ARBORISTS AND INSECT CONTROL: PAST, PRESENT, AND FUTURE[1]

by David G. Nielsen

Abstract. Arborists relied on cultural manipulation and plantsmanship more than insecticides to maintain healthy landscape trees and shrubs prior to the 1950's in the U.S. Availability of inexpensive and extremely effective synthetic organic insecticides, beginning after World War II, caused tree managers to rely more heavily on routine application of insecticides instead of tree health care methods to minimize pest damage. Arboriculture in the 21st century will employ proven tree health care tactics to enhance the urban forest while reducing pesticide exposure and risk to humans and other non-target organisms. Arborists and institutional researchers are encouraged to work together to develop sound scientific information on which to base cultural recommendations for improving tree health, thereby reducing maintenance costs associated with insect control.

The purpose of this paper is to introduce the audience to an historical perspective, in time and orientation, of arboriculture in the U.S. and to indicate how we can all work together to make the art and science of our discipline more responsive to the needs of trees and people.

Early Arboriculture

Arboriculture, the scientific cultivation of landscape trees and shrubs to promote their vigor, longevity, and beauty, was originally defined to also include commercial forestry. The term has now been narrowed to exclude silviculture, the cultivation of trees for timber and fiber production. Although arboriculture was practiced long before forestry, it did not receive institutional and legislative support, so educational advancement in the discipline was slow (James 1972). Commercial forestry dominated a fledgling organization known as the International Society of Arboriculture (ISA) in the early 1900's (no relation to the current organization with that name).

The earlier ISA began publishing a magazine called *Arboriculture* in 1902. The purpose of the organization was stated in article #2 of its incorporation document: "The purpose of the Association is to introduce judicious methods in dealing with forests and woodlands; to advance and advocate a public interest in this subject; to promote the afforestation of unproductive lands; to encourage the planting and care of shade trees in parks, public and private grounds, and along streets and highways; to inspire an interest in our remaining native forests and groves of ancient trees, and to seek their preservation; to supply information to railway officials in regard to timber culture for railway uses, and incite railway and other corporations to plant trees for economic purposes." (Anonymous 1904).

New York, Pennsylvania, Massachusetts, and Ohio were pioneer states in recognizing the importance of enlightened forest management. In the early 1900's, following decades of timber harvesting and production agriculture that depleted soil fertility, a group of prominent Bostonians proposed that an organization of at least 100 stockholders, each contributing $1000, be formed to demonstrate practical and profitable forestry. A similar organization in Ohio, The Forest Nursery and Lumber Company, emphasized culture of the fast-growing, long-fibered *Catalpa speciosa* to practice profitable forest tree management. In those days, arboriculturists saw potential for greater advancement in practical forestry in Ohio than in other, so-called, western states. Governor Herrick encouraged the Ohio State University to develop a forestry curriculum and proposed legislation to advance forestry in the state. The State Experiment Station (now The Ohio Agricultural Research and Development Center of The Ohio State University) had already begun planting small tracts to forests and announced plans to establish a 100-acre model forest with blocks of economic tree species to demonstrate practical tree culture to Ohio's farmers. These plantings comprise a significant portion of the Secrest Arboretum near Wooster.

There were indications that insects influenced arboricultural practices around the turn of the cen-

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tury. Black locust was popular in cities during the 1800's, but was in disfavor by 1904 because it sprouted wildly and was devastated by borers, presumably the long-horned beetle known as locust borer. In the early 1900's, the State of Massachusetts hoped to exterminate the gypsy moth by rearing and releasing parasites, as prescribed by a California entomologist. The U.S. Congress was asked to support this effort with an appropriation of $250,000.

Insecticides have been used in commercial and urban forests in the U.S. for many years. Hammond's *SLUG-SHOT* was first advertised in 1880. The company also provided a pamphlet on *Bugs and Blights.* The use of insecticides had become a necessity with farmers and landscape managers soon after the turn of this century. The rapid increase in noxious insects was blamed on destruction of forests causing reduction in bird populations (Anonymous 1907).

