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THE OTTAWA NATURALIST.

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No. 12

THE EGGS OF THE FRESH-WATER LING.

By Professor E. E. PRINCE and ANDREW HALKETT, Marine and Fisheries Department, Ottawa.

The discovery of the eggs of the burbot or fresh-water ling (*Lota maculosa*, LeSueur) deposited by the parent fish, exhibited in the tanks of the Ottawa Fisheries Museum, is a matter of unusual scientific interest.* While the burbot is not a valuable or esteemed species, it is, in many ways, an interesting fish to the naturalist. It is known in different parts of Canada by no less than fifteen different names,† most of them uncomplimentary; indeed, as the late Frank Buckland said, many years ago, of the British burbot or burbolt, "they are such a stupid and ugly fish that I cannot advise trouble to be taken with their dissemination they are so destructive to the eggs of all other fish . . . they eat an enormous quantity of fry, and they swim after the manner of eels." The same author stated that they are a nocturnal fish, spawn in the deepest holes in lakes, 480 to 540 feet deep, and after having been frozen stiff will revive. Belonging, as the burbot does, to the family *Gadidae*, which includes the cod, haddock, hake, whiting, and other valuable food fishes, it might be imagined that it is excellent as a table fish. Of its edible qualities the most opposite opinions are held. On some lakes of the Northwest it is highly regarded; but in other localities, indeed generally, it is not regarded with favor, and has been even pronounced poisonous. In this connection, the following extract from a special report, published in the Blue Book of the Marine and Fisheries Department, 1900, has an interest and may be appropriately quoted here (*vide* report mentioned pp. lv-lvi).

*The eggs were collected by Mr. Andrew Halkett for study in a fresh living condition, while others were preserved by him in formalin.

"If great variations obtain regarding the naming or misnaming of this fish, a corresponding diversity of opinion exists regarding its edible qualities. At a remote Hudson Bay post, in the Canadian Northwest, I found that the flesh was regarded as poisonous, indeed, cases of poisoning after Indians and employees of the post had eaten the fish were mentioned, and it was pointed out that even the dogs would not eat it. The dogs are usually on the excellent whitefish and decline being put off with inferior fare, and it is a fact pointed out by various explorers that the dogs of the Northwest, used in the dog-trains, refuse to eat the burbot. I found, however, at another Hudson Bay post, that the fish was often eaten and was regarded as most excellent, no ill effects having been noticed. Belonging as it does to the cod family, it should be an excellent fish for the table, like its near relatives the cod, haddock and hake. In one of the lakes of New York State (Lake Winnipiseogee) it is pronounced equal to the whitefish for table use, and the liver is generally considered a rare delicacy.

"Dr. Richardson (*Fauna Boreali-Americana*) is recorded to have said that 'the flesh of the fresh-water cusk is firm, white and of good flavor; the liver and roe are considered delicacies, when well bruised and mixed with a little flour, the roe can be baked into very good biscuits, used in the fur countries as tea bread.' Professor Brown Goode spoke of it as a very excellent fish, especially for boiling; though Dr. T. H. Bean pointed out that apart from the liver, the fish is not esteemed in the Great Lake region and northward, but in the rivers of Montana the burbot is in great favor."†

Pennell states that the flesh of the English burbot is white and firm, and is considered superior in flavor to that of the eel.

It has a very wide geographical distribution in the old world and on this continent. It has been recorded in Germany, Austria, Russia and other countries; but it is of very local occurrence in the British Islands, being wholly absent from some rivers and plentiful in none. The belief prevails that it is decreasing in numbers and doomed to extinction. It does not appear to be

† Report of Department of Marine and Fisheries (Fisheries) 1900, p. lv.

found in Scottish or Irish waters. From New England and the basin of the St. John River, New Brunswick, it extends through the Great Lakes and more northern waters to the Manitoba and Athabaska lakes and rivers, while specimens have been procured in the Okanagan and Columbia river regions in British Columbia. Drs. Jordan and Evermann speak of it as abundant in the north as far as Bering Straits and the Arctic Seas, but rare in the Ohio and Upper Mississippi. A number of specimens are preserved in the Ottawa Fisheries Museum, some being local, *e.g.*, Lake des Chene, Ragged Lake, Algonquin Park, Healy's Falls, and Rock Lake, Haliburton Co., Ont., and one specimen sent from Swan River, near Vernon, B.C. As a rule it is regarded as a pest, and fishermen are of opinion that it is a great destroyer of the spawn and young of valuable fishes; but its feeding habits require accurate investigation

As the cod and most of the *Gadidae*, so far as known, produce eggs, which, as Dr. A. S. Packard states, "rise to the surface of the water, on which they float," it has long interested naturalists to know of what character are the eggs of the burbot, the only fresh-water member of the family. If, as seems practically certain, the burbot is a species of the cod family which has changed its habits and become a non-marine form, it was highly interesting to ascertain whether its eggs retained the characteristics of its ocean-inhabiting relations or not. Fish authorities and embryologists have long been on the look out for the eggs of the burbot for that reason. The minute delicate glassy transparent globes, floating lightly, like invisible soap-bubbles near the sea's surface, are called pelagic or buoyant eggs; and the eggs of the cod, haddock, pollock, whiting, hake, marine ling, and other *Gadidae*, are typically pelagic. Could it be that a species of that family, permanently resorting to fresh water, would have retained that interesting type of egg, or has the character of the egg changed with the change of the habitat of the fish?

