

Resistance of Peanut Genotypes to *Cylindrocladium Crotalariae*¹

J. C. Wynne, R. C. Rowe, and M. K. Beute²

ABSTRACT

Peanut (*Arachis hypogaea*) genotypes representing Virginia, Spanish, and Valencia botanical types were screened for resistance to *Cylindrocladium* black rot (*Cylindrocladium crotalariae*) at two North Carolina locations for two seasons. Means for percentages of visibly infected plants and the degree of pod damage were lower for the Spanish types than for either the Valencia or Virginia types. Some genotypes did not perform consistently at the two locations. NC Acc 3033, a small-fruited Virginia type having Spanish 2B in its parentage, was the most resistant line at both locations and offers a source of germplasm usable in developing CBR-resistant varieties.

Additional index words: Disease resistance, black rot.

Cylindrocladium black rot (CBR) of peanuts (*Arachis hypogaea* L.), caused by *Cylindrocladium crotalariae* (Loos) Bell and Sobers, is a relatively new disease of peanuts which poses a serious threat to continued production in the southeastern United States. This disease was first identified in North Carolina in 1970 (1), and by the end of the 1973 growing season CBR was found in 13 of 17 peanut-producing counties (2). Some control of the disease has been demonstrated with the use of wide-spectrum soil biocides, especially sodium azide (2). However, control of CBR with chemicals in North Carolina has been erratic (M. K. Beute, 1974, unpublished data). A preliminary study has shown that peanut cultivars varied in susceptibility to CBR (2). Consequently, an extensive program was initiated to determine if sources of resistance could be found in cultivated peanuts. This paper reports the results of screen-

ing a diverse collection of peanut germplasm for CBR resistance in two naturally infected North Carolina soils.

Materials and Methods

Peanut lines were planted in fields infested with *C. crotalariae* at two locations in North Carolina during the 1973 and 1974 growing seasons. Soil types of the two fields, located ca. 50 miles apart in Martin and Northampton counties, were a Dunbar fine sandy loam and a Wagram loamy sand, respectively. The Martin County field is the oldest known site of infestation in North Carolina.

A total of 103 entries were evaluated in 1973 and/or 1974. Forty-seven peanut genotypes representing Virginia, Spanish, and Valencia types were tested for CBR resistance during 1973 in a single randomized block design. Twenty-eight of the 47 lines tested in 1973 plus an additional 56 entries (lines and check cultivars) were screened during 1974.

Entries were evaluated in three separate randomized block designs at each location during 1974. Each line was replicated twice in 1973 and three times in 1974. Plots consisted of two rows ca. 6 m in length with 30 seeds planted per row in 1973 and 12 m in length with 50 seeds per row in 1974. The number of visibly infected and dead plants were counted for each entry in late September or early October. Pod damage was evaluated at harvest on a scale of 0 to 5 with 1 = 1-20% and 5 = 81-100% damaged pods.

Results and Discussion

All botanical types tested were susceptible to *C. crotalariae* infection, but large differences in genotypic response within each botanical type were observed (Tables 1-3). As a group, Spanish cultivars or lines were more resistant than either Valencia or Virginia - type lines. The six Spanish lines tested for 2 years at both locations had an average of 6.7% visibly infected plants, while the five Valencia and the 20 Virginia lines averaged 15.9 and 22.9%, respectively. Pod damage ratings were also lowest for the Spanish types, averaging 1.6 compared to 3.1 for the Valencia types and 3.4 for the Virginia types (Table 1). The comparison of 12 Virginia with 14

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²Assistant Professor of Crop Science; former Research Associate of Plant Pathology (presently with Department of Plant Pathology, Ohio Agricultural Research and Development Center, Wooster, Ohio 44691) and Associate Professor of Plant Pathology, North Carolina State University, Raleigh, N. C. 27607; respectively.

