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Sources of Bacterial Spot Resistance in Plum Cultivars

O. M. MARTINS[1] AND M. C. B. RASEIRA[1]

Abstract

Bacterial spot (*Xanthomonas campestris* pv. *pruni*) resistance in Japanese and European-type plum cultivars was evaluated under greenhouse conditions by means of a pressure infiltration inoculation procedure. Cultivars 'Pluma 7' (susceptible) and 'The First' (resistant) were used as standards for comparison to the genotypes inoculated with an inoculum concentration of 1 x 10^8 cfu/ml. Resistance levels were rated using a scale based on percentage of affected leaf area. Cultivars 'Harry Pickstone,' 'Carmesin,' 'Wickson,' 'Frontier,' 'Rosa Mineira,' 'Reubennel,' 'Amarelinha' and 'Santa Rosa' were highly susceptible while 'Wade,' 'Ozark Premier' and 'Methley' were moderately resistant. 'Bruce,' 'Stanley,' 'Burbank,' 'D'Agen' and 'America' were selected as major sources of resistance to the pathogen.

Introduction

Most high quality commercial plum cultivars (*Prunus salicina* Lindl. and *P. domestica* L.) are susceptible to *Xanthomonas campestris* pv. *pruni* (Smith) Dye in warm, humid, temperate conditions in Southern Brazil. It is estimated that there is less than 5000 ha of plums in the country. The number of plum orchards has decreased in recent years due to this disease and leaf scald. Most of the cultivated plums are Japanese-type because generally, they have a lower chilling requirement. The European-type are acceptable in colder regions for its desirable blooming time and higher degree of resistance to bacterial spot. Bacterial leaf and fruit spot, tree defoliation and stem canker vary from year to year, sometimes occurring in epidemic proportions due to the frequency of rains and favorable temperature. Chemical control is costly and often ineffective, and the use of disease resistant cultivars is the recommended approach to disease control (8, 9, 11). Selection for germplasm resistant to bacterial spot has been considered an important part of management programs in several countries, for reducing the risk of loss from this disease (3, 4, 7, 10, 11). The purpose of this paper is to report the resistance levels of commercial plum cultivars in Brazil as determined by an artificial inoculation procedure in the greenhouse.

Materials and Methods

Eighteen plum cultivars budded on peach rootstock cv. 'Capdeboscq' (Table 1) were grown in 30 x 30 x 20 cm plastic bags containing 3:1 (V/V) mixture of sterilized soil and vermiculite. The soil was poured weekly with

[1]EMBRAPA/CPACT, Agriculture and Animal Research Center for Temperate Regions. Cx. Postal 403, 96001-970 Pelotas, RS, Brazil.

a balanced nutrient solution. Plants with 10-week-old shoots were inoculated with an isolate of *X. campestris* pv. *pruni* maintained in the bacterial collection of the Agriculture and Animal Research Center for Temperate Climate Regions (EMBRAPA/CPACT). Inoculum was obtained from 48-hour-old cultures streaked on 523 medium (6). A colony was cultured in 50 ml of 523 broth medium in a shaker for 14 hr at 28C. The bacterium was pelleted by centrifugation at 1309g for 15 min and suspended in sterile distilled water. The turbidity of the suspension containing 1 x 10^8 cfu/ml was adjusted in the spectrophotometer (Varian 634), according to the following equation line at 550 nm wavelength: y = 507.36 - 56.16x, where, y = transmittance (%), x = log of the concentration. Plants were kept at 27C and 90% relative humidity for 48 hr before inoculation. Inoculum suspension was applied to the abaxial surface of the leaves of the whole plant with a spray gun connected to a compressed air supply (1.7 kg/cm^2) (5) until the tissue became uniformly water-soaked. Control plants were sprayed with sterilized distilled water. After inoculation plants were held in a controlled environment under the same previous conditions for 2 days (2), and then returned to greenhouse conditions with temperature ranging from 14C to 32C. The experiment was a randomized complete block replicated three times. Each plot consisted of two plants. Disease index was rated in eight leaves per plant 40 days after inoculation on a 1 to 5 scale, where, 1 = 0% to 2% of the leaf surface affected, 2 = 2% to 6% of the leaf surface affected, 3 = 6% to 12% of the leaf surface affected, 4 = 12% to 15% of the leaf surface affected, and 5 = over 15% of the leaf surface affected.

Results and Discussion

There was a wide range of variability in reaction to bacterial leaf spot between plum genotypes (Table 2). Water-soaked spots developed on the surface of the leaves 18-20 days after inoculation. Typical lesions of the disease were well separated on inoculated

Table 1. Ancestry and country of origin of plum cultivars tested for bacterial leaf spot resistance.

