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THE OTTAWA NATURALIST.

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ANIMAL COLORATION.

By Professor EDWARD E. PRINCE, Dominion Commissioner of Fisheries, Ottawa.

Many years ago I delivered the opening lecture in a course of scientific addresses in the University of Toronto. I chose as my subject the colors of animals, and the same theme has been dealt with by me on several subsequent occasions. Apart, however, from a short article, entitled "Spots and Stripes," in the London "*National Observer*," and a brief notice in THE OTTAWA NATURALIST in 1893, I have not published my views on this subject.

It is a subject of general interest; and many authorities, Poulton, Beddard, Eimer, Garstang, and others, have treated it more or less fully; but as Professor McIntosh, in the "Annals of Natural History" last year, pointed out, very many of the theories offered are wholly inapplicable to some of the most familiar and striking cases of animal coloration

My own conclusion is that pelagic animals, the small colorless creatures abounding at the sea's surface, are primitive. All animal life was originally colorless and possibly transparent, like glass. The first colors appearing in animals were due to vegetable food, or to parasites, especially "plant commensals"; but by-products, resulting from digestive and other processes, also produced animal colors. Colors of a brilliant prismatic character appeared, no doubt, in jelly-fishes and other transparent animals in the seas of the early world. These rainbow tints may be due to "thin plates" as discovered by Sir Isaac Newton in the soap-bubble, and seen also in the wings of the house-fly, elytra of beetles, scales on butterflies' wings, &c., or may be produced by minutely grooved or striated surfaces, producing lustrous tints as in

mother-of-pearl, feathers of tropical birds, insects and shells. Sir David Brewster found that the wax impression of a pearl showed rainbow colors like the original pearl. These "interference" colors, due to striations on the surface, or to prism-like transparent parts of animals, illustrate some of the most gorgeous effects observable in living things. The silvery color of many animals is not due to pigment or color, but to glistening smooth surfaces, and thus must be classed merely as "specular reflection."

Ancestral Coloration.—The ocean is, as August Weissmann declared, the original birthplace of all animal life. The simple protozoan animals, and larval stages of higher forms, abounding in the sea, are in most instances, of a colorless transparency, at any rate in the earliest period of their lives. Even in such highly organised creatures as the fishes, the minute embryos, at a very early stage of development, are colorless and translucent. Further, the body is not only colorless, but it is wormlike, segmented, or metameric. Annelids, insects, crustaceans, mollusks, ascidians, fishes, reptiles, nay even birds and the highest animals, may exhibit a colorless metameric body.

When color spots first appear in these, they are grouped serially, thus forming transverse patches or stripes from the head to the tail. This metameric coloring is very prevalent in the young of all classes of animals.

If the segmented body be ancestral, then there is strong presumption that repeated stripes and spots are ancestral also. They persist even though their use and meaning may have gone. Like the two buttons on a dress coat which served to hold up the sword-belt when our forefathers were accustomed to carry swords; but are now of no use, though, thanks to the tailor, they still persist, so we find transverse stripes, still appear as the first coloration in a vast number of animals.

A larval cod, a week or ten days after hatching out from the egg, exhibits a series of black stripes, and the young salmon and trout show cross bars, or "parr marks," which may be readily derived from the striped condition just referred to. Now, in some young flat-fishes the bars along the sides of the body divide into spots or large patches, four rows of them, and still preserving the metameric or serial succession from the head to the tail. Thus

from successive cross-stripes, the spots arise, and these surface arrangements of color appear to continue long after the internal organs, the muscles, &c., have wholly altered their original anatomical arrangement. Further, the successive series of spots may unite later as longitudinal stripes, and such stripes we find in the post-larval ling (*Molva*). We thus have a key to the arrangement of color in a vast number of animals. Wild pigs, though uniformly tinted when adult, exhibit when young a spotted skin, says Mr. Alfred Tylor, and later become striped. The dark tapir shows white spots, like the Virginian deer, when young. The Canadian lynx is striped with dark reddish lines along its deep brown body, as described in 1883 by Mr. Montague Chamberlain, who hence deduced that it must be related to the Ocelot group of the Felidae. Chickens, ducks, and other birds are similarly striped, quite unlike their parents. No doubt the repeated spots, bars and patterns, seen in caterpillars and many larval insects, are really ancestral. Weissmann held that these stripes have come down from a geological time when jointed reeds, and ribbed grasses preponderated; but this is apparently not a primitive cause; but like the zebra's and tiger's stripes they were ancestrally-metameric and utility explains their persistence, and modification. The striped tiger is practically invisible in his haunts among the yellow sword-grasses of the jungle, while a troop of zebras on the African plain, moving as they do in the moonlight, are practically invisible, owing to their remarkable arrangement of colors. Many young birds, like the gannet, may be of a dull brown color until their third year, possibly a case of blurred spots or stripes, which disappear and give place in the species named to a creamy white plumage. The dark bars of the yellow perch (*Perca*) and of tropical fishes like the Chaetodons, aid in obscuring these creatures amongst aquatic weed-blades. On the other hand, spots of color may be so modified as to resemble staring eyes, and may serve as Poulton suggested, to direct the attention of enemies to non-vital parts. The effect may, however, be the opposite and the eye-like spots may so suddenly strike the attention of enemies and startle them as to frighten them away.* The peacock butterfly (*Vanessa Io*),

