Distribution, Prevalence, and Severity of Fungal Foliar Diseases of Spring Wheat in New York in 1984 and 1985

W. C. da LUZ, Graduate Student, and G. C. BERGSTROM, Assistant Professor, Department of Plant Pathology, Cornell University, Ithaca, NY 14853

ABSTRACT

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Ten fungal foliar diseases were found in surveys of two spring wheat cultivars, Max and Sinton, in 12 central and western New York counties in 1984–1985. Stagonospora nodorum spot, tan spot, and powdery mildew were the most prevalent and severe diseases in 1984. Powdery mildew was also prevalent and severe in 1985. Fungal leaf spots, although prevalent, were less severe in 1985 than in 1984; *Phaeosphaeria nodorum* was the most commonly isolated leaf spot fungus. Spot blotch and Ascochyta spot were scattered and of low severity in 1984 and were absent in 1985. Stem rust was severe on Max late in the 1984 growing season, but it was completely absent in 1985. Leaf rust and Stagonospora avenae spot were severe in a few fields in 1984 but occurred infrequently and in slight amounts in 1985. Scab occurred in relatively low levels in both years. Loose smut occurred in trace amounts in two fields of Sinton in each year.

Additional key words: *Bipolaris sorokiniana, Cochliobolus sativus, Drechslera tritici-repentis, Leptosphaeria avenaria* f. sp. *triticea, L. nodorum, Phaeosphaeria avenaria* f. sp. *triticea, Pyrenophora tritici-repentis, Septoria avenae* f. sp. *triticea, Septoria nodorum, Stagonospora avenae* f. sp. *triticea, Stagonospora nodorum*

Hard red spring wheat (*Triticum aestivum* L.) production is usually confined to small areas in central and western New York State. One objective of the wheat breeding and agronomy programs at Cornell University is to develop and release spring wheat cultivars with improved yields and other desirable agronomic features that would make spring wheat a more competitive alternative crop for New York producers. To fully implement such a program, knowledge of disease occurrences in the state and the relative importance of specific pathogens is imperative.

Two spring wheat cultivars, Sinton and Max, have shown the greatest promise for expanded acreage and were the two most widely grown cultivars in 1984 and 1985. The purpose of this study was to determine the identity, prevalence, distribution, and severity of fungal foliar diseases on spring wheat in New York State.

MATERIALS AND METHODS

Field selection. Two spring wheat cultivars, Max and Sinton, were monitored within central and western New York, the predominant area where spring wheat was grown in 1984 and 1985 (Fig. 1). Fields for survey (17 in 1984 and 19 in 1985) were chosen in cooperation with extension agents mainly on the basis of convenient access at relevant growth stages.

Disease ratings. Disease severity was rated in four 2-m^2 areas of each field located at the vertices of a rectangular area marked with flags, with each vertex 20–25 m from the edge of the field. A satellite sample of 20 plants was collected from a 2-m^2 area 5 m from each disease rating area for laboratory identification of leaf-spotting fungi.

Disease severity was estimated as percentage of leaf and head areas showing symptoms or signs of the pathogens according to James (13), modified for use on different sets of leaves. These observations were done on the three lower leaves at growth stages 31 (first node detectable), four middle leaves at growth stage 45 (boots swollen), four upper leaves at growth stage 69 (anthesis complete), and two upper leaves and spikes at growth stage 80 or 85 (early dough or soft dough) of Zadoks et al (24).

Organism recovery and identification. Recoveries of organisms were made from the lesions on leaves and spikes by plating surface-sterilized sections of the infected