Thirty years ago a Belgian investigator, Dr. C. Van Bambeke, described the egg of the fresh-water ling, inhabiting rivers and lakes in Europe,* but he never secured them after being deposited

* Mém. Couronn. l'Acad. Roy. de Belgique, tome XL. 1876.

naturally. He took them from the parent fish before they were deposited, and while he obtained and described the egg and published a drawing of it, no one could say if the features described were normal or not, and it was not possible to say whether or not it possessed buoyancy, and belonged to the pelagic type of ovum. Van Bambeke's account described the egg of the burbot as an extremely small, spherical, translucent ovum, with a pale greenish oil globule, surrounded by a thin coat of protoplasm, the globule being held in a fixed situation, in the yolk matter, by a column, or thick strand, of tenacious protoplasmic material. How does this description compare with the features of the eggs, several hundreds of which were deposited, at the end of January, by the parent fish in the Ottawa Fisheries Museum and examined under moderate powers of the microscope? A study of these eggs yielded this remarkable result, that they have all the features of the typical pelagic eggs which occur abundantly in the ocean where cod, sea-ling and other Gadoids spawn. The burbot's egg is somewhat buoyant, of minute size, extremely transparent, and delicate in structure. As Van Bambeke stated, there is a single large oil-globule, greenish in hue, though almost colorless in transmitted light, but not fixed or held in place by a strand of protoplasm. Now, the burbot is a close relative of the sea-ling (*Molva vulgaris*) and of the sea-cusk (*Brosmius brosme*, Muller), and bears a strong external resemblance to them, having an elongated eel-like body, a flattened head, a small first dorsal fin, and a very long second dorsal and anal fin, as well as a rounded spatulate tail. The sea-ling and sea-cusk produce small pelagic eggs, each of which contains a single large bright oil-globule, that in the ling's egg pale greenish; that in the sea-cusk's egg being terracotta in tint. The egg of the fresh-water ling almost exactly resembles the ovum of its marine relative in all essential features. The ova of the marine ling (*Molva vulgaris*), to quote from the large Scottish monograph (the most elaborate account of fishes' eggs ever published),* "are less buoyant than some other Gadoids, e.g., *Gadus morrhua* and *G. aglefinus*, and sometimes, though living, sink to the bottom in quiescent water, yet success-

* Professors McIntosh and Prince, Trans. Roy. Soc., of Edinburgh, Vol. xxxv, Pt. iii, No. 19, p. 668.

fully develop. The ova of the ling are, indeed, more delicate and more susceptible to unfavorable conditions than those of the cod and haddock." Now, these observations would apply exactly to the present egg. It is so light that the slightest movement in the water carries it hither and thither. In still water it falls to the bottom, and, indeed, unlike marine eggs, which are in water of greater specific gravity, the egg of the fresh-water ling cannot permanently float. It is perfectly spherical and has a diameter of 1.77 mm. (= .0695 inch) and the globular oil sphere measures .354 mm. (= .039 inch) in diameter. The egg of the marine ling measures 1.68 mm. (= .066 inch, or even .0916 inch) in diameter and the oil globule .96 mm. (= .037 inch), so that the fresh-water species produces an egg in general of smaller size, indeed in proportion, it may be said to the different size reached by the full grown form in both species. Whereas the burbot reaches a length of only 12 to 30 inches and a weight (according to Pennell) of 2 to 8 pounds; the marine ling may measure 24 to 72 inches in length and a weight ranging from 15 to 60 pounds.

None of the burbot's eggs were fertilised, so that no germinal disk was formed, though a thin layer of protoplasm surrounded the ball of clear yolk fluid. The yolk was not granular, and the bright globule of oil lay free in the yolk and moved readily about as the egg revolved when pushed by a scalpel on the stage of the microscope. In some of the eggs a thin irregular envelope of protoplasm collected round the globule, but in most examples it was not present. A perivitelline space separates the yolk-globe from the thin capsule of the egg. The capsule itself is a simple transparent shell, as in all pelagic types of ova; and in optical section it appeared as if double, and concentrically striated—a false effect—but repeated and careful examination showed radial striations in the thin capsule; these striations apparently corresponding with minute dots or pits occurring all over the exterior. The micropyle showed the usual features, a slight conical thickening in the centre of which was the aperture seated in a crater-like depression. As in the case of the marine ling, the eggs of this fresh-water form are delicate in the extreme, and very readily

burst when manipulated under microscopic examination.* The tension, due to capillary attraction when a cover-glass was placed upon the glass-side, caused them to burst, and the bright oil-globule lightly bounded out of the egg, while the thick yolk slowly poured out like clear mucilage. Unfortunately, no ripe male fish was available or the early embryonic stages of the fertilised ovum, and larval form of this species, could have been studied for the first time. In view of the character of the eggs, as now discovered, the larva is without doubt a very minute and delicate creature, far more minute and delicate than possibly any other young fresh-water fish. The post-larval stages of the marine ling, we know, are very wonderful and extraordinary owing to the enormous wing-like ventral fins, "their most striking feature being the extraordinary length of the ventral fins of an ochre yellow color, with specks of black pigment scattered over the inter-radial membrane."*

No doubt Buckland when he defined the spawning period of the European burbot as from the end of January to the beginning of March based his conclusion upon an examination of the ovaries in dissected specimens, and his conclusion was accurate, as the mature eggs now described were deposited about the twentieth of the month of January. The statement that the spawning sites selected are in the deepest holes in lakes, etc., † cannot be correct, as a delicate and practically pelagic egg, such as that now demonstrated to be the burbot's egg, must be deposited in clear shallow water, and judging by analogy, the development will be rapid, and the young hatch out in a few days, possibly ten to twenty days. Actual observations alone can decide the validity of these surmises, but the newly-deposited egg, as now described, differs from that of any other fresh-water fish hitherto recorded.

