VI.—Phenological Observations, Canada, 1898, Compiled by A. H. MacKay, LL.D., *Halifax, from Observations of the Botanical Club of Canada, and of over seven hundred of the Public Schools of Nova Scotia.*

(Read April 17th, 1899.)

In order to continue the publication of the series of the observations of the Botanical Club of Canada, I give hereafter a table of the observations made by the thirteen members making a phenological report for 1898. I can but give a summary of selections from seven hundred reports from as many localities in the Province of Nova Scotia. That these observations are of very great value in measuring the phenological conditions of the various portions of the province can be readily inferred from the facts, that each report comes from a school in which numbers of pupils were observing on their way to and from school under the direction and stimulation of the teacher, and is therefore likely to be in most cases more accurate than one made by a single observer; that the reports represent every part of the province; and that they represent more or less numerous localities in each county of the province.

For the compilation of the tables which immediately follow, ten of the most complete schedules or reports from each county were selected (except in the cases of the counties of Queens, Antigonish and Guysboro, where the full schedules were not sufficiently numerous, and were respectively five, five and six). From these were selected the same TEN plants which had the time of "first flowering" and the time when "flowering was becoming common" both recorded. From these averages or mean dates of flowering have been found, which we may speak of as "phenochrons," the times of the appearances of the phenomena observed expressed in the terms of the days of the year. For such computations it is necessary to have some

simple method of indicating the point of time. For the conversion of the ordinary mensual date to this annual one, or *vice versa*, all that is necessary to assist the operation of mental arithmetic, is to have such a scheme as the following before the eye :—

Day of the year, corresponding to the last day of each month.			
January	31	July	212
February	59	August	243
March	90	September	273
April	120	October	304
May	151	November	334
June	181	December	365

(For *leap* years increase each number except the first by 1.)

Below is a table of phenochrons for the flowering of ten plants in each county, and for each county, for the spring of 1898, in Nova Scotia, based on ten of the best sets of observations made in each county. The first column is the average date of the "first flowering" observed, the second is the average date when the flowering was considered to be "becoming common." The counties are arranged in the order of their phenochrons based on the average of both columns.

	Yarmouth. 130.68.		Annapolis. 132.22.		Kings. 134.19.	
Mayflower	83.0	100.7	89.2	103.8	93.9	104.7
Blue Violet	113.7	126.5	122.5	130.3	122.1	133.1
Red Maple	120.6	129.1	119.0	130.2	117.7	129.2
Dandelion	113.6	126.4	120.2	130.1	124.0	134.4
Strawberry	115.0	130.8	132.3	131.3	116.6	136.5
Wild Red Cherry	137.9	146.9	134.7	142.0	141.3	146.9
Buttercup	131.5	145.3	142.6	150.7	140.3	151.0
Indian Pear	139.5	144.9	136.2	140.0	139.8	143.7
Apple	142.6	152.5	142.2	147.2	144.5	151.5
Lilac	154.7	162.7	151.8	158.1	152.5	160.2
	125.21	136.56	128.07	136.37	129.27	139.12

	Digby. 134.27.		Hants. 134.97.		Shelburne. 135.19.	
Mayflower	92.4	104.4	96.0	109.3	86.1	102.9
Blue Violet	122.8	132.9	122.8	131.2	120.9	128.7
Red Maple	127.9	134.8	119.2	127.0	122.7	131.5
Dandelion	111.9	127.1	124.0	133.2	121.8	129.8
Strawberry	117.5	132.1	123.4	133.5	126.0	135.4
Wild Red Cherry	140.7	150.9	141.1	145.8	144.7	150.5
Buttercup	145.4	155.8	140.3	152.5	139.9	152.1
Indian Pear	138.4	143.7	140.2	144.5	139.2	145.1
Apple	141.6	150.5	146.2	151.5	146.8	153.2
Lilac	151.7	163.0	156.0	161.8	159.0	166.4
	129.03	139.52	130.92	139.03	130.71	139.56
	Pictou. 135.41.		Lunenburg. 135.43.		Queens. 135.72.	
Mayflower	97.9	111.6	93.4	105.5	90.8	112.0
Blue Violet	121.2	133.4	119.1	132.2	123.4	131.0
Red Maple	122.3	132.3	116.4	127.1	119.4	128.0
Dandelion	120.4	132 3	126.2	134.4	126.2	133.2
Strawberry	124.2	135 5	123.8	133.9	125.4	133.8
Wild Red Cherry	143.3	148.8	140.8	146.2	140.8	145.4
Buttercup	142.0	149.6	149.5	158.0	148.8	157.2
Indian Pear	139.2	144.5	138.2	143.7	139.0	144.6
Apple	146.4	151.7	145 0	151.3	142.6	150.2
Lilac	152.3	159.3	159.2	164.8	157.6	165.0
	131.92	139.90	131.16	139.71	131.40	140.04
	Colchester. 137.23.		Halifax. 137.29.		Cumberland. 139.20.	
Mayflower	96.8	110.5	92.8	107.2	101.4	111.7
Blue Violet	125.6	136.2	123.7	131.8	132.0	139.0
Red Maple	125.6	133.9	122.7	129.7	130.4	136.1
Dandelion	125.3	134.8	124.7	132.4	131.1	137.8
Strawberry	125.5	136.5	124.9	134.0	130.9	138.8
Wild Red Cherry	141.1	146.6	146.6	151.4	142.7	146.9
Buttercup	148.0	156.8	148.4	156.5	147.1	155.7
Indian Pear	142.5	148.2	139.7	144.7	139.8	146.1
Apple	145.4	151.4	150.4	155.6	147.1	151.3
Lilac	153.7	160.2	161.0	167.7	155.6	162.5
	132.95	141.51	133.49	141.10	135.81	142.59

