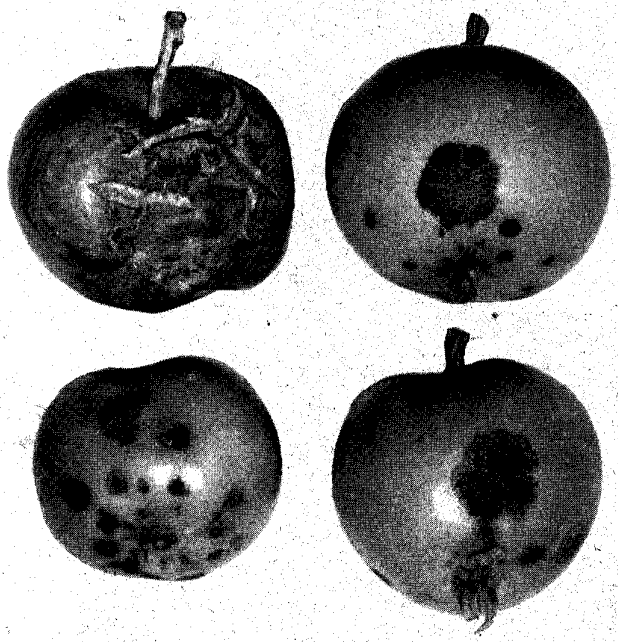
Vol. 42. No. 1. March 1962

Canadian Plant Disease Survey

Compiled and Edited by D. W. Creelman



PLANT RESEARCH INSTITUTE
RESEARCH BRANCH
Canada Department of Agriculture

CANADIAN PLANT DISEASE SURVEY

Volume 42 March 1962 Number 1

CONTENTS

1. Cereal rusts in Canada in 1961
G.J. GREEN and D.J. SAMBORSKI 1

2. Phenological data at four Canadian localities in 1961
R.C. RUSSELL and I.J. BASSETT 19

Vol. 42, No. 1 Can. Plant Dis. Survey March 1962

CEREAL RUSTS IN CANADA IN 1961[1]

G. J. Green and D. J. Samborski[2]

RUST DEVELOPMENT IN WESTERN CANADA IN 1961

Prevalence of the Cereal Rusts

Leaf Rust of Wheat

Although leaf rust of wheat (Puccinia recondita Rob. ex. Desm.) was the most prevalent of the cereal rusts in 1961 it was even less common than in 1960 and caused little or no damage. It was first observed on July 11 at Morden, Manitoba, and at Kyle, Saskatchewan. In other years it has been found as early as the middle of June. After its late appearance it developed slowly and on August 9, when harvesting was beginning in southern Manitoba and southern Saskatchewan, only a scattering of moderately resistant type infections were present in fields of the resistant variety Selkirk in southern Manitoba. Infections were light also (up to 20%) on susceptible varieties in experimental plots. Leaf rust was less common on the western prairies than in Manitoba.

Stem Rust of Wheat

Stem rust of wheat (P. graminis Pers. f. sp. tritici Erikss. and Henn.) was scarce in Western Canada in 1961. It usually appears in southern Manitoba in the third or fourth week of June but in 1961 it was found first at Kyle, Saskatchewan, on July 13. It was not found in Manitoba until July 24, at Morden. Rust development was slow and on August 9 only small amounts (5%) were present on susceptible varieties in experimental plots in southern Manitoba and traces were present on susceptible Hordeum jubatum L. The most stem rust observed in a commercial field was a trace to 5% on all plants in a very late field of Montcalm barley one mile north of Swan River on August 22. It was not found in fields of the resistant wheat variety Selkirk in Manitoba. In Saskatchewan and Alberta stem rust was scarce.

Stem Rust of Oats

Stem rust of oats (P. graminis Pers. f. sp. avenae Erikss. and Henn.) was rarely observed in Western Canada in 1961. It was not found until August 1 at Morden, Manitoba, and infections were found only seven times during the remainder of the growing season. It was not reported in Saskatchewan or Alberta.

Crown Rust of Oats

Crown rust of oats (P. coronata Cda. var. avenae Fraser & Led.) was not found in Western Canada until August 9 at Altona, Manitoba. During the remainder of the growing season mere traces were observed only in the Red River Valley and adjacent areas.

---

[1] Issued as Report No. 17, Plant Pathology Section, Canada Department of Agriculture Research Station, Winnipeg, Manitoba.

[2] Plant Pathologists.

Other Cereal Rusts

Leaf rust of barley (P. hordei Otth.) was not found until August 9 when traces were found near Altona, Manitoba. It was not reported elsewhere in Western Canada. Leaf rust (P. recondita Rob. ex. Desm.) and stem rust (P. graminis Pers. f. sp. secalis Erikss. and Henn.) of rye were not reported in Manitoba or Saskatchewan. Stem rust of rye was observed in the rust nursery at Lethbridge, Alberta.

Influence of the Weather on the Prevalence of Rust

The most important feature of the weather in Western Canada in 1961 was the severe drought that occurred in most areas. Throughout most of Manitoba and Saskatchewan, precipitation from April 1 to early September was about one-half of normal. In Alberta rainfall was only slightly below normal for this period. The drought commenced early in the rust area of Manitoba and eastern Saskatchewan. Snowfall was light during the previous winter and most of it disappeared during March and early April. Surface moisture was adequate for seed germination but subsoil moisture reserves, apart from summerfallow, were poor to fair. Precipitation continued to be light and seeding progressed rapidly after mid-May when temperatures rose. The warm weather continued into June, promoting seed germination and rapid early growth. Showers during June and the first half of July alleviated the drought in a few localities but general rains did not occur until towards the end of July. The rains, where they occurred, came too late to greatly improve yield prospects. Hot, dry weather prevailed in Manitoba and Saskatchewan during early August and harvesting was under way in southern areas by August 9.

The extremely dry conditions in the rust area, the rust resistance of the commonly-grown cereal varieties, and a deficiency of rust inoculum (Table 1) reduced cereal rust infection to negligible amounts. Although a light spore shower occurred in the last week of June, subsequent infection was limited by the lack of moisture to a mere scattering of wheat leaf rust. The continuation of dry conditions and a scarcity of air-borne inoculum prevented any appreciable development of rust on susceptible varieties for the remainder of the growing season.

Prevalence of Air-borne Rust Spores in Western Canada

The amount of air-borne rust inoculum in Western Canada in 1961 was determined by exposing vaseline-coated microscope slides in spore traps and counting the number of spores caught on each slide. The slides were exposed for 48-hour periods at Winnipeg, Morden, and Brandon, Manitoba, and at Indian Head, Regina, and Saskatoon in Saskatchewan. The Plant Pathology Section of the Research Station at Saskatoon reported on the number of spores present on slides exposed at Saskatoon. The slides from the other locations were examined at Winnipeg. The number of stem rust and leaf rust spores caught during each 48-hour exposure, expressed as spores per square inch of slide except at Saskatoon, are shown in Table 1.

