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THE GRASPING POWER OF THE MANUS OF ORNITHOMIMUS ALTUS,* LAMBE.

By LAWRENCE M. LAMBE, F.G.S., F.R.S.C., of the Geological Survey of Canada.

(With two plates.)

In the collection of vertebrate remains from the Belly River series of the Cretaceous of Alberta, Canada, made by the writer in 1901, there are a number of phalanges of the manus of *Ornithomimus altus* that throw further light on the structure of this dinosaur and on its probable habits. As little is known of the manus, or indeed of the skeleton generally of the different species of this genus, it is thought that a few descriptive remarks on the phalanges of the Belly River form may prove of some interest.

Of the pes of *O. altus* we already know that it was adapted to swift running and that the digits terminated in long, rather straight, pointed claws.

Five species of the genus have been named by Marsh from the Upper Cretaceous of the Western States. These are: *O. velox* from the "Ceratops beds of Colorado," *O. tenuis* and *O. grandis* from the "same horizon in Montana," and *O. sedens* and *O. minutus* from the "Ceratops beds of Wyoming." Of these species scarcely anything is known of the fore limb. Marsh describes and figures the metacarpals of *O. velox* and a claw bone of the manus of *O. sedens*.

The material collected by the writer does not admit of the reconstruction of the entire manus. It proves that the claws were of quite a different shape from those of *O. sedens*. (Fig 9.)

*Communicated by permission of the Acting Director of the Geological Survey of Canada.

The Upper Jurassic compsognathoid form, *Ornitholestes hermanni*, lately described by Professor Osborn, shews many points of resemblance to its supposed successor *Ornithomimus altus*. Like *O. altus* it was terrestrial in its habits and a swift runner. The similarity in form of the ungual phalanges of the manus in the two species is strikingly apparent (see figs. 3 and 4). Among the remarkable characters of *Ornitholestes* is mentioned as most distinctive "the narrowing of the manus and the great elongation of the metapodials and phalanges of the second digit, suggesting the rapid grasping power of agile and delicate prey."

Compared with that of *Ornitholestes* the manus of *Ornithomimus altus* is much stouter and less elongated, but it probably had an equally great grasping power. The terminal phalanges curve more rapidly, are proportionately deeper proximally but are less compressed laterally; from those of *Ornithomimus sedens* they differ in being deeper, much more curved and in having a greater lateral compression.

The phalanges of the manus of *Ornithomimus altus* represented in the accompanying figures, 1—6, are presumably those of the second digit; they all resemble those of the pes in being to a certain extent hollow.

The proximal phalanx is about one-third longer than the second one and about the same length as the distal one. Its proximal end is conspicuously enlarged above and at the sides and the articular surface (fig. 1*a*) is evenly concave. The condyles of the distal end are greatly enlarged in a vertical plane and a deep channelling of the articular surface extends in a curve round the end through an angle of about 223°. Posteriorly below a decided roughening of the surface of the bone occurs for muscular attachment.

The second phalanx (fig. 2) is short above but a backward extension of the inferior surface adds greatly to its length below. The proximal articular surface exhibits a sharp vertical keel, on either side of which the bone is well excavated; the distal surface has a decided medium groove extending through an angle of 180°. The enlargement below the proximal articular face combined with a well-defined roughening of the bone suggests great muscular

strength at this point. Both these phalanges are laterally compressed and have deep excavations, in the form of round pits, on either side of their distal ends. These pits are more decided on one side than on the other.

The ungual phalanx (fig. 3) is deep proximally, is much compressed laterally and terminates in front in a sharp point that is directed downward when the articular face is in a vertical position. A well-marked claw groove extends, on either side from the upper border at the apex, backward for about two-thirds of the length where it bifurcates, the upper groove reaching the articular surface below the upper border, the lower and deeper one passing downward behind a roughened enlargement of the lower surface for the attachment of the flexor tendon. The bone is rough also on the sides and upper border for a short distance in advance of the articular face. This face is vertically concave with a moderately well defined median keel extending from the lower to the upper margin.

Besides the phalanges of the second digit figured, the corresponding ones of the other manus were also obtained, as well as a few, including distal ones, belonging to other digits, all presumably of the same individual. The additional ungual phalanges are smaller than that of the second digit, are broader in proportion to their length and not so deep (see fig. 7).

In the original description of *Ornithomimus altus* reference is made to the phalanges above described as well as to the distal end of the interrupted first metacarpal, all found within a few feet of each other in the Red Deer river district of Alberta (Belly river series).

Figure 5 indicates the amount of rotation possible of the second and distal phalanges round the proximal phalanx. This is principally due to the extensive development of the distal articular surface of the proximal phalanx and is suggestive of great grasping power.

It may be surmised that *Ornithomimus altus* was capable of rapid motion in pursuit of prey which it had the power of tenaciously grasping with its fore limbs. The claws covering the terminal phalanges of the manus were evidently both long and sharp.

Ornitholestes is supposed to have pursued such "agile and delicate prey" as the Jurassic birds; *Ornithomimus altus*, also a rapid runner but of larger build, with a more robust manus of a strong grasping capacity, may be supposed to have attacked larger animals, possibly those not unworthy even of the notice of his more bulky and formidable contemporary *Deinodon horridus* of Leidy.

Ottawa, Dec. 23, 1903.

EXPLANATION OF PLATES.

PLATE I.

Phalanges of second digit of manus of *Ornithomimus altus*, natural size.

Figure 1.—First phalanx viewed from the side; 1*a*, from behind; 1*b*, from in front; 1*c*, from below.

Figure 2.—Second phalanx viewed laterally; 2*a*, from behind; 2*b*, from in front; 2*c*, from below.

Figure 3.—Third or terminal phalanx as seen from the side; 3*a*, from behind; 3*b*, from below.

PLATE II.

Figures 4 and 5.—Lateral views of the phalanges, figured in Plate I, to shew rotation. Figure 5 represents the position of the phalanges when grasping.

Figure 6.—The same phalanges from below.

Figure 7.—Ungual phalanx of manus of *Ornithomimus altus*; probably that of third digit.

The above figures natural size.

Figure 8.—Terminal phalanx of second digit of manus of *Ornitholestes hermanni*, Osborn, side view; one-half natural size.

Figure 9.—Terminal phalanx of manus of *Ornithomimus sedens*, Marsh, side view; one-half natural size.

SOME CANADIAN ANTENNARIAS.—II.

By EDW. L. GREENE.

Continuing the study of the Chilliwack Valley material collected by Mr. James M. Macoun in 1901, it becomes more and more evident that the genus *Antennaria* is strongly developed in British Columbia; so much so, that for the western slope of North America it may be said to have there its centre of distribution. And this interesting forecast is further warranted by the fact that, from the vicinity of Banff, Mr. N. B. Sanson has obtained, among other species of the genus, at least two more that are hitherto undescribed.

In attempting to describe the new species, I can not but regret the absence of specimens of the staminate, or male plants; for these have their own characters that help to establish the validity of species; and I would beg of future collectors of British Columbian Antennarias, that they make special search for male plants. They are, it is well recognized, less common than the pistillate; but they should be sought, diligently, at every opportunity.

A. SEDOIDES. Low, loosely matted, rather obviously suffrutescent, the short and slender stolons bearing a rosette of leaves at the end, these scarcely ½ inch long, rather abruptly spatulate-contracted below a very broad and short obtuse terminal part, both faces finely densely and permanently silvery-woolly or satiny; flowering stems only 2 or 3 inches high, very slender but firm, their lower leaves oblong-linear, the upper linear: heads 4 or 5, their involucres with ovate rather acute dull-white scarious tips.

By roadsides at Banff, B.C., 28th May, 1901, N. B. Sanson; only pistillate plants, and these much too young; not even yet in flower. But the rosetted stolons, looking like those of some Sidum, are very characteristic.

