PHONY PEACH DISEASE

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Phony peach disease (PPD) is caused by a fastidious, xylem-limited bacterium, *Xylella fastidiosa*. Isolates of this same bacterium cause plum leaf scald and other diseases of woody plants, such as Pierce's disease of grapes, citrus variegated chlorosis, and leaf scorch of almond, coffee, elm, oak, oleander, and sycamore. PPD occurs from North Carolina to Texas, wherever the average annual minimum temperature is warmer than 13°F. PPD is spread by leafhoppers, small wedge-shaped insects that may be quite abundant in peaches. The pest status of leafhoppers in peach is solely attributable to vectoring or spreading PPD. PPD is commercially important in Georgia south of a line from LaGrange to Augusta. In south Georgia, PPD is very often the major factor that limits peach orchard life. Major epidemics of PPD occurred in Georgia in 1929, 1951, and 1976. Another epidemic can be expected whenever orchard conditions are favorable for the spread of the disease.

SYMPTOMS

Trees with symptoms of PPD were first noticed in Georgia around 1890. Starting in early July, phony trees appear more compact, leafier, and darker green than normal trees because of shortened internodes (Figure 1). Fruit size, quality, and number are drastically reduced. Fruit may be more highly colored and ripen a few days earlier than normal. PPD-infected peach trees bloom several days earlier than normal trees and hold their leaves later in the fall. Peach leaves, in contrast to plum leaves, are not scorched or scalded. Trees that develop PPD symptoms before bearing age never become productive.

Figure 1. Symptoms of phony peach disease include greener foliage and shortened internodes on stems.

DISEASE DEVELOPMENT

X. fastidiosa, the PPD organism, multiplies and spreads slowly up and down the xylem of the tree from the site of infection. Symptoms develop 18 months or more after infection. Symptoms may develop in one scaffold limb or over the entire tree at the same time. An extremely dry summer seems to delay the development of symptoms for at least a year. PPD does not kill the tree, but may make it susceptible to other diseases.

X. fastidiosa is readily transmitted by root grafts. The bacteria are plentiful in roots of infected peach trees and in roots and stems of infected plum trees. Grafting experiments and microscopic examination of the xylem indicate that few *X. fastidiosa* are present in peach stems during much of the year. Colonization by high populations of *X. fastidiosa* in vascular tissue restricts water movement in the xylem, but the true biochemical and biophysical mechanisms involved in PPD symptom manifestation remain unknown.

INSECT VECTORS

Figure 2. One of the major vectors of phony peach disease in the Southeast, the glassy-winged sharpshooter (*Homalodisca coagulata*), also transmits Pierce's disease of grapes. Image by Jeff Brushwein.

Figure 3. Leafhopper vectors of *Xylella fastidiosa* have enlarged heads that house the musculature necessary to penetrate and feed against the negative pressure gradient of the xylem tissue.

PPD is spread (vectored) by leafhoppers, insects that are commonly called sharpshooters. The major insect vector in the coastal plain of the southeastern United States is probably *Homalodisca coagulata*, the glassy-winged sharpshooter (Figure 2), but any xylem-feeding insect must be considered a potential vector of PPD and related diseases. *H. insolita*, *Oncometopia* spp., *Graphocephala* spp., and *Draeculacephala* spp. leafhoppers are also commonly found in association with the host plants and pathogen. Leafhoppers can become infectious after feeding on a diseased tree for a short period of time (Figure 3). Once infected, adult leafhoppers apparently remain infectious until death. *H. coagulata* is eight times more abundant in south Georgia (Brooks County area) than in middle Georgia (Ft. Valley area). *H. coagulata* reaches its peak abundance in peaches later on the fall line than in the lower coastal plain. *H. coagulata* numbers peak in the fall in middle Georgia, and in June to July in south Georgia and north Florida (Figure 4). Orchards with poor weed control and greater plant diversity will have higher numbers of leafhoppers. Healthy peach is usually not a favorite host plant of most leafhopper vectors, and trees displaying PPD symptoms will not support *H. coagulata*. Other plant species such as crapemyrtle, *Lagerstroemia indica*, native and domesticated plum, grape, sumac, *Rhus* sp., *Baccharis halimifolia*, and many other woody and herbaceous weeds are used frequently as hosts by the vectors. Leafhoppers feed and oviposit on an extremely wide range of plant species, but the adults (Figure 5) and nymphs (Figure 6) have different nutritional requirements. The number of host plant species capable of supporting nymph development of *H. coagulata* is much lower than the number of acceptable adult feeding hosts. Overwintering adults of *H. coagulata* do not hibernate, but their winter behavior is not well understood. In winter, they feed mostly on oak and perhaps other hosts and fly during warm spells. Leafhoppers infected with *X. fastidiosa* have been collected in almost every month of the year in south Georgia.

