Orchard Tests Substantiate

ROLE OF PEAR PSYLLA IN PEAR

C. Q. GONZALES · W. H. GRIGGS · D. D. JENSEN · S. M. GOTAN

Field scale tests with young pear trees last year at Davis provided further evidence that the pear psylla (Psylla pyricola Foerster) plays a central role in the pear decline disease.

A TOTAL OF 133 pear trees consisting of commercial varieties on different rootstocks were subjected to pear psylla feeding tests in an orchard plot at Davis during 1962. The trees destined to be rootstocks had been planted in February 1961 and were top-grafted during 1961 and early 1962. Scions of the commercial varieties were grafted on scaffolds from 15 to 30 inches above the ground to provide more than one scion branch and graft union per tree.

Adult pear psylla, usually 50 to 100 per cage, were confined on the test trees by means of one or more organdy sleeve cages. They were allowed to feed and lay eggs for two to four weeks before being removed, leaving only the newly hatched nymphs to develop on the caged branches. An equal number of control trees were kept free of psylla and other pests by spraying with Dieldrin and Kelthane. As an added precaution, some of these control trees were enclosed in organdy sleeve cages and others in 4 by 4 by 8-foot plastic screen (Saran) cages. All of the uncaged control trees were inspected frequently and kept free of psylla and other pests by periodic sprays, except during a short period in August when adults escaped during transfer procedures. These were eliminated by additional sprays.

Serotina rootstock

Commercial pear varieties on *Pyrus serotina* (Oriental type) rootstocks have proven to be very susceptible to pear decline disease throughout the Pacific Coast. With this in mind, 33 trees including Bartlett, Winter Nelis or Hardy varieties on *serotina* rootstocks were infested with pear psylla adults on May 17. The

Both young pear trees to right were Hardy on Pyrus serotina rootstock in test plots at Davis. The healthy control tree, labeled R10-T57, was kept free of psylla feeding. The tree to right, showing collapse, was exposed to psylla feeding.

psylla (collected in an abandoned orchard near Danville, Contra Costa County) were introduced into the sleeve cages and allowed to feed and reproduce for about two months before being killed by spraying. Thirty-one similar trees were kept free of psylla as controls.

The first evidence of what appeared to be a quick decline condition was observed on July 31, when four of the infested trees began to show varying degrees of wilting. The foliage on *serotina* branch and sucker growth wilted and died before the foliage on the branches of the scion variety. On August 16, six trees that had completely collapsed, had brown lines at the graft unions. Studies of the phloem at graft unions revealed abnormalities similar to those which have been described by previous workers as characteristic of the pear decline disease. More of these trees showed poor growth and symptoms of wilting as the season progressed.

DECLINE

TABLE 1. EFFECT OF PEAR PSYLLA FEEDING IN FIELD TESTS INVOLVING COMMERCIAL PEAR VARIETIES ON PYRUS SEROTINA ROOTSTOCK, MAY 17, 1962

	Psylla-infested trees	Control trees
Total experimental trees	33*,	31
Trees that collapsed	7	0
Trees with brown line	8	0
Trees exhibiting premature reddening of foliage	25	1
Trees with definite phloem abnormalities	19**	1***
Trees positive for phloem necrosis	8**	1***

* Psylla collected in an abandoned orchard near Danville, Contra Costa County, and placed on Winter Nelis seedlings overnight before transporting to Davis.
** Only 21 trees sampled and examined.
*** Only 19 trees sampled and examined.

Plastic screen cages 4 x 4 x 8 feet high, shown in photo to left, and on cover, were used to exclude psylla from controls in studies with young field pear trees to determine relation of psylla to pear decline.

By October 31, twenty-five of the 26 infested trees still alive showed marked reddening of the foliage compared to only one of the 31 control trees as shown in Table 1.

Bark samples for brown line and phloem studies were taken from the graft unions of all the trees in this test. Of the 40 samples processed to date, all of those taken from psylla-infested trees showed phloem abnormalities similar to pear decline and eight of them had brown line. None of the control trees developed a brown line at the graft union. However, one control tree, which developed red foliage, had phloem abnormalities similar to those found in pear-decline trees. All of the other control trees were still green and healthy on October 31.

Late-season psylla feeding

The effects of a psylla-free period in the early part of the season, followed by late-season psylla feeding, were tested on Bartlett and Winter Nelis grafted to *Pyrus serotina* rootstocks. Ten test trees (five Bartlett and five Winter Nelis) were infested with pear psylla on July 4. After eggs had been laid and the adults removed, populations were allowed to develop through October. Ten similar trees, enclosed with Saran screen cages from June 5, were used as controls. One of the infested trees collapsed about the first week in October and a bark sample from the graft union had phloem abnormalities similar to those of trees suffering from the pear decline disease. On October 19, seven of the ten test trees had developed some red foliage, but the caged controls showed no indication of stress or reddening of foliage.

