

# THE PROBABLE HOME OF PIERCE'S DISEASE VIRUS\*

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Historical records indicate that Pierce's disease virus is not indigenous to California, but that the virus was probably introduced into the State. The widespread distribution of the virus in the United States Gulf Coastal Plain area, coupled with the fact that several *Vitis* species highly tolerant to the virus are indigenous to the same area, indicate that this is the probable home of the virus. Repeated failures of bunch grape plantings in the southern United States over many years have probably been the result of Pierce's disease virus. It also seems likely that the virus may have been introduced into California in grape wood from this area.

For many years Pierce's disease virus has been known to be widely distributed in California (6, 13). The virus has been identified in the variety Thompson Seedless (*Vitis vinifera*) near Carizzo Springs, Texas (13), in Florida (4, 23, 24), at Meridian in Mississippi and at Fort Valley in Georgia (15). The disease has also been observed in seedling bunch grapes and muscadine grapes at Auburn, Alabama (15). These localities spot the disease over much of the Coastal Plain areas of the United States and in many parts of California.

Pierce's disease was first identified in southern California near Pomona and Anaheim about 1884 (6, 20), in northern California in Napa County in 1887, in Livermore in 1888 (6), in the Sacramento Valley and in the Santa Clara Valley about 1900 (21, 22). Apparently the first report of the disease in the San Joaquin Valley was about 1921 (13). During the epiphytotic of 1935-1941 the disease was found in most of the principal vineyard districts of California (13).

In California, historical records show that the Mission grape was first planted

at the time of the building of the Spanish missions at San Diego in 1769, at San Gabriel in 1771, and subsequently at other missions as they were established in more northerly areas. These were without question the first plantings of the European grape *Vitis vinifera* L. in California (20). Plantings at San Gabriel grew well, they were extensively planted and apparently were the center of distribution of the variety to other missions. During the next 100 years there were no records of widespread destruction of grapes by disease in California.

Newton B. Pierce, in his bulletin "The California Vine Disease" (20), gives a thorough and very well-documented review of the introduction of the European vine into California, and the spread, growth, and development of the grape industry prior to 1884. The principal object of this review by Pierce was to establish that the European grape was extensively planted in California before 1884, that there were many very old plantings, and specifically, that there was no record of any previous destruction of grapevines by disease such as that which occurred between 1884 and 1900.

The only statement that I have found in historical records which might appear to conflict with the evidence that Pierce's disease did not occur in California for many years prior to 1884 is in a report by Ethelbert Dowlen published in 1890 (6). He was employed by the California State Viticultural Commission to study the "Anaheim vine disease". In this report Dowlen states, "The Anaheim disease has probably existed in the State for many years past. It was noticed in Napa County in 1887 and again in Napa and Livermore in 1889 . . .". This reference to many years past appears to be an opinion, for no facts were given to substantiate it. It probably refers to a period of not more than 10 or so years because, in the summer of 1939, I talked with Mr. W. Shehon, the owner of a vineyard that had belonged to his father on Spring Mountain in Napa

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County, California, in which the disease was first identified in northern California. While in his vineyard Mr. Shehon identified the disease in some of the vines and stated that it was the "California Vine Disease" and that it had been identified in his father's place in 1887 by a man from the United States Department of Agriculture and several other people. Records show that L. F. Scribner of the United States Department of Agriculture and Pierre Viala, Professor of Viticulture at National School of Agriculture, Montpellier, France, along with others, visited the Napa Valley in 1887 and identified the disease in two localities (6, 27). Mr. Shehon further showed me the location in the vineyard where the disease first became apparent. It was in a block of vines adjacent to the Shehon mother nursery of "American" *Vitis* species that were introduced for the purpose of testing their resistance to *Phylloxera*. Mr. Shehon recalled that his father had introduced "wild grape" from nurseries in Missouri and Texas and possibly from other places. Mr. Shehon could not remember the date of the first evidence of the disease for, as he said, he was only a boy at the time. However, he agreed that it was possible that the disease could have been in the vineyard for a few years without being recognized because of *Phylloxera* damage to the vines.

