YELLOW DWARF (virus) was tr.-sl. in plantings at Ste. Anne de la Pocatière, Que, (R.O. Lachance),

CHLOROTIC LEAF BANDING (high soil-surface temperatures) caused mod. damage to seedlings at Madison, Sask. (B,J.S.),

PHOSPHORUS DEFICIENCY resulted in stunted plants with purplish leaves on high land at Bickleigh, Sask. (T. C. Vanterpool).

RYE

STEM RUST (Puccinia graminis). Trace amounts occurred on Prolific rye in the Rust Nurseries at Charlottetown, P.E.I. (J.E. Campbell).

LEAF RUST (Puccinia recondita) was mod. on Prolific rye at Charlottetown, P.E.I. (J.E.C.).

CEREAL RUSTS IN CANADA IN 1959

B. Peturson, G.J. Green and D.J. Samborski

The following report is a condensed form of Report #15 issued in January, 1960 by the Plant Pathology Section, Canada Department of Agriculture Research Station, Winnipeg, Man

Prevalence of Air-borne Rust Spores in Western Canada

Slides were exposed in stationary spore traps at several localities in Man. and e. Sask. in 1959 to determine the prevalence of air-borne rust spores.

North winds prevailed over the Great Central Plains area during most of May and conditions were unfavorable for the northward movement of rust spores except for about a three day period centering on May 24th when strong south winds were general. During that period (May 22 - 25) several leaf rust spores were caught on slides exposed at Morden and Winnipeg. During the remainder of this month no spores appeared on any of the slides exposed.

During June and July south winds prevailed and there were several periods when wind movements were very favorable for northward spore dispersal. Rust spores, particularly leaf rust spores, were much more prevalent in the air over Man. than during the last few years. The spore-trap data indicate that the early spore showers were centered over Man. and extended westwards as far as Brandon, but not as far west as Indian Head and Regina in Sask.

In 1959, cereal rusts first appeared in the Prairie Provinces in the southern part of the Red River Valley, and gradually spread northward and westward throughout most of Man. and n.-e. Sask. The advance of the rusts westward into the dry areas of s.-w. Man., Sask., and Alta, was greatly retarded by lack of moisture and only trace amounts of rust developed in these areas.

Leaf Rust of Wheat (Puccinia recondita)

As in 1958, leaf rust was the most prevalent cereal rust in Western Canada, It was first observed in Man, on June 15, two weeks earlier than in 1958. It developed rapidly on Thatcher and other susceptible varieties and spread northwestward into n.-e. Sask, where moderately heavy infections developed on Thatcher, In the Red River Valley an 85 per cent infection developed on Thatcher before the end of the season. In a 12-acre experimental field of Thatcher near Winnipeg in which portions of the field were protected by a good rust control fungicide there was a substantial increase in yield in the treated parts of the field over the unprotected parts. In the protected parts of the field, where leaf-rust infection amounted to 10 per cent, the per acre yield was 31.3 bushels, while in the untreated parts of the field, where leaf-rust infection averaged 85 per cent, the yield was 22.1 bushels per acre, indicating a yield loss of 9.2 bushels per acre due to leaf rust, The actual yield loss owing to leaf rust in this field was probably 10 bushels per acre or higher as complete rust control was not achieved with the fungicidal treatment, In several other controlled experiments leaf rust caused as great or greater yield losses to Thatcher. Since about 100,000 acres were sown to Thatcher wheat and other leaf-rust susceptible varieties in Man, in 1959, a yield loss of 1,000,000 bushels is indicated for Man, this year owing to the use of leaf-rust susceptible varieties, In the main wheat crop, consisting largely of the leaf-rust resistant variety Selkirk, infection was light and did not get firmly established until late in the season and appeared to cause only an unimportant yield loss.