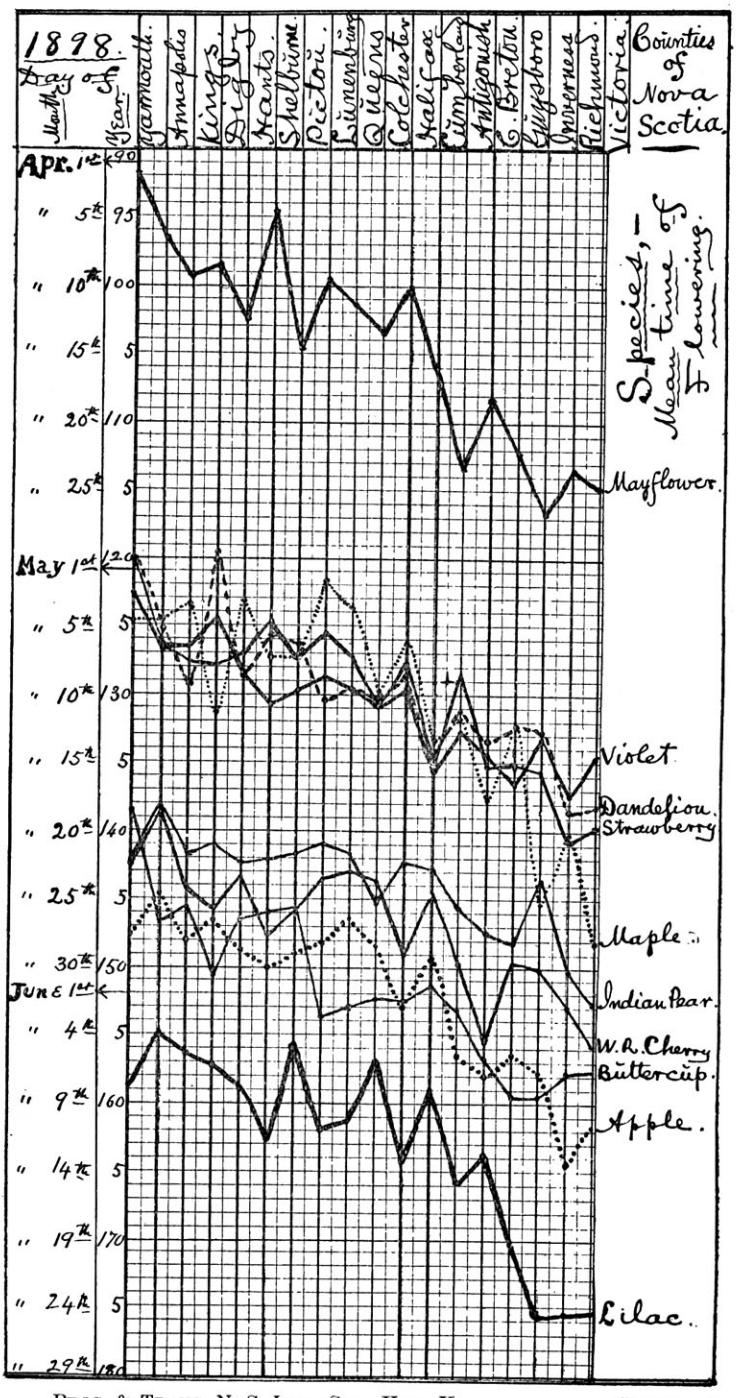
	Antigonish. 140.93.		Cape Breton. 143.05.		Guysboro. 143.28.	
Mayflower	106.2	120.8	101.5	114.8	100.2	124.2
Blue Violet	130.2	135.6	131.2	137.9	132.5	141.2
Red Maple	129.6	134.2	133.9	141.6	126.3	138.0
Dandelion	130.0	132.6	130.2	136.5	125.2	139.2
Strawberry	120.6	136.8	129.2	141.2	130.2	140.5
Wild Red Cherry	146.8	152 8	151.9	158.7	148.2	151,5
Buttercup	149.0	157.2	153.5	160.2	154.3	164.7
Indian Pear	143.6	147.8	144.9	150.1	146.5	149.8
Apple	154.2	158.8	155.6	160.5	152.0	161.0
Lilac	162.6	169.2	160.9	166.8	167.7	172.7
	134.28	144.58	139.28	146.83	138.30	148.26
	Inverness. 145.07.		**Richmond. 146.65.**		**Victoria. 147.97.**	
Mayflower	111.0	122.4	105.2	121.7	108.2	121.6
Blue Violet	126.9	139.4	132.9	142.0	131.1	138.3
Red Maple	141.7	149.0	137.0	143.2	146.0	150.4
Dandelion	125.8	139.9	134.7	142.4	134.2	142.5
Strawberry	129.4	142.0	135.5	145.9	134.4	145.3
Wild Red Cherry	146.0	154,2	149.2	156.9	152.7	159.1
Buttercup	154.9	164.1	152.9	162.9	152.6	162.3
Indian Pear	136.0	151.3	146.0	154.4	148.6	157.3
Apple	153.6	162.2	161.4	167.6	159.5	164.2
Lilac	171.3	180.3	166.4	174.9	172.5	178.7
	139.66	150.48	142.12	161.19	143.98	151.97