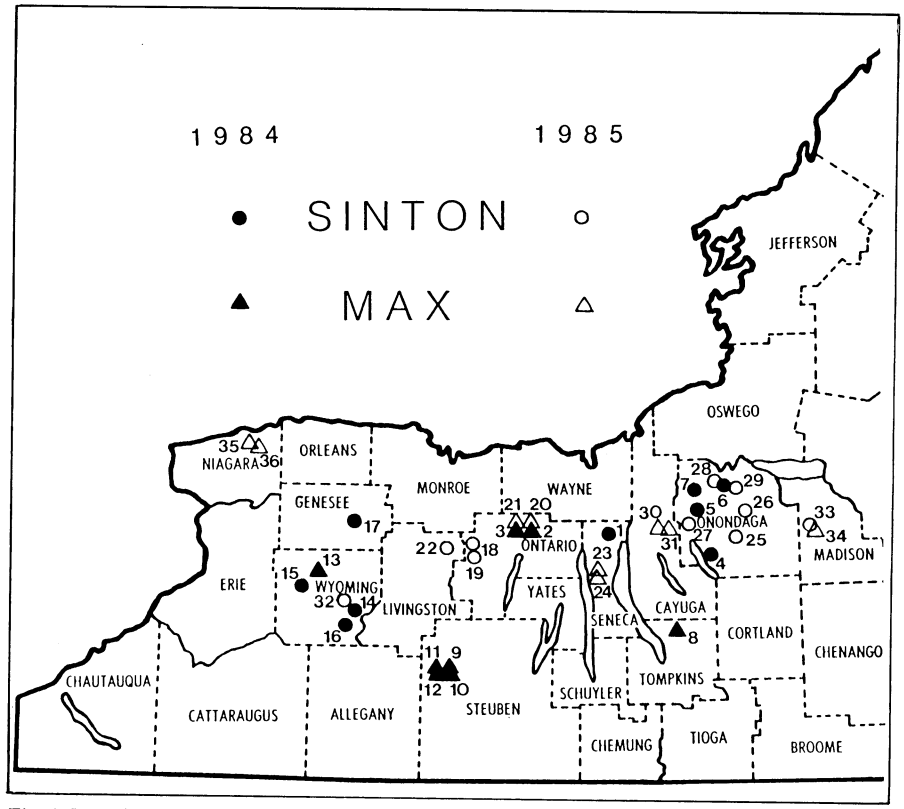

Fig. 1. Locations of spring wheat fields in New York State monitored for fungal foliar diseases in 1984 and 1985.

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tissue on moist filter paper. Spotted leaf sections were surface-sterilized by dipping them into 70% alcohol for 15 sec, then into a solution of 1% sodium hypochlorite for 15 sec, and finally into sterile distilled water. Four hundred lesions (100 from each of four sampling areas) were examined from each wheat field at growth stages 31 and 45, and 200 lesions were examined at growth stages 69 and 80–85. Plates were maintained under near-ultraviolet light from four Sylvania F40-BLB lamps for a photoperiod of 12 hr at 21 ± 1 C. The presence of the necrotrophic (spot-inducing) organisms was recorded 4–5 days later. When necessary, the organisms were transferred to V-8 juice agar plus streptomycin for later identification. All identifications were based on characteristic fungal morphology in accordance with previously published descriptions (1,4–12,14,15,18–23).

Controversy exists concerning the nomenclature of fungi designated commonly by the anamorphs *Septoria nodorum* and *Septoria avenae* f. sp. *triticea*. We accept the arguments of Castellani and Germano (6) and of Bissett (4), who designated the anamorphs of these fungi as *Stagonospora nodorum* (Berk.) Cast. & Germ. and *Stagonospora avenae* (Frank) Bisset f. sp. *triticea*, respectively. For the teleomorphs of these fungi, we accept the taxonomic arguments of Hedjaroude (11) and of Eriksson (10), who transferred them from *Leptosphaeria* to *Phaeosphaeria* as *P. nodorum* (Müller) Hedja. and *P. avenaria* (Weber) O. Eriks. f. sp. *triticea*, respectively.

RESULTS

Occurrences of the diseases are given in Table 1. Fields surveyed throughout the wheat-growing season showed mostly moderate to severe leaf spot symptoms in 1984. Leaf spot diseases became severe after growth stage 45. Individual fields of Max showed severe leaf spot development in Tompkins and Steuben counties and moderate development in Ontario and Wyoming counties. Leaf spot on Sinton was severe in most fields in Onondaga County and moderate in fields in Genesee, Ontario, Seneca, and Wyoming counties. In 1985, in most fields, leaf spots were observed in trace to slight amounts at most growth stages and were moderately severe at growth stage 85. Severe leaf spot development was observed only in single fields in Livingston and Seneca counties.