The small numbers of spores caught reflect the scarcity of rust in Western Canada in 1961. The first spore shower of the season was first detected at Winnipeg on June 22-23 and by June 26-27 spores were caught at all spore-trap locations. The largest numbers of spores caught were 11 stem rust and 29 leaf rust at Morden on June 24-25. In 1960, also a light

Table 1. Numbers of urediospores of stem rust and leaf rust caught on vaseline-coated slides, exposed for about 48 hours at three locations in Manitoba and at three locations in Saskatchewan in 1961.

	Winnipeg[1]		Morden[1]		Brandon[1]		Indian Head[1]		Regina[1]		Saskatoon[2]	
	Stem Rust	Leaf Rust	Stem Rust	Leaf Rust	Stem Rust	Leaf Rust	Stem Rust	Leaf Rust	Stem Rust	Leaf Rust	Stem Rust	Leaf Rust
May 3-4	0	0	--	--	--	--	--	--	--	--	--	--
5-6	0	0	0	0	0	0	0	0	0	0	--	--
7-8	0	0	0	0	0	0	0	0	0	0	--	--
9-10	0	0	0	0	0	0	1	0	0	0	--	--
11-12	0	0	0	0	0	0	0	0	0	0	--	--
13-14	0	0	0	0	0	0	0	0	0	0	--	--
15-16	1	0	0	0	0	0	0	0	1	1	--	--
17-18	0	0	0	0	0	0	0	0	1	0	--	--
19-20	0	0	0	0	0	0	0	0	0	0	--	--
21-22	0	0	0	0	0	0	0	0	0	0	--	--
23-24	0	0	0	0	0	0	0	0	0	0	--	--
25-26	1	0	0	0	0	0	0	1	0	0	--	--
27-28	0	1	0	0	0	0	0	0	0	0	--	--
29-30	0	0	0	0	0	0	0	0	0	0	0	0
May Total	2	1	0	0	0	0	1	1	2	1	--	--
May 31 - June 1	0	0	0	0	0	0	0	0	0	0	0	0
June 2-3	0	0	0	1(?)	0	0	0	0	0	0	0	0
4-5	0	0	0	0	0	1(?)	0	0	0	0	0	0
6-7	0	0	0	0	0	0	0	0	0	0	0	0
8-9	0	0	0	0	0	0	0	0	0	1	0	0
10-11	0	0	0	0	0	0	0	0	0	0	0	0
12-13	0	0	0	0	0	0	0	0	0	0	--	--
14-15	0	0	0	0	1	0	0	0	0	0	0	0
16-17	0	0	--	--	0	0	0	0	0	1	0	0
18-19	0	0	2	3	0	0	0	1	0	1	0	0
20-21	0	0	0	0	0	0	1	2	0	1	0	0
22-23	0	2	0	0	0	0	0	0	0	0	0	0
24-25	0	2	11	29	0	2	0	0	0	0	0	0
26-27	8	12	5	4	2	4	0	2	2	4	0	8
28-29	0	0	0	0	0	0	0	0	0	5	0	10
June Total	8	16	18	37	3	7	1	5	2	13	0	18
June 30 - July 1	0	0	0	3	0	0	2	2	0	2	0	5
July 2-3	1	0	0	0	0	0	0	1	1	1	3	2
4-5	0	2	0	0	1	2	2	0	0	2	0	0
6-7	0	2	0	0	0	0	1	0	2	3	0	0
8-9	3	5	1	2	0	2	5	2	1	3	0	9
10-11	0	0	3	3	2	0	1	3	0	0	3	12
12-13	0	0	1	0	0	0	0	0	0	0	0	0
14-15	0	0	1	3	0	0	0	0	0	4	0	0
16-17	1	0	0	0	0	0	0	4	0	3	0	9
18-19	0	0	0	0	0	0	0	0	1	1	0	2
20-21	0	0	0	0	0	2	0	0	0	0	0	0
22-23	0	0	0	0	0	0	0	0	0	2	0	5
24-25	2	4	1	3	0	3	0	2	2	0	0	9
26-27	0	0	0	0	0	6	0	0	0	0	0	4
28-29	0	0	0	0	0	0	0	0	0	0	0	12
30-31	0	0	0	0	0	0	1	0	0	0	0	0
July Total	7	13	7	14	3	15	12	14	7	21	6	69
Aug. 1-2	0	0	1	3	0	3	0	0	0	0	0	24
3-4	1	5	0	4	0	3	0	4	1	6	0	19
5-6	0	3	1	4	0	0	1	3	0	3	0	27
7-8	2	7	0	6	0	4	0	0	0	0	0	24
9-10	8	4	2	4	4	7	0	0	2	6	0	6
11-12	3	4	10	8	1	2	0	6	0	4	0	21
13-14	1	8	6	17	0	4	1	4	6	4	2	12
15-16	12	21	17	39	3	6	8	10	8	5	0	26
17-18	8	15	10	9	8	11	2	11	2	9	--	--
19-20	7	14	14	28	2	6	0	3	4	10	--	--
21-22	8	5	4	2	0	4	0	4	0	4	--	--
23-24	4	10	8	16	0	8	1	6	1	7	--	--
25-26	1	3	4	11	--	--	--	--	2	8	--	--
27-28	4	8	5	5	--	--	--	--	--	--	--	--
29-30	12	16	2	5	--	--	--	--	--	--	--	--
Aug. Total	71	123	84	161	18	58	13	51	26	66	2	159
Total	88	153	109	212	24	80	27	71	37	101	8	246

[1] Number of spores per square inch of slide.
[2] Number of spores per slide

rust year, 316 stem rust and 219 leaf rust spores were caught at Morden on June 25-26. The number of spores caught in August, 1961, is small compared to earlier years. In 1960, 6773 leaf rust spores were caught at Saskatoon on August 18-19. The largest number of spores caught in 1961 was 39 leaf rust spores at Morden on August 15-16. The total numbers of spores caught in 1961 were 293 stem rust and 863 leaf rust. In 1960 the numbers were 2715 and 19,587 respectively.

CEREAL RUSTS AND OTHER DISEASES IN THE RUST NURSERIES IN 1961

In 1961, the rust nurseries were grown at 34 locations in Canada with at least one nursery in each Province. Most of the nurseries were planted and cared for by co-operators whose assistance makes this project possible. When the plants were approaching maturity, each co-operator sent a small sheaf from each row in the nursery to Winnipeg, where disease ratings were assessed. These ratings appear in Tables 2 to 7.

