

PHENOLOGICAL OBSERVATIONS IN NOVA SCOTIA AND CANADA,
1902.—BY A. H. MACKEY, LL. D.

(Received for publication, May, 1903.)

I present in the two tables following a summary of (1) the detailed observations made in Nova Scotia, mainly through the agency of the public schools, and (2) the more general observations made throughout the Dominion of Canada.

The object sought for in the Nova Scotian public school system is the educational one; for the pupils of the schools are the observing naturalists, the teacher being the responsible compiler and recorder of the observations.

The smaller work of the general compilation and publication of the averages of local observations is only the secondary object; but the results are now deemed to be more accurate than those made by individuals only at each station.

References in my previous papers have been made to the observations collected and published by Dr. Ihne of Darmstadt from the continent of Europe; to the school observation system like our own, which is now being, with interesting results, tried in Denmark, under the inspiration of Mr. Carl Michelsen, of Skanderborg, and the practical guidance of M. J. Mathiassen; and to the Natural History Society work of British Columbia.

I have only just received the Report on the Phenological Observations of Great Britain and Ireland for 1902, by Edward Mawley, F. R. Met. Soc., F. R. H. S., which is published in the *Quarterly Journal* of the *Royal Meteorological Society*, vol. XXIX. No. 126, April, 1903. This shows an advance in the treatment of these observations over other publications seen at date; and our system of using "annual" instead of "mensual" dates is exploited in a capital series of phenochronic graphs.

NOVA SCOTIAN PHENOCHRONS.

As these are based on about 350 schedules, it will be observed that, as a rule, a good many schedules are averaged for each of the ten meteorological or biological regions of the province. The individual schedules are annually bound up into a volume which can be utilized by weather students in the future with every facility. There are already a number of such volumes in existence. And those of the last years have, to a considerable extent, been analyzed and compiled by a staff of specialists so as to give the phenochrons of the coast, lowland and highland belts of each county. These sheets are likewise being bound up in annual volumes. The Nova Scotian table published here is merely the most generalized average of averages.

A close study of the tables showing individual observations, will create the impression that observers are not always in a position to note the phenomena of the seasons when they first appear. In this respect the observations conducted by the public schools are more accurate. For they are made by a large number of individuals travelling nearly every day to school and radiating from this central point of the community for a distance generally of about two miles. As the teachers stimulate "observing" by noting the first one who brings evidence of the first appearance of a flower, etc., there is a great deal of competitive observation on the part of the young people. This not only makes the travelling to and from school more interesting; but is found to be a great aid to general "nature study." Accuracy is assured by the bringing of the specimen to the school room when practicable.

But even in schools mistakes may occur through accident in recording, and sometimes from lack of sufficient knowledge of the natural history of the locality. In order to discover such mistakes, and to enable directions to be framed in order to minimize them, as well as for the purpose of studying and compiling regional phenochrons, the observation schedules filled in by the teacher of each school is sent to one of a staff of special-

ists. Their criticisms are annually published in the *Journal of Education of Nova Scotia*, which also contains the names of observers and number of observations made in each of the schools reporting. Under the advice of this phenological staff several changes were made in the schedules issued after 1902, which are known as the "1903 schedule."

The names and addresses of the Nova Scotian phenological staff at present are as follows :

- C. B. Robinson, B. A., Science Master, Pictou Academy.
- E. J. Lay, Principal, Amherst Academy.
- J. E. Barteaux, Science Master, Truro Academy.
- Antoinette Forbes, B. A., Windsor Academy.
- Burgess McKittrick, B. A., Principal, Lunenburg Academy.
- Minnie C. Hewitt, Lunenburg Academy.
- G. R. Marshall, Principal, Richmond School, Halifax.
- Stanley C. Bruce, Principal, Shelburne Academy.
- A. W. Horner, Principal, Public School, Yarmouth.

CANADIAN PHENOCHRONS.

The second table contains the observations of the following members of the Botanical Club of Canada on the dates of the first appearances of the phenomena briefly indicated only in the table, although precisely specified in the schedules for recording them ; and are published here in order to keep the series published in the Transactions of our Institute continuous. The addresses and stations of the observers are as follows, in the order of the table :

- T. A. Good, Woodstock, New Brunswick ; J. M. Duncan, Charlottetown, Prince Edward Island ; John McSwain, Charlottetown, Prince Edward Island ; Dr. Cephias Guillet, Ottawa, Ontario ; Mrs. Frank E. Webster, Beatrice, Muskoka, Ontario ; Dr. J. H. Elliott, Gravenhurst, Muskoka, Ontario ; T. R. Donnelly, Pheasant Forks, Assiniboia ; Percy B. Gregson, Blackfalds, Alberta ; J. K. Henry, B. A., Vancouver, British Columbia.

