WHEAT STRIATE MOSAIC, A VIRUS DISEASE TO WATCH ON THE PRAIRIES [1]

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Abstract

Wheat striate mosaic, caused by a virus transmitted by the leafhopper Endria inimica (Say), was found on a trace to 1 percent of the plants in nearly all wheat fields examined in early July, 1961, along a route from Carlyle, Sask. to Winnipeg, Manitoba. Diseased Ramsey and Selkirk plants were severely stunted and many died before normal maturity, Several other spring wheat and all durum varieties tested at Ottawa proved highly susceptible, but the reactions of many other varieties of spring wheat, and most varieties of winter wheat ranged from immune to moderately susceptible. Most varieties of oats and barley developed only faint to moderate symptoms. Brome grass was also infected by the virus, and may be a reservoir host,

Cerealists should become aware that if wheat striate mosaic virus became abundant it could cause immense damage to highly susceptible varieties now used on the prairies, but that many other varieties and breeding lines would probably not be seriously affected by the disease,

Introduction

Wheat striate mosaic was first recognized as a destructive disease of wheat in 1951 when it was proved to be caused by a virus that was transmitted by a common grass-feeding leafhopper, Endria inimica (Say)(2). Virus workers in Nebraska have verbally reported striate mosaic virus in wheat and oats, and Dr. H. Jedlinski has reported in private communication that the disease occurs in Illinois. Timian found that the disease was prevalent on durum and hard red spring wheat in North Dakota in 1959 (4). He also stated verbally that he saw symptoms of the disease on wheat in southern Manitoba in 1959. The vector, E. inimica, is common and often extremely abundant in grassland areas across southern Canada (1).

During a survey for cereal viruses in July 1961, severe symptoms of wheat striate mosaic were found on a few plants in almost all fields of Ramsey durum and Selkirk spring wheat examined along a route from Carlyle, Sask. through Brandon to Winnipeg, Manitoba (3). Although the incidence of striate symptoms was not above 1 per cent in any of the fields, the distribution was surprisingly uniform along the route of survey. The diseased plants were characterized by fine, parallel, yellow to white dashes and streaks on young leaves, severe chlorosis and necrosis of older leaves, reduction in head development, and sterility. Diseased plants were stunted 30 to 50 per cent, and usually died prematurely. The foliage of the healthy wheat was sparse because of severe drought in 1961 and the diseased plants were readily seen, whereas they may have been hidden if the foliar growth of the

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healthy plants had been more abundant.

It appeared that varietal susceptibility could be an important factor related to the widespread appearance of the disease, hence tests were done at Ottawa to determine the reactions of various cereal varieties and grass species to the striate mosaic virus,

Transmission tests and host reactions

Diseased wheat plants dug from fields in southeastern Saskatchewan and Manitoba were packed with their roots in polyethylene bags to which water was added to keep the roots moist. The tops were covered with cloth sleeves to serve as cages. Live leafhoppers (E. inimica) collected in the vicinity of wheat fields were placed in the cages. Because the weather was hot and dry, the plants were packed in a foam plastic ice chest, cooled by a frozen pack of ice substitute, and transported by air to Ottawa. Diseased plants collected at Winnipeg later in July by Dr. W. A. F. Hagborg were also forwarded to Ottawa for tests. Striate symptoms, similar to those observed in the field, developed on Ramsey durum and Selkirk spring wheat on which E. inimica that had been kept on diseased wheat were allowed to feed. An incubation period of one to three weeks was required between infection and the development of symptoms on the wheat plants.

For further experiments leafhoppers were collected on lawns and on grass plots on the Central Experimental Farm, Ottawa. All Endria inimica from these sources were non-infective to wheat until after they had fed on diseased plants. A high proportion of the insects became infective with feeds as short as one-half hour on diseased plants, but for most tests they were left on the diseased plants for 2 days, and usually 60 per cent or more became infective. Regardless of the time on the diseased plants, the insects were not able to infect healthy plants with striate virus until 6 or more days after they first fed on the diseased plants. However, some insects remained infective for several weeks to two months, and often for the remainder of their lives,