The varieties grown in the nurseries are: Wheat: McMurachy, R.L. 1313; Lee, R.L. 2477; Kenya Farmer, R.L. 2768; Red Bobs; Marquis, R.L. 84; Mindum, R.L. 1344; Thatcher, R.L. 1945; Selkirk, 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; C.I. 4023; Ceirch dubach, R.L. 269. Barley: Montcalm, C.A.N. 1135; Vantage, Br. 1356; Parkland, Br. 3833. Rye: Prolific. Flax: Bison, Dakota, and Raja.

Stem Rust of Wheat

The amount of wheat stem rust on the susceptible varieties Red Bobs and Marquis in the nurseries (Table 2) indicates that conditions for rust development were very different in Eastern and Western Canada in 1961. In Western Canada, apart from Creston, B.C., the highest stem rust rating was 5% in the nurseries in Manitoba. In most years infections in the Manitoba nurseries exceed 70%. The small amount of rust on susceptible varieties in the nurseries in the Prairie Provinces is attributable, for the most part, to the lack of moisture. Moderately heavy infections are usual at Creston. Physiologic race surveys have indicated that rust inoculum from the prairies is not carried into the Creston area and that Creston is in an ecological region that includes north-eastern Oregon, eastern Washington and western Idaho. Moderate to severe infections occurred in most nurseries in Ontario and Quebec and at Kentville and Nappan in Nova Scotia. The severe rusting of the susceptible varieties was caused mainly by race 56 which, presumably, was carried into Eastern Canada by air currents, and was able to develop under the cool, moist conditions that prevailed there.

The reactions of the different varieties in the nurseries reflect the predominance of race 56 and the reduced prevalence of race 15B. The varieties Lee, Mindum, and Thatcher, that are resistant to race 56 and susceptible to race 15B, were lightly rusted. The resistant varieties Kenya Farmer, Selkirk, and Pembina were free from rust in all nurseries.

Table 2. Percent infection of stem rust of wheat (Puccinia graminis tritici) on 13 wheat varieties in 34 uniform rust nurseries in Canada in 1961.

Locality	McMurachy	Lee	Kenya Farmer	Red Bobs	Marquis	Mindum	Thatcher	Selkirk	Canthatch	Exchange	Frontana	Ramsey	Pembina
Saanichton, B.C.	0	0	0	0	0	0	0	0	0	0	0	0	0
Agassiz, B.C.	0	0	0	0	0	0	0	0	0	0	0	0	0
Creston, B.C.	0	0	0	50	30	1	0	0	0	t	0	0	0
Beaverlodge, Alta.	0	0	0	0	0	0	0	0	0	0	0	0	0
Edmonton, Alta.	0	0	0	0	0	0	0	0	0	0	0	0	0
Lethbridge, Alta.	0	0	0	0	0	0	0	0	0	0	0	0	0
Lacombe, Alta.	0	0	0	0	0	0	0	0	0	0	0	0	0
Scott, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0
Melfort, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0
Indian Head, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0
Brandon, Man.	0	t	0	5	1	0	0	0	t	t	t	0	0
Morden, Man.	0	0	0	5	3	0	0-5	0	0	t	0	0	0
Winnipeg, Man.	0	0	0	5	5	0	0	0	0	0	0	0	0
Fort William, Ont.	0	0	0	50	60	0	0	0	0	0	0	0	0
Kapuskasing, Ont.	0	1	0	70	40	0	0	0	0	0	0	0	0
St. Catharines, Ont.	0	0	0	0	0	0	0	0	0	0	0	0	0
Guelph, Ont.	1	0	0	75	70	0	2	0	0	25	0	0	0
Kemptville, Ont.	0	0	0	80	70	0	0	0	0	1	0	0	0
Merrickville, Ont.	0	0	0	60	60	t	0	0	0	5	0	t	0
Mindemoya, Ont.	0	2	0	70	70	t	0	0	t	30	2	0	0
Appleton, Ont.	t	0	0	70	70	t	0	0	0	0	0	0	0
Macdonald College, Que.	0	0	0	20	30	0	0	0	0	0	0	0	0
Lennoxville, Que.	0	0	0	t	t	0	0	0	0	0	0	0	0
Ste. Anne de la Poc., Que.	t	t	0	40	40	0	t	0	t	5	t	0	0
Normandin, Que.	0	0	0	30	40	0	0	0	0	t	0	0	0
L'Assomption, Que.	0	t	0	90	90	t	t	0	t	20	10	0	0
Fredericton, N.B.	0	0	0	0	0	0	0	0	0	0	0	0	0
Kentville, N.S.	0	0	0	40	40	0	t	0	0	1	t	0	0
Brule, N.S.	0	0	0	0	0	0	0	0	0	0	0	0	0
Nappan, N.S.	0	0	0	50	60	0	0	0	0	0	0	0	0
Boulardarie, N.S.	0	0	0	0	0	0	0	0	0	0	0	0	0
Charlottetown, P.E.I.	0	0	0	0	0	0	0	0	0	0	0	0	0
St. Johns West, Nfld.	0	0	0	0	0	-	0	0	0	0	0	0	0
Doyles, Nfld.	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3. Per cent infection of leaf rust of wheat (Puccinia recondita) in 1961 on 13 wheat varieties in uniform rust nurseries at 23[1] locations in Canada.

Locality	McMurachy	Lee	Kenya Farmer	Red Bobs	Marquis	Mindum	Thatcher	Selkirk	Canthatch	Exchange	Frontana	Ramsey	Pembina
Agassiz, B.C.	5	0	5	10	10	0	10	t	20	0	0	0	0
Creston, B.C.	70	15	35	75	65	25	70	30	70	5	t	5	25
Saanichton, B.C.	25	15	15	30	15	15	35	t	25	5	5	5	t
Lethbridge, Alta.	1	1	t	5	5	0	1	1	5	0	0	0	t
Brandon, Man.	--	t	t	t	t	0	--	--	--	0	0	0	--
Morden, Man.	2	2	1	3	2	0	5	1	5	0	0	t	t
Winnipeg, Man.	t	t	1	1	1	0	1	1	1	0	0	0	t
Fort William, Ont.	65	5	5	65	60	0	60	10	45	0	0	0	t
Kapuskasing, Ont.	50	2	5	65	40	0	50	10	50	0	0	t	1
St. Catherines, Ont.	0	0	0	t	0	0	t	0	t	0	0	0	0
Guelph, Ont.	35	10	10	40	40	2	35	10	35	t	1	2	10
Kemptville, Ont.	60	5	15	50	45	3	60	20	65	t	t	5	1
Merrickville, Ont.	30	t	1	40	30	t	40	5	30	t	2	t	t
Mindemoya, Ont.	75	25	30-10	60	55	5	75	20	70	10	5	5	20
Appleton, Ont.	50	5	10	40	25	10	35	15	40	5	1	5	t
Macdonald College, Que.	40	t	5	25	40	t	40	0	30	t	0	0	0
Lennoxville, Que.	15	0	t	10	10	t	10	0	10	0	0	t	0
Ste. Anne de la Poc., Que.	50	25	20	55	55	20	60	10	60	5	5	10	10
Normandin, Que.	20	1	5	20	20	t	10	t	15	t	0	t	0
L'Assomption, Oue.	70	30	35	75	70	15	70	20	75	5	5	10	10
Fredericton, N.B.	20	2	3	15	15	0	20	0	20	0	0	0	0
Kentville, N.S.	30	2	5	40	35	0	40	10	35	5	3	0	t
Charlottetown, P.E.I.	1	t	1	1	0	0	1	0	1	0	0	t	0

[1] Wheat leaf rust was not found in 11 nurseries. For complete list of nurseries see Table 2.

