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CONTENTS.

	PAGE
1. Description of a Species of <i>Cardioceras</i> from the Crow's Nest Coal Fields, by J. F. Whiteaves	65
2. Nesting of Some Canadian Warblers (3rd Paper), by Wm. F. Kells	68
3. Report of Botanical Section, 1902	71
4. Sub-Excursions	73
5. Botany	76
6. Hunting for Caterpillars, by Arthur Gibson	77
7. Nature Study—No. 3	81

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THE OTTAWA NATURALIST.

VOL. XVII.

OTTAWA, JULY, 1903.

No. 1.

DESCRIPTION OF A SPECIES OF *CARDIOCERAS* FROM THE CROWS NEST COAL FIELDS.

By J. F. WHITEAVES.

The genus *Cardioceras* of Neumayr and Uhlig consists of a few species of Ammonites with compressed involute whorls, a crenulated keel, and acute radiating ribs,—that were formerly referred to the Amalthei of Von Buch, and that have hitherto been regarded as peculiar to the Callovien and Oxfordien subdivisions of the European Upper Jurassic. It was first described in the twenty-seventh volume of the "Palæontographica," published at Cassel in 1881.

In the second volume of the "Handbuch der Palæontologie" (1881-85), Zittel regards *Cardioceras* as closely related to the Liassic genus *Amaltheus*, but Hyatt, in his latest and much more recent classification of the Ammonites in Eastman's translation of Zittel's Text-book of Palæontology (1900), places these two genera in different families, and says that "the young are very distinct."

One of the commonest and best known species of *Cardioceras* is the fossil originally described by James Sowerby in 1813 (Mineral Conchology, vol. 1.) as *Ammonites cordatus*, which is abundant in the Oxfordien of England, France, Switzerland, and Russia. Of this species there are several good specimens in the Museum of the Geological Survey, that were collected by the writer in 1859 or 1860, from the Oxford Clay and Coral Rag near Oxford, England.

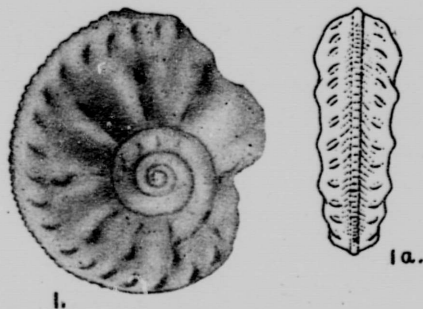
The genus has not previously been recognized in rocks of any age on the North American continent, but the *Ammonites cordi-*

formis of Meek and Hayden, from the Jurassic rocks of the Black Hills of Dakota, that was first described in 1858, is evidently a typical *Cardioceras*.

Three years ago, in June, 1900, Mr. James McEvoy who was then on the staff of the Geological Survey, discovered a small specimen of an Ammonite, that appears to be a true *Cardioceras*, from a coarse grit near the top of a ridge running N. 20° E. and situated two miles and a quarter N. 70° E. from Fernie, B.C., about 4,000 feet above the sea level. The specimen is only a natural hollow mould of the exterior of a shell that is imperfect at the aperture and about thirty-two millimetres, or an inch and a quarter, in its maximum diameter. But, this mould is so sharply defined that good white gutta percha impressions of it, or "squeezes" from it, show both the shape and surface markings of the whole of one side of the fossil and of part of the other, remarkably well.

These impressions indicate the immature stage of a species of *Cardioceras* that seems to be very closely related to the European *C. cordatum*, but that may be provisionally named and described as follows.

CARDIOCERAS CANADENSE, nom. prov.



Cardioceras Canadense.

Fig. 1. Side view of a gutta percha impression from the natural mould collected by Mr. McEvoy.

Fig. 1a. Peripheral view of the same, slightly restored on one side.

Fig. 1 slightly enlarged, Fig. 1a of the natural size.

Shell, at least in its immature stage, compressed, shallowly and rather widely umbilicated, with a small and minutely crenulated keel. Whorls about five, increasing rather rapidly in size and rather strongly embracing, about one-half of the sides of the inner ones being covered by the overlap of those that succeed them. Umbilicus occupying about one-third of the entire diameter, on each side, though its margin is rounded and very indistinctly defined; peripheral carina neither very prominent nor distinctly compressed.