* The eyelike spots on some larvæ of Lepidoptera may have this effect, e.g. the larva of the Elephant Hawk Moth (*Chærocampa elpenor.*)

the Emperor moth, nay even the *Polypectron*, the gorgeous Malacca pheasant, the ocellated turkey with a row of eye-like spots at the end of the tail, may thus find explanation. Many of the small shore fishes, like the Gobies, and the Skulpin (*Callionymus*), exhibit in the dorsal fin one or more shining eye-like spots, often explained as due to sex-selection, as the males usually bear these ornaments; but they may be of a warning character.

Trophic Coloration.—Food is frequently potent in color production. Translucent young fishes may have a bright pink color over the abdominal area, due to Copepods, &c., undergoing digestion, while Salpae often owe their yellow color to diatoms swallowed as food. N. Chautard found that green chlorophyll remained unchanged in color when taken in by animals. Examples are green oysters among Mollusks, and the green Cantharides among insects. Medical men are familiar with the effect of digesting colored materials. Young children may be brilliantly tinted over the head, face, arms and skin after accidentally swallowing aniline dyes, and bird-fanciers, who give young canaries Cayenne pepper in their food, can deepen the yellow plumage, as the fatty Triolin of the pepper (not the Capsicin as often stated) passes to the feathers. Sauermann's experiments with white hens showed that the Triolin colored the breast feathers most markedly, but the head remained perfectly white. Red, in plumage, is often a very fleeting color, and Moseley found a South African stork whose brilliant rose-color was all washed out by a heavy shower of rain! The seasonal red-color of the crossbill, the brown linnet and red pole disappears, changing to a greenish yellow in the bird first-named, while the carmine breast and forehead of the latter fades away altogether, like the dark blue of the Indigo bird's feathers, which assume a dingy brown color for the winter. Trophic colors, or tints due to food have been as yet little studied although the Cochineal insect is of great commercial value, owing to the red color of the food stored up in the body of the wingless female, of which 70,000 dried specimens, I am informed, go to make 1 lb weight of the dye material. The caterpillar of *Bryophila* is yellow when it feeds on *Lichen juniperinus*; but grey when subsisting on the grey *Lichen saxatilis*. Such instances undoubtedly exemplify trophic coloration. Allied to trophic coloration and yet distinct from it, is

that which may be distinguished as "*Physiological*" coloration. Thus the transparent colorless embryo bird acquires a pale pink tint, when red blood first begins to circulate through the rudimentary body. Red blood as in the *Chironomus* larva imparts color, as also does red blood and green blood in many Annelids. Doubtless the Chlorocruorin in the green blood has a physiological function similar to the Tetronerythrin in yellow sponges. Tetronerythrin converts oxygen into ozone. Oddly enough it is the substance to which the feathers of many birds owe their orange color. The Gephyrean *Bonellia* and the Coelenterate *Hydra viridis* owe their color to minute plant-like bodies filled with green chlorophyll granules. In many Planarians the same green particles occur and Professor Geddes proved that by them oxygen was liberated as indeed Dr. Joseph Priestley, towards the end of the eighteenth century, had discovered, finding that the carbondioxide in sunlight was broken up and the oxygen given off.* Some colors are "*Morphological*" or due to features in the anatomy of animals. Many shrimps appear patched with color. A dark patch in the cephalothorax is produced by the liver; and their viscera appear as color-masses. The longitudinal dark stripe down the back of the zebra follows the course of the spinal cord, while the white stripes on the face of the tiger coincide with the branches of the infra-orbital nerves.

Closely allied to physiological coloration is that which may be called "*Pathological.*" White animals such as white crows, hawks, peacocks,‡ moles, eels &c., are abnormal, and known as albinos. Usually the eyes are red owing to the absence of pigment in the retina, as in the rest of the body, though white cats may have blue eyes, are usually deaf, as Darwin found out, and as a rule are tom-cats as Lawson stated. A white hedgehog (*Erinaceus*) i. e. one with the usually brown acuminate spines as white as ivory, was found to lack the normal integumentary nerve twigs. Albinos are evidently abnormal in regard to their peripheral nerve supply.

* Brandt regards such green particles in animals as parasitic plants in the tissues, or rather commensals supplying oxygen to the host.

‡ The surface of the feathers in the white peacock shows the 'eyes' and usual pattern just as a black horse shows a dappled pattern or glistening spotted appearance.

The white or yellowish eels, occasionally found, owe the disappearance of color to nervous causes due to sex, and the enlargement of the eyes is connected with the same cause, of a nervous and emotional nature.