A. SANSONII. Short leafy stolons and slender though firm stems closely tufted, the latter 6 or 8 inches high; basal leaves small and very narrow, linear-spatulate, acutish, ½ to ¾ inch long, densely, closely and very permanently silky-woolly, the

cauline linear, acute or accuminate, erect ; cymes neither dense nor lax, of 8 or 10 heads of middle size; involucre rather strongly woolly at base, each bract marked with a brown spot at base of the long and conspicuous scarious but faintly pinkish tip, only the innermost tips acutish, the others obtuse, all apt to be a little incised.

A rather neat and elegant firmly erect species, obtained by Mr. H. B. Sanson on the slopes of Sulphur Mountain, near Banff, B.C., 16th July, 1901. It is somewhat related to *A. acuminata*, although distinct enough by its compact habit, and permanently silvery foliage. Even the dead leaves of a former year are not divested of their indument. The type is the Geol. Survey No. 26,857.

A. CHLORANTHA. Low, rather loosely tufted, 3 to 5 inches high, the short stolons not densely leafy, and leaves large for one of the *A. alpina* group, the largest about an inch long, cuneate-obovate to obovate-spatulate, acutish and mucronulate, white with a rather loose and flocculent (not compact and silvery) indument, this deciduous, the leaves of the former year quite glabrous and of a light green ; those of the stem about 4, an inch long, oblong-linear, acute, suberect, less woolly : cyme capitate, the subsessile heads about 5 ; bracts of the involucre with long deep-green scarious tips elongated and mostly acute, the innermost acuminate.

Chilliwack Valley, B.C., at 6,500 feet, by Mr. J. M. Macoun, 23 July, 1901, being No. 26,197 of the Survey ; also apparently the same under No. 26,196, from an altitude of 5,600 feet. All the specimens are too young, and show only the pistillate state, unfortunately; but the species is well marked as to habit, foliage and pubescence.

A. LANULOSA. Habitally resembling *A. chlorantha*, taller, more slender, the stolons rather rigid, sparsely leafy, the leaves smaller, more abruptly narrowed from below the obovate summit, of thinner texture, loosely white-woolly, those of the preceding year glabrous but brown and dead ; cauline linear, acuminate :

cymes large, of 8 to 12 rather large heads; involucres short but well imbricated, the scarious part of the bracts light brown, the outer obtuse, the inner scarcely acute: small achenes minutely glandular-hirtellous.

Chilliwack Valley, B.C., at 6,000 feet, J. M. Macoun, 29 Aug, 1901. Notwithstanding some likeness to the preceding, I doubt if this belongs really to the *A. alpina* group of species. Geol. Surv. No. 26,194.

A. MACULATA. Rather compact, the slender flowering stems only 2 to 4 inches high: short stolons densely leafy; leaves ½ inch long, obovate-spatulate, subcoriaceous, loosely white-woolly when young, glabrate on both faces in age and of a light green; small stem-leaves suberect, varying from spatulate-linear and obtuse in the lower to oblong-linear and acute in the upper: middle-sized heads about 5, capitate-clustred; bracts of the involucre unusually numerous and imbricated, each with a conspicuous dark spot in the middle just below the base of the scarious tip, the tips dull-white, broad and short, the outer acute, the inner obtuse, all irregularly and incisely serrate under a lens.

Also of the Chilliwack Valley, by Mr. Macoun, 29 Aug., 1901, from an altitude of 6,000 feet. The specimens are rather immature, and of the pistillate plant only, unfortunately. The Geol. Surv. number is 26,195.

Washington, D.C., March, 1904.

BIRD NOTES.—On April 26th, I surprised a pair of migrant shrikes (*Lanius ludovicianus migrans*) in the act of making a meal of a song sparrow. Rather large prey for so small a shrike. Their usual food is beetles.

Mr. J. H. Fleming, of Toronto, writes me that he once saw a Connecticut warbler at Ottawa. He being a highly capable observer, this is an addition to the local bird-list.

G. E.

RELATIONSHIP BETWEEN THE WEATHER AND PLANT GROWTH.

A COMPARATIVE STUDY OF THE LAST TWO SPRINGS.

By CEPHAS GUILLET.

During the spring of 1902 and that of 1903—that is to say from the latter part of March to the latter part of June—I have observed about 360 wild plants in bloom in and around Ottawa, 300 of which are natives. I have selected about half, or 170 (all but 27 being natives), as being the most accurately observed during both years as regards their first coming into bloom. For purposes of accurate comparison I have divided each month into periods of ten days, and shall call these periods the first, middle and last periods of the month. When the month has thirty-one days the last part contains eleven.

Of the 170 plants, I find I observed 33 to come into bloom on the same date each year, namely 9 in the middle and 8 in the last part of April; 5 in the first, 5 in the middle and one in the last part of May; and 4 in the first and one in the middle part of June. It will be observed that the synchronous observations are especially numerous in April, half occurring then, and become less numerous as the season advances, there being only six during the last part of May and the month of June If this were all the evidence we had, we might surmise that the two seasons ran more nearly parallel during the first half than during the last, which is unusual.

But the other observations establish this in a more exact and satisfactory manner. Of the remaining 137 plants under discussion only 39 bloomed earlier in 1902, while 98 bloomed earlier in 1903. And of the 39 which bloomed earlier in 1902, 31, or about 80 per cent of them, bloomed in March, April and the first part of May, while of the 98 which bloomed earlier in 1903, only 11 bloomed in the corresponding period. The table given herewith will make this plainer. It shows in a striking way that the season of 1903 overtook and passed that of 1902 before the middle of May.

TABLE SHOWING THE PARALLELISM OF TEMPERATURE AND PLANT-GROWTH DURING THE SPRINGS OF 1902 AND 1903.

	March.			April.				May.				June.				Total.
	First & Middle	Last.	Total.	First.	Middle.	Last.	Total.	First.	Middle.	Last.	Total.	First.	Middle.	Last.	Total.	Four Months.
(*a*) Synchronous observations	....	....	......	....	9	8	(17)	5	5	1	(11)	4	1	....	(5)	33
(*b*) Earlier bloomers of 1902........	....	2	(2)	3	4	11	(18)	11	2	3	(16)	2	1	....	(3)	39
(*c*) ,, ,, 1903.... ...	....	....	......	....	4	3	(7)	4	23	25	(52)	24	15	....	(39)	98
Total number of plants under consideration	....	2	(2)	3	17	22	(42)	20	30	29	(79)	30	17	....	(47)	170
Average lead of (*b*) four days.																
,, ,, (*c*) ,, until the middle part of May, when the lead became (in days)........	....	..	......	....	....	....	......	....	7	10	......	9	8	....	......	......
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Average maximum temp. in 1902...	37.1	52	(42.32)	50	54.4	62.8	(55.7)	56.6	65.1	70.3	(64.6)	71.6	71.9	67.1	(70.2)	(58.15)
,, ,, ,, 1903...	40	45.5	(42)	48.2	54	62.8	(55)	67.7	81.1	70.8	(73)	80.5	67.8	71.1	(73.1)	(60.7)

Now, looking more closely, we find that the earlier bloomers of 1902 in April and the first part of May were on the average four days ahead of their sisters (or perhaps I should rather say children) of 1903; indeed, that is also the average of all the earlier bloomers of 1902. But the earlier flowers of 1903, while surpassing those of the same species in 1902 by only this same number of days in the earlier part of the season, yet in the latter part, *i.e.*, after the 10th of May, blossomed on the average between eight and nine days earlier than their representatives of 1902. This means that the season of 1903, which began and continued for a time four days behind that of 1902, rapidly gained twelve days on that season in the middle part of May, and held this position well on into the month of June at least. For I find that the average lead of eight days is pretty constant throughout the four periods from the 10th of May to the 20th of June, being seven, ten, nine and eight days respectively.

