

Distribution and Severity of Plum Leaf Scald Disease in Brazil

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ABSTRACT

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Plum leaf scald, a disease of Japanese and European plum associated with xylem-limited bacteria, was widespread in the south of Brazil. The disease, known locally as "plum decline," caused extensive dieback and, in some cases, the total destruction of commercial orchards. Plum leaf scald was recorded on 31 Japanese and six European cultivars. Santa Rosa, the major cultivar of the region, appeared highly susceptible. Seven genera of leafhoppers including several species of *Oncometopia*, an important vector genus of similar xylem-borne phytopathogenic bacteria, were collected from infected orchards.

Additional key words: *Aulacizes*, *Bucephalogania*, *Dilobopterus*, *Prunus domestica*, *Prunus salicina*, *Tapajosa*, *Torresabela*, *Tretogonia*

Japanese plums (*Prunus salicina*) are grown commercially in temperate regions of Brazil from São Paulo state south to Rio Grande do Sul. For more than 30 yr, growers in Paraná, Santa Catarina, and Rio Grande do Sul states have experienced heavy losses due to an unknown decline. In recent years the decline has become epidemic in Paraná, limiting production and halting expansion of the plum industry (1). Plum decline, characterized by foliar desiccation and extensive dieback, caused the death of some cultivars within 1-3 yr. In 1978, plum leaf scald (PLS) was reported for the first time in Brazil (6) on a few trees in the south of Rio Grande do Sul state. Xylem-limited bacteria, often referred to as rickettsialike bacteria, were found to be closely associated with PLS in South America (6,10) and southeastern United States (7,13).

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The Brazilian agricultural research organization, EMBRAPA, initiated this study to determine whether PLS was associated with the widespread decline syndrome of plums. Isolates in axenic culture of PLS bacteria from Brazil and Florida and phony peach disease (PPD) bacteria from Florida appeared to be identical on the basis of cultural and serological criteria (2). PPD, known only from the southeastern United States, is vectored by several genera of xylem-feeding leafhoppers (12). One of the most important vectors, *Homalodisca coagulata*, is also a vector of PLS in Florida (5). To date, no South American vector of PLS has been reported.

This paper reports the distribution and severity of PLS in southern Brazil in relation to plum decline, the likeliness of a common etiology between PLS and plum decline, and the occurrence of potential insect vectors.

MATERIALS AND METHODS

Plum orchards and nurseries in the states of Paraná, Santa Catarina, and Rio Grande do Sul were inspected for PLS in February and March 1980. Many of the 36 sites selected had a history of plum decline. Diagnosis of PLS was based primarily on symptomatology and was

confirmed by laboratory assays of samples from five to 10 trees per area. Leaves and stems from diseased plants were examined for the presence of PLS bacteria. Xylem sap was expressed from plant tissue with forceps directly onto a microscope slide, then mixed with a drop of 0.1 M potassium hydroxide and examined by phase contrast microscopy (4). Expressed bacteria from 10 representative samples were tested with antiserum to a Florida strain of PLS bacterium. The procedure was double-sandwich ELISA (11) and immunofluorescent assay (9). Attempts were made to culture the bacteria on JD3 (3), PW (2), and nutrient agar media.

The plum cultivar collection orchard at UEPAE de Cascata, Rio Grande do Sul, was inspected for PLS in 1978, 1980, and 1981 to assess cultivar susceptibility and to determine the rate of spread. Diagnosis was based on foliar symptoms and, when necessary, confirmed by serology and culture techniques as described above.

A preliminary survey of potential insect vectors was conducted near Cascata, Rio Grande do Sul, and near Araucária and Lapa, Paraná. Leafhoppers and spittlebugs were collected in and adjacent to plum orchards in Cascata from December 1980 to April 1981 and during April 1980 in Paraná. Insects were preserved in 70% ethanol for later identification.

RESULTS

Upon inspection, we determined that what had generally been termed 'plum decline' by growers was actually PLS. PLS was prevalent and severe in 30 of 36 orchards in the states of Rio Grande do Sul, Santa Catarina, and Paraná. The disease had devastated numerous orchards near Curitiba, Irati, and Imbituva, Paraná; near Fraiburgo and Videira, Santa Catarina; and near Farroupilha and Caxias do Sul, Rio Grande do Sul. In

a 7-yr-old orchard in Paraná, 2,000 trees were dead and many of the remaining 8,000 trees had advanced symptoms of PLS. About 4,000 of the 8,000 trees in a 17-yr-old orchard in Rio Grande do Sul were dead, and the surviving trees were heavily infected with PLS. We observed widespread PLS damage in large orchards that had been abandoned because of plum decline.

PLS was found in plum cultivar collection orchards in four state experiment stations. The disease was also observed in cultivar stock blocks in nurseries in Paraná and Rio Grande do Sul.

Symptoms. The symptoms in this survey were characteristic of PLS as described elsewhere (10). Typically the disease first appeared as a slight, irregular chlorosis at the leaf margin, intensifying after a few days, becoming brown and dry. The affected area was sometimes separated from the green area by a diffuse chlorotic band. The symptoms appeared first on the lower leaves of a branch and advanced progressively toward the tip. In early stages of an infection, symptoms usually appeared only on one branch or on a portion of a branch, and unaffected foliage appeared normal. Later, more leaves appeared scorched, growth was reduced, branches died, and eventually the tree died.