In n.-e. Sask. the leaf rust infection on Thatcher, although moderately heavy in some fields, came later and probably caused only minor damage. Only trace amounts of leaf rust occurred in the dry areas of Sask. and in Alta, and caused no appreciable damage there,

Stem Rust of Wheat (Puccinia graminis tritici)

Wheat stem rust was found first in the Red River Valley in 1959, on June 19, about the normal date for its appearance, However, 85 per cent of the wheat acreage in Man, was sown to the highly stem-rust resistant variety Selkirk. All but a fraction of 1 per cent of the remainder was sown to durum wheat and to the varieties Thatcher, Lee, Redman and Regent, which are resistant to the prevalent races of stem rust except race 15B. This race was not very common in Western Canada and very little stem rust developed on these varieties in Man,

Extremely dry conditions in much of the rust area of Sask, and the culture of Thatcher wheat there precluded stem rust damage, As stem rust did not spread westward into Sask, and Alta. where considerable acreages of susceptible wheats are grown, the entire wheat area of Western Canada escaped stem rust damage in 1959. Had susceptible wheat varieties been grown in the rust area of Western Canada it seems certain that heavy rust damage would have occurred in the localities where rainfall was plentiful as high percentages of stem rust developed on wild barley and on susceptible varieties in experimental plots in

c. and e, Man, For example, 75 per cent infection of leaf rust and upwards of a 60 per cent infection of stem rust developed in a 12-acre experimental field of Marquis near Winnipeg. This summer-fallowed field yielded 10.4 bushels per acre of wheat that weighed 53 pounds per bushel, whereas, a field of Selkirk wheat on similar land on an adjoining farm yielded 35 bushels per acre.

Light rust infections occurred on the durum variety Ramsey and on some barley varieties but not in sufficient amounts to cause appreciable damage. Only trace amounts of stem rust developed on these crops in Sask. and Alta.

Stem Rust of Oats (Puccinia graminis avenae)

Oat stem rust was not found until July 23, at Rosenfeld, in the Red River Valley. Subsequent development was slow, and late in the season only small amounts of rust were present on susceptible varieties in experimental plots and on wild oats in Man, Traces of stem rust were present on oats as far west as Indian Head, Sask.

Crown Rust of Oats (Puccinia coronata)

A few widely scattered pustules of crown rust were observed on oats in the Red River Valley on June 30. Apparently air-borne crown rust spores were scare during June and early July for crown rust increased very slowly (much slower than leaf rust of wheat) and only a light sprinkling of this rust was present on oats in the Red River Valley by early Aug. In this area, oat crops that ripened by mid-August were infected only slightly and were not damaged by rust, However, oat fields that did not ripen until early Sept. carried a crown rust infection averaging about 40 per cent and suffered small yield reductions. Most oat fields ripened before crown rust became prevalent and the total damage caused by crown rust in e. Man. was minor, Outside the Red River Valley light infections of crown rust occurred only in w. Man. and e. Sask.

Leaf Rust of Barley (Puccinia hordei)

A light infection of leaf rust was present on barley throughout Man. and westward into Sask, as far as Saskatoon, Although considerable amounts occurred in some fields in e, Man. it arrived late and did not cause much damage,

Leaf Rust of Rye (Puccinia recondita)

A trace of rye leaf rust was found in the Red River Valley in Man. but it was not found in w. Man, or in Sask, and Alta.

Flax Rust (Melampsora lini)

Ninety-five per cent of the flax acreage in Man, was sown to highly rust resistant varieties. An extensive rust survey failed to detect any rust on the resistant varieties. However, a light infection of rust was found on Redwing, a susceptible variety, in one locality in the western part of the Red River Valley. In Sask., a high percentage of the flax acreage was sown to resistant varieties. Virtually no rust was present oh flax in that province in 1959. Rust was not found on flax in s, Alta. in 1959. However, trace amounts of rust on flax were found in the Ft. Vermilion area, One field of Redwing was severely infected.