Surface of each side of the outer volution marked with a few comparatively large and distant but narrow and acute primary radiating ribs, that commence at the suture and terminate about half way across, in a small pointed tubercle. Of these ribs there are about ten in the specimen figured. Besides them there are rather more than twice as many small short secondary ribs, that are little more than narrow, transversely elongated, compressed and acute tubercles, on the outer half of each side. The primary ribs almost bifurcate from a median tubercle, and seem to occasionally alternate with an intercalated secondary rib, but the secondary ribs are not quite continuous with any of the primaries. Between the secondary ribs, also, and parallel to them, there are a few fine radiating raised lines.

Sutural line unknown, as are also the exact shape and sculpture of the adult, and the contour of the outer lip.

Judging by Meek and Hayden's figures, specimens of *C. cordiforme* of about the same size as the fossil collected by Mr. McEvoy, have much smaller and more numerous radiating ribs, that are devoid of tubercles.

The discovery of a species of *Cardioceras* in the Crows Nest Coal fields is of considerable interest, as tending to show that the grits in which it was found are probably of Jurassic age. Associated with *Cardioceras* in these grits, there are fragments of guards of a rather slender belemnite.

Ottawa, June 6, 1903.

NESTING OF SOME CANADIAN WARBLERS.

THIRD PAPER.

By WM. L. KELLS, Listowel, Ont.

BLACK-THROATED GREEN WARBLER (*Dendroica virens*).

This species is more often observed in the periods of the spring and fall migrations than during the intervening season, except in certain favorite localities. The majority of these migrants that pass through south-central Ontario in the spring season, appear to go further north for the nesting season; though it may be that many more pairs remain and nest in the swamp woodlands of south Ontario than the few who in this country have yet made the life-history of our minor woodland birds a subject of special study are aware of. Occasionally, specimens of this species are noted in certain lowland woods in the vicinity of Listowel, in the breeding season; and every year—in early summer—I note the song of the male bird at a period when the female is doubtless incubating. I feel certain that some of the species nested on *Wildwood* in past years, for on one occasion I examined a specimen of this species in its nesting plumage, that was shot in the back wood on the premises, in the month of August; and, earlier the same season, a pair had been noted frequenting a clump of conifers in the vicinity; but the clearing up of the original forest and the draining of the low grounds have, with the improvement of the country, effected many changes in the summer haunts and nesting homes of various species of our woodland birds,—among others, in the more original habits of the beautiful and ever interesting Black-throated Green Warbler.

In the middle of June of last season (1902), I was agreeably surprised to discover a pair of these wildwood rangers in full song, and actively gleaning their insect prey, in a large, deep-shaded orchard, five miles west of this town. For some time my companion and I watched the movements of both sexes among the foliage, and listened to the song of the male with deep interest. This performance was effected in a very animating manner, but in a rather doleful tone, and much resembled the song of the White-crowned Sparrow, but was more subdued. This was the nesting time of the species; I was, therefore, in hopes of finding their

nest, and for a time my hope of collecting the eggs seemed about to be realized, as I saw the female fly to the top of a tall apple tree and alight beside a newly-formed nest. On examination I found the nest completed, but it contained no eggs; it was composed of materials much similar to that of a Chipping Sparrow, but not nearly so bulky as the nests of this species usually are. However, neither time nor circumstances permitted me again to revisit the site till the nesting season was over; but I feel certain that the bird nested in that orchard the past season.

On the 11th of May past, I noted this species, the first time for the season of 1902, in a lowland wood north-west of this town. It was then in its beautiful spring plumage and mingling its song notes with those of a number of other Warblers—also new to the season—and all were actively searching for their insect food among the budding branches of the forest trees. Here, I have no doubt, some pairs of them remain through the season, and nest, as I think, also in another tract of woods to the south of the town, where every June I hear the song of the male of this species.

The Black-throated Green Warbler is a lively, active species ever on the move during daylight hours, and from the time of its spring advent till the nesting period is over, a constant and not unpleasing songster. This period extends from the second week of May to the first week of July, after which it is heard no more for the year, though it is probable that it remains in the vicinity of its summer home till the advent of September, when, with other species of its family, and the other woodland birds, it leaves this country and begins its aerial voyage towards its southern home, which appears to be the shores and islands of the Gulf of Mexico. In February the species begin their northward return journey; but it is the early days of June before the more adventurous reach the northern limits of their wanderings. Thus, year after year, such repetitions of movements constitute the principal features of the life history of the species, but it cannot with certainty be told what term of years constitutes the "old age" of a warbler: probably ten to fifteen years is with them the allotted span of existence.

