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THE OTTAWA NATURALIST.

VOL. XIX. OTTAWA, MAY, 1905. No. 2

ON THE FOOD VALUE OF CERTAIN MUSHROOMS.

(No. 2.)

By FRANK T. SHUTT, M.A., and H. W. CHARLTON, B.A.Sc.

In a preliminary note on the food value of certain mushrooms, which appeared in the number of THE OTTAWA NATURALIST for July, 1904; the writers presented the results of some partial analyses they had made of the following species:—The Grey Coprinus (*Coprinus atramentarius*), the Shaggy Coprinus (*Coprinus comatus*), and the Fairy ring Champignon (*Marasmius oreades*). These mushrooms were selected for investigation by reason of their more or less common occurrence, and the fact that they are highly prized for their excellent flavour.

To complete the analytical data given in the article referred to, as well as to extend the research, further and larger collections of the Shaggy Coprinus were made last summer and autumn and submitted to analysis. The results now presented will indicate the composition, more particularly as regards nitrogenous content, of this mushroom at various stages of growth and also furnish information respecting the relative food value of the umbrella and stalk.

In table No. 1, analytical data are given from the examination of *Coprinus comatus* taken (*a*) when quite young (a total length of 3½ inches); (*b*) somewhat older, but still edible. The mushrooms in collections (*c*) and (*d*) were the largest obtainable and many of them were beginning to turn black, but all as yet were in excellent condition for use. The analyses were made on the whole mushroom—stalk and umbrella.

TABLE No. I.

COPRINUS COMATUS—The Shaggy Coprinus or Horsetail Mushroom

	The Freshly Gathered Mushroom.				Water-free Substance.			
	Water.	Crude Protein.		Ash.	Crude Protein.		Ash.	Percentage of Crude Protein present as Albuminoids.
		Albuminoids.	Amides.		Albuminoids.	Amides.		
a.	91.24	1.94	1.94	1.36	22.14	22.15	15.52	50.0
b.	91.81	1.68	1.51	1.19	20.51	18.43	14.53	52.6
c.	92.33	1.63	1.25	1.20	21.25	16.29	15.64	56.6
d.	93.52	1.44	1.00	.70	22.22	15.43	10.80	59 0

DRY MATTER:—It is worthy of note that the percentage of dry matter decreases somewhat in the mushroom with age, i.e., as the condition of edible maturity is approached. This peculiarity no doubt is more strongly marked in the deliquescent mushrooms, but possibly does not exist to any degree in those varieties, such as the *Marasmius*, which can be gathered when mature and preserved for future use by simply drying. The data from *C. comatus* show a decline from 8.76% to 6.48% during its growth, *i.e.* from the very earliest stage to the condition usually considered as best for cooking.

PROTEIN:—The nitrogenous character of mushrooms was emphasized in our previous contribution on this subject. It is this feature which gives them their especial value as food. Although they do not contain more "dry matter" than many of our succulent vegetables, this dry matter, unlike that of the vegetables, consists of from one-third to one-half nitrogen compounds.

The nitrogen compounds in vegetable matter are grouped under the term Crude Protein, but by appropriate methods of analysis they may be differentiated into Albuminoids and Non-

albuminoids or Amides. The former are much the more valuable, since they particularly perform the function of repairing the waste of the body consequent upon daily activity and of building up its tissues. It is for this reason that the Albuminoids constitute the most important of the nutrients in all classes of foods.

Considering now our results, it will be seen that while the percentage of Crude Protein in the fresh material decreases as the mushrooms grow larger (from 3.88% to 2.41%). the proportion of Albuminoids suffers but little loss during growth. This is the more prominently brought out by the data on the water-free substance, which clearly show that the dry matter of the large and edibly mature mushroom is equally rich in the "flesh-formers" with that of the very young fungus. The last column of the table is instructive in pointing out that as growth advances the proportion of true Albuminoids in the Crude Protein increases.

ASH OR MINERAL MATTER:—The ash constituents in the fresh material decrease with the age of the mushroom, namely, from 1.36% to .7%. This is not entirely due to the smaller proportion of dry matter in the older plant, for reference to the analysis of the water-free substance shows a falling off in ash from 15.5% to 10.8%. We may conclude from these results that it is more particularly during the earlier stages of growth that the mineral elements are absorbed.