Mean Flowering Phenochrons of ten plants in each County of the Province of Nova Scotia for the year 1898, being the Means of Observations at ten stations in each County (excepting Antigonish, Guysboro and Queens, where they are five, six and five respectively). These Phenochrons are the means of the two series of observations, "When first seen" and "When becoming common."

Flower.	Yarmouth.	Annapolis.	Kings.
Mayflower	91.85	96.50	99.30
Blue Violet	120.10	126.40	127.60
Red Maple	124.85	124.60	123.45
Dandelion	120.00	125.15	129.20
Strawberry	122.80	126.80	126.55
Wild Red Cherry	142.40	138.35	144.10
Buttercup	138.40	146.65	145.65
Indian Pear	142.20	138.10	141.75
Apple	147.55	144.70	148.00
Lilac	153.70	154.95	156.35
Co. Phenochrons	130.88	132.22	134.19
	Digby.	Hants.	Shelburne.
Mayflower	98.40	102.65	94.50
Blue Violet	127.85	127.00	124.80
Red Maple	131.35	123.10	127.10
Dandelion	119.50	126.60	125.30
Strawberry	124.80	128.45	130.70
Wild Red Cherry	145.80	143.45	147.60
Buttercup	150.60	146.40	146.00
Indian Pear	141.05	142.35	142.15
Apple	146.05	148.85	150.00
Lilac	157.35	158.90	162.70
Co. Phenochrons	134.27	134.97	135.13
	Pictou.	Lunenburg.	Queens.
Mayflower	104.75	99.45	101.4
Blue Violet	127.30	125.65	127.2
Red Maple	127.30	121.75	123.7
Dandelion	126.35	130.30	129.7
Strawberry	129.85	128.85	129.6
Wild Red Cherry	146.05	143.50	143.1
Buttercup	145.80	153.75	153.0
Indian Pear	141.85	140.95	141.8
Apple	149.05	148.15	146.4
Lilac	155.80	162.00	161.3
Co. Phenochrons	135.41	135.43	135.72

Flower.	Colchester.	Halifax.	Cumberland
Mayflower	103.65	100.00	106.55
Blue Violet	130.90	127.75	135.50
Red Maple	129.85	126.20	133.25
Dandelion	130.05	128.55	134.45
Strawberry	131.00	129.45	134.85
Wild Red Cherry	143.85	149.00	144.80
Buttercup	152 40	152.45	151.40
Indian Pear	145.35	142.20	142.95
Apple	148.40	153.00	149.20
Lilac	156.95	164.35	159.05
Co. Phenochrons	137 23	137.29	139.20
	Antigonish.	Cape Breton.	Guysboro.
Mayflower	113.50	108.15	112.20
Blue Violet	132.90	134.55	136.85
Red Maple	131.90	137.75	132.15
Dandelion	131.30	133.35	132.25
Strawberry	128.70	135.20	135.35
Wild Red Cherry	149.80	155.30	149.85
Buttercup	153.10	156.85	159.50
Indian Pear	145.70	147.50	148.15
Apple	156.50	158.05	156.50
Lilac	165.90	163.85	170.20
Co. Phenochrons	140.93	143.05	143.28
	Inverness.	Richmond.	Victoria.
Mayflower	116.70	113.45	114.90
Blue Violet	133.15	137.45	134.70
Red Maple	145.35	140.10	148.20
Dandelion	132.85	138.55	138.35
Strawberry	135.70	140.70	139.85
Wild Red Cherry	150.10	153.05	155.90
Buttercup	159.50	157.90	157.45
Indian Pear	143.65	150.20	152.95
Apple	157.90	164.50	161.85
Lilac	175.80	170.65	175.60
Co. Phenochrons	145.07	146.65	147.97

On the opposite page these phenochrons are plotted so as to show the characters of the curves.