The Hon. G. W. Allen, of Toronto, one of the pioneer ornithologists of Ontario, writing to "The Ontario Farmer," says

regarding this species: "The Black-throated Green Wood-Warbler is occasionally seen through the summer in this part of Canada; but I have never met with the nest of this bird, and am inclined to believe that the majority of them breed farther north. They appear here in little parties of twos and threes on their southward journey in September, and are said to spend the winter in the tropics. Their plumage is very beautiful. The male has the upper parts a very light yellowish green; the front of the head, a band over the eye, the cheeks and the sides of the neck and the upper parts of the sides of the body, are deep black; the rest of the lower parts are white, tinged with yellowish; the quills and tail feathers are brownish-black, the secondary coverts largely tipped with white, as are the tail feathers, of which the greater part of the outer three, and a patch on the inner web of the fourth, are white. . . . Those who have seen the nest of this species describe it as being placed among the thick branches of an evergreen tree, from 20 to 50 feet off the ground, and being composed of small twigs, strips of pine bark, fibres of wood, and horse-hair; and the set of eggs to be four in number, of a whitish hue, spotted with reddish-brown."

Mr. Vennor, in his Notes on the Wood-Warblers of Montreal, 1861, does not mention this species; but Mr. D. Wintle, in his "Birds of Montreal," 1896, records it as a "common spring migrant," but a scarce summer resident. "I saw one on June 18, 1887, in Mount Royal Park, and shot a male and a female specimen on July 1st, 1885, at Calumet; also observed two or three young of this species on August 27, 1892, in Mount Royal Park. Observed here in spring, in May, and in autumn, from October 4th to 10th."

Mr. McIlwraith, in his "Birds of Ontario," says: "The Black-throated Green Warbler is a regular visitor in spring and fall. It appears earlier in spring than some others of its class, and soon announces its arrival by frequent utterances of its characteristic notes, which are readily recognized when heard in the woods."

Mr. M. Chamberlain, of St. John, N.B. wrote regarding this species: "It occurs from the Atlantic border to Lake Huron, and

north to Point-des-Monts. It is said to range to the Great Plains, but has not been observed in Manitoba."

In Cook's "Birds of Michigan," this species is recorded as a common spring and autumn migrant, yet as nesting in various parts of that State.

Mr. C. W. Nash, in his "Birds of the Garden," has written regarding this species: "With the Black-throated Green Warbler we have more concern (than with the Black-throated Blue Warbler); it is quite common and regularly breeds throughout its range in the province (of Ontario); though, unless there are a good many green trees about, it is not likely to stay in the garden to nest, its preference seemingly being for rather open places, where cedars and hemlocks are dotted about. In some large gardens I know, I find it settled every summer. It has a rather peculiar sort of song, which it keeps up all through the season, even in the hottest weather, when nearly all birds are silent. It leaves us early in October, and goes south to Central America."

REPORT OF BOTANICAL SECTION, 1902.

During the spring and summer of 1902 there was a revival of interest among the botanical members of the Club, and more work was done than has been accomplished in any season for some years. Foremost among those who were at work were Dr. Fletcher and Professor Macoun, who studied special genera and re-visited many of the localities at which the rarer species growing in this vicinity are to be found. Many new stations of little known species were discovered and several new species were added to the local flora.

Dr. Sinclair and many of the Normal School students were at work both in the spring and in the autumn, and a greatly increased interest in botany was noticeable among the students.

Though comparatively few of those attending the Ottawa University are members of our Club, we are pleased to record here that many of the pupils, with their instructors, made frequent excursions into the fields and woods of the vicinity. These have

resulted in not a little new information concerning the distribution of our local plants.

Dr. Cephas Guillet continued his field instruction to the boys attending his school. Over 500 species were noted in flower.

In addition to the general work recorded above, many individual members of the Club were active in field research.

One of the results of this renewed activity in botanical study has been the inauguration of bi-monthly meetings of the botanical section. Two meetings have been held this year, the first at the house of Dr. Fletcher, the second at Prof. Macoun's. The principal object of these meetings is to enable working botanists to keep in touch with one another and so make it possible for them to work with greater advantage to themselves and one another.

Dr. Fletcher is growing all the species of Canadian violets obtainable, and he now has all of the Ottawa species, most of which are thriving under cultivation. Plants of nearly all have been grown from seed.

April 19. A sub-excursion of 150 to Aylmer. *Epigaea repens* was collected in perfection of bloom. *Acer rubrum* was also in full flower and exceptionally bright in colour this year.

