Introduction

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INTRODUCTION

The dramatic increase in the human population during the present century has focused ever-increasing attention on forests and their products. This once unlimited natural resource no longer satisfies the demands placed upon it. These circumstances have led to an increased interest in forest protection and an awareness of the destructive capacity of forest insects. We have learned a great deal about the biology and ecology of many destructive forms and now know how to reduce or eliminate much of the loss. Although much has been accomplished, much more remains to be learned before a new ecological balance in a managed forest is achieved.

In the primeval forest an ever-shifting ecological balance existed between the natural reproduction and growth of trees and the depredations of insects, fire, floods, disease, and climatic factors. When great losses resulted from any one or a combination of these destructive agents, natural ecological succession gradually restored the balance. It wasn’t particularly important that several hundred years might be required to restore the original forest.

A managed forest must satisfy a multiplicity of needs ranging from the most ethereal esthetic end of the spectrum to the economic realities of tree farming at the other end. Losses from insects, fire, and disease are regarded as avoidable and action may be taken to reduce or eliminate them.

Although insects superficially appear to be the least dramatic of the destructive agents in a forest, they actually kill more trees each year than the combined total of all other natural factors (R. F. Anderson 1960:203). Among the insects, one group consisting of the two families Scolytidae and Platypodidae, commonly known as bark and ambrosia beetles, stand alone in their destructive capacity. It has been estimated that, in the United States, 90 percent of all tree mortality is caused by insects and more than 60 percent of the total is caused by representatives of the Scolytidae (Anderson 1960:203). The Platypodidae, almost entirely tropical in distribution, equal or replace the Scolytidae in this role in tropical countries. For a variety of reasons the Platypodidae will not be considered further in this volume.

More than 6000 species of bark beetles have been named from throughout the world wherever woody plants grow. About 477 species occur in the United States, with approximately 179 of these, plus a few endemic species, extending their ranges into Canada and Alaska (Bright 1976). About 605 species are found in Mexico and about 632 in Central America; allowing for overlap in distributions, there are about 1,430 species in North and Central America combined. Most species restrict their breeding activity to one or a limited number of host plant species. In addition, most species have specialized ecologically to infest only a restricted part of their host plant. For example, some species confine their attacks to the cones or fruits of their host, others infest only tiny twigs, others small branches, limbs, boles, or roots. Some breed only in shaded-out branches of standing, living trees, others in felled or broken material, etc. A few are very aggressive and attack healthy, living tissue, and others prefer dying or dead plants.

Because of the large number of species and the extreme diversity in their habits, bark and ambrosia beetle attacks on economically important plants can be evaluated and meaningful corrective action taken only if species involved are correctly identified. In addition, research notes based upon incorrectly identified specimens may not only be meaningless, but misleading. This volume was written to simplify the process of identification of Scolytidae for those who work with problems involving these insects. Coleopterists and zoogeographers will also find information compiled here useful in their work.

Three noteworthy attempts have been made to classify North and Central American
Scolytidae (Blandford 1895-1905, Swaine 1918, Chamberlin 1939). Almost as noteworthy are series of revisional and other taxonomic articles relating to classification by Hopkins, Blackman, Wood, and Bright. This volume attempts to summarize and update their contributions as well as to add new information not previously reported.

**BIOLOGICAL ACTIVITIES**

**Ecological Niche**

Most bark and ambrosia beetle species live only in recently cut, injured, or unthriftily tissues of woody plants that are in the process of dying. In most genera, they complete one generation only in this material then abandon it to search for other material in suitable condition. Host tissues must contain sufficient moisture for the completion of development. Such material usually bears wilted or yellowish green leaves. Older host material usually is unattractive to the beetles; however, a few species apparently prefer host material that is completely dead. Several other species normally attack healthy, living tissue of vigorous plants and cause its death. A few species of ambrosia beetles (e.g., *Corthylus columbianus* Hopkins) are capable of attacking a living tree, completing a system of galleries, and emerging a generation later without killing the host, although a permanent scar remains in the wood.

Bark and ambrosia beetles usually are the primary attackers of recently injured or felled woody plants. Most species complete their development in about 20 to 90 days then move to fresher material. Other wood- and bark-feeding insects usually arrive later or develop more slowly, thus reducing or eliminating competition. Those scolytid species with longer life cycles and those arriving late in the ecological deterioration of their host usually encounter much greater competition for survival from other insect groups.

**Host Specificity**

Most Scolytidae are restricted in the number and variety of host species in which they can successfully reproduce. In general, phloemophagous (phloem infesting) species tend to be more restricted or specific in their selection than are xylomycetophagous (wood-boring ambrosia beetle) species. The apparent reason for this difference is that the former feed directly on host tissues, and the latter feed on fungal spores; any host on which the symbiotic fungus can survive will be satisfactory for beetle development.

Only two known species (*Coccotrypes*, tribe Dryocoetini), one in Malaya and one in New Guinea, confine their attacks to Pteridophyta. Representatives of 14 of the 25 tribes recognized here in the world fauna normally breed in Gymnospermae, but of the 10 most primitive tribes worldwide only the Hylastini, Tomicini, and Scolytini are included within these 14. It is of interest that all species of the Hylastini are restricted to the family Pinaceae of the Gymnospermae. Representatives of all tribes, with the exception of Hylastini, breed largely or exclusively in the Dicotyledoneae, although the American Polypodaphini occur exclusively in conifers. Fewer than a dozen known species confine their activities to Monocotyledoneae, but only one of these represents a primitive group (*Cnesinus testicus* Eggers, tribe Bothrosterini). In addition to these, several species of polyphagous Xyloborus may also breed in various palm logs, but host preference is not involved in the selection.

Within tribal or generic groups host specificity may be extreme, with most species confining their breeding activity to one or to a very restricted number of host species. For example, American *Scierus*, *Hylurgops*, *Hyastes*, *Carphoborus*, *Polygraphus*, *Cryptaphus*, *Crypargus*, *Dohurgus*, *Pityogenes*, *Orthotomicus*, *Pityokecines*, *Ips*, and *Pityoborus* are restricted to the Abietineae of Pinaceae, *Phloacosinus* to the Cupressineae or Taxodiioideae of Pinaceae (many Oriental species occur in other plant families), *Phrixosoma* to the Gutiferae, *Dendrocragnus* to the Curbitaceae, *Pseudopityophthonus* to the plant genus *Quercus*, etc. The Bothrosterini, Cryptalini, and Xyloborini are unusually polyphagous.

**Host Selection and Dispersal**

Scolytid beetles are dependent upon their power of flight to move from their brood tree to a new host. The original pioneer beetles