Although this experience was from Mr. Shehon's memory and is now reinterpreted from my notes of the conversation, the records (6, 27) indicate that the information was essentially correct. If so, then it is probable that the virus may have been introduced into this Napa County area along with "American" *Vitis* species from which it spread to native plants and to the European grapes growing nearby.

In California, Pierce's disease virus has been recovered from a wide variety of host plants, over 80 species in about 70 genera and 27 families of dicotyledonous and monocotyledonous plants (12, 13). The virus may have been introduced into California in any one or a number of different species of plants. It is also probable that the virus may have been introduced in wild grape from the Gulf Coastal Plain

area of the United States, and that it may have been introduced a number of times in different localities. The virus spread because there were vectors present in California.

There are many records of introductions into California of named varieties of American grape species and of collections of cuttings of wild grapes from parts of Texas, Missouri, Arkansas, Florida, Nebraska and other States for testing their resistance to *Phylloxera* and their suitability as a rootstock for the European grape. Some of the largest introductions into northern California were made around 1876 and later (1, 5, 7, 16, 17, 19). However, none of these introductions can be specifically associated with the first outbreaks of Pierce's disease.

There were also many introductions of American grape varieties including the muscadines (*Vitis rotundifolia* Michaux) into southern California (3, 18, 20), but no records could be found of introductions that were directly associated with the first appearance of the disease near Anaheim and Pomona.

In the Southeastern Coastal and the Gulf Plain areas of the United States it is apparently well established that most bunch grapes do not survive for very many years after planting. Stoner (24) briefly reviewed the failure of bunch grape culture in Florida and showed degeneration of vines in the State to be caused by the Pierce's disease virus. Stoner, Stover and Parris (23) listed groupings of grape varieties that had been tested using longevity as an index of tolerance to degeneration. Stoner (24) and recently Crall and Stover (4) showed that the vectors of the virus in Florida belong to the same genera as some of those reported in California (10, 11, 14).

Hewitt, Loomis, Overcash and Parris (15) have shown that the virus is present in Meridian, Mississippi. In addition there are many early reports in the literature which record the failures of bunch grapes in many parts of the Gulf Coastal Plain area. These records attribute the failure to various causes. No attempt is made in this report to search out all such records. Only a few are mentioned to indicate the

nature of the records of the failure in establishing satisfactory grape culture in the Gulf States. A report by Earl (8) in 1896 on grape culture in Mississippi states that "a careful selection of varieties is essential as all are not equally successful." He further wrote that none of the European or *Vitis vinifera* type grapes can be recommended. "They may grow well for a time, especially if trained against a building, but they are much troubled with mildew and other diseases . . .".

The following report from Alabama is a typical case history of bunch grape failure in many parts of the South Coastal Plain area. Bondurant and Clayton (2) report that six vines each of most of the 48 varieties of bunch grapes planted in 1886 were dead by 1893. In fact, the only survivors in the vineyard were a few vines of the varieties Concord, Delaware, Ives, and Perkins, of which 100 vines each had been planted originally. Another vineyard planted in 1889 had a few surviving plants in only 17 out of 78 varieties that were originally planted. In contrast, all vines in eight varieties of *Vitis rotundifolia* planted at the same time were growing well. The death of the bunch grape plants was attributed to bunch rot.

Earl and Austin (9) in 1900 report that this root rot was one of the most serious diseases of grapes. They showed that over 75 percent of 651 vines planted in 1894 were dead by 1900, but the root rot could not be attributed to any specific organism. There were only two varieties, Herbemont (*Vitis bourquiniana* Munson) and Rulander, out of 16 varieties planted that were entirely resistant.

Root rot is one of the symptoms characteristic of Pierce's disease of grapevines in California. The tops and roots die back at about the same rate. The last part of the vine to die is usually near the crown. The fact that the root rot in Alabama could not be attributed to a fungus pathogen is a factor favoring the hypothesis that Pierce's disease was responsible for the death of the vines.

Stubbs, Burnette and Watson (25) in 1898, reporting on grape culture, stated that "over 100 varieties of grapes have been grown on the different stations.

