Distribution of Physiologic Races

Puccinia graminis var. tritici

In 1956 collections of wheat stem rust from nearly every province in Canada yielded 315 isolates. Nineteen races and subraces were identified. These races (number of isolates in brackets) are: 11 (40), 11-Can. 1 (23), 15 (1), 15B (59), 15B-Can. 4 (69), 29-Can. 1 (10), 29-Can. 2 (14), 32 (3), 34 (3), 39 (3), 48 (1), 48A (15), 56 (67), 59 (2), 59C (1), 87-Can. 1 (1), 87-Can. 2 (2), and 147 (1).

Wheat stem rust races were identified on 6 standard differential varieties: Marquis, Reliance, Arnautka, Mindum, Einkorn and Vernal. Whenever there was doubt as to the correct identity of a culture reactions were determined for the varieties Kota, Spelmar, Kubanka, Acme and Khapli, which complete the set of standard differential hosts. The accessory varieties used in both 1955 and 1956 were Lee, Golden Ball, Selkirk, Kenya Farmer, McMurachy, Kenya 321 B. T. 1. B. 1, Kenya 117A, and Mayo 54. The variety Bowie replaced Selection 131 in 1956. The varieties Ramsey, Mida-McMurachy-Exchange 11-47-26, Yuma and Langdon were added to the accessory hosts in 1956, whereas, Thatcher, Kenya 58 F(L), and Kenya 360H, used in 1955, were omitted in 1956. Kenya 321 B. T. 1. B. 1 was replaced by the new durum variety Ramsey when the survey was about half completed because the Kenya variety appeared to have little value as a differential.

The most important changes in the race pattern in 1956 are in the prevalence of known races rather than in the appearance of new races. There was a reduction in the prevalence of the race 15B complex from 66% of the isolates in 1955 to 40% in 1956. A subrace of 15B (15B-Can. 4), which can attack certain durum wheats such as Golden Ball and Ramsey, increased greatly in prevalence, whereas, the ordinary form of 15B, which attacks neither Selkirk nor Golden Ball, diminished in prevalence to 18% of the isolates from 61% in 1955 and 76% in 1954. Some cultures of the ordinary 15B have considerably greater virulence on the new durum varieties Yuma and Langdon than other cultures of the race. The well-known race 56 was next in prevalence to 15B, constituting 21% of the isolates. This race has been increasing in prevalence for several years. An increase in the prevalence of race 11 to 20% of the isolates paralleled the increase of race 56. About one-third of the race 11 isolates belonged to the subrace 11-Can. 1 which is virulent to Golden Ball. Two subraces of race 29 (29-Can. 1 and 29-Can. 2) were isolated which are moderately virulent to Selkirk. Race 48A was as prevalent as in 1955 and for the first time a culture of this race that was virulent to Selkirk was obtained. Other interesting races isolated rarely are: race 15 which has considerable virulence on Langdon and Yuma; race 32 which can attack Selkirk, McMurachy and Mayo 54; race 87-Can. 2 which can attack Golden Ball and Selkirk; and race 147 which is more virulent on Langdon than on Yuma.

In the study of the reaction of accessory hosts to the races isolated in 1956, the varieties Lee, Golden Ball, Selkirk, Bowie and McMurachy have been the most valuable for distinguishing subraces of practical importance. The reactions of the durum variety Yuma closely resemble those of Langdon except that race 147 is less virulent on Yuma than on Langdon. Kenya Farmer (Kenya 338 AC. 2. E. 2), and Mida-McMurachy-Exchange 11-47-26 were resistant to all the cultures to which it was tested. Three cultures of race 32 were isolated which could attack Mayo 54. This variety sometimes produced a (2) to (3) type of reaction to this race but in several tests it showed complete seedling susceptibility.

At the rust conference in Mexico City, March, 1956, a number of varieties were suggested as new international differential hosts. These varieties, excluding those already among our accessory hosts, and the susceptible variety Prelude, were tested to 46 cultures (16 races and subraces) obtained in 1956. (Illinois x Chinese^2) x Timopheevi is a good differential for a number of these races but did not distinguish between race 15B and races 15, 32, 87 and some cultures of race 11. Triticum timopheevi, Fontana-K-58-New Thatch II - 50-17, and Khopstein do not appear to be especially useful at the present time.

Stem Rust on Barley

All collections of stem rust on barley and wild barley (Hordeum jubatum) were tested on Little Club wheat and Rosen rye to determine the presence of wheat and rye stem rust. In all, 40 isolated of wheat stem rust and 15 of rye stem rust were obtained. The distribution by province was as follows:

Province	Wheat Stem Rust	Rye Stem Rust
N. B.	0	2
Ont.	4	0
Man.	22	9
Sask.	9	3
Alta.	5	1

In Manitoba, rye stem rust appeared earlier than wheat stem rust and could be found easily on wild barley before rust appeared in nearby wheat fields. This gave rise to the relatively large number of rye stem rust isolates from that province.

Rye stem rust was somewhat more common on barley and wild barley than in 1955 but, with the exception of the area about Fredericton, N. B., it does not appear to be a factor in barley production.

Puccinia triticina

In the identification of races, each rust collection was initially increased on the susceptible variety Little Club. When infections were well developed, two single-pustule isolates were established and used for race identification. These isolates served the purpose of random sampling. 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, Klein Titan and Langdon. The purpose of this procedure was to ascertain the presence of any rust strains particularly virulent to one or another of these varieties.

Altogether 336 isolates were studied and identified, as to race, as follows (number of isolates in brackets): 1 (6), 5 (35), 9 (4), 11 (22), 15 (129), 35 (14), 58 (70), 126 (42), 140 (4).