The reactions of a large number of cereal varieties to wheat striate virus were tested in the greenhouse. The results (Tables 1 to 5) showed a remarkable range in the reactions of wheat varieties, Some spring wheats were highly susceptible, a few developed no visible symptoms, but most developed faint to moderate symptoms. The disease would not be readily recognized in the field on many of the latter varieties. It is interesting to note that Selkirk is one of the most susceptible varieties, and develops pronounced fine yellow streaks, necrosis and severe stunting. In contrast, Thatcher, Rescue and Chinook were among the few that did not develop symptoms. All the durum varieties tested were classed as highly susceptible. Most winter wheats, including all Ontario varieties, developed only vague, mild, symptoms that would not be easily recognized in the field. Severe symptoms developed on only three named varieties of winter wheat including Minter and Nebred, which were the varieties on which the disease was first recognized in South Dakota, and Winalta, a new variety with Minter parentage developed for southern Alberta. Most varieties of oats and some barley varieties developed mild to moderate symptoms, Victory oats appeared highly susceptible.

Table I. Reactions of Spring and Durum Wheat Varieties to Straite irus*

O No Symptom:	I Faint Chlorosis or indistinct streaks	II Mild to Moderate Straite and Stunting	III Severe Striate Stunting and Necrosis
SPRING WHEAT VARIETIES			
Thatcher C.A. N. 1820	Lee WG57920	Acadia C.A.N. 3541	Cadet WG58368
Willet	Mida WG57842	Canthatch C.A. N. 3968	Lake WG59147
	McMurachy WG57667	Cascade C.A.N. 3593	Prelude C.A.N. 1481
	Red Bobs WG59131	Ceres WG57669	Redman WG59141
	Red Fife C.A.N. 1515	Conley WG57963	Regent WG59139
		Exchange	Renown WG59138
		Henry WG59427	
		Hope WG59440	
		Marquis	
		Reward WG59135	
SPRING WHEAT CO-OP TEST VARIETIES			
C. T. 503 Thatcher	C.T. 323	C. T. 1 Marquis	Selkirk
707 Rescue	406 Saunders	229 Pembina	C.T. 253
708 Chinook	428	244	257
740		512	258
743		812	259
744			260
745			261
746			427
			429
DURUM WHEAT VARIETIES			
			Cappelli
			Carleton
			Golden Ball WG59156
			Mindum WG59154
			Nugget WG59159
			Ramsey WG59160
			Sentry WG57818
			Stewart WG59158
			Tehuacan

*These varieties were supplied by Dr. R.G. Anderson, Research Station, Research Branch, Canada Agriculture, Winnipeg, Manitoba.

Table 2. Reactions of wheat breeding material to wheat striate virus*

0 No Symptoms	I Faint Chlorosis or indistinct streaks	II Mild to Moderate Striate and Stunting	III Severe Striate Stunting and Necrosis
Bowie	Bonza WG571167	Aniversario	Helvia WG59345
Chapinge 52	Chapinge 53 WG58278	Bage	Super Helvia WG59346
H46146 WG58371	Frontana-Kenya 58-Newthatch	Frontana	Mariache WG59344
Vilufen WG59523	Gabo	Klein Titan	Mayo 54
S615 WG571071	Gabo 56 WG5944	Maria Escobar	Yaqui 53
	K338AA. 1.A. 2 WG5725	Marquis line with Sr. 6	
	Kenya Farmer WG57670	Marquis line with Sr. 7	
	Klein Lucero	Marquis line with Sr. 8	
	Lee Frontana	Marquis line with Sr. 9	
	Lerma rojo WG57715	Mentana Rhodesian	
	Mayo 48 WG58379	Mida-McMurachy-Exchange	
	Nainari 60	ND34 WG5961	
	Pergamino gaboto WG59166	ND40-2 WG58363	
	Rio Negro	ND4 WG57681	
	Rhodesian	Orofen	
	Rhodesian Sinvalocho	R. L. 2265	
	R.L. 2564	R.L. 2520	
	Yaqui 50 WG58279	Sinvalocho	
		Yaktana 54	

* These varieties were supplied by Dr. R. G. Anderson, Research Station, Research Branch, Canada Agriculture, Winnipeg, Manitoba.