The most prevalent and severe fungal leaf spot diseases on spring wheat in New York in 1984 were tan spot (= yellow spot), caused by *Pyrenophora tritici-repentis* (Died.) Drechs. (anamorph: *Drechslera tritici-repentis* (Died.) Shoem.), and Stagonospora nodorum spot (= Septoria nodorum spot, Septoria nodorum blotch, glume blotch), induced by *Phaeosphaeria nodorum* (anamorph: *Stagonospora nodorum* (Table 2). *P. tritici-repentis* was the predominant leaf spot fungus in Onondaga, Ontario, and Seneca counties at all growth stages and in Steuben County at growth stage 85; this organism was also prevalent in one field in Wyoming County. *Phaeosphaeria nodorum* was predominant in Genesee, Tompkins, and Wyoming counties. In 1985, the most prevalent leaf-spotting fungus in most of the fields surveyed was *P. nodorum*.

Table 1. Severity of various fungal foliar diseases on two spring wheat cultivars in New York State in 1984 and 1985

Cultivar, field location[a]	Growth stage[b]	Disease severity (% leaf or spike area with signs or symptoms)						
		Powdery mildew	Leaf spots	Leaf rust	Stem rust	Glume spots	Scab (spikes)	Loose smut
			1984					
Sinton, 1	31	55[c]	t	0	0	...	...	...
	45	20	5	0	0	...	...	...
	69	t	15	0	0	...	...	...
	85	0	20	1	0	3	t	0
Max, 2	31	0	t	t	0	...	...	...
	45	0	7	1	0	...	...	...
	69	0	20	2	0	...	...	...
	85	0	22	50	5	5	5	0
Max, 3	31	0	t	t	0	...	...	...
	45	0	1	2	0	...	...	...
	69	0	20	10	0	...	...	...
	85	0	25	62	t	10	t	0
Sinton, 4	31	5	0	0	0	...	...	...
	45	10	9	0	0	...	...	...
	69	47	20	0	0	...	...	...
	80–85	60	27	0	0	10	t	0
Sinton, 5	45	10	56	0	0	...	...	...
	69	20	60	0	0	...	...	...
	85	5	54	0	0	5	t	t
Sinton, 6	31	25	5	0	0	...	...	...
	45	10	10	0	0	...	...	...
	69	20	27	0	0	...	...	...
	85	7	30	0	0	1	t	t
Sinton, 7	31	5	t	0	0	...	...	...
	45	15	5	0	0	...	...	...
	69	15	10	0	0	...	...	...
	85	0	20	t	0	1	t	0
Max, 8	31	0	5	t	0	...	...	...
	45	0	12	t	0	...	...	...
	69	0	45	3	0	...	...	...
	85	0	40	50	10	15	5	0
Max, 9	31	0	5	t	0	...	...	...
	45	0	10	2	0	...	...	...
	69	0	45	4	0	...	...	...
	85	0	50	9	0	18	t	0
Max, 10,	31	0	t	0	0	...	...	...
	45	0	5	t	0	...	...	...
	69	0	35	5	0	...	...	...
	85	0	40	10	0	10	t	0
Max, 11	45	0	22	2	0	...	...	...
	69	0	45	10	0	...	...	...
	85	0	56	30	42	42	10	0
Max, 12	45	0	12	t	0	...	...	...
	69	0	50	5	0	...	...	...
	85	0	60	35	37	40	5	0
Max, 13	80	0	20	15	0	5	t	0
Sinton, 14	85	15	10	t	0	1	t	0
Sinton, 15	85	10	15	0	0	5	t	0
Sinton, 16	85	0	20	t	0	5	t	0
Sinton, 17	85	0	20	0	0	10	t	0
			1985					
Sinton, 18	31	16[c]	t	0	0	...	...	...
	45	4	4	0	0	...	...	...
	69	t	13	0	0	...	...	...
	85	1	20	0	0	1	0	0
Sinton, 19	31	9	0	0	0	...	...	...
	45	1	2	0	0	...	...	...
	69	0	7	0	0	...	...	...
	85	0	12	0	0	1	t	0
Max, 20	31	0	7	0	0	...	...	...
	45	0	9	0	0	...	...	...
	69	0	3	2	0	...	...	...
	85	0	12	15	0	1	t	0
Max, 21	31	0	t	0	0	...	...	...
	45	0	10	0	0	...	...	...
	69	0	20	11	0	...	...	...
	85	0	30	12	0	t	0	0
Sinton, 22	31	3	0	0	0	...	...	...
	45	20	1	0	0	...	...	...
	69	23	3	0	0	...	...	...
	85	48	5	0	0	0	t	0

