and Carolin 1977, Hodges and others 1983, Krombein and others 1979, USDA FS 1985). Genera in families and species in genera are presented in the order of their relative importance as pests.

The discussion for each insect contains subsections on hosts, range, description of the life stages, biology, injury and damage, and control. Subsections on hosts, range, and description are abbreviated (most verbs and articles omitted). Some life stage descriptions are omitted where information is lacking. Biologies are summarized to help predict damage and to suggest plans for managing infestations. Natural, cultural, chemical, and other controls are discussed, but specific insecticides are not named because they are subject to constant change and vary from state to state. The parasites listed for individual borer species are insect parasites unless otherwise indicated, and most are parasitic on the larval and/or pupal stages of the host. Photographs illustrate (to the extent possible) the insects and their damage. Although not executed to exact scale, photographs of insect stages are printed to relative or proportional size.

The **Literature Cited** section (p. 699) will be useful to readers who want more information on specific insects. The **Glossary** (p. 635) is included to aid those unfamiliar with scientific terminology in this field (Ford-Robertson 1971, Torre-Bueno 1962).

This guide presents scientific names followed by common names for each insect borer. Common names approved by the Entomological Society of America (1989)

are used when available. *For species that have no approved common name, nomenclature in vernacular use is given in brackets [].* An index to both the scientific (Chemsak and Linsley 1982, Fisher 1928, Hodges and others 1983, Smith 1979, Spencer and Steyskal 1986, Wood 1982) and common names of the insects is presented (p. 681).

Although no keys are presented, a **Diagnostic Host Index** will help the reader identify insect borers (p.639). Where possible, host names follow the nomenclature in *Checklist of United States Trees (Native and Neutralized)* by Little (1979). Several other references on host nomenclature were used to supplement Little's checklist (Kartesz and Kartesz 1980, Kelsey and Dayton 1942, Terrell and others 1986, Van Dersal 1939, Vines 1960). A list of corresponding common and scientific names of host plants is also presented (p.689).

Introduction

Insect borers are important pests of hardwood trees, shrubs, and other woody angiosperms, causing defects in the wood that lower its value for lumber, veneer, and other products. Borer holes in lumber, for example, have been responsible for annual losses of $21 per thousand board feet in oaks harvested in the South (Morris 1977) and $24 per thousand board feet in Appalachian oaks (Donley 1974). At current values, the average losses are $45 per thousand board feet, which comes to $158 million dollars for the 3.5 billion board feet of oaks cut annually in the United States (U.S. Department of Commerce 1988).

Borer larvae construct tunnels in the terminal shoots, branches, trunks, and roots of woody plants of all sizes. Larvae of most borer species hatch from eggs deposited on the surface and then chew their way into the tissue. Adults of some species oviposit directly into the tissue, and others chew niches through the bark and then deposit eggs within the tissue. Naturally regenerated stands are sometimes heavily infested by girdler and pruner borers. Nursery stock and young plantings close to heavily infested natural stands or woodlots are especially vulnerable. Young transplanted trees are very susceptible to attacks by flatheaded borers and often require extra protection. Insect borers are also responsible for tree decline and mortality in windbreaks.

The consequences of borer infestation are multifold. Loss of terminals and main stems reduces growth and deforms trees in young hardwood plantations. Twig and shoot borers can drastically decrease the number of fruit- and nut-bearing branches and reduce the crops in orchards and nut-tree groves. Girdled branches die and must be removed around residences, and wormholes and healed-over bark scars diminish the esthetic value of shade and ornamental trees and shrubs.

Borers sometimes invade the cambium and callus tissue around new grafts and prevent the union of scion and stock. Trees recently topworked with new grafts may suffer serious damage. Trees stressed by borer attacks and other agents are susceptible to bark and ambrosia beetles. Bark beetles transmit the fungal pathogen—*Ceratocystis ulmi* (Buisman) C. Moreau—for Dutch elm disease, which has killed countless elms across North America.

Insect borers are commonly concealed beneath the bark or in the wood, making them difficult to detect and costly to control. However, damage by many borer species can be greatly minimized by following recommended cultural practices in both artificial plantings and natural stands.

The cryptic habits of insect borers have hampered efforts to document their activities. Information about them is widely scattered, much of it in older, not readily accessible literature. The information in this guide is based on a careful survey of the literature and on 30 years of personal experience studying borers in the field. For many species, information in the guide is presented for the first time.

By far, the greatest numbers of insect

borer species covered in this guide are in the orders Lepidoptera (moths) (99) and Coleoptera (beetles) (182). Smaller numbers of borer species are in the order Hymenoptera (sawflies and horntails) (14), and still fewer species in the order Diptera (flies) (5).