Figure 4. Leafhopper vector populations may be monitored using yellow sticky traps.

Figure 5. Leafhopper vectors feed on many host plant species from trees to grasses and are well camouflaged with the plant for protection.

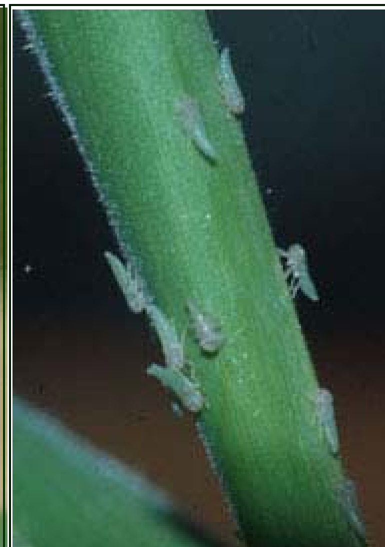

Figure 6. Leafhopper vector nymphs feed on the leaves of host plants.

HOST PLANTS

The full range of host plants for the *X. fastidiosa* isolate that causes PPD is not known. *X. fastidiosa* has a diverse host range encompassing over 30 families of monocotyledonous and dicotyledonous plants. Only recently have laboratory tools been developed to detect and identify different isolates of *X. fastidiosa*. Wild and domestic plums are known carriers, but many plums show few, if any, disease symptoms (Figure 7). Wild cherry, *Prunus serotina*, may be a minor host of PPD. Goldenrod is a host of *X. fastidiosa*, and future research will probably identify additional hosts. Johnsongrass, which is a host of Pierce's disease in California, has been reported to contain *X. fastidiosa* in Georgia. However, the strain of the bacterium found in Johnsongrass was not shown to cause PPD. *X. fastidiosa* can be extracted from a large number of hosts that display no symptoms of infection. Whether these are only transient colonizations or chronic infections is unknown, but remains an important, unanswered aspect of understanding the epidemiology of PPD.

Figure 7. Symptoms of plum leaf scald caused by *Xylella fastidiosa*.

CONTROL

There is no cure for PPD or any other disease caused by *X. fastidiosa*. Control efforts are limited and focused on preventing disease spread. Satisfactory control is difficult in areas of heavy infection. In Georgia, information on orchard inspection for PPD is available from the State Department of Agriculture. Removal of diseased trees in 2- to 5-year-old peach orchards extends productive orchard life, although the underlying mechanism explaining this phenomenon remains unknown. Infected trees are readily identified by their reduced shoot growth in July and August unless trees are summer-pruned. Diseased trees should thus be identified and removed before an orchard is pruned. Avoid heavy summer-pruning, because the vigorous regrowth that often follows is especially attractive to leafhoppers. Plant new orchards as far as possible (at least 300 yards) from all existing peaches and wild cherries. Do not plant peaches near plums, and remove or kill all plums, whether wild or domestic, near any peach site before planting. Never plant a new orchard near an orchard showing PPD symptoms. This has been tried with disastrous results. Maintain weed-free tree rows with a herbicide program and closely mowed sod middles in orchards to reduce feeding and breeding plants for leafhoppers. This usually reduces leafhopper populations in the orchards, although leafhoppers are strong fliers and can easily travel long distances in search of hosts and mates. Elimination of adjacent hardwood stands, particularly oaks, and broadleaf weeds near the orchard may minimize overwintering and alternate feeding sites for the leafhoppers. Routine spraying of orchards after harvest to control leafhoppers will not eliminate disease spread and is not cost-effective. In a 3-year program from 1948 through 1950, DDT was sprayed on a 1,000 acre (100,000 trees) orchard in middle Georgia. This program was judged a failure. Similarly, plots sprayed with parathion every other week during June and July in south Georgia failed to show a consistent decrease in leafhoppers.

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