* Professor McIntosh noted this feature in *Molva vulgaris* and said, "The zona is not so soft and tough as in the cod and haddock; but shows greater resistance, bursting rather than collapsing under pressure." Trans. Roy. Soc. Edin. Vol. xxxv, p. 827.

** McIntosh and Prince: *op. cit.* p. 830.

† Buckland, Nat. Hist. Brit. Fishes, 1881, p. 35.

EUPITHECIA YOUNGATA.

A GEOMETRID MOTH FROM OTTAWA NEW TO SCIENCE.

By GEO. W. TAYLOR, Wellington, B.C.

During the past three years I have devoted nearly all my leisure to the study of North American Geometridæ, and I have been very greatly helped by a number of entomologists who have allowed me to examine the specimens in their cabinets and who have, moreover, liberally added to my own collection. In this way I have made the acquaintance of a large majority of the American species so far made known to science. There are, however, many forms that are still undescribed, and, though these "new species" are naturally more numerous in the West and South than in the Eastern Provinces of Canada or the older States in the Union, where entomological researches have been carried on for a century or more, there are still some—perhaps more than we suppose—of these nondescripts to be found even in Ontario.

Indeed, the subject of the present paper was captured close to Ottawa itself, which, when we consider the many eminent entomologists who have worked there so enthusiastically during the last twenty-five years and the activity of the members of the Field-Naturalists' Club generally, might be looked upon as the least likely place in all Canada to produce novelties. The captor of the species I am about to describe, was Mr. C. H. Young. Mr. Young has sent me for study, from time to time, specimens of nearly all the Geometridæ he has taken at Ottawa, Meach Lake and the Mer Bleue; and, after seeing these specimens, many of which he has generously allowed me to retain in my own cabinet, I am compelled to say, as so many others have said, that more beautifully prepared specimens could not be imagined.

Mr. Young sent me not long ago a number of small Geometridæ from Ottawa for determination. Among these I found no fewer than eight species of the interesting genus *Eupithecia*. Of these little moths, "Pugs," as we used to call them in England, there must be over one hundred species native to North America; but only about one-half that number have been

described, and most of these have been made known in quite recent years.

When Walker catalogued the Eupitheciæ of the world in 1862, he only credited North America with five species. In Packard's Monograph published in 1876, only twelve species were recognized. But the labors of Dr. Hulst have vastly increased our lists in this genus and the allied genera, so that in Dyar's Catalogue we find enumerated no fewer than 55 species of *Eupithecia*, four of *Gymnocelis* and eight of *Eucymatoge*—67 pugs in all; and, yet, even this number falls considerably short of the number of apparently distinct species which are represented at the present moment in my own collection.

The species sent by Mr. Young all belong to the typical genus *Eupithecia*, and I have determined them as follows :

1. *Eupithecia geminata*, Pack., (which is probably, but not certainly, the *Eupithecia coagulata* of Guenee and is certainly *not* the *E. absinthiata*, Linnæus, under which name it appears in all our recent lists,
2. *Eupithecia ornata*, Hulst,
3. " *latipennis*, Hulst,
4. " *palpata*, Packard,
5. " *albicapitata*, Pack. (a very rare species, so far as I know, this being the first specimen to come under my notice),

and three species which are apparently without names. Two of these require further study of more abundant material before they can be safely characterized ; but the third I propose to describe now and to name after my kind correspondent from whom I have received the very beautiful and absolutely perfect specimen which I shall designate the type of the species.

I may add here that I shall be greatly obliged, and I am sure science will be benefited, if Canadian entomologists will endeavor to collect good series of *Eupitheciæ* during the coming season, in order that the species native to the Dominion may be correctly determined, and those that prove new, furnished with suitable names.

Eupithecia youngata, n. sp.—Expanse, 25 mm. Palpi not very long, bushy, blackish. Front dusky, cinereous. Thorax

brown with a dark transverse band anteriorly. Abdomen as thorax, 2nd segment a little darker, posterior edge of each segment whitish. Forewings obtuse at apex, outer margin well rounded, same color as thorax, the costa rather darker and the cross lines distinctly lighter than the ground color; basal line double, very irregular, being angled sharply outwardly at cell and below vein 2; median line also double, not well marked, making a sharp outward angle to include the conspicuous black discal dot, then running in an almost straight line to middle of inner margin; extra discal line also double, dislocated at vein 6, then in a regular curve parallel to outer margin; both median and extra discal lines show in more or less well-defined whitish spots on veins 2 to 6 inclusive; and there are short black dashes on each of these veins between the median and extra discal lines; submarginal line white, conspicuous, regularly scalloped at each vein and forming a distinct V at anal angle; a fine black marginal line; fringe dotted with dark brown between veins. Hind wings well rounded, lighter brown than fore wings with six darker lines: the first two are basal and do not extend further from inner margin than to vein 2; the next two lines are extra discal and almost complete; the two outer lines extend completely across the wing; a very small and faint discal dot; marginal line and fringe as on fore wings. Beneath paler; fore wings with a linear discal dot and the extra discal markings of the upper surface reproduced; basal portion of wing without markings except a dark spot on the costa, indicating the position of basal line. Hind wing as above, but with all the lines more regular and reaching to the costa; the discal spot is distinct, black; the 1st extra discal line is diffuse and very evident; the 3 outer lines appear as spots between the veins, the outermost line being least conspicuous. The under side of thorax and of the basal segments of the abdomen is very pale, almost white, but the posterior portion of the abdomen is nearly black.