The first column is the average of about 350 schedules of observations made by as many of the public schools of the province of Nova Scotia, and the active members of the club among whom the following have been sending in reports: Rev. James Rosborough, Musquodoboit Harbor, Halifax Co.; Miss Louise MacMillan, Sydney Mines, Cape Breton; Mrs. G. Ormond Forsyth, Port Hawkesbury, Inverness Co.; and Miss Janet Keith Bruce Kelley, Yarmouth.

The last column is the average of scattered observations from about ten observers in different parts of the south of British Columbia, five being from Vancouver Island or the coast, two from the dry belt, and three from the mountain belt. These observations were made on the schedule prepared and published by the Natural History Society of the province, and were communicated to me by A. J. Pineo, Esq., B. A., of Victoria, and are published in detail in my report from the Botanical Club of Canada to the Royal Society of Canada.

NOVA SCOTIAN PHENOCHRONS, 1902.
 FLOWERING AND OTHER PHENOCHRONS FOR EACH REGION OF THE PROVINCE OF NOVA SCOTIA, COMPILED FROM 350 PUBLIC
 SCHOOL OBSERVATION SCHEDULES.

[The phenochrons for each region (which are averages of many observations) have the fractions omitted.]

WHEN FIRST SEEN.										WHEN BECOMING COMMON.											
REGIONS.										REGIONS.											
1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb. Col. Pictou and Antig.	8. Breton, Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average for Province.	1. Yarmouth and Digby.	2. Shelburne, Queens and Lunenburg.	3. Annapolis and Kings.	4. Hants and South Colchester.	5. Halifax and Guysboro.	6. South Cobequid Slope (S. Cumb. and Col.)	7. North Cumb. Col. Pictou and Antig.	8. Breton, Richmond and Cape Breton.	9. Bras d'Or Slope (Inv. and Victoria).	10. Inverness Slope to Gulf.	Average for Province.
94	88	88	88	101	96	96	96	96	96	101.0	107	96	103	98	103	103	103	103	103	103	101.0
108	88	90	92	90	101	98	98	105	111	112.3	120	118	114	101	118	114	101	110	106	112	112.3
186	88	90	92	90	101	98	98	103	103	107.4	103	101	103	108	107	110	109	109	112	113	107.4
113	117	115	117	121	118	120	123	121	124	127.0	118	126	123	126	124	125	125	130	129	129	127.0
110	114	115	117	115	119	117	123	121	123	124.9	119	122	123	124	124	125	125	130	128	129	124.9
118	115	116	111	116	115	117	124	123	117	123.8	125	122	121	119	124	124	123	129	128	123	123.8
186	127	130	132	125	127	127	146	146	131.8	136.3	134	135	144	138	133	129	127	134	134	128	136.3
120	125	114	119	118	121	120	128	122	123	130.2	133	132	125	126	129	129	127	133	131	128	130.2
111	119	117	118	118	121	120	128	122	123	129.0	121	127	127	127	133	131	129	127	127	133	129.0
127	152	135	128	126	121	120	128	122	123	138.8	127	126	125	126	134	133	128	127	127	133	138.8
120	125	129	127	126	126	132	133	130	134	117.4	123.4	129	125	102	137	136	134	139	139	140	123.4
116	119	114	116	117	116	119	122	119	118	117.6	125.2	123	129	124	127	132	129	130	129	140	125.2
157	163	157	164	167	165	167	178	175	172	166.6	178.4	174	176	173	177	179	174	180	186	184	178.4

*Last year the date here should have been 154 instead of "114" which was a clerical error.
 †The "154" of last year should have been 158.

