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Progress in the Management of Peach Fungal Gummosis *(Botryosphaeria dothidea)* in the Southeastern US Peach Industry

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Abstract

Peach fungal gummosis, incited by *Botryosphaeria dothidea* [(Moug.:Fr.) Ces. & De Not.] has been shown to be capable of reducing growth and yield by up to 40% on susceptible peach [*Prunus persica* (L.) Batsch] cultivars. At this time there is no management program for this disease other than practices to reduce inoculum in the orchard. In field tests under high inoculum pressure no fungicide tested appeared to provide effective control and in one test not only did all of the trial fungicides fail to provide control but even a proven (though no longer registered) fungicide failed as well. However, several paint treatments appeared promising. Field screens under high inoculum pressure have demonstrated that some important peach cultivars utilized in the southeastern US peach industry are highly susceptible to this disease. The relative susceptibility of additional peach cultivars, including many recently introduced, was determined, the majority of which were either moderately or highly susceptible to gummosis. However, several varieties appear to have high levels of resistance to fungal gummosis and may prove suitable as founding parents for resistance breeding. The large proportion of recent releases that appear to be highly susceptible makes this approach all the more urgent.

Recent work has demonstrated that failure to control peach tree fungal gummosis, incited by *Botryosphaeria dothidea*, can result in yield reductions approaching 40% in mature trees of susceptible peach cultivars such as 'Summergold' (2). However, at this time there is no management program other than the reduction of inoculum in the orchard via detailed pruning followed by removal and disposal of prunings or flail mowing to speed their decomposition (4), and the judicious application of irrigation in late summer to reduce infection (19). While chemical control appeared to be technically feasible in the 2003 trial cited above (2), the best material, Difolatan, is no longer registered for use on peach. Nevertheless, several fungicides have been reported to be efficacious in controlling other diseases incited by *B. dothidea*, i.e. panicle blight on pistachio (1, 13, 15) and stem blight on blueberry (22). In addition, Taylor and Sherman (23) demonstrated some limited ability of phosphorous compounds to suppress peach fungal gummosis. These studies all suggest that chemical control with currently available fungicides may be possible.

The current absence of a chemical management control strategy for peach also makes genetic resistance an attractive alternative worth pursuing. This is especially so given the questionable cost-effectiveness and longevity of any chemical control program that might be developed if it requires a spray application frequency approaching that required with Difolatan in an earlier trial (2). Information on the relative susceptibility of a small number of important commercial peach cultivars to fungal gummosis was recently published (3). Their study demonstrated that there was a considerable range in the susceptibility of

The use of trade names does not imply endorsement of the products named or criticism of similar ones not named.

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current commercial cultivars, including some with very low disease ratings. This is in contrast to an earlier study (18) in which the least susceptible materials were typically exotic germplasm accessions with fruit quality and appearance attributes well below commercial standards. One of the least gummosis susceptible lines in that study, 'Eagle Beak', would bring many undesirable fruit traits (e.g. poor shape, small size, low red blush and poor eating quality) into a breeding program, thereby requiring numerous additional breeding cycles to recover selections with commercial qualities combined with gummosis resistance. The use of gummosis resistant germplasm already displaying commercial qualities would clearly be preferred.

Our objective here is to report the results of fungicide field trials for their efficacy in controlling gummosis, compile the results of several cultivar trials testing their relative susceptibility to fungal gummosis and, finally, to point out areas still needing additional research.

1998 Fungicide Trial

Materials and Methods. Trees of 'Summergold' peach budded to 'Halford' rootstock were established in the spring of 1998 in a randomized complete block (RCB) design under a trellis inoculation system previously described (17, 21). The system involved inoculation of peach prunings with a pathogenic strain of *B. dothidea*, BD-20, isolated from peach in Georgia (18), and the placement of colonized prunings on support wires above the test trees. Periodic mist dispersed fungal spores from the prunings to the test trees and created conditions conducive for infection. Spray materials used in this and other trials reported herein are listed in Table 1. Trade names are used throughout the text for the sake of brevity.