Type, one specimen. Meach Lake, Ottawa, 7 June, 1905, C. H. Young. Co-types, two specimens. Catskill Mountains, 2 and 10 July, 1901, (No. 1) R. F. Pearsall.

THE CULTIVATION OF OUR NATIVE ORCHIDS.

By J. H. C. DEMPSEY, Hamilton, Ont.

About four years ago I was shown a specimen of *Cypripedium pubescens* by Dr. Douglas Storms, of Hamilton. Often as I had been rambling around the mountain and ravines in our neighborhood, I had never found it; but I made up my mind to discover its retreat, no matter how secluded. So one Sunday a couple of friends joined me in an expedition up the ravine leading from the "Valley Farm," where Mr. Hendrie keeps his racing stable near the Valley Inn on the Waterdown road. We came on it in all its glory, a truly fairy flower, with its canary-colored sabot, and its red-veined corkscrew sepals standing straight out. It looked so odd, so out of place, that being unacquainted with it before we declared it more beautiful than any rose. It proved quite plentiful in this particular spot, the shade was not too dense, and the sun flickered through the foliage, the land had been undisturbed, saving that the big forest trees had been thinned out; and just enough space and light and sunshine for their proper growth and to paint the blossoms in their brightest hues, and not have them looking sickly from being in too much shade.

Through the ravine ran a stream, and about thirty feet up the hillside on a substratum of red clay with a top soil of leaf-mould it grew. Occasionally we found a stem with two blooms on it. On the hill-top, in an oak wood, we found the "bird-on-the-wing," a lovely lavender-pink orchid-colored flower much like an orchid. We brought away about thirty plants of *Cypripedium pubescens*, and next year they all bloomed and some have borne seed. I planted them in a fern bed in a shady spot where they got the sun part of the day for a few hours, as I have found them under similar conditions.

Since finding *Cypripedium pubescens* I have found *Cypripedium parviflorum* at Lake Medad and planted it on similar ground, and it was in blossom last year about the end of April, and grows successfully and multiplies.

Last year I went for a drive with some friends to a concession back of Lake Medad about three miles, and found the *Cypri-*

pedium spectabile, and when we saw it at first I thought of those lines from Gray's Elegy :

" Full many a flower is born to blush unseen,
And waste its sweetness on the desert air."

We found it, as large as an Iris, hidden amongst the cedars in the damp mold, sometimes pure white in the shade, and where it drank in the sunshine, suffused with a rosy purple blush or striped on the sabot as if it had been done by some peri. We brought home a couple of dozen plants, some in blossom, sometimes two on a stem, and others in bud. This was the middle of June, but they stood the removal all right after a night's refreshment in a pail of water, and they got well heated in the ground and the unopened buds came out. They were found in a ravine about 100 feet in depth on either side and about 300 yards wide, with a cedar swamp in the bottom, and a tropical atmosphere, an ideal place for orchids. We also found several varieties of *Habenaria* coming into bloom in the swamp, and on the hill-top in a rich wood the Showy Orchis in great abundance, just out of bloom a week or so, with three or four stems of bloom on a clump which had borne from five to six flowers; it was in seed pod at the time.

In treating them after removal I imitated natural conditions as much as possible, dug a trench one and a half feet deep and put a bottom layer of broken flower pots and stones, on top of that a layer of moss from the limestone rocks at the mountain, and again on top of that a layer of sphagnum moss, about eight inches of moss in all, and on top of that a couple of inches of leaf mould, set my plants on it, and again three or four inches of leaf mould and swamp muck.

In April last I sent to Mr. Edward Gillett, of Southwich, Mass., U.S., for some bulbs of the native orchids advertised in his catalogue. Among the varieties I sent for were: *Calypso borealis*, which grew but did not bloom, but I hope to see it next year; *Calopogon pulchellus*, a dainty little purple-pink flower, very beautiful, with from four to five blossoms, which blossomed in the same bed with *Cypripedium spectabile*; *Cypripedium acaule*, which I planted in higher ground, and out of a dozen plants I got four blooms, very lovely and most delicately veined with pink of a reddish hue. I am very doubtful if I will see it again next year,

as Mr. Alexander, of the Customs Department, brings it down every year from his island in Georgian Bay. I saw a lovely bunch of it in his garden in bloom, but he said it slipped away and he did not expect to see it again next year; *Cypripedium montanum*, which blossomed all right and bore four or five small white blossoms on a stem, the sabot pure white with purple dots inside and red wings, not curled as in *pubescens*. It is not a native here but of the west beyond the Rockies; *Cypripedium spectabile*, which was gorgeous in the extreme. I had three clumps with ten or eleven blossoms on at once. Two clumps had each two stems with twin blooms on a stem. I had them photographed, they looked so rare and lovely, as if they came from the "Garden of Allah"; *Habenaria blephariglottis*, which grew but did not bloom; *Habenaria ciliaris*, which grew but did not blossom. I hope to see them next year; *Liparis liliifolia*, which blossomed with a raceme of six or seven purple-brown flowers, a true orchid but inconspicuous; *Pogonia ophioglossoides*, a lovely pink and white flower which blossomed successfully; *Spiranthes cernua* (ladies' tresses) grew but did not blossom.