Cereal Rusts and Other Diseases in the Rust Nurseries in 1959

In 1959 rust nurseries were grown at 32 locations in Canada. At least one nursery was located in each province,

The varieties grown in the rust nurseries are: Wheat: McMurachy, R.L. 1313; Lee, R.L. 2477; Kenya Farmer, R.L. 2768; Marquis, R.L. 84; Mindum, R.L. 1344; Thatcher, R.L. 1945; Selkisk, R.L. 2769; Canthatch, R.L. 2936; Exchange, R.L. 1803; Frontana, R.L. 2336; Ramsey, Ld. 369; Pembina, R.L. 2814, Oats: Bond, R.L. 1130; Trispernia, R.L. 3; Exeter, R.L. 53; Garry, R.L. 1692.27; Clinton, R.L. 66; Landhafer, R.L. 91; Rodney, R.L. 2123; R.L. 2278. Barley: Montcalm, C, A.N. 1135; Vantage, Br, 1356; Parkland, Br. 3833, Rye: Prolific. Flax: Bison, Dakota and Raja.

Wheat Stem Rust (Puccinia graminis tritici)

Wheat stem rust infections were generally light in the rust nurseries in 1959 as has been the case for several years. The amount of rust, as indicated by the infection on the susceptible variety Marquis, was greatest at Creston, B.C. and in the Red River Valley in s. Man. Lighter infections occurred at most locations in Ont. and Que. although some varieties in the nursery at Mindemoya, Ont., were severely infected. There was little or no rust in nurseries in Sask., Alta. and the Atlantic Provinces,

Most of the rust in the Creston nursery was race 11, but In the rest of the country race 56 predominated. The return to predominance of race 56 has greatly affected the amount of rust found on varieties such as Lee and Thatcher. While race 15B predominated these Varieties were susceptible and were often severely attacked but since 1956 they have been lightly infected. The moderate infections on McMurachy in Ont. and Que. were caused by races 29-1 (Can.) and 48A. Selkirk and the new varieties Canthatch and Pembina were nearly free from rust in all nurseries.

Wheat Leaf Rust (Puccinia recondita)

Heavy leaf rust infections occurred in nurseries in all provinces except Alta. The heaviest infections were recorded in Man, and n. -e. Sask. The leaf rust reaction of the varieties in the nurseries was the same as in 1958. Rust reactions on Mindum, Ramsey and Exchange at Creston were of a moderately resistant type. All rust reactions on Selkirk were of a resistant or moderately resistant type, Exchange and Frontana were highly resistant to all locations.

Oat Stem Rust (Puccinia graminis avenae)

Oat stem rust infections were absent or quite light in all nurseries except those at Winnipeg, Man,, Appleton, Ont., and Ste. Anne de la Pocatière, Que, The scarcity of this rust probably resulted from the very late arrival of inoculum from the south. Oat stem rust was not observed in s. Man. until July 23. The severe infection at Winnipeg may have originated from nearby artificially inoculated plots. There is a possibility that barberry was responsible for the severe infections at Appleton and Ste. Anne de la Pocatière.

The infections on the variety Garry at Winnipeg were of a resistant type but a 10 per cent infection on Rodney was of a susceptible type and was caused by race 7A. The infections on these two varieties at Kemptville, Merrickville, Appleton and Ste. Anne de la Pocatière were of a susceptible type and were caused by races such as 8A, 6A and 13A.

Oat Crown Rust (Puccinia coronata avenae)

varieties at Christie in s, Man, and a light to moderate infection occurred on Bond, Exeter, Garry and Rodney at Morden, Man, Crown rust was not found in any of the nurseries west of Melfort, Sask. In Eastern Canada, moderate to heavy infections developed on some of the varieties at Merrickville, and Mindemoya, Ont., at Ste. Anne de la Pocatière, Que., and at Brule, N. S. A light infection was present at Normandin, Que. Elsewhere in Eastern Canada, crown rust was either absent or occurred in trace amounts in the nurseries.

The Rusts on Barley and Rye

The distribution of the leaf and stem rusts attacking barley and rye is much like the distribution of the wheat rusts, Stem rust infection on the susceptible barley variety Montcalm was severe only in the nurseries in s. Man. Moderate or light infections occurred at Creston, B. C. and in several nurseries in Eastern Canada. The stem rust resistant varieties Vantage and Parkland were not severely attacked in any nursery, More than the usual amount of barley leaf rust occurred in nurseries at Brandon and Morden in Man.