Certain features in the foregoing results made it a matter of interest to ascertain what differences in composition might exist between the umbrella and the stalk—the analyses already discussed being made on the whole mushroom. Consequently, two gatherings were made, (*a*) of small and medium size and (*b*) of large and mature specimens, and the umbrellas and stalks, separately, submitted to examination.

TABLE No. II.

COPRINUS COMATUS—Analysis of Umbrellas and Stalks.

—	Freshly Gathered Mushrooms.				Water-free Substance.			Percentage of Crude Protein present as Albuminoids.
	Water	Crude Protein.		Ash.	Crude Protein.		Ash.	
		Albuminoids.	Amides.		Albuminoids.	Amides.		
a. Umbrella	91.97	2.10	1.47	.71	26.15	18.30	8.84	58.8
Stalk....	92.72	.77	1.19	.77	10.58	16.34	10.58	39.2
b. Umbrella	92.82	1.55	1.45	.82	21 58	20.20	11.42	55.0
Stalk....	91.73	1.45	.96	.89	17.53	7.98	10.75	60.1

These data are not, we regret to say, in all particulars thoroughly satisfactory, yet they may safely be considered as indicating that the umbrella is decidedly richer in albuminoids than the stalk, though the difference becomes less as the mushroom matures. They would further seem to show that as growth advances the umbrella decreases slightly in its nitrogen content while there is a concomitant increase in the value of the stalk.

Our work with *Coprinus atramentarius*, the Grey Coprinus or true Ink-cup, has not been so extensive as that with *C. comatus*, yet it may be of interest to insert for comparison with the data of Table 1, a recent analysis made by us of this most excellent mushroom collected in its edible condition :

Analysis of COPRINUS ATRAMENTARIUS.

Constituent.	Fresh Material.	Water-free Substance.
Water	93.31	—
Albuminoids	1.02	15.43
Amides	.71	10.74
Ash	.77	11.49

Percentage of Crude Protein present as Albuminoids, 58.9.

Though containing practically the same amount of dry matter as the mature *C. comatus*, it is evident that this species is decidedly inferior as regards its albuminoid content, a result which confirms the conclusion reached in our previous examination.

In our preliminary note we remarked that the consumption of mushrooms was much restricted by the dread that many persons have of gathering by mistake poisonous species, popularly known as toadstools. There is, unfortunately, no rule which may generally apply to distinguish the edible from the dangerous mushrooms, and thus it is not surprising that this dread is widespread. It is not necessary, however, to be well versed in cryptogamic botany before venturing to collect mushrooms. The differences between many of the edible and non-edible varieties may not on first acquaintance be very great, but on further scrutiny and practice, assisted at the outset by the instruction of "one who knows", the identification of the more commonly occurring edible forms becomes a matter of little difficulty. When in addition to their qualifications as a delicacy it is remembered that mushrooms possess a comparatively speaking high food value (as made evident by their protein content), it would seem well worth while to devote some time and pains to the acquirement of this knowledge.

CANADIAN BOTANICAL EXCHANGE BUREAU.—This bureau is organized for the purpose of aiding public schools, high schools teachers and others interested in botany in making collections of Canadian plants. Full particulars of the conditions under which exchanges may be made will be sent inquirers by Mr. Geo. L. Fisher, Box 983, St. Thomas, Ont.

POPULAR ENTOMOLOGY.

HALISIDOTA TUSSOCK MOTHS.

By ARTHUR GIBSON.

Among the insects which occur at Ottawa more or less commonly every season, are three different kinds of arctian moths belonging to the genus *Halisidota*. They are all of about the same size, measuring, when the wings have been expanded, from one and a half to two inches, and not one of the three would probably ever be picked out in a collection of insects as being specially attractive, or as possessing any particular or striking beauty. In the realm of nature, however, it is by no means only the so-called attractive or beautiful objects that are studied; all have their place in this interesting world of ours, and even the smallest or most inconspicuous-looking insect will be found worthy of some thought and investigation biologically.

The genus *Halisidota*, according to the latest revision, is not an extensive one in North America, there being only eight species found north of Mexico. The majority of these are southern or western in range, but, as above stated, three of them, viz., *H. tessellaris*, S. & A., *H. maculata*, Harr., and *H. caryæ*, Harr., may be found in the Ottawa district almost any season.

The moths of these three species emerge from their cocoons during the month of June, and, being nocturnal in habit, only fly at night. Like all insects they vary in numbers with the seasons. Some years the moths are noticeably abundant, others the reverse, but, as a rule, these insects may be collected any season in either the larval or adult states of their existence.