Table 4. Per cent infection of stem rust of oats (Puccinia graminis avenae) in 1961 on 9 oat varieties in 15 uniform rust nurseries in Canada[1]

Locality	Bond	Trispernia	Exter	Garry	Clinton	Landhafer	Rodney	C.I. 4023	Ceirch dubach
Kemptville, Ont.	10	10	5	25	5	30	15	5	10
Merrickville, Ont.	80	70	30	30	50	80	60	5	40
Mindemoya, Ont.	t	t	0	0	0	t	t	0	0
Appleton, Ont.	70	70	70	70	70	70	70	10	50
Macdonald College, Que.	0	0	0	0	0	t	0	0	0
Lennoxville, Que.	0	0	0	0	0	t	t	0	t
Ste. Anne de la Poc., Que.	t	1	t	0	0	1	0	0	0
Normandin, Que.	0	0	0	0	0	0	0	0	0
L'Assomption, Que.	1	0	t	t	0	0	t	0	--[2]
Fredericton, N.B.	0	0	0	0	0	0	0	0	0
Kentville, N.S.	0	0	0	0	0	0	0	0	0
Brule, N.S.	1	t	t	0	0	--	0	0	1
Nappan, N.S.	0	0	0	0	0	0	0	0	0
Boulardarie, N.S.	0	0	0	0	0	0	0	0	0
Charlottetown, P.E.I.	5	10	1	0	1	--	0	0	--

[1] No rust was observed in nurseries west of Kemptville, Ont., or in nurseries in Newfoundland. The locations of these nurseries are shown in Table 2.

[2] A dash signifies that no observation was made.

Leaf Rust of Wheat

Leaf rust of wheat was scarce in the nurseries located in the Prairie Provinces while infections in B.C. and Eastern Canada were similar to those in 1960 (Table 3).

The infections on Mindum, Ramsey, Selkirk, Pembina, Exchange, and Frontana were all of a resistant or moderately resistant type. Observations in some cases were made on over-mature plants which would give an exaggerated estimate of rust infection on resistant varieties since a partial breakdown of rust resistance often accompanies leaf senescence.

Stem Rust of Oats

The scarcity of oat stem rust throughout Canada in 1961 is clearly indicated by the lack of infection in most rust nurseries (Table 4). Moderate to severe infections occurred only at Kemptville, Merrickville, and Appleton in eastern Ontario where barberry occurs. The absence of rust in most nurseries suggests that barberry may occur in those localities where even small amounts of rust were observed.

Table 5. Percent infection of crown rust of oats (Puccinia coronata avenae) in 1961 on 9 oat varieties at 14 locations in Canada1/

Locality	Bond	Trispernia	Exeter	Garry	Clinton	Landhafer	Rodney	C.I. 4023	Ceirch dubach
Creston, B.C.	5	0	5	t	5	0	5	5	0
Fort William, Ont.	10	0	2	1	2	0	0	0	0
Guelph, Ont.	15	t	15	5	5	t	5	5	t
Kemptville, Ont.	45	0	40	15	15	t	25	15	10
Merrickville, Ont.	25	1	30	20	25	1	15	15	0
Mindemoya, Ont.	25	t	25	15	25	t	15	5	t
Appleton, Ont.	30	2	30	10	25	3	15	20	t
Macdonald College, Que.	5	t	2	t	5	t	t	t	t
Lennoxville, Que.	1	0	t	0	1	0	0	0	0
Ste. Anne de la Poc., Que.	1	0	1	0	1	0	0	0	0
L'Assomption, Que.	1	0	1	t	1	0	t	0	0
Kentville, N.S.	15	2	15	2	5	2	t	1	t
Brule, N.S.	5	0	5	0	0	0	0	5	1
Charlottetown, P.E.I.	1	0	t	0	t	t	0	t	0

1/ No crown rust was found in the other 20 nurseries. See Table 2 for a complete list of the nurseries.

The severe infection in the three eastern Ontario nurseries on the variety Garry, which is highly resistant in Western Canada, indicates that the races in these localities are mostly the 6A-13A type. The variety C.I. 4023 had comparatively light infections as was to be expected since it is resistant to races 6A, 8A, and 13A.

Crown Rust of Oats

Crown rust was scarce or absent in most of the rust nurseries in 1961 (Table 5). There was no crown rust in any nursery located in Manitoba, Saskatchewan, and Alberta while infections were generally light in Eastern Canada.

The Rusts of Barley and Rye

The leaf rusts and stem rusts of barley and rye in the nurseries (Table 6) were distributed much like the wheat rusts. Since physiolgic race identifications indicate that the wheat rusts were carried into Eastern Canada by air currents, it seems likely that the rusts on barley and rye, for the most part, were spread also by air movements. Apparently the stem rust observed on the susceptible barley variety Montcalm was mostly wheat stem rust. Leaf rust of barley was generally scarce and the severe infection at Mindemoya,

Table 6. Per cent infection in 1961 of stem rust (Puccinia graminis) and leaf rust (P. hordei) on 3 barley varieties and of stem rust and leaf rust (P. recondita) on Prolific rye in uniform rust nurseries at 34 locations in Canada.

