THE NEED FOR ALTERNATIVES TO SPRAYING: CALIFORNIA PERSPECTIVE[1]

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Basic application equipment used for pest control on ornamental plants has changed very little since the hydraulic sprayer was developed over 50 years ago. There have been variations on spray equipment in the intervening years, such as low volume air carrier units, refinements in pumps and nozzles, improved chemical formulations, etc., but basically we are still directing volumes of pesticides to vegetation of varying heights by inefficient means. Inefficiency, in this context, refers to the fact that much of the pesticide directed toward the target vegetation is not actually delivered effectively to the target and is lost through drift and runoff. Inefficiency tends to increase as target vegetation increases in height, for obvious reasons.

If California attitudes are any indication of the future of pest control on ornamentals by spraying, there are serious problems ahead. Spraying, unfortunately, is accorded about the same status as nuclear power. What the public reads in the popular press about chemical pest control is overwhelmingly negative, and public pressure against the practice of spraying shade trees is growing. Given the inefficiency and growing public resistance to spraying, what are some alternatives?

Trunk Implantation with Systemic Insecticides

The concept of introducing substances toxic to insects into the vascular system of trees, and allowing normal tree processes to carry these substances to the site of insect feeding, has had a long experimental history. Its practical history has been much more brief. Implantation allows tree treatment during weather unsuitable for spraying; negates the need to move parked cars or post streets, as may be required before spraying; is extremely economical in terms of insecticide needs; and probably spares the lives of beneficial insects on trees, for residues are confined to internal vegetation parts. Its most attractive feature, however, is complete freedom from drift and runoff. Limitations of implantation include the inability of some tree species to accept presently-available insecticide formulations within a reasonable length of time after introducing them, essentially requiring such trees to be declared unimplantable; inability of insecticides to reach certain sites of insect feeding; plant configuration characteristics such that implantation is not physically possible or practical; and the incompletely resolved question of the long term effects of trunk wounding caused by implantation, particularly if done repeatedly.

Experiences with trunk implantation in California since the mid 1960s have been summarized by Koehler and Campbell (1968) and Koehler (1979). These have resulted in the recognition that present implantation technology is not likely to accommodate more than a small fraction of the urban vegetation insect problems which require control. The need exists for pressure-operated implanting equipment which can shorten treatment time, and which hopefully can lessen acute and chronic injury resulting from implantation wounds. Such equipment must be a closed system, for again, if California's posture and attitude toward pest control portend developments elsewhere, equipment which exposes the operator or the public to hazardous materials is not likely to gain acceptance.

Pest-resistant Ornamentals

For many years agriculture has had available limited numbers of crop varieties, developed through plant breeding, which are resistant to specified insects and plant diseases. Resistant crop varieties have been well received by growers, for their use negates or at least reduces the need for plant protection by spraying or other artificial means. The ornamentals industries have

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not directly participated in, or enjoyed the benefits of, breeding efforts designed to develop insect or disease-resistant plants. Yet through the relatively simple process of testing and selection, pest resistant ornamentals could become widely available.

One characteristic of urban ornamental vegetation makes this approach extremely attractive and practical, and that is the wide variety of vegetation which is available and acceptable as ornamental material. When particular species or cultivars of plants are recognized as troublesome because of their high pest control requirements, there are others which can be grown which require much less pest control. This concept of selecting for growing those shade trees which local experience had shown to be low-maintenance trees was noted over 70 years ago by Felt (1905).

Initial efforts to identify pest-resistant ornamentals in California were initiated by Munro (1963), who evaluated arboretum plantings of ceanothus in Southern California for susceptibility to the ceanothus stem gall moth, *Periploca ceanothiella* (Cosens). This insect forms galls on the stems of its host, reducing flower cluster size and sometimes killing stems. Of 40 species and cultivars evaluated, over half showed no occurrence of the insect. Only six were noted as having moderate or heavy occurrence. Munro (1965) also evaluated 112 species of acacia and 6 species of albizzia for susceptibility to the acacia psyllid, *Psylla uncatoides* (Ferris and Klyver), an insect which causes chlorosis and dieback of terminals of host plants. As in the case of ceanothus, the vast majority of tested plants supported no, or very low numbers of, acacia psyllids.

The writer has evaluated 38 species of acacia for resistance to the acacia psyllid under northern California conditions. The results in general support the earlier findings of Munro, but suggest that minor regional differences in psyllid susceptibility may exist. Nineteen species of Cupressaceae have also been screened for resistance to the cypress tip moth, *Argyresthia cupressella* Walsingham, an insect which causes the browning of susceptible plants by the foliage-mining activities of the larvae. As before, a relatively few plant species were found highly susceptible to the tip moth, while the majority were highly resistant or immune to attack.

Identifying and using pest-resistant ornamentals are not without problems and shortcomings. Weidhaas (1976) documents several of these. For example, he notes that individual plants may escape insect infestation, while neighboring plants of the same species may be devastated, as a result of asynchrony between insects and particular plants. Or, the availability of preferred host plants may lead to those less favored being declared resistant, whereas in the absence of preferred hosts those less favored might be heavily infested. In both these instances, a serious mistake might be made by identifying these "escapes" as resistant. He further notes that truly resistant ornamentals which might be identified and grown today run the risk of infestation by new pests which invade the growing area at some future time.

Separately or collectively, trunk implantation and the use of pest-resistant urban vegetation will not displace spraying. Yet the need to develop and expand all alternatives to spraying is most important. Treatment of urban vegetation, as we now do it, is a practice which is becoming out-of-step with societal attitudes toward pest control in populated areas.

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