Managers responsible for pest control through the 1940's had a limited arsenal of insecticides. Arsenate of lead, a stomach poison, was used to control defoliators. Carbon disulphide was injected into borers' galleries to kill them. Lime-sulphur, nicotine dust, nicotine sulphate, or a highly refined oil was used to kill sucking insects.

An enlightened tree care specialist, C.F. Greeves-Carpenter (1928), stated that if spraying is not done thoroughly it should not be done at all. He was stressing the importance of thorough coverage to achieve maximum effect against the target insect. Thorough coverage has been and will continue to be a key cornerstone for any insect control strategy.

The importance of selecting trees for specific sites and implementation of proportional or ratio plantings to minimize devastation by insects was professed by Ablett (1888). Greeves-Carpenter (1928) championed tree health care as a way to minimize depredations of insect borers. He worked in the Philadelphia area in the early 1900's and considered bronze birch borer and peachtree borer as the most notable examples or borers attacking trees at that time. He recommended using preventative measures rather than spraying. He stated that, "The old adage, a stich in time . . ., can very well be applied to trees, and preventive measures are much better and cheaper in every sense than curative attempts." As soon as tree vigor began to decline it should be fertilized to minimize chances of borer attack. Also, infested tree parts should be removed and burned to reduce the likelihood of reinfestation. Tree trunks were to be inspected in spring and fall for signs of borers and prompt action should ensue to determine the species of borer and the best method of control. He also made a general recommendation regarding use of aeration to minimize impact of water-logged soil, and aeration in combination with puddling (deep watering) during periods of summer or fall drought to improve tree vigor.

To summarize, arborists in the U.S. during the first half of this century had a small arsenal of insecticides but enjoyed sound advice from a small group of knowledgeable tree care specialists regarding the importance of tree health care in helping trees to help themselves, in terms of resisting insect attack and damage.

Today's Arboriculture

Commercial forestry dominated arboriculture in the U.S. during the first part of this century; the urban forest was mostly neglected, except on estates of the wealthy, in a few large cities and around governmental institutions. Now that silviculture has become a discipline of its own, and most of us live in cities or suburbs, urban forestry has begun to dominate both the literature and practice of arboriculture.

The importance of justifying urban forestry was recently stated by Fred Bartenstein (1981), Dayton Climate Project Director, Dayton, Ohio: "Trees stand the best chance for survival if they are valued for their contributions to a city's physical, economic and social welfare. These values must be better understood, and translated into clear costs and benefits before forestry can effectively or fairly compete for scarce tax dollars." Bartenstein believes we must even justify having *healthy* trees in the urban environment. Personal interviews with urban foresters in selected Midwest cities revealed that managers are justifying urban forestry programs on the basis of providing an aesthetically pleasing and safe environment (Sievert et al. 1982). Perhaps the safety factor provided through implementation of

sound urban forest management can be emphasized more when competing for public support, including tax dollars.

Readers of the Journal of Arboriculture during the past 5 years know that much has been learned about tree culture that refutes early practice and improves the efficiency of our craft. Shigo (USDA, Forest Service) has shown that healthy trees compartmentalize wounds, restricting rot within bounds that vary with the tree species. Furthermore, he has shown that wound dressings are only of value for cosmetic purposes and may, in fact, delay healing and promote attack by bacteria and fungi that cause decay. Smith (Ohio State University, Horticulture) and others have shown that topical application of nitrogen after first hard frosts optimizes tree growth most efficiently. Sydnor (Ohio State University, Horticulture) and others are fine-tuning rating and analysis of shade trees in shade tree evaluation plots. Clark (University of Washington, Horticulture), Whitcomb (Oklahoma State University, Horticulture), and others have shown that native backfill and planting without pruning enhance tree establishment and survival. These developments indicate to me that our discipline is changing.

