PEAR PSYLLA PROVEN CARRIER OF PEAR DECLINE VIRUS

Recent studies provide very strong evidence that quick decline disease of pears is caused by a virus transmitted by the pear psylla rather than by an insect toxin alone.

D. D. JENSEN • W. H. GRIGGS • C. Q. GONZALES
HENRY SCHNEIDER

PEAR DECLINE DISEASE has been a serious problem in Italy since 1944, in the Pacific Northwest since 1948, and in California since 1959. Despite the scope and destructive nature of the disease, involving well over a million trees on susceptible (Oriental type) rootstocks in California alone, the ultimate cause has remained obscure. Experiments in the state of Washington implicated the pear psylla (*Psylla pyricola* Foerster), as causing the disease by introducing a nonviral insect toxin into the pear trees while feeding. Research in California also indicated that the pear psylla played a key role in the problem, but some of the results could be better attributed to a psylla-transmitted virus than psylla toxin alone.

The 1963 entomological investigations carried out in California on the relation of pear psylla to pear decline, now provide very strong evidence that quick decline disease of pears is due to a virus transmitted by the pear psylla rather than by an insect toxin alone. The transmission experiments reported here were carried out in orchard plots at Davis.

The test trees were commercial varieties, mostly Bartlett, on *Pyrus serotina*, Rehder (Oriental type) seedling rootstocks. The majority of the trees were growing in a new experimental plot planted in January 1963. The others were larger trees, planted in 1961, and enclosed since early 1962 in 4 × 4 × 8-foot plastic screen (Saran) cages. Part of the test trees in both plots were made available for six to eight days for feeding by adult psylla that had been transferred from slow-decline pear trees for virus transmission experiments. Another group of trees was exposed to feeding by heavy populations of apparently virus-free adults and nymphs for three months. A third group of similar trees was held as an untreated check plot.

California pear psylla, apparently free of virus, were obtained by allowing greenhouse-colony adults to lay eggs on small pear trees raised from seed in the greenhouse. These unhatched eggs were dissected from the leaves and hatched in a petri dish. The young nymphs were transferred to small pear seedlings where they matured and reproduced. A separate stock, developed in the greenhouse at Berkeley but derived from overwintering adults sent from Geneva, New York, is also apparently free of pear decline virus.

During July, 1963, 100 adult psylla that had been reared on slow decline pear trees in El Dorado County or at Danville, California, were caged on a single branch of each of 42 healthy test trees where they were allowed to feed for only six to eight days. The psylla were then killed by sprays that also destroyed the eggs that had been laid.

At the same time, each of another series of 35 trees received 75 to 100 pear psylla adults that had not previously fed on pear decline trees and were apparently free of virus. They were allowed to feed and reproduce on the test trees for three to four months. During this period, large populations of both nymphs and adults developed and ultimately defoliated most of the infested branches. A third group of 78 comparable trees was kept as a control plot and received no experimental psylla feeding. They were kept free of uncontrolled psylla feeding by either weekly inspections and an intensive spray program, or by the plastic screen cages.

Approximately two months after the test feedings began, quick decline symptoms (wilting and collapse of foliage and succulent shoots) developed in several of the trees that had been exposed to feeding for only six to eight days by adult psylla transferred from slow decline trees. Within three months, 12 out of 24 trees in one series collapsed with quick decline. In contrast, only one of 35 trees wilted that were fed on by large populations of apparently virus-free nymphs and adults over a three-month period. All 78 untreated control trees remained healthy.

Some of the trees, fed on by adult psylla in the virus series, also developed chlorosis of the leaves on the subapical portion of the new succulent shoots. Some of these trees subsequently collapsed, while others retained their foliage throughout the season. This symptom was inconspicuous at first but became progressively more noticeable as the season advanced. These trees also developed conspicuous red foliage earlier in the fall than did either the untreated controls or trees receiving only psylla toxin from the virus-free psylla. Most of the trees in the virus test series had red foliage October 30, whereas the psylla toxin and control trees were still green. However, by November 18, ten of the trees receiving only psylla toxin had developed some red foliage, compared with only three of the untreated controls.

On September 24, 1963, bark samples for microscopic examination were taken at the graft union of representative trees receiving the different experimental treatments. Nineteen trees receiving psylla

CALIFORNIA AGRICULTURE
Progress Reports of Agricultural Research, published monthly by the University of California Division of Agricultural Sciences.

William W. Paul ..... *Manager*
Agricultural Publications

Jerry Lester ..... *Editor*
California Agriculture

California Agriculture will be sent free upon request addressed to: Editor, *California Agriculture*, 207 University Hall, 2200 University Avenue, Berkeley, California 94720.

141

A. Bartlett pear tree on Pyrus serotina (Oriental type) rootstock remains healthy after two branches were exposed to large populations of apparently virus-free psylla for over three months. Cloth bags confine psylla to branches. Photographed October 30, 1963.

B. Bartlett pear tree on Pyrus serotina (Oriental type) rootstock remains healthy after one branch (to left) was exposed to large populations of apparently virus-free psylla for three months. Psylla were killed and cloth bag which confined them was removed October 9. Photographed October 30, 1963.

C. Bartlett pear tree on Pyrus serotina (Oriental type) rootstock showing symptoms of quick decline. One branch of the tree was fed on for only eight days in July, 1963 by adult psylla transferred from trees with slow decline. Tree collapsed two months after the test feeding began. Photo Oct. 30, 1963.

from slow decline trees were sampled. Twelve of these were diagnosed as positive for pear decline by the Schneider test, five were probable and two were indeterminable. Of eight trees sampled that had received virus-free psylla, none was positive for pear decline, but two were listed as probable and two as indeterminable. All five untreated control trees sampled were normal.

The results obtained in these experiments indicate that a psylla-transmitted virus causes the sudden wilting and collapse of pear trees and that psylla toxin—even in relatively large and continuous doses over a period of three months—does not cause quick decline in vigorously growing trees, in the absence of the virus.

These conclusions are also supported by evidence obtained from graft transmission experiments (see accompanying article) in which quick decline symptoms were produced in some trees in the absence of pear psylla, by budding from pear decline sources.

These experiments should not be interpreted to mean that pear psylla, in the absence of virus, cannot seriously damage pear trees. Prolonged heavy infestations are injurious even to trees on French rootstocks. Moreover, the data reported here show that psylla toxin may have an effect on the development of premature red foliage in some of the trees receiving psylla feeding over a long period of time. The present findings do indicate, however, that a psylla-transmitted virus is responsible for most of the tree losses that have been associated with pear decline disease.

D. D. Jensen is Professor and Entomologist in the Experiment Station, University of California, Berkeley; W. H. Griggs is Professor and Pomologist in the Experiment Station, University of California, Davis; C. Q. Gonzales, formerly Assistant Research Entomologist in the Experiment Station, University of California, Berkeley, now Assistant Professor of Biology, St. Michael's College, Santa Fe, New Mexico; and Henry Schneider is Plant Pathologist in the Experiment Station, University of California, Riverside.