Recovery of B. dothidea. In July of 1999 bark tissue was removed at the necrotic-healthy interface of several gumming lesions on each trellis tree. A small segment (2 mm x 8 mm) of tissue at the interface was removed, immersed in sodium hypochlorite (1.31%) for

Table 1. Spray materials used in trials (Byron, Ga., 1998-2009).

Trade name	Common name	Manufacturer
Abound	azoxystrobin	Syngenta Crop Protection Inc., Greensboro, NC
Actiguard 50WG	acibenzolar-S-methyl	Syngenta Crop Protection Inc., Greensboro, NC
Aliette	aluminum tris (O-ethyl phosphonate)	Bayer Environmental Science, Research Triangle Park, NC
Botran	dicloran	Gowan Co., Yuma, AZ
Bravo Weatherstik	chlorothalonil	Syngenta Crop Protection Inc., Greensboro, NC
Captan	captan	Chevron, Wilmington, DE
Difolatan	captafol	Chevron, Wilmington, DE
Ferbam Granuflo	ferbam	Taminco, Ghent, Belgium
FNX-100	phosphorous acid	Foliar Nutrients Inc., Cairo, GA
Garlic	garlic	-
Lexx-A-Phos (Biophos)	dipotassium phosphate and dipotassium phosphonate	Foliar Nutrients Inc., Cairo, GA
Ni-Plus	nickel lignosulfonate and urea	Nipan LLC, Valdosta, Ga
Orbit	propiconazole	Syngenta Crop Protection Inc., Greensboro, NC
Rovral	iprodione	Bayer Environmental Science, Research Triangle Park,NC
Yellow Jacket Sulfur	sulfur	Georgia Gulf Sulfur, Bainbridge, GA
Topsin-M	thiophanate-methyl	Elf-Atochem (now Arkema), King of Prussia, PA
Vangard	cyprodinil	Syngenta Crop Protection Inc., Greensboro, NC
Ziram	ziram	Elf-Atochem (now Arkema), King of Prussia, PA

2 minutes and rinsed twice with sterile deionized water. Specimens were placed onto Difco Potato Dextrose Agar (PDA) and incubated at 24°C under a 12-hour light-dark photoperiod. Conidia of *B. dothidea* that developed from the samples were identified microscopically after 14 days.

Data collection. A gummosis rating system has been previously described (2). Trunk caliper was measured 30 cm from the soil line in the fall of 1999 at the end of the experiment.

Results and Discussion. Recovery of fungal colonies consistent with *B. dothidea* ranged from 63% (water check) to 100% and averaged 86% across all treatments in this trial. Mean gummosis ratings and trunk cross sectional area (TCSA) at the end of the experiment are summarized in Table 2. Neither Actiguard nor Garlic provided any control of gummosis compared to the water check. Aliette, Orbit, Captan alternated with Orbit, and Abound all provided some suppression compared to the water check. Aliette is a phosphorous-based compound similar to that used in a trial by Taylor and Sherman (23) and showed a similar partial suppression of gummosis. Not unexpectedly Difolatan significantly suppressed gummosis. Of considerable interest though were the Orbit/paint mixture treatments which were just as effective as Difolatan. Unfortunately, the absence of a simple paint treatment made it impossible to determine if paint alone would have been as effective as Difolatan in this trial. Though it was disappointing to find that none of the registered peach fungicides tested could approach Difolatan in efficacy (even with the exorbitant application regime used in this trial), it was very encouraging to note that a single application of white latex paint supplemented with Orbit was the equal of 13 applications of Difolatan.

Only trees treated with Aliette and Orbit/white latex paint (applied 5 times) grew better (as estimated by trunk cross sectional area) compared to the water check (Table 2). This is in contrast to an earlier long term study where

Table 2. Effect of fungicides and paints on fungal gummosis infection and final trunk cross sectional area (TCSA) of 'Summergold' peach (Byron, Ga., 1998-1999).

