# *Distribution of*

# PEAR DECLINE VIRUS

# *in California orchards*

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Pear decline virus is present in both healthy and weak appearing pear trees on all common rootstocks in commercial orchards in California. Vigorous condition of any tree probably results from true tolerance of the rootstock to the disease rather than the chance that it may have escaped infection. Research suggests a possible relationship between pear leaf curl and pear decline.

THE ESTABLISHMENT of young pear orchards has become increasingly difficult in several commercial growing areas of California during the last 10 years. Young orchards are often irregular in vigor with many weak and nonproductive trees. New pear plantings and replants in old orchards have generally been grown on *Pyrus communis* rootstock (seedlings from Bartlett, Winter Nelis, and other domestic varieties) which were considered tolerant to pear decline. Within the first four to seven years, however, a portion of these trees have shown reduced vigor and many show symptoms of pear decline (red and orange leaf coloration in the fall, reduced growth and occasionally phloem necrosis or brown line at the bud union).

A project was started in 1966 to determine whether the pear decline virus is widespread regardless of rootstocks in commercial orchards, and if the difference in the vigor of individual trees with the so-called tolerant rootstocks could be attributed to the presence or absence of the decline virus. Eleven plots were established in five major pear-growing districts. Both old and young orchard trees growing with a wide range of rootstock were used. These included trees growing on Domestic *Pyrus communis*, Oriental, Quince and Old French rootstocks. At each plot, a portion of the orchard was graded for vigor, and trees were rated as vigorous or weak.

In late April and May 1966, small pear trees growing in containers were brought to each orchard and approach-grafted to

TABLE 1. ORCHARD DISTRIBUTION OF PEAR DECLINE TEST INDICATOR TREES

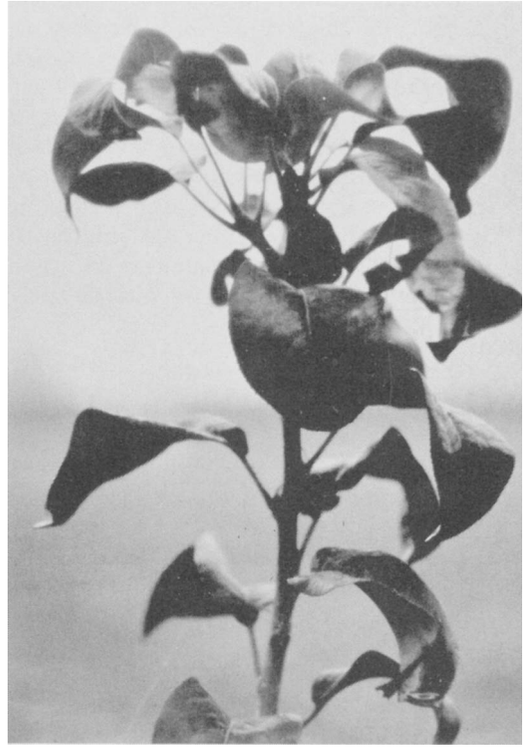
| County | Number of orchards | Grafted on weak trees | Grafted on vigorous trees | Ungrafted check trees |
|---|---|---|---|---|
| El Dorado | 3 | 26 | 28 | 13 |
| Lake | 1 | 8 | 8 | 4 |
| Mendocino | 2 | 16 | 16 | 8 |
| Sacramento | 3 | 24 | 24 | 12 |
| Santa Clara | 2 | 12 | 13 | 5 |
| | | 86 | 89 | 42 |

TABLE 2. INCIDENCE OF PEAR DECLINE ON INDICATOR TREES 30 MONTHS AFTER GRAFTING TO WEAK AND VIGOROUS ORCHARD TREES ON VARIOUS ROOTSTOCKS

| Orchard trees category and rootstock | Indicator trees showing collapse or brown line at graft union | | |
|---|---|---|---|
| WEAK TREES ON: | No. * | | % |
| Domestic French/(P. communis) | 11/32 | | 34 |
| Old French/(P. communis) | 3/8 | | 38 |
| Oriental/(P. serotina, P. ussuriensis) | 6/25 | | 24 |
| Quince/(Cydonia oblonga) | 9/20 | | 45 |
| Total | 29/85 | Mean | 34 |
| VIGOROUS TREES ON: | | | |
| Domestic French | 14/32 | | 44 |
| Old French | 2/8 | | 25 |
| Oriental | 3/26 | | 12 |
| Quince | 12/20 | | 60 |
| Total | 31/86 | Mean | 36 |

* Disease fraction: number of indicator trees with pear decline symptoms over total trees grafted.