(*continued on next page*)

Table 1. (*continued from preceding page*)

Cultivar, field location[a]	Growth stage[b]	Disease severity (% leaf or spike area with signs or symptoms)						
		Powdery mildew	Leaf spots	Leaf rust	Stem rust	Glume spots	Scab (spikes)	Loose smut
Max, 23	31	0	t	0	0	...	...	...
	45	0	2	1	0	...	...	...
	69	0	20	5	0	...	...	...
	85	0	16	15	0	t	t	0
Max, 24	31	0	t	0	0	...	...	...
	45	0	3	3	0	...	...	...
	69	0	26	4	0	...	...	...
	85	0	41	15	0	t	2	0
Sinton, 25	31	16	1	0	0	...	...	...
	45	27	2	0	0	...	...	...
	69	2	2	0	0	...	...	...
	85	1	2	0	0	0	t	0
Sinton, 26	45	33	2	0	0	...	...	...
	69	41	4	0	0	...	...	...
	85	0	2	0	0	t	t	t
Sinton, 27	45	22	4	0	0	...	...	...
	69	32	8	0	0	...	...	...
	85	33	10	0	0	0	0	0
Sinton, 28	45	0	t	0	0	...	...	...
	69	23	2	0	0	...	...	...
	85	25	5	0	0	0	0	0
Sinton, 29	31	5	t	0	0	...	...	...
	45	7	4	0	0	...	...	...
	69	10	6	0	0	...	...	...
	85	15	7	0	0	t	t	t
Max, 30	31	0	t	0	0	...	...	...
	45	0	4	0	0	...	...	...
	69	0	10	1	0	...	...	...
	85	0	20	2	0	9	3	0
Max, 31	31	0	t	0	0	...	...	...
	45	0	4	0	0	...	...	...
	69	0	12	t	0	...	...	...
	85	0	19	2	0	5	2	0
Sinton, 32	45	14	3	0	0	...	...	...
	69	15	3	0	0	...	...	...
	85	15	4	0	0	4	0	0
Sinton, 33	31	10	t	0	0	...	...	...
	45	21	3	0	0	...	...	...
	69	22	5	0	0	...	...	...
	85	34	15	0	0	5	t	0
Max, 34	31	0	t	0	0	...	...	...
	45	0	5	0	0	...	...	...
	69	0	19	0	0	...	...	...
	85	0	20	0	0	3	1	0
Max, 35	85	0	10	10	0	t	0	0
Max, 36	85	0	4	5	0	0	0	0

[a] Refers to locations in Figure 1.
[b] According to scale of Zadoks et al (23): 31 (first node detectable), 45 (boots swollen), 69 (anthesis complete), 80 (early dough), and 85 (soft dough).
[c] Percentage of leaf area showing pathogen signs or disease symptoms according to James (13), modified for use on different sets of leaves (t = less than 1%). Observations done on three lower leaves (GS 31), four middle leaves (GS 45), four upper leaves (GS 69), two upper leaves (GS 80–85), and spikes (GS 80–85). For loose smut and stem rust, observations were recorded as percentage of smutted spikes and percentage of stem rust on the stems, respectively.