Gradually, one by one, the number is reduced and today but few are found suited to different localities of the state".

Munson in his book on "Foundations of American Grape Culture" published in 1909 (19) recognized that few northern varieties grew successfully in the Gulf regions.

*Vitis* species reported to have resistance to Pierce's disease are *V. rupestris* (Schede) Linn. (21), *V. champini* Planchon (19), *V. coriacea* Shuttleworth (19, 23, 24), *V. simpsoni* Munson (19), and *V. rotundifolia* Michaux (13). There are probably other species such as *V. riparia* that have resistance to Pierce's disease but have not been tested.

The resistance of *V. rupestris* to Pierce's disease was noted by Pierce (21) when the disease was prevalent in the Santa Clara Valley of California. He states that some susceptible varieties such as Mataro (*V. vinifera*) are quite resistant when grafted onto the St. George (*V. rupestris*). I have also observed that selections of St. George appear to be resistant and in some cases apparently immune to the virus. The variety Grenache (*V. vinifera*) has apparent klenodusity to the disease and when grafted onto St. George rootstock the resistance appears to increase. In contrast, the variety Green Hungarian (*V. vinifera*) and many others are very susceptible when grown on their own roots and also when grown on St. George rootstocks.

Munson (19) pointed out the resistance of *V. champini* to Pierce's disease. He states on page 39 of his book, ". . . and it is one of the most resistant species against the *Phylloxera* and Anaheim disease". During my recent visit at Meridian (15), N. H. Loomis pointed out that *V. champini* grows very well without apparent symptoms of Pierce's disease, and when used as a rootstock, it also lengthens the life of the variety grafted upon it.

The Florida species *V. coriacea*, *V. simpsoni*, and perhaps others, have been shown to be resistant to Pierce's disease in Florida (23, 24). Munson (19) wrote of *V. coriacea*, "It appears to me that this species offers good material upon which to base a valuable strain of table and wine grapes for the Gulf regions where few northern

varieties succeed".

Some varieties of *V. rotundifolia* showed good resistance to Pierce's disease in California plantings. From observations made on a recent trip into the Southern States (15), it appears that seedlings of crosses between varieties of *V. rotundifolia* show varying degrees of resistance to the disease. Some plants are susceptible, nevertheless many are symptomless carriers of the virus and others may have been immune. I recovered the virus, however, from a resistant plant listed as *V. rotundifolia* under test in a planting on the campus of the University of California at Los Angeles in 1941 that did not have any symptoms of Pierce's disease. \*

The varieties Lenoir (Jaquez) and Herbeumont and their seedlings which Munson (19) considers varieties of *V. bourquiniana* Munson will grow very well in areas of the South where many of the other varieties of bunch grapes degenerate as pointed out by Stubbs, 1898 (25), Munson (19), and by Earl and Austin (9). Pierce (22) found Lenoir resistant to Pierce's disease in California.

These different species of grapes which have resistance to Pierce's disease virus are native to regions within the vast Coastal Plain area (19, 27, 28). Many other *Vitis* species native to other regions of the United States and Europe such as *labrusca*, *californica*, *arizonica*, and *vinifera*, are not resistant to Pierce's disease. This report makes no effort to include all grape species, indeed, there are many species that are yet unclassified with respect to their susceptibility to Pierce's disease.

### CONCLUSION

The long history of over a hundred years' culture of European grape varieties in southern California prior to the first appearance of Pierce's disease at Anaheim and Pomona in 1884 is fairly good evidence that the virus which causes this disease was not native to southern California. There is a possibility that the virus might be native to the northern coast counties of California, but since *Vitis californica*, native to this area, is susceptible to Pierce's disease and the vines degenerate and die out with the disease, it is

not likely the virus had been there for a long period.

If we accept the premise suggested by the writings of Vavilov (26) that *Vitis* species resistant to the disease most likely developed in areas native to the virus, then, since the *Vitis* species native to the United States Gulf Coastal Plain area are the only ones known to have resistance to Pierce's disease and since Pierce's disease virus is known to be present in these areas, it is probable that Pierce's disease virus is native to the Gulf Coastal Plain areas of the United States.

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