1898.
Day of
Month
Year
Yarmouth.
Annapolis
Kings.
Digby
Hants.
Shelburne.
Victoria.
Lunenburg
Queens
Colchester
Halifax
Cumberland
Antigonish
C. Breton.
Guysboro
Inverness.
Richmond.
Victoria.
Counties of Nova Scotia.
Species, - Mean time of Flowering.
Apr. 1st 90
" 5th 95
" 10th 100
" 15th 5
" 20th 110
" 25th 5
May 1st 120
" 5th 5
" 10th 130
" 15th 5
" 20th 140
" 25th 5
" 30th 150
June 1st
" 4th 5
" 9th 160
" 14th 5
" 19th 170
" 24th 5
" 29th 180
Mayflower.
Violet
Dandelion.
Strawberry
Maple
Indian Bar.
W.R. Cherry
Buttercup.
Apple.
Lilac.

An interesting irregularity in the phenochrons of the different counties is shown in nearly every part of this table. Their order is not parallel in the different counties. Very often it is reversed. As the phenochrons are averages of ten observations, it cannot be laid altogether to the charge of defective observation. The rarity of certain species in certain counties, or in the districts in which the observations were made, tends to make the phenochron later there, for the plants may be in flower before they are met with. But the character of the soil, the elevation, the slope, &c., must have had some influence. And then, may it not be possible that the same species may develop a tendency to an earlier or later maturing in different regions? These are questions which careful future observations may help to answer.

To illustrate the effect of asymmetry of stations on the phenochrons of a large district of country, I select five of the best observed plants, giving first their phenochrons for a period of seven years, 1892 to 1898, based on the few irregularly distributed stations of the Botanical Club of Canada; secondly their phenochrons for the year 1898, based on the observations made at the eight stations, Berwick, Windsor, Musquodoboit, Wallace, Pictou, New Glasgow and Port Hawkesbury; and giving, thirdly, their phenochrons derived from 180 stations, ten in each of the eighteen counties of the province, observed in connection with the public schools of the province.

First Flowering of the	Seven Year Phenochrons,— Bot. Club.	Phenochrons for 1898,— Bot. Club.	Phenochrons for 1898,— 180 Schools.
Mayflower	103.0	93.1	97.0
Maple	125.0	121.8	126.0
Strawberry	129.1	125.7	125.3
Amelanchier	142.6	140.7	140.9
Lilac	155.3	155.1	159.2
General Phenochrons	131.0	127.3	129.7

From the general phenochrons we infer that the Spring of 1898 in the Province of Nova Scotia, was according to the Botanical Club, 3.7 days earlier than the average of the seven years preceding, and according to the Schools only 1.3 days earlier. But what is the cause of this difference of 2.4 days difference between the Club and the Schools? Not defective observations, but the fact that of the eight stations of the Botanical Club, nearly all were either southern or central, while those of the Schools were evenly distributed from Cape Sable to Cape North.

Average flowering dates of five plants selected from the preceding tables, (*a*) for the first nine counties of the Province in the series,—the South-Western; (*b*) for the second nine counties,—the North-Eastern; and (*c*) for the whole Province:

A.—"First Flowering," 1898.

Species.	(*a*) S. W. Counties.	(*b*) N. E. Counties.	(*c*) All Counties.
Mayflower	91.4	102.6	97.0
Strawberry	121.6	128.9	125.3
Maple	120.6	132.6	126.6
Indian Pear	138.8	143.1	140.9
Lilac	155.0	163.5	159.2
Average	125.48	134.14	129.80

B.—"Flowering Becoming Common," 1898.

Species.	(*a*) S. W. Counties.	(*b*) N. E. Counties.	(*c*) All Counties.
Mayflower	106.1	117.1	111.6
Maple	129.9	139.6	134.7
Strawberry	133.6	140.1	136.8
Indian Pear	143.9	150.0	146.9
Lilac	162.3	170.3	166.3
Average	135.16	143.42	139.26

This table shows at a glance the phenological differences between the warmer and colder halves of the Province, and

also the average difference between the first flowering and when the observers thought it might be said that "flowering was becoming common." In other words, the South-Western half of the Province was in advance of the North-Eastern half as measured by the "first flowering" and when "flowering was becoming common" so far as the said five plants are concerned as follows:

Flowering, 1898.	First Flowering.	Becoming Common.	Average.
Mayflower	11.2 days.	11.1 days.	11.15 days.
Maple	12.0 "	9.7 "	10.85 "
Strawberry	7.3 "	6.5 "	6.90 "
Indian Pear	4.3 "	6.1 "	5.20 "
Lilac	8.5 "	8.0 "	8.25 "
Average	8.66 days.	8.28 days.	8.47 days.