Spanish lines in a separate test conducted at both locations during 1974 verifies these results. The Spanish lines averaged 11% visibly infected plants and had a pod rating of 3.0 compared to 28% visibly infected plants and a pod rating of 4.3 for the Virginia types. The most resistant line tested, however, was a Virginia type, NC Acc 3033 (Table 1). It had the lowest percentage of visibly infected plants and the least pod damage. NC Acc 3196, also a Virginia type with A48 (NC 4 x Spanish 2B) as a common parent with Acc 3033, was also as resistant as the Spanish cultivars tested (Table 1). Both NC Acc 3033 and NC Acc 3196 have small fruit and do not meet the market specifications for large-seeded Virginia peanuts. The pedigrees of both lines include Spanish types and both were previously selected for resistance to southern stem rot caused by *Sclerotium rolfsii* Sacc.

Table 1. Disease response of selected peanut lines grown at two locations during 2 years in fields infested with *Cylindrocladium crotalariae*.*

NC accession	Identity	Botanical classification	% visibly infected plants [†]	Pod rating [‡]
3033	Ga 207-7 x A48	Virginia	3 ^a	1.3 ^a
15936	Argentine	Spanish	6 ^a	2.4 ^{c-f}
3196	(547 x 549) x A48	Virginia	6 ^{ab}	2.5 ^{c-g}
15938	Dixie Spanish	Spanish	8 ^{a-c}	1.8 ^{a-c}
353	Schwarz 21	Spanish	8 ^{a-d}	2.2 ^{b-d}
15941	Spanhoma	Spanish	8 ^{a-d}	3.0 ^{d-1}
15937	Tennessee Red	Valencia	10 ^{a-d}	1.8 ^{a-c}
15940	Starr	Spanish	11 ^{a-d}	2.9 ^{d-1}
15939	Spantex	Spanish	12 ^{b-e}	2.3 ^{c-e}
15946	PI 331283	Valencia	13 ^{c-f}	3.5 ^{h-k}
10454a	F ₃ 4507 x A8	Virginia	16 ^{c-f}	3.1 ^{e-1}
7510	F ₃ 4507 x F ₇ #13	Virginia	16 ^{c-f}	3.1 ^{e-1}
3284	(547 x 549) x Ga 207-7	Virginia	19 ^{d-g}	3.2 ^{f-j}
15949	PI 337380	Valencia	19 ^{d-h}	3.3 ^{f-k}
3139	NC 2 x A48	Virginia	21 ^{e-i}	1.5 ^{ab}
10452a	F ₃ 4507 x A8	Virginia	23 ^{e-i}	2.7 ^{d-h}
10488a	F ₃ 4507 x F ₃ 4508	Virginia	25 ^{e-i}	2.5 ^{c-g}
10475a	F ₃ 4508 x F ₃ 4508	Virginia	25 ^{f-i}	3.4 ^{h-k}
10211a	F ₃ 4507 x Reurved	Virginia	27 ^{f-i}	4.4 ¹
15973	Florunner	Virginia	28 ^{f-i}	3.3 ^{f-k}
1908	Flop	Virginia	30 ^{g-i}	3.5 ^{h-k}
1943	Hedera	Virginia	30 ^{g-i}	4.0 ^{j-1}
323	NC 2	Virginia	31 ^{g-i}	3.5 ^{h-k}
15942	PI 337396	Valencia	33 ^{h-j}	3.0 ^{d-1}
348	Florigiant	Virginia	34 ^{jk}	4.2 ^{kl}
10477b	F ₃ 4508 x F ₃ 4508	Virginia	36 ^k	3.3 ^{f-k}
333	NC 5	Virginia	39 ^k	4.3 ¹
342	F ₇ #7	Virginia	50 ^k	3.6 ⁱ⁻¹

*Means are averaged for four tests. Means in columns with letters in common are homogeneous (P = 0.05 by Duncan's multiple range test).

†Data transformed and significance established using arcsin scale.

‡Explanation of rating system: 1 = 1-20% and 5 = 81-100% damaged pods.

