URBAN SHADE TREES AND CARPENTER ANTS

by H.G. Fowler and M.D. Parrish

Abstract. Carpenter ants nests were found in 75% of the 306 urban shade trees sampled in central New Jersey during 1981-1982. Silver maple demonstrates the greatest nesting usage by carpenter ants, while white pine is the least used (apparently avoided). There is an overall pattern of nesting activity associated with visible tree damage. Nesting activity increases the risk of wind breakage, and may open invasion channels for secondary tree pests and pathogens. Additionally, carpenter ant colonies have an indirect effect on shade trees through their protection of honey-dew producing insects.

Carpenter ants are native components of the wooded areas of North America. These ants generally nest in trees, gnawing out, but not eating, wood to provide a protected nest site (Anderson 1960). Most species of carpenter ants nest in fallen trees, in various stages of decomposition, but a few species are noted for nesting in the trunks and major limbs of live standing trees (Fig. 1). As wooded areas were cleared to establish urban areas, these species of carpenter ants, and especially *Camponotus pennsylvanicus* in the northeastern United States, adapted quite easily to man and his environment. They use man's structures and his shade trees as nesting sites. Consequently, these ants have become major structural pests, and significant shade tree pests, under certain conditions. In this paper, we will discuss some specific examples of carpenter ant activity and how this activity affects the urban public.

Tree species, damage, and nesting. In general, the species densities and diversities of urban shade trees are reduced compared with the native forests. As tree density is generally quite low, and trees tend to be regularly spaced, single shade trees can represent the only available nesting site for carpenter ant colonies, especially if human structures are protected and well maintained.

The propensity of some species of carpenter ants to nest in live standing trees has been well documented (Fitch 1856; Graham 1918; Felt 1928; Sanders 1864). However, the effect of tree species and mechanical damage to the tree on carpenter ant nesting has not been examined. Therefore, we conducted a survey of the shade trees of some urban streets of central New Jersey. We then calculated the percentage of trees of each species having carpenter ant nests, and their relative utilization using Ivlev's (1961) electivity (E) index, and "nesting" ratio (E') (Fig. 2). A positive E represents utilization greater than expected if nesting were proportional to abundance, while negative ratios represent the converse. For nesting ratios, indices greater than one indicate preference, while values less than one indicate non-preferred species. Ratios in the neighborhood of one indicate that a constant fraction of the trees available are utilized as nesting sites.

The results of our survey (Fig. 2) suggest a rank progression of electivity, or "preference," from white pine upward through silver maple. White pine is apparently avoided as a nesting site, at least in the area of our survey. Overall, 75% of all trees surveyed had carpenter ant nests, corresponding to a similar finding for the trees of urban parks in central New Jersey (Fowler 1980). White pine was the only species not used as a nesting site by carpenter ants.

To examine the effects of visible damage on the presence of carpenter ants, trees were scored for ant nests and visible mechanical damage, such as collision scars from automobiles, loose bark, pruning wounds, etc. (Table 1). By tree species, only red maple, Norway maple, and red oak

demonstrated a significant association (Fisher's P) between visible damage and carpenter ant nesting. Insufficient sample sizes may have precluded a significant association for other tree species. Nevertheless, over all tree species, the association between visible damage and carpenter ant nesting was highly significant (Fisher's P = <0.01). This suggests that proper tree maintenance is important in minimizing carpenter ant nesting, as colonization usually occurs via wounds (Herrick 1935).

Effects of carpenter ant nesting on shade trees. Because a high percentage of urban shade trees are used as nesting sites by carpenter ants, their nesting activity poses several problems. In forests, carpenter ant nests have been implicated as contributing to wind breakage (Graham 1918; Felt 1928; Schread 1952). The effect of tree size and carpenter ant nesting on wind breakage has recently been documented for urban trees (Fowler and Roberts 1982). However, unless the tree is highly exposed, and nest excavations are extensive, wind breakage should not present a substantial problem, as the incidence of wind breakage of trunks and major limbs is not high. However, in exposed situations where wind
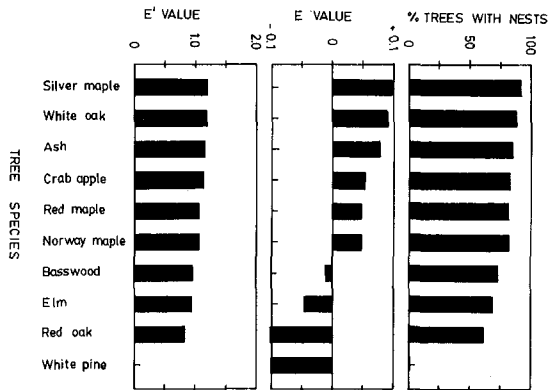

Figure 2. Percent of trees with carpenter ant nests for each tree species examined. Given also are Ivlev's indices of electivity (described in text).

breakage could produce substantial property or bodily damage, trees should be inspected for carpenter ant nest excavations. Large accumulations of sawdust serve as a warning that wind breakage may have to be evaluated. If the risks of property damage are deemed high, the tree should be removed. Treatment of the colony with a recommended pesticide may be warranted to prevent further structural weakening if ant excavations are in an early stage in an exposed tree. In such a case, the treated nest should then be sealed to prevent future colonization by carpenter ants, other insects, or pathogens.