However, in my opinion many of you are dealing with the insect control part of your work as if you are a pest control operator (PCO). If that is your business, then we should expect that you are not only a certified applicator, but that you achieve and maintain competence as a PCO by reading insect control information provided annually by the Cooperative Extension Service in your state or a neighboring state and by attending educational sessions that include state-of-the-art pest control recommendations. Highly competent PCO's are a valuable resource to the discipline of arboriculture. In my opinion, they and their activities have dominated this organization since the 1950's.

Most of the research done with insects that attack trees and shrubs during the past 25 years has dealt with insecticidal control. You're familiar with the so-called "Big Bugs" programs: gypsy moth, elm bark beetles, southern pine beetle, and spruce budworm. This work has resulted in safe and effective chemical control recommendations for nearly all pests that attack and damage woody landscape plants.

Pest control operators are not necessarily arborists, one who practices scientific cultivation of trees and shrubs. And, all arborists are not PCO's. Arborists who address pest control solely in terms of pesticidal sprays are failing to take advantage of horticultural tactics that enhance the beauty and vigor of their clients' trees, and minimize susceptibility to pest attack and damage.

Horizons in Arboriculture

We can depend upon a diminishing availability of conventional insecticides in the future for use in densely populated areas including urban forests and parks. Costs associated with pesticide development have increased dramatically. There is little profit incentive for an agricultural chemical company to develop a pesticide for our limited market, especially when the public and the U.S. Environmental Protection Agency are hesitant to permit use of even relatively non-toxic substances like Sevin and malathion in the urban forest.

Products developed for use on agricultural crops will be adapted for use against pests of woody plants. And, insecticides will continue to be a valuable tactic in tree management strategies. However, in the future, spot spraying to control only the segment of an insect population causing damage or expected to cause damage if it is not controlled may be emphasized to manage both pest populations and pesticides more efficiently. Prescriptions for killing only 60-80 percent of a pest population may become popular, if we know that the residual pest population will be stabilized at a non-economic level by a reservoir of natural enemies, either introduced or augmented. This tactic is now in use in the management of some orchard crops.

Insect sex pheromones can be used to detect presence of a pest species, define its local distribution, and time application of direct control measures. You may be familiar with this strategy for dealing with gypsy moth, bark beetles, and clearwing moth borers. This is rather new technology that has not yet become commonplace in arboriculture. But, I believe pheromones will become a standard tactic in pest management strategies in the future. They may even be used as direct control measures by mass-

trapping male insects before they can inseminate females or by confusing male moths so they are unable to locate females.

Optimization of pesticide usage in the urban forest is essential to improve pest control, reduce costs associated with tree maintenance, and reduce pesticide exposure/risk to humans and other non-target organisms. There is a sound body of scientific literature to help us accomplish these objectives. But, I believe a move toward practical arboriculture of the 1930's will be an even more significant approach to improving professionalism of our discipline and enhancing tree health, beauty, and longevity.

Has the time arrived for arborists to implement Tree Health Care as a practical approach to managing the urban forest? I first addressed this subject at the ISA meeting in Atlanta in 1980, with some trepidation but was gratified at the response to my remarks, both immediately after the presentation and after its publication. In fact, there was enough honest interest in the approach that I have done some consulting to help arborists begin to think in terms of tree health care for their customers as a way to minimize the need for conventional insecticides.

This approach is not a new concept. During the literature review for this paper I found that other authors were championing the tree health care or preventative medicine approach to minimizing pest problems in the 1920's (Greeves-Carpenter 1928). Others explained the trials and tribulations of city life for trees in America much earlier.

Troubles of Trees in Cities

Taken from the woods where the soil is rich, mulched with decaying leaves accumulations of many years, shaded from scorching sun by the foliage of its fellows, its roots at all times finding abundant moisture: its foliage protected from insect pests by numerous birds: the storms of winter broken of their power by the surrounding forest: and thence removed and planted in the city where all its environments are the reverse of what they were in the forest, the city tree has a difficult task to maintain an existence.