Phaeosphaeria avenaria f. sp. *triticea* (anamorph: *Stagonospora avenae* f. sp. *triticea*), incitant of Stagonospora avenae spot (= Septoria avenae spot, Septoria avenae blotch, speckled leaf blotch), was the most common organism isolated from leaf spots at growth stages 45 and 69 in Steuben County in 1984. This organism was also associated with a considerable amount of necrosis in Genesee, Onondaga, Tompkins, and Wyoming counties. The pathogen was not observed in Ontario County. Cultural, morphological, and pathogenic characteristics of *Phaeosphaeria avenaria* f. sp. *triticea* isolates were described earlier (16). *P. avenaria* f. sp. *triticea* was more restricted in distribution and severity in 1985 than in 1984, being found only in Livingston and Madison counties.

Spot blotch, incited by *Cochliobolus sativus* (Ito & Kurib.) Drechs. ex Dastur (anamorph: *Bipolaris sorokiniana* (Sacc. in Sorok.) Shoem.), was seen occasionally, but severity was minor in 1984 (Table 1). In 1985, spot blotch was not found in any of the fields surveyed.

Leaf spot caused by *Ascochyta tritici* Hori & Enj. occurred in low amounts in six of 17 fields surveyed and accounted for fewer than 5% of the total lesions examined in 1984 (Table 2), and only at early growth stages. In 1985, this disease was not observed.

Powdery mildew incited by *Erysiphe graminis* DC. ex Mérat f. sp. *tritici* was recorded in all fields during growth stages 31 and 45 where the cultivar Sinton was grown in 1984 (Table 1). About 50% of the Sinton fields examined had severe powdery mildew development on the lower leaves. Extremely severe powdery mildew was observed in one field in Onondaga County where mildew covered 60% of the flag leaf and 20% of the spike surfaces including awns. In 1985, high disease severity on leaves and spikes was observed late in the season in three fields in Livingston, Madison, and Onondaga counties. All plants of Max showed immunity to existing races of powdery mildew.

Leaf rust, incited by *Puccinia recondita* Rob. ex Desm. f. sp. *tritici*, occurred in moderate to severe amounts late in the season in Ontario, Tompkins, and Steuben counties on cultivar Max in 1984. This disease was generally present in trace or slight amounts at growth stages 31, 45, and 69. The disease developed extremely rapidly up to the flag leaf during stages 69 to 85. Leaf rust was either absent or in trace amounts in all Sinton fields, even those near Max fields showing extensive leaf rust development. In 1985, leaf rust occurred in slight amounts in most Max fields and did not appear in Sinton fields (Table 1). The *Puccinia recondita* f. sp. *tritici* races were UN 5 (virulence genes corresponding to resistance genes *Lr*1, *Lr*3, *Lr*10), UN 6 (virulence genes corresponding to *Lr*1, *Lr*2c, *Lr*3, *Lr*10), and UN 17 (virulence genes corresponding to *Lr*2a, *Lr*2c, *Lr*3, *Lr*10). Races were determined by D. L. Long, Cereal Rust Laboratory, USDA, Saint Paul, MN.

Stem rust, incited by *Puccinia graminis* Pers. f. sp. *tritici*, appears to be a potentially serious problem in the cultivar Max as evidenced by its severe development late in 1984 in Steuben County. However, stem rust was not found on Max in 1985. Stem rust was completely absent from all Sinton fields examined in both years. The *P. graminis* f. sp. *tritici* race found in 1984 was 15-TNM (identification by D. Casper, Cereal Rust Laboratory, USDA, Saint Paul, MN).

Spike discoloration was observed in 100% of the fields examined in 1984 (Table 1). The maximum severity observed was 42% of the spikes discolored on Max at growth stage 85 in Steuben County. (Table 1). Only zero or trace amounts of head diseases were noted before or at growth stage 69 (complete anthesis). In 1985, head discoloration was also widely distributed in the surveyed fields but in slight severity. *Phaeosphaeria nodorum* caused not only leaf spot but also glume spot and was the main pathogen in the glume spot pathogen complex in both years.

