Rust Nurseries

Diseases caused by species of Septoria were rather widely distributed and were conspicuous in some nurseries. Speckled leaf blotch of oats was found in all Eastern nurseries examined for its presence and occurred also in B.C. The fact that it was not found in nurseries in the Prairie Provinces should not be taken to indicate that it does not occur in that region, as it was found occasionally, in small amounts, in farmers' fields. Speckled leaf blotch of barley (S. passerinii) occurred in all the nurseries in Man. and e. Sask. and was found also in 2 of the 4 nurseries in Alta. Septoria avenae f.sp. triticea caused sev. infection of leaves and sheaths of wheat in the nurseries in Man. and e. Sask. This organism occurred generally throughout this area and probably caused a mod. yield reduction in Man. S. nodorum occurred also in some of the Western nurseries and was present at a number of points in Eastern Canada. S. tritici was found only in nurseries located in areas in which some winter wheat is grown.

Scald of barley (Rhynchosporium secalis) was found in only 2 nurseries in Alta., 2 in Sask., and in 2 nurseries in Que. Infection was heavy only at Edmonton, Alta. Light infection was recorded at Lacombe, Alta., and Scott and Melfort, Sask. In Que. mod. infection occurred at Lennoxville, and a mere trace at Ste. Anne de la Pocatiere.

Infection caused by Helminthosporium sativum and H. teres occurred on barley in many nurseries, but as it is difficult to distinguish between the symptoms caused by these fungi without making cultural studies, it was decided not to include in this report such observations as were made.

PHYSIOLOGIC RACES OF CEREAL RUSTS IN CANADA IN 1955

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Only that part of Report No. 11, issued by the Plant Pathology Laboratory, Winnipeg, Man., February 1956, on the distribution of physiologic races of cereal rusts in Canada will be reported here.

Distribution of Physiologic Races

Puccinia graminis var. tritici

In the 1955 physiologic race survey 17 races, including several biotypes, of wheat stem rust were identified from 306 isolates obtained from the various cereal producing regions of Canada. The races (number of isolates in brackets) were: race 1 (1); race 11-1 (18); race 15B, 3 biotypes (202); race 29, 4 biotypes (20); race 34 (2); race 39 (1); race 48A (16); race 36, 2 biotypes (43); race 87-1 (1); race 139 (1); and race 179 (1). The biotypes were: 15B (187), 15B-3 (10), 15B-4 (5); 29-1 (15); 29-2 (3), 29-3 (1); 29-4 (1); and 56 (41); 56A (2).

Several varieties not used previously as differential or accessory hosts were employed in 1955. These are: Thatcher, Mayo 54, Kenya 117A,

Table 2. Incidence of certain pathogenic fungi on wheat, oats, barley and rye grown at 35 locations in Canada in 1955