That is, the one half of the Province is on the average eight and a half days in advance of the other half as divided above. The difference between the extreme counties is very much greater, however, as shown by some of the other tables.

MEANS OF TWENTY PHENOLOGICAL OBSERVATIONS, NOVA SCOTIA, FOR THE SEVEN YEARS, 1892 TO 1898, (BOTANICAL CLUB).

Species common to the Tables of the seven years.	Average Date, 1892.	Average Date, 1893.	Average Date, 1894.	Average Date, 1895.	Average Date, 1896.	Average Date, 1897.	Average Date, 1898.	Seven Year Normals or Phenochrons of the Species.	
(First appearance).									
Mayflower, flower.	98	108	104.7	107.0	102.70	106.	93.14	102.79	12 Apr.
Alder, "	102	114	116.3	103.8	107.55	119.	103.50	109.45	19 "
Aspen, "	131	123	122.2	117.5	121.90	128.	118.66	123.18	3 May.
Maple, "	123	130	126.3	123.85	124.55	124.8	121.80	124.90	4 "
Strawberry, "	129	133	131.6	128.55	128.50	126.5	125.75	128.99	8 "
Dog-tooth V., "	135	136	132.2	125.	128.50	131.	126.	130.53	10 "
Cherry (Cult.) "	146	142	146.3	136.6	143.00	146.	141.80	143.10	23 "
Indian Pear, "	145	144	146.	138.35	141.65	141.8	140.71	142.50	22 "
Cherry Wild "	150	144	147.	138.15	145.25	142.6	143.20	144.31	24 "
Apple, "	146	146	152.1	143.7	151.10	155.3	148.40	148.94	28 "
Lilac, "	154	160	162.3	153.5	160.50	157.	155.14	157.49	6 June.
Hawthorn, "	163	160	160.3	148.75	160.25	156.	158.	158.04	7 "
Wild Goose	54	88	70.6	78.00	80.00	80.	73.80	74.91	15 Mar.
Robin	96	94	73.2	99.30	96.14	91.	58.	86.81	27 "
Song Sparrow	99	115	79.	96.65	94.66	95.6	71.	92.99	2 Apr.
Frogs plping	105	113	112.8	110.55	106.30	113.2	101.80	108.95	18 "
Swallow	106	119	119.	125.75	117.76	(117.5)	(117.5)	(117 50)	27 "
Kingfisher	128	137	128.7	127.50	122.00	141.6	130.50	130.76	10 May.
Humming Bird	143	159	143.0	137.25	139.30	143.	143.50	144.01	24 "
Night Hawk	150	134	158.8	148.00	154.33	165.5	145.30	152.28	1 June.
Annual Phenochrons, 1892 to 1898..	125.15	130.45	126.62	124.39	126.30	129.07	120.88	126.12	
Corresponding day of Month	5 May.	10 May	6 May.	4 May.	6 May.	9 May,	30 April.	6 May.	6 May.

To conclude this exhibit of phenological observations, I give a few from those made by the Botanical Club extending across Canada.

CANADA, 1898.

	Nova Scotia.	Muskoka, Ontario.	Pheasant Forks, Assa.	Olds, Alberta.	Vancouver, B. C.
Frogs (first Piping).....	101.8	98	112	106	41
Dandelion (first flowering).	124.4	121	150	153	84
Strawberry "	125.7	130	142	142	96
Wild Red Cherry "	143.2	136	161	.....	110
Apple	148.4	146	... ..	.....	116
Lilac	155.1	147	182	.....	.....

To further illustrate what has been done and what has not been done, I give the figures for each of the above six phenomena, so far as obtained, for Nova Scotia, New Brunswick, Ontario (Muskoka and Niagara), Winnipeg, Pheasant Forks in Assiniboia, Olds in Alberta, and Vancouver in British Columbia, for the series of four years from 1895 to 1898.

CANADA, 1895 TO 1898.

FROGS *(First Piping)*.

YEAR.	N. S.	N. B.	Ontario.	Winnipeg.	Ph. Forks.	Olds.	Vancouver.
1895.....	110.6	120	106.5	92 5	.....	98	53
1896.....	106.3	116	104.5	112.	115	.....	50
1897	113.2	....	92	104.	105	.....	33
1898.....	101.8	.....	98	.....	112	106	41
DANDELION *(First Flowering)*.							
1895..... .	125.4	131	118.5	123	.....	143	99
1896.....	128.5	133	121.5	.....	149	.....	88
1897.....	132.4	.....	118	135	.....	.....	89
1898.....	124.4	.....	121	.....	150	153	84

