Resistance of Peanut Germplasm to Sclerotinia Sclerotiorum[1]

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ABSTRACT

Several peanut cultivars, breeding lines, and plant introductions were screened in the field for susceptibility to Sclerotinia blight, caused by **Sclerotinia sclerotiorum.** Differences in susceptibility ranged from slight to severe. Of the cultivars screened, Florigiant appeared to be the most resistant to **S. sclerotiorum.** Florigiant and NC 17165 pod yields were significantly greater and plants were killed less frequently than plants of other cultivars. Breeding lines with Spanish and Valencia pedigrees were more resistant to **S. sclerotiorum** than **Florigiant.**

Additional index words: **Arachis hypogaea,** soilborne pathogens, **Whetzelinia sclerotiorum,** ground nut.

Sclerotinia blight, caused by *Sclerotinia sclerotiorum* (Lib.) DeBary (*S. minor* Jagger) (11), has recently become a serious disease of peanuts (*Arachis hypogaea* L.) in Virginia and North Carolina. This disease was found in isolated areas of the peanut belt of both states in 1972 (10). Sclerotinia blight was widespread in Virginia in 1974 (Powell and Porter, unpublished data). The degree of infection ranged from slight to severe, and under severe disease conditions, pod yields were greatly reduced. Although certain fungicides provide excellent control of Sclerotinia blight of peanuts, none is cleared for use at this time (2).

The increase in the severity of Sclerotinia blight of peanuts in both states seems to have coincided with improved fungicidal control of the Cercospora leafspot fungi. Leafspot control reduced defoliation and enhanced plant growth (9). With other crops such as beans (6, 7), tomatoes (7), potatoes (7, 8), and mint (12), luxuriant plant growth also enhances the severity of *S. sclerotiorum.* Haas and Bolwyn (6) noted that high plant-top weight was correlated with the severity of white mold of bean caused by *S. sclerotiorum.* Beans with smaller plant types were less susceptible to *S. sclerotiorum* than larger types of plants (1). Excessive plant growth and dense foliage favors reduced air circulation, higher humidities, prolonged dews, and cooler soil temperatures, especially along the soil surface. Prime requisites for infection of other crops by *S. sclerotiorum* include high humidity (3, 6, 7), moderate temperatures of 16-27 C (4, 6) and heavy dews (5).

Reported here are field data collected on peanut susceptibility to *S. sclerotiorum.* The objectives were (a) to determine the relative susceptibility of currently grown peanut cultivars to *S. sclerotiorum,* (b) to determine levels of resistance to *S. sclerotiorum* in certain peanut breeding lines and plant introductions.

Materials and Methods

Peanut cultivars, breeding lines, and plant introductions were grown during 1973 and 1974 in selected fields in Virginia and North Carolina having histories of Sclerotinia blight. Land preparation, planting of seed (May 10-15), cultivation, and pesticide usage were the same as those recommended for growers. Nematicides were not used. Plots (two rows wide and 15 m long) were arranged in randomized complete blocks with four replications.

The percentage of plants infected was determined by the presence of visible above ground symptoms. A plant having any evidence of disease, however slight or severe, was considered infected. The disease index was established on a scale of 1 to 5, with 1 being severely infected and 5 with no infection. Observations reported are the means of scores obtained by two individuals. The number of rotted pods per plant was determined by a scale of 1 to 10, with 1 being 0-10% of pods rotted and 10 being 91-100% of pods rotted. To determine yield, peanuts were windrowed for 3 days following digging, pods were picked from plants and dried to a moisture content of ca 12%, and weight per plot was calculated.

Table 1. Susceptibility of peanut genotypes to Sclerotinia sclerotiorum in Virginia during 1973.