Locality	WHEAT				OATS			BARLEY				RYE	
	P. gr. tritici	P. triticina	Erysiphe graminis	Septoria*	P. gr. avenae	P. cor. avenae	Septoria avenae	P. graminis	P. hordei	Erysiphe graminis	S. passerinii	P. gr. secalis	P. secalina
Saanichton, B.C.	0	3	4	2**	2	0	0	0	0	4	0	1	-
Agassiz, B.C.	0	4	4	2	0	0	4	0	4	4	2	0	4
Creston, B.C.	3	4	3	2**	2	0	1	3	0	2	0	0	-
Beaverlodge, Alta.	0	0	0	1	0	0	0	0	0	0	0	0	-
Edmonton, Alta.	1	2	0	2	3	0	0	0	0	-	1	-	-
Lethbridge, Alta.	1	2	1	0	1	0	0	0	0	0	0	0	1
Lacombe, Alta.	2	4	0	1**	4	0	0	0	0	0	4	1	0
Scott, Sask.	1	2	0	-	2	1	0	1	0	0	0	1	1
Melfort, Sask.	1	4	0	-	3	1	0	1	0	0	3	1	2
Indian Head, Sask.	4	4	0	2***	4	3	0	1	0	0	3	1	4
Dauphin, Man.	4	4	-	2	4	3	-	1	1	0	2	1	3
Brandon, Man.	4	4	-	3	4	4	-	2	1	-	3	1	4
Morden, Man.	4	4	-	4	4	3	-	2	2	-	4	2	4
Winnipeg, Man.	4	4	-	4	4	2	-	3	2	-	4	3	3
Fort William, Ont.	4	4	0	-	4	1	4	2	4	0	2	2	4
Kapuskasing, Ont.	1	-	-	1***	1	0	-	0	1	-	1	0	1
St. Catharines, Ont.	2	4	2	0	1	2	0	1	0	2	0	1	4
Guelph, Ont.	1	4	2	1	2	3	1	1	3	4	1	1	4
Kemptville, Ont.	-	-	-	-	-	2	-	-	0	-	-	-	2
Ottawa, Ont.	1	4	-	1***	-	2	3	-	1	3	-	1	4
Merrickville, Ont.	2	4	-	-	1	4	-	2	2	-	0	2	3
Mindemoya, Ont.	4	4	-	-	4	3	2	1	3	3	-	2	4
Appleton, Ont.	-	-	-	-	-	2	-	-	1	-	-	2	2
Macdonald College, Que.	1	4	-	-	3	2	3	2	3	0	3	3	2
Lennoxville, Que.	1	4	0	-	2	1	4	1	4	1	1	1	4
Ste. Anne de la Poc., Que.	1	-	-	4	2	2	4	0	-	-	0	1	2
Normandin, Que.	2	-	0	4***	1	0	4	0	2	0	2	0	2
L'Assomption, Que.	0	3	0	0	1	1	2	1	0	0	0	0	-
Fredericton, N.B.	-	3	-	-	-	3	-	-	2	-	-	-	-
Kentville, N.S.	3	3	3	0	1	2	4	0	4	0	0	1	-
Nappan, N.S.	1	4	3	-	2	2	3	0	2	0	0	0	2
Pictou, N.S.	1	4	3	-	2	4	2	0	4	0	0	1	2
Lower South River, N.S.	0	1	0	-	2	2	0	0	4	0	0	0	0
Charlottetown, P.E.I.	2	4	-	3***	2	3	3	0	2	-	-	1	2
St. John's West, Nfld.	0	0	-	-	0	2	-	0	0	-	-	0	0

Note: - signifies that no observation was made; 1 = trace; 2 = light; 3 = moderate; 4 = heavy

* Examination to determine identity of species was not always made. Septoria from Western Canada was principally S. avenae f. sp. triticea.

** Septoria tritici present.

*** Spore measurements indicate that some of the infection was caused by S. nodorum.

Kenya 58F(L), Kenya 321.B.T.1.B.1, and Kenya 360H. Rust collections were identified to races on the varieties Marquis, Reliance, Arnautka, Mindum, Einkorn and Vernal. These varieties differentiate all races isolated in Canada in the last ten years with the exception of races 2 and 59, which are uncommon. The varieties Kota, Spelmar, Kubanka, Acme and Khapli, which complete the set of hosts used in previous years, were included periodically with the six varieties mentioned above. Their reactions always confirmed the race identification made with the abbreviated set of hosts.

In the last few years sub-races or so-called biotypes have been found in several common and some uncommon races. With few exceptions these sub-races have been distinguished largely by their ability to attack varieties resistant to other cultures of the race. When the first biotypes were discovered they were designated by a capital letter following the race number as 59A, 15A, 15B, 48A, etc. This system of nomenclature was satisfactory as long as accessory varieties used for race identification were not numerous. However, the inclusion among accessory hosts of several sources of resistance has resulted in a further splitting up of biotypes and this has led, in some instances, to complications in race nomenclature. The problem is exemplified in races 15 and 29. In race 15 there are already described, in addition to biotypes 15A, 15B and 15C, the sub-biotypes 15B-1, 15B-2, 15B-3 and 15B-4. Should any of these biotypes be subdivided further this numbering system would become rather unwieldy. In the last two years we have found four subdivisions in race 29 and have called them 29-1, 29-2, 29-3, and 29-4 (see above). This type of designation, also used for races 11-1 and 87-1, has been employed to avoid, firstly, a succession of letters and digits, and secondly, confusion with biotypes identified by other workers using a similar system of nomenclature but different accessory hosts.