STRAWBERRY *(First Flowering).*

YEAR.	N. S.	N. B.	Ontario.	Winnipeg.	Ph. Forks.	Olds.	Vancouver.
1895.....	128.5	126.8	126	129	.....	136	110
1896.....	128.5	128.5	127.5	144	134	.....	102
1897.....	128.6	.....	128.5	140	140	.....	89
1898.....	125.7	.....	130	.....	142	142	96
WILD RED CHERRY *(First Flowering).*							
1895.....	139.8	130.5	128	.....	.....	.....	124
1896.....	145.2	144	130	.....	.....	.....	126
1897.....	142 6	.....	137.5	140	.....	.....	111
1898.....	143.2	.....	146	.....	.....	.....	116
APPLE *(First Flowering).*							
1895.....	143.7	145	129	128	.....	.....	.....
1896.....	151.1	152	131.5	.....	.....	.....	126
1897.....	155.3	.....	143	.....	.....	.....	117
1898.....	148.4	.....	146	.....	.....	.....	116
LILAC *(First Flowering).*							
1895.....	153.7	150	137.5	136	.....	.....	125
1896.....	160.5	158	133.5	.....	.....	.....	133
1897.....	157	.....	148	145	.....	.....	131
1898.....	155.1	.....	147	.....	182	.....	.....

The blanks in the table above show that the great difficulty is to obtain observers who can keep up their observations regularly for a series of years.

PHENOLOGICAL OBSERVATIONS, CANADA, 1898.

Number	Day of the year 1898, corresponding to the last day of each month. Jan.... 31 July ..212 Feb ... 59 Aug ..243 Mar. .. 90 Sept...273 April..120 Oct... 304 May...151 Nov ...334 June ..181 Dec 365	Berwick, N. S.	Windsor, N. S.	Halifax, N. S.	Musquodoboit Harbor, N. S.	Wallace, N. S.	Pictou, N. S.	New Glasgow, N. S.	Hawkesbury, N. S.	Charlottetown, P. E. I.	Muskoka, Ont.	Pheasant Forks, Assiniboia.	Olds, Alberta.	Vancouver, B. C.
	Wild Plants Flowering.													
1	Alder	95	106	107	....	87	121	....	....	140	110	....	....	60
2	Aspen	128	....	107	....	....	....	121	....	135	113	133	....	....
3	Mayflower	91	78	....	96	101	86	94	106	105	....	....	....	....
4	Blue Violet	127	113	....	124	135	125	125	144	....	116	140	....	....
5	White Violet	120	....	....	122	127	125	....	144	....	121	....	....	....
6	Red Maple	....	108	125	...	...	123	121	132	....	107	....	....	....
7	Bluets (Houstonia)	....	....	128	....	....	....	....	....	....	....	....	....	....
8	Equisetum	....	119	....	....	143	113	124	....	....	130	....	....	....
9	Dandelion	123	106	125	135	131	125	118	132	135	121	150	153	84
10	Adder's-Tongue Lily	....	....	....	....	....	126	....	....	....	121	....	....	....
11	Hepatica	....	....	....	....	....	....	....	....	....	....	....	....	....
12	Gold-Thread	131	....	141	132	140	136	140	144	....	140	....	....	....
13	Strawberry	123	120	129	128	131	128	113	134	142	130	142	142	96
14	do. Fruit ripe..	159	155	164	174	163	168	158	182	....	167	175	173	144
15	Wild Red Cherry	....	140	144	....	138	147	147	....	....	136	161	....	110
16	do. Fruit ripe	....	....	....	....	....	...	....	....	....	192	....	....	....
17	Blueberry	132	121	....	....	142	179	....	....	....	129	....	....	....
18	do. Fruit ripe....	196	....	204	....	202	....	....	....	....	....	....	....	....
19	Ranunculus acris	142	....	156	154	152	....	139	....	....	152	....	....	....
20	Ranunculus repens	....	...	....	....	....	....	....	163	....	....	....	....	....
21	Clintonia	139	....	151	152	....	148	....	....	....	....	....	....	....
22	Trilium	139	136	....	150	....	145	....	....	....	134	....	....	....
23	Trientalis	140	149	....	....	....	156	....	....	....	157	....	....	....
24	Cypripedium	149	....	....	156	....	156	....	....	....	....	....	....	....
25	Calla	155	....	...	....	....	....	....	....	....	166	....	....	....
26	Indian Pear	138	132	140	137	...	143	141	154	....	129	142	....	118