April 26 was too wet for a sub-excursion.

May 3. Sub-excursion to Beaver Meadow, Hull, which about 60 attended.

May 10. Sub-excursion to Rideau Park; 40 turned out. A severe frost the previous night (13 degrees) had spoiled nearly all flowers open at the time.

May 17. First excursion; 300 attended. A large botanical class of Normal School students.

May 26. Sub-excursion to Rockliffe. Violets in bloom; but, as a class, these plants were much injured this year by the frost of May 9-10.

May 31. There was a small sub-excursion to Dow's swamp.

The long autumn of 1902 with good collecting weather enabled the botanists to do a great deal of active field work; sub-excursions were held during September to Rockliffe, Aylmer, Chelsea and Hull.

The first severe frost was not till October 4. On September

6 a large botanical excursion was held to Gilmour's Grove, Chelsea ; 150, including many of the Normal School students, attended. Violets in fine fruit were collected, and the differences between the species represented were explained by Dr. Fletcher,

J. M. MACOUN.
CEPHAS GUILLET.
D. A. CAMPBELL.
A. E. ATTWOOD.
S. B. SINCLAIR.

ANOTHER INSECT COLLECTOR.—Dr. Fletcher's note in the last number of THE NATURALIST calls to mind a similar interesting incident noted on the 8th June. In this case, however, it was a young Red Squirrel, which was busily engaged eating a June Beetle (*Lachnosterna*). These beetles, especially when they are as abundant as during the present year, doubtless furnish food for many of our small native mammals.

ARTHUR GIBSON.

SUB-EXCURSIONS.

The fourth weekly outing of the Club was the second visit to a part of that division of the Ottawa district henceforth to be known as Quebec West. On the afternoon of Saturday, May 2nd, at least 120 members and friends rambled about the Beaver Meadow, collecting specimens in various branches of natural history.

The most striking characteristic of the amateur botanist of this season is a desire to acquire at least a nodding acquaintance with our native trees. So closely were the leaders pressed in the work of identifying twigs and sprigs that they fervently wished that either night or a professional botanist might come.

At 4.30 about one hundred persons assembled to hear the speakers. Dr. Sinclair presided. Mr. J. C. Spence gave the names of all the plants in flower that were submitted. Mr. A. E. Attwood said a few words on the principles observed in naming plants. Mr. S. E. O'Brien showed a fine specimen of the Walk-

ing Fern (*Camptosorus rhizophyllus*) which he had found among the rocks to the west of the Beaver Meadow. This fern is rare but is also found in several other places near Ottawa.

Mr. W. J. Wilson informed the audience that the best example in this region of a moraine was to be found directly north of the Chaudiere bridge. The mass of débris is pierced by the railway that crosses the Royal Alexandra bridge. In the course of his remarks he said that, while a mineralogical specimen should always have a fresh surface, a rock that has been long exposed is often more serviceable for palæontological purposes, as the fossils are then weathered into prominence.

Mr. Andrew Halkett exhibited a classified collection of small animals captured during the afternoon. After speaking at some length on the various representatives of the different orders of Invertebrata, he showed two species of snakes—the Garter Snake (*Eutainia sirtalis*) and the Grass Snake (*Leiopeltis vernalis*). There was a mild protest offered when he asserted that the snakes and the members of the audience belonged to the same class—Vertebrata.

A party of entomologists and botanists accompanied by Dr. Fletcher and Mr. Gibson went as far as Fairy Lake and made very interesting collections. Unfortunately, this party got back to the rendezvous too late to take part in the addresses.

A. E. A.

On the 9th May about 200 members and friends of the Club met at the southern end of Preston street to enjoy the fifth sub-excursion of the season to the Central Experimental Farm. Here they were met by Dr. Saunders and the officers of the Farm. As an unusually large number of leaders in all branches of the Club's work were present, their presence added much to the value and success of the outing. After a short stop in the woods bordering St. Louis dam, where the spring flowers of *Viola Dicksonii*, *V. pubescens* and *V. canina*, var. *sylvestris*, were in excellent condition, a start was made for the Arboretum and Botanic Garden of the Experimental Farm. Here a considerable time was spent in examining the large collection of shrubs and trees. Those which were most admired, were the pines, larches

and spruces. The different species of ash also attracted attention. Some of the early butterflies were noticed, but none of them were numerous. The early white *Pieris oleracea-hiemalis* was the most abundant, and some nice specimens were secured. A single example of the small Fritillary (*Argynnis bellona*) was seen flying; the 9th May is an early date for the species.