134	139	136	138	141	140	140	148	145	150	141.2	15	Prunus Pennsylvanica, L.	147.6	141	146	144	144	144	150	145	146	153	151	156
217	210	...	...	...	...	...	...	...	...	...	16	" (fruit ripe)	228.8	231	212	...	...	...	...	...	...	...	...	...
129	131	137	137	143	143	162	151	150	141.0	141.0	17	Vaccinium Penn. v. Can., Lam.	160.4	139	141	144	146	152	163	151	161	161	157	157
139	144	139	144	162	142	147	160	133	131	147.2	18	" (fruit ripe)	220.8	211	189	211	150	161	154	156	168	139	157	213
145	143	153	153	157	158	157	161	162	164	155.3	19	Ranunculus acris, L.	165.9	150	151	150	159	167	163	164	163	163	168	...
142	145	146	158	156	154	165	166	166	155.2	155.2	20	R. repens, L.	161.1	154	156	149	159	167	165	159	172	173	...	...
139	144	135	148	158	148	146	169	155	141	148.0	21	Trillium erythrocarpum, Mich.	153.2	152	152	161	155	153	149	154	170	170	145	...
142	145	135	148	158	148	163	151	147	147.4	147.4	22	Trientalis Americana, Pursh.	154.7	149	153	146	153	154	157	162	170	168	155	...
139	144	135	148	158	148	160	168	161	147	158.4	23	Cypripedium acaule, Ait.	163.3	158	158	147	163	165	166	162	170	164	...	...
151	152	151	157	159	164	180	168	161	147	160.6	24	Calla palustris, L.	190.0	162	163	179	149	146	164	168	165	166	166	...
137	135	133	134	139	139	144	158	165	177	160.6	25	Amelanchier Canadensis, T.	145.3	144	141	139	141	146	144	142	168	159	150	147
151	152	151	157	159	164	180	168	161	147	160.6	26	"	210.6	212	207	210	168	...	...	...	...	...	...	...
156	163	154	154	159	158	152	164	162	138.6	138.6	28	Rubus strigosus, Michx.	166.9	166	170	161	168	...	...	...	...	...	...	...
205	201	206	181	200	207	215	219	207	203.8	203.8	29	" (fruit ripe)	173.9	175	173	173	171	...	...	...	...	...	...	...
165	165	164	160	169	165	176	160	170	166.1	166.1	30	Rubus villosus, Ait.	173.9	175	173	173	171	...	...	...	...	...	...	...
231	216	225	228	...	...	...	...	...	...	...	31	" (fruit ripe)	241.4	246	229	226	245	...	...	...	...	...	...	...
144	145	140	147	146	151	138	167	161	142	151.4	32	Kalmia glauca, Ait.	157.5	152	151	155	153	...	...	...	...	...	...	...
142	165	150	178	157	178	178	162	167	163.7	163.7	33	K. angustifolia, L.	170.1	171	167	182	163	...	...	...	...	...	...	...
144	149	144	149	146	151	150	161	156	163	152.4	34	Cornus Canadensis, L.	160.6	154	160	152	158	166	159	158	167	166	167	...
245	203	...	...	...	...	...	...	...	...	...	35	" (fruit ripe)	225.1	249	207	229	...	...	...	...	...	...	...	...
132	154	151	154	158	157	175	163	163	158.5	158.5	36	Sisyrinchium angustifolium	166.4	161	161	188	162	166	166	168	181	170	171	...
160	159	159	164	168	171	172	175	179	178	168.6	37	Linnaea borealis, L.	174.5	167	166	164	169	176	178	178	181	186	182	...
158	172	178	...	...	...	...	...	...	...	...	38	Linaria Canadensis, Dum.	176.4	176	171	182	...	...	...	...	...	...	...	...
166	168	165	170	...	...	...	...	...	...	...	39	Rhinanthus Crista-galli, L.	173.8	173	174	175	176	...	...	...	...	...	...	...
160	163	165	154	...	...	...	...	...	...	...	40	Sarracenia purpurea, L.	180.0	190	177	176	179	...	...	...	...	...	...	...
171	171	174	173	...	...	...	...	...	...	...	41	Brunella vulgaris, L.	198.0	206	187	200	...	...	...	...	...	...	...	...
182	178	175	182	...	...	...	...	...	...	...	42	Epilobium angustifolium, L.	192.6	202	184	180	186	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	43	Rosa lucida, Ehrh.	173.5	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	44	Hypericum perforatum, L.	177.4	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	45	Leontodon autumnale, L.	149.6	142	143	148	156	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	46	Prunus Cerasus (cultiv.)	210.4	213	112	199	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	47	" (fruit ripe)	164.9	163	164	162	164	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	48	Crataegus Oxyacantha, L.	162.7	168	160	161	152	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	49	C. coccinea, L.	131.5	143	148	146	148	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	50	Prunus domestica (cultivated)	184.1	180	180	183	181	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	51	Pyrus malus (cultivated) early	161.8	160	156	160	160	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	52	" late	147.9	138	144	142	146	150	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	53	Ribes rubrum (cultivated)	205.6	212	202	228	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	54	" (fruit ripe)	149.4	147	146	145	147	151	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	55	R. nigrum (cultivated)	214.2	219	205	227	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	56	" (fruit ripe)	167.9	165	163	161	165	172	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	57	Solanum tuberosum, L.	198.5	187	188	198	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	58	Phlox pratensis, L.	179.3	163	168	178	183	175	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	59	Trifolium repens, L.	170.3	164	167	165	168	171	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	60	T. pratense, L.	168.7	159	163	164	166	168	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	61	Triticum vulgare, L.	210.8	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	62	" .....	...	...	...	...	...	...	...	...	...	...	...	...