All of the large-seeded Virginia types tested were extremely susceptible to *C. crotalariae*. The Virginia-type commercial cultivars and several advance generation breeding lines had from 23 to 40% visibly infected plants and pod ratings ranging from 3.7 to 5.0. Development of CBR-resistant large-seeded Virginia cultivars may be possible by transfer of resistance from Spanish lines.

A significant location x entry interaction (P =

Table 2. Disease response of selected peanut lines grown during 1 year in fields infested with *Cylindrocladium crotalariae*.

NC accession and year grown	Identity	% visibly infected plants*	Pod rating [†]
1973			
15907	Va 72R	23 ^a	3.8 ^{bc#}
10247	(F ₇ #13 x Reurved)	24 ^a	3.3 ^b
15729	(C12 x A18) X ₇ X ₅ X ₃ X ₁	25 ^a	3.8 ^{bc}
10449a	F ₃ 4507 x F ₃ 4508	25 ^a	4.0 ^{bc}
15949	New Mexico Valencia	25 ^a	3.8 ^{bc}
15745	(C12 x A18) X ₇ X ₅ X ₁	27 ^{ab}	3.8 ^{bc}
15948	PI 331286	29 ^{ab}	3.0 ^{ab}
302	45184 (C12 x C37)	30 ^{ab}	4.0 ^{bc}
6727	F ₃ 4518 x F ₃ 4507	33 ^{ab}	2.3 ^a
301	45185 (C12 x C37)	33 ^{ab}	4.5 ^c
10450a	F ₃ 4507 x F ₃ 4508	35 ^{ab}	3.8 ^{bc}
1268	PI 149645	35 ^{ab}	3.5 ^b
1715	Cup	40 ^{ab}	3.5 ^b
343	F ₇ #10 (C12 x C37)	41 ^{ab}	4.0 ^{bc}
15943	PI 331304	42 ^{ab}	4.8 ^c
324	NC 4	43 ^{ab}	3.5 ^b
10488a	F ₃ 4507 x F ₃ 4508	43 ^{ab}	3.8 ^{bc}
10272	(4508 x Reurved)	43 ^{ab}	3.3 ^b
408	Holland Va. Runner	48 ^b	4.0 ^{bc}
1974			
6339	F ₃ 3424 x F ₇ #13	16 ^a	3.0 ^b
7226	F ₇ #13 x F ₃ 4508	18 ^{ab}	3.8 ^{cd}
6735	F ₃ 4508 x F ₃ 4507	30 ^{bc}	3.0 ^b
10477a	F ₃ 4508 x F ₃ 4508	33 ^c	1.8 ^a
15714	NC-F1a 14	35 ^c	4.7 ^{de}
896	PI 162858	36 ^c	4.0 ^{c-e}
17111	PI 269092	36 ^c	2.7 ^{ab}
17096	Avoca 102	39 ^c	3.7 ^{b-d}
849	PI 152122	43 ^{cd}	3.7 ^{b-d}
438	Bulk from Japan	53 ^d	5.0 ^e

*Means are averaged for two tests. †Explanation of rating system: Rated with 1 = 1-20% and 5 = 81-100% damaged pods. #Means in columns with letters in common are homogeneous (P = 0.05 by Duncan's multiple range test).

0.01) was found when data from the 28 lines grown at both locations over both years were analyzed. The location x entry interaction was also significant for both traits for the test involving the 12 Virginia and 14 Spanish cultivars conducted during 1974. For the 1974 test involving only the large-seeded Virginia types, neither trait showed a significant location x entry interaction. The significant interaction obviously occurs because of the differential response of the Virginia types at the two locations (Fig. 1). Some Virginia-type lines such as NC Acc 342, NC 4, Shulamit, NC 2, and NC 5 have greater percent visibly infected plants when grown at the Northampton location, while other lines such as NC Acc 1908, Florigiant, and Florunner show fewer diseased plants at the Northampton location. The Spanish lines and some lines such as NC Acc 3033 show little differential response to location. The significant location x entry interaction could indicate differences in the populations of *C. crotalariae* at the two locations, although Rowe and Beute (3) could not detect physiological races of the fungus when they screened six peanut cultivars in the greenhouse. Further examination of the response of the diverse genotypes shown in Figure 1 to different isolates of the fungus should be made.