Scab, caused by *Gibberella zeae* (Schw.) Petch., was widespread, but it reached a maximum severity of 10% of the spike area in 1984 and 3% in 1985 (Table 1).

Loose smut, incited by *Ustilago nuda* (Jensen) Rostrup, was found in trace levels in two Sinton fields in Onondaga County each year.

DISCUSSION

Many fungal foliar diseases known to

Table 2. Frequency of recovery of various fungi from spots on leaves and glumes of two spring wheat cultivars in 1984 and 1985

Cultivar, field location[a]	Growth stage[b]	Fungi recovered (%)										
		Pyrenophora tritici-repentis	*Phaeosphaeria nodorum*		*Phaeosphaeria avenaria* f. sp. *triticea*	*Cochliobolus sativus*		*Ascochyta tritici*	Others		No organisms	
			Leaf	Glume		Leaf	Glume		Leaf[c]	Glume[d]	Leaf	Glume
					1984							
Sinton, 1	31	90[e]	0	···	0	0	···	0	10	···	10	···
	45	92	0	···	0	0	···	2	15	···	3	···
	69	95	0	···	0	0	···	0	18	···	0	···
	85	98	0	90	0	0	0	0	16	17	0	3
Max, 2	31	95	0	···	0	0	···	0	1	···	5	···
	45	100	0	···	0	0	···	0	14	···	0	···
	69	97	3	···	0	0	···	0	16	···	0	···
	85	94	3	62	0	0	0	0	19	18	0	25
Max, 3	31	91	0	···	0	0	···	4	12	···	5	···
	45	96	0	···	0	0	···	0	18	···	4	···
	69	93	5	···	0	0	···	0	15	···	0	···
	85	91	8	59	0	0	0	0	18	14	0	29
Sinton, 4	31	75	28	···	0	0	···	1	3	···	6	···
	45	82	25	···	0	0	···	0	12	···	0	···
	69	89	22	···	18	0	···	0	18	···	0	···
	80–85	85	27	72	32	0	0	0	19	35	0	1
Sinton, 5	45	98	0	···	0	0	···	0	16	···	2	···
	69	60	27	···	22	0	···	0	14	···	0	···
	85	57	31	74	20	0	0	0	17	31	0	2
Sinton, 6	31	81	24	···	0	0	···	0	9	···	4	···
	45	73	32	···	0	0	···	0	16	···	0	···
	69	64	19	···	25	0	···	0	15	···	0	···
	85	54	35	79	14	0	0	0	15	28	0	2
Sinton, 7	31	85	3	···	0	0	···	0	3	···	12	···
	45	75	15	···	0	0	···	0	10	···	10	···
	69	68	29	···	16	0	···	0	18	···	0	···
	85	37	59	71	18	0	0	0	11	36	0	1
Max, 8	31	3	53	···	41	0	···	3	4	···	5	···
	45	30	46	···	24	0	···	5	15	···	0	···
	69	29	47	···	25	0	···	0	16	···	0	···
	85	24	55	97	22	0	0	0	17	12	0	2
Max, 9	31	0	66	···	0	28	···	0	7	···	6	···
	45	2	33	···	39	25	···	0	15	···	4	···
	69	32	14	···	40	15	···	0	16	···	0	···
	85	82	10	78	5	11	20	0	19	10	0	0
Max, 10	31	21	30	···	45	0	···	2	6	···	8	···
	45	19	35	···	41	3	···	2	12	···	5	···
	69	30	27	···	42	5	···	0	12	···	0	···
	85	85	13	77	12	5	16	0	17	15	0	0
Max, 11	45	18	35	···	51	0	···	0	7	···	8	···
	69	23	32	···	46	0	···	0	18	···	0	···
	85	84	18	95	15	0	1	0	16	12	0	0
Max, 12	45	10	32	···	55	0	···	0	10	···	0	···
	69	27	29	···	41	13	···	0	19	···	0	···
	85	52	10	75	10	26	21	0	15	14	0	0
Max, 13	80	65	14	94	26	0	6	0	14	10	0	0
Sinton, 14	85	25	46	90	18	11	9	0	13	16	0	0
Sinton, 15	85	37	48	85	9	8	15	0	15	12	0	0
Sinton, 16	85	24	57	89	18	2	6	0	12	13	0	0
Sinton, 17	85	35	49	82	20	0	0	0	10	20	0	1
					1985							
Sinton, 18	31	2[e]	94	···	0	0	···	0	8	···	5	···
	45	12	79	···	0	0	···	0	12	···	9	···
	69	25	64	···	0	0	···	0	13	···	0	···
	85	73	23	91	0	0	0	0	15	14	1	1
Sinton, 19	31	0	0	···	0	0	···	0	0	···	0	···
	45	0	89	···	0	0	···	0	4	···	7	···
	69	0	93	···	0	0	···	0	6	···	2	···
	85	2	92	90	0	0	0	0	5	15	4	5
Max, 20	31	0	86	···	0	0	···	0	5	···	10	···
	45	0	85	···	0	0	···	0	5	···	9	···
	69	0	87	···	0	0	···	0	6	···	8	···
	85	4	88	93	0	0	0	0	5	3	4	4
Max, 21	45	85	11	···	0	0	···	0	3	···	2	···
	69	94	2	···	0	0	···	0	3	···	2	···
	85	96	3	90	0	0	0	0	4	11	1	4
Sinton, 22	31	0	0	···	0	0	···	0	0	···	0	···
	45	13	79	···	0	0	···	0	15	···	10	···
	69	14	78	···	0	0	···	0	10	···	7	···
	85	18	65	0	5	0	0	0	10	0	3	0
Max, 23	31	83	15	···	0	0	···	0	3	···	5	···
	45	34	54	···	0	0	···	0	12	···	10	···
	69	12	91	···	0	0	···	0	8	···	9	···
	85	17	86	92	0	0	0	0	5	13	14	8
Max, 24	31	10	70	···	0	0	···	0	12	···	12	···
	45	13	76	···	0	0	···	0	10	···	0	···
	69	18	71	···	0	0	···	0	8	···	3	···
	85	22	73	97	0	0	0	0	2	12	4	2