In 1956, as in 1955, the majority of isolates from the Prairie Provinces were virulent to Hope and H44 derivatives. In other parts of the country these strains occurred much less frequently.

The race distribution in 1956 differed from that of 1955 chiefly in the decreased prevalence of race 5 (10.4% in 1956 and 30.0% in 1955). Race 15 was the most prevalent race while second in order of prevalence was race 58. Regional distributions of these two races expressed as a percentage of the total isolates in the respective areas were as follows: In Man., Sask., Alta., race 15 (58.0), race 58 (2.5); in Ont. and Que., race 15 (6.1), race 58 (57.0).

Analysis by the screening set showed a marked increase in 1956 in the number of isolates virulent to seedling leaves of Lee. Since there was little leaf rust on Lee in the rust nurseries or elsewhere in Canada, it is probable that Lee possesses adult plant resistance to many of these isolates. In general, Lee and Kenya Farmer show marked similarities in their reactions to leaf rust isolates. However, some isolates are virulent to Kenya Farmer but cannot attack Lee.

Langdon was susceptible in the seedling stage to many of the isolates, particularly those from Eastern Canada. It showed susceptibility to some isolates of all common races - most isolates of race 58 and about 25% of race 15 isolates from Man. and Sask. were virulent to Langdon.

The other varieties in the screening set were susceptible in the seedling stage to only a few isolates in 1956 - Exchange (2), Frontana (3), Selkirk (2), Klein Titan (3). One culture of race 58 attacked seedling leaves of Mindum.

Puccinia graminis var. avenae

In 1956 oat stem rust collections yielded 159 isolates made up of 11 races. The races isolated (number of isolates in brackets) are: 1 (6), 2 (3), 4 (7), 5 (1), 7 (98), 7A (11), 8 (18), 10 (5), 11 (7), 12 (1), and 13 (2).

Race identification was carried out as in the past several years. Rust collections were increased on the susceptible variety Victory and then were inoculated to the standard differential varieties White Russian, Richland, and Sevenothree, and to the varieties Rodney, which is susceptible to race 7A only, and Garry, which is resistant to all races.

The races isolated and their distribution differed little from 1955. Again in 1956, race 7 (61% of the isolates) predominated in most parts of the country and race 8 (11.3%) was next in order of prevalence. Race 6, which was uncommon but widely distributed in 1955, was not isolated in 1956, but the rather similar races 4 and 13 occurred in a number of collections from Eastern Canada. The increase in the prevalence of race 7A from 2.7% of the isolates in 1955 to 6.9% in 1956 was of interest because nearly all the isolates of this race were obtained in Man. where Rodney occupies 66% of the oat acreage. Of the 10 Man. isolates of this race 6 were obtained from Rodney.

Puccinia coronata var. avenae

Collections of crown rust were obtained from many localities in Eastern and Western Canada in 1956. Isolates from these collections were identified on the basis of rust reactions produced on the 10 regular differential hosts, Anthony, Victoria, Appler, Bond, Landhafer, Santa Fe, Ukraine, Trispernia, Bondvic, Saia, and the two accessory hosts, Garry and Rodney. The two accessory hosts are now the predominant oat varieties grown in Western Canada and are becoming increasingly common in Eastern Canada, and it was thought advisable to get as much information as possible about their response to the races and sub-races of crown rust present.

In all, 36 races and sub-races were identified from 132 isolates studied. Six races, 201, 202, 209, 212, 239 and 240 and their sub-races comprised 64.4% of the isolates identified. In 1955 these six races comprised 68.0% of all isolates. The remaining races and sub-races were much less prevalent, 8 being isolated only once and 11 only twice.

Seven races (251, 263, 274, 276, 279, 284 and 285) were isolated for the first time in Canada. However, all these seven races have been previously found in the United States and one of them, 263, was isolated by Dr. Marr D. Simons, Ames, Iowa, in 1953 from a collection made in Canada. Two of the races, 251 and 284, do not attack the varieties used in breeding for crown rust resistance and are of no greater importance than the common crown rust races. The other five races, 263, 274, 276, 279 and 285 are of particular significance because each one of them can heavily attack all our commercial varieties and one or more of the varieties used as resistant parents in breeding for crown rust resistance. Race 263 heavily attacks Trispernia, Landhafer, Santa Fe and Bond but not Ukraine and Victoria. Race 276 heavily attacks all the last named six varieties except Victoria, and races 274, 279 and 285 can all attack Victoria.

Garry is resistant to 18 of the races and sub-races identified and susceptible to 18, while Rodney is resistant to 22 of the races and sub-races and susceptible to 14. Rodney was resistant to 80% and Garry to 73% of the isolates studied.

The races and sub-races identified (number of isolates in brackets) were: 201 (7), 202 (23), 203 (5), 205 (2), 209 (15), 210 (4), 211 (3), 212 (10), 213 (1), 228 (2), 229 (1), 230 (1), 231 (3), 234 (4), 235 (5), 236 (2), 237 (1), 238 (1), 239 (14), 240 (20), 251 (1), 263 (2), 274 (1), 276 (3), 279 (3), 284 (3), and 285 (1).

Isolates from aecia collected on Rhamnus cathartica in 1956

In 1956, aecial collections were obtained from Rhamnus cathartica from Eastern and Western Canada. Spores from these collections were transferred to the grass hosts which differentiate the various varieties of crown rust that are known to occur in Canada. Three varieties avenae, secalis and festucae were isolated. Of these, the variety avenae was the commonest. Sixteen isolates of this variety were obtained and the isolates yielded 7 races as follows (number of isolates in brackets): 202 (1), 209 (2), 212 (4), 228 (3), 231 (3), 239 (5) and 240 (6).