Table 3. Disease response of commercial cultivars and advanced generation breeding lines grown at two locations during 1974 in fields infested with *Cylindrocladium crotalariae*.

NC accession	Identity	% visibly infected plants*	Pod rating†
15973	Florunner	23 ^a	3.7 ^{a#}
17178	Goldin I	24 ^{ab}	4.8 ^{de}
323	NC 2	25 ^{ab}	4.0 ^{a-c}
17087	Avoca 11	25 ^{ab}	4.2 ^{a-d}
1132	C-35	26 ^{a-c}	4.7 ^{c-e}
731	Va. Runner; Safahan, Iran	27 ^{a-d}	4.3 ^{a-e}
693	3278 (Va 110740 x Cullipher, 1938)	29 ^{a-d}	3.8 ^{ab}
333	NC 5	29 ^{a-d}	4.2 ^{a-d}
15905	Va 72R	30 ^{a-d}	4.2 ^{a-d}
1046	A-36	30 ^{a-d}	3.8 ^{ab}
17163	NC 5 x Florigiant	30 ^{a-d}	4.5 ^{b-e}
17211	NC 5 x Florigiant	30 ^{a-d}	4.3 ^{a-e}
15714	NC-Fla 14	33 ^{a-e}	5.0 ^e
17209	NC 5 x Fla 393	36 ^{a-e}	4.5 ^{b-e}
17215	NC 5 x Va 61R	36 ^{a-e}	4.8 ^{de}
348	Florigiant	37 ^{b-e}	4.3 ^{a-e}
15717	NC 17	37 ^{b-e}	5.0 ^e
324	NC 4	39 ^{c-e}	4.3 ^{a-e}
15975	Va 70 Composite	40 ^{de}	4.5 ^{b-e}
17088	Shulamit	46 ^e	4.8 ^{de}

*Means are averaged for two tests. †Explanation of rating system: Rated with 1 = 1-20% and 5 = 81-100% damaged pods. #Means in columns with letters in common are homogeneous (P = 0.05 by Duncan's multiple range test).

These results suggest that CBR-resistant peanut cultivars can be developed. Disease resistance must be transferred from lines such as NC Acc 3033 and 3196 to large-seeded Virginia types. Because this will require crossing and simultaneous selection for plant type, fruit size, and disease resistance, large segregating populations will be necessary in any CBR-resistance breeding effort.

Selection should also be practiced at more than one location because of the location x entry interaction.

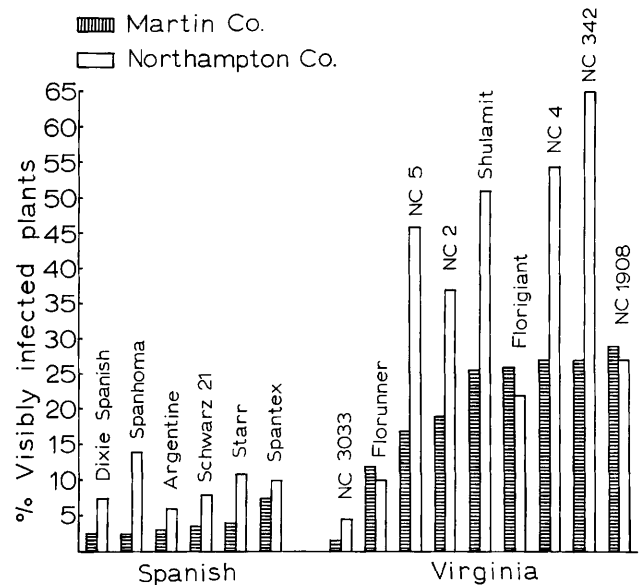


Fig. 1. Response of 15 peanut genotypes representing Spanish and Virginia types to *Cylindrocladium black rot* at two locations.

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