Pear shoot from an indicator tree showing symptoms of leaf curl.



Two grafted indicator trees above showing pear decline collapse and two ungrafted check trees showing healthy condition as a result of decline-tolerant rootstock.

equal numbers of weak and vigorous orchard trees in an attempt to transmit the decline virus, if present. A few small ungrafted indicator trees were also placed in each orchard as checks. A total of 217 trees were placed in the eleven plots (table 1).

The indicator trees consisted of a Bartlett selection free of known viruses, grafted on seedlings of one of two Oriental pear species (*P. serotina* or *P. usuriensis*). Both of these scion-root combinations are susceptible to pear decline. The small trees had been grown under screens to protect them from the pear psylla (*Psylla pyricola*), the insect vector of the pear decline virus.

## Indicator protection

As the small trees were placed in each orchard, they received an application of insecticide, and then all trees were promptly covered with an organdy sleeve cage to protect them from exposure to psylla while in the field. Both the grafted and ungrafted indicator trees remained in the various orchards for approximately two and one-half months. At the end of this period, the grafts were severed, leaving a small portion of the orchard tree attached to the indicator tree. The small trees were then returned to a screenhouse at Davis for observation.

After 30 months, 18 of 86 trees (21 per cent) that had been attached to vigorous orchard trees had collapsed; 13 of 85 trees (15 per cent) that had been attached to weak orchard trees had collapsed, and none of the 39 ungrafted check trees showed symptoms. Tree collapse was diagnosed as pear decline.

Observations made during the following two years revealed that although very few indicator trees continued to collapse, many trees were in a state of slow decline and displayed a brown line at the bud union—a symptom typically found in pear decline. Considering both collapse and brown line as evidence of transmission, there was 34 per cent transmission from weak orchard trees at the end of the project and 36 per cent transmission from vigorous trees. One ungrafted check tree was found with brown line at the bud union.

## Virus is present

The decline transmission from each type of rootstock appears in table 2. These results indicate that the pear decline virus is present in trees with any of the common rootstocks in the commercial pear growing areas of California. It occurs both in healthy appearing orchard trees, and in weak trees that are expressing the external decline symptoms. It would appear that many pear trees on so-called tolerant rootstock are weak due to pear decline, and that the vigorous condition of trees on similar rootstock is probably due to true tolerance of the disease rather than to the remote chance that it may have escaped infection by the vector.

In the fall of 1966, it became apparent that in addition to pear decline, pear leaf curl (a recently observed disease of pears), had also been transmitted to some of the indicator trees. The symptoms of leaf curl express themselves most vividly in the fall, with the leaves becoming thick and curled and taking on a deep purplish hue. Young trees having this disease are often smaller than those showing no symptoms. Twenty-one percent (36 trees) of the grafted indicator trees displayed curl symptoms—half of which came from weak orchard trees and half from vigorous orchard trees. Of these 36 trees, 31 (86 per cent) eventually collapsed from decline, or have shown brown line at the bud union. Of the 42 covered but ungrafted indicator trees, one tree developed curl symptoms.

Additional observations of the root systems of the indicator trees while they were being repotted in the spring of 1967 revealed a great decrease in the root system of trees that had expressed pear leaf curl symptoms the previous fall. In the fall of 1967, 15 trees with leaf curl were visually compared with symptomless trees, and in all cases were found to be practically devoid of feeder roots and to have smaller and fewer main roots. In the fall of 1968, the tops and roots of ten indicator trees in each category were washed and weighed. The trees showing curl had an average weight of 7.5 oz and the symptomless trees, an average weight of 22.1 oz. This reduction in root mass and size, the presence of brown lines on almost all curl trees, and high percentage of curl trees that subsequently died of pear decline, suggest a possible relationship between pear leaf curl and pear decline.

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