Flax Rust

Flax rust was found in only the nurseries at Beaverlodge and Edmonton in Alta., and at Kapuskasing and Merrickville in Ont. Nowhere did the infection exceed 1 per cent on Bison and Dakota and no rust was observed on Raja. Flax rust was scarce or absent in all flax fields examined in Western Canada, except in one field of Redwing near Fort Vermilion, Alta., where infection was severe.

Diseases other than rusts

A summary of the incidence in the nurseries of diseases caused by Erysiphe graminis, Septoria spp. and *Bipolaris and Dreehslera spp, appear in Table 2 along with a summary of the rust nursery data for the rusts, Mildew

* See footnote, page 1 (D, W. C.).

Table 2, Incidence[1] of certain pathogenic fungi on wheat, oats, barley and rye at 32 locations in Canada in 1969

	WHEAT				OATS			BARLEY						RYE	
	P. gr. tritici	P. recondita	Erysiphe graminis	Septoria spp.	P. gr. avenae	P. cor. avenae	S. avenae f. sp. avenae	P. graminis	P. hordei	Erysiphe graminis	S. passerinii	D. teres	B. sorokiniana	P. gr. secalis	P. secalina
Agassiz, B.C.	0	3	0	2	0	0	2	0	0	0	0	0	2	1	3
Creston, B.C.	4	4	0	2	2	0	0	3	0	0	0	0	1	2	0
Beaverloage, Alta.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Edmonton, Alta.	0	2	0	0	0	0	0	0	2	0	1	0	0	0	2
Lethbridge, Alta.	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0
Lacombe, Alta.	0	0	0	0	3	0	0	0	0	0	0	3	0	0	0
Scott, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yelfort, Sask.	2	4	0	1	0	1	0	0	0	0	0	1	0	0	0
Indian Head, Sask.	1	3	0	0	1	0	0	1	0	0	0	0	0	0	0
Brandon, Man.	3	4	-[2]	-	2	1	-	4	2	-	-	-	-	1	3
Morden, Man.	4	4	0	-	2	3	0	4	3	0	4	-	-	2	3
Christie, Man.	3	4	0	2	1	2	0	-	-	0	0	-	4	0	1
Winnipeg, Man.	4	4	0	-	4	-	-	2	2	-	4	-	-	1	2
Fort William, Ont.	3	4	-	-	2	1	-	1	1	-	-	-	-	1	2
St. Catharines, Ont.	1	2	2	1	0	0	-	1	0	-	-	-	-	4	2
Guelph, Ont.	3	3	0	1	1	2	3	2	0	4	0	0	0	1	2
Kemptville, Ont.	-	-	-	-	3	0	3	2	-	4	-	-	-	2	-
Ottawa, Ont.	1	1	-	-	0	0	-	0	0	-	-	-	3	0	0
Merrickville, Ont.	2	1	3	-	2	4	4	2	0	4	-	-	-	2	2
Mindemoya, Ont.	4	4	0	-	3	4	0	3	1	3	0	0	0	3	3
Appleton, Ont.	3	2	2	2	4	1	3	2	0	3	-	0	3	4	3
Macdonald College, Que.	2	3	1	0	2	0	0	1	1	2	1	0	1	1	3
Lennoxville, Que.	2	3	0	0	2	1	2	0	0	0	1	0	1	2	4
Ste. Anne de la Poc., Que.	3	3	0	3	4	3	4	1	0	0	1	-	2	1	3
Normandin, Que.	3	3	0	3	3	2	4	0	1	-	4	0	2	1	2
L'Assomption, Que.	3	4	0	0	2	0	2	2	1	0	0	0	0	0	3
Fredericton, N.B.	1	3	0	3	0	0	4	1	1	0	1	0	1	2	3
Kentville, N.S.	2	3	-	4	3	1	3	0	0	0	0	0	4	3	2
Brule, N.S.	0	3	-	-	1	4	-	0	0	-	0	0	3	0	0
Nappan, N.S.	0	4	-	1	0	1	4	0	0	0	1	0	2	0	0
Charlottetown, P.E.I.	0	4	0	2	4	1	4	0	0	0	0	0	2	1	3
St. John's Test, Nfld.	0	2	0	1	3	0	3	0	0	0	4	0	0	0	2

1/ 1 = trace, 2 = light, 3 = moderate, 4 = heavy.
For the rusts 1 = tr. - 1%, 2 = 2 - 20%, 3 = 21 - 50%, 4 = over 50%

2/ A dash signifies no observation was made.