Genotypes	% Infected Plants[1/]		
	Aug. 16	Aug. 28	Sept. 28
F 439-16-6	44[a 2/]	60[a]	38[abc]
NC 344	40[a]	61[a]	38[abc]
Va. 61R	28[ab]	59[a]	38[abc]
Va. Bunch 46-2	26[ab]	50[a]	41[abc]
Ga. 119-20	25[ab]	54[a]	68[a]
NC-Fla 14	22[ab]	36[a]	28[bc]
Va. 70C	20[ab]	58[a]	41[abc]
NC 5	20[ab]	54[a]	41[abc]
NC 17	19[ab]	45[a]	25[c]
Va. 56R	19[ab]	24[ab]	15[c]
NC 17165	15[bc]	35[a]	34[abc]
Wvoco 11	15[bc]	51[a]	65[ab]
NC 2	15[bc]	35[a]	18[c]
Shulamit	14[bc]	35[a]	54[abc]
Va. 72R	14[bc]	55[a]	40[abc]
IAR 71-369	10[bc]	49[a]	39[abc]
Florunner	10[bc]	35[a]	34[abc]
Florigiant	8[c]	16[b]	24[c]
P. I. 343392	5[c]	42[a]	45[abc]

1/ Percentage of infected plants per 18 m row.

2/ Means followed by same letter are not significantly different at the 5% level according to Duncan's multiple-range test.

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Table 2. Susceptibility of peanut genotypes to infection by Sclerotinia sclerotiorum in Virginia during 1974.

Genotypes	% Infected plants[1]				D. I.[2]	Dead Plants[1]	Yield (Kg/ha)
	Aug. 22	Aug. 29	Sept. 5	Oct. 1	Oct. 1	Sept. 5	Oct. 15
Shulamit	46[a][3]	53[ab]	61[a]	100[ns]	1[a]	5[ab]	1,099[ab]
Va. 72R	45[a]	57[a]	59[ab]	100	2[ab]	1[cd]	1,309[bcd]
Va. 70C	45[a]	53[ab]	62[a]	100	2[ab]	5[ab]	1,167[ab]
Florunner	43[ab]	51[ab]	52[ab]	100	1[a]	2[bc]	1,553[def]
Va. Bunch 46-2	41[ab]	54[ab]	61[a]	100	1[a]	3[bc]	874[a]
NC 17	41[ab]	54[ab]	62[a]	100	2[ab]	7[a]	1,492[de]
NC 344	39[ab]	52[ab]	61[a]	100	2[ab]	7[a]	1,167[ab]
NC-Fla 14	39[ab]	50[ab]	57[ab]	100	2[ab]	3[bc]	1,432[cde]
NC 5	39[ab]	51[ab]	60[ab]	100	3[b]	3[bc]	1,432[cde]
Avoco 11	39[ab]	44[cd]	49[ab]	100	3[b]	2[bc]	1,240[bc]
Va. 61R	37[bc]	49[bc]	61[a]	100	3[b]	1[cd]	1,356[cd]
F439-16-6	35[bc]	49[bc]	56[ab]	100	1[a]	7[a]	1,363[cd]
NC 17165	34[bc]	51[ab]	47[b]	100	2[ab]	0[d]	1,743[f]
Va. 56R	34[bc]	48[bc]	56[ab]	100	1[a]	2[bc]	1,146[ab]
Ga. 119-20	34[bc]	42[cd]	55[ab]	100	2[ab]	1[cd]	1,519[de]
NC 2	33[bc]	45[bcd]	57[ab]	100	2[ab]	2[bc]	1,403[cd]
IAR 71-369	30[c]	42[cd]	53[ab]	100	1[a]	1[cd]	1,661[ef]
Florigiant	21[cd]	39[cd]	45[b]	100	3[b]	0[d]	1,696[ef]
P. I. 343392	18[d]	28[e]	33[c]	100	1[a]	1[cd]	1,472[de]

1/ Percentage of infected plants and number of dead plants per 18 m row.

2/ Disease index scale 1 to 5; with 1 severe infection and 5 no infection.

