

Current Status of Soybean Stem Canker in Florida

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ABSTRACT

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Soybean-growing areas in Florida were surveyed in 1983, 1984, and 1985 for soybean stem canker. Incidence of the disease was much lower in 1984 and 1985 than in 1983. As many as 81% of the fields in a given county in 1983 contained diseased plants, but the highest comparable proportions in 1984 and 1985 were 8 and 2%, respectively. An abrupt reduction in the use of susceptible cultivars was observed during the 1984 and 1985 seasons in counties where the disease was perceived as a threat to soybean production after 1983 (counties with severe stem canker in 1983 or in adjacent counties). Whereas about 50% of the seed sold in these counties in 1983 were susceptible to stem canker, generally less than 10% of the seed sold in the same counties in 1984 and 1985 were of susceptible cultivars. In contrast, in counties not affected by stem canker in 1983 about 50% of the seed sold during 1984 and 1985 were of susceptible cultivars.

Additional key words: *Diaporthe phaseolorum* var. *caulivora*, southern *D. phaseolorum*

Sporadic occurrences of soybean stem canker have been reported in the southeastern United States since the disease was recognized in Mississippi in 1974 (8). Stem canker was first reported in Florida in 1983 (11). During that season, the incidence and severity of the disease was high in certain counties in the Florida panhandle. Stem canker is now found in all states in the Southeast, although certain areas within some of these states have yet to report the disease.

A stem canker similar to that found in the Southeast affects soybeans grown in the Midwest (1). Although the symptomatology of the midwestern and southeastern stem cankers are virtually indistinguishable, recent data suggest that the pathogens causing the respective diseases are closely related but distinct organisms (4,10). Therefore, the pathogen responsible for stem canker in the Southeast will be referred to in this paper as southern *Diaporthe phaseolorum* (4) to distinguish it from *D. phaseolorum* (Cke. & Ell.) Sacc. var. *caulivora* Athow & Caldwell, which incites stem canker in the Midwest (1).

In the Midwest, soybean stem canker caused significant losses during the early 1950s (6). Use of cultivars susceptible to the disease was discontinued in this region of the country after several years during which the disease was particularly severe. As a result of this change in cultivars, stem canker has not been an

important disease in the Midwest for about 25 yr.

Most of the soybean-growing areas in Florida are in the panhandle. To date, stem canker has been found only in this

region of the state. The purpose of this paper is to report the current status of the disease in the Florida panhandle and to determine the effect the 1983 epidemic had on the use of susceptible cultivars during the 1984 and 1985 seasons. A portion of the results of the 1983 disease survey (11) and the 1983 and 1984 cultivar surveys (9) have been published previously.

MATERIALS AND METHODS

Field survey. Soybean fields in the Florida panhandle were surveyed on 13-23 September during the 1983 season, 10-14 September during the 1984 season, and 12-17 September during the 1985 season for soybean stem canker (Fig. 1). A total of 483, 567, and 478 fields were examined in 1983, 1984, and 1985, respectively (Table 1). All fields were visually surveyed for leaf lamina showing interveinal chlorosis and necrosis typical of the disease (2). Plants showing foliar



Fig. 1. Counties surveyed for soybean stem canker and cultivar use in the Florida panhandle (1983-1985).

Table 1. Occurrence of soybean stem canker in Florida during the 1983-1985 seasons

County	Hectares surveyed (no.)			Fields surveyed (no.)			Fields with symptoms (%) ^a		
	1983	1984	1985	1983	1984	1985	1983	1984	1985
Escambia	422	1,089	726	47	45	49	81	7	0
Santa Rosa	230	847	338	41	80	53	2	0	2
Okaloosa	390	321	343	38	27	27	8	0	0
Walton	246	255	533	29	29	52	52	0	0
Holmes	256	227	247	28	35	36	75	0	0
Washington	410	262	315	49	48	41	65	8	0
Jackson	978	400	421	111	57	56	63	0	0
Calhoun	629	310	560	53	58	33	2	7	0
Gadsden	264	153	338	29	29	39	7	0	0
Gulf	ns ^b	158	377	ns	10	12	ns	0	0
Madison	402	515	887	32	51	55	0	0	0
Jefferson	147	85	ns	26	21	ns	0	5	ns
Hamilton	ns	130	ns	ns	17	ns	ns	0	ns
Suwannee	ns	269	247	ns	30	25	ns	0	0
Total	4,372	5,022	5,332	483	567	478

^a Fields containing plants with foliar symptoms of stem canker. Foliar symptoms were confirmed by examining plants for stem lesions typical of the disease.