Shortly after 5 o'clock the company gathered near the Director's house, where Mrs. Saunders had kindly prepared most welcome refreshments. At the request of the President, Dr. Saunders gave an interesting talk relating to some of the work carried on by the Dominion Experimental Farms. Special mention was made of the value of the experiments in the hybridizing of fruits for the North-west, which gave every promise of great success. On invitation from the President, several questions were asked by some of those present, on natural history and farm work. Short addresses were also delivered, appreciative of the good work being done by the Club, by Mr. White, the Principal of the Normal School, and by Father Lajeunesse, of the Ottawa University. Before the members dispersed, the President drew their attention to the presence, in a near-by tree, of the Purple Finch and the Brown Thrasher. These charming birds were singing merrily, each vying with the other to enchant the visitors with the sweetness of their notes.

A. G.

The excursion of May 30th to Queen's Park, Aylmer, was attended by some twenty members of the Club—mainly from the botanical section. The burnt grass and the scarcity of many of the flowering plants told of the unusual spring drought but emphasized the beauty of the trees and shrubs. Especially worthy of note was the tall, graceful Sweet Viburnum (*V. lentago*), very prominent near the Chute.

During the afternoon Prof. Macoun found *Salix longifolia* and *Salix amygdaloides*, and Mr. O'Brien discovered both species of Hepatica. *Ranunculus septentrionalis* was found along the line of the railway, and a fine patch of the large yellow Water-Crowfoot (*Ranunculus multifidus*) in the swamp. Prof. Macoun and Mr. Clarke came upon a nesting whip-poor-will in a shady, retired spot. The bird floated from the nest in its moth-like

manner, and disclosed the full set of two eggs in a mere depression of dead leaves. It alighted near at hand and remained motionless, thus permitting a sufficient description.

The excursionists assembled to listen to short addresses from the leaders. The president, in answer to a request, made a promise of a field guide to the trees of the district. Mr. Attwood explained his system of recording field notes, and Prof. Macoun emphasized the necessity of written observations.

T. E. C.

BOTANY.

MACRAE'S CORAL-ROOT (*Corallorhiza striata*, Lindl.).

A beautiful specimen of this widely distributed, but always rare orchid, was found at Renfrew, Ontario, in full flower, on 23rd May last, by Master John Forgie, who has kindly presented it through Mr. W. A. Stickle, the Principal of the Renfrew Model School, to the herbarium of the Central Experimental Farm. It is a very acceptable addition to the collection. This species, though very local and very rare, is widely distributed. I have received specimens from Masset, Q. C. I. (Rev. J. H. Keen); Victoria, B.C. (J. R. Anderson); Aweme, Man. (Norman Criddle); and Ottawa.

J. FLETCHER.

A DOUBLE TRILLIUM GRANDIFLORUM.

On the 21st of May last, Miss Edith Courtney showed me a very handsome large double trillium that her father had found at Chelsea. Instead of three white petals, it had some twenty-four, arranged, though without perfect regularity, in six groups of four each, the six outer petals being the largest, the others getting smaller towards the centre. It presented the appearance of a beautiful white rose. Unfortunately, the root was not obtained; otherwise, the attempt might have been made to preserve so lovely a variation by cultivation. Is it not possible, however, that such a variety might be produced by cultivation?

CEPHAS GUILLET.

ERRATUM.—In the June number of THE NATURALIST, on page 55, line 3, instead of "hissing sound," read "kissing sound."

HUNTING FOR CATERPILLARS.

By ARTHUR GIBSON,

The study of insect life is so intensely interesting that it is difficult to say which branch of entomology is the most fascinating ; each has its own devotees. One branch of the subject which certainly is exceptionally useful and fascinating, is the collection and study of our native caterpillars. Of late years much has been done in working out the life-histories of American insects, but there is still a vast field in which to make research. The life-histories of our butterflies are fairly well known, but only a very small percentage of the larvæ of even our common moths have been studied. Lepidopterous larvæ can be collected at any time of the year, but the best opportunities are to be found during the summer for acquiring a knowledge of these interesting creatures.