3/ Means followed by same letter are not significantly different at the 5% level according to Duncan's multiple-range test.

Results and Discussion

S. sclerotiorum infected all peanut genotypes screened in the field in Virginia and North Carolina during 1973 and 1974. However, differences in susceptibility were reflected by the percentage of plants infected, number of plants killed, disease severity, and yield (Tables 1, 2, 3, 4). In 1973, significant differences between peanut cultivars and susceptibility to *S. sclerotiorum* were noted on August 16, August 28 and September 28 (Table 1). On these dates, infection by *S. sclerotiorum* was significantly less in Florigiant plots than in most other plots, particularly on August 16. None of the breeding lines and plant introductions were any more resistant to *S. sclerotiorum* than Florigiant.

In Virginia in 1974, environmental conditions were favorable and Sclerotinia blight was severe. Significantly fewer infected plants were found in plots of Florigiant than in plots of Shulamit, NC 17, Va. 70C, Va. Bunch 46-2 and NC 344 (Table 2). On August 29 and September 5 significantly fewer infected plants were observed in plots of P. I. 343392 than in plots of Florigiant. On October 1, all plants in each plot were infected. However, on this date disease severity ratings among genotypes were distinct (Table 2). The average number of dead plants per plot ranged from 0 to 7 (Table 2). Dead plants were not observed in plots of Florigiant or NC 17165. Yields of peanuts grown under severe Sclerotinia blight conditions ranged from 874 to 1,743 kg/ha (Table 2). Highest yields were recorded in plots of NC 17165 and Florigiant. Lowest yields were noted in plots of Va. Bunch 46-2, Shulamit, Va. 70C, and Va. 56R.

Table 3. Susceptibility of peanut genotypes to Sclerotinia sclerotiorum in North Carolina during 1974.

Genotypes	% Infected plants[1] Sept. 18	Rotted pods[2] Oct. 6
Florunner	53[a][3]	1.7[ab]
Va. 72R	46[a]	1.3[ab]
Goldin 1	39[ab]	2.0[ab]
NC-Fla 14	38[ab]	2.7[a]
Shulamit	36[ab]	2.3[a]
NC 5	33[ab]	1.3[ab]
NC 4	25[ab]	1.7[ab]
NC 2	25[ab]	1.3[ab]
NC 17	23[ab]	1.7[ab]
Avoco 11	21[ab]	1.3[ab]
Va. 70C	15[b]	1.0[b]
Florigiant	14[b]	1.0[b]

1/ Percentage of infected plants per 30 m row.

2/ Percentage of rotted pods made by visual examination using a scale of 1 for 0-10% rot and 10 for 91-100% rot.

3/ Means followed by the same letter are not significantly different at the 5% level according to Duncan's multiple-range test.

In North Carolina in 1974, under moderate disease conditions, the percentage of infected plants per row on September 18 ranged from 14 to 53 (Table 3). Plots of Florigiant and Va. 70C exhibited significantly fewer infected plants than plots of Florunner and Va. 72R. Significantly less pod

Table 4. Susceptibility of peanut genotypes including breeding lines and plant introductions to Sclerotinia sclerotiorum in North Carolina during 1974.

Genotypes	Botanical[1] Type	% Infected[2] Plants Sept. 18	Rotted[3] Pods Oct. 6
Va. 61R X NC 5	Virginia	80[a][4]	1.3[ab]
NC 5 X Fla 393	Virginia	65[ab]	2.0[ab]
Florigiant X NC 5	Virginia	44 [bc]	1.7[ab]
NC 5 X Acc. 6339	Virginia	44 [bc]	0.7 [b]
NC 5 X Acc. 7484	Virginia	34 [bcd]	2.7[a]
Florigiant X Acc. 6333	Virginia	30 [cd]	1.3[ab]
NC 2 X NC 5	Virginia	29 [cd]	0.7 [b]
NC 5 X Acc. 9088	Virginia	27 [cd]	1.0 [b]
B_2 (Gregory Coll. No. 486)	Virginia	27 [cd]	0.7 [b]
A_2 (Gregory Coll. No. 190)	Valencia	17 [cd]	1.3[ab]
Florigiant X Acc. 7484	Virginia	16 [cd]	0.3 [b]
Florigiant	Virginia	14 [cd]	1.0 [b]
P. I. 262090	Virginia	12 [cd]	1.0 [b]
P. I. 262000	Spanish	9 [d]	1.7[ab]
P. I. 275751	Valencia	7 [d]	1.0 [b]
P. I. 261924	Spanish	5 [d]	0.7 [b]