Psychological or, as I prefer to distinguish them "*Emotional*" colors, are apparently due to intense temporary nervous states, recalling the "pallor," or the "redness" in the human face due to fear or to anger respectively. The cuttle-fishes rapidly change color, becoming red, green, or yellow under different emotional states, which influence the nerves affecting the chromatophores or large pigment spots, and iridescent plates in the integument A captive Octopus when annoyed by a goad assumes a deep crimson color as though red with rage. Many fishes assume the most varied, often extremely beautiful colors, when dying. The large moon-fish or opah (*Lampris luna*) exhibits flitting rainbow tints, while the 3-spined stickleback (the male at least) acquires a deep scarlet tint about the throat, and the sides glisten with golden green. The 10-spined stickleback (*G. pungitius*) becomes inky black about the throat and abdomen, paler on the sides, before death. Sex coloration may be included under the heading "emotional" and what is called "sexual selection" is probably wholly secondary and subordinate in spite of Darwin's famous observations on the subject. Some of the most gorgeously-tinted male animals known to me do not support Darwin's view. Certain Pacific salmon, for example, notably the sockeye (*Oncorhynchus nerka*) coming in from the sea are of a steel-blue color; but the males change to a bright rose pink or madder on approaching the spawning grounds. For hundreds of miles countless numbers of these brightly tinted fish may be seen crowding the great rivers of the West. In the shallow upper waters tens of thousands occur in the Fall like struggling armies of "gold fish," 200 to 1,000 miles from the sea. Swiftly through the water foaming over the pebbly shallows, the crowded male fish speed, and fight and kill each other, and the gorgeously colored victors assume greater brilliance under the excitement. Any selection by the more sober-tinted female fish is out of the question in the terrible turmoil and rush. Like the antlers of deer and other seasonal out-growths in various animals, the colors referred to are the physical and visible expression of emotional

excitement. *Seasonal* colors are of a different character. Thus the stoat, Alpine hare, Arctic fox, &c., change from the sombre summer hues to snowy white, the tail or ear-tips remaining black in some instances. The beetle, *Carabus auratus*, is dusky in winter, but green in summer, while the spring and summer broods of one butterfly, a *Vanessa*, are in great contrast as regards color, &c. The winter pupa emerges in spring as *Vanessa levana*, while the second brood emerging in summer is distinguished as *Vanessa prorsa*, the contrast in coloration being attributed mainly to temperature, just as melanism, or the appearance of dark forms of certain species is said to be due to temperature and moisture.

If animals have appreciation of colors as is certainly the case, there are types which must be classed as "*Aesthetic*" implying delight in or preference for certain tints and arrangements of color.

Lord Avebury proved that bees prefer blue colors and Professor Poulton has found other instances. Darwin satisfied himself that female birds prefer brilliantly tinted male birds · but this "sex selection" is only a particular form of "aesthetic preference." Aesthetic coloration affords some of the most enchanting examples known to the naturalist, and perhaps the acme is reached in the gorgeous male Nicobar pigeon, a native of Java and Sumatra, which glitters in the serried hues of emerald, gold and metallic blue, surpassing the wondrous colors of the parrots and birds of Paradise.

Parasitic colors are due to parasitism, and are usually sombre for protection's sake like some of the bird ticks; but the horse and deer ticks (*Trichodectes*) and others are striped down the dorsum. Many parasites especially entoparasites are opaque white, having lost all coloration, from their mode of life in the interior of their hosts. Their surroundings are dark like the cave animals. *Environmental* colors are a form of mimicry and ensure the safety of the possessors. They may be classed as passive or procrpytic, the various flounders and shrimps, which most accurately resemble the sandy bottom, are examples. Others are active or anticryptic colors like those of the tiger, which is concealed by its stripes and thus able to spring unobserved upon its prey. Spiders and many predaceous creatures show anticryptic coloration.

Warning coloration, called sematic by Poulton, implies disagreeable features disguised, it may be, under a very beautiful exterior. The strikingly colored skunk can be mistaken for no other mammal, the wasps, and similar offensive insects and many gorgeous larvæ repel animals, which might by mistake attempt to prey upon them, and be stung or poisoned. Many brilliant tropical fishes are said to be poisonous and unsuitable for food. Their coloration, as Mr. A. R. Wallace expresses it, is "an outward sign" of their non-edibility.

Recognition colors no doubt aid animals to readily detect their own kind The white tail of the rabbit is believed to direct the young to follow their parents to safety when danger looms.

Mimicry involves not only protective colors, but also protective shape or form. The lappet moth, the stick insect, the leaf insect are familiar cases of color combined with striking form-resemblance. The mimicry is perfect.

It is clear that these types ofcolor often overlap. Thus aesthetic and sex coloration may combine in the same examples. It may be that in some cases the coloration has as its end the destruction of the individual in the interest of the tribe. Thus the brilliant color of the male sockeye must attract the attention of bears, fish-hawks and other enemies. As a rule the number of males is excessive, their reduction is a benefit, hence they not only fight most fiercely and thus perish, but are exposed to numberless dangers by reason of their striking colors.