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	Wild Plants Flowering.													
27	Indian Pear, Fruit.....	....	....	...	....	....	....	....	....	....	.. .	...	....	....
28	Raspberry	149	155	....	172	....	....	....	....	....	....	171	....	....
29	do. Fruit ripe....	....	....	....	203	202	....	....	213	....	197	212	...	....
30	Blackberry	166	....	179	....	....	176	....	182	....	165	....	....	113
31	do. Fruit ripe..	239	....	....	....	....	....	....	230	....	....	....	....	....
32	Pale Laurel.....	....	....	....	169	157	....	....	....	....	152	....	....	....
33	Sheep Laurel	144	....	....	177	173	182	....	....	....	....	....	....	....
34	Pigeonberry	138	134	148	168	157	148	....	....	....	158	....	....	....
35	do. Fruit ripe..	....	....	....	....	203	....	....	....	....	....	....	....	....
36	Blue-eyed Grass.....	157	....	....	....	149	159	161	177	....	155	171	....	....
37	Linnæa	....	....	....	....	173	175	....	....	....	158	....	....	....
38	Linaria.....	....	....	....	....	....	194	211	....	....	....	....	....	....
39	Rhinanthus	....	....	....	179	...	....	....	....	....	....	....	....	....
40	Sarracenia...	....	....	....	174	....	....	....	....	....	....	....	....	....
41	Brunella	180	....	173	179	....	175	....	....	....	169	....	....	...
42	Epilobium	....	....	192	200	195	191	..	....	....	189	....	....	....
43	Rosa lucida	172	....	197	....	....	....	....	182	....	197	...	....	....
44	Hypericum	187	....	195	....	....	201	192	....	....	165	....	....	....
45	Leontodon	211	156	178	....	....	200	....	176	....	198	....	....	....
46	Cherry (cult.) Flower.	138	133	....	144	147	....	144	147	155	....	....	....	102
47	do, Fruit ...	196	....	....	....	203	....	....	....	....	....	....	....	155
48	English Hawthorn	....	....	....	....	....	....	162	....	....	....	...	....	....
49	American Hawthorn ..	....	....	....	....	....	164	152	....	....	157	161	....	133
50	Plum (cultivated)	143	134	....	....	148	145	144	155	....	136	....	....	....
51	Apple (early) Flower...	....	140	153	....	147	....	147	155	152	146	....	....	116
52	do. (late) do. ...	145	....	....	....	....	....	149	....	....	....	....	....	....

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	Wild Plants Flowering.													
53	Currant (red), Flower..	141	134	....	145	140	....	....	147	....	138	146	...	....
54	do Fruit....	197	....	....	197	200	....	....	213	....	189	....	....	....
55	Currant (black), Flower	....	....	....	....	....	....	....	155	....	138	148	....	....
56	do. Fruit....	....	....	...	....	199	....	....	....	....	193	....	....	123
57	Lilac, Flower	153	142	163	160	157	160	151	....	162	147	182	....	....
58	Potato, Flower	180	....	..	....	....	....	....	191	....	179	....	....	....
59	Timothy, Flower	....	....	153	....	....	....	191	202	....	....	....	....	....
60	Clover (white), Flower.	135	148	163	...	156	163	153	176	....	158	....	....	....
61	do. (red), Flower....	153	140	156	....	156	164	153	163	....	158	....	....	....
62	Wheat, Flower	....	....	....	....	....	....	....	....	....	....	....	....	....
63	Oats, Flower	....	....	....	....	....	....	....	....	....	...	....	....	....
64	Buckwheat, Flower....	....	....	...	....	....	....	....	....	....	....	....	....	....
65a	Earliest Leafing	....	....	....	....	....	....	....	....	....	....	....	....	....
65b	Latest Leafing.....	....	....	....	....	....	....	....	....	....	139	....	....	....
	(First Phenomena).													
66	Plowing	....	....	....	....	127	....	....	....	....	100	....	....	....
67	Sowing	....	....	....	....	143	....	....	....	126	106	122	....	....
68	Planting Potatoes.....	....	....	....	....	139	....	....	130	....	145	137	....	....
69	Sheep Shearing	143	141	....	....	136	....	....	130	....	131	156	....	...
70	Hay Cutting.....	....	....	130	....	....	....	....	202	....	189	200	....	....
71	Grain Cutting	....	....	223	....	....	....	....	....	231	220	222	....	....
72	Potato Digging	....	....	....	....	269	....	....	....	....	268	283	....	....
73a	Rivers Opening	....	.. .	....	....	66	....	79	....	94	....	110	....	....
3b	Lakes Opening	....	....	....	....	87	....	82	107	....	....	....	....	....
74a	Ground Snow, Spring.	....	117	....	116	116	....	117	96	....	109	....	118	....
74b	Air " "	....	....	....	....	....	....	....	116	....	109	....	119	....