It is strange that most people seem to regard caterpillars as repulsive, horrid things ; but this, of course, can only be accounted for by the fact that they have never really taken the trouble to look at one. None of Nature's children are horrid. It is only our unfortunate uninterestedness that is accountable for such inaccurate views. There is really nothing in nature which is not beautiful, if carefully examined and properly understood, and, even those caterpillars which are thought by many to be most repulsive, are of themselves not at all responsible for feelings akin to disgust or horror. When exhibiting a case of butterflies or moths, it is quite usual for the onlooker to make some remark regarding the beauty of the specimens ; but, when shown the caterpillars of these same species, our visitor, as a rule, shrinks back, and a remark not at all corresponding with the first exclamation is heard. Although presenting sometimes a rather formidable appearance, with the exception of a very few kinds, which are provided with irritating hairs, caterpillars are quite harmless. Some of the Sphingidæ will jerk their heads from side to side and even snap their mandibles, but they are unable to bite anything

thicker than the edge of a leaf, as a very slight examination will show.

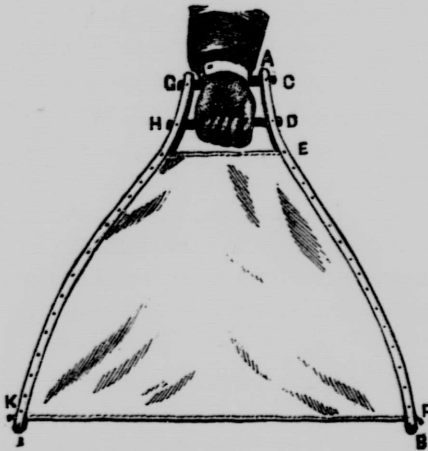
Insects are so abundant that they can be found at any time, and almost in any place. Their presence everywhere offers a ready means for learning something of the ways and habits of the creatures which constitute so large a portion of the animal kingdom. Even a cursory study of any of our caterpillars will soon convince one that there is much of interest as regards the habits of even the commonest species, many of which show remarkable traits.

During the first warm days of spring, even before the snow has entirely disappeared, reddish or mouse-coloured hairy larvæ, about an inch in length, are often seen walking across the sidewalks of outlying streets, or especially along the railroad tracks. These are the caterpillars of *Phragmatobia rubricosa*, Harr., and are chiefly interesting to local collectors in view of the fact that two distinct forms of the moths have been met with at Ottawa, and it is not at all improbable that we may have here two good species instead of one, as now recognized by standard lists.

The spring time is also opportune for the collection of arctiid and noctuid larvæ, under stones, etc., particularly in open places. Along the grassy sides of railroad tracks there are usually numbers of strips of bark, broken pieces of plank, etc.; and, underneath the same, many of these larvæ, which pass the winter about half, or nearly full grown, can be found hiding at that time of the year. The old leaves of mullein plants also harbour various kinds of caterpillars.

After the May and June, by which time many caterpillars will have hatched from eggs laid during those months, doubtless the most prolific way of collecting larvæ is by beating them off the plant they are feeding upon, into a beating net. Dealers in entomological supplies have for sale nets made specially for the purpose; but the accompanying figure shows a good pattern for an easily made net, which can be held beneath the plants with one hand, while the larvæ are beaten down on to it with a light rod held in the other hand. This beating net consists of a stick on each side and a flat sheet of cotton between, three feet wide at the top and one foot at the bottom. Two cross bars close together

at the base allow of this net being easily held by taking the upper bar in the left hand, so that the lower bar rests against the back



of the wrist. We have used these nets in connection with our official field work and have found them very serviceable. Dr. Fletcher has recommended them in his departmental reports as of much value in collecting various insects which are troublesome to the market gardener, etc., so that they can be afterwards destroyed.

There are many kinds of caterpillars, however, which cannot be collected by beating, or gathered from beneath stones, bark, etc., on the ground. Some of these are borers, which pass the whole of their larval existence feeding inside the stems and roots of various plants. The caterpillars of the genus *Papaipema* (*Hydræcia*) have, within the last few years, been given special attention by some students. These larvæ are true borers and work within the stems of burdock, goldenrod, etc. *Papaipema cataphracta*, which bores in burdock, is a common species at Ottawa wherever the plants are numerous, and the presence of the caterpillar can usually be detected by the withering and discolouring of the tips. The caterpillars of *P. appassionata*, which have only recently been discovered, were found, by Mr. Henry Bird, of Rye, N.Y., feeding in the roots of the Pitcher-plant (*Sarracenia*). Last season, when at the Mer Bleue, the writer examined many pitcher-plants, but could not find any larvæ, although in the root of one plant the work of a noctuid caterpillar was detected, as well as some frass, but of course we do not know that it was of this species.