CANADIAN PHENOCHRONS, 1902.

OBSERVATION STATIONS—WHEN FIRST SEEN.

Number.	Day of the year 1902 corresponding to the last day of each month. Jan 31 July 212 Feb 59 Aug 243 March 90 Sept 273 April 120 Oct 304 May 151 Nov 334 June 181 Dec 365	Average dates for Nova Scotia.	Woodstock, N. B.	Charlottetown, P. E. I. (1)	Charlottetown, P. E. I. (2).	Ottawa, Ont.	Beatrice, Muskoka, Ont.	Muskoka, Ont.	Pheasant Forks, Assa.	Blackfalds, Alberta	Vancouver, B. C.	Average dates for British Columbia
1	<i>Alnus incana</i> , Willd.....	93.5	*95	116	123	97	87	...	...	...	d59	d108.7
2	<i>Populus tremuloides</i> , Mx.....	103.5	*102	...	127	96	*99	...	137	135	...	...
3	<i>Epigæa repens</i> , L.....	94.9	...	76	107	*106	...	99	...	...	...	...
4	<i>Viola cucullata</i> , Gray.....	119.1	*102	117	...	132	*110	114	137	123	e97	...
5	<i>V. blanda</i> , Willd.....	116.9	*102	117	...	120	*112	103	140	...	100	...
6	<i>Acer rubrum</i> , L.....	117.1	*115	121	123	96	*110	107	...	...	f92	...
7	<i>Houstonia cærulea</i> , L.....	131.8	...	...	...	...	...	...	...	...	...	...
8	<i>Equisetum arvense</i> , L.....	122.4	...	...	...	104	*142	...	...	...	80	...
9	<i>Taraxacum officinale</i> , Web....	119.8	122	120	130	109	*126	112	138	195	...	...
10	<i>Erythronium Amer.</i> , Ker.....	130.8	*122	...	...	108	*142	112	...	...	...	...
11	<i>Hepatica triloba</i> , Chaix.....	117.4	...	...	...	86	...	87	...	...	...	...
12	<i>Coptis trifolia</i> , Salisb.....	128.3	*143	...	...	120	*142	123	...	...	.....	.....
13	<i>Fragaria Virginiana</i> , Mill.....	117.6	125	147	138	111	*161	120	127	156	...	102.8
14	“ (fruit ripe).....	166.6	...	...	...	161	...	...	183	200	...	153.
15	<i>Prunus Pennsylv.</i> , L.....	141.2	143	...	...	127	*138	133	147	143	g116	...
16	“ (fruit ripe).....	223.1	...	232	...	...	...	...	...	223	...	...
17	<i>Vaccinium Penn.</i> , Lam.....	141.0	145	...	...	119	...	123	...	...	...	128
18	“ (fruit ripe).....	207.1	...	...	...	...	*216	...	...	219	...	185.1
19	<i>Ranunculus acris</i> , L.....	147.2	149	166	...	140	*156	153	120	170	*130	119.6
20	<i>R. repens</i> , L.....	155.3	151	127	...	154	...	...	...	...	...	125
21	<i>Clintonia borealis</i> , Raf.....	155.2	...	...	...	...	...	145	...	...	...	...
22	<i>Trillium erythrocarpum</i>	148.0	*143	...	...	125	*130	138	...	...	...	...
23	<i>Trientalis Ameri.</i> , Pursh.....	147.4	...	145	...	137	...	141	...	...	h124	...
24	<i>Cypripedium acaule</i> , Ait.....	158.4	...	...	...	137	*163	142	...	b170	...	k121.8
25	<i>Calla palustris</i> , L.....	160.6	...	...	...	194	*156	...	...	...	...	...
26	<i>Amelanchier Canadensis</i>	138.8	...	147	...	120	*126	124	144	c143	...	c123.5
27	“ (fruit ripe).....	194.0	...	...	...	...	...	...	...	205	...	...