As to the growing of our native orchids, nature must be imitated as much as possible both in location of planting and nature of soil. Those found in sphagnum moss in bogs and swamps should be planted in about a foot of sphagnum moss with a top dressing of four or five inches of swamp muck and leaf mould, and the ground and place prepared with as much care, and no manure of any kind used with them other than pine needles or cedar leaves, and a sprinkling of powdered charcoal which can be given them every three years, as it sets the color and makes it of a richer hue. These take the place of more violent manures.

Cypripedium acaule and *Calypto borealis* are the hardiest to grow. I think in a bed made of chopped granite mixed with coal ashes, with plants set in rotten leaf mould and pine needles well rotted, the turpentine would kill insect pests and cut-worms, and the undersoil would be too poor for cut-worms and other enemies to exist in. I inferred this from the fact that in Manitoba and Parry Sound, where it is so hard to get worms for bait for fishing, the ground seems denuded of them, and the earth seems free from the pests that attack most plants.

The orchids found in the vicinity of Hamilton are *Cypripedium pubescens*, in quantities when you find its hiding-place; *Cypripedium parviflorum*, at Lake Medad and its neighborhood, sometimes pale yellow, sometimes rich canary, according to location and the richness of the soil, but it is not plentiful; *Cypripedium acaule*, said to be found near Grimsby, but I have never met it yet in nature; *Cypripedium spectabile*, in a ravine back of Lake Medad and very plentiful there; several varieties of *Habenaria*. I found *Goodyera*, or rattle-snake orchid, at the Marsh, or "Cattle's Paradise" in a ravine where the broad beech fern was plentiful. This is the only place I know where you can find it here. *Orchis spectabilis* I had in bloom in my garden last year, a pretty waxy white and lavender, found in a ravine near Desjardin's canal (but not very healthy or luxuriant plants), about ten feet above a little brook. I have found it since back of Lake Medad, and hope to have it fine next year.

In closing, I would say that those found in boggy places, like *Cypripedium spectabile*, *Calopogon pulchellus*, *Habenaria blephariglottis*, *Habenaria ciliaris*, *Liparis liliifolia*, *Pogonia ophioglossoides* place in a false bog as I have described and they will grow with success, and water them twice a day while the sun is not on them with a good soaking each time.

For *Cypripedium pubescens*, *Cypripedium parviflorum*, *Orchis spectabilis*, *Goodyera*, and *Spiranthes*, put a subsoil of red or blue clay to retain the moisture and a top dressing of leaf mould three or four inches and you will have them year after year as I have had them for the last three years; and water them well once a night with a plentiful supply of good cold water.

Ferns and orchids are more of a fad with me. I have taken up the collecting of them in my spare moments in a particular line of botany, and it has proven very interesting. I have about thirty-two or thirty-three varieties of our native ferns, and had five varieties of *Cypripedium* in blossom at once last June.

I can assure my readers that it has given pleasure and also brought me into a closer acquaintance with the aristocrats of the floral kingdom—the orchid, so shy, so exclusive and so secluded.

Jan. 6th, 1906.

BOREMYS, A NEW CHELONIAN GENUS FROM THE
CRETACEOUS OF ALBERTA.*

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

The writer described in the January number of this journal a new species of Pleurosternid turtle from the Cretaceous rocks (Belly River or Judith River formation) of Red Deer river, Alberta. The material on which the species was based, was obtained by the writer on Red Deer river in 1898 and 1901, and consists of the entire plastron with the anterior half of the carapace of one individual (type), a second carapace, and parts of other plastra, all of the specimens being from the same locality and horizon near the mouth of Berry creek, a tributary of Red Deer river. The species in question was named *pulchra* and was referred to Leidy's genus *Baëna*. It is now considered that this species belongs to a new genus, distinct from *Baëna*, for which the name *Boremys*, indicative of a northerly habitat, is proposed.

The carapace of *Boremys pulchra* is remarkable in having a row of three large supramarginal shields on each side, in line with the 2nd, 3rd and 4th vertebral shields, between the costals and the marginals. The total number of costal shields is twelve, there being the normal number, eight, with one on each side of the 1st vertebral and one on each side of the 5th vertebral.

The presence of supramarginals is regarded as a generic character of some importance which, taken in conjunction with the structure of the plastron, indicates a hitherto undescribed type of Pleurosternid quite distinct from *Baëna*, its probable nearest ally.

As regards the anterior and posterior costal shields of *Boremys pulchra*, the anterior ones at least occur in *Baëna arenosa*, *B. undata* and *B. hebraica*, as described and figured by Cope in his "Tertiary Vertebrata," vol. iii, 1884.

The genus *Boremys* may be characterized as follows :—

Supramarginal shields present in the carapace ; mesoplastra well developed, in contact in the median line for some distance ;

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

intergular shield divided; inframarginal shields present on the bridges.

The specific characters of *Boremys pulchra*, the type of the genus, are:—

Costal shields short and pointed distally; supramarginals well developed, longer than broad; first neural plate divided; entoplastral plate narrow, diamond shaped; plastron longer than broad; anterior plastral lobe smaller and more pointed than the posterior lobe; bridge long and rather narrow.

In *Baëna arenosa*, Leidy, 1870, from the Bridger Eocene of Wyoming, the type of the genus, there are no supramarginals, nor are there any in *B. undata*, Leidy, 1871, also from the Bridger Eocene of Wyoming. In the latter species the mesoplastral plates (not shewn in Leidy's figure of the plastron of the type specimen) converge to a point inwardly and meet in the median line.

