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Scab Occurrence on Pecan Clones in Alabama in a Year of High Disease Incidence[1]

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Abstract

Occurrence of scab, a fungus disease of pecan (*Carya illinoensis* (Wangenh.) K. Koch) caused by *Cladosporium caryigenum* (Ell. et Lang.) Gottwald [= *Fusicladium effusum* Wint.) was rated on 63 pecan clones at five locations in Alabama during a year of high disease incidence. Locally-selected clones of seedling origin, 'Deakle's Special,' 'Dixie,' and 'Gafford,' were entirely free of scab symptoms on both nuts and leaves of unsprayed trees. Advanced USDA selections 70-3-34 and 72-2-9 had very low scab incidence. Seven other USDA selections, 75-5-32, 78-15-51, 72-6-36, 76-7-41, 73-1-10, 72-10-51, and 70-4-9 had significantly worse scab than did the standard cultivar 'Desirable.'

Introduction

Scab is the most destructive and widespread disease of pecan (4). Cultivars vary greatly in susceptibility, and genetic resistance is a primary goal in breeding and selection of potential new cultivars for humid locations (8). In Alabama in 1991, preliminary observations in midseason indicated unusually high scab incidence following rainy humid weather that predominated throughout the state during spring and summer. This unusual season provided an uncommon opportunity for evaluating scab incidence, which was high even on fungicide-treated trees. The need for this information on promising clones, including many being considered for expanded evaluation by the USDA pecan breeding program, prompted this report. No published information on scab incidence is available for many of the clones evaluated in this report.

Materials and Methods

Scab incidence was rated at five locations in the southern half of Alabama during 1991. Four locations were experimental orchards with trees planted in a randomized, replicated test, and the other location was a grower's unsprayed orchard. The modified Barratt-Horsfall rating system proposed and illustrated by Bertrand (1) was used for all ratings. The ratings are based on the percent surface area visibly affected by symptoms: 1 = no disease, 2 = trace-6%, 3 = 7-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-94%, 7 = 95-99%, and 8 = 100%. Data from each location were subjected to statistical analysis, using analysis of variance procedures with mean separations using Duncan's Multiple Range test. The methods allowed for comparisons among cultivars at a given location, but not for comparisons across locations.

Ainsley orchard. This orchard located near Foley in Southwest Alabama is comprised of 11 clones topworked onto nine-year-old 'Cape Fear' trees in 1987. The design is a randomized complete block, with three single tree replications. Most of the clones are seedling selections from Alabama. The clones were included in the experiment because of previous observations of

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outstanding scab tolerance. 'Cape Fear' is included as a control cultivar for comparison. None of the trees have been sprayed with fungicide since the experiment began. Ratings of leaf and nut scab incidence were made on 20 randomly selected compound leaves and on 20 (where available) randomly selected nuts on each tree on 13 August 1991.

E. V. Smith Research Center. This orchard near Shorter, in east central Alabama, was planted in December, 1990. The trees were rated on 8 July 1991, in their first season of growth. Only leaves were available for rating on the nonbearing trees, and five randomly selected compound leaves were evaluated on each tree. The experiment is a randomized complete block with four two-tree replications, and twenty-two clones. None of the trees were sprayed with fungicides in 1991.

Tompkins orchard. This orchard was planted in 1986 near Union Springs in east central Alabama. There are 29 clones in a randomized complete block design, with three two-tree replications. Trees were sprayed twice in 1991 with 126 g propiconazol per ha (4.0 oz Orbit 3.6E per acre, Ciba-Geigy Corp., Greensboro, NC) prior to ratings on 26 August 1991. One spray was applied at budbreak and the other was applied two weeks later. This is a minimal spray program which was designed to maintain tree health but allow sufficient disease development for rating. Ten randomly selected compound leaves and nuts (when available) were rated on each tree.

Gulf Coast Substation. A pecan cultivar trial was planted near Fairhope, in Southwest Alabama, in February, 1983 (5). The station is near the Gulf of Mexico and Mobile Bay in a warm, humid climate, averaging over 60 inches of rainfall with an average growing season of 270 days. The planting is a randomized complete block design, with four five-tree replications for each of 14 clones in the main block. The observation block has nine additional clones with three trees of each in a completely randomized design. Ratings of leaf and nut scab incidence were made on 25 randomly selected compound leaves and on 25 randomly selected nuts on each tree on 14 Aug. 1991. Trees were sprayed in early season three times at two week intervals with propiconazol, then for the remainder of the season at three week intervals with triphenyltin hydroxide, following the standard fungicide spray schedule recommended in Alabama (11).