Cultivar	Parents	Country of Origin
Amarelinha	—[1]	Brazil
America	—	USA
Bruce	(*Prunus salicina* x *P. angustifolia*) x Excelsior	USA
Burbank	—	USA
Carmesin	(Kelsey Paulista x Roxa de Itaquera)	Brazil
D'Agen	—	France
Frontier	(Mariposa x Laroda)	USA
Harry Pickstone	Gaviota x (Methley x Wickson)	South Africa
Methley	(*P. salicina* x *P. cerasifera*)	USA
Ozark Premier	(Burbank x Methley)	USA
Pluma 7	(The First x Santa Rosa)	Brazil
Reubennel	Gaviota x (Methley x Wickson)	South Africa
Rosa Mineira	—	—
Santa Rosa	Complex hybrid	USA
Stanley	(Agen x Grand Duke)	USA
The First	—	USA
Wade	(Beauty x Ozark Premier)	USA
Wickson	(Kelsey x Burbank)	USA

[1]Unknown.

leaf surfaces of all cultivars at the time of the assessment.

Cultivars 'Carmesin,' 'Frontier,' 'Harry Pickstone,' 'Rosa Mineira' and 'Wickson' were rated as highly susceptible to bacterial leaf spot (Table 2). These genotypes showed higher disease index than 'Pluma 7,' used as the susceptible standard. Cultivars 'Amarelinha,' 'Pluma 7,' 'Santa Rosa' and 'Reubennel' were less susceptible than the group above, followed by an intermediate group represented by 'Methley,' 'Ozark Premier' and 'Wade.' The highest resistance ratings were for 'America,' 'Burbank,' 'Bruce,' 'D'Agen' and 'Stanley.' No significant differences ($P < 0.05$) were shown between these genotypes and 'The First,' used to compare resistance levels. Some of these genotypes were previously rated for leaf bacterial spot along with stem canker index under field conditions of the Northeastern Mountains of the State of Rio Grande do Sul, where the lowest temperature occurs in winter (1). 'Amarelinha,' 'Harry Pickstone,' 'Reubennel,' and 'Santa Rosa' were susceptible to bacterial spot, and 'America,' 'Burbank,' 'Methley,' 'Ozark Premier' and 'Stanley' were rated as resistant (1). These results agree entirely with those in Table 2. In test orchards, bacterial spot ratings for 'Stanley' were low, moderate for 'Burbank,' 'Ozark Premier' and 'Santa Rosa,' and severe for 'Methley,' when only estimates of infected leaves were made (7). Behavior of 'Methley' and 'Burbank' reported by Keil and Fogle (7) were different from data in Table 2. The results obtained for 'Harry Pickstone' and 'Reubennel,' (both susceptible) (Table 2) disagree with those found by Topp and Sherman (10). Following these authors, those cultivars were resistant. Mean percentages of inoculated areas with water soaked spots on detached leaves of 'Reubennel' reported by Du Plessis (5) were significantly higher (5), in agreement with our results.

Table 2. Disease index[1] of plum cultivars evaluated for resistance to *Xanthomonas campestris* pv. *pruni*.

Cultivar	Disease Index
Harry Pickstone	4.79a[2]
Carmesin	4.75a
Wickson	4.70a
Frontier	4.62ab
Rosa Mineira	4.41 b
Pluma 7	3.91 c
Reubennel	3.91 c
Amarelinha	3.66 c
Santa Rosa	3.00 d
Wade	2.41 e
Ozark Premier	1.75 f
Methley	1.41 g
The First	1.16 gh
Bruce	1.04 h
America	1.00 h
Burbank	1.00 h
D'Agen	1.00 h
Stanley	1.00 h

[1]Percentage of leaf area affected by bacterial spot: 1 = 0% to 2%; 2 = 2% to 6%; 3 = 6% to 12%; 4 = 12% to 15%; 5 = over 15%.
[2]Values followed by the same letter are not significantly different ($P < 0.05$) according to Duncan's Multiple Range Test.

Du Plessis (5) stated that some cultivars appeared to be resistant in comparison with other cultivars in some geographic regions but highly susceptible when evaluated in other regions. This inconsistency in response to bacterial spot in the stone fruit growing areas may be due to differential interactions between pathogenic variants of *X. campestris* pv. *pruni* and stone fruit cultivars (5). In addition, it has been observed that wind plays an important role in the disease dissemination in Southern Brazil. Thus, the position of plants along a slope can also influence the degree of bacterial spot. Besides, it is recommendable to establish wind breaks, specially, on the south side of the orchard, if possible a year before planting.

'Carmesin' and 'Rosa Mineira' are important cultivars in commercial plantings in São Paulo State, although these genotypes were rated as susceptible to bacterial leaf spot (Table 2).

Those cultivars are not recommended for commercial orchards located in Rio Grande do Sul State, where high relative humidity (70 to 75%), the temperature, and dominant winds are favorable to the disease development.

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