To anticipate the objection that these observations, while all of the vicinity of Ottawa, were not always of exactly the same locality for the same species, I selected those of the observations to which this objection could not be taken, and found that the result was substantially the same. The average for the period named is eight days, and for the different parts of that period seven, nine, eight and eight respectively. This indicates that, for example, when a given plant is blooming in Beechwood, it is likely to be blooming in Billings Bridge too; and when you find a certain species in bloom in Beechwood swamp, you may confidently look for it in bloom in Dow's or in the Britannia swamp, if it is to be found there at all. While this may be taken as the rule, there will doubtless be found localities where the conditions of soil or location are distinctly peculiar. Chelsea, for example, is situated on a southern mountain slope some two hundred feet above Ottawa; the spring plants will be earlier there. Blueberry Point, on account of a certain peculiarity of soil and flora, is also possibly an exceptional spot. It is safer to compare such places only with themselves in one's phenological comparisons. When possible, I have always used preferably observations from the same locality, and, in the case of trees, from the same tree.

Sports, also, must be excepted from such comparisons. Of

these I found at least two striking instances. One plant of the common wild strawberry, *F. virginiana*, was in bloom some ten days before its sister plants in 1902, namely on the 1th of April; and on the 17th of April, 1903, I found one Canada violet expanded, while I found no others anywhere till eight days later. Both these plants are still growing and blooming late in the fall; and winter had in this case probably caught both of them in bud, Thus the strawberry, being a perennial, and the Canada violet, protected by the thick snowy garment, acting probably as a winter annual, were both ready to proceed and open their blossoms as soon as Winter released his grip.

To account for the remarkably sudden and rapid advance in the growth of the plants last May, we should naturally infer that there must have been some remarkable phenomenon in the weather of that month. In order, then, to ascertain this accurately and to see whether the conclusions from my observations of the Comparative Phenology of 1902 and 1903 were borne out by the Comparative Meteorology of these two seasons, I, after writing the above conclusions, applied to the weather bureau for a statement of the progress of the weather during the periods named, and particularly of the temperature and rainfall. These were courteously furnished me by the Deputy Minister of Marine.

Comparing first the daily maximum temperature for the two seasons, it came out that while the maximum daily temperature of March was just about the same in both years, namely 42.3° in 1902, ar. . 42° in 1903, yet it was better distributed to stimulate growth in 1902. For, while the first eighteen days were the same in both months, the next two days were unusually cold in 1902 and unusually warm in 1903, and consequently the rest of the month, *i.e.*, the last third, the important part for vegetation, was on an average 6.5° warmer per day in 1902, being 52° in 1902 and 45 5° in 1903. This gave that year a slight advantage at the start, which was seen in the blooming of hepaticas, for example, on the 28th March, 1902, and on the 30th in 1903; and of the silver maple on the 26th in 1902 and the 29th in 1903. This slight advantage in favor of 1902 was increased during the first third of April which was warmer in 1902 by 1.8° per day. During the rest of April, 1902 had a slightly higher average daily maximum

temperature, so that 1902 would naturally retain its lead. But the last four days of this month were on an average considerably warmer (6.7° per day) in 1903, and this continued the case throughout the two following months except in the second part of June.

It was in the closing days of April, therefore, that 1903 began to gain on 1902, and the rapidity with which it overtook and passed 1902 is readily explained by a comparison of the temperatures in May. During the first five days 1903 was only warmer by 1.4° per day. but during the next five days by 18° per day! It was evidently during those five remarkably warm May days that the vegetation of 1903 overtook that of 1902. During the second third of May the days were 16° warmer than in 1902, or almost as much warmer as during the second five days, thus accounting for the remarkable spurt in vegetation in the middle of May, 1903, which my observations showed to exist. That last season's lead should have continued and even increased in the last third of May, is again explained by the fact that the daily maximum temperature during this period was higher in 1903 by .5°. But, although the temperature was still warmer in the first part of June, 1903, as compared with 1902, by 9°, yet there was a falling off of one day in the lead of the vegetation of 1903. Some other controlling factor seems to have operated here. During the middle part of June the maximum temperature of 1903 was less than that of 1902 by 4° per day. This change is indicated by my observations, which show a lead of eight days during this ten-day period as against nine for the previous period.

The daily *minimum* temperature, though of course not so good an index of plant growth, yet tells in a general way the same story. In both the years under consideration the average minimum daily temperature was below the freezing point up to and including the 6th April. After that date there were only five days in 1902 when the minimum fell to or below 32°, the last time being the 11th of May;* whereas in 1903 this occurred fifteen times,

* It might be pointed out in this connection, that, as the flow of the maple sap through the tap-hole is dependent upon the fluctuation of the temperarure above and below the freezing point, or 32° F., the sugar season around Ottawa must have practically ceased on the 6th April in 1902.

the last frost being, however, earlier (the 6th of May) and not severe. The minimum temperature throughout April was also considerably higher in 1902 than in 1903. So that here again we see the early part of the spring of 1902 to have been a more favorable season for growth than that of 1903.

But, while there was very little frost in the spring of 1902, there was one exceptionally severe frost, and that so late as the morning of the 10th of May, when the thermometer went down to 21° above zero. This frost did considerable damage to vegetation and must have retarded growth. One Arbor Day we had planted in the same spot at my school round leaved and red osier dogwood shrubs from Rockliffe, and they grew luxuriantly. This frost of May the 10th, 1902, nipped the round-leaved dogwood, withering all its leaves, but spared the red osier growing with it. I noticed that it also spared the alder. But, partly, no doubt, because of their nearness to the ground, it played havoc with many herbs. The early lily and lily-of-the-valley families, in particular, were badly wilted and blackened. I found no *Clintonia* in bloom that season, owing, I thought, to the frost.

While in March the minimum daily temperatures ran roughly from 20° to 35°, and in April from 30° to 40°, in May and June they ran from 40° and 45° respectively to 60°. But dividing the months into three periods, it is found that the average minimum temperatures for the three parts are roughly 40°, 40° and 50° in May 1902, but 40°, 50° and 50° in May, 1903; and 40°, 50° and 50° in June, 1902, but 50°, 50° and 50° in June, 1903; showing that the middle part of May and the first part of June were much colder in 1902 and that the month of May, 1903, had about the same minimum temperature as the month of June 1902. This reinforces our previous conclusions regarding the phenomenal growth in May, 1903.

I was struck with the steadiness and evenness of the rise of the minimum as compared with the maximum temperature: a fact due to the constancy with which the earth absorbs heat and the tenacity with which it retains it, as compared with the rapidly waxing strength of the sun's ever more perpendicular rays, much of whose heat, however, is often intercepted and irradiated by

clouds and winds, or absorbed in the evaporation of rain. The average minimum temperatures of every ten days of May and June, 1903, were respectively 37.8°, 51.8°, 51.1°, 52.6°, 51.8° and 53.3°; while the corresponding maximum temperatures were 67.7°, 81.1°, 70 8°, 80.5°, 67.8° and 71.1°. It was in May that the most rapid rise in minimum temperature took place, namely that from about 40° to about 50° during the middle of May, 1903, and the latter part of May, 1902.

