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Relative Susceptibility of Ornamental Peach Cultivars to Fungal Gummosis *(Botryosphaeria dothidea).*

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Abstract

Peach fungal gummosis, incited by *Botryosphaeria dothidea* (Moug.:Fr.) Ces. & De Not., is an unsightly disease of peach trees [*Prunus persica* (L.) Batsch] that depresses growth and can cause significant dieback and even tree death on susceptible peach cultivars. Little is known about the relative susceptibility of ornamental peach cultivars utilized in the United States landscape industry. Peach prunings inoculated with *B. dothidea* and placed on trellis wires served as an inoculum source which was delivered to the test subjects planted below via intermittent misting during March through June of the first year. Disease severity was evaluated at the end of the second growing season after visible symptoms developed. The 13 ornamental genotypes tested separated into four distinct classes with 'White Glory', 'Jerseypink' and PI091459 ('Red Weeping') in the most susceptible, and 'Helen Borchers' and 'McDonald' in the most resistant classes. Trunk cross-sectional area at the end of the second growing season and relative growth rate during the second growing season were negatively correlated with gummosis severity.

Introduction

Peach fungal gummosis, incited by *Botryosphaeria dothidea* (Moug.:Fr.) Ces. & De Not., significantly depresses growth and yield on susceptible peach [*Prunus persica* (L.) Batsch] cultivars (2). Moreover, peach cultivars vary significantly in their susceptibility to this pathogen (3). However, little is known about the fungal gummosis susceptibility of ornamental peach cultivars. In ornamental use, the loss of fruit may have little if any consequence. However, dieback induced by gummosis and the gum exudates themselves can significantly detract from the appearance of these trees in a landscape setting (Fig. 1). While chemical control appears to be technically feasible, the best material tested, captafol (Difolatan), is no longer registered for use on peach and requires an exorbitant application regime (up to 10 sprays per growing season) to achieve admittedly imperfect disease suppression (2). The current absence of a proven chemical or management control strategy makes genetic resistance a goal worth pursuing. This is especially so, given the questionable cost-

Figure 1. Heavy gummosis *(Botryosphaeria dothidea)* infection on the trunk and scaffold limbs of 'Summergold' peach (photo by R. P. Pusey).

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effectiveness and longevity of any chemical control program that requires a high number of spray applications.

Information on the relative susceptibility of ornamental peach cultivars to fungal gummosis would be immediately usable by nurserymen and landscapers to make decisions about cultivar selection and disease management strategies appropriate to the disease pressure present on a given site. Moreover, this information would be essential to breeders in guiding parent selection for the development of new cultivars with superior disease resistance. Advanced selections could be evaluated for specific disease resistance under uniform conditions using cultivars of known susceptibility as comparisons to eliminate highly susceptible selections.

The intent of this study was to determine the relative fungal gummosis susceptibility of currently available ornamental peach cultivars utilizing uniform, replicated material with a screening methodology demonstrated to provide high disease pressure (13).

Materials and Methods

Trellis Construction: A trellis system was used consisting of 4 rows, 45.7 m long, with 6.1 m middles. Support braces 1.9 m tall and 1.2 m wide (6 per row) were used to suspend 3 steel wires and steel fencing (5 cm x 10 cm cells x 1.2 m wide) the length of each trellis. A mist system, controlled by an electric timer, was placed on the wire with mist emitters (32.9 LPH) at 1.7 m intervals.

Preparation of Inoculum. The inoculum source was prepared in February, 2003 by collecting prunings (typically 1 to 1.5 m long with side branches intact) from a 'Redglobe' peach orchard at Byron sufficient to cover the trellis wire (ca. 400 total). The prunings were placed on a chain-link drag (to facilitate delivery to the test site) and 11.4L of inoculum of *Botryosphaeria dothidea* (2.3×10^5 spores mL^{-1}) was applied with a compressed air hand sprayer. Isolate used was a known pathogenic strain collected from peach in Georgia, Bd-20 (11). The inoculated prunings were left undisturbed in partial shade at the edge of a wooded area until needed, then placed on the trellis (ca. 2 per m) and the mist system started.