Williams orchard. This orchard was originally comprised of predominately 'Schley' and 'Success' trees approximately 60 years old near Grand Bay in southwest Alabama. Many of the trees in this orchard were topworked 15 years ago to an outstanding seedling selection named 'Cherryle' by the orchard owner, Wincen Williams. We were interested in 'Cherryle' because of its outstanding kernel quality, which we had judged in our Alabama pecan shows, and because of grower reports of outstanding performance with minimal care. We randomly selected five 'Cherryle' trees and five 'Success' trees for scab evaluation. Twenty compound leaves and nuts from each tree were rated for scab on 15 Aug. 1991. No fungicide sprays were applied in the orchard during 1991.

Results

Ainsley orchard. Scab incidence was high in this unsprayed orchard for the moderately susceptible standard cultivar 'Cape Fear' (Table 1). While all ten test selections had lower leaf scab incidence than 'Cape Fear,' seven of the eight selections having nuts had lower nut scab incidence than the standard. It appears that several of the selections have strong promise in relation to resistance to pecan scab. 'Deakle's Special,' 'Dixie,' 'Gafford,' and 'Jubilee,' which are seedling selections from Alabama, were entirely free

Table 1. Leaf and nut scab ratings in 1991 for pecan cultivars at the Ainsley orchard, Foley, Ala.[z]

Cultivar	Scab rating[y] leaf	nut
Deakle's Special	1.0 a	1.0 a
Dixie	1.0 a	1.0 a
Gafford	1.0 a	1.0 a
Jubilee	1.0 a	1.0 a
Francis	1.0 a	1.1 a
Syrup Mill	1.0 a	1.1 a
Behar's Bright	1.0 a	NA
Mayo	1.0 a	NA
Cherryle	2.0 b	2.8 b
King	2.5 c	5.0 c
Cape Fear	3.7 d	4.4 c

[z]Ratings made 13 August 1991. No fungicides applied.
[y]Scab ratings represent the mean percentage of leaf or nut surface area visibly affected by symptoms: 1 = no disease, 2 = trace-6%, 3 = 7-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-94%, 7 = 95-99%, and 8 = 100%. NA—Insufficient nuts available for rating.
[x]Mean separation in columns by Duncan's Multiple Range Test, 5% level.

of scab symptoms on both leaves and nuts at this location.

E. V. Smith Research Center. Scab incidence was higher than one might expect in a first-year planting and on a new site where inoculum levels could be expected to be low. Eight of the 22 clones, 7 numbered selections and 'Pawnee,' had significantly higher leaf scab incidence than did the standard cultivar 'Desirable' (Table 2). Conversely, the USDA selections 72-2-9 and 70-3-34, and 'Jubilee' had very low scab incidence. Perhaps testing of these should be expanded since these clones have exhibited adequate nut quality and size in preliminary evaluation.

Tompkins orchard. Only ten of the 29 test selections had sufficient nuts for rating, and there was a range of nut scab incidence from completely scab-free ('McMillan') to very severe ('Woodward' and 'Grimes') (Table 3). 'Elliott' was free of scab lesions on leaves. The incidence of scab on leaves of 'Cheyenne' and 'Desirable' was significantly higher than for the other 27 selections.

Gulf Coast Substation. Scab incidence was low with the full-season fungicide spray program at this location, but there was sufficient disease development to determine distinct differences among cultivars (Tables 4 and 5). No scab lesions were detected on sampled leaves and nuts from 'Elliott,' 'Gloria Grande,' 'Jubilee,' 'Melrose,' 'Schley Harris,' or USDA 56-6-148. 'Cheyenne' had the highest numerical scab incidence rating and significantly worse leaf and nut scab incidence than any of the other 14 selections in the main block.

Williams orchard. The mean scab rating on leaves of 'Cherryle' was 2.72 and the mean nut scab rating was 5.91.