Isolation and serology. The bacteria associated with PLS were isolated from samples taken from each of the plum growing regions. Rod-shaped bacteria were expressed from leaf petioles and branches and observed by phase contrast microscopy. Bacteria were consistently isolated on PW media from PLS-infected branches and leaf petioles and failed to grow on PD3 or nutrient agar. The colonies were typical of PLS isolates as described elsewhere (2). Serological tests were positive for PLS.

Host range. PLS was recorded on a total of 37 plum cultivars in collections and commercial orchards. Of these, 31 cultivars were Japanese types: Amarelinha, America, Blood, Burbank, Carmesin,

Chabot, Cherry, The First, Friar, Georgetown, Golden Japan, Hale, Kahinta, Kelsey Paulista, Methley, Ozark Premier, Pluma 2, Pluma 3, Pluma 4, Pluma 5, Pluma 6, Pluma 7, Rosa Grande, Roxa de Itaqueira, Santa Rita, Santa Rosa, Sanguinea, Satsuma, Sugar Jaboticaba, Ura Boni, and Wickson. The six infected cultivars of the European type were Anna Spath, Reine Claude, d'Agen, Imperial, President, and Tragedy.

In commercial orchards, PLS was the most severe on Santa Rosa, a Japanese cultivar that constitutes more than 90% of the plums grown in southern Brazil. Santa Rosa trees usually died 2–3 yr after PLS symptoms first appeared. Other cultivars, such as Santa Rita and Sanguinea, appeared to be slightly more tolerant to PLS.

Rate of increase. The incidence of PLS in a 183-tree cultivar orchard at UEPAE, Cascata, increased from <2% in 1978 to >9% in 1980 and to >35% in 1981.

Potential vectors. Seven leafhopper genera were collected in or near plum orchards in Paraná and Rio Grande do Sul (Table 1). The leafhoppers were all in the tribes Cicadellini and Proconini, which also contain the seven species of phony peach vectors (12). In addition to feeding on plum, species of *Aulacizes* and *Oncometopia* were commonly observed on *Lantana* sp. in Rio Grande do Sul and on *Schinus terebinthifolius* Raddi in Paraná.

DISCUSSION

PLS was widespread and destructive in southern Brazil. The disease was spreading, constituting a serious threat to the plum industry in that region. In our survey, PLS was the only disease found in constant association with the decline syndrome in each of the plum growing areas. It is not known when PLS first appeared in Brazil; however, growers indicated to us that the disease was present in Rio Grande do Sul in the 1950s. PLS was widely disseminated in the south, presumably, in domestically produced nursery trees. Short-range

transmission was probably by those leafhoppers that were abundant in the region. In our survey, most new infections could be traced to local sources of infection rather than infected nursery plants.

At present there is very little information regarding the origin or geographic range of PLS. In addition to Brazil, it is known to occur in Argentina (10), Paraguay (6), and the United States (7). Although the disease was first described from Argentina more than 40 yr ago, the range has been restricted to the delta of the Paraná River. The known range of PLS in Paraguay is also very limited. In contrast, PLS is widespread in the southern United States, occurring in Florida, Georgia, South Carolina, Alabama, and as far west as Arizona (5). The disease occurs over much of the same range as phony peach disease and is spread by at least one of the same leafhopper vectors (*H. coagulata*) (5). PLS was reported from nursery stock collections in the southeastern United States. The disease was readily disseminated by budding and grafting (8) and also spread in rooted cuttings of Marianna plum (French, unpublished). Therefore, we suggest that PLS is native to the United States and was introduced into South America on several separate occasions through shipments of infected plants.

Our suggestions for control are the use of disease-free nursery stock, isolation of orchards from infected orchards, and prompt removal of infected trees to reduce natural spread of the disease.

Added in galley: In March 1982, the senior author confirmed the presence of plum leaf scald disease in commercial orchards near Paranapanema. This is the first report of the disease in São Paulo state.

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Table 1. Leafhoppers collected in or near plum orchards in Brazil in 1980–1981

Taxon	Location
Homoptera: Cicadellidae: Cicadellinae	
Tribe: Cicadellini	
<i>Bucephalagonia xanthophis</i> (Berg.)	Paraná
<i>Dilobopterus</i> sp.	Rio Grande do Sul
<i>Torresabela fairmairei</i> (Signoret)	Rio Grande do Sul
Tribe: Proconini	
<i>Aulacizes conspersa</i> Walker	Paraná
<i>Aulacizes obsoleta</i> Melichar	Rio Grande do Sul
<i>Oncometopia facialis</i> (Signoret)	Paraná
<i>Oncometopia fusca</i> Melichar	Paraná, Rio Grande do Sul
<i>Oncometopia</i> sp. near <i>lineatifrons</i> Melichar	Rio Grande do Sul
<i>Oncometopia</i> sp.	Paraná, Rio Grande do Sul
<i>Tapajosa rubromarginata</i> (Signoret)	Paraná, Rio Grande do Sul
<i>Tretogonia</i> sp.	Rio Grande do Sul

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