*When becoming common. a *Rosa blanda* b *Cypripedium hirsutum*.
c *A. alnifolii*. d *Alnus rubra*. e *Viola palustris*. f *A. macrophyllum*.
g *Prunus emarginata*. h *Trientalis Europæa*. k *Calypso*.

CANADIAN PHENOCHRONS, 1902.
OBSERVATION STATIONS—WHEN FIRST SEEN.

Number.	Day of the year 1902 corresponding to the last day of each month.	Average dates for										Average dates for British Columbia.
		Nova Scotia.	Woodstock, N. B.	Charlottetown, P. E. I. (1).	Charlottetown, P. E. I. (2).	Ottawa, Ontario.	Beatrice, Muskoka, Ont.	Muskoka, Ont.	Pleasant Forks, Assa.	Blackfolds, Alberta.	Vancouver, B. C.	
28	<i>Rubus strigosus</i> , Michx.....	158.6				151	*166	151	170	180	169	141.6
29	“ (fruit ripe).....	203.8					*211			210	149	196.
30	<i>Rubus villosus</i> , Ait.....	166.1				153	*166	155				
31	“ (fruit ripe).....	232.7					*222					
32	<i>Kalmia glauca</i> , Ait.....	151.4				171		142			*122	
33	<i>K. angustifolia</i> , L.....	163.7				171						
34	<i>Cornus Canadensis</i> , L.....	152.4	147			142	*166	142			127	133.2
35	“ (fruit ripe).....	216.1										
36	<i>Sisyrinchium angustifol.</i> ..	158.5				148		181	173	160		
37	<i>Linnaea borealis</i> , L.....	168.6				160	*193					137.7
38	<i>Linaria Canaden.</i> , Dum.....	171.5				176		196				
39	<i>Rhinanthus Crista-galli</i> , L ..	170.5										
40	<i>Sarracenia purpurea</i> , L.....	165.2				171	*163	176				
41	<i>Brunella vulgaris</i> , L.....	171.5				160	*176	166				179.7
42	<i>Epilobium angustifolium</i>	186.9					*192	181		200	*171	177.
43	<i>Rosa lucida</i> , Ehrh.....	181.5						^a 166	168	173	^j 141	^j 142.6
44	<i>Hypericum perforatum</i> , L.....	170.0					*193	186		200		
45	<i>Leontodon autumnale</i> , L.....	169.6		168			*310			206		
46	<i>Prunus Cerasus</i> (cultiv.).....	143.3	147	145							103	
47	“ (fruit ripe).....	197.2									159	
48	<i>Crataegus Oxyacantha</i> , L.....	158.5	167									151
49	<i>C. coccinea</i> , L.....	155.2	158	163	140	*133			151			
50	<i>Prunus domestica</i> (cult'd).....	145.4	147		125				158		97	
51	<i>Pyrus malus</i> (cult'd) early.....	147.6	150	154	132	*144					114	128.6
52	“ “ late.....	155.8										
53	<i>Ribes rubrum</i> (cultivated)....	141.9					*131		144		91	113.9
54	“ (fruit ripe).....	193.7				193						
55	<i>R. nigrum</i> (cultivated).....	142.9					*134		149			

* When becoming common.
Rosa. *C. nutallii*.^a *Rosa blanda*.^j *Rubus spectabilis*.

CANADIAN PHENOCHRONS, 1902.

OBSERVATION STATIONS—WHEN FIRST SEEN.