The perfect insects, as is the case with hundreds of other kinds of moths, are attracted to lights, and everyone has noticed on warm, close evenings, during the months of June and July, the swarms of insects of all kinds which fly around the electric lights, particularly those in the outskirts of cities and towns. The attraction which these arc lights have for insects is well known to the entomologist, and anyone desirous of securing moths for study can easily collect ample material during almost any warm evening from May till October.

The caterpillars of these Halisidotas are general feeders, and all have been found here at Ottawa feeding on oak, elm, willow, basswood, ash, etc. They become full grown in autumn, and after wandering about in search of a suitable place to make their winter home, each caterpillar spins an oblong-oval cocoon composed of the hairs from its body, interwoven with some silk. Soon after completing its cocoon, it changes to a reddish-brown object, called the pupa, and while in this state it gradually transforms into the perfect insect, the moth emerging the following June. These cocoons may often be found in open woods in spring, under pieces of old plank, dry logs, or even flat slabs of stone, which in some way have been disturbed or dislodged. After having collected these cocoons and brought them home to watch for the appearance of the moths, it often happens that one is surprised to see in the box, or breeding cage, in which they have been placed, a large fly somewhat like the ordinary house fly except in size, or a still larger kind of fly, in the sense of being longer, viz., one of the hymenoptera, instead of what we expected to see—the perfect insect or moth. To one who studies insects, however, this is not always a disappointment, as a knowledge of our parasitic, or beneficial species, is of much value, and were it not for these parasitic forms, some kinds of which prey to such a marked extent upon our native species of injurious insects, these latter would soon multiply enormously, and quickly destroy all vegetation.

The Checkered Halisidota, *H. tessellaris*, S. & A., is slightly larger than the other two species found at Ottawa, and expands, when the wings have been spread, about two inches. It is a delicate looking moth with semi-transparent wings, of a buff color. The forewings, which are narrower, making them appear more pointed than in *maculata* and *caryæ*, are checkered with five irregular transverse bands, margined narrowly with black, the 2nd, 4th and 5th of which extend right across the wing. The shoulder covers and collar of the thorax are the same color as the wings, but are margined on the inside with greenish-blue. Down the centre of the thorax is a stripe of the same greenish-blue. The balance of the thorax, the upper surface of the abdomen and the legs are yellowish-orange.

The caterpillar of the Checkered Halisidota, when full grown, is over an inch in length, with a black head, the body covered with hairs of a delicate buff-yellow color. In front are four dorsal blackish pencils, or conspicuous tufts, besides which are two pairs of shorter lateral white tufts, and, near the end of the body, a pair of whitish tufts. At Ottawa the basswood seems to be a favorite food plant of the larvæ, although they are often found on a number of other trees, such as hickory, walnut, beech, and frequently on fruit trees, to which, however, they do no serious harm. These caterpillars have, also, been recorded as a nuisance on shade trees in cities in New Jersey, but in Canada no complaint of this nature has, I think, been made.

Halisidota maculata, Harris. (Original.)

The Spotted Halisidota, *H. maculata*, Harr., is a more conspicuous moth than *tessellaris*. The forewings are ochre-yellow, spotted with blotches of dark brown, the outer of which form a distinct band across the wing. The other blotches form four partial transverse bands, the 2nd, 3rd and 4th of which join, in most specimens, in the centre of the wing, forming one large blotch. The body is of much the same color as the forewings, and just behind the collar are two oblique stripes, which converge and almost form a V-shaped mark. The hindwings are paler than the forewings, translucent, and without spots.

The larva of this species is larger and quite different from the preceding. The body is black, covered with tufts of bright-yellow and black hairs, the black tufts being on the four anterior and three posterior segments, and the yellow tufts on the remaining segments. The latter are centered down the middle of the back with a row of black tufts. We have not found this caterpillar as commonly, at Ottawa, as the other two species. The oak is probably the favorite food plant, and some writers speak of the species as "The Oak Tussock Moth."

Halisidota caryæ, Harris. (Original)

The Hickory Halisidota, *H. caryæ*, Harr., is quite different from either of the foregoing. The ground color of the forewings is ochre-yellow, but is heavily dusted with brown scales. On the forewings are five, more or less, transverse bands, or rows of spots, joined together. The outer two rows of these are pearly, the others mostly the ground color of the wings, edged with brown. The hindwings are semi transparent, the same as in the Checkered Halisidota. The body is of about the same color as the wings, the shoulder covers of the thorax being margined with brown on the inside.