A vast series of examples of animal colors, must at present be classed as *indifferent*. Like the bright tints of marble or agate, or the colors of the diamond, they seem to serve no purpose. The gorgeously tinted Nemerteans living in similar surroundings are of the most various hues. The rose pink of the Arctic Pterpods serves no apparent end, for they are most tempting food for many animals. I have found Copepods of a rich emerald color, while others are reddish or brown. The solitary frog has a rich topaz eye, the young *Cottus* shows a St. Andrew's cross over its iris, and all these instances are difficult to explain. The palate of the orang outan is black, while that of the chimpanzee is bright

pink*. The gall-bladder is often emerald green, the peritoneal membrane, as in certain fishes,† is silvery, bespangled with yellow, black and red stars. It is difficult to understand these internal colors and there are multitudes of inexplicable examples of external color too, which offer problems for biologists to solve in the future.

BOTANICAL NOTE.

FRUIT AND SEED.

In Botany the word fruit signifies the enlarged and matured ovary, whatever its substance may be and whether fit to eat or not. It is sometimes difficult to decide when speaking of the small fruiting organs of some plants whether these are fruits or true seeds. In the Butercup, Sunflower, Borage, and Mint families. the seed-like bodies are really fruits, while in the Mustard, Pink, Pea and Evening Primrose families. they are true seeds. All of these are usually spoken of as seeds which is the term commonly used by seedsmen, farmers and others. Dr. L. H. Grindon, the eminent English botanist, in his "British and Garden Botany," makes the following concise distinction: "There is an infallible distinction between a fruit and a seed, however much they may resemble each other: The fruit always has *two* scars, one at the base, showing where it was attached to the peduncle. and another upon the summit, indicating the former presence of the style or stigma; but the seed has never more than *one* scar, indicating the point at which it was connected with the pod that contained it."

J. F.

* No less inexplicable is the curious fact, mentioned by Darwin, that in the hornbill, *B. bicornis*, the inside of the mouth is black in the male; but flesh-colored in the female.

†For example *Gastrosteus*.

CONTRIBUTIONS TO CANADIAN BOTANY.*

By JAMES M. MACOUN, Assistant Naturalist, Geological Survey of Canada.

XVIII.

MITELLA DIVERSIFOLIA, Greene.

Near Trail, Columbia River, B C., May 19th, 1902. No. 64,574.† (*W. Spreadborough.*) New to Canada.

HEUCHERA FLABELLIFOLIA, Rydb., N. A. Fl. XXII : 115.

H. parvifolia, Cat. Can. Plants 1 : 158 & 526.

All the Canadian specimens referred to *H. parvifolia* in our herbarium prove to be *H. flabellifolia*. They are from Milk River Ridge, Alta. No. 10,560; Cypress Hills, Alta. No. 8,514, and Crow Nest Pass, Rocky Mts. No. 20,167. (*John Macoun.*) Milk River Ridge, Alta. No. 8,515. (*Dr. G. M. Dawson*)

HEUCHERA COLUMBIANA, Rydb., N. A. Fl. XXII : 116.

H. cylindrica, var. *alpina*, Cat. Can, Plants, 1 : 526 in part.

H. cylindrica, var. *ovalifolia*, Contr. Can. Bot. No. 6, p 5, in part.

Crow Nest Pass, Rocky Mts. No. 8,500. (*Dr. G. M. Dawson.*) Waterton Lake, Rocky Mts. No. 10,561; Eagle Pass, C. P. Ry., B.C. No. 8,503. (*John Macoun.*) Trail, Columbia River, B.C. No. 64,571. (*J. M. Macoun.*) Referred to *H. glabella* by Rosendahl, but apparently a good species.

SAXIFRAGA RUFIDULA, (Small).

S. occidentalis, Cat. Can. Pl.. II : 321 in part.

Micranthes rufidula, Small, N. A. Fl., XXII : 140.

Well characterized by the red-tomentose under-surface of the leaves. Described from specimens collected by Prof. John Macoun on Mount Finlayson, Vancouver Island, May

*Published by permission of the Director of the Geological Survey of Canada.

†Specimens have been distributed from the herbarium of the Geological Survey under these numbers.

17th, 1887. Collected July 17th, 1887, on Mount Arrowsmith, V.I., and May 19th, 1893, on Parson's Mountain near Victoria, V.I., by Prof. Macoun. The specimens collected in 1887 formed part of the material upon which Watson based his *S. occidentalis*.

SAXIFRAGA LATA, (Small.)

S. occidentalis, Cat. Can. Pl., II: 321 in part.
Micranthes lata, Small, N. A. Fl., XXII: 145.

Described from specimens collected by Prof. John Macoun at Lytton, B.C., April 16th, 1890. Not rare west of the coast range. ‡

RIBES OXYCANTHOIDES, L. var. CALCIOLA, Fernald, Rhodora, VII: 155.

This variety resembles the species "but young branches, petioles and lower leaf surfaces permanently and densely white-tomentose." Collected or noted growing in calcareous soils in Bonaventure and Gaspé counties, Quebec, by Messrs. Collins, Fernald and Pease at the following places: Carlisle, Tracadigash Mt., mouth of Bonaventure River, New Richmond, Grand River, Percé, Little Cascapedia River and Dartmouth River. This variety was collected on "the island" Baddeck, Cape Breton Island, N.S., by Prof Macoun in 1898, Herb. No. 19,102. An intermediate form was collected on Cape Breton Island, the same same year at Grand Narrows, No. 19,100, and Big Intervale, Margaree, No. 19,101.