^b County not surveyed during this season.

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symptoms were examined further for stem cankers.

Plants with lesions on stems or petiole bases and asymptomatic petiole bases, leaves, and stems were stored over ice during transport to the laboratory during the 1984 and 1985 surveys. Pieces of tissue from lesion margins were placed on an agar medium selective for the recovery of southern *D. phaseolorum* (Phillips' [7] medium). Asymptomatic plant tissue was surface-disinfested with 1% NaClO for 2 min before placement on Phillips' medium. Both types of tissue were incubated at about 25 C for 4 days without light before observation for growth of the pathogen.

Cultivar survey. A survey of seed distributors in the counties surveyed for stem canker in 1983, 1984, and 1985 was conducted after the 1984 and 1985 seasons to identify cultivars and quantify seed sold for the three seasons. These counties were placed in one of three categories on the basis of disease incidence during the 1983 epidemic: 1) counties with a high incidence of stem canker during the 1983 season (52–81% of the fields in a given county with foliar symptoms of the disease), 2) counties with a low incidence of disease (2–8% of the fields in a given county with foliar symptoms) and adjacent to counties in the first category, and 3) counties in which the disease was not detected in 1983. Although an unspecified proportion of seed sold by the surveyed distributors was probably used in counties outside those in which they were sold, in several instances, it was possible to determine that most of the seed sold by a distributor was used in that county. Finally, cultivars reported in the survey were rated susceptible (susceptible and moderately susceptible) or resistant (resistant and moderately resistant) on the basis of cultivar susceptibility ratings compiled in 1983 (3).

RESULTS

During the 1983 disease survey, a high incidence of stem canker was detected in five counties in the western and central panhandle (Table 1). Stem canker was very severe in fields in these counties, particularly in those planted to susceptible cultivars. Seed were commonly not harvested in these fields because of severe yield suppression. Stem canker was not found in 1983 in the eastern panhandle.

The incidence and severity of stem canker in Florida was much lower in 1984 and 1985 than in 1983. In 1983, as many as 81% of the fields in a given county were affected by the disease (showed foliar and stem symptoms), but the highest comparable proportion during the 1984 survey was 8%; stem canker was found in only one field in a single county (2%) during the 1985 season (Table 1). Stem canker was not severe (>20% plants dead in a given field) in any of the 1,045 fields sur-

veyed in 1984 and 1985 (R. C. Ploetz, unpublished).

Southern *D. phaseolorum* was routinely recovered on Phillips' (7) medium from lesion margins on stems and petiole bases during the 1984 and 1985 seasons. The pathogen also was commonly recovered from asymptomatic petiole bases during the 1984 season (18 of 55) and less frequently during the 1985 season (two of 68). The pathogen was not recovered from asymptomatic stem or leaf tissue.

In general, seed of susceptible and resistant cultivars were sold in equal proportions in surveyed counties during 1983 (Table 2). However, during the 1984 and 1985 seasons, seed of susceptible cultivars made up a much lower proportion of the total amount sold in either counties in which disease incidence was high in 1983 (8 and 5% in 1984 and 1985, respectively) or in counties adjacent to those counties (16 and 4% in 1984 and 1985, respectively). In contrast, in counties in which the disease was not found or probably did not occur in 1983, 58% of the seed sold during 1984 and 42% of the seed sold during 1985 were of susceptible cultivars.

DISCUSSION

Soybean yields have been significantly reduced due to soybean stem canker in several southeastern states in the past. Losses caused by the disease in 1983 were valued at $\$36.5 \times 10^6$ in seven states in the Southeast (J. Arnett, personal communi-

cation). A monetary value for soybean yield reductions caused by stem canker in 1983 in Florida is not available. However, the disease was very severe in the counties of Escambia, Holmes, Jackson, Walton, and Washington in Florida during this season. The severity of stem canker was much lower in Florida during the 1984 and 1985 seasons.