Treatment[z]	Rate	Gummosis rating[y]	TCSA (cm^2)
Water check	-	3.50 a [x]	11.62 c
Actiguard 50WG	1.50 g•L^{-1}	3.43 a	10.79 c
Garlic	1 bulb [w]	3.29 a	13.61 bc
Aliette	5.99 g•L^{-1}	2.65 b	24.51 a
Orbit	0.47 ml•L^{-1}	2.44 b	16.08 bc
Captan/Orbit alternating [v]	3.01 g or 0.47 ml•L^{-1}	2.22 b	14.57 bc
Abound	0.61 ml•L^{-1}	2.21 b	14.01 bc
Orbit in latex paint 1x [u]	188.76 ml•L^{-1}	1.25 c	12.58 bc
Difolatan	4.80 g•L^{-1}	0.94 cd	16.32 bc
Orbit in latex paint 5x[t]	186.76 ml•L^{-1}	0.78 d	18.57 ab

[z] All treatments applied 13 times (weekly from June 2, 1998 through August 25, 1998) with exceptions noted below. Ten single tree replications of each treatment.

[y] All treatments evaluated Fall, 1999. Rating scale: 0 = no visible gum, 1 = 1 or 2 gum sites, 2 = 3-10 gum sites on trunk or scaffolds, 3 = 11-25 gum sites on trunk or scaffolds, 4 = 26-50 gum sites on trunk or scaffolds, 5 = 50 or more gum sites on trunk or scaffolds.

[x] Statistical analysis by the General Linear Models (GLM) program of the Statistical Analysis System for personal computer (SAS Institute, Cary, NC). Mean separation via Waller-Duncan, k-ratio=100 (equivalent alpha level of 0.05%).

[w] Garlic treatment prepared by pureeing one whole garlic for 30 sec in 100 ml of water, filtering through cheesecloth and diluting with water to 3.785 L (1 Gal.).

[v] Captan applied on first and last application dates.

[u] Applied on initial treatment date only.

[t] Applied on initial treatment date and then every other spray treatment date until 5 applications had accrued.

Table 3. Effect of fungicides and paint on fungal gummosis infection and final trunk cross sectional area (TCSA) of 'Summergold' peach (Byron, Ga., 2004-2005).

Treatment [z]	Rate	Gummosis rating [y]	TCSA (cm^2)
Lexx-A-Phos	20.00 ml•L^{-1}	4.63 a[x]	11.63 c
Bravo	10.00 ml•L^{-1}	4.44 ab	13.14 bc
White latex paint	Twice	4.21 ab	12.13 c
Difolatan	3.00 g•L^{-1}	4.19 ab	13.18 bc
Water check	-	4.07 ab	19.16 a
White latex paint	Once	4.06 ab	11.10 c
Ni-Plus (Nickel)	3.33 ml•L^{-1}	4.06 ab	8.96 c
Aliette	6.00 g•L^{-1}	4.00 b	13.29 bc
'Redskin' untreated	-	2.06 c	18.35 ab

[z] All treatments applied 3 times (April 24, June 24 and August 22, 2004) except paint treatments which were applied either once (March 16) or twice (March 16 and June 24). Eight single tree replications of each treatment.

[y] All treatments evaluated Fall, 2005. Gummosis rating scale: 0=none, 1=light, 2=medium, 3=medium-heavy, 4=heavy, and 5=severe.

[x] Statistical analysis by the General Linear Models (GLM) program of the Statistical Analysis System for personal computer (SAS Institute, Cary, NC). Mean separation via Waller-Duncan, k-ratio=100 (equivalent alpha level of 0.05%).

Difolatan treatments provided a significant increase in growth by the end of the second year (2). The growth boost of Aliette is somewhat surprising given its only modest suppression of gummosis compared to the water check in this trial. Possibly it had a nutritional effect.