(continued on next page)

Table 2. (*continued from preceding page*)

Cultivar, field location[a]	Growth stage[b]	Fungi recovered (%)										
		Pyrenophora tritici-repentis	*Phaeosphaeria nodorum*		*Phaeosphaeria avenaria* f. sp. *triticea*	*Cochliobolus sativus*		*Ascochyta tritici*	Others		No organisms	
			Leaf	Glume		Leaf	Glume		Leaf[c]	Glume[d]	Leaf	Glume
Sinton, 25	31	10	80	...	0	0	...	0	5	...	6	...
	45	8	78	...	0	0	...	0	4	...	10	...
	69	10	71	...	0	0	...	0	8	...	3	...
	85	22	73	97	0	0	0	0	2	12	4	2
Sinton, 26	45	90	8	...	0	0	...	0	6	...	5	...
	69	93	10	...	0	0	...	0	0	...	2	...
	85	95	12	95	0	0	0	0	1	12	0	0
Max, 27	45	0	95	...	0	0	...	0	1	...	5	...
	69	0	94	...	0	0	...	0	1	...	6	...
	85	1	97	0	0	0	0	0	0	0	3	0
Sinton, 28	45	10	80	...	0	0	...	0	8	...	3	...
	69	5	75	...	0	0	...	0	12	...	8	...
	85	15	82	0	0	0	0	0	5	0	1	0
Sinton, 29	31	53	42	...	0	0	...	0	1	...	4	...
	45	50	47	...	0	0	...	0	2	...	1	...
	69	45	50	...	0	0	...	0	4	...	2	...
	85	60	52	96	0	0	0	0	1	6	0	0
Max, 30	31	4	91	...	0	0	...	0	4	...	2	...
	45	3	90	...	0	0	...	0	6	...	4	...
	69	8	91	...	0	0	...	0	10	...	1	...
	85	10	84	96	0	0	0	0	6	4	0	0
Max, 31	31	13	80	...	0	0	...	0	6	...	1	...
	45	15	81	...	0	0	...	0	5	...	1	...
	69	15	78	...	0	0	...	0	4	...	5	...
	85	18	85	93	0	0	0	0	3	6	1	1
Sinton, 32	45	41	53	...	0	0	...	0	10	...	3	...
	69	32	61	...	0	0	...	0	5	...	6	...
	85	44	52	81	0	0	0	0	2	10	7	10
Sinton, 33	31	30	59	...	0	0	...	0	0	...	...	...
	45	17	78	...	0	0	...	0	2	...	...	...
	69	8	75	...	0	0	...	0	7	...	...	...
	85	32	81	83	0	0	0	0	0	20	1	1
Max, 34	31	0	85	...	0	0	...	0	4	...	12	...
	45	3	84	...	0	0	...	0	6	...	8	...
	69	20	73	...	0	0	...	0	5	...	5	...
	85	23	72	87	4	0	0	0	2	12	4	2
Max, 35	85	0	82	90	0	0	0	0	1	3	17	7
Max, 36	85	30	56	0	0	0	0	0	13	0	4	0