Other larvæ of smaller species of moths form various kinds of cases, inside of which they live and change to the pupal state,

and some kinds even produce gall's, or more or less decided enlargements of the stems of their food plant. These of course can only be collected by hunting for them at the proper time. A large number of still smaller caterpillars are leaf miners feeding on the soft cellular tissues under the epidermis. The moths of these leaf miners are very beautiful, but delicate little creatures.

The tips of plants may often be seen drawn together by threads of fine silk, and, if the leaves are separated, the caterpillar which caused this tying can be collected. A species of economic importance, because it does considerable damage at times, has been called the Greenhouse Leaf-tyer, from the habit it has of drawing the leaves of the plants together, and fastening them with silk.

The pleasure derived from collecting caterpillars and watching their varied habits, will be found very helpful and fascinating. There are many lessons which they teach us, from which we could derive untold benefit. Every species is worthy of study, and, as there is so much yet to be done in working out the life-histories of our butterflies and moths, particularly of the latter, there is in this branch of study alone a vast field for much original investigation. The value of such work cannot be over-estimated. From an economic standpoint, it is only when a complete knowledge of all stages is known that we can hope for the best results in combating the ravages of many injurious species. I feel sure that anyone who devotes any time to the rearing of larvæ, will not regret the hours spent in collecting and watching their specimens. On the contrary, however, they will be surprised at the interest they find themselves taking in the development of their captures, and, even if they should not be successful in bringing the specimens to maturity, they will not, I venture to say, allow this disappointment to lessen the interest aroused in these creatures.

NATURE STUDY—No. III.

(The following is the concluding summary of Dr. S. B. Sinclair's lecture on "Nature Study in American Universities," delivered to the Club on February 10th. A *full* report is given in the May and June numbers of the Educational Monthly of Toronto.)

It may be said that experimentation and investigation have established the following general principles regarding Nature Study.

1. Nature Study should not be considered the be all and end all of education. The humanities and mathematics must always be prominent subjects in a rationally constructed school curriculum. It is probable, however, that with wiser selection of subject matter and method in every department, better results will be secured with less expenditure of time and energy than formerly, and that the introduction of Nature Study will not prove an additional burden to the student.

2. Nature Study should have a place in the curriculum of every grade in every elementary school. The work in early years should consist of that comparatively spontaneous, non-technical and undifferentiated study of surroundings which develops in later life into a scientific study of Nature with a definite problem and by careful and accurate laboratory methods.

3. The aim of such study in the elementary school is not so much information as character. The purpose is not at the beginning to furnish a scientific laboratory training or to fill the mind with scientific facts, but to develop an attitude—a power of interpretation and appreciation of Nature and also a power of self-expression, which will enable the child to gain better control of himself and of his surroundings, to live a fuller life and to be of greater service in society than he otherwise would be.

4. In the selection of materials and methods, this aim should be kept in view. For example, the study of the various processes by which the wool of the sheep is worked up into cloth, is usually of greater value educationally to the city child than to the country child, who may already be fairly familiar with the facts. Thus, it is impossible to lay down a definite course of study which will be adapted to different school conditions. The material studied should be closely related to the problems of child life experience

and should be adapted to the hunger and needs of the child. During the symbolic or play period of later infancy, and during the keenly observant but still comparatively unreflective period of early childhood, emphasis should be cast upon the sensory-motor, the historic, the individual, the social, rather than upon the abstract, the technical, the scientific.

In the primary grades of the school, therefore, the greatest stress should be placed upon activities connected with the child's immediate experience, involving a study of his surroundings—geography and history.

While the work should be purposive, it should not to any great extent appeal to the *commercial* instinct. The child is usually specially interested in certain living forms of plants and animals; but he is not interested in *all* such forms, nor are inanimate objects devoid of interest to him. The construction of a thermometer or a study of various forms of water may lie closer to the child's life interest than an investigation of certain animal forms.

The material should not be selected on the basis of trivial superficial interest, but should be of such a nature that when the child realizes what is there and what it means to him, it will become interesting. The despised and persecuted common toad, usually looked upon as an ugly venomous and loathsome beast, becomes an object of genuine interest when the child learns that the toad is entirely harmless, that it is one of the most humane and valuable fly traps yet discovered, that it destroys large numbers of injurious insects, that its life cycle extends over thirty years, that it is easily tamed and that it is destined to become a valuable and highly appreciated domestic pet.