Plant Materials and Management. Eight replicates of 13 ornamental peach cultivars or selections plus 'Redskin' (resistant check) and 'Summergold' (susceptible check) were planted (January 16, 2003) at 0.9 m in-row spacing in a randomized complete block design with two replicates of each cultivar under each of the four trellises (Table 1). With the exception of 'Redskin', all trees were propagated on Guardian ™ (BY520-9) peach seedlings in a fumigated nursery at the Byron location. Trees of 'Redskin' propagated on Halford peach seedlings were obtained from a commercial source. Observations in a previous peach rootstock trial demonstrated that there is no significant effect of peach seedling rootstocks on scion susceptibility to peach fungal gummosis (Beckman, unpublished data). Trees were planted into a raised bed of ca. 25 cm height (at planting). A raised bed was used because of concerns about the possible negative impact of the large amount of water that would be delivered through the mist system during the inoculation process. Trees were trained to two scaffold limbs each. Weeping types were staked to facilitate establishment of scaffolds. Scaffolds were orientated perpendicular to long axis of trellis. Mist system was set to run for 15 min. every hour for 30 days beginning March 10, 2003. System was then reset to mist for 15 min. every 3 hours for an additional 65 days from April 9, 2003 through June 13, 2003. No pesticides were applied to trees during the course of trial except for the use of herbicides to maintain a weed-free strip ca. 3 m wide centered on the tree row.

Data Collection: Trunk diameter ca. 30 cm from soil line was measured shortly after planting and again in the fall of 2003 and 2004 (following cessation of growth and fall defoliation). Disease severity on trunk and main scaffold limbs was rated November 30, 2004 using a previously published scale (3):

Table 1. Ornamental peach cultivars evaluated for susceptibility to peach fungal gummosis (Botryosphaeria dothidea) (2003-2004).

Name	Origin	Estimated chilling[z]	Flower		Leaf color	Tree form	Ref
			Type	Color			
Crimson Cascade	AR	850	Double	Red	Red	Weeping	(1, 9, 10)
Flordahome (Fla.4-3)[y]	FL	250 y	Double	Pink	Green	Normal	(1, 9) y
Helen Borchers	CA	950	Double	Pink	Green	Normal	(10)
Jerseypink	NJ	1200	Double	Pink	Red	Normal	(1, 8, 10)
McDonald	WV	1000	Double	Red	Green	Normal	(10)
Martha Jane	FL	475	Double	Pink	Red	Normal	(1, 10)
Pink Cascade	AR	850	Double	Pink	Red	Weeping	(1, 9, 10)
PI062602 (Pi Tao)	China	1000	Double	Pink	Green	Normal	(16)
PI065821 (Shau Thai Tao)	China	400	Double	Pink	Green	Normal	(16)
PI091459 (Red Weeping)	CA	1100	Double	Red	Green	Weeping	(16)
TSU-5	TN	950	Double	White	Green	Normal	?
White English	?	950	Double	White	Green	Normal	(10)
White Glory	NC	900	Single	White	Green	Weeping	(1, 10, 15)

[z] Chill units (cu), hours below 7C.

[y] Flordahome as marketed at this time is actually Fla.4-3 rather than Fla.H97 (Sherman, personal communication). Similar in appearance but chilling requirement (250 cu) is lower than originally reported for Flordahome (400 cu). Pedigree of Fla.4-3 = ((((Southland x Jewel) op) x Flordahome) op) op.

0 = no gumming
1 = light, few gum spots mostly on trunk
2 = medium, few-numerous gum spots on trunk and scaffold limbs
3 = medium-heavy, many gum spots, some large, on trunk and scaffold limbs
4 = heavy, many large gum spots on trunk and scaffold limbs
5 = severe, gumming coalescing on trunk and scaffold limbs, tree or limbs dying.

Growth measurements and gummosis ratings were analyzed by the General Linear Models (GLM) program of the Statistical Analysis System for personal computer (SAS 9.1 for Windows, SAS Institute, Cary, NC). Gummosis rating treatment means, error degrees of freedom and error mean square terms were used to perform a cluster analysis (7).

Results and Discussion

The cultivars separated into four distinct classes for gummosis susceptibility (Table 2). 'Summergold' was the most susceptible to fungal gummosis as expected from earlier observations (3, 6, 13). 'White Glory' and 'Jerseypink' were also in this highly susceptible class, as was PI091459 ('Red Weeping') which is in the pedigree of 'Jerseypink' (8). The next most susceptible class (B) contains the largest number of cultivars, including several which are commercially available. TSU-5 is an unreleased selection from a now inactive breeding program at Tennessee State University, Nashville, TN and was never officially released. These first two classes developed significant symptoms and most likely would be deemed unsatisfactory in a landscape setting if this disease were not managed. The low susceptibility class contains 'Redskin', a known 'resistant' standard, two commercially available cultivars ('White English' and 'Flordahome'), and PI065821 ('Shau Thai Tao'). PI065821 is in the pedigree of 'Flordahome' (1,10). Two commercial ornamental peaches, 'Helen Borchers' and 'McDonald' separated out in a very low susceptibility class (D). These might be the best choices for landscape use, especially where significant fungal gummosis inoculum is present. However, their high chilling requirement will prevent their use in low and moderate chill areas. 'Flordahome' and PI065821 ('Shau Thai Tao') appear to be the best choices for low and moderate chill areas, respectively. 'Helen Borchers' and 'McDonald' represent the best level of gummosis resistance observed in commercial material to date and might prove useful in a breeding program.