CRATAEGUS BRUNETIANA, Sargent.

A common species about Quebec. Our specimens were collected in fruit near Quebec in 1902 by Dr. Robt. Bell.

SPIRÆA SORBIFOLIA, L.

Escaped from cultivation and well naturalized on the bank of the Gatineau River at the railway station, Wakefield, Que., 1903. *(John Macoun)*

GEUM PULRCHUM, Fernald, Rhodora, VIII: 11.

Known in Canada only from specimens collected by Williams, Collins and Fernald, in boggy meadows by the St.

‡The Geographical limits given in these papers refer to Canada only.

Lawrence River at Bic, Quebec, but will probably be found elsewhere. Characterized by its "large, wide-spreading crimson calyx, deep claret-colored styles and the strongly contrasting broadly obcordate bright yellow petals"; suggesting *Geum macrophyllum* in the outline of the leaf only.

MEDICAGO DENTICULATA, Willd.

Toronto, Ont. *(W Scott.)* Not recorded from Ontario.

VICIA VILLOSA, L.

Camlachie, Ont, June 18th, 1901, No. 34,280. *(John Macoun.)* New to Canada, rare in North America. Introduced.

GERANIUM PRATENSE, L.

Roadsides and pasture fields, Wakefield, Que., 1903. *(John Macoun)*

LINUM CATHARTICUM, L.

On the left side of the entrance road, Beechwood Cemetery, Ottawa, Ont., 1903 *(John Macoun.)* Not before recorded from Ontario.

EMPETRUM NIGRUM, L., var. ANDINUM, DC.

Distinguished from *E. nigrum* by its red fruit and tomentose or lanate young leaves This plant was sent us from Newfoundland many years ago and was named *E. rubrum*. Mr. L. Fernald has shown (Rhodora, vol. IV: 147-151) that it is apparently identical with the Andes plant described by De Candolle.

RHUS VERNIX, L.

R. venenata, Macoun, Cat Can. Plants, I: 100 and 505.

Abundant by the little lake west of East Templeman, Que., 1903. *(John Macoun.)* Not recorded east of S. W. Ontario.

IMPATIENS NOLI-ME-TANGERE, L.

On Kent street, Ottawa, Ont. Noticed there for several years previous to 1901, when flowering specimens were collected in September.

MALVA ALCEA, L.

Common by roadsides in Masham township near Wakefield, Que., 1903. *(John Macoun.)*

ANTHRISCUS CEREFOLIUM, Hoffm.

Roadsides at Cap à L'Aigle, Que. No. 67,994. *(John Macoun.)* New to Canada.

CICUTA DOUGLASII, (DC.) C. & R.

In marshes, Chilliwack Lake, B.C. No. 44,480. *(J. M. Macoun.)* New to Canada.

SANICULA NEVADENSIS, Wats.

Revelstoke, B.C., 1902. *(W. Spreadborough.)* Eastern limit in Canada.

MONOTROPA FIMBRIATA, Gray.

In woods near Trout Lake, B.C. *(E. Wilson.)*

GAULTHERIA HUMIFUSA, (Graham) Rydberg.

C. Myrsinites, Hook.

Mountains at Lake Agnes, No. 66,473, and at Pipestone Creek, No. 66,474, Rocky Mountains, 1904. *(John Macoun.)* Not recorded from Rocky Mountains since Drummond's time.

GLAUX MARITIMA, L. var. OBTUSIFOLIA, Fernald, Rhodora, IV: 215. *G. maritima*, Cat. Can. Pl. I: 315 in part.

With the exception of a single specimen from Assinaboine Rapids, Man., (*John Macoun*), our herbarium specimens of this variety are from either the Pacific or Atlantic coasts. In the east it is represented in our herbarium by specimens from Brackley Point, Prince Edward Island, No. 15,982; Grand Narrows, Cape Breton Island, N.S., No. 19,849; Salmon River, Que., No. 68,641, and Murray River, Que., No. 68,642 (*John Macoun*); Oak Island, Mahone Bay, N.S., No. 23,060 (*Dr. C. A. Hamilton*); Campbellton, N.B., No. 15,985 (*Dr. R. Chalmers*); Bathurst, N.B., No. 60,463 (*Williams* and *Fernald*); Cacouna, Temiscouata Co., Que., No. 67,057 (*Collins* and *Fernald*). From the Pacific coast,

Chase River, Vancouver Island, No. 15,981; Comox, Vancouver Island, No. 635; Burrard Inlet, B.C., No. 15,979 (*John Macoun*); Lacomb Island, Portland Canal, B.C., No. 14,978 (*J. McEvoy*): Renfrew District, Vancouver Island, No. 41,413 (*Rosendahl* and *Brand*).

DODECATHEON PUBERULUM, (Nutt.) Piper.