A significant trend toward the sale (use) of cultivars resistant to stem canker took place in the western and central panhandle of Florida during the 1984 season and was still evident during the 1985 season, even though the severity of stem canker was very low during the 1984 season in these areas. Whether this pattern of cultivar use will continue and what effect it will have on the severity of this disease in Florida in the future is not clear. Backman et al (2) have suggested that races of the stem canker pathogen reported by Keeling (5) jeopardize "... the long-term status of resistant cultivars."

Given the importance of cultivar susceptibility on the occurrence of this disease, it is probable that the reduced levels of stem canker observed in western and central panhandle counties during the 1984 and 1985 seasons were due, in part, to the reduced use of susceptible cultivars. Hence, the disease data from these areas for 1984 and 1985 are not strictly comparable to those for 1983 because of the change in cultivars grown in these counties during the former seasons. Still, it was apparent that disease

Table 2. Percentages of susceptible and resistant soybean cultivars grown in Florida during the 1983, 1984, and 1985 seasons^a

Counties severely affected during 1983 epidemic	1983 Seed sales ^b		1984 Seed sales		1985 Seed sales	
	S	R	S	R	S	R
Escambia	54	46	41	59	17	83
Holmes	30	70	0	100	nd ^c	nd
Jackson	41	59	7	93	0.2	99.8
Walton	87	13	0	100 ^d	4	96
Washington	90	10	11	89	55	45 ^d
Total ^e	54	46	8	92	5	95
Counties adjacent to those severely affected in 1983						
Calhoun	50	50	10	90	3	97
Gadsden	59	41	2	98	3	97
Okaloosa	49	51	31	69	nd	nd
Santa Rosa	49	51	21	79	6	94
Total ^e	50	50	16	84	4	96
Counties not affected by stem canker in 1983						
Gulf	nd	nd	51	49	33	67
Jefferson	100	0	51	49 ^d	36	64 ^d
Leon	100	0 ^d	100	0 ^d	nd	nd
Suwannee	nd	nd	58	42	44	56
Total ^e	100	0	58	42	42	58

^aSeed sold by distributors in a given county.

^bPercentage of seed of cultivars susceptible (S) or resistant (R) to soybean stem canker; S = susceptible or moderately susceptible, and R = resistant or moderately resistant according to Hiebsch (3).

^cNo data.

^dPercentages from total of less than 750 bu. of seed.

^ePercentages of total quantities of seed sold in a given category of counties.

pressure in these areas during 1984 and 1985 was much lower than during 1983. Little or no stem canker was evident in several fields planted to susceptible cultivars (Ring Around 604, Asgrow 7372, Bragg, and Hutton) in Holmes, Jackson, and Washington counties during the 1984 and 1985 seasons. Obviously, factors other than host susceptibility are responsible for the occurrence of this disease in the field. Research is needed to determine what factors influence host infection and development of this disease after infection has taken place. To date, little is known of the circumstances surrounding either of these events in the disease cycle.

During the disease surveys reported in this paper, soybean fields were rated for foliar symptoms of soybean stem canker. During the 1984 and 1985 surveys, it was apparent that this disease occurs often in fields in which foliar symptoms are absent. In our experience, foliar symptoms of stem canker are manifest only after the host's vascular system is severely disrupted. On the basis of stem lesions, the disease was found frequently in fields in six of 14 counties surveyed during 1984; 43–77% of these fields

contained plants with stem lesions (R. C. Ploetz, *unpublished*), but only 0–8% of the same fields had foliar symptoms (Table 1). Symptomless infection of petiole bases was also detected during the 1984 and 1985 seasons.

It is then apparent that soybean stem canker may be inconspicuous in the field unless foliar symptoms of the disease are evident. The existence of "cryptic" infection and disease raises questions concerning the past and present distribution of stem canker in the Southeast. In Florida, as in other areas of the Southeast, this disease was first noted only after it had caused significant damage. It is probable that stem canker existed in Florida before 1983, when it was first reported, and that it is now in areas in and outside Florida presently thought to be free of the disease. Given the destructive capabilities of soybean stem canker, it may be advisable to discontinue the use of susceptible cultivars in all areas in the Southeast. It is evident from our work, however, that this sort of change may not occur in areas supposedly free of the disease unless yield-reducing levels of stem canker occur first in these areas.

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