Comparing now the rainfall of the two seasons, we find that there is a marked difference in the amount and still more in the distribution of precipitation. It 1902 it amounted during the four months under consideration to 12.32 in.; in 1903 to 8.97 in. Or, leaving out of account the last third of June, which my plant-observations do not cover, 10.65 in. and 5.06 in.; that is more than twice as much rain in 1902 as in 1903 for the period covered by my observations. In 1902 the rain was well distributed, being for March, April, May and the first two thirds of June 3.47, 2.74, 1.82 and 2.62 inches respectively, which is not very different from the average for 20 years. But in 1903 the figures are 1.35, .95, .12 and 2.64 inches. In 1903, therefore, there was comparatively little precipitation in the spring before June, and next to none in May; and even in June the rain did not fall in any appreciable amount until the 12th, when it rained 1.59 inches and continued rainy throughout the rest of the month. Furthermore, there was no rain in April after the 7th. In fact from the 8th April to the 11th June inclusive there fell only .22 in. of rain! That period, therefore, of over two months' duration, was literally one long drouth. Occurring as it did, however, so early in the year, when the ground was saturated with the winter snows, its effect was, as we have seen, to force vegetation forward rather than to retard it, *until towards the end of the drouth.* For we found that, in spite of the fact that the weather continued warmer, and indeed increasingly warmer in the first part of June, 1903, as compared with 1902, yet there was an actual falling off in the lead of 1903 over 1902 in plant-growth during that period, when the average daily temperature was 7° higher in 1903.

I was not surprised at this result, as I remember noticing the blighting effect of the drouth on certain of our wild plants. I

noticed *Unifolium Canadense* in bud as early as the 29th of April. On the 15th May I have the following note: "Most of the bunches of buds of *Unifolium Canadense* have shrivelled up; others—lately developed probably—are about ready to open, but rain is needed!" The flowers expanded about a week later. This was in Beechwood Cemetery. At Chelsea they came into bloom about a week earlier than here and at the same time as the previous year but not so abundantly. Wild columbine, which already had large buds on the 27th April, seemed to be affected by the drouth, being very slow in opening its buds in May. In the middle of May, 1902, I found plenty of *Capnoides sempervirens* in bloom on the rocks of the island at Chelsea; at the same time last year I could find no trace of the plant. I found *Anemone riparia* in bloom in abundance at the Beaver Meadow very early in June, 1902; last year I did not find it there at all. Several plants found blooming in the lane near the bridge at Beaver Meadow, Hull, in 1902, were not to be seen there in 1903, as *Sedum acre* and *Capnoides aureum*. *Iris versicolor* was abundantly in bloom in the swampy ground near by very early in June, 1902, but not last year. I found *Trifolium aureum* earlier in bloom last June than the previous June, but its growth was stunted. Twin-flower and the pitcher plant were burnt brown by the heat where exposed. The drouth had probably something to do with all these failures.

At the end of April, 1902, I found *Draba nemorosa* pretty abundantly in bloom along the river bank at Tétreauville, and before many days its little yellow flowers covered the ground. Last year I was unable to find the plant at all. The dry spring was probably unfavorable to its growth. Prof. Macoun, to whom I am indebted for much cheerfully given help in this investigation, told me that *Draba nemorosa* had been found only once before around Ottawa, namely in 1900 by himself near the St. Louis Dam. Other rare plants I found in bloom in 1902 are *Cynoglossum virginicum*, 17th June, at Tétreauville; *Symphoricarpos racemosus*, 28th June, at Rockliffe; *Heracleum lanatum*, 28th June, near the mouth of the creek draining Hemlock Lake; and in 1903, 25th May, *Corallorhiza corallorhiza* at Britannia.

It was not the purpose of this paper to compare these two seasons in detail with the preceding. I have also not dealt with

bird-migration, which is another interesting index. Suffice it to say that my plant notes and bird notes, and the weather records kindly furnished me by Mr. Stupart, the director of the meteorological service, alike show these last two springs to have been both unusually early. Both had in March and April almost the same mean temperatures, which were in March 10.9° (1902) and 11.4° (1903) higher than the average for twenty years,* and in April 4.5° (in 1902) and 2.9° (in 1903) higher than the normal. And the hot, dry month of May, 1903, of which we have spoken at length above, was 3.6° hotter than the normal, while May, 1902, was 1.7° cooler than the normal, and June of both years cooler than the average by 4.4° and 2.4° respectively.

Comparing the past two springs with the previous two, we see again how remarkably early they were. The mean monthly temperature of March, in 1900, was 18.6°, in 1901 it was 24.3°, while in 1902 it was 33.9° and in 1903 34.4°. It is little wonder that hepaticas and silver maples bloomed earlier in 1902 and 1903 than in 1900 and 1901. But why they should have bloomed from two to three weeks earlier is not so apparent, when we consider the interesting fact that the *temperature of April was about the same for all four years.* But happily we are not left without an explanation, which lies in the state of the soil. In the falls of 1901 and 1902 snow fell early and steadily before the frost had entered the ground, consequently there was no frost in the ground to retard vegetation when the snow went off in the spring. In the previous two years the conditions were precisely the contrary: the frost got well into the ground before the frost came, so that the succeeding springs of 1900 and 1901 were much retarded not

* These mean temperatures are somewhat higher than that of March, 1898, which was the warmest March of which we have any record prior to 1902, its average maximum temperature even exceeding those of the Marches of 1902 and 1903 by a small fraction of a degree, being 42.36°. Miss V. Lees informs me that she found hepaticas in bloom on Pine Hill, New Edinboro', on the 27th of that month, which is the earliest record for hepaticas of which I have heard. While this article is printing I am able to state that this spring hepaticas have not, so far as I know, been found in bloom earlier than the 16th April, and up to to-day (23rd April) I have seen no other wild plants in bloom. Till to-day the temperature has not reached 50° One swallow does not make a summer, nor one hepatica a spring !

only by the slowness with which the snow melted in those cold, ice-bound Marches, but also by the frost in the ground under the snow tending to delay growth.

It is not to be expected that two springs so unusually early, two Marches of so remarkably high a temperature, will be followed by a similar one. One of the conditions that make for the early growth of plants is certainly present. I have found, by digging down through the three feet of closely packed snow and ice in the woods, that the ground there is not frozen though it is in the open field. Therefore, when the snow disappears, or, indeed, before that, plant-growth will be possible in the woods. But the snow this year is of unusual depth,* and will be longer in melting, not only because there is more to go, but because the very presence of such a mass of frozen matter makes for lower temperatures. It is probable, however, that when spring does come it will come in with a rush and be a rapid season. For with temperature, as with other things, there is always a tendency to rhythm, to wave-motion ; so that, as we are having temperatures so constantly, so phenomenally low this winter, we may expect unusually high temperatures later on. Although a cold winter does not always presage a warm spring (it did not in 1875, the coldest winter on record, nor in 1883, nor in 1885), yet it is not usual, Mr. Stupart informs me, to have more than three consecutive months below normal. In dealing with the weather, however, it is certainly easier to be wise after the event. Long forecasts regarding the weather, indeed, partake rather of the nature of guess work than of true prophesy. The conditions affecting weather are so numerous, complex and remote, as to make meteorology the most difficult and the most backward of all sciences, not even excepting physiology.

Finally, comparing the spring drouth of 1903 with previous drouths at that season, we see how phenomenal it was. Mr.

* As this article is being printed, I have ascertained the snowfall of the past winter to be 105.7 inches, which is 8.8 inches above the average for thirty years. Even this heavy snowfall did not everywhere protect the ground in the open during the past severe winter. The snowfall of the previous winter was unusually light, being but 72.9 inches.

Stupart has kindly furnished me with a record of the dry April-May periods of the past thirty years. They are as follows:—

1876--2.15 inches of rain.
1879—2 64 "
1896—3.10 "
1898—3.21 "
1900—3.76 "
1903—1.07 "

It is certain, therefore, that the drouth of 1903, lasting from 8 h April to 11th June, during which only about a fifth of an inch of rain fell at Ottawa, is easily the driest spring on record. It is remarkable how little harm it did, which shows how well fitted our finely watered district is to withstand drouth. As an instance, however, of the fact of compensation, of the fact that things do tend to average up, it is worth mentioning that, in spite of the long drouth in the Ottawa Valley last spring, the precipitation here for the year 1903 was only one inch below the average mean of 33.6 inches; and the additional fact that in revenge for the unusually hot May we had an unusually cool summer. The hottest day last year was the 19th of May, when the thermometer registered 90° in the shade. The average annual maximum temperature of Ottawa is 93.8°. July, which, as is usually the case, was the hottest month, exceeded May in average maximum temperature by only 3.7°. August had a lower maximum than May.