Table 3. Reactions of winter wheat varieties to striate virus*

0 No Symptoms	I Faint Chlorosis or indistinct streaks	II Mild to Moderate Striate and Stunting	III Severe Striate Stunting and Necrosis
Atlas	Bison	Austin	Minter
Cappelle Desprez	Comanche	Seabreeze	Nebred
Cheyenne	Concho		Winalta
Frisco	Cornell 595 C. A. N. 2486		
	Crockett		
	Dawbul C. A. N. 2489		
	Fairfield C. A. N. 2487		
	Genesee C. A. N. 2516		
	Kharkov 22 M. C. C. A. N. 2360		
	Michigan Amber		
	Pawnee		
	Richmond C. A. N. 2517		
	Rideau C. A. N. 2485		
	Kent C.A.N. 2532		
	Tenmarq		
	Westal		

* Most of these varieties were supplied by Dr. M. N. Grant, Research Station, Research Branch, Canada Agriculture, Lethbridge, Alberta.

Table 4. Reactions of winter wheat lines to wheat striate virus*

0 No Symptoms	I Faint Chlorosis or indistinct streaks	II Mild to Moderate Striate and stunting	III Severe Striate Stunting and Necrosis
5523 - 74	4335 - 1	4353 - 53	4354 - 118
- 116	4338 - 13	4358 - 10	
- 117	4353 - 26	4460 - 11	
	4358 - 6	4467 - 9	
	4467 - 15	4560 - 16	
	- 22	- 175	
	4560 - 3	- 178	
	- 12	- 181	
	4759 - 1	4758 - 5	
	- 10	- 21	
	4768 - 52	4768 - a	
	- 54	- 33	
	- 66	5523 - 40	
	- 106	- 53	
	- 115	- 102	
	5419 - 8		
	- 35		
	5523 - 4		
	- 7		
	- 48		
	- 79		
	- 99		
	- 127		
	- 139		

*These wir r wheat lines, received from 3r. M. N. Grant,

Table 5. Reactions of cereal varieties to striate virus

0 No Symptoms	I Faint Chlorosis or indistinct streaks	II Mild to Moderate Striate and Stunting	III Severe Straite Stunting and Necrosis
SPRING OAT VARIETIES	Abegweit C.A.N. 693 Cornell 527AB-2B6	Ajax **C.A.N.** 660 Albion C.I.4918 C.I. 792 Clintland C.A.N. 819 Clintland 60 **C.** A. N. 891 Cornell 5271AB-2B6 Fulghum C.I. 3067 Fulghum ***C.*** I. 6954 Fundy C.A. N. 822 Garry **C.A.** N. 809 Glen **C.** A. N. 826 Rodney **C.A.N.** 761 Russell C.A.N. 844 Saia C.I. 6954 Shield C.A.N. 821 Strigosa escura **C.I.** 186614	Victory **C.A.N.** 426
BARLEY VARIETIES Montcalm C.A.N. 1135	Black Hulless Club Mariout Hannchen C.A.N. 1109 O.A.C. 21 C.A.N. 1086 Tojo Wong C.A.N. 175 York **C.A.N.** 239	Hudson **C.A.** N. 249 Kenate C.A.N.232 Vantage C.A.N. 1162	
WINTER RYE VARIETIES Horton Dominant Petkus Sangaste			
CORN VARIETIES W79A 106		Gaspe **Flint**	

Thirty grass species were tested but only brome grass and Italian ryegrass became infected and developed symptoms.

Discussion and Conclusions

It cannot be stated categorically that wheat striate mosaic has or has not caused serious losses in Canadian grain crops, but the virus has the potentialities to cause immense damage. Since the leafhopper, E. inimica, is widespread and usually abundant, and is highly efficient as a vector, an increase in suitable virus reservoirs and the extensive use of highly susceptible wheat varieties could lead to a spectacular increase in virus incidence and serious crop losses.

The tests done to date have demonstrated that different varieties and breeding lines of wheat differ greatly in reaction to the isolates of wheat striate mosaic virus obtained in 1961. Although some of the currently important wheat varieties are very susceptible, some other varieties appear to be resistant or even immune. If necessary, it should be possible to develop new varieties with resistance. Of course, there is no assurance that the virus itself is not variable in virulence. Future tests may show that varieties of wheat that appeared to be resistant in the above tests are susceptible to other strains of the virus not yet recognized,

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