The following Eocene, Laramie and Cretaceous species have been assigned to the genus *Baëna*:—

B. hebraica, Cope, 1872. Bridger Eocene of Wyoming; no supramarginals.

B. ponderosa, Cope, 1873. Bridger Eocene of Wyoming; known only from small fragments of carapace.

B. hatcheri, Hay, 1901. Laramie of Wyoming; no mention of supramarginals in the carapace.

B. marshi, Hay, 1904. Laramie of Wyoming; no mention of supramarginals in description.

B. cephalica, Hay, 1904. Laramie of Wyoming; known from the skull only.

B. antiqua, Lambe, 1902. Belly River (Judith River) formation of Alberta; type specimen does not include the distal ends of the costal shields.

Relying on the presence of supramarginals as the chief character of the carapace of *Boremys* by which this genus is to be distinguished from *Baëna* it is clear that information regarding the structure of the carapace in some of the species of the above list is needful before their true generic affinities can be fully determined. Judging from the shape of the mesoplastral element (in combination with a divided gular shield and the development of

inframarginals on the bridge) in *Baëna hatcheri* and *Baëna marshi* it is possible that these two species may be found to be referable to *Boremys* rather than to *Baëna*.

Supramarginal shields are described as occurring in *Proganochelys quenstedti*, Baur, from the Upper Trias (Keuper) of Wurtemberg. They are stated to be present in *Platycheilus oberndorferi*, Wagner, of the Upper Jurassic of Bavaria, although in the figures of the carapace it is not made clear to what extent they are developed. Also they are found in the living *Macroclermys temmincki* (Alligator Turtle) of the Mississippi and Missouri valleys.

The presence of supramarginal shields in the carapace of this Cretaceous species is regarded as an archaic character handed down from earlier forms. The presence of six costal shields on each side also appears to be a stage in the gradual reduction of the total number of shields of the carapace.

BOTANICAL BRANCH.

On the evening of January 4th, the following members of the Botanical Club met at the residence of Mr. A. E. Attwood: Prof. Macoun, Dr. Ami, Dr. Blackadar, Messrs. W. T. Macoun, R. B. Whyte, T. E. Clarke, W. C. Ewing, and D. A. Campbell.

The greater part of the evening was devoted to discussing the merits of a plan or key for the easy identification of the ferns of Ontario. It was decided to test the efficacy of the so-called popular key next summer.

Some time was devoted to microscopic work, after which Dr. Ami showed a large number of specimens of fossil fruits collected some years ago in the State of Vermont. Dr. Ami has written an interesting account of these fossil fruits, and his paper will appear in a future number of THE OTTAWA NATURALIST.

A. E. A.

NATURE STUDY.—No. XXXII.

THE SCHOOL GARDEN AND THE COUNTRY SCHOOL.

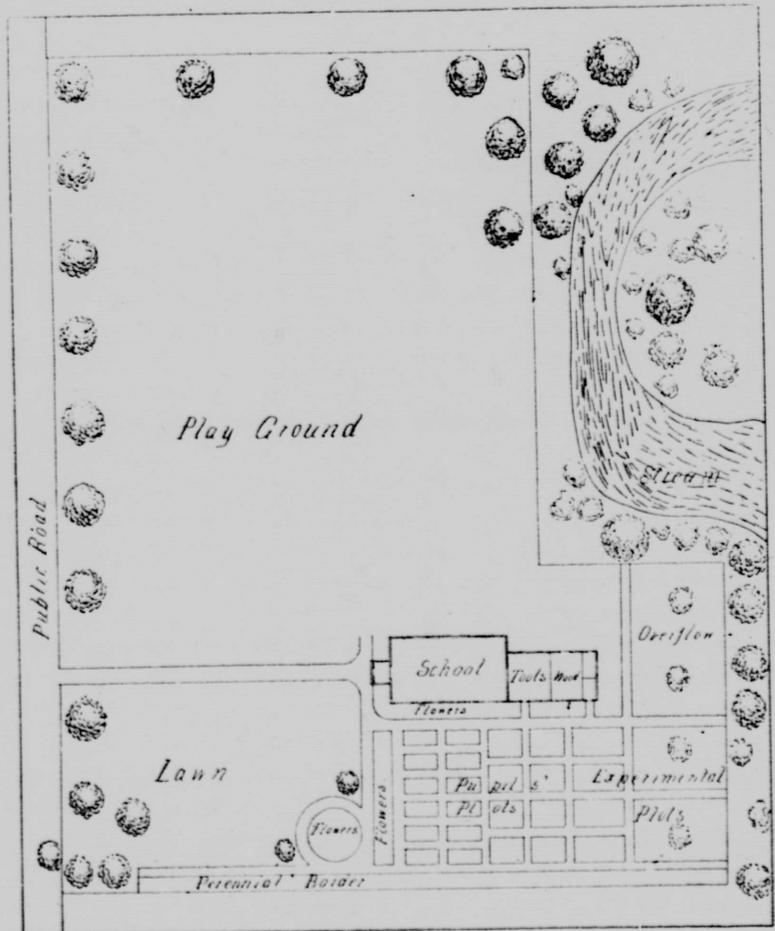
By GEO. D. FULLER, Director of School Gardens, Macdonald Rural Schools, Knowlton, Que.