Grassy slopes, Penticton, Lake Okanagan, B.C. No. 61,247. (*W. Spreadborough.*) Damp spots at Trail, Columbia River, B.C. No 66,531; west of Sophie Mt., B C. No. 66,532. (*J. M. Macoun.*)

CYNANCHUM VINCITOXICUM, R. Br.

Escaped from cultivation at Niagara Falls, Ont., 1904. (*W. Scott.*)

NEMOPHILA BREVIFLORA, Gray.

Very abundant on damp grassy slopes at an altitude of 5,000 feet, Sophie Mt., S.W. of Rossland, B.C. No. 66,614. (*J. M. Macoun.*) New to Canada.

POLEMONIUM ELEGANS, Greene, Pittonia. III: 305.

P. confertum, Cat. Can. Pl., II: 330.

Summit of South Kootenay Pass, Rocky Mountains. No. 16,221. (*Dr. G. M. Dawson.*) Summit of Sheep Mountain, Waterton Lake, Rocky Mountains. No. 11,807. (*John Macoun.*) Second summit west of Skagit River, near the International Boundary. Alt. 7,000 ft. No. 68,716. (*J. M. Macoun.*)

CYNOGLOSSUM BOREALE, Fernald, Rhodora, VII: 249

C. Virginicum, Cat. Can. Pl. I: 335 and 567.

C. occidentale, Cat. Can. Pl. I: 567, and II: 344.

This species is not uncommon in Ontario and eastward throughout the Maritime Provinces, but west of Lake Superior it is very rare. In our herbarium we have no specimens from the wooded country north of the prairie region, where it was collected by Drummond, nor have we any specimens from the Rocky Mountains. Our herbarium material from British Columbia is represented by specimens from Donald in the Columbia valley and from Vernon near Lake Okanagan.

ASPERUGO PROCUMBENS, L.

Waste places at Banff, Alta., 1903. (*V. B. Sanson.*) Not recorded west of Ontario.

VERBENA BRACTEOSA X STRICTA.

A *Verbena*, evidently a hybid between *V. bracteosa* and *V. stricta* was found growing very abundantly on dry sandy ground near Pt. Edward, Ont., Aug. 20, 1903. (*C. K. Dodge.*)

MERTENSIA OBLONGIFOLIA, Don.

Common on hillsides around Trail, Columbia River, B.C. Nos. 66,567 and 66,568. (*J. M. Macoun.*) New to Canada.

MERTENSIA CILIATA, Don.

South fork of Salmon River, near Idaho boundary. No. 66,566. 1902. (*W. Spreadborough.*) New to Canada.

TEUCRIUM LITTORALE, Bicknell.

Along the shore below Mahone Bay, N S. (*Dr. C. A. Hamilton.*) New to Canada.

SCUTELLARIA NERVOSA, Pursh.

Dry open woods, Cedar Creek, Arner, near Kingsville, Ont. No. 54,679 (*John Macoun.*) New to Canada.

MENTHA ARVENSIS, L. var. LANATA, Piper, Bull. Torr. Bot. Club, XXIX : 223.

Size and habit of var. *Canadensis*, Briquet (*M. Canadensis*, L.) but the calyx, stem, petioles and often the whole underside of the leaf-blade densely lanate-pubescent.

Dry bed of torrent, Middle Creek, Chilliwack River, B.C. No. 54,657; bank of Chilliwack River, B.C. No. 54,656. (*J. M. Macoun.*) New to Canada.

SOLANUM CAROLINENSE, L.

Very abundant at Point Edward, Lake Huron. No. 54,531. (*John Macoun.*)

PHYSALIS PRUINOSA, L.

Streets of Southampton, Ont, No. 54,524. (*John Macoun.*) New to Canada.

VERBASCUM LYCHNITIS, L.

Roadsides at Sandwich, Ont. No. 54,510. (*John Macoun.*)

CHÆNORRHINUM MINUS, (L.) Lange.

Linaria minor, Desf.; Macoun, Cat. Can. Plants, 1 : 353. Contr. to Can. Bot. Pt. XII.

Kincardine, Ont. (*W. Scott.*) Point Edward. No. 54,467, and Sarnia Ont. No. 54,466; along the railway at East Templeman, Que., 1903. (*John Macoun.*)

PENSTEMON PULCHELLUS, Greene.

Rocky summits, alt. 6,000 ft., Tami Hy Mountain, Chilliwack Valley, B. C. 1901. (*Jas. M. Macoun.*) New to Canada. Probably not a good species but only a form of *P. procerus*.

PENSTEMON DIGITALIS, (Sweet) Nutt.

Another locality for this species is Farm Point, four miles from Cascade, Que. It is not easy to account for the occurrence of this plant as though generally treated as a garden escape it is found where there is no record of its having been cultivated.

CASTALLEJA SUKSDORFII, Gray.

Abundant on sub-alpine slopes between the Chilliwack River and Mount Cheam, B.C., alt. 4,000 ft. Nos 54,442 and 54,443. (*J. M. Macoun.*) Not recorded from Canada.