This trial was a turning point in our program as it demonstrated that, even with an exorbitant application regime, many of the currently registered fungicides for peaches would not be able to provide significant suppression of fungal gummosis under field conditions. This led us to rethink our screening protocol. Future trials would not utilize such extraordinary application regimes. If materials could not provide significant control with a few, i.e. perhaps 2 or 3, applications at the most then they were unlikely to be cost effective or sustainable in view of concerns over the development of pathogen resistance. However, the discovery that latex paint in combination with an otherwise unexceptional fungicide for this purpose could provide good suppression encouraged continuation of this line of research.

2004 Fungicide Trial

Materials and Methods. Trees of 'Summergold' peach budded to 'Guardian' rootstock and trees of 'Redskin' peach budded to 'Nemaguard' rootstock were established in a RCB design under a trellis inoculation system in the spring of 2004. We have not observed any rootstock influence on scion susceptibility to gummosis in previous rootstock trials (Beckman, unpublished data). 'Redskin' had previously demonstrated good resistance to fungal gummosis (3), hence its inclusion as an internal standard for comparison to the fungicide treatments. A modified trellis design and management program has been previously reported (3). The chemical and paint treatments/rates that were used are summarized in Table 3.

Data collection. Modified gummosis rating system has been previously described (3). Trunk caliper was measured 30 cm from soil line in the fall of 2005 at the end of the experiment.

Results and Discussion. Surprisingly, no fungicide or paint barrier treatment provided a significant suppression of gummosis compared to the water check as shown in Table 3. However, the untreated 'Redskin' and 'Summergold' trees (water check) displayed gummosis symptoms similar to those ob-

Table 4. Effect of fungicides and paint on fungal gummosis infection and final trunk cross sectional area (TCSA) of 'Summergold' peach (Byron, Ga., 2008-2009).

Treatment[z]	Rate	Gummosis rating[y]	TCSA (cm^2)
Botran	6.6 g•L^{-1}	3.56 A[x]	5.04 ab[w]
Ferbam	5.4 g•L^{-1}	3.50 A	6.25 ab
Orbit	0.625 ml•L^{-1}	3.44 A	6.21 ab
Captan	9.6 g•L^{-1}	3.31 A	5.09 ab
Bravo	6.25 ml•L^{-1}	3.29 A	5.87 ab
Aliette	6 g•L^{-1}	3.25 A	6.07 ab
Rovral	2.4 g•L^{-1}	3.21 A	4.82 ab
Vanguard	0.75 g•L^{-1}	3.19 A	3.57 b
Ni-plus (Nickel)	3.33 ml•L^{-1}	3.06 A	4.12 b
Abound	1.2 ml•L^{-1}	3.00 A	4.35 ab
Water check	-	2.93 A	5.15 ab
Topsin M	0.7 ml•L^{-1}	2.87 A	4.41 ab
FNX-100	20 ml•L^{-1}	2.86 A	5.76 ab
Ziram	9.6 g•L^{-1}	2.86 A	6.72 ab
Sulfur	14.4 g•L^{-1}	2.81 A	5.08 ab
Non-mildew res. paint	Twice	2.43 B	3.00 b
Difolatan	4.8 g•L^{-1}	2.13 B	5.53 ab
Mildew res. paint	Twice	1.79 B	5.68 ab
Non-mildew res. paint	Once	1.79 B	4.30 ab
Mildew res. paint	Once	1.75 B	5.11 ab
'Redskin' untreated	-	1.31 B	8.55 a