Table 2. Leaf scab ratings in 1991 for pecan clones at the E. V. Smith Research Center, Shorter, Ala.[z]

Clone	Leaf scab rating[y]
Jubilee	1.0 a[x]
USDA 70-3-341	1.1 ab
USDA 72-2-9	1.1 ab
USDA 76-4-44	1.2 abc
USDA 72-6-12	1.2 abc
Oconee	1.4 abc
USDA 74-4-3	1.4 abc
Kendale	1.5 abc
Surprize	1.7 bcd
USDA 70-6-13	1.7 bcd
Desirable	1.8 cde
USDA 74-1-12	2.1 def
Moreland	2.2 efg
USDA 70-6-15	2.3 efg
USDA 70-4-9	2.5 fg
USDA 72-10-51	2.6 fgh
USDA 73-1-10	2.8 gh
Pawnee	3.1 hi
USDA 72-6-36	3.2 hi
USDA 76-7-41	3.2 hi
USDA 78-15-51	3.4 i
USDA 75-5-32	4.0 j

[z]Ratings made 6 September 1991. No fungicides applied.
[y]Scab ratings represent the mean percentage of leaf or nut surface area visibly affected by symptoms: 1 = no disease, 2 = trace-6%, 3 = 7-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-94%, 7 = 95-99%, and 8 = 100%.
[x]Mean separation in columns by Duncan's Multiple Range Test, 5% level.

Table 3. Leaf and nut scab ratings in 1991 for pecan clones at the Tompkins orchard, Union Springs, Ala.[z]

Clone	Scab rating[y]	
	leaf	nut
Jubilee	1.0 a	1.8 ab
Gloria Grande	1.0 a	2.5 bc
Elliott	1.0 a	NA
McMillan	1.1 a	1.0 a
Melrose	1.1 a	NA
Sumner	1.1 a	NA
Super Stuart	1.1 a	NA
Grimes	1.2 ab	6.0 f
Carter	1.2 ab	NA
Candy	1.3 ab	NA
Kiowa	1.5 abc	NA
Gracross	1.6 abcd	NA
USDA 64-16-182	1.7 abcde	4.4 e
Pawnee	1.7 abcde	NA
Jackson	1.8 abcde	NA
USDA 53-9-225	2.0 abcde	2.6 bcd
Choctaw	2.3 bcdef	3.8 de
USDA 55-23-30	2.6 cdef	3.3 cde
Woodward	2.8 def	6.3 f
Stuart	2.0 abcde	NA
Forkert	3.2 f	NA
Owens	3.2 f	NA
Western	3.2 f	NA
Cape Fear	3.3 fg	NA

[z]Ratings made 14 August 1991. A full season fungicide spray program (see text) was applied.
[y]Scab ratings represent the mean percentage of leaf or nut surface area visibly affected by symptoms: 1 = no disease, 2 = trace-6%, 3 = 7-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-94%, 7 = 95-99%, and 8 = 100%. NA—Insufficient nuts available for rating.
[x]Mean separation in columns by Duncan's Multiple Range Test, 5% level.

These ratings were compared to 2.77 for leaf scab and 6.22 for nut scab on the standard 'Success.' Ratings did not differ (P = .05) between the two cultivars. Moderate scab susceptibility for 'Cherryle' is indicated, and agrees with the ratings for the same cultivar at the Ainsley orchard.

Discussion

Many observations from numerous locations and years would be necessary to confidently predict the scab resistance of a pecan clone. Physiologically different strains of scab exist at different locations 3, 5,). A given clone may appear resistant at one location but quite susceptible at another. The fungus is known to adapt so that a previously resistant clone often eventually becomes susceptible (2, 9). Therefore, clones that had few symptoms in this evaluation may not necessarily exhibit a comparable degree of scab resistance at all other locations.

On the other hand, the 1991 season was a season in which scab incidence was very high, and the presence of high levels of inoculum provided a good opportunity for expression of symptoms if a clone was susceptible to the strain present at the test location. While it cannot be presumed that the high degree of scab resistance exhibited by many clones will persist at other locations, those exhibiting scab resistance in this particular year do warrant further evaluation.

We also suggest that those cultivars that had a high incidence of scab in

Table 4. Leaf and nut scab ratings for pecan clones in the main block at the Gulf Coast Substation, Fairhope, Ala.[z]

Clone	Scab rating[y]	
	leaf	nut
Elliott	1.0 a[x]	1.0 a
Melrose	1.0 a	1.0 a
Sumner	1.0 a	1.0 a
USDA 61-6-67	1.0 a	1.0 a
Davis	1.0 a	1.1 a
Jackson	1.0 a	1.2 ab
USDA 53-9-1	1.0 a	1.3 bc
Choctaw	1.1 ab	1.5 cd
Kiowa	1.2 b	1.1 a
Pawnee	1.2 bc	1.9 e
Forkert	1.3 c	1.3 bc
Stuart	1.3 c	2.2 f
Cape Fear	1.6 d	1.7 de
Maramec	1.6 d	2.5 f
Cheyenne	3.2 e	4.2 g

[z]Ratings made 14 August 1991. A full season fungicide spray program (see text) was applied.
[y]Scab ratings represent the mean percentage of leaf or nut surface area visibly affected by symptoms: 1 = no disease, 2 = trace-6%, 3 = 7-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-94%, 7 = 95-99%, and 8 = 100%.
[x]Mean separation in columns by Duncan's Multiple Range Test, 5% level.