The caterpillar of the Hickory Halisidota is the commonest larva of the genus, which we have in this district. It has a black head and the body is clothed with dense tufts of white hairs, with a ridge of black hairs down the centre of the back, and two pairs of long black pencils on the 1st and 7th abdominal segment. When full grown it is about one and a half inches in length.

The female moth lays her eggs in a cluster on the underside of a leaf, and the young caterpillars in their earlier stages have the habit of congregating. As they approach maturity, however, they separate, and wander off by themselves. During the past summer the writer had a brood of these caterpillars under observation, some of which were kept in glass jars. An interesting point noted was that when the caterpillars, in their last stage, were being returned to the jars, after these had been cleaned, if they happened to drop against the sides of the jars, they were able at once to hold on to the glass by their feet, instead of dropping to the bottom.

When disturbed all of these *Halisidota* caterpillars have the habit of falling to the ground and curling up, remaining in such position for some little time. They can, therefore, be collected easily from the trees, or bushes upon which they feed, by simply holding, with one hand, an inverted umbrella under the food plant and tapping the branches or twigs with a light stick held with the other hand.

THE GLACIATION OF MOUNT ORFORD, P Q.

By R. CHALMERS, LL.D.

In a paper recently published by Prof. C. H. Hitchcock of Dartmouth College, Hanover, N. H., on the *Glaciation of the Green Mountains*,* he brings up anew the question of the glaciation of Mount Orford, and reiterates his former belief that it was overridden by ice from the Laurentides during the glacial period. As the writer ascended this mountain in 1896 and spent some time in an examination of its higher slopes and summit, the results of which led him to an entirely different conclusion, which is briefly stated in an official report issued in 1898,† a few remarks and explanations seem now to be required.

Mount Orford is one of the isolated summits of the Sutton range, or north-east extension of the Green Mountains into Canada, and is situated near the northern end of Lake Memphremagog. The altitude has been ascertained by the Geological Survey of Canada, (Ells, Giroux and the writer) to be 2,860 feet above sea level. On the summit there are patches of bare rock. From the highest of these there is a magnificent view of the lake and surrounding country on a clear day. A flag-staff has been erected here for the guidance of mountain climbers, and a foot-path leads up to it on the south-west slope.

In climbing this mountain I took a guide with me who was familiar with the trails, and instead of following the beaten path I went round to the north-west side mounting the slope along an untrodden route. My object in doing this was to observe the glaciation on the stoss, or struck side, and to ascertain how high the ice ascended it, and whether it really overrode the mountain top. Though we had a very difficult climb, through woods, and over ledges, boulders and fallen trees, the ascent was successfully accomplished. On the way up we noted striæ and grooves, boulder-clay, and crystalline boulders, till we reached an elevation of about 1,800 feet. At a point 2,080 feet high, however, I thought I detected grooves, but I see by my notes made on the spot, that they are marked *doubtful*. Above this no glacial marks,

* Argos and Patriot Press, Montpelier, Vt. 1904.

† Annual Report, Geol. Survey of Canada, Vol. X, 1898, p. 30 j and p. 46 j.

boulder-clay, or crystalline boulders were observed. Reaching the north-west and west brow of the mountain summit we found the rock surface broken, jagged and angular, instead of worn and rounded as it should be if ice had passed over it. Continuing thence to the highest point on which the flag-staff stands, parts of it were found to be bare rock, while bushes and stunted trees grew in the hollows and crevices. Striking evidences of decay are apparent on every hand, the rock being everywhere rent and fractured. A broad weathered chasm with angular blocks in it which have fallen from the sides, crosses the summit in the direction of S. 40° E. and N. 40° W. mag.; but there was no sign of glaciation here. The rents and cracks in the rock surface referred to are sometimes parallel to the chasm and sometimes not, and when the sharp edges of the smaller and finer cracks become weathered they resemble glacial grooves. In other places however, the surface of the rock is uneven, lumpy and without any appearance of planation. No boulders of gneiss or granite were observed on this part of the summit The whole aspect of the mountain is that of one rapidly crumbling to ruins, the nature of the rock, an altered diabase, being such that in an exposed position, it could not have retained glacial marks for the length of time which has elapsed since the glacial period, even if it had once been overridden by ice.

