PHYSIOLOGIC RACES OF CEREAL RUSTS IN CANADA IN 1948

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In the following report are recorded the distributions in Canada, in 1948, of physiologic races of the following cereal rusts: Puccinia graminis var. Tritici, Puccinia graminis var. Avenae, Puccinia triticina, and Puccinia coronata var. Avenae. A record is also given of the results of infection studies carried out on cereals and grasses with aeciospores collected on barberry and buckthorn in Eastern Canada.

Cereal Rust Development in the Prairie Provinces in 1948

In Man., initial development of all the cereal rusts began rather late. The first infections of leaf rust of wheat were not seen until the second week of July and stem rust on wheat and oats was not found until the third week. The middle part of July was dry and further rust development was slow until the end of the month when good rains occurred and leaf rust, in particular, spread rapidly. At maturity, after the middle of August, Thatcher generally carried about 80% leaf rust infection and Redman only a little less; but, owing to the late date at which rust development took place, damage was not very great. Only a trace of stem rust was found on Thatcher, Regent and Redman but where susceptible wheats could be found they frequently carried 80% or more infection. On barley, stem rust was generally prevalent but only occasionally severe. On oats, stem rust infection was general and rather light except for late-sown oats which became heavily rusted in some localities. Crown rust occurred for the most part only in trace amounts. Leaf rust of barley was absent from most fields but trace infection was found here and there.

In Sask., light to moderate stem rust infection occurred on susceptible wheats in the eastern parts and trace to light infection was found on barley. Leaf rust infection on wheat was moderate to severe in most of the eastern part of the province but dwindled to light and trace infections in the central and western parts. Oat stem rust infection varied from slight to severe in the central eastern parts but only trace amounts were found elsewhere. Trace crown rust infections were found in the eastern parts.

In Alta., wheat stem rust was first found at Lethbridge on 4 Aug. Slight general infection developed in the southern part of the province about 20 Aug. and severe infection occurred in late-maturing stands of soft wheat in the Brooks area at the end of the month. In areas farther north, trace and light infections were found at the end of August. In southern Alta., moderate to severe infection of leaf rust of wheat occurred about 20 Aug. Trace infections of stem rust on oats and barley were found in the southern part of the province at the end of August.

Light stem rust and leaf rust infection of rye was noted in a few places in all three provinces.

Distributions of Physiologic Races of the Cereal Rusts

Nine races of Puccinia graminis var. Tritici were obtained from 132 isolates. The races, with the number of isolates of each in brackets, were in order of decreasing prevalence: race 56 (56), race 38 (31), race 29 (20), race 17 (17), race 39 (4), and races 15, 19, 36, and 80 (1). As compared with 1947 there was a notable increase in the prevalence of race 38, which together

with the similar race 39 comprised about 26% of all isolates in 1948 as against 7% in 1947. A marked increase also took place in the prevalence of the two closely related races 17 and 29, which in 1948 comprised 29% of all isolates as compared with 4% in 1947. These changes in racial distribution are probably without significance for the rust resistant common wheats now grown in Canada; but it is possible that an increased prevalence of race 38 may affect the reaction of barley varieties, in view of the fact that infection tests have indicated that this race is somewhat more virulent than race 56 towards barley.

Sixteen races of P. triticina were identified from 207 isolates. The races, in order of decreasing prevalence, were: race 126a (44), race 5a (42), race 15a (37), race 58 (23), races 1 and 11 (13), race 3 (8), race 9 (7), race 44 (5), races 15 and 126 (4) race 128a (3) and races 31, 33, 35, and 93 (1). (Races designated by the letter "a", as 126a, are those that show particular virulence towards Hope and H44 derivatives). Thus, about 85% of the isolates were accounted for by races 126a, 5a, 15a, 58, 1, and 11 and 60% of all the isolates were "a" races, capable of attacking Hope and H44 derivatives. That these three races are responsible for most of the leaf rust present on Regent and Redman is indicated by the fact that they collectively accounted for 49 of the 53 isolates from these wheat varieties. Geographically, these races were concentrated chiefly in the Prairie Provinces but two of them, races 15a and 126a, were not uncommon in Eastern Canada. Each of these three races has shown a slight increase in prevalence since last year but race 128a, which accounted for much of the rust on Regent and Renown from 1944 to 1946, but which diminished greatly in prevalence in 1947, has now almost disappeared.