It is well known that plant growth is dependent upon meteorological conditions and particularly upon temperature and rainfall; but that the dependence is so absolute, that the parallelism is so true and delicate as even these few observations with all their liabilities to error yet indicate, was to me very interesting and gratifying: interesting as the spectacle of the orderly reign of law must be to everyone who studies it; and gratifying, as proving that my observations, which I was, to tell the truth, a little fearful of putting to the test, must have been fairly accurate.

Such a study tends to clarify one's ideas regarding many interesting phenomena That the plants, instead of all springing up together at the first blush of spring, should range themselves, so to speak, in a procession throughout the season, is partly due

to their varied sensitiveness to heat, as well as to their more or less favorable situation for receiving the heat. The sensitiveness of our wild plants to heat has been determined in very few cases. In our hemlock, the lowest temperature at which the chlorophyll-corpuscles turn green is between 44.6° and 53.6° F. The decomposition of carbon dioxide with evolution of oxygen begins in potomogeton between 50° and 59°, and in the eel-grass above 42.8°. Even the most sensitive, *i.e.*, the most prompt to react in this way, as the larch and meadow-grass, require a temperature above the freezing point, between 32.9° and 36.5° in the case of the larch, and between 34.7° and 38.3° for the meadow-grasses. From our observations we might reasonably infer that silver maples, hepaticas, spring beauties and the trailing arbutus, all of which have been found *blooming* in March in one or both of the last two springs with a maximum temperature of about 50°, rank with these in readiness to react to heat stimuli; while golden-rod, asters and indeed most of the Composite family must require a great deal of heat. On the 6th of April, 1903, after several cool days and frosty nights, I have this record: "Still cool and cloudy; no growth." In going about the streets and the woods I had noticed little or no change in the vegetation those days. The aspen and alder catkins, which I noticed well shaken out on the fifth, did not begin to shed pollen until the ninth, which was a fine mild day, the temperature reaching 56°. The habit of the plant as regards the order of growth of stock, leaves and flowers is another factor conditioning the time of blooming. Plants such as the hepatica, trailing arbutus, early coral-root, silver maple, alder, aspen, hazel, and glaucous willow, which in the spring devote their new-found energies of growth to the unfolding of flowers-buds already formed the previous year, will naturally bloom early; while those which, like the golden-rod and oak and ash, attend first to the growth of stock and stem and leaves will naturally bloom relatively late.

A word might be said here regarding the time when the various orders and families of plants come into bloom. During April in these two exceptionally early springs I found 75 species of plant in bloom, including two grasses and six sedges. Leaving out of consideration the sedges and grasses, which I observed

only in April, I find that the chief blossoming-time for our flowering plants is the end of May and the beginning of June. During the last third of May and the first third of June I found 136 plants coming into bloom, or exactly 68 for each period. This is about 40% of the whole number found blooming before the end of June. In every ten-day period before this, the numbers gradually increase towards this climax, while they fall off thereafter. I found no violets come into bloom after May and very few of the lily and lily-of-the-valley families; they are found from the middle of April on. On the other hand the St. John's Wort family, which belong to the same order as the violets but have a different habitat, come into bloom in July. The poppy family has some April representatives. The poplars and willows, elms and maples bloom early; indeed most, if not all, of our trees are in bloom before June. The irises and orchids do not bloom before May. The order of the *Ranales* and the rose order begin to bloom early and furnish a great number of species, perhaps 80% of their number, throughout April, May and June, beginning with the hepatica, our earliest flower. Much the same may be said of the cress or mustard family (which begins with the cut-leaved toothwort) and the heath order (beginning with the trailing arbutus, almost, if not quite, as early as the hepatica) though they are not quite so abundant in the beginning. The cress family may nearly all be found in bloom before the middle of June, while quite a number of the heath order bloom in July. The pink family and the umbel order have each only one representative in the latter part of April, viz., the larger mouse-ear chickweed (*Cerastium vulgatam*) for the former, and the dwarf ginseng for the latter; but soon after they become very abundant, especially the umbel order. The more highly developed plants seem to be, as a rule, poorly represented in the spring, being largely summer bloomers, which would suggest that their greater complexity required time to unfold. I refer to the primrose, borage, mint, potato and figwort families, the gentian order, and especially the great order of the *Campanulales* which includes the numerous *Composite* family. Of the *Rubiales* I found only one species of galium blooming in May, but six in June; *mitchella repens* also is not found till towards the end of June; but the honeysuckle family, while furnishing but one plant

blossoming in the latter part of April (the 30th), furnishes many in May and June. The earlier plants of spring are mostly woodland or (generally rather later) swamp plants; which, not requiring much heat, find the moist and shady woods or the cool, wet swamps a favorable habitat. Such are, for the woods, the violets, the lilies, the early poppies, the saxifrages and mitreworts, strawberries and hepaticas; and for the swamps and wet places, many orchids, irises, cresses and speedwells, etc. Towards the end of spring the flower-lover will find the woods comparatively bare of flowering species and will turn to the sunny shores of lake and river, both in the water and on land, where will greet him water plants of many kinds, and spiræas, button-bush, St. John's wort, loosestrifes, bluebells, epilobiums; and to the clearings, the fields and roadsides, where he will find roses, raspberries, peas and clovers, and finally mallows, mints, gerardias, lobelias, gentians, thistles, beggar-ticks, sunflowers, golden-rods, asters, and in short all those highly-developed plants which delight to bask in the direct rays of the sun.

The weeds, with very few exceptions, are late bloomers, which may be explained by the fact that they are mostly annuals, springing from the seed which has lain dormant until awakened by the warmth of spring. There is therefore considerable growth necessary before flowers can be produced and this takes time. The following weeds, however, I found blooming in April: the European strawberry, shepherd's purse, Buxbaum's speedwell and the dandelion. Of these the strawberry and dandelion are perennials that bloom continually throughout the season, and only suspend growth while the unfavorable winter conditions last. They are therefore ready to go on blooming early in spring. The shepherd's purse is a winter annual, germinating and vegetating in the fall, and so ready likewise to bloom early in the spring. The other weed that I found blooming in April, namely Buxbaum's speedwell, may possibly also have acted as a winter annual.

I might add that having found plants in bloom in March and well on in November, there are only three months when one need never look for wild flowers around Ottawa, viz., December, January and February. And I am not so sure that dandelions, or sweet clover, or *Linaria linaria*, popularly known as butter-and-

eggs, might not be found still blooming at the beginning of December some very late fall in favorable situations. But the only way to see our wild plants in bloom in the middle of winter is to dig them up and bring them home in the fall. I have got sweet cicely to bloom in this way, and my pupils were able to have hepaticas and spring beauties in flower at Christmas-time,—a charming little bit of the spring woods! It can not be said of all Canada, however, that wild flowers never bloom in February in their own habitat; for on the British Columbia coast, under the influence of the warm Pacific current, at Chilliwack and Vancouver for example, spring opens in the latter part of February with the blossoming of willows and alders; while on Vancouver Island there is hardly any cessation of growth at all during the winter, and a great many species of wild plants may be found blooming in February.

That seeds long dormant should suddenly germinate and grow luxuriantly when the frost cover is removed, is doubtless due to the great amount of heat, and possibly light, necessary to the germination and growth of these plants—an amount that does not exist in the shade of the poplars, spruces and pines. When these trees grow up again, the heat-loving willow-herb and golden-rod, blueberry and raspberry die away, leaving their seeds, or in some cases the roots, to represent them and to assert their rights when the proper heat-stimulus is again present. The need of oxygen for the germination of the seed is also a factor here. The clearing away of forest cover allows a freer circulation of air, and the oxygen in the air has a better chance to come into contact with the dormant seeds.