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	(First Phenomena,)													
75a	Hard Frost, Spring	....	....	....	....	....	....	....	....	130	77	165	....	119
75b	Hoar Frost, Spring	168	....	....	...	....	....	161	....	....	108	....	187	....
76a	Streams "highest"	....	....	....	....	....	....	...	....	....	.. .	....	....	....
76b	do. "lowest"	....	....	....	....	....	....	....	....	....	....	....	....	....
77a	Hoar Frost, Autumn ..	255	....	255	....	268	....	....	240	....	316	....	241	....
77b	Hard Frost, " ..	....	....	331	....	283	....	283	305	285	254	251	....	....
78a	Air Snow, " ..	....	....	....	316	....	....	....	264	....	287	....	246	....
78b	Ground Snow, " ..	....	....	....	319	....	....	319	283	315	290	....	273	....
79a	Lakes Closing	. .	....	....	....	....	....	....	....	....	....	....	....	....
79b	Rivers Closing.....	....	....	....	....	....	...	343	...	363	....	319	....	....
		....	....	....	23	...	....	....	....	....	....	....	....	....
		....	....	....	....	....	....	....	43	....	....	....	....	....
		106	105	....	....	....	....	....	77	....	75	....	116	....
		....	140	....	106	....	....	....	159	....	131	122	130	....
		....	....	182	182	182	....	182	163	182	149	151	142	....
		....	....	....	....	183	....	184	176	....	152	153	158	....
		....	....	....	....	184	....	185	182	....	158	163	160	....
		....	....	....	....	....	....	....	....	185	175	171	170	....
80	Thunder	....	....	....	....	....	....	....	....	....	181	177	171	....
		....	....	....	....	....	....	....	....	....	189	182	172	....
		....	....	....	....	....	....	....	....	....	199	183	175	....
		....	....	....	....	....	....	....	....	....	....	191	178	....
		....	....	....	....	....	....	....	....	....	....	198	179	....
		....	....	....	....	....	....	....	....	....	....	....	180	....
		....	....	....	....	....	....	....	....	....	....	....	182	....
		....	....	....	....	....	....	....	....	....	....	...	183	....
		....	....	....	....	....	....	....	....	....	....	...	185	....

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	(First Phenomena.)													
	Thunder *(Continued)*	....	....	....	....	...	....	....	...	....	....	....	186	....
		....	....	....	....	....	....	....	....	....	....	....	192	....
		....	....	....	....	....	....	....	....	....	....	....	193	....
		....	....	....	....	....	....	....	....	....	....	....	197	....
		....	....	....	....	....	....	....	....	....	....	....	199	....
		227	....	235	235	221	....	218	201	212	200	204	202	....
		....	....	....	....	229	....	....	214	221	209	205	203	....
		....	....	....	....	....	....	....	....	....	....	....	206	....
		....	....	....	....	....	....	....	....	....	....	....	209	....
		...	....	....	...	....	....	....	....	....	....	212	210	....
		....	....	....	....	....	....	....	221	....	215	215	215	....
		....	....	....	....	....	....	....	....	....	....	220	221	....
		...	....	....	....	....	....	....	....	....	....	....	223	....
		....	....	....	....	....	....	....	....	....	224	225	224	....
		....	....	....	....	....	....	....	....	....	227	226	226	....
		....	....	....	....	....	....	....	....	....	....	231	232	....
		....	....	....	....	234	...	....	233	...	234	232	233	....
		237	....	237	237	....	....	237	237	236	239	...	238	....
		248	....	....	....	247	....	238	....	....	....	245	246	....
		....	....	....	....	248	....	247	....	248	250	....	262	....
		....	....	....	....	....	....	....	....	259	258	266	263	....
		....	....	....	270	265	....	....	....	....	276	288	265	....
		....	....	....	303	332	....	....	303	....	....	....	314	....
	(First Migration.)													
81	Wild Duck.....	....	....	....	....	....	....	....	....	....	....	103	96	....
82	Wild Goose, going north	75	....	62	....	72	74	86	....	73	....	95	96	....
	do. going south	....	....	....	....	....	....	....	....	....	300	....	276	....

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	(First Migration.)													
83	Song Sparrow	74	....	73	....	....	....	....	66	78	78	...	84	....
84	American Robin.....	67	....	65	....	74	....	....	26	93	....	108	100	....
85	Junco	74	..	84	....	85	....	....	....	90	....	5	....	....
86	Spotted Sandpiper	....	....	143	....	....	....	....	132	....	....	....	....	....
87	Meadow Lark	....	....	....	....	....	....	....	....	....	....	....	....	....
88	Kingfisher	....	....	129	....	....	....	....	132	....	....	....	....	....
89	Yellow Crown Warbler	....	....	....	....	....	....	....	111	....	....	....	....	....
90	Summer Yellow Bird ..	130	....	....	....	....	....	135	130	....	....	....	....	....
91	White Throat Sparrow.	....	....	126	....	....	....	....	....	142	....	....	....	....
92	Humming Bird	141	134	....	142	144	....	155	145	....	136	143	....	....
93	King Bird	....	....	142	....	....	....	....	147	....	....	....	....	....
94	Bobolink.....	124	134	....	....	....	....	....	155	....	....	....	....	....
95	American Goldfinch ...	136	....	....	....	....	....	....	144	....	....	....	....	....
96	American Redstart	....	....	151	....	....	....	....	....	....	....	....	....	....
97	Cedar Waxwing.....	....	....	....	....	....	....	....	....	....	....	....	....	....
98	Night Hawk.....	145	....	144	....	....	....	....	202	147	146	145	....	....
99	Frogs heard	89	...	104	....	106	100	....	110	107	98	112	106	41
100	Snakes seen	129	....	....	....	....	....	....	132	....	100	118	....	....