Discussion

The most common effects of carpenter ant colonies located in shade trees is probably that of a nuisance. Throughout the summer, carpenter ants subsist primarily upon honey-dew (Fowler and Roberts 1980). Although their protection of aphid colonies, especially in cherry trees, may lead to extensive leaf-curling in ornamentals and shade trees, these effects probably can be controlled by placing sticky bands around the trunks to preclude ant visitation. Aphid populations are then generally reduced by natural controls, such as predation by coccinelid beetles. When colonies occur in large shade trees in parking lots, over picnic areas, or alongside driveways, and these trees

Figure 1. Schematic diagram of carpenter ant nest workings in a cross-section of a trunk. Note that the gnawed out portions follow the general pattern of the growth ring.

contain aphid populations, the amounts of honey-dew produced may be very large, leading to the voiding of copious amounts. In such cases the ants may not be able to harvest all of the honey-dew. Honey-dew may then build up under the tree, fall on, and sometimes mar the finishes of automobiles or other unprotected objects. It may also attract a variety of undesirable insects such as yellowjackets. Under such conditions efforts must be made to control the aphids, but not the ants.

One of the most common indirect effects of carpenter ants on shade trees is that of opening up passages for subsequent invasion by other pests and pathogens (Craighead 1950). These effects are obvious, and we will comment on only one type of pathogen that may be associated with carpenter ants: chestnut blight, Endothia

parasitica. Anagnostakis (1982) has shown that carpenter ants are capable of transporting chestnut blight, and has suggested (personal communication) that these ants may have been one of the principal vectors of this disease which has all but decimated our native chestnuts.

The effects that we have discussed are generally not major. However, some of these problems can be of economic importance, given the appropriate conditions. Much more research is needed on these ants, which are very common in urban areas of the Eastern U.S. In particular, research needs to be done on risk assessment, and the interaction of these ants with other tree pests and pathogens. We hope, however, that our brief review of carpenter ants in shade trees will provide basic information necessary for decision making on the part of tree care specialists.

Table 1. The effects of mechanical damage and tree species on the nesting activity of carpenter ants in street trees of central New Jersey. Given are Fisher's exact probability level (one-tailed) of the association of mechanical damage with carpenter ant nesting. Also shown is the presence (+) or absence (−) of nests and damage with the number of trees observed in each category.

Tree Species	Ant nest	Mechanical damage		Fisher's P
		+	−	
Acer saccharinum (silver maple)	+	16	7	
	−	1	1	0.55
Quercus alba (white oak)	+	13	6	
	−	0	2	0.13
Fraxinus americana (ash)	+	15	7	
	−	1	2	0.29
Malus spp. (crab apple)	+	11	5	
	−	1	2	0.30
Acer rubrum (red maple)	+	19	11	
	−	1	5	0.05
Acer platanoides (Norway maple)	+	41	18	
	−	4	8	0.02
Tilia americana (basswood)	+	16	9	
	−	3	6	0.12
Ulmus rubra (elm)	+	7	4	
	−	3	2	0.65
Quercus rubra (red oak)	+	18	8	
	−	6	11	0.03
Pinus strobus (white pine)	+	0	0	
	−	6	10	——
All species	+	156	75	
	−	26	49	<0.01

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ABSTRACT

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With a century of research behind us, we have many registered insecticides, and we have the programs necessary to back control efforts. But we also have more regulations, more awareness of the environment effects of certain controls, and more experts offering varied advice. In the balance we are left with a problem maybe more difficult than the one faced by Victorian counterparts. In reality the struggle is not only with the moth but also with the issues surrounding its control. Should we spray or not? Who should finance the research and control programs — federal, state, or local government, or the private sector? Is it better to use chemical or biological controls? Can our efforts have any effect, or should we let the moth run its natural course? Do we know too much or too little? Last year the gypsy moth defoliated more than 12.8 million acres of woodland. Hardwoods respond to losing more than 50 to 60 percent of their leaves by refoliating in mid-summer, using buds earmarked for next year's growth. This creates a drain on a tree's energy supply. Healthy trees can survive several defoliations. But weak trees, or those that face unfavorable moisture conditions after defoliation, are in serious trouble. Homeowners are often relieved when their trees refoliate, but then are dismayed when those trees die two to five years later. They overlook the fact that weakened trees are easy prey for organisms such as the two-lined chestnut borer or shoestring root rot fungus. In the forest, figures show that oak mortality ranges from 6 to 70 percent on certain sites over a five-year period.