Finally, it would appear from this study that the vegetation of a given region would be just as true a criterion of its climate as the climate would be of its flora. They are converse propositions. And plant-growth, being really the resultant of the complex conditions making up what we call *weather*, is thus a very simple and beautiful index of the progress of the seasons.

February, 1904.

MEETINGS OF ENTOMOLOGICAL BRANCH.

Meeting No. 11 was held at Dr. Fletcher's on January 14th, 1904; seven present. Dr. Fletcher explained that the meetings had been interrupted for several months, owing to absence of members and to other causes, but that in resuming them it was recognized that they were of much value to the members, upon whom he called to set forth the results of their past season's collecting and observations. Mr. Gibson read a paper on "An Interesting Enemy of the Iris," in which he described the larva of *Macronoctua onusta*, which had infested the stems of irises at the Experimental Farm. Dr. Fletcher instanced, among such stemboring caterpillars, the larva of *Gortyna purpurifascia* which had in a previous season greatly infested their columbines. Mr. Gibson said that larvæ of the rare *Apantesis superba* (var. *nevadensis*, Dyar's List) had been received from Vernon, B.C., and had been successfully reared. Of six caterpillars, two had been inflated and four bred to the moth. Larvæ of *A. docta* (var. *arizonensis*) had also been received from Phœnix, Ariz. Dr. Fletcher spoke of the value of the chitinous head-case of some larvæ as of even greater value than the skin in determining the number of the moult of the caterpillar. In reply to an enquiry by Dr. Sinclair as to the chief value of breeding these forms, he explained that one of the principal aims of such studies was to ascertain that stage in the life of the insect in which injurious forms might be most easily and economically destroyed. The habits of various cutworms were mentioned, and the remedies, such as bunches of poisoned weeds, etc., which might be applied to check their depredations. Mr. Metcalfe exhibited a collection of Homoptera, chiefly the smaller leaf-hoppers, which he had made at Brockville during the summer. There were about forty species named by Mr. Van Duzee, and many of these were represented by long series of carefully mounted specimens. He also showed samples of the curious little Chrysomelid beetle, *Exema dispar*, which is obtained from goldenrods by using a sweeping or beating-net, and which probably escapes many enemies by its marked resemblance to the excrement of caterpillars. Mr. Baldwin showed the results

of some recent outings, among which was a *Bombus ternarius* impaled upon a thorn by a shrike. Dr. Fletcher described the success which he and Mr. Gibson had attained in breeding the rare moth *Apocheima rachelæ*. Two of the hairy wingless females were shown alive, and mounted examples of the delicately colored, winged males, with inflated larvæ in all stages. The various stages of *Leucobrephos middendorfii* were also shown Dr. Sinclair spoke of the opportunities afforded to naturalists by the country surrounding his summer residence in Muskoka, and some discussion followed on the flora and fauna of that region, and on the occurrence of rattlesnakes in Canada. Dr. Fletcher briefly outlined his summer lecture tour in Manitoba, the Territories and British Columbia. The ascent of Mt. Cheam had been a disappointment, as unusually bad weather prevented any effective collecting. A couple of days were passed at Kaslo, B.C., where Dr. Dyar with two assistants had spent several weeks, making large collections of lepidoptera and breeding about 200 species. The new Moth Book published by Dr. Holland was examined and much admired by the members.

SUB-EXCURSION.—The first outing of 1904 took place on Saturday, January 23rd, at the Experimental Farm, when eight, including two ladies, turned out on snow shoes, to see how things appeared in mid-winter. The tramp was through the arboretum to the canal, returning by a circuit again through the aboretum. The great depth of snow offered little chance for collecting, as all smaller forms of vegetation were buried, and the finds were limited to some cocoons and galls. A very pleasant and instructive hour was passed, however, in examining the trees, and appetites were sharpened to do justice to a good hot supper prepared by the host and his assistant.

MEETING No. 12 was held at Mr. Harrington's, on Jan. 26th, 1904 ; five present. Mr. Gibson read an interesting paper entitled "A Night's Collecting at Meach Lake," descriptive of a visit paid by him to Mr. Young during the summer, and mentioning some of the most important moths which had been taken at sugar and light. The neighbourhood of the lake has always

proved productive to all naturalists who have attended the Club excursions, and Mr. Young during two summers spent there has made extensive collections. Fourteen species of the rarer moths were shown. Mr. Metcalfe exhibited a neatly mounted collection of flies, mostly small species, consisting of about 500 specimens, which he presented to Dr. Fletcher, for the museum of the Experimental Farm, to the collections in which it will be a valuable addition. Mr. Harrington showed two large pupal cases, apparently of a Hepialus, which he had taken from an old maple tree on the Aylmer road. He also exhibited two boxes of insects in various orders taken during 1903, and containing several species as yet undetermined. Dr. Fletcher exhibited a female *Mantis carolina* which he had kept living for some time and whose rapacious habits he graphically described. Mr. Harrington referred to a larger species, equally voracious, which he had frequently observed in Japan. Mr. Baldwin showed some galls from willows and raspberry.

MEETING No. 13.—Held at Mr. Gibson's on February 10th, 1904; eight present. Mr. Baldwin showed some recently collected cocoons of moths, also of the sawfly *Trichiosoma triangulum*, and of spiders. Mr. Metcalfe submitted a list of 43 species of hemiptera, representing 34 genera, taken at Brockville, Aug.-Nov., 1903. Mr. MacLaughlin stated that, while unable to do any collecting, it appeared to him that there was an unusual scarcity of dragonflies last year, due probably to the excessively dry spring. Dr. Fletcher referred to the immense swarms of a species of Gomphus which had appeared in Ottawa some years ago, and which had not since been observed in any special abundance. He also spoke of the myriads of dragonflies seen by him last summer upon the North-west prairies, chiefly *Diplax rubicundula* and *D. costifera*.

Mr. Harrington exhibited a case of Ottawa Buprestidæ, containing about 40 species of these destructive beetles, and read a paper giving the dates of appearance and notes on the habits of the various species; regarding the majority of which much is to be learned. Dr. Fletcher had found *Buprestis langii* abundant in the upper country of Alberta and British Columbia upon the

bracken fern. He also reported that a species of Agrilus had recently become a serious enemy to the birch. A white birch tree near his house had been killed apparently by this insect, but as the beetles emerged during his absence he had obtained no specimens. Mr. Harrington thought it might be *A. obsoletæguttatus*, of which both sexes had been taken upon birch. Some discussion followed as to the duration of the larval stage of Buprestidæ and on retarded development in these and other insects, due to deficient heat, moisture or food, or to causes not yet understood. Mr. Young showed a hawk-moth, *Cressonia juglandis*, and described a curious crepuscular flight of the males, which he had observed at Meach Lake; the moths flying too and fro across a patch of smooth water and repeatedly dipping the tip of the abdomen in the water. He also showed *Thecla læta*, a little blue butterfly, new to the Ottawa list, and which is a well known cotton pest in the Southern States. Dr. Fletcher exhibited, as a really rare insect, the fine moth *Hepialus thule*. This species was described from a specimen taken some years ago at Montreal, and so far it has not occurred elsewhere. It is stated to fly only between 8 and 9 o'clock, p.m., during the brief period of its winged existence. Dr. Fletcher also read some extracts from proofs sheets of the Entomological Record for 1903 (Rept. Ent. Soc. Ont.), which indicated that entomologists, especially in the Western provinces, had made many good captures during the year and had largely added to our knowledge of Canadian insects. Mr. Gibson said that in 1991 eggs of a then undescribed arctian moth had been received from Mr. Cockle of Kaslo. Last year similar eggs had again been received and the moths had been bred. Dr. Dyar had also bred the species at Kalso and had named it *Diacrisia kasloa*. Inflated larvæ, pupæ and five imagos were exhibited.