Locality	Stem Rust			Leaf Rust			Stem Rust	Leaf Rust
	Montcalm	Parkland	Vantage	Montcalm	Parkland	Vantage	Prolific Rye	
Saanichton, B.C.	0	0	0	5	0	0	0	0
Agassiz, B.C.	0	0	0	0	0	0	0	30
Creston, B.C.	50	30	5	5	5	5	5	5
Beaverlodge, Alta.	0	0	0	0	0	0	0	0
Edmonton, Alta.	0	0	0	0	0	0	0	0
Lethbridge, Alta.	0	0	0	0	0	0	t	0
Lacombe, Alta.	0	0	0	0	0	0	0	0
Scott, Sask.	0	0	0	0	0	0	0	0
Melfort, Sask.	0	0	0	0	0	0	0	0
Indian Head, Sask.	0	0	0	0	0	0	0	0
Brandon, Man.	1	0	0	-	-	-	0	0
Morden, Man.	t	0	0	t	t	t	0	0
Winnipeg, Man.	0	0	0	0	0	0	0	0
Fort William, Ont.	t	0	0	0	0	0	0	15
Kapuskasing, Ont.	0	0	0	0	0	0	0	1
St. Catharines, Ont.	0	0	0	-	-	-	0	0
Guelph, Ont.	30	0	0	10	5	10	10	20
Kemptville, Ont.	30	10	5	5	5	5	30	20
Merrickville, Ont.	t	5	t	0	0	0	60	25
Mindemoya, Ont.	5	0	0	60	60	60	t	60
Appleton, Ont.	30	5	10	5	5	5	20	20
Macdonald College, Que.	0	0	0	0	0	0	t	25
Lennoxville, Que.	0	0	0	t	0	t	0	25
Ste. Anne de la Poc., Que.	t	0	0	0	0	0	t	10
Normandin, Que.	0	0	0	0	0	0	0	0
L'Assomption, Que.	t	0	0	t	t	t	1	10
Fredericton, N.B.	0	0	0	0	t	t	0	t
Kentville, N.S.	1	t	0	2	2	2	50	35
Brule, N.S.	0	0	0	0	0	0	0	-
Nappan, N.S.	0	0	0	10	10	10	0	0
Boulardarie, N.S.	-	-	-	0	0	0	0	0
Charlottetown, P.E.I.	0	0	t	t	t	t	1	20
St. John's West, Nfld.	0	0	0	0	0	0	0	0
Doyles, Nfld.	0	0	0	0	0	0	0	-

Table 7. Incidence[1] of certain pathogenic fungi on wheat, oats, barley and rye at 34 locations in Canada in 1961.

Locality	Wheat				Oats			Barley						Rye	
	P. gr. tritici	P. recondita	Erysiphe graminis	Septoria spp.[3]	P. gr. avenae	P. cor. avenae	Septoria avenae[3]	P. graminis	P. hordei	E. graminis	S. passerinii	P. teres	B. sorokiniana	P. gr. secalis	P. recondita
Saanichton, B.C.	0	3	3	0	0	0	0	0	2	3	0	0	0	0	0
Agassiz, B.C.	0	2	3	0	0	0	1	0	0	0	0	0	0	0	3
Creston, B.C.	3	4	0	3	0	2	-[2]	3	2	0	0	0	4	2	2
Beaverlodge, Alta.	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Edmonton, Alta.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Lethbridge, Alta.	0	2	1	0	0	0	-	0	0	-	-	-	-	1	0
Lacombe, Alta.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scott, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melfort, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indian Head, Sask.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brandon, Man.	2	1	0	0	0	0	0	1	-	0	0	1	0	0	0
Morden, Man.	2	2	0	0	0	0	0	1	1	0	0	0	0	0	0
Winnipeg, Man.	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Fort William, Ont.	4	4	-	-	0	2	3	1	0	0	0	0	4	0	2
Kapuskasing, Ont.	4	3	0	0	0	0	2	0	0	0	0	0	3	0	1
St. Catharines, Ont.	0	1	2	0	0	0	0	0	-	0	0	0	3	0	0
Guelph, Ont.	4	3	2	3	0	2	3	3	2	4	0	0	2	2	2
Kemptville, Ont.	4	4	4	3	3	3	4	3	2	3	0	0	4	3	2
Merrickville, Ont.	4	3	4	0	4	3	0	2	0	0	0	0	3	4	3
Mindemoya, Ont.	4	4	0	0	1	3	4	2	4	-	-	-	-	1	4
Appleton, Ont.	4	3	0	3	4	3	3	3	2	-	-	-	-	2	2
Macdonald College, Que.	3	3	2	2	1	2	3	0	0	4	-	-	-	1	3
Lennoxville, Que.	1	2	0	2	1	1	4	0	1	0	0	0	3	0	3
Ste. Ann de la Poc., Que.	3	4	0	1	1	1	3	1	0	0	0	0	0	1	2
Normandin, Que.	3	2	0	3	0	0	4	0	0	0	3	0	3	0	0
L'Assomption, Que.	4	4	0	2	1	1	3	1	1	0	0	0	2	1	2
Fredericton, N.B.	0	2	-	-	0	0	1	0	0	0	0	0	4	0	1
Kentville, N.S.	3	3	-	-	0	2	3	1	2	-	-	-	-	3	3
Brule, N.S.	0	0	0	0	1	1	4	0	0	0	0	0	0	0	-
Nappan, N.S.	4	0	0	2	0	0	3	0	2	-	-	-	-	0	0
Boulardarie, N.S.	0	0	0	0	0	0	4	-	0	-	-	-	-	0	0
Charlottetown, P.E.I.	0	1	0	0	2	2	0	1	1	0	0	0	0	1	2
St. John's West, Nfld.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Doyles, Nfld.	0	0	0	3	0	0	-	0	0	-	-	-	-	0	-

[1] 1 = trace, 2 = light, 3 = moderate, 4 = heavy
For the rusts 1 = trace - 1%, 2 = 2 - 20%, 3 = 21 - 50%, 4 = over 50%

[2] A dash signifies no observation was made

[3] Septoria spp. on wheat observed on the variety Lee, Septoria avenae observed on the variety Rodney.

Ontario is difficult to explain. Leaf rust and stem rust of rye were not observed in nurseries in the Prairie Provinces. Their common occurrence in Eastern Canada probably results from favorable conditions for development which were lacking in the west. Some spread of rye stem rust from barberry probably occurred at some locations in Eastern Canada.

Flax Rust

Rust on flax (Melampsora lini (Ehrenb.) Lev.) was observed only on the variety Bison (5%) in the nursery at Beaverlodge, Alta.

Diseases other than Rusts.

A summary of the incidence of the rusts and some other common diseases of cereals is presented in Table 7. Powdery mildew (Erysiphe graminis DC. ex Mérat) and Septoria leaf blotch (Septoria spp.) of wheat were not very common in 1961. Severe infections of mildew occurred only at Kemptville and Merrickville in Ontario. Speckled leaf blotch of oats (Septoria avenae Frank f. sp. avenae) was widespread and often severe in nurseries in Eastern Canada. Spot blotch (Bipolaris sorokiniana (Sacc. in Sorok.) Shoemaker) was the most common of the leaf diseases of barley but it did not occur in nurseries in the Prairie Provinces.

Scald of barley (Rhynchosporium secalis (Oud.) J.J. Davis), not shown in Table 7, was observed only in the nurseries at Beaverlodge (moderate) and Edmonton (light). A small amount of physiologic spotting of barley was observed in the nursery at Ste. Anne de la Pocatiere, Que.

DISTRIBUTION OF PHYSIOLOGIC RACES

Puccinia graminis Pers. f. sp. tritici Erikss. and Henn.