With regard to the distribution of physiologic races in 1955, race 15B predominated in both Eastern and Western Canada, as it has for several years, but its frequency diminished from 76% of the isolates in 1954 to 61% in 1955. The prevalence of race 15B-3, a biotype of 15B virulent to Selkirk, increased from 1.6% in 1954 to 3.3% in 1955. Five of the 10 isolates of this biotype were obtained from Selkirk wheat in Man. where the greatest acreage of this variety is located. The prevalence of race 15B-4, a biotype of 15B which can attack the durum variety Golden Ball and some of its derivatives, increased very slightly over 1954. An interesting feature of the 1955 race distribution was the increase of race 56 to 14% of the isolates. The prevalence of this race had decreased since 1950 to a low of 4% in 1954. As in some former years, this race was most frequently collected in Alta. A biotype of 56, called 56A, was discovered in the spring of 1955 when a culture of race 56 from Normandin, Que., was found to attack McMurachy and about half the plants of Selkirk at low temperature. Other cultures of this race attacked these varieties only at high temperature. Two isolates of this biotype, one in Ont. and the other in Alta., were obtained in 1955. Race 29 (6.5% of the isolates) constituted about the same proportion of the isolates as in 1954. The 3 biotypes of this race described in 1954 were again isolated and a fourth was discovered; the latter can attack Kenya 117A, Kenya 321.B.T.1.B.1 and Kenya 360H. Two of the four biotypes of race 29 are virulent to Selkirk. A biotype

of race 11, called 11-1, was isolated rather frequently from the durum variety R. L. 3206 in Man. The 1955 cultures of this race were alike and are regarded as a biotype because they are more virulent on Golden Ball and its derivative 3206 than a 1953 culture of race 11. The biotype of race 48 known as 48A was again fairly common, comprising over 5% of the isolates. A single culture of race 87 was identified. It differs from 2 cultures of this race obtained in 1954, as the latter isolates attack McMurchy and Selkirk whereas the 1955 isolate does not. Races 1, 34, 39, 139 and 179 occurred rarely and do not appear to threaten any important commercial variety in Canada.

The varieties Kenya Farmer and Mayo 54 were resistant to all isolates.

Stem Rust on Barley

Stem rust collections on cultivated barley and on the wild grass, Hordeum jubatum, in N.B., Man., Sask., and Alta. were tested for rye stem rust and wheat stem rust by inoculating Rosen rye and Little Club wheat. As only 9 of the 54 collections tested proved to be rye stem rust, it appears that this rust was not important on barley in 1955.

Puccinia triticina

The procedures used in the identification of the races of wheat leaf rust were as follows. Each rust collection was initially increased on the susceptible variety Little Club. When the infections were well developed, two single-pustule isolates were established and used for race identification. These isolates thus represent a random selection of the races. The remainder of each original culture on Little Club was used to inoculate a "screening" set composed of the varieties Exchange, Kenya Farmer, Lee, Frontana, Selkirk and Klein Titan. The purpose of this procedure was to ascertain the presence of any rust strains particularly virulent to one or other of these varieties.

Altogether 313 isolates were studied and identified as to race, as follows (number of isolates in brackets): race 1 (4); race 3 (3); race 5 (94); race 9 (6); race 11 (10); race 15 (106); race 35 (5); race 58 (42); race 93 (1); race 126 (39); and race 140 (3). By the use of the variety Renown along with the regular differential hosts, the pathogenicity of each isolate on this variety was determined. The isolates highly virulent to Renown are designated by the suffix a. These virulent races (number isolates in brackets) found in 1955 were as follows: race 1a (3); 3a (1); 5a (78); 9a (3); 15a (85); 58a (3); 126a (30). The number of isolates to which Renown responded by either a resistant or an indeterminate reaction may be readily found by substracting the figures for the a races from those given earlier for the races as a whole.

The use, in past years, of Renown and Hope as accessory differential hosts has indicated the increasing prevalence, especially in races 5, 15 and 126, of strains virulent to Hope and H44 derivatives in the Prairie Provinces

where such varieties have been widely grown. In other parts of the country these strains have occurred and still occur much less frequently. In 1955, of the total number of isolates, the virulent strains accounted for 28.7% in Eastern Canada, 94.6% in the Prairie Provinces and 39.1% in B.C.

The race distribution in 1955 appears to be little different from that of 1954. Race 15 was the most prevalent race; it made up 33.9% of the total isolates as against 30.7% in 1954. Second in order of prevalence was race 5 which accounted for 30.0% of the isolates, as compared with 28.1% in 1954. Third and fourth in order of frequency of collection were race 58, which is and has been for many years the predominant race in Eastern Canada, and race 126, which occurs rather generally in Eastern Canada and the Prairie Provinces. Other races occurred but rarely. Among these may be mentioned race 35 found only in P.E.I. and Ont. and race 140 in P.E.I. and Man. The former is distributed chiefly in the eastern parts of the U.S. and Canada; the latter is of rare occurrence and was found previously only in Ont. and Man. in 1951.