W. H. H. (Sec.)

MEETING OF THE BOTANICAL BRANCH.

The first meeting in the new year was held at the residence of Mr. A. E Attwood on January 7th. Those present were Dr. J. Fletcher, Prof. J. Macoun, Dr. C. Guillett, Mr. E. R. Cameron, Mr. W. T. Macoun, Mr. R. B. Whyte, Mr. J. M. Macoun, Mr. D. A. Campbell and Mr. Robert Hamilton.

By special request Mr. W. T. Macoun read a very graphic description of a trip made by him several years ago up Mount Arrowsmith, Vancouver Island. The reading of the paper was followed by some very interesting and amusing reminiscences by Prof. Macoun and Dr. Fletcher, who have also made the ascent of this very picturesque mountain.

Mr. E. R. Cameron read an extract on "Weeds" from John Burroughs' "Pepacton" in corroboration of what Prof. Macoun had stated on that subject at the previous meeting.

"It is a fact," writes Burroughs, "that all our most pernicious weeds, like our vermin, are of Old World origin. . . . .We have hardly a weed we can call our own; I recall but three that are at all noxious or troublesome, namely, milkweed, ragweed and golden-rod."

Some time was spent discussing a question asked by the chairman: "Why are the plants of my window-garden not thriving better?" Lack of success with potted plants in an ordinary living-room may be due to unsuitable soil, injudicious watering, dryness of the atmosphere, the presence of dust and insects on the plants, insufficient sunlight, inadequate development before bringing into the house, or worms in the soil.

As an outcome of the discussion on the management of potted plants, it was decided to prepare a list of books that would be of assistance to the amateur and professional lover of plant life. The following may therefore be considered as a select bibliography of guides in the identification and cultivation of plants.

I.—BOTANICAL KEYS.

An Illustrated Flora of the Northern United States and Canada. Britton and Brown. 3 vols. $9.

Field, Forest and Garden. A Simple Introduction to the Common Plants of the United States east of the Mississippi—both wild and cultivated. Asa Gray.

Manual of the Flora of the Northern States and Canada. Nathaniel Lord Britton, Ph.D. 1080 pp. $1.50.

Manual of the Flora of the Northern States and Canada. New edition. (In preparation.)

II.—POPULAR BOTANICAL GUIDES.

Our Northern Shrubs and how to Identify them. Harriet L. Keehler. 500 pp. 240 ill. $2.

Handbook of the Trees of New England with Ranges throughout the United States and Canada. Lorin L. Dame and Henry Brooks. 200 pp. 87 plates. $1.

Trees, Shrubs and Vines of the North-eastern United States. H. E. Parkhurst. 250 ill. $1.50.

Our Native Trees and how to Identify them. Harriet L. Keehler. 500 pp. 340 ill. $2.

Studies of Trees in Winter. A Description of the Deciduous Trees of North-eastern America. Annie Oakes Huntington. 190 pp. 80 ill. $2.50.

A Guide to the Trees. Alice Lounsberry. 312 pp. 64 col. ill, 164 bl. & wh. ill. 54 dia. $2.

Nature's Garden. An Aid to a Knowledge of Our Wild Flowers and their Insect Friends. Neltje Blanchan. 400 pp. 80 ill. $3.

How to Know the Wild Flowers. Frances Theodora Parsons (Mrs Dana). 48 col. ill. $2.

A Guide to the Wild Flowers. A description of 500 plants. Alice Lounsberry. 347 pp. 64 col. ill. 100 bl. and wh. ill. 54 dia. $2.

Mushrooms, Edible and Poisonous, with recipes for cooking, and the chemistry and toxicology of mushrooms. Prof. Geo. F. Atkinson. 320 pp. 230 ill. $3.

The Mushroom Book. Nina L. Marshall.

Our Ferns and their Haunts. Willard Nelson Chute. 332 pp. 200 ill. $2 15.

How to Know the Ferns. Frances Theodora Parsons (Mrs. Dana). 150 ill. $1.50.

Ferns. A Manual for the North-eastern States. C. E. Waters, Ph.D. 362 pp. 200 ill. $3.

Sylvan Ontario. A Guide to our Native Trees and Shrubs. Dr. W. H. Muldrew, B.A. 131 leaf-ill.

III.—Works on Plant Cultivation.

The Window Flower Garden. Julius J. Heinrich. 120 pp. Illustrated. 50c.

Home Floriculture. A Practical Guide to the Treatment of Flowering and other Ornamental Plants in the House and Garden. Eben E. Rexford. 300 pp. 72 ill. $1.

Garden-Making. Suggestions for the Utilization of Home Grounds. L. H. Bailey. 417 pp. 256 ill. $1.

How to Make a Flower Garden. A manual of practical information and suggestions. A charming book by experts on every branch of the subject. 370 pp. 200 ill. $2.

NATURE STUDY—No. XIII.

NATURE STUDY IN THE WINNIPEG SCHOOLS.

By J. B. WALLIS, Supervisor of Nature Study. Winnipeg.

For some years there have appeared on the Programme of Studies for Manitoba a number of suggestions as to subjects which might be classed as Nature Study. Such was Agriculture, which took the forms of a small box of chemicals and of colored plates of some common Manitoban flowers and weeds. These had a definite value ; but the teachers did not know exactly what was required of them, and too often the experiments in agricultural chemistry were allowed to degenerate into an hour's amusement; and the colored plates were put away in a drawer, or were used to decorate the school walls. It is safe to say that Nature Study as we know it to-day, had then no place in the work of the schools. In a few cases, a teacher, herself enthusiastic, would arouse the enthusiasm of her pupils about Nature ; but, even then, it was usually done with little thought of the curriculum. The trouble was, the work was too indefinite ; and it remained for the committee which completed its labors last year, to place on the Programme of Studies a series of definite topics which covered the whole range of the subject as understood by its most advanced advocates.

Even then, the troubles had by no means all disappeared. The teachers were frightened of the work. Arithmetic, history, etc., they could teach ; but this new work, which they were not to *teach* was, even with its assigned topics, something altogether different.

The Winnipeg School Board realized this, and appointed a supervisor of Nature Study for one year. In that time, they considered the subject should be on a firm basis and the teachers all able to continue the work without further supervision.

The plan was inaugurated last September, and a valuable fortnight was taken up in finding what had already been done in the schools and what material was within reach. Programmes were drawn up, meetings of teachers held and the topics and purposes of the work explained. The main purposes kept in view

were : (1) Interest of the pupils in their surroundings ; (2) Training in self dependence ; (3) Knowledge.

(1) It was felt that, without interest, the very life and soul of the work would be lost ; so, all first efforts were directed towards this end. If the pupils were interested, observation would naturally follow. Few people realize how blind the majority of us are.

(2) Training in self dependence was believed to be one of the greatest values of Nature Study. In other subjects, books may be used, the teacher may help ; but the very essence of Nature Study is that it is the pupil's own eyes and brain that do the work ; it is all first hand, so that this value has been considered almost more than any other.

(3) While fully realizing the value of the knowledge to be gained, it was deemed advisable not to accentuate this too much. The teachers were already inclined to lose sight of the other values and consider only this, which was so much more in line with the usual school work.

Keeping these purposes in view, each monthly programme was made as varied as possible. The more varied the subjects, the more chance of appealing to the individual pupils and of interesting the teachers. And, further, the design was to arouse the pupils' interest in their whole environment.

The following outline gives a few of the topics on the programmes, with the reason for their appearance and the suggested methods of taking them up.