PLANTAGO ARISTATA, Michx.

Galt, Ont. (*W. Herriot.*) Roadsides near Windsor, Ont. No. 54,701. (*John Macoun.*) Introduced from the west, now well established.

PLANTAGO MEDIA, L.

Roadsides under the shade of the maples along the Whortley Road, near London, Ont. (*J. Dearness.*) Of very rare occurrence in Canada.

GALIUM BIFOLIUM, Wats.

Abundant on clay banks along the Dewdney Trail, west of Sophie Mt., B.C. Alt. 5,000 ft. No. 64,890. (*J. M. Macoun.*) New to Canada.

ANAPHALIS MARGARITACEA, B. & H. var. OCCIDENTALIS, Greene.

Characterized by its bright green leaves, glabrous above. Confined in Canada, apparently, to the vicinity of the Atlantic and Pacific coasts where it is rare. We have no specimens from the interior.

XANTHIUM GLABRATUM, (DC.) Britton.

In ditches by roadsides and along streams near Sarnia, Ont. (*C. K. Dodge.*) New to Canada. Mr. Dodge has also collected *X. Pennsylvanicum* at Port Huron, Mich., just opposite Sarnia.

XANTHIUM CANADENSE, Mill.

Typical specimens of *X. Canadense* were collected by Prof. Macoun by the mill at Blue-berry Point, near Aylmer, Que., in 1903. During the same summer he collected *X. echinatum*, Murr., at Wakefield, and *X. Pennsylvanicum*, Wall. near St. Patrick's Bridge, Ottawa.

GALINSOGA PARVIFLORA, Cav.

Toronto, Ont , 1904. (*W. Scott.*) First collected in Canada by J. Dearness in north London, Ont. in 1901 and more recently in the southern part of that city.

CHRYSANTHEMUM LEUCANTHEMUM, L.

Typical *C. Leucanthemum* as represented in our herbarium seems to be confined to the Atlantic and Pacific coasts our only specimens being from Newfoundland, No. 10,955, (*Robinson* and *Schrenk*) ; Boylston, N.S., No. 22,830, (*Dr. C. A. Hamilton*) ; Big Intervale, Margaree, Cape Breton Island, N.S., No. 19,672, (*John Macoun*) ; New Carlisle, Bonaventure Co., Que., No. 69,071, (*Williams* and *Fernald*); Montmorency Falls, Que., No. 68,327, (*John Macoun*) ; Cedar Hill, Vancouver Island, B C., No. 14,503, (*John Macoun.*) The var.

subpinnatifidum, Fernald, Rhodora, v: is abundantly represented in the herbarium of the Geological Survey by specimens from Labrador to British Columbia.

ARTEMISIA BIENNIS, Willd.

Near the mouth of Albany River, James Bay, 1904. (*W. Spreadborough.*) Probably introduced.

ARNICA GASPENSIS, Fernald, Rhodora, VII: 148.

Described from specimens collected on ledges of a hill near Ste. Anne des Monts, Gaspé, in 1881, by Mr. J. A. Allen.

ARNICA PLANTAGINEA, Pursh.

Described from specimens collected in Labrador and recorded from several stations there. Re-described by Mr. Fernald, Rhodora, VII: 247.

ARNICA SORNBORGERI, Fernald, Rhodora, VII: 147.

Bank of a mountain brook at Rama, Labrador. (*J. D. Sornborger.*)

CARDUUS NUTANS, L.

In the pasture on the Pêche River above the schoolhouse at Wakefield, Que., 1903. (*John Macoun.*) Not recorded west of the Maritime Provinces.

CIRSIUM ARVENSE, Hoffm. var. SETOSUM, Ledeb.

In a second-growth woods about 200 yards from the Grand Trunk Railway at Lachine, Que., 1905. No. 67,797. (*Dr. Robt. Campbell.*)

CENTAUREA JACEA, L.

Waste places at Owen Sound, Ont., 1901. Herb. No. 26,445. (*John Macoun.*) New to Eastern Canada.

LEONTODON HISPIDUS, L.

Moist meadows, Galt, Ont., 1902. (*W. Herriot.*) New to Canada.

SONCHUS ARVENSIS, L.

Albany, James Bay. 1904. (*W. Spreadborough.*)

LACTUCA PULCHELLA, DC.

Mouth of Albany River, James Bay, [illegible]. (*W. Spreadborough.*) Not recorded from that region.

PRENANTHES RACEMOSA, Mx.

The Beacon, mouth of Moose River, James Bay, 1904. (*W. Spreadborough.*) Not recorded from that region.

AGOSERIS ALTISSIMA, Rydb.