(Erysiphe graminis) infections were light except on barley in Eastern Canada. Oats were severely attacked by Septoria avenae f. sp. avenae throughout Ont., Que. and the Atlantic Provinces. Speckled leaf blotch (Septoria passerinii), net blotch

Creston, B.C. Usually this disease is common in Alta. and w. Sask,

Distribution of Physiologic Races

Puccinia graminis f. sp. tritici

Twenty races and subraces of wheat stem rust were identified in Canada in 1959, These races, number of isolates in brackets, are: 10 (1), 11 (5), 11-1 (Can.) (5), 15 (4), 15B-1 (Can.) (7), 15B-1L (Can.) (20), 15B-4 (Can.) (40), 17 (3), 29-1 (Can,) (21), 29-3 (Can.) (1), 29-5 (Can.) (1), 32 (3), 34 (1), 38 (4), 48A (13), 56 (113), 56A (2), 59 (3), 87 (1), 97 (1).

The distribution of races in 1959 was similar to that in 1958, The greatest change was an increase in the prevalence of race 56 from 32.2 per cent of the isolates in 1958 to 45.4 per cent in 1959, Race 56 has been increasing in prevalence since 1955. The subraces of 15B were about as prevalent as in 1958 but the prevalence of the other more common races diminished, probably because of the increased predominance of race 56, Races 29-1 (Can.) and 48A continued to be more common in Eastern Canada than in the Prairie Provinces.

An appreciable number of 1959 collections were from susceptible hosts. The distribution of races from these hosts is probably a more accurate indication of the relative prevalence of some races than from the data which includes isolates from resistant and hence selective varities. Race 56 appears to have constituted about 60 per cent of the rust in Canada in 1959, not 46 per cent as indicated above.

Puccinia recondita

Twelve races of wheat leaf rust were identified in the 1959 physiologic race survey. The races isolated are (number of isolates in brackets): 1 (10), 5 (87), 9 (27), 11 (42), 15 (132), 2'8(11), 30 (5), 35 (12), 52 (2), 58 (32), 126 (15), 140 (2).

In 1957 and 1958, races 1 and 11 were predominant in Sask, These races are characteristic of the western coastal areas and of s. Alta, In 1959, the races prevalent in Sask, were similar to those in Man, This represents a return to the usual pattern of race distribution. The race distribution in other parts of Canada was similar to that observed in recent years,

* See footnote, page 1 (D.W.C.).

The commercial variety Selkirk was resistant to all cultures tested. Different cultures produce (0: to 1-) or (2) reactions on Selkirk but no culture virulent on Selkirk (type 4 reaction) has been isolated in Canada,

Puccinia graminis f. sp. avenae

Eleven races of oat stem rust were found in Canada in 1959. The races, with the number of isolates in brackets, are: 1 (3), 2 (3), 6 (4), 6A (35), 7 (28), 7A (30), 8 (3), 8A (2), 10 (1), 11A (2), 13A (4). The letter "A" indicates races virulent on Rodney.

The distribution of oat stem rust races in 1959 differs in several respects from the 1958 distribution. In 1958 race group 1, 2, 5, race group 3, 7, 12 and race group 4, 6, 13 were about equally prevalent. In 1959 races 1, 2, 6, 8, and 10 occurred rarely but race 7, the predominant race from 1953 to 1957, again was the most common of the older races. Race 7A, which is virulent on the variety Rodney has steadily become more prevalent since its discovery in 1952. Its prevalence increased from about 15 per cent of the isolates in 1958 to 26 per cent in 1959, The 1959 figure probably over-estimates the prevalence of this race because many of the isolates were obtained from selective varieties. Despite the apparent exaggeration of the prevalence of race 7A it is reasonably certain that its prevalence has increased, It was overwhelmingly predominant on completely susceptible varieties at Macdonald College and Indian Head. The most important feature of the 1959 survey was the appearance for the third consecutive year in Eastern Canada of races virulent on Garry. Races 8A and 13A have been isolated in each of the last three years, race 6A in the last two years and race 11A for the first time in 1959. Seven of 10 isolates of race 6A from Que. were collected on different varieties at Ste. Anne de la Pocatiere and the remaining 3 isolates came from Riviere Quelle. Twenty-one of the 25 Ont. isolates were collected on different varieties at Appleton and the remaining 4 isolates were from Merrickville. The isolates of races 8A, 11A and 13A also came from these 4 locations. The distribution of races isolated from susceptible varieties supports the conclusion that race 7 predominated in 1959.