There were significant differences in vigor displayed by the material tested (Table 3). Differences at planting and at the end of the first year likely represent inherent cultivar differences in vigor. The weeping forms were among the lowest vigor tested. Trunk cross-sectional area at the end of the trial (Fall, 2004) and relative growth rate in the 2004 growing season were negatively correlated with gummosis severity, $r = -0.43$ ($P<0.0001$) and $r = -0.65$ ($P<0.0001$), respectively, indicating a suppression of growth by this fungal pathogen.

Current management options for peach fungal gummosis in commercial peach orchards are limited primarily to inoculum reduction and include pruning of diseased wood followed by either its removal from the orchard or flail mowing to speed decomposition of the infected prunings (5). There are no fungicides currently registered for control of fungal gummosis on peach. Most fungicides registered for control of other diseases on peach do not have much useful effect on fungal gummosis under field conditions (2, 4, 14, Beckman and Reilly, unpublished data). Currently, the best strategy in a landscape setting may be to refrain from planting highly susceptible cultivars on sites with high inoculum pressure and to further reduce inoculum through proper pruning and removal of infected prunings from the planting site. High inoculum pressure is likely to be encountered when planting individual trees into settings with already heavily infected trees. Stress, particularly drought

Table 2. Relative fungal gummosis (*Botryosphaeria dothidea*) susceptibility of thirteen ornamental peach genotypes and resistant ('Redskin') and susceptible ('Summergold') peach cultivars (Byron, Ga., 2003-2004).

Class A[z] High susceptibility		Class B Moderate susceptibility		Class C Low susceptibility		Class D Very low susceptibility	
Cultivar	Rating[y]	Cultivar	Rating	Cultivar	Rating	Cultivar	Rating
Summergold	4.44	Martha Jane	3.44	Redskin	1.75	Helen Borchers	0.81
White Glory	4.42	Crimson Cascade	3.40	White English	1.50	McDonald	0.50
Jersey Pink	4.13	Pink Cascade	3.19	Flordahome	1.44		
PI091459	4.00	TSU-5	2.63	PI065821	1.13		
		PI062602	2.56				
Group Mean:	4.24		3.04		1.45		0.66

z Significance of class separations: AB<0.0001, BC<0.0000, and CD<0.0061.
y Gummosis rating scale: 0=none, 1=light, 2=medium, 3=medium-heavy, 4=heavy, and 5=severe (trees rated Nov., 2004)

stress during late summer (12), has been shown to be an important factor enhancing disease severity. The judicious use of irrigation on susceptible cultivars may lessen disease severity.

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Table 3. Relative vigor of peach cultivars and ornamental genotypes (Byron, Ga., 2003-2004).

	Trunk cross-sectional area (cm^2)						Relative growth rate (% increase)[z]			
Cultivar	Spring, 2003		Fall, 2003		Fall, 2004		2003		2004	
Flordahome	0.52	ABC	10.71	A	29.36	A	3334	A	177	AB
Helen Borchers	0.59	AB	6.77	BC	19.10	B	1266	BCD	179	A
Redskin	0.59	AB	7.20	B	15.88	BC	1166	BCD	118	D
TSU-5	0.61	A	6.77	BC	15.46	C	1005	BCD	134	CD
White English	0.35	ABCD	5.78	CDE	13.49	CD	1789	BCD	136	BCD
Summergold	0.46	ABC	6.36	BCD	11.82	D	1538	BCD	75	E
PI065821	0.38	ABCD	4.21	FGHI	11.02	DE	1077	BCD	160	ABC
PI062602	0.50	ABC	4.60	EFG	9.95	DEF	902	CD	119	D
Martha Jane	0.59	AB	5.34	DEF	7.71	EFG	1043	BCD	43	EF
McDonald	0.34	BCD	3.30	HIJ	7.31	FG	1438	BCD	121	CD
Pink Cascade	0.60	AB	4.32	FGH	6.09	GH	696	D	42	EF
Jerseypink	0.43	ABC	3.62	GHIJ	5.68	GH	801	CD	53	E
White Glory	0.29	CD	3.68	GHIJ	5.50	GH	1892	BC	41	EF
Crimson Cascade	0.32	CD	2.86	J	4.80	GH	860	CD	38	EF
PI091459	0.15	D	3.06	IJ	3.68	H	2027	B	4	F
MSD[y]	0.26		1.25		3.60		1124		41	

[z] Calculated as % increase in TCSA (1) from Spring, 2003 to Fall, 2003 and (2) from Fall, 2003 to Fall, 2004.

[y] MSD=Minimum Significant Difference, Waller Duncan k-ratio t Test (k-ratio=100).

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