[a] Refers to locations in Figure 1.
[b] According to scale of Zadoks et al (23): 31 (first node detectable), 45 (boots swollen), 69 (anthesis complete), 80 (early dough), and 85 (soft dough).
[c] Included *Alternaria tenuis, Aspergillus* spp., *Cladosporium herbarum, Colletotrichum graminicola, Curvularia* spp., *Epicoccum purpurascens, Fusarium avenaceum, Fusarium* spp., *Penicillium* spp., *Phoma* spp., *Rhodotorula* spp., *Sporobolomyces roseus*, and nonsporulating fungi.
[d] Included *A. tenuis, C. herbarum, E. purpurascens*, and *Gibberella zeae*.
[e] Data collected from 400 lesions (100 from each of four sampling areas) at growth stages 31 and 45 and from 200 lesions at growth stages 69 and 80–85.

be severe in other areas of the United States and the world are well established in New York. No field was free of disease, and two or more diseases frequently occurred in the same field and even on the same plant part. Frequently, more than one fungus was recovered from a single lesion.

This survey resulted in the first record of two wheat pathogens (*Phaeosphaeria avenaria* f. sp. *triticea* and *A. tritici*) in New York and the first observation in recent history of *Pyrenophora tritici-repentis* in the state. The disease induced by *P. tritici-repentis*, now known as tan spot, was first reported on wheat in the United States in 1942 by M. F. Barrus (3) in the same region of New York where this survey was conducted. It is unlikely that these diseases are new; rather, surveys that might have revealed them have not been conducted in recent years. Our results emphasize a need for comprehensive disease surveys to provide guidance to breeding and integrated pest management programs on this crop.

The 1984 spring wheat growing period was considered extremely favorable for leaf spot diseases because of heavy rains and the high temperatures on some days during the season (2). In 1985, fungal leaf spot diseases were less severe than in 1984, probably because of drier and cooler weather during most of the spring wheat growing period.

The high severity and wide distribution of Stagonospora nodorum spot and tan spot on spring wheat in New York should stimulate research on these diseases. A high powdery mildew severity was observed, because most wheat growers continued seeding the susceptible cultivar Sinton. Also, fungicides were rarely applied. Namuco (17) showed that within the *E. graminis* f. sp. *tritici* population in New York in 1984, there were isolates with virulence that could overcome one or more of all but two of the known *Pm* resistance genes in wheat.

Disease surveys should be expanded to soft white winter wheat, which is the predominant wheat in New York. The epidemiological significance of soft white winter wheat to development of fungal diseases in spring wheat should also be investigated.

Observations of severe leaf diseases suggested that considerable yield losses may have occurred in 1984 and to a lesser extent in 1985. A study of yield losses caused by foliar diseases on spring wheat in New York is imperative. Further monitoring of the occurrence, prevalence, distribution, and severity of fungal foliar diseases in New York should be done in conjunction with yield loss studies to facilitate prediction of potential damage to spring wheat by foliar diseases.

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