A point that should not be overlooked in a race survey is the tendency of particular varieties to select certain races. In the 1954 report, it was pointed out that there was some evidence that Lee was being rusted more by race 126 than by other races. When the data from the 1955 survey were tabulated it was evident that race 126, which made up 12.5% of the total isolates and only 3.2% of the isolates from Redman, accounted for 32.1% of the isolates from Selkirk and 37.5% of those from Lee. There is also some evidence that race 15 occurs more frequently on Selkirk and Lee than on other varieties.

From greenhouse tests with seedling and adult plants of Lee it seems that this variety does not react identically to all isolates of race 126. To some isolates, the reaction was resistant, to others it was only partially resistant or moderately susceptible. There is similar evidence for races 11 and, though less conclusive, for races 5 and 15. It seems quite possible that the isolation of unexpectedly large numbers of isolates of races 126 and 15 from Lee is due to adaptation of these races to Lee by the production of strains congenial to that variety.

Puccinia graminis var. avenae

In the 1955 physiologic race survey, 12 races of oat stem rust were identified from the 186 isolates studied. These races (number of isolates in brackets) are: 1 (1); 2 (6); 4 (1); 5 (8); 6 (10); 7 (104); 7A (5); 8 (26); 10 (14); 11 (6); 12 (4); and 13 (1).

The races were identified by the method used for several years. Each field collection was increased on the susceptible variety Victory and the resulting inoculum was used to inoculate the varieties Richland, White Russian, Sevnothree, Rodney and Garry for race identification.

The distribution of the races was much the same as in the last several years. Race 7, which has predominated, comprised 56% of the isolates and race 8, the second commonest race, 14%. For several years race 6 has occurred only in Eastern Canada but this year it was found as well in all three of the Prairie Provinces. It is still an uncommon but potentially dangerous

race because Richland and White Russian types of resistance are ineffective against it. Like race 8, it can attack varieties such as Ajax, Exeter and Fortune which are widely grown in Western Canada. Race 7A, the only race capable of attacking the new variety Rodney, was scarce; this race was found only in Man., where Rodney is most widely grown, and 4 of the 5 isolates of the race were from that variety. The new variety Garry was resistant to all races. Some fields of these two varieties showed rather heavy infections of small pustules in 1955. But as these pustules yielded races to which the varieties were resistant it is believed that this year's high summer temperatures had caused a partial breakdown of resistance and permitted some rust development.

Puccinia coronata var. avenae

From 94 isolates obtained from collections on oats in many localities in Eastern and Western Canada in 1955, 18 physiologic races were identified. These races (with the number of isolates in brackets) were as follows: 201 (14); 202 (23); 203 (2); 209 (8); 210 (1); 211 (3); 212 (3); 226 (1); 228 (6); 231 (4); 232 (5); 234 (2); 235 (2); 237 (1); 238 (2); 239 (6); 240 (10); and 280 (1). All these races except 280 have been found in Canada in previous surveys.

There were few changes from the races identified in 1954. Only races 205, 216 and 229 failed to reappear in 1955. However, there was a slight change in the prevalence of some races. In 1954, 80.5% of the isolates from Western Canada and 49.5% from Eastern Canada belonged to races that heavily attack varieties possessing the Bond type of crown rust resistance. In 1955, the corresponding figures were 72.8% for Western Canada and 41.3% for Eastern Canada.

No races were found in Canada this year capable of attacking the varieties that are currently being used in breeding.

Isolates from Aecia collected on Rhammus cathartica

Collections of aecia on Rhammus cathartica were obtained from Man., Ont., N.B. and P.E.I. in 1955. Two varieties of crown rust, avenae and secalis were isolated when the aeciospores were transferred to cereal and grass hosts that differentiate the various varieties. Apparently the variety avenae was the predominant crown rust variety in 1955. Five physiologic races were represented as follows: race 202 (8); 212 (1); 239 (1); and 240 (2). Var. secalis was isolated 3 times. The prevalence of race 202 was in agreement with the results obtained from the race survey using the uredinial collections on oats.