In another test with trees on *Pyrus serotina* rootstocks, the adult psylla were collected from trees showing severe symptoms of slow decline in an orchard near Camino, El Dorado County. From 75 to 100 of these adults were introduced into sleeve cages on each of 16 trees on July 24. Sixteen trees enclosed in Saran screen cages were used as controls. By October 25, two of the infested trees had collapsed and bark samples from both were positive for phloem necrosis. Reddening of the foliage was marked on 13 of the 16 test trees, whereas none of the control trees exhibited any evidence of red foliage. The controls were still vigorous and green November 8 when four more infested trees were in early stages of collapse.

On June 6, pear psylla were caged on 26 trees of the rootstocks shown in Table 2. Additional trees were infested during July and August. By October 25, two of the infested trees had collapsed and 22 of a total of 58 test trees had developed red foliage. All of the trees that developed red foliage or collapsed were on Oriental rootstocks. These results substantiated earlier reports that trees on Oriental rootstocks were susceptible to the harmful effects of psylla feeding. Trees on *Pyrus communis* rootstocks were more resistant, and in these studies, the only apparent harmful effect from one season's feeding was reduced shoot growth on infested branches.

To determine if psylla feeding on one scion branch would affect foliage on

TABLE 2. THE EFFECT OF PEAR PSYLLA FEEDING ON WINTER NELIS AND BARTLETT TREES ON DIFFERENT ROOTSTOCKS IN THE FIELD, DAVIS, 1962

Rootstock	Number of trees	Trees with red foliage on Oct. 25*	Number that collapsed
Pyrus serotina (Oriental	17	11	2**
P. ussuriensis (Oriental)	9	6	0
P. calleryana (Oriental)	5	5	0
P. communis			
Variolosa rooted cuttings	8	0	0
Old Home rooted cuttings	7	0	0
Bartlett seedlings	12	0	0

* An equal number of trees designated as controls were also examined but none developed red foliage.
** Both trees that collapsed were diagnosed as positive for phloem necrosis. A single control (P. serotina) was also sampled for phloem necrosis and diagnosed negative. For comparison, one control and one infested tree on Old Home roots were sampled and both found to have normal phloem.

branches having separate graft unions, about half of the 133 test trees received psylla on only one scion branch while the remainder received psylla on all scions. The results thus far indicate that adverse effects on susceptible trees occur at about the same rate and extent regardless of the number of grafts upon which psylla are feeding.

These studies indicate that the pear psylla introduced some factor into the young pear trees on *Pyrus serotina* rootstocks that adversely affected the entire tree. The symptoms produced included retarded growth, reddening of the foliage, phloem necrosis and brown line at the graft union, wilting and collapse. A toxin could account for the effects in trees experimentally infested with pear psylla although this does not exclude the possibility of a virus being involved. However, one control tree developed decline symptoms and one other tree (not treated as a control, but apparently free of psylla feeding) collapsed. In these two cases, the disease must have been initiated by the feeding of only one or a few adults. The similarity of pear decline symptoms in commercial orchard trees and those induced by pear psylla feeding on young trees in these field plots substantiates greenhouse evidence by workers in Washington and California in showing an intimate relationships between pear psylla and decline.

C. Q. Gonzales is Assistant Research Entomologist in the Experiment Station, University of California, Berkeley; W. H. Griggs is Professor and Pomologist in the Experiment Station, U.C., Davis; D. D. Jensen is Professor and Entomologist in the Experiment Station, U.C., Berkeley; and S. M. Gotan is Plant Pathologist, California Department of Agriculture, Sacramento.

P. H. WESTIGARD · H. F. MADSEN

PEAR PSYLLA
in Abandoned Orchards

Abandoned orchards studied during the 1962 season showed substantial variation in their ability to support heavy populations of the pear psylla. There were indications that trees abandoned for several years may have arrived at a point where biological control factors will control the densities of this pest. The removal of single trees or of entire orchards that had been in this neglected state for several years is, therefore, of questionable value. However, in those orchards left unsprayed for only one or two years, psylla populations did reach high densities. Under these high summer population levels, several psylla adults were captured on traps placed considerable distances from the orchard. This greatly increases the danger from abandoned orchards in the adequate control of this pest in commercial plantings.

EL DORADO COUNTY, in the Sierra foothills, has been one of the areas in California most ravaged by pear decline. As the orchards became commercially unprofitable, they were abandoned in many cases. While it is likely that most of the trees in these orchards will eventually die, they represent potential reservoir areas, while alive, for the buildup of the pear psylla—and a threat to the remaining commercial plantings. To evaluate this problem the University of California, in cooperation with the California State Department of Agriculture, re-

Graph 1—Pear psylla populations in abandoned orchard at Placerville, 1962.