1/ Classification of botanical type based on branching pattern.

2/ Percentage of infected plants per 30 m row.

3/ Percentage of rotted pods made by visual examination using a scale of one for 0-10% rot and 10 for 91-100% rot.

4/ Means followed by same letter are not significantly different at the 5% level according to Duncan's multiple-range test.

rot occurred on Florigiant and Va. 70C than on cultivars NC-Fla 14 and Shulamit.

Of the 15 breeding lines screened in North Carolina in 1974, the number of infected plants per row ranged from 5 to 80 (Table 4). Three of the most resistant plant introductions were of the Spanish and Valencia botanical plant types. All breeding lines with NC 5 in their pedigree were highly susceptible to Sclerotinia blight.

Although Florigiant and NC 17165, both Virginia botanical types, were more resistant to *S. sclerotiorum* than other currently grown cultivars, the level of resistance was not great enough to prevent drastic reductions in pod yield. Spanish and Valencia botanical types might offer sources of greater resistance to *S. sclerotiorum* and should be utilized in future breeding programs.

Literature Cited

1. Anderson, F. N., J. R. Steadman, D. P. Coyne and H. F. Schwartz. 1974. Tolerance to white mold in Phaseolus vulgaris dry edible bean types. Plant Dis. Reptr. 58:782-784.
2. Beute, M. K., D. M. Porter and B. A. Hadley. 1975. Control of Sclerotinia blight of peanuts. Plant Dis. Reptr. (in press).
3. Burke, D. W., J. C. Gomes and W. G. Foeppel. 1957. Observations on Sclerotinia wilt of beans in northeastern Colorado. Plant Dis. Reptr. 41:72-73.
4. Cappellini, R. A. 1960. Field inoculations of forage legumes and temperature studies with isolates of Sclerotinia trifoliorum and Sclerotinia sclerotiorum. Plant Dis. Reptr. 44:862-864.
5. Eddins, A. H. 1937. Sclerotinia rot of Irish potatoes. Phytopathology 27:100-103.
6. Haas, J. H. and B. Bolwyn. 1972. Ecology and epidemiology of Sclerotinia wilt of white beans in Ontario. Can. J. Plant Sci. 52:525-533.
7. Moore, W. D. 1955. Relation of rainfall and temperatures to the incidence of Sclerotinia sclerotiorum in vegetables in South Florida during the years 1944 to 1954. Plant Dis. Reptr. 39:470-472.
8. Partyka, R. E. and W. F. Mai. 1962. Effects of environment and some chemicals on Sclerotinia sclerotiorum in laboratory and potato field. Phytopathology 52:766-770.
9. Porter, D. M. 1970. Effectiveness of benomyl in controlling Cercospora leafspot of peanuts. Plant Dis. Reptr. 54:955-958.
10. Porter, D. M. and M. K. Beute. 1974. Sclerotinia blight of peanuts. Phytopathology 64:263-264.
11. Purdy, L. H. 1955. A broader concept of the species Sclerotinia sclerotiorum based on variability. Phytopathology 45:421-427.
12. Skotland, C. B. and J. D. Menzies. 1957. Two peppermint diseases found in the Yakima valley of Washington. Plant Dis. Reptr. 41:493-495.