The place the school garden is to occupy in connection with the country schools of Canada is yet an unsolved problem. We are told of its advantages and are beginning to realize something of its possibilities as a field for nature study, as the laboratory for the student of natural science, and as a training school for the progressive farmers of a coming generation. Certainly its advantages are great, but there are many difficulties to be surmounted before the school garden can become recognized as a necessary part of the equipment of every rural school.

The solution of this problem has been begun in a systematic way in the Macdonald Rural schools, which have been endowed by Sir William C. Macdonald, and are being directed by Prof. Jas. W. Robertson, and perhaps there is no better way to indicate the progress made, to tell of the difficulties encountered, and to enlist the co-operation of others, than to describe one such school garden and tell what it has done for one country school. Such an account may point the way to teachers who wish to test the benefits of a school garden and may help them to surmount the difficulties and avoid some of the failures others have encountered.

In the spring of 1903, at Brome, Quebec, a little red school house, dull and dingy, seated with hard plank benches, was occupied by a teacher and some 25 pupils. Although in the country surrounded by large farms and farm houses with attractive grounds, the school yard was only four rods square, so that the wood shed crowded the school house almost into the road. For play ground there was the smooth, well travelled road. The poorest houses in the vicinity were less bare and uninviting. Fortunately the soil was fertile, well cultivated and with good natural drainage, so that the problem was not complicated by the question of moving to a locality where soil suitable for a garden could be obtained.

An acre of land immediately adjacent to the original school yard was bought and fenced by the Macdonald Rural School Fund, and plans for a suitable play ground and a school garden



Macdonald Rural School, Brome, Que.

were begun. This aroused the people of the school district to action, and they determined that, as suitable grounds had been provided, they would not have the front door of the school house

open into the street; so the school house was moved 100 feet back from the road and the wood shed placed behind it; both were painted and modern desks were placed in the school room.

These changed conditions made changes in the garden plan necessary, and an effort was made so to lay out the grounds that they might with advantage be copied by other rural schools in making the school environment a potent factor in promoting the refinement, courtesy and happiness of the pupils.

The trees fringing the banks of a stream made a good back ground for the whole. As one enters the gate a straight path leads directly to the door. On the left is the main play ground clear of trees except in the corners and along the sides, while on the right is a smooth lawn with trees which in a few years will make it cool and shady. Beginning towards the road, a border runs along the fence to the back of the garden, now well filled with perennials brought by the pupils and donated by friends. Beds of annual flowers front the garden and border the school house. Immediately back of the flower border come the vegetable plots, one for each pupil, while still farther in the rear are a few experimental plots, a few young fruit trees and extra space for coarse growing vegetables.

This arrangement provides a good open play ground, a pleasant bit of lawn and a garden convenient in size and design, the whole surrounding the school building so as to make an attractive picture. At a very small expenditure the school and its surroundings have been made cheerful and beautiful, in striking contrast to their former desolate condition.

The flower plots are under the charge of the older girls, but all the pupils join in caring for them. During the past season, from May till October, there was not a week but saw some bloom to delight the young gardeners, and often large bunches of flowers were picked every day. Pansies were the first to come and the last to go. The crocus and tulip too were favorites on account of their early flowering. Sweet alyssum, sweet peas, Phlox Drummondi, balsams, asters, verbenas, nasturtiums, poppies and sunflowers have proved the most satisfactory of the annuals. A

few of the plants were started in window boxes in the school, but most of the seed was sown in the open ground.

The coming of autumn frosts did not end the enjoyment of the flowers : as the heating did not permit window gardens at the school, the school flower garden was transferred to the pupils' homes. In October some of the more easily growing winter-blooming bulbs, such as paper white narcissus, Roman and Dutch hyacinths, and freesias, were potted at the school garden. These the pupils took home, and, treating them according to directions, they were soon able to report a fine lot of flowers. The pupil gardener was often so proud of his home-grown flowers that he would wrap up the pot and bring it to school to exhibit his success.

A most convenient size for the individual vegetable plots was found to be 4 x 10 feet for the younger pupils, and 8 x 10 feet for the older ones. Each pupil eight years old or over, was given a plot and allowed much freedom in choosing what should be grown in it; but radishes, lettuce, carrots, beans, cabbages, cauliflowers, beets and turnips have been most satisfactory. At the back of the garden, in an extra space, larger and more ambitious pupils grow corn, potatoes, squashes and cucumbers. All the produce of the individual plots is the property of their pupil owners and is removed and disposed of as each particular boy or girl decides, a wise restriction being that it shall only be removed when the instructor is present.

"But how," you may say, "is the school garden work done?"

While it is still winter, plans are made for the spring planting. These plans may be drawn to scale by the older pupils and will provide a good drawing lesson. Then, as warm days indicate the approach of spring, boxes of soil are placed in the windows and seeds are sown so that the plants may be well grown when spring has really come. This is also the best time to study the germination of seed and the growth of young seedlings; for, when the time for planting out of doors arrives, with it will come a profusion

of material and work to crowd the nature study hour to its utmost.

The garden is treated like the ordinary kitchen garden in the spring. It is fertilized with stable manure, ploughed, harrowed, and the services of a laborer are secured to assist in laying out the paths and removing a few inches of soil from them. Then the pupils assume ownership of their miniature gardens, level and rake their plots and sow them with the seed they have planned. Classes working together prepare the flower beds and sow the seed. During the planting season an hour or two each day are spent in the garden; or, if rain prevents work for a couple of days, the greater part of the afternoon is devoted to the garden as soon as the soil is dry enough to work.