[z] All treatments applied 3 times (April 15, May 20 and June 17, 2008) except paint treatments which were applied either once (April 16) or twice (April 16 and May 28). Eight single tree replications of each treatment.
[y] All treatments evaluated Fall, 2009. Gummosis rating scale: 0=none, 1=light, 2=medium, 3=medium-heavy, 4=heavy, and 5=severe.
[x] Significance of class separation: AB ≤ 0.0001. Gummosis ratings were analyzed by the General Linear Models (GLM) program of the Statistical Analysis System for personal computer (SAS Institute, Cary, NC). Gummosis treatment means, error degrees of freedom and error mean square terms were used to perform a cluster analysis (7).
[w] Statistical analysis by the General Linear Models (GLM) program of the Statistical Analysis System for personal computer (SAS Institute, Cary, NC). Mean separation via Waller-Duncan, k-ratio=100 (equivalent alpha level of 0.05%).

served in previous trials. In six trials from 2001 to 2007 the average gummosis rating of 'Summergold' was 3.84 (range: 2.93 – 4.44) while that of 'Redskin' was 1.49 (range: 0.50 – 2.06). The gummosis rating for 'Redskin' in this trial was only slightly higher than the highest rating observed in these other trials. Hence, it appears that although all chemical and paint treatments failed in this trial the genetic component was still stable. We are unable to explain the failure of the fungicide and paint treatments, as we inoculated with the same fungal isolate used in the 1998 trial, and rainfall during the summer of 2004 was typical. Regardless, this points out a significant potential weakness in relying on chemical control of fungal gummosis and that is that it may fail completely. Genetic control may be a more reliable approach. An inexplicable anomaly in this experiment is the apparent reduction in TCSA of all chemical and paint treatments compared to the water check even though gummosis symptoms were similar.

2008 Fungicide Trial

Materials and Methods. Trees of 'Summergold' peach budded to 'Nemared' rootstock and trees of 'Redskin' peach budded to 'Guardian' rootstock were established in a RCB design under a trellis inoculation system in the spring of 2008. The trellis design and management program have been previously reported (3).

Data collection. A modified gummosis rating system has been previously described (3). Trunk caliper was measured 30 cm from soil line in the fall of 2009 at the end of the experiment.

Results and Discussion. Mean gummosis ratings and trunk cross sectional area (TCSA) at the end of the experiment are shown in Table 4. A cluster analysis (7) was used on the mean gummosis ratings as it more clearly shows how the treatments separate into two groups. With the exception of the Difolatan treatment all of the fungicide treatments behaved much like the water check, failing to effectively suppress gummosis. This is in partial agreement with the findings on other crops which found Topsin-M and Bravo to provide only moderate and erratic control (1). However, we found Abound to be equally ineffective in contrast to their evaluation of it to be "good and reliable". Our results with Ziram and Captan agreed with those observed when these materials were tested for control of *Botryrosphaeria* stem blight on blueberry (22). In contrast, all of the paint treatments grouped with the Difolatan and 'Redskin' scion treatments. However, the apparent reduction in TCSA of the twice applied non-mildew resistant paint treatment (and to a lesser extent the single application of the same product) when compared to the water check, though not statistically significant, is of concern. It would suggest that some paint formulations may be phytotoxic and although they might suppress gummosis symptoms they may still reduce tree growth and presumably subsequent productivity. This issue needs to be addressed in future work, i.e. to determine if different paint formulations might vary in this regard.

Scion Susceptibility to Gummosis

Since our initial test of the relative scion susceptibility to fungal gummosis (3) we have continued with these trials. Unfortunately, the high susceptibility class which was formerly the smallest is now the largest (Table 5). At this time it is hard to judge the significance of this finding since all of the southeastern tree censuses are now 15 or more years old (5, 6, 8, 9, 10, 11, 16) and certainly some shifts in relative importance of cultivars have occurred as older cultivars have presumably been replaced by newer ones. Additionally, many of the new additions are relatively recent releases that either had not been released at the time of these surveys or had not yet found their place in the industry. However, it is reasonable to assume that the most important cultivars identified in these surveys, i.e., 'Redglobe', 'Harvester' and 'O'Henry' (first, second and third, respectively), are still of considerable importance. 'O'Henry' falls into the high susceptibility class while 'Redglobe' and 'Harvester' fall into the moderate and low susceptibility classes, respectively. Useful differences in blueberry cultivar susceptibility to *B. dothidea* has also been noted (22) and the authors in that study suggested a breeding approach to address the problem of stem blight in the blueberry industry.