Nine races of wheat stem rust were identified in Canada in 1961 (Table 8). In 1960, twelve races were found and 20 occurred in 1959. The small amount of stem rust that developed in 1960 and 1961 may account, in part, for the few races isolated. In 1959, 249 isolates were identified, in 1960 the number was 164, and in 1961 it was 151. Race 56 (72.8% of the isolates) continued to predominate in 1961 and increased slightly in prevalence. Race 15B-1L (Can.) was next in order of prevalence (9.3% of the isolates) but race group 15B declined in prevalence from 20% of the isolates in 1960 to 11.3% in 1961. The number of subraces of 15B found diminished from five in 1960 to two in 1961. The two subraces found in 1961 (15B-1L (Can.) and 15B-4 (Can.)) are distinguished by their virulence on varieties of durum wheat. Race 15B-4 (Can.) can attack Golden Ball and Ramsey and 15B-1L (Can.) can attack Langdon and, to a lesser degree, Yuma. The widespread cultivation of Langdon and Ramsey in North Dakota may account for the presence of these races. The disappearance of race 15B-1 (Can.), which is regarded as the original race 15B, is of interest. It became prevalent in 1950 and caused severe losses in 1953, 1954, and 1955. It was isolated in every year from 1950 to 1960. The six other races identified in 1961 were not common. They have been found in earlier years and, like race 56, do not threaten the varieties recommended in the rust area of Western Canada.

Physiologic races were identified by means of the standard differential host varieties, although the varieties Kota, Spelmar, Kubanka, Acme, and Khapli were omited in later stages of the survey. Subraces were identified

Table 8. Distribution by provinces of physiologic races of Puccinia graminis f. sp. tritici collected on wheat, barley and grasses in 1961.

Race	Province						Total Isolates	Per cent of Total Isolates
	N.S.	Que.	Ont.	Man.	Sask.	B.C.		
11	-	-	2	-	-	5	7	4.6
11-1 (Can.)	-	-	1	-	-	-	1	0.7
15B-1L (Can.)	-	1	5	8	-	-	14	9.3
15B-4 (Can.)	-	-	-	3	-	-	3	2.0
17	-	1	4	-	-	-	5	3.3
29-1 (Can.)	-	-	1	-	-	-	1	0.7
38	-	1	5	2	-	-	8	5.3
48A	-	-	-	2	-	-	2	1.3
56	4	17	42	43	4	-	110	72.8
Total No. of Isolates	4	20	60	58	4	5	151	100.00

Table 9. Infection types produced on supplementary host and other wheat varieties by physiologic races of stem rust identified in 1961.

Race	Variety								No. of Cultures
	Lee	Golden Ball	Yuma	Marquis Sr6	Marquis Sr7	Marquis Sr8	Marquis Sr9	Marquis Sr10	
11	;1	2	;	;	3+	2	2	3+	4
11	;1	2	;1=	;1=	12+CN	2-	2-	4-	1
11	;1	2	;	;	3±	2	3+	3+	1
11-1 (Can.)	;1	4	;1-	;1	3±CN	4	2	3+	1
15-B-1L (Can.)	3	2	3C	;	23CN	2-	2-	X-	14
15B-4 (Can.)	3	4	;	;	23CN	2	4	4	3
17	1	2	;	;	3	3	3	3	1
17	1	4	;1-	;	3+	4	2	X	1
17	1	4	;1=	;	23CN	3+	2	X=	3
29-1 (Can.)	1	4	;	4	4	4	2	4	1
38	;1	3	;1=	;	23CN	2	2	;1	8
48A	;1	4	;1=	2	4	2	2	2	2
56	;1	2	;1=	;	4	2	2	3+	110

on the varieties Lee, Golden Ball, and Yuma (see Table 9). Kenya Farmer was inoculated with all isolates but none could attack it.

Five lines of the variety Marquis, each carrying one of the genes Sr6 (from Kenya 58), Sr7 (from Egypt Na 101), Sr8 (from Red Egyptian), Sr9 (from Red Egyptian), and Sr10 (from Egypt Na 95), have been used with the differential hosts since 1959. They have become increasingly valuable as differential hosts and as sources of resistance in breeding programs. These genes can be added in any desired combination to formerly-resistant commercial varieties such as Lee, Thatcher, and Redman by backcrossing. This method of breeding is

advantageous because it is based on a reasonably complete knowledge of the type of resistance being added to the commercially acceptable variety. The use of the "single-gene-lines" as differential hosts indicates immediately any potentially dangerous races and assists in the identification of races. The reactions of the supplementary differential host varieties and the "single-gene-lines" to the races isolated in 1961 are shown in Table 9. When the resistant reaction is expressed, Sr6 produces flecks, Sr7 type 2 to type 3 infections with diffuse chlorosis and necrosis, Sr8 and Sr9 type 2 infections, and Sr10 a mesothetic reaction. The "single-gene-lines" and the durum variety Golden Ball differentiate several subraces in races 11 and 17. It may be significant that these races were isolated from areas where barberries have been reported.

The practice was continued of attempting to detect new and dangerous combinations of virulence by means of a "screening set" composed of highly resistant varieties. Urediospores of about twenty isolates were bulked. The bulked spores were used to inoculate the common wheat varieties Selkirk, Pembina, C.T. 244, Mayo 54, Mida-McMurachy-Exchange II-47-26, and Frontana-K58-Newthatch II-50-17, and the durum wheat varieties D.T. 165, C.I. 8155, St. 464, and D.T. 161. D.T. 165 is from the cross D.T. 146 x Langdon and D.T. 161 is from the cross Stewart^{8} x St. 464. No new races were found.

Puccinia recondita Rob. ex. Desm.

Eight races of wheat leaf rust were isolated in the 1961 race survey (Table 10). For years, the predominant races have been 5 and 15 in Manitoba and Saskatchewan, 1 and 11 in Alberta and British Columbia, and race 58 in Eastern Canada. The most notable changes in 1961 were the increased prevalence of races 5 and 15 in Ontario and the isolation of race 161. Race 161, which has not been previously isolated in Canada, was the most prevalent race in B.C. and Alberta. However, the occurrence of race 161 is of no practical significance.

In 1961, the Committee of North American Leaf Rust Research Workers published the first list of supplemental differential varieties for wheat leaf rust race identification and described 15 races which were found in studies with these varieties. Races identified on these supplemental differentials carry the designation NA 61. All cultures isolated in Canada in 1961 were studied on these supplemental differentials and nine NA 61 races were found. The reactions of the supplemental differentials to these nine races are shown in Table 11. The NA 61 races found in the standard physiologic races in 1961 are shown in Table 13 while the geographic distribution of NA 61 races is shown in Table 12.

Puccinia graminis Pers. f. sp. avenae Erikss. and Henn.