Its roots mutilated in removal: carelessly planted in hard ground, insufficiently watered and nourished, exposed to the rays of torrid sun: and to the strongest winds of all seasons: its leaves smothered with smoke and dust: air and moisture denied by street and sidewalk pavements: its bark knocked off by vehicle hubs and gnawed by respectable citizens' horses: foliage eaten by insects, sap sucked up by aphids, trunk riddled by borers: branches mutilated by telegraph linemen: roots destroyed by pavement contractors and sewer excavations: the tree in the city indeed has a strenuous existence, and it is no wonder that by far the greater majority fail to grow. The ability of trees to overcome discouragement, and to grow under very adverse conditions is remarkable. (Anonymous 1907b).

So, we should wonder why trees do as well as they do in cities and be thankful. But, we should not wonder what needs to be done to improve health of the urban forest. We've known all along that trees require certain basics, including soil, drainage, water, sunlight, and nutrients. But, the profession of arboriculture drifted away from scientific tree care as cheap and effective insecticides and fungicides became available for dealing with opportunistic insects and diseases that exploit weakened trees.

Let's, as arborists, become plantsmen once again, scientific gardeners, who convince clients, and perhaps even landscape architects, that some kinds of trees should simply not be planted on some sites. And, let's convince ourselves and others that annual tree health care is cost effective in terms of trees and people. When new propositions are presented, a certain amount of education and training are required before change can occur. Perhaps the tree health care approach to reduce pest problems and maintenance costs is this kind of proposition, since current generations of arborists and clients are conditioned to use remedial measures to deal with pest problems, rather than managing tree health much as physicians help us practice preventive medicine.

I must tell you that we have not yet developed a sound body of scientific evidence to support claims that healthy trees suffer less from depredations by specific pests. But, clinical observations indicate that healthy trees are more beautiful and live longer than stressed ones and that cultural tactics, including proper pruning, watering, and fertilizing promote tree vigor. Investigations are

underway or planned by researchers to measure the influence of tree vigor on insect pest populations and determine how cultural manipulation changes insect host-tree relationships.

I hope the recent interest in nature and coincident growth in urban forestry have created an environment conducive to significant and long-term governmental support for this kind of research. I also recommend that institutional researchers and arborists begin planning more research together, as a team, to take advantage of the field staff that is both familiar with tree problems and in a position to apply treatments and collect data to measure their impact. By working together in this way, we can make the art and science of arboriculture more responsive to the needs of trees and people.

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ABSTRACT

Hoy, M.A. 1982. **The gypsy moth — here again.** California Agriculture 36(7): 4-6.

During 1981, 41 male gypsy moths were trapped in Santa Barbara County. Lesser numbers were trapped in other southern and northern California counties — Los Angeles (3 months), Marlin (7), San Diego (3), Santa Cruz (2), and Ventura (2). Capture of male moths in traps does not prove that the gypsy moth has become established; those found may have developed from eggs or pupae brought into the state on vehicles and camping equipment from infested areas in the eastern United States. However, intensive surveys in Santa Barbara during the fall and winter revealed four egg masses, indicating that a breeding population of the gypsy moth exists there. Surveys for egg masses at the other locations have been negative to date, so it is unclear if those trap catches indicate establishment. The gypsy moth, *Lymantria dispar,* is not new to California. Over 400 egg masses were found in Santa Clara County in 1976, and the California Department of Food and Agriculture mounted an apparently successful eradication program against that infestation using two aerial applicatons of the insect growth regulator diflubenzuron (Dimilin). The impact the gypsy moth might have had upon California's forest and shade trees, if not eradicated from Santa Barbara or elsewhere in the state, can't be predicted precisely, because our climate and vegetation are different from those in the northeastern United States, where this pest has occurred for over a century. However, the gypsy moth is likely to be a serious pest in California.