Prof. Hitchcock reports that in October, 1897, he ascended this mountain, and at the Boston meeting of the *American Association for the Advancement of Science* in 1898,* he gave the results of his examination, making the altitude 5,000 feet, and stating, as already mentioned, that ice had passed entirely over it striating the summit and distributing boulders of Laurentian gneiss upon it, etc. But any one, understanding glacial geology, who has been on the higher part and around the mountain cannot avoid seeing that if he were there at all his examination must have been very imperfect. I am constrained to believe that Prof. H. never was on the highest part of this mountain, but only reached its upper slopes.

In regard to Owl's Head, a mountain 16 miles to the south of Mount Orford, and 2,400 feet high, Prof. Hitchcock remarks, "I may say that I have examined the summit of this mountain and

* Proc. of the A. A. A. of Science, 1898, p. 292.

found no striæ, because the rock has deteriorated and the glacial surface destroyed." If glacial marks could be destroyed in this way on the summit of a mountain 2,400 feet high is it likely they would be preserved on one 2,850 feet high, the rocks being practically the same in both ?

The Canadian Record of Science for 1900-92,* also contains a criticism of my work on Mount Orford by Prof. J. A. Dresser, of Richmond, P Q., in a short paper entitled *Note on the Glaciation of Mount Orford.* In this note, after quoting my statement about the mountain having been glaciated only to a height of 1,800 feet, he says: "From these conclusions it is evident that the observations on which they were based did not include that dome-shaped part of the summit of the mountain which is apparently its highest point." ..... "Here, near the point where a flag-staff has stood for the past few years, a fine-grained and much altered diabase is distinctly striated, and the whole eminence has a generally—smoothed and rounded appearance." Though Prof. Dresser writes so confidently he is not a glacialist, and in his desire to support his friend Prof. Hitchcock, has evidently fallen into the error of supposing that the weathered grooves and ruts in the dome-shaped part of the mountain summit, described by me, are glacial striæ As regards this, however, he can console himself with the thought that he is not alone in making this mistake, for Prof. Hitchcock, if he ever were there at all, has fallen into the same error. In another paragraph Prof. Dresser says :—"Reasoning from this limit of the height reached by the ice-sheet, viz., 1,800 feet, Mr. Chalmers shows that if it passed over the range of hills along the United States boundary line, some 2,000 feet in height, as was probably the case, that those hills must have stood relatively lower than at present. This hypothesis is then applied to the explanation of certain high-level terraces near the international boundary line, and the deformation of gravel beds around Lake Memphremagog and along the Coaticook and Salmon rivers. But in view of the evidence of ice-action at a much greater altitude than 1,800 feet, the hypothesis may no longer be needed," etc.

This gratuitous comment shows Prof. Dresser to be quite

Can. Record of Science. Vol. VIII. 1900-92, pp. 223-25.

innocent of any knowledge of the subject under discussion, and of the reasons why an hypothesis of this kind should be considered necessary. It is surprising how many writers on glacial questions there are who do not seem to know that a moving glacier, like running water, cannot flow higher than its source. According to the views of these scientists there would appear to be no difficulty in ice flowing from the Laurentides, which are only 1,500 to 2,000 feet high, over the north-east Appalachians 2,500 to 5,000 feet high or more. The hypothesis of a greater elevation and a vast sheet of ice in the Laurentian region has, of course, been advanced, but this does not satisfy the conditions of the problem, in fact it is merely one hypothesis brought forward in support of another. If we admit the principle of oscillations at all, is it not just as reasonable to assume that these took place in the Appalachians as in the Laurentides? To suppose the former to have been a stable region in the glacial period, while the latter was rising and falling, as has been done by the advocates of great glaciers, does not seem probable, and moreover, the evidence adduced in support of such a condition of things is of little or no value. But the limits of this note will not permit me to go into further details at present. I may remark, however, that in my official work, while broaching several hypotheses, I have been conservative; and in regard to the glaciation of the St. Lawrence valley, I have taken existing levels as those which may, after all, have obtained in the early part of the Pleistocene period. These, I found sufficient, at all events, to enable me to explain the striation and transport of boulders in south eastern Quebec up to the international boundary.

NESTING OF THE NIGHT-HAWK IN OTTAWA

A BIT OF NATURE-STUDY ON ONE'S OWN HOUSETOP.

By G. EIFRIG.