Table 5. Leaf and nut scab ratings in 1991 for pecan clones in the observation block at the Gulf Coast Substation, Fairhope, Ala.[z]

Clone	Scab rating[y]	
	leaf	nut
Gloria Grande	1.0 a	1.0 a
Jubilee	1.0 a	1.0 a
Pioneer	1.0 a	1.0 a
Schley/Harris	1.0 a	1.0 a
USDA 56-6-148	1.0 a	1.0 a
Candy	1.0 a	1.3 a
Surprize	1.2 a	1.3 a
Owens	1.3 a	1.1 a
Shoshoni	1.3 a	1.4 a

[z]Ratings made 14 August 1991. A full season fungicide spray program (see text) was applied.
[y]Scab ratings represent the mean percentage of leaf or nut surface area visibly affected by symptoms: 1 = no disease, 2 = trace-6%, 3 = 7-25%, 4 = 26-50%, 5 = 51-75%, 6 = 76-94%, 7 = 95-99%, and 8 = 100%.
[x]Mean separation in columns by Duncan's Multiple Range Test, 5% level.

these evaluations may not exhibit sufficient resistance to be considered for release in humid areas of very high disease incidence. Often, when cultivars are widely planted in monoculture, disease incidence becomes worse as orchards mature. Therefore, it is presumed that scab may intensify over time with these genotypes. Genotypes showing high susceptibility possibly can be grown in more normal years of less scab pressure and with various levels of chemical scab control.

Literature Cited

1. Bertand, P. 1984. Disease evaluation. pp. 46-52 *in* Crocker, T. F., Pecan pest management in the Southeast. Ga. Coop. Ext. Serv. MP-176.
2. Cole, J. R., and A. C. Gossard. 1956. Stuart pecan found to be susceptible to scab in Mississippi. Plant Dis. Rep. 40(2):156.
3. Converse, R. H. 1960. Physiologic specialization in *Fusicladium effusum* and its evaluation in vitro. Phytopathology 50(7):527-531.
4. Demaree, J. B. 1924. Pecan scab with special reference to sources of early spring infections. J. Agric. Res. 3:321-333.
5. Demaree, J. B. and J. R. Cole. 1929. Behavior of *Cladosporium effusum* (Wint.) Demaree on some varieties of pecan. J. of Agric. Res. 38(6):363-370.
6. Goff, W. D., R. McDaniel, and E. Carden. 1991. Pecan cultivars for landscape and home plantings in the Southeastern U.S. J. of Arboriculture 17(3):73-78.
7. Goff, W. D., M. Patterson, and J. R. McVay. 1989. Pecan Production Circ. ANR-54. Ala. Coop. Ext. Ser.
8. Hunter, R. E., T. E. Thompson, and R. S. Sanderlin. 1986. Control of pecan diseases through genetic resistance. Proc. SE Pecan Growers Assoc. 79:51-54.
9. KenKnight, G. 1968. Resistance of pecan to scab and bunch disease in Louisiana. Plant Disease Reporter 51(4):307-309.
10. Latham, A. J. 1982. Effects of some weather factors and *Fusicladium effusum* conidium dispersal on pecan scab occurrence. Phytopathology 72:1339-1345.
11. McVay, J. R., W. D. Goff, P. Estes, W. S. Gazaway, M. Patterson and J. Everest. 1991. Commercial pecan insect, disease and weed control recommendation. Cir. ANR-27. Ala. Coop. Ext. Ser.

Blossom Season and Peach Seed Germination

A highly significant correlation was observed between time of bloom and the number of days required for resulting selfed seed to reach 80% germination of both local Mexican (r = 0.71) and introduced (r = 0.87) genotypes. Pollinating peaches with low chilling requirement with high chilling requirement types delayed germination up to 16 days compared to seeds from selfing. Reversing the process and putting pollen from low chilling requirement types on late blossoming types accelerated germination 10 to 24 days.

From: Perez-Gonzales, S. 1990. Relationship between parental blossom season and speed of seed germination in peach. *HortScience* 25(8):958-960.