It is discouraging to note that many of the cultivars listed in the high susceptibility class (Table 5) are relatively recent releases. The implementation of a screening protocol in breeding programs would appear to be needed. Though the methodology used in the trials reported herein is not particularly lengthy it does, nonetheless, require additional time and effort and would require extensive infrastructure to screen large seedling populations. This could presumably be reduced through the identification of molecular markers for gummosis resistance and their incorporation into a larger marker assisted selection (MAS) program for a number of important breeding traits so that the cost incurred could advance a number of breeding priorities simultaneously.

Conclusions and Future Directions

Current management options for peach fungal gummosis are still limited primarily

Table 5. Relative fungal gummosis (incited by *Botryosphaerioa dothidea*) susceptibility of commercial cultivars utilized by the southeastern US peach industry (Byron, Ga., 2001-2006).

Class A [z]		Class B		Class C	
High Susceptibility		Moderate Susceptibility		Low Susceptibility	
Cultivar [y]	Rating [x]	Cultivar	Rating	Cultivar	Rating
Blazeprince*	4.2	**Babygold #5**	2.9	**Springprince***	2.2
Gulfking*	4.1	**Gulfcrest***	2.9	Suwanee	2.2
Autumnprince*	4.1	**Loring**	2.9	Harvester	2.1
Sureprince	4.1	GaLa	2.8	Majestic	2.1
Summergold	4.0	Coronet	2.7	Juneprince	2.1
Parade	4.0	Redglobe	2.7	Goldprince	1.9
Winblo	4.0	**Southern Pearl**	2.7	Cary Mac	1.9
Contender	3.9	Surecrop	2.6	June Gold	1.9
Flordadawn	3.8	**Fireprince**	2.6	Gulfprince	1.7
Scarletprince*	3.6	**Big Red***	2.6	Redskin	1.7
Topaz	3.5	Redhaven	2.6	Springcrest	1.6
Gulfcrimson*	3.5	Sunbrite	2.6	Flordaking	1.6
Summerprince	3.5	Flordacrest	2.5	Sunprince	1.6
Rubyprince*	3.4	Dixiland	2.5	**Bounty**	1.3
Flameprince	3.4	Empress	2.4		
Monroe	3.4	Cresthaven	2.4		
Julyprince*	3.2	**Jefferson**	2.4		
Sunland	3.2				
O'Henry	3.0				
Mean:	3.7		2.6		1.8

[z] Significance of class separations: AB ≤ 0.0001 and BC ≤ 0.0001. Gummosis ratings were analyzed by the General Linear Models (GLM) program of the Statistical Analysis System for personal computer (SAS Institute, Cary, NC). Gummosis treatment means, error degrees of freedom and error mean square terms were used to perform a cluster analysis (7).

[y] Gummosis ratings for cultivars shown in bold are from evaluations conducted since our first report on the relative susceptibility of peach cultivars to gummosis (3). Cultivar names with an asterisk appended were released around or after the last round of southeastern tree surveys in the 1990's. Consequently, their relative importance is difficult to judge, though 'Gulfking', 'Julyprince' and 'Big Red' have been planted in large numbers (M. Vaughn, personal communication).