5. The study in the initial stages should not consist of set formal lessons. For example, the metamorphoses of an insect or the development of a plant from seed to fruit may be observed for months, with an occasional brief conversation to organize the facts learned up to the present, and to direct observation for the future. By spending an hour a week, in brief or extended discussion (as the conditions of the case require), much valuable work can be done in every grade. The school garden, and the field excursion, when properly conducted, afford the ideal conditions for elementary Nature Study.

6. While supplementary readers, pictures, lantern illustrations and prepared specimens are of great service when properly used, their advantages can easily be over-estimated. Nothing can take the place of living interest and actual contact. The pet squirrel that the child knows as a companion and cares for day by day, the flower which he has planted and watered and provided with proper light, heat and moisture conditions, is a thousand times better than any dead specimen.

7. Technical terms and static classification should not to any great extent enter into the initial work. In this connection, Burrough's criticism is well taken when he says: "The clerk of the woods is so intent upon the *bare fact* that he does not see the spirit or the meaning of the whole. He does not see the bird; he sees an ornithological specimen. He does not see the wild flower; he sees a new acquisition to his herbarium. In the birds nests he sees only another prize for his collection. Of that sympathetic and emotional intercourse with nature which soothes and enriches the soul, he experiences little or none."

8. The best results will never be obtained until Public School classes are reduced to a sufficiently small number (say a maximum of forty) to admit of individual supervision, and until teachers know enough of natural science to make them enthusiastic and wise leaders. Under present conditions in graded schools, the latter difficulty may in a measure be overcome by an interchange of teachers of different classes, which will make it possible for the specialist in science to teach in different grades. A primary class in a well organized school does not suffer by a change of teachers several times during the day.

9. Nature Study should be correlated with other cognate studies, especially with form study, drawing, and colour work. The representations should be mainly from life and imagination and not from copies. Modelling should form an important feature.

The subjects studied in Nature lessons may be made the basis for drawing lessons. The study and representation of abstract conventional type forms should not precede the investigation and expression of the forms of the individual objects met with in the child's experience. It is not surprising that the schools do not develop more and better artists, when we consider the character of

the work done. With but few exceptions colour is never referred to, and much of the drawing work is conventional and lifeless.

All who have observed the results of a sequential course in the study of life forms accompanied by expression in model and colour work from the kindergarten through the entire school course, must be convinced of the great value of such training. So long as the public are content with the notion that the acme of school art is achieved when pupils can draw straight lines to vanishing points, little will be accomplished.

Such a reform would necessitate the securing of teachers of drawing who are themselves artists and who possess sufficient knowledge and love for Nature to enable them to guide their pupils to artistic expression. This would involve an additional expenditure for teacher's salaries ; but, even from the commercial standpoint, the extra amount would be a good investment.

WHAT IS NATURE-STUDY ?

Nature-study from the public school teacher's point of view is the maintaining in educative directions of the child's natural interest in its environment. For such work the knowledge of paramount importance to the teacher is the knowledge of child-nature ; the knowledge of plants, animals, earth and sky, though necessary, is secondary. Learning to train the child how to use the materials of knowledge, obtained at first-hand through sense-activity, in the proper development of the intellectual, emotional and volitional phases of its being, is the indispensable preparation of the successful teacher of nature-study. The name is unfortunate because it is so liable to be regarded as the equivalent of acquiring knowledge of nature. Even some who are writing books and giving lectures to teachers on nature-study (*sic*) are substituting information for education. Educationally, the study of nature may be different from nature-study and as inferior to it as a horse-chestnut is different from and inferior to a chestnut-horse.

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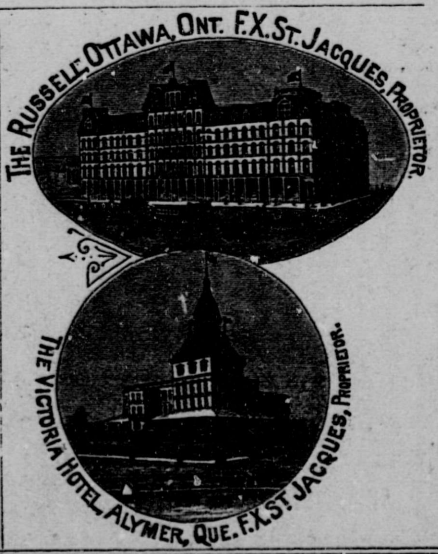
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