Garden work is the most popular thing at school, and there is never any trouble in getting the garden planted and well cared for during the school session. The size of the plots is a troublesome question. Larger plots are more difficult to have kept clear of weeds during the summer months, but they promote interest on account of the larger material returns. The larger boys in particular wish to see a crop worth growing. Plots 10 x 16 feet have been well cared for by boys and girls 13 or 14 years of age.

After the planting season a half hour twice or three times a week keeps the garden clean and free from weeds. This time may be taken so as to interrupt the regular work very little. A little longer intermission in the afternoon, or closing the school room classes a half hour earlier, will provide plenty of time, and the book studies will not suffer; indeed, where school gardens have been started, the teachers have nearly always reported more interested pupils and a greater regularity of attendance, while parents at first opposed to the garden idea admit that it has not made progress in other subjects less rapid.

As the seeds have sprouted and the young plants have increased in size, the pupils have learned the conditions necessary for plant life, and, as they have seen buds unfold and leaves expand, the garden has provided material to be used in the class room as the subject of drawing lessons or English composition work.

The school garden has taken advantage of the love of activity so prominent in child nature, and by providing a field for the exercise of these activities has afforded an excellent opportunity for training the hand and the eye, and thus reaching the mind.

The care of the garden during the summer holiday has proved the most troublesome of all the school garden problems, and its solution is yet incomplete. Last summer very satisfactory results were attained by having the instructor and pupils meet once each week at the garden and spend two or three hours in caring for the plots. This vacation attendance was entirely voluntary; yet, so thoroughly were they interested in their work that there was a weekly attendance of 33 to 60 per cent. of the pupils enrolled. This was regarded as very satisfactory and sufficed to keep nearly everything in good order. One or two of the larger boys were usually hired to do any further work required to keep the weeds in check. Should the teacher be absent during the holidays, a hired caretaker for the summer will be necessary.

While it will not be desirable to abolish the summer vacation, where school gardens are established it may with advantage be shortened. The school should not close before the end of June, nor open later than the middle of August.

The commercial side of garden work has received no emphasis, although at one school a globe was purchased with money coming from the sale of vegetables, while many of the pupils have augmented their supply of pocket money by the sale of the produce of their plots.

The possibilities of the school garden as a field for nature study and as a treasury from which material may be drawn for class work in natural science, are as yet only touched upon. The drawing books contain representations of things from the garden, while diaries and reports of observations made, and experiments attempted, have given pupils practice in expressing their ideas in good English.

The experimental plots have done good work educationally. Plots of better varieties of vegetables and grain have attracted

attention of both pupils and parents by the larger yields thus obtained. The crop resulting from good seed has been compared with the produce of poor seed of the same variety, but the most satisfactory experiments have been those made with potatoes, both in comparing the different varieties and in showing the advantages of using the Bordeaux mixture to keep the plants free from disease.

The effects of spraying with the Bordeaux mixture were eagerly watched by the surrounding farmers, and the results were considered remarkable. In 1904 the sprayed plots in two gardens yielded 30 per cent more than the others, while in one garden the sprayed potatoes produced more than twice the quantity of marketable tubers dug from plots which had received no Bordeaux mixture. In 1905 spraying added over 10 per cent. to the crop in three gardens, 25 per cent. increase in one garden and 50 per cent. in another being the best results obtained.

Seeing potatoes grown under scientific treatment, which when dug yield over 100 bushels per acre more than those grown as their father's manage the crop, makes a more lasting impression on embryo farmers than any number of lectures or reports. This work in the school garden will bridge the chasm which has in the past existed between the experimentalist and the practical farmer, and, if these experiments with potatoes lead a fourth of the farmers in the district to adopt similar methods in their own fields, the community will be yearly enriched by cash returns many times greater than the cost of maintaining the school garden.

The aim of this part of the school garden work is not to teach technical agriculture but to lead to such an appreciation of scientific methods that pupils will come to regard the work of the scientist with favor, and be ready to accept his improved methods to aid them in more successfully meeting the conditions of modern life, whether that life be spent in the office, the workshop or on the farm.

The teachers in the schools where the gardens have been maintained for two years, have all declared that the results have surpassed their expectations, and they favor a continuation of the

work. It is true that it has added to the teacher's cares and responsibilities; but this has been more than repaid by the added interest and enjoyment it has brought into the school life.

As the pupils have planned their plots, have measured and staked them out, planted the seed and cared for the plants, they have become more skilful of hand and more accurate of eye, while working from a definite plan has trained the judgment and taught them to foresee the future. All these results would warrant the existence of school gardens, but more noticeable has been the response to the appeal made to the higher nature of the child.

As the school environment has been improved, there has been a marked change in the moral tone of the school. The pupils' attention has been turned to a consideration of the beautiful to the exclusion of many baser thoughts, and the resulting moral culture has found expression in more orderly behavior. A smooth bit of lawn and a lawn mower have proved themselves aids to good discipline, for the play hours are more rationally enjoyed on well kept grounds than on the old rubbish-littered premises, where the chief joy was often found in working greater destruction. In some schools there has been a very noticeable change in the attitude of the pupils towards the school room and grounds, and they now take pride in beautiful surroundings and care for them where formerly they sought but to make desolation more hideous. Some of the pupils have been led to attempt flower and vegetable plots at their own homes, and it seems hard to over-estimate the better training for good citizenship which pupils receive in such schools where school gardens have broadened the educational horizon and improved the school environment so greatly.

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