Certain of the other races show a marked tendency to be concentrated in given areas. Race 58 was the predominant race in Ont. and Que. where it comprised 50% of the isolates. In the southern parts of Sask. and Alta. there was a concentration of races 1, 9, 11, and 44. The presence of these races is probably connected with the cultivation in this area and adjacent American territory of winter wheats and of varieties of spring wheat not commonly grown elsewhere. It may be noted here that race 11 is rather highly pathogenic to the new leaf-rust resistant wheat Hope x Timstein.

The distribution of races of P. graminis var. Avenae in 1948 was very similar to that of 1947 (race 1 (10), race 2 (36), race 5 (8), race 7 (2), race 8 (25), race 10 (10), and race 11 (8) in 99 isolates). The race group 1, 2, 5 made up 54.6% of all isolates as compared with 50.5% in 1947; and the race group 8, 10, 11, which is virulent towards many of the newer oat varieties, comprised 43.4 in comparison with 49.5% in 1947. A study of rust collections made on oat varieties equally susceptible to both race groups indicates that races 1, 2, and 5, the common races of former years, make up about 70% of the oat stem rust in the country. The only other race collected in 1948 was race 7, which was found once in N.S. and once in Ont.

Fourteen races of P. coronata var. Avenae were obtained from 91 isolates. The races were race 1 (3 isolates), race 2 (12), race 3 (38), race 4 (1), race 5 (6), race 6 (5), race 24 (6), race 34 (7), race 38 (2) races 45 and 1946-1 (4) and races 1947-1, 1948-1, 1948-2 (1). Their distribution agrees with that of preceding years in that races 2 and 3 are still the predominant races. The apparent diminution in prevalence of races 1 and 4 is perhaps due to the fact that few collections could be secured from Man. and Sask. where these races have been most common in

past years. The 1948 results differ from those of previous years in the greater proportion of isolates capable of attacking the variety Bond, which may possibly have resulted from the increased acreage in the United States devoted to the growing of Bond and its derivatives. Two races, 1948-1 and 1948-2, were found that apparently differ from any described previously. Neither of these races is highly pathogenic to varieties possessing the Victoria type of resistance but one of them is virulent towards Bond.

Infection Studies with Aecia on Berberis and Rhamnus in 1948

Isolations from Aecia on Berberis

A study of the varieties of stem rust (Puccinia graminis) occurring in collections of aecia from barberry in 1948 agrees with similar studies made in previous years in showing that varieties Secalis and Agrostidis are the ones most prevalent. In the 23 collections of aecia studied, of which 21 came from Eastern Canada, var. Agrostidis occurred 17 times, var. Secalis (rye stem rust) 16 times, var. Avenae (oat stem rust) and Poae 3 times each, and var. Tritici once. The three collections of var. Avenae gave rise to four physiologic races: 1, 7, 10, and 12. The occurrence of races 7 and 12, which are very rarely found on oats in Canada, is worth noting as is also the fact that the single collection of var. Tritici gave rise to race 87, which is rarely collected on wheat.

Isolations from Aecia on Rhamnus cathartica and R. Frangula

Aecial collections were obtained on R. Frangula at Fredericton, N.B., and on R. cathartica in various localities in Ont., N.B., and P.E.I. in 1948.

One crown-rust variety, Puccinia coronata Corda var. Agrostis Erikss. was isolated from the aecial material obtained on R. Frangula. Three crown-rust varieties, P. coronata Corda var. Avenae Erikss., P. coronata Corda var. ?Bromi (Muehl.) and P. coronata Corda var. Festucae Erikss. were isolated from the aecial collections obtained on R. cathartica. Of the three crown-rust varieties occurring on R. cathartica the variety Avenae was the most prevalent. This variety was isolated from 11 of the 12 collections studied. The variety Bromi was isolated from 7 and the variety Festucae from one of these 12 collections.

Seven isolates of race 3, four of race 2, and three of race 38 were obtained from the cultures of the crown-rust variety Avenae obtained from the 11 cultures established of that variety. These results agree with those of 1947 in that race 3 was again by far the most prevalent race.

Several varieties of grasses and cereals were tested for their reaction to the variety Bromi. The tests demonstrated that this rust variety has a very wide host range. Several species of Bromus and Agropyron as well as varieties of barley and rye showed different degrees of susceptibility to the variety. The ability of this variety to infect such a large number of common grass and cereal hosts accounts for its frequent and widespread occurrence on R. cathartica in Eastern Canada.