The distribution of the 12 races of oat stem rust that were identified in Canada in 1961 is shown in Table 14. The survey in Western Canada was not satisfactory because of the small number of isolates identified. The results obtained indicate that race group 1, 2, 5, race group 3, 7, 12 and race group 8, 10, 11 have continued the decline in prevalence which began in 1957. Race 6 (four out of seven isolates) appears to have been predominant in Western Canada in 1961. In 1960 it comprised less than ten per cent of the isolates from the west. In Eastern Canada races 6A, 6, and 13A predominated as they did in 1960.

Table 10. Distribution by geographic areas of physiologic races of Puccinia recondita isolated in Canada in 1961.

Race UN		Geographic Areas: Maritime Provinces	Quebec	Ontario	Manitoba & Sask.	B.C. & Alta.	Total Isolates	Per cent of Total Isolates
1	1	--	1	--	--	5	6	3.8
2	15	2	2	22	33	6	65	41.4
3	58	5	10	11	1	--	27	17.2
3	161	--	--	2	--	10	12	7.7
5	5	1	2	10	10	2	25	15.9
9	9	--	--	--	3	2	5	3.2
10	11	--	1	4	--	8	13	8.2
13	35	--	2	1	--	1	4	2.6
Total Isolates		8	18	50	47	34	157	100.0

Table 11. Reaction of the wheat varieties making up the NA 61 set of supplemental leaf rust differential hosts to 9 NA 61 races of Puccinia recondita.

NA 61 race number	Reaction of differential variety: Lee (C.I. 12488)	Westar (C.I. 12110)	Sinvalocho (C.I. 12595)	Waban (C.I. 12992)
1	R	R	R	R
3	R	R	S	R
4	R	R	S	S
5	R	S	R	R
7	R	S	S	R
8	R	S	S	S
10	S	R	S	R
12	S	S	R	R
14	S	S	S	R

Table 12. Distribution by geographic areas of NA 61 races of Puccinia recondita isolated in Canada in 1961.

Geographic Area	Number of Isolates of Indicated NA 61 Races								
	1	3	4	5	7	8	10	12	14
B.C. & Alta.	3	1	-	-	-	-	14	10	7
Man. & Sask.	-	-	-	3	1	-	-	5	38
Ont.	4	2	-	-	11	1	-	-	32
Que.	1	1	2	-	10	-	-	-	3
Maritimes	-	3	-	-	5	-	-	-	-

Table 13. Number of isolates of NA 61 races of Puccinia recondita found in certain standard physiologic races in 1961 in Canada.

Standard race Number	Number of Isolates of Indicated NA 61 Races								
	1	3	4	5	7	8	10	12	14
1	-	-	-	-	-	-	-	4	2
5	-	1	-	-	-	-	-	1	24
9	-	-	-	3	-	-	-	2	-
11	8	-	-	-	-	-	-	4	1
15	-	5	-	-	-	-	4	4	51
35	-	-	3	-	-	1	-	-	-
58	-	-	-	-	25	-	-	-	2
161	-	-	-	-	2	-	10	-	-
Total Isolates	8	6	3	3	27	1	14	15	79

Race 6 has been prevalent in Eastern Canada for several years and it might be assumed that it has spread from eastern barberry areas into the Great Plains region. This may have occurred but there is no evidence from the physiologic race survey to support the hypothesis. The race 6 from Eastern Canada is different from the race 6 that has suddenly become prevalent in the west. The western isolates are tentatively designated race 6F because they attack oat varieties carrying only the F gene for resistance. The isolates of race 6 from Eastern Canada do not attack these varieties.

Table 14. Distribution by provinces of physiologic races of Puccinia graminis f. sp. avenae identified in Canada in 1961.

Race	Province							Total Isolates	Per Cent of Total Isolates
	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	B.C.		
2	-	-	-	-	-	-	1	1	1.4
4A	-	-	-	-	1	-	-	1	1.4
6	7	3	1	3	2	-	-	16	22.8
6A	-	-	-	6	20	-	-	26	37.1
6F	-	-	-	-	-	4	-	4	5.7
7	-	-	-	-	-	1	-	1	1.4
7A	1	-	-	-	-	2	-	3	4.3
8	-	-	1	-	-	-	1	2	2.9
8A	-	-	-	2	-	-	-	2	2.9
10	-	1	-	-	-	-	-	1	1.4
10A	1	1	-	-	2	-	-	4	5.7
13A	-	-	-	6	3	-	-	9	12.9
Total No. of Isolates	9	5	2	17	28	7	2	70	

Physiologic races were identified by the same methods used in earlier years but four new hosts were tested in 1961. The varieties C.I. 4023 (genes BEF?) and R.L. 524.1 (genes BF), which were resistant to all isolates, were used from the beginning of the survey. A composite of F_3 lines carrying the F gene from R.L. 524.1 was added soon after the survey commenced. The composite was replaced later in the survey by two lines, one (Eagle^2 x C.I. 4023) carrying the F gene from C.I. 4023 and the other (Eagle^2 x R.L. 524.1) carrying the F gene from R.L. 524.1. The lines with the F gene were useful in differentiating between race 6 from Eastern Canada and race 6F from Western Canada. The F gene confers a valuable type of resistance since it is effective against races 4A, 6A, 8A, 10A, and 13A from Eastern Canada. No important differences were detected between the F gene from C.I. 4023 and the F gene from R.L. 524.1.

Puccinia coronata Cda. var. avenae Fraser & Led.

Twenty-four races of crown rust were identified in 1961 (Table 15). No estimate of race distribution can be given for the Prairie Provinces since only

two collections of crown rust were obtained from this area. Ninety cultures were isolated from collections made in Eastern Canada. Nineteen of these isolates, comprising five races, attacked Victoria, twelve isolates comprising six races attacked Saia and nine isolates of two races attacked Landhafer. Nearly all isolates, regardless of race, attacked Garry and Rodney.

Table 15. Distribution by geographic areas of physiologic races of Puccinia coronata avenae collected on oats in Canada in 1961.

Physiologic Race	Geographic areas			
	Que. and Maritime Provinces	Ontario	Manitoba and B.C.	Total Isolates
201	2	0	0	2
203	0	8	0	8
209	1	0	0	1
210	11	9	0	20
211	0	2	0	2
212	1	1	0	2
216	1	4	2	7
228	2	3	1	6
229	0	1	0	1
230	0	1	0	1
231	1	0	0	1
236	0	1	0	1
239	0	0	1	1
272	0	1	0	1
274	1	8	0	9
275	0	2	1	3
279	0	1	0	1
280	2	0	0	2
284	2	10	1	13
285	1	0	0	1
289	3	0	1	4
294	2	2	0	4
295	1	4	0	5
300	1	0	0	1
Total Isolates	32	58	7	97

Puccinia hordei Otth.

Ten collections of barley leaf rust were studied in 1961. All collections from Manitoba and Saskatchewan were identified as race 44 while races 4 and 44 were obtained from Ontario, New Brunswick and Nova Scotia.