Number.	Day of the year 1902 corresponding to the last day of each month.	Average dates for										
		Nova Scotia.	Woodstock, N. B.	Charlottetown, P. E. I. (1)	Charlottetown, P. E. I. (2)	Ottawa, Ont.	Beatrice, Muskoka, Ont.	Muskoka, Ont.	Pheasant Forks, Assa.	Blackfalds, Alberta.	Vancouver, B. C.	Average dates for British Columbia.
	Jan..... 31	July..... 212										
	Feb..... 59	Aug..... 243										
	March.... 90	Sept..... 273										
	April..... 120	Oct..... 304										
	May..... 151	Nov..... 334										
	June..... 181	Dec..... 365										
56	R. nigrum (fruit ripe).....	207.1				193						132.6
57	Syringa vulgaris, L (cult.)....	160.8		161	163	195	146		163		123	165.6
58	Solanum tuberosum, L.....	185.9									200	178.4
59	Phleum pratense, L.....	177.9									180	137.5
60	Trifolium repens, L.....	162.6				143		144		170	125	144.8
61	T. pratense, L.....	159.5		180		151		152			133	180.
62	Triticum vulgare, L.....	205.0									205	
63	Avena sativa, L.....	201.7									205	
64	Fagopyrum esculentum, L....	194.9				177		192				
65a	Earliest full leafing of tree....	137.5						140				
65b	Latest " ".....	165.2										
66	Ploughing (first of season)....	104.6				90	*121		113	97		
67	Sowing " ".....	117.2		106	113				121	97		
68	Potato-planting " ".....	115.1		113			*136		147	123		
69	Sheep-shearing " ".....	125.5	100				*132		153	175		
70	Hay-cutting " ".....	192.9					205			200		
71	Grain-cutting " ".....	231.0		231	232		234		240			
72	Potato-digging " ".....	258.3					262			205		
73a	Opening of rivers " ".....	72.7		5	67	95			83	101		
73b	Opening of lakes " ".....	78.9								120		
74a	Last snow to whiten ground..	103.0		133			148			153		98.2
74b	" " to fly in air.....	123.2				92	148			153	81	
5a	Last spring frost—hard.....	140.5				129	149			144	89	
5b	" " hoar.....	154.9		141	154					144	115	
6a	Water in streams—highest....	85.9					312			186		
76b	" " lowest....	245.0					330			309		
77a	First autumn frost—hoar.....	264.7		258	231				209	241	296	
77b	" " hard.....	290.3		289					244	268	322	
78a	First snow to fly in air.....	293.4		298					305	259	310	

* When becoming common.

CANADIAN PHENOCHRONS, 1902.

OBSERVATION STATIONS—WHEN FIRST SEEN.

Number.	Day of the year 1902 corresponding to the last day of each month.	Average dates for											Average dates for British Columbia.				
		Nova Scotia.	Woodstock, N. B.	Charlottetown, P. E. I. (1).	Charlottetown, P. E. I. (2).	Ottawa, Ont.	Beatrice, Muskoka, Ont.	Muskoka, Ont.	Pheasant Forks, Assa.	Blackfalds, Alberta.	Vancouver, B. C.						
	Jan. 31	July	212														
	Feb. 59	Aug.	243														
	March 90	Sept.	273														
	April 120	Oct.	304														
	May 151	Nov.	334														
	June 181	Dec.	385														
78b	First snow to whiten ground.		313.1		298							307	300	310			
79a	Closing of lakes.		346.5										311				
79b	“ rivers.		354.3		345	344							312				
81a	Wild ducks migrating, N.		76.3	80								97	82				
81b	“ “ S		295.1									305	300				
82a	Wild geese “ N.		76.1	73	60	62	98					96	80				
82b	“ “ S		310.3			263		319				307	300				
83	Melospiza fasciata, North		85.4	88		90	74					120					
84	Turdus migratorius “		78.3	79	87	93	74	84				82	120				
85	Junco hiemalis “		79.1	87		92	86	67				88					
86	Actitis macularia “		124.0					106									
87	Sturnella magna “		107.0					95				98					
88	Ceryle Alcyon “		121.3	115				140									
89	Dendroeca coronata “		137.2	132	150												
90	D. aestiva “		140.2	138				126									
91	Zonotrichia alba “		103.5	128				113									
92	Trochilus colubris “		146.1	140				137				182					
93	Tyrannus Carolinensis “		138.7	138				140				147					
94	Dolychonyx oryzivorus “		132.9	138				133									
95	Spinis tristis “		132.8	108				130									
96	Setophaga ruticilla “		127.7	142				130									
97	Ampelis cedrorum “		138.0	9				74									
98	Chordeiles Viginianus “		126.7	142		143	142					150					
99	First piping of frogs		91.1	103	104	101	84	91				104	112	46			
100	First appearance of snakes		101.7					91	119			117	135				