(*a*) Flowers and Seeds. This was meant to give the pupils a speaking acquaintance with a few of our common fall flowers. Seeds which had special means of dispersion were collected, and during the winter were discussed with the classes, attention being directed to the clever ways in which mother plants distribute their seeds. Common fruits were also studied. This proved a delightful topic with the children, who doubtless will watch the plants during the coming summer with great interest.

(*b*) Animals. The study of animals was taken up by all grades up to the sixth, but from very different standpoints. In the junior grades, the object was to interest the pupils more fully in the habits and care of domestic animals ; in the senior grades, in the relation of the animal to its environment ; and the chief object was the preparation of the pupils for the fuller study of adaptation in spring. This work proved exceedingly interesting, and, among the older pupils, much individual observation work was done and many hypotheses advanced to answer questions suggested by themselves.

(*c*) The Moon. The great purpose of this topic was to show pupils that by thoughtful observation many interesting problems could be solved, and to stimulate them to find out about some of the wonders of creation which are so often taken as matters of course. The pupils were to make observations and drawings, and then by wise questions the teacher was to lead them to suggest causes for the apparent double motion of the moon and for its change in appearance. This topic proved both a brilliant success and a dismal failure. In a few cases it was simply astonishing how readily the pupils—without being told anything—came to a clear understanding of the motions and phases of the moon, but in others very little was accomplished. On the whole, while the chief object was not always attained, so much interest was aroused that no doubt the moon will be looked upon by the pupils very differently in the future.

(*d*) Evaporation and Condensation. An effort has been made to arouse wonder in the children's minds, so that they may desire to understand all they see. Thus when it snows, the wish to know why it snows, where snow comes from, how it got there, and many other queries would naturally arise. These studies were taken up in order that such questions should be answered. The results were fairly satisfactory, though in a few cases the desire of the teacher to tell, worked somewhat against complete success.

(*e*) Stars. The senior grades were helped to find a few of the prominent constellations and to recognize some of the brighter stars. This proved most successful. The purpose was to arouse interest and the pupils, on the whole, were delighted with the work. It was almost amusing, too, to notice how the teachers seized upon this topic as something they could do, something tangible, something requiring explanation; and, with this, the poorest Nature Study subject we have taken up, they felt quite at home.

From the above an idea of what we are attempting may be gathered. During the coming months we hope to do a great deal of most interesting work. Birds, flowers, insects, the weather, and much else will receive attention. Special work will be: seed germination and experiments on the growth of plants; insect study, such as of the ant, with experiments suggested by the pupils; a flower-growing competition, and, not least, aquaria-keeping, with particular study of such creatures as mosquitoes, dragonflies, toads, and almost anything which the class may propose.

Having now touched upon what has been done in our schools, it may be well to mention some of the difficulties that had to be faced.

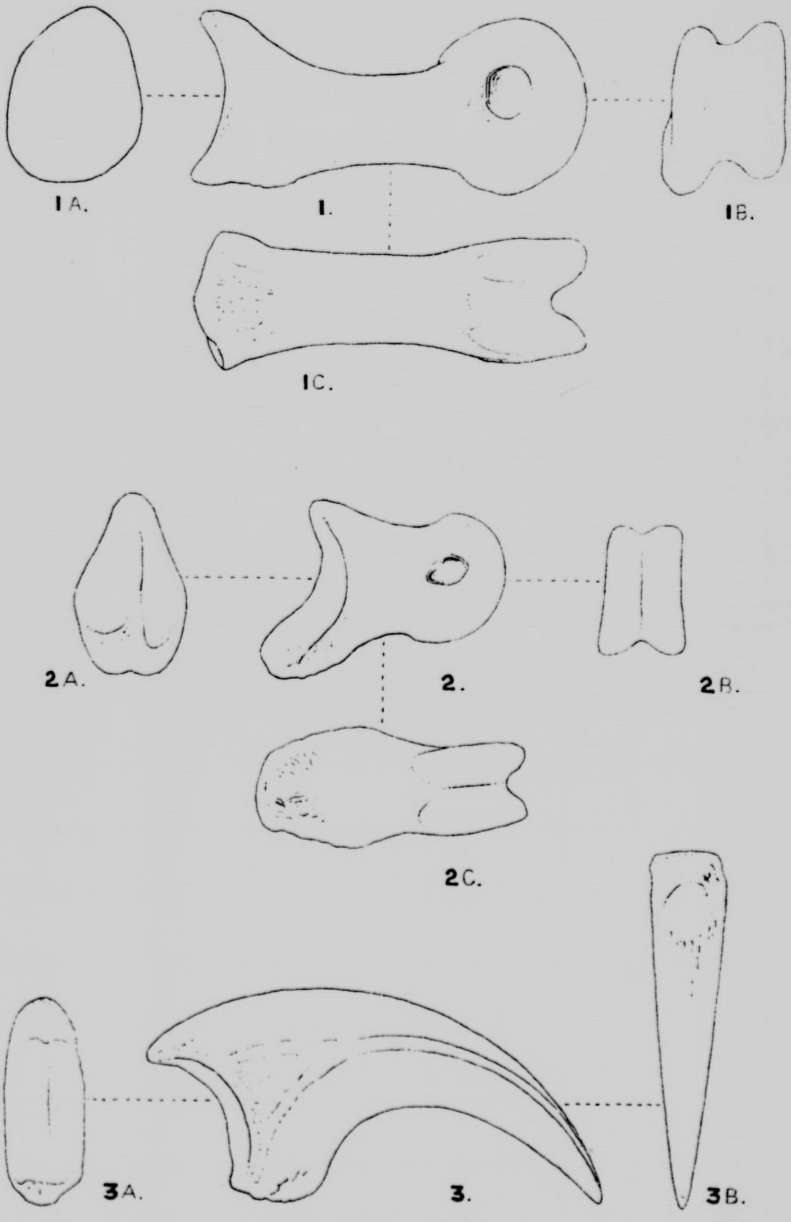
First came the question of time. The curriculum seemed already crowded. Other work showed results which could be seen; Nature Study was so entirely a matter of attitude that naturally there was a strong temptation to let it, if anything, be left undone.

Then, in the teachers themselves some difficulties arose. It was hard for them to forget the habits of years and cease to regard knowledge as the chief object of education. They wished to give information and when directed not to tell too much, in some cases went to the opposite extreme and did not even guide, but turned their classes adrift. Their lack of knowledge troubled them, and in a few instances topics were shunned for fear the pupils might ask questions which they could not answer. In spite of these difficulties, however, the teachers have done remarkably well; and I must express my admiration of the Winnipeg teachers as a body, for having taken up so well, work which was completely foreign to all their traditions.

Another difficulty arose with the pupils, in a few cases. They thought they knew all about the topics suggested. "Fancy studying a cat!" They had had one in the house for years. A very little trouble showed them how much they really knew.

Another difficulty was the "parent who didn't believe in such nonsense as studying a butterfly's wing." We heard of a few parents who objected to the work and at the same time showed a consummate ignorance of all about it. However, I am glad to say we received from the parents more encouragement than the reverse.

Last of all arises the question: "What results have been attained?" It is too soon to answer such a question when it is remembered that the work has for its end, not the mere acquisition of knowledge, but the development of interest and mental power; still I think that results can be seen, for I have asked many times: "Do you see any results?" and have received such answers as: "They see much more;" "They see things they would never have seen before and are always asking questions about something." Surely interest and faculty for observation are things worth working for, and, to those who ask for knowledge as a result, many things can be pointed out as having added to the pupils' stock of facts. We have four months more to work in. If at the end of that time we can feel that the pupils as a whole are a little more interested, sympathetic, observant and self-reliant; and if they realize better that in all things, great or small, animate or inanimate, there is something wonderful, something worthy of study, then indeed our work has not been in vain.



To illustrate Mr. Lambe's Paper.

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