The first night-hawks or bullbats (*Chordeiles virginianus*) of the season 1904 that came to my notice, I saw sailing about over the eastern part of the city on May 11th. This interesting bird has of late years changed its nesting habits to accommodate itself to the encroachments of civilization. Many individuals of the species have forsaken their natural nesting or rather breeding places—since they build no nests whatever—that is, dry open fields and rocky ledges, and now simply deposit their usual set of two eggs on some of the many flat-roofed houses in the cities. My house having a so-called deck-roof, with a balustrade around the gravel-covered "deck," I wondered whether this might not prove attractive enough for one of the night-hawk couples to go to housekeeping on it. However, on account of an absence from the city I did not get to look until May 28th. As I lifted the cover from the manhole leading up to the deck, away flew a night-hawk from the gravel. I looked at the place vacated by her, but for several minutes saw no eggs, until I finally discovered one right before me, where I had been looking all the time. It measured 1.20 x .86 in., the ground color was dull olive-gray, irregularly blotched and spotted with blackish-brown and thus being very difficult to detect among the variously colored gravel.

The bird had not flown far, but squatted lengthwise, as this bird and the whippoorwill usually do, on one of the ridges of the roof nearby. No other egg was laid, perhaps, because the bird evidently had been hurt on one wing; some of the greater wing coverts over the secondaries were missing as through a pebble or bullet had passed through, which however, did not incapacitate her from flying. After several visits she did no longer fly off, but allowed of close approach, and as a perfectly quiet sitter before a camera, though only three feet away, would have delighted any photographer. The male, much more conspicuous and pretty than his demure little mate by reason of the white band across the throat and the white spots on wings and tail, would sometimes

come from some nearby large willows or houses and utter some queer rattling or clucking notes of alarm or protest. In the evenings, when the air was full of bullbats performing their marvellous aerial evolutions and incidentally catching their insect prey, this male bird would sometimes dart down right near to me, producing the loud booming for which these birds are known, the female even then sitting at my feet.

The female was faithfully brooding her solitary egg, rain or shine, early in the morning and late in the evening until the morning of June 11th, when, before my eyes, out of the shell a young tiny bullbat emerged into the world. It was covered with grayish down, some black being sprinkled over all, and this combination of neutral tints made it again difficult to detect in the gravel. It was able to wabble about immediately. The mother now lost some of her former good nature, she hissed with wide open mouth—which in these birds is really cavernous—in the most startling manner. During the next three days she always brooded her offspring whenever I looked at them; as late as 10 o'clock in the evening the mother was there. The feeding must have taken place later in the night. The youngster grew fast and gave every promise of becoming a valiant boomer amongst his kind, when, alas, a stroke of bad fortune blasted my and, I suppose, more so the faithful mother's hopes—if night-hawks ever have any. As the lives of Ernest Thompson Seton's animals end in tragedy, so did this one. When I looked up on the morning of June 14th, the mother was there, appearing different than before, however; disconsolate it seemed; but the young one was gone. The lower bar of the balustrade being several inches above the platform, the young bird had fallen from it onto the steep roof, and I found its lifeless little body in the grass below. The old bird stayed about the roof for a few days longer, as though still hoping for the appearance of her offspring, and then she disappeared.

A week or so after this I again noticed a night-hawk prowling around my roof. On June 29th I looked on the platform above and found another female bullbat sitting on her eggs. These were greener and more densely spotted than the former one, and, like this one, laid on the bare roof between the gravel without any nesting material whatever. It was not the same bird as before, as

could easily be seen. Perhaps this one too had suffered some misfortune at her first nesting place, because this was certainly too late to be her first attempt. I found this bird off her eggs the first time on July 4th at 8 o'clock p.m., but she soon came after I had come near the eggs. The male also flitted around me, noiselessly, like a huge moth. In the greatest heat at mid-day, when the gravel and tarred platform about her exhaled still more heat, this faithful bird was always sitting on her eggs. On July 11th her labors were rewarded by the appearance of two healthy looking young birds, looking like pepper and salt as the one before. To prevent a recurrence of the tragedy aforesaid, I had placed boards along the open under border of the balustrade. The young ones were lively, trying to get away from a person already on the second day. The old one showed correspondingly bad temper. When she was not brooding them, she would always be next to them, always in such a position that her shadow fell over the small birds, which during the hot noonday hours certainly must have been a great protection for them. Whether this was "purposely" or accidentally done, who knows? July 17th, the young showed the first signs of feathers; the male from nearby showed much wrath when the young were approached. On July 22nd one of the young had more feathers than the other; was also livelier, sturdier. By July 26th their downy natal dress was entirely replaced by feathers. The next day the more precocious young one had gone from the platform and the other one almost flew into my face. However, even now, when all dangers seemed to be over, one of the young, and that the stronger one, nearly came to grief. It must have perched low down somewhere, for all at once a neighboring cat was seen carrying it in the mouth. When chased she dropped it and it had luckily not been damaged. The next morning, July 28th, all three were again assembled on the deck of the roof, but at our approach they all flew away. They remained about for a few more days, when they disappeared, most probably on their long migration southward, which is begun early by some of these birds.