[x] Gummosis rating scale: 0=none, 1=light, 2=medium, 3=medium-heavy, 4=heavy, and 5=severe.

to inoculum reduction as established in the 1980's (4). At this time, there are still no fungicides registered for control of fungal gummosis on peach. Our tests to date have yet to identify a promising candidate fungicide for this approach. However, the positive results that other groups have had with newer materials such as Switch (cyprodinil and fludioxonil, Syngenta Crop Protection Inc., Greensboro, NC), Pristine (pyraclostrobin and boscalid, BASF, Research Triangle Park, NC), Cabrio (pyraclostrobin, BASF), and Elite (tebuconazole, BayerEnvironmental Science, Research triangle Park, NC) on diseases caused by *B. dothidea* on other crops (1, 15, 22) should encourage their trial for control of gummosis on peach. In the meantime, further work with paint applications is warranted but not without an investigation into the potential phytotoxicity of these materials. A reduction in disease symptoms may be of little value if the paint treatment itself stunts the tree. Also of great importance would be the establishment of a long term economic study to document the efficacy of this approach to reduce, if not eliminate, the negative impact of fungal gummosis on growth and yield of peach.

Scion resistance is a particularly attractive alternative control strategy for this disease problem. However, even if there was at this moment a group of suitable commercial cultivars that would serve the season long needs of the southeastern industry the reality is that it would take at least two decades for them to be introgressed into the industry's variety mix. This industry expects at least 15 years of productive life from an orchard and needs such productivity to offset the high establishment costs associated with a perennial crop (14). Consequently, the introduction of new cultivars into the industry is a gradual process proceeding only as old orchards age and ultimately become unprofitable, necessitating their replacement. The fact that many of the new cultivars introduced over the last two decades are highly susceptible to fungal gummosis is most unfortunate.

We have made an initial effort to determine the relative gummosis susceptibility of our advanced peach selections and our breeding parents. This is being done within a cooperative regional program to develop new moderate chill cultivars for the early season peach industry along the lower coastal plain of the southeastern US where fungal gummosis is a notable problem (12). In the future we hope to use markers for gummosis resistance in order to streamline the development of peach cultivars resistant to fungal gummosis. To this end a segregating population was recently field screened for its gummosis susceptibility.

At this time we would suggest that the most promising means of suppressing fungal gummosis would be an early spring application of a mildew resistant white latex paint to the trunk following planting followed up by a second application to the trunk and scaffold limbs once visible cracking appears in the first coat for the first 2 seasons (Figure 1). Although we do not yet have economic data to demonstrate its long term efficacy, latex paint may endure long enough to significantly reduce infection of the trunk and major scaffold branches during the first year or two after planting when the bark tissue is most susceptible to invasion through lenticels (24). This approach is suggested by an earlier study that was designed to determine the seasonal period of tree susceptibility to fungal gummosis (20). In that study plastic protective covers were placed on the trunks of some peach trees for nearly 2 years after planting. During a 3-year observation period following the removal of the covers, only a minimal number of necrotic lesions appeared in the areas previously covered, as contrasted to severe disease development on the trunks of trees not protected during that same 2 year period (21). Trunk applications of latex paint have the potential added benefit of providing protection to young trees from trunk burn caused by overspray of post-emergent burn down type herbicides (F. Funderburk and K. Taylor, unpublished data).

Fig. 1. Example of trunk and scaffold limbs of a young peach tree painted with white latex paint for protection against fungal gummosis (*B. dothidea*) infection.