Puccinia coronata f. sp. avenae

Collections of crown rust of oats (leaf rust) were obtained from various scattered localities in Eastern and Western Canada in 1959. Twenty-six races and subraces of crown rust were isolated from these collections. Only seven races and subraces (with the percentage of each given in brackets) were isolated in Western Canada: 201 (1.4), 211A (2.7), 213 (2.7), 216 (35.6), 237A (1.4), 274 (52.0), and 279 (4.2). In this area races pathogenic on the variety Victoria and its derivatives predominated. These races have increased greatly in prevalence in the past several years. None of the races pathogenic to Landhafer and Santa Fe were found in Western Canada,

Twenty-four crown rust races and subraces were isolated from the collections originating in Eastern Canada. These were (With percentage of each race given in brackets) as follows: 201 (1.7), 202C (1.7), 203 (3.4), 209 (3.4), 210 (1.7), 210A (3.4), 211 (3.4), 211A (8.5), 212 (1.7), 212B (3.4), 216 (8.5), 228 (1.7), 231 (3.4), 238 (3.4), 239 (1.7), 264 (1.7), 274 (13.5), 276 (1.7), 279 (1.7), 284A (1.7), 290 (3.4), 293 (6.8), 294 (16.8) and 295 (1.7).

In Western Canada 94.5 per cent of the crown rust races isolated are highly pathogenic to oat varieties with resistance from Victoria, while in Eastern Canada only 23 per cent of the isolates are pathogenic to Victoria. However, in the east, six of the races isolated (264, 276, 290, 293, 294 and 295) comprising 32. 1 per cent of all isolates are pathogenic to Landhafer and Santa Fe which have been extensively used in Canada and the United States in breeding for resistance to crown rust, Apparently, in both Eastern and Western Canada most of the crown rust present is pathogenic to the commonly grown oat varieties.

Puccinia hordei

isolations) and race 44 (5 isolations) were the only races identified. All collections studied were obtained from Man. and Sask.

Cereal Diseases at 24 Locations in Alberta and British Columbia

W.P. Campbell and D.W. Creelman

The following report was compiled from data submitted by W.P. Campbell and represents the results of a disease survey on varieties of barley, oats and wheat at 22 locations in north and central Alberta and 2 locations in B.C. For the purposes of this report the stations will be grouped as follows: Central Alberta 13 stations south, to Calgary, of a line extending through Vermilion, Vegreville, Edmonton and Fallis; North Alberta and B.C., 11 stations north of a line extending from Bonnyville through Beaverlodge and including Baldonnell and North Pine in B. C.

Barley Diseases

Eight barley varieties were grown at most c. Alta. stations but additions to and deletions from the basic list resulted in a range of 5-9 varieties. The standard list of varieties was: Wolfe, Parkland, Olli, Traill, Gateways Husky, Nord and Pirkka. Most n. Alta. and B.C. stations had 7 varieties with Wolfe deleted from most tests. The following barley diseases were recorded.

SCALD (Rhynchosporium secalis), in c. Alta,, Acme, 8 - sl./9; Airdrie, 1-mod. 8-sev./9; Bentley, 8-sev./8; Castor, 0/6; Cheddarville, 8-sev./8; Drumheller, 2-tr. 2-sl./6; Evansburg, 1-mod. 7-sev./8; Fallis, 8-sl./8; Leslieville, 6-sl. 2-mod./8; Metiskow, 0/6; Olds, 7-sl./8; Vegreville, 2-tr. 6-sl. /8; Vermilion, 2-tr./5,