Like the first, these two latter ones were also fed at night only, and when we consider how quickly they grew and matured, we can imagine what an enormous amount of food, and this all noxious insect food, must be supplied by the old ones. They are worthy of every protection in our cities and should not be made the target of the air-gun and sling-shot of the boys on the street.

NATURE STUDY—No. XXIII.

THE CLOUDED SULPHUR BUTTERFLY (*Colias philodice*, Godt.)

A NATURE STUDY.

By JAMES FLETCHER, Ottawa.

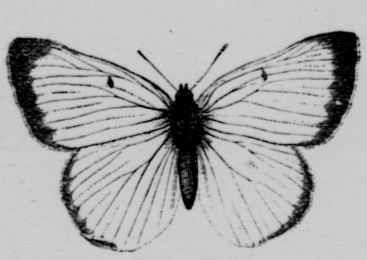

Fig. 1.—Male.

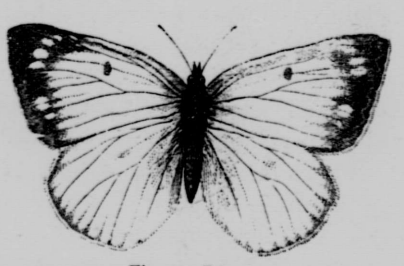

Fig. 2.—Female.

In Nature Study work a few common objects studied thoroughly as to their essential and salient points will be of more use than a large number of disconnected facts relating to many different objects. The limitations of work undertaken must be clearly defined both as to method and aims. These must be thought out by the teacher beforehand and must be kept constantly in mind. With a view to directing the attention of teachers and others to a convenient exercise in studying insect life which is available to all, I would suggest that the common Clouded Sulphur Butterfly offers special advantages. The butterfly is striking in appearance and interesting in habits ; it is common in all parts of Canada east of the prairies. It appears early in the year, and the various members of the pea and clover family upon which the caterpillars feed occur everywhere. Eggs of this butterfly can be secured with the greatest ease, and as its whole life-history, from the egg to the perfect butterfly takes only about one month no one need tire of the exercise before it is completed. The beauty of the egg, the rapid development of the caterpillar and the various changes as it passes from moult to moult, from the time of hatching until it reaches full growth, will be found exceedingly interesting to all who will observe them, but the fascination of watching the change from caterpillar to chrysalis and then the gradual appearance of color and its increasing intensity day by day as the butterfly forms inside the shell, must be a source of keenest delight and wonder

to all studunts who have watched the young caterpillar from the time it left the egg to that period. For such, few human experiences can equal the delightful suspense of watching for the bursting forth of the perfect insect from its frail chrysalis prison, through the walls of which the colors of the butterfly have been plainly visible for several hours.

The exercise suggested is simply to procure eggs of the Clouded Sulphur Butterfly and watch the development of the caterpillars through all stages to the perfect insect. To do this all the apparatus necessary is two or three 6-inch flower pots, a yard or two of mosquito netting, a few feet of wire and some india rubber bands.

The first thing to do is to transplant into the flower pots good strong plants of Alsike or of common white clover. Any clover will do but these kinds are convenient to handle on account of their smaller growth. This should be done early in May and the plants will be well established by the middle of the month, when the first specimens of the Clouded Sulphur Butterfly may be seen flying hurriedly along roadsides and over meadows. On catching a few of these it will be at once noticed that there are among them two patterns of ornamentation on the wings. These indicate the sexes. The males (Fig. 1) have a regular black margin to all the wings, while the females (Fig. 2) have the margin of the upper wings much wider with some yellow spots inclosed.

