THE NATURE OF RESISTANCE TO INSECTS

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Resistance of trees to insects may be broadly divided into two general categories: (1) resistance to attack, and (2) resistance to injury. Resistance to either attack or injury may be either genetic or environmental, and sometimes it may be difficult to determine which of the two is chiefly responsible for producing an observed condition of resistance. For example, resistance to attack by Dendroctonus beetles on ponderosa pine seems to be a function of age and vigor, and trees may be grouped into classes, as formulated by Keen, that will have different degrees of susceptibility to attack. Almost surely the vigor classes are a reflection of both site conditions and the inherited qualities that permit certain individual trees to utilize the site more efficiently than others, Thus, in testing the resistance of trees to the attack of beetles, all of the complex of factors that are combined in site must be equalized in some way.

Sometimes resistance is the result of observable characteristics of individual trees that are not greatly influenced by site conditions. To illustrate, resistance to injury by Dendroctonus beetles is the result of the ability of individual trees to produce a heavy flow of resin at points of beetle attack. Such trees are capable of "pitching out" the beetles.

Since the ability to produce resin is apparently related to the number of resin ducts present in the outer annual ring, the relative ability of the trees in a series to overcome beetle attack might easily be determined by direct examination of the wood.

Similarly, individual hard pine trees exhibit the ability to overcome the attack of the reproduction weevil, an insect that feeds on the phloem of young pines in the West Coast states. The resistance is the result of a copious flow of resin, In this instance, a tremendous increase in the number of resin ducts occurs in the wood laid down during the season of attack. A hybrid of Jeffrey and Coulter pines produced at Placerville is especially resistant to this insect, but individual trees of the various species of hard pines also show resistance, thus affording opportunities for selection.

Pines resistant to injury by the reproduction weevil also possess another physiological characteristic that is useful in overcoming an attack; that is the ability to surround and wall off areas of phloem which are injured with cork cells.

If similar characteristics were sought we might find individual pines that would be relatively resistant to the white pine weevil and other insects that attack the phloem of resinous species.

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Visible characteristics other than those mentioned may cause trees to be more or less resistant to certain insects. For example, aspens vary considerably in the character of the bark surface, and insects show a distinct preference for certain types of bark. The poplar borer prefers very smooth bark, and individual clones with relatively rough bark at an early age appear to be almost immune from the attack of this serious enemy of aspen.

In almost every insect infestation, individual trees exhibit more or less resistance. Little attention has been given to the detailed study of such trees to determine the causes of resistance. It seems likely that such studies would disclose some discernible characteristics that could be used to distinguish resistant trees.

Very often, however, resistant trees show no easily distinguishable differences from the susceptible individuals. For example, spruce trees resistant to the spruce gall aphid thus far have shown no recognizable difference from their susceptible neighbors. Possibly the resistant individuals have in their tissue some chemical substance repellent or toxic to the insects or lack some attracting substance.

Reportedly, the nun moth in Europe refuses to feed upon certain individual trees in the forest, but when branches from these trees are kept in water for a time they lose their repellent quality. Presumably some volatile substance, perhaps an oleoresin, is responsible for this.

Too little is known about the causes of resistance and some most promising opportunities for research lie in this field.