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Literature Cited

1. Adaskaveg, J., D. Gubler, T. Michailides and B. Holtz. 2010. Efficacy and timing of fungicides, bactericides and biological for deciduous tree fruit, nut, strawberry and vine crops 2010. http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf.
2. Beckman, T.G., P.L. Pusey and P.F. Bertrand. 2003. Impact of fungal gummosis on peach trees. HortScience 38:1141-1143.
3. Beckman, T.G. and C.C. Reilly. 2005. Relative susceptibility of peach cultivars to fungal gummosis (*Botryosphaeria dothidea*). J. Amer. Pom. Soc. 59(2):111-116.
4. Britton, K.O. and F.F. Hendrix. 1989. Fungal gummosis. p. 105-108. In: S.F. Myers (ed.) Peach production handbook. Coop. Ext. Service, Univ. of Georgia, Athens, GA.
5. Findley, D.S. 1994. Texas peach tree inventory survey – 1994. Texas Agric. Statistics Service, Austin, Texas, 2 pp.
6. Frank, A.D. 1994. Louisiana peach tree survey. Louisiana. Dept. of Agriculture and Forestry, Baton Rouge, La. 21 pp.
7. Gates, C.E. and J.D. Bilbro. 1978. Illustration of a cluster analysis method for mean separation. Agronomy J. 70:462-465.
8. Graham, R.A. and S. Pavlasek, Jr. 1996. South Carolina Fruit Tree Survey. http://cherokee.agecon.clemson.edu/fb_all.pdf
9. Guinn, B., M. Harris, M. Kelsey and S. Thompson. 1993. Tennessee – Commercial apple and peach tree inventory. Tennessee Agric. Statistics Service, Nashville, Tenn., 18 pp.
10. Hubbard, E.E., W.J. Florkowski, T.A. Park and H.J. Witt. 1998. Commercial Peach Tree Inventory and Prospectus, Georgia 1995. http://www.ces.uga.edu/pubs/PDF/RR-650.PDF
11. Kleweno, D. 1993. Alabama peach tree survey. Alabama Agric. Statistics Service, Montgomery, Ala., 4 pp.
12. Krewer, G., T.G. Beckman and W.B. Sherman. 1998. Moderate chilling peach and nectarine breeding and evaluation program at Attapulgus, Georgia. Acta Hort. 465:155-160.
13. Ma, Z., D.P. Morgan, D. Felts and T.J. Michailides. 2002. Sensitivity of *Botryosphaeria dothidea* from California pistachio to tebuconazole. Crop Protection 21:829-835.
14. Miller, R.W. 1994. Estimated peach tree losses 1980 to 1992 in South Carolina – causes and economic impact. p. 121-127. In: A.P. Nyczepir, P.F. Bertrand and T.G. Beckman (eds.). Proc 6th Stone Fruit Decline Workshop, 26-28 October, 1992, Ft. Valley, Ga.
15. Morgan, D.P., G.F. Driever and D. Felts. 2009. Evaluation of two disease warning systems for *Botryosphaeria* panicle and shoot blight of California pistachio and efficient control based on early-season sprays. Plant Dis. 93:1175-1181.
16. Murphy, B. 1997. North Carolina Commercial Fruit Tree Inventory Survey. http://www.ncagr.com/stats/fruit/survey/
17. Okie, W.R. and P.L. Pusey. 1996. USDA peach breeding in Georgia: current status and breeding for resistance to *Botryosphaeria*. Acta Hort. 374:151-158.
18. Okie, W.R. and C.C. Reilly. 1983. Reaction of peach and nectarine cultivars and selections to infection by *Botryosphaeria dothidea*. J. Amer. Soc. Hort. Sci. 108:176-179.
19. Pusey, P.L. 1989. Influence of water stress on susceptibility of nonwounded peach bark to *Botryosphaeria dothidea*. Plant Dis. 73:1000-1003.
20. Pusey, P.L. and P.F. Bertrand. 1993. Seasonal infection of nonwounded peach bark by *Botryosphaeria dothidea*. Phytopathology 83:825-829.
21. Pusey, P.L. and W.R. Okie. 1992. Update on peach tree fungal gummosis in the Southeast. p. 49-58. In: A.P. Nyczepir (ed.). Stone Fruit Tree Decline, Sixth Workshop Proc., Oct. 26-28, 1992, Fort Valley, Ga.
22. Smith, B.J. 2009. *Botryosphaeria* stem blight of southern blueberries: cultivar susceptibility and effect of chemical treatments. Acta Hort. 810:385-394.
23. Taylor, J.B. and W.B. Sherman. 1997. Foliar applied phosphorous fertilizers inhibit peach gummosis. Proc. Fla. State Hort. Soc. 110:182-183.
24. Weaver, D.J. 1979. Role of conidia of *Botryosphaeria dothidea* in the natural spread of peach tree gummosis. Phytopathology 69:330-334.