Having caught two or three females put them inside a cage made over the potted clover plants by first bending two pieces of wire 18 inches long into hoops, and having crossed them at right angles over the plants, push the ends down into the earth. Over this framework stretch a piece of mosquito netting and keep it in place by putting an elastic band arouud the rim of the flower pot. The cage is now ready and by raising one edge of the netting the butterflies can be slipped into it, care being taken not to injure them in any way. The cage must then be placed in some shady place out of doors. In a couple of days, if the females are ready to lay, the exquisitively beautiful pale yellow, striated, spindle-shaped eggs will be seen standing erect on the upper surface of the leaves. From this time on the notebook must be kept close at hand, and changes worth recording will occur every day. The

eggs, which on the day they are laid are of a delicate waxy yellow, by the second day have changed to deep pink. On the third day they are crimson, but by evening have darkened to lead color. On the next day they are almost black and the young caterpillars emerge. The first sign of the young caterpillar will be its jaws as it eats its way out through the delicate egg shell. This operation will take about an hour, after which its first meal is generally made from its own egg shell. The young caterpillar is about one-twelfth of an inch long, olive green in color and has a black head. Under a magnifying glass it will be seen that each segment has five transverse creases and that each ridge between these has several black dots upon it from which rise short club-shaped hairs or processes. These hairs are arranged somewhat regularly in rows across the body. When quite young the little caterpillar spins a pathway of silk on the surface of the leaf, along which it walks out to feed and then retires to the centre of the leaf to rest. Throughout its life it resembles very much the color of the leaf upon which it feeds and is doubtless by this, as well as by its habit of dropping to the ground when disturbed, much protected from its enemies. Three days after hatching it has increased so much in size that its skin has become too tight for it. It then stops feeding and remains with the body hunched up on its silk platform for about a day preparing for its first moult. Gradually the tiny black head projects from the body and close behind it a new head may be seen beneath the translucent skin. The black ocelli, or simple eyes, of which there are five on each side of the head, are very conspicuous. When the proper time comes the skin bursts down the middle of the back close behind the head, and with a series of muscular contortions, the old skin is worked backwards and our caterpillar walks out arrayed in a new suit. The last part of the operation is getting rid of the old head case, which it does by twisting its head from side to side against the food plant. It will now be seen that the skin is of a much brighter green and the head is also green instead of black. After this first moult the length of the body is about one eighth of an inch. This stage lasts for three or four days and as the next moult is approached the caterpillar again becomes sluggish and, as before, ceases feeding. After the second moult the length is about one-third of an inch. The color has become darker, the sides are marked more distinctly with a faintish whitish stripe and there is a

dark green stripe down the back. The caterpillars as they grow larger become more voracious and the leaves of our first clover plant, if we have more than a dozen caterpillars feeding upon it, will now probably be much eaten. When the caterpillars have ceased feeding preparatory to the third moult, some of them may be removed to a fresh plant. This is done, not by taking them from their silken mats, but by cutting off the whole leaf upon which they are resting and dropping it in among the leaves of the other food plant. After the third moult they will crawl up on to the leaves of the new plant and will be seen to have improved in appearance. They are now three-fifths of an inch in length, the lateral stripe is more distinct and marked with red on some of the front segments. In some specimens black lunate spots occur beneath the stripe. In the next and final stage the colors are more intense, the body being dark velvety green above and a crimson line runs down the centre of the side stripe on which the breathing pores or spiracles are situated. When full grown these caterpillars are over an inch in length; they then begin to wander from the food plant, unless confined in a gauze cage, and look for a suitable place to change to the chrysalis condition. There a mat of silk is spun over the surface with a button of pink silk at one end. The hind feet are attached to the button and the front legs are hooked into the silk of the mat. After resting for some hours the caterpillar spins a very slender girdle from side to side of its body, and then slips it over its head and rests upon it. While the girdle is being spun it is passed several times over a small cushion-shaped organ beneath the neck of the caterpillar, evidently to strengthen the cord.

Fig. 3.

The chrysalis is about an inch long, somewhat, but not quite, like Fig. 3, is apple-green in color and has a yellow stripe down each side. About six days after it is formed the color of the future butterfly begins to show, and the exciting period of watching for the perfect insect begins. As a rule about the ninth day the critical moment arrives, and lucky is the watcher who is fortunate enough to see the emergence of the butterfly.

The above account gives only in a general way the life-history of the Clouded Sulphur Butterfly ; there are many other points of interest which will be discovered by an observant student, some of which have been purposely left untold. In addition there is always much variation in the way in which, even in the same brood, some individuals develop when compared with others. Noting these differences demands just such an attitude of mind as Nature study calls for, together with close observation and constant attention so as to cultivate the powers of perception.

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