Acknowledgments

The authors are grateful for the generous assistance given by many cooperators, too numerous to mention individually here, in the care of rust nurseries and the collection of rust specimens. Anyone in Canada interested in cereals is encouraged to forward collections of the cereal rusts to the Winnipeg station for race identification.

Acknowledgment is due also to Mr. J.H. Campbell, Mr. W. Ostapyk, Mr. S. Nichol, Mr. W.L. Timlick, and Mr. T. Watson for their technical help in the identification of physiologic races and making disease ratings in the rust nurseries.

CANADA AGRICULTURE RESEARCH STATION,
WINNIPEG, MANITOBA.

PHENOLOGICAL DATA AT FOUR CANADIAN LOCALITIES IN 1961

R.C. Russell and I.J. Bassett[1]

The first dates of anthesis for forty-two species of native plants were recorded at Winnipeg, Saskatoon and Edmonton by Dr. B. Peturson, R.C. Russell and W P. Campbell respectively and compiled by the senior author. Similiar data was recorded for thirty-three species at Ottawa by the junior author.

The 1961 season at Winnipeg opened somewhat early in April, but ensuing cold weather held back the development of the native flora to a considerable extent throughout the month of May. The remainder of the season was sufficiently warm and dry to mature native and cultivated plants earlier than normal.

At Saskatoon the season opened at about the usual time, but cold weather in the latter part of April and the first half of May retarded growth until June. From then on, higher than average temperatures and lack of rain hastened the development of native plants and wheat, with the exception that severe drought appeared to delay the flowering of some of the native plants that normally appear in the latter part of July. The high temperatures and severe drought matured the early-sown wheat very early.

The appearance of the native flowers at Edmonton was close to the normal dates until the early part of June. From then on the warmest, sunniest summer on record there resulted in the early appearance of all the listed species that bloomed throughout the rest of the season. Wheat sown two weeks later than normal was mature at about the average date.

[1] Plant Pathologist, Canada Agriculture Research Station, Saskatoon, Sask. and Botanist, Plant Research Institute, Canada Agriculture, Ottawa, Ont.

Table 1. Phenological data at Winnipeg, Saskatoon and Edmonton - 1961

	Winnipeg		Saskatoon		Edmonton	
Pulsatilla ludoviciana	6/4	4E	21/4	3L	26/4	1L
Corylus rostrata	--	--	--	--	27/4	N
Populus tremuloides	10/5	15L	23/4	2E	27/4	N
Phlox hoodii	--	--	28/4	1E	--	--
Acer negundo	15/5	8L	14/5	7L	7/5	4L
Salix petiolaris	--	--	--	--	1/5	1L
Shepherdia canadensis	--	--	--	--	3/5	N
Betula papyrifera	--	--	19/5	8L	3/5	4E
Prunus americana	21/5	7L	--	--	--	--
Amelanchier alnifolia	22/5	4L	21/5	6L	21/5	4L
Prunus pensylvanica	--	--	23/5	3L	19/5	1L
Viola rugulosa	--	--	23/5	2L	23/5	N
Smilacina stellata	28/5	4L	25/5	N	23/5	2E
Crataegus chrysocarpa	27/5	3L	--	--	27/5	3E
Prunus melanocarpa	29/5	4L	29/5	1L	31/5	3L
Cornus stolonifera	31/5	1E	3/6	4L	3/6	2L
Viburnum lentago	2/6	1E	--	--	--	--
Elaeagnus commutata	--	--	4/6	N	9/6	4L
Lonicera glaucescens	--	--	6/6	2E	11/6	4L
Hedysarum americanum	--	--	6/6	1E	--	--
Thalictrum turneri	--	--	--	--	6/6	1L
Maianthemum canadense	--	--	--	--	7/6	1L
Achillea lanulosa	--	--	12/6	2L	--	--
Anemone canadensis	5/6	1E	10/6	1E	12/6	11E
Viburnum opulus	7/6	2E	--	--	--	--
Galium boreale	--	--	9/6	5E	8/6	11E
Rosa alcea	--	--	17/6	3E	5/6	4E
Campanula petiolata	--	--	25/6	3L	7/7	4E
Bromus inermis	17/6	4E	16/6	7E	19/6	6E
Spiraea alba	--	--	16/6	14E	--	--
Symphoricarpos occidentalis	21/6	6E	20/6	12E	23/6	12E
Chamaenerion spicatum	--	--	--	--	4/7	5E
Lactuca pulchella	--	--	3/7	5E	--	--
Psoralidium argophyllum	--	--	1/7	9E	--	--
Phleum pratense	--	--	--	--	7/7	1E
Apocynum androsaemifolium	--	--	--	--	20/6	21E
Solidago missouriensis	--	--	8/7	6E	--	--
Solidago canadensis	--	--	--	--	15/7	6E
Grindelia perennis	--	--	24/7	1L	--	--
Oligoneuron canescens	--	--	6/8	11L	--	--
Aster conspicuus	--	--	--	--	20/7	3E
Aster laevis	--	--	6/8	7L	25/7	5E
Wheat sown	5/5	6L	24/4	6E	16/5	14L
emerged	--	--	15/5	2L	22/5	10L
headed	24/6	7E	26/6	6E	16/7	12L
mature	28/7	12E	23/7	16E	22/8	2L

Table 2. Phenological data at Ottawa, Ontario - 1961

Species	No. of years of observation	First dates of anthesis, 1961	No. of days departure from average
Acer saccharinum	26	11/4	1L
Ulmus americana	26	20/4	9E
Corylus cornuta	9	21/4	5L
Populus tremuloides	21	21/4	2E
Populus grandidentata	10	21/4	2E
Acer rubrum	10	30/4	3L
Betula papyrifera	10	4/5	2L
Acer negundo	21	9/5	4L
Acer saccharum	26	No flowering	
Fraxinus americana	9	15/5	2L
Celtis occidentalis	8	15/5	3L
Prunus pensylvanica	20	18/5	4L
Quercus macrocarpa	10	19/5	2E
Barbarea vulgaris	10	19/5	4L
Smilacina stellata	20	23/5	3L
Alopecurus pratensis	10	24/5	8L
Rumex acetosella	9	27/5	6E
Pinus sylvestris	26	29/5	2L
Fagus grandifolia	9	No flowering	
Juglans nigra	10	30/5	6E
Tilia americana	20	3/6	2E
Carya cordiformis	17	4/6	9E
Poa pratensis	10	6/6	8L
Dactylis glomerata	10	9/6	N
Sambucus nigra	12	14/6	1E
Phleum pratense	20	23/6	2E
Bromus inermis	20	26/6	7L
Rhus typhina	15	11/7	14L
Catalpa ovata	18	14/7	11L
Cephalanthus occidentalis	16	14/7	4E
Ambrosia trifida	10	29/7	13L
Ambrosia artemisiifolia	9	2/8	4E
Hamamelis virginiana	18	4/9	16E