Prairies near Old Wives' Lake, north of Peace River, Atha., 1903. No. 61,242. (*J. M. Macoun.*) Known before only from type locality in Montana.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

At the annual meeting of the Entomological Society of Ontario held at the Ontario Agricultural College, Guelph, on the 10th and 11th October, three of the local members of the Club, Messrs. Fletcher, Gibson and Young presented papers, and, Dr. Fletcher, was honoured by being elected President of the Society for the ensuing year. Other members of the Club who contributed papers during the convention were Mr. J. D. Evans, of Trenton, Mr. H. H. Lyman, of Montreal, Prof. Wm. Lochhead, of the Macdonald Agricultural College, Ste Anne de Bellevue, Que., Mr. C. W. Nash, and Mr. J. B. Williams, of Toronto, and the Rev. Professor Bethune, of Guelph. Among the exhibits shown was a beautiful collection of exquisitely mounted tineid moths, collected and prepared by Mr. C. H. Young, of Ottawa. Mr. Young has been most energetic in the collection of these interesting little insects and during the past two years has mounted upwards of four thousand specimens. We hope, as Mr. Young is getting his material identified by the well known specialist, Mr. W. D. Kearfott, of Montclair, N. J., that he will publish in the OTTAWA NATURALIST, at an early date a list of the species he has found in the Ottawa district. One of the important features of the meeting was a full discussion on the habits of the Codling Moth and the best methods of controlling it. Mr. Paul Hahn of Toronto

delivered the popular lecture on "An Entomological trip to Algonquin Park"—This was illustrated by lantern slides from photographs taken during the trip.

A. G.

LIMNÆA MEGASOMA.

Limnæa megasoma is undoubtedly the finest of the pond shells of North America. In the vicinity of Ottawa it is found only in Meech's Lake, where it is least rare in a sheltered bay about two hundred yards north of the Tilley Cottage. The species occurs in many of the lakes of northern Ontario. It is abundant in both the outlets of Lake Temagami and is doubtless to be found in every bay of this beautiful lake. At the mouth of the French River and in the northwest arm of Lake Nipissing, it is quite common. But nowhere does it appear in greater numbers than in the centre of the new silver district— Cobalt Lake. Here with unnumbered millions in value of precious mineral surrounding it, *L. megasoma* flourishes, despite the large quantity of arsenic present in the water, and many of the mature shells preserve the rich brown tints which constitute the chief beauty of the young of the species.

F. R. L.

NOTE.

The undersigned would ask all members of the Field Naturalists' Club, who are so inclined, to send notes on birds which have been observed—where there is no doubt as to the facts given—as well as specimens for identification, and especially old nests of this year, together with data of the species that built it, in what location it was, etc., in to him. By co-operation of this kind much valuable information can be accumulated, which can afterwards again be made use of for the benefit of the whole club.

C. W. G. EIFRIG,
210 Wilbrod Street,
Ottawa.

NATURE STUDY No. XXXVIII.

School Exhibits of Pressed Plants.

By James Fletcher, Ottawa.

Largely as an outcome of the Nature Study movement, much attention has recently been given in rural schools to the formation of collections of various Natural history objects. The appreciation of the value of this work has found expression in the efforts made by the authorities of local Fairs and Exhibitions to encourage the teachers and scholars of their several districts, by offering prizes to be competed for under stated conditions. It cannot be doubted that the small expenditure involved has in the main been amply justified by the results. There are, however, some features of this work which may be advantageously considered by the teachers when themselves entering upon these competitions or persuading their scholars to do so. In this, as in every other kind of work, the first consideration should be: Is it advisable? If this is decided in the affirmative, then some definite idea should be formed beforehand as to the educational use the effort is to be put to and the way it is to be carried out. The writer has had many opportunities during the past ten years of examining and judging collections of plants, native woods and seeds, etc., which have been entered for competition at various Exhibitions. In most cases, there has been evidence of much energy, patience and care in making and preparing the specimens for exhibition; but there have also been signs that the makers of some of the collections have not quite understood the main principles involved in making a collection at all, or of making it educationally valuable. Most of the short-comings seem to have been due to a lack of knowledge of what the results of long experience, gathered from many different students, have shown is the best way to make a representative collection of natural history objects. It is with the hope of helping my many friends among the teachers and scholars of our country that I write this note. I believe that the encouragement of these natural history competitions, extended by Exhibition Associations, is a very wise one:—from their own point of view in the first place, the large number of visitors who invari-

ably crowd around these exhibits, bears testimony to the great interest in the subject, not only on the part of the friends of the exhibitors, but also among the general public; and, besides, it is highly commendable, because they are stimulating the study of branches of knowledge which are now acknowledged to be of the utmost importance, in finding simple means for preventing loss in the crops of the country and thus increasing enormously its revenues, as well as, at the same time, the prosperity and happiness of the individual citizen. Teachers and students may therefore feel quite justified in giving the necessary time and thought required in trying to learn the true nature of some of the common natural history objects around them. These to most minds will be found on closer acquaintance to be so attractive that they will stimulate further study and engender a craving for more knowledge concerning all similar objects. This will bring with it increased powers of observation and comparison, in short, a scientific attitude of mind which strives to see things in their true light, to think correctly, and to understand what is being considered. To do this will require much patience and mental self control. as well as great care to avoid jumping to hasty conclusions. It may be claimed, then, that this work is certainly useful, not only from an educational point of view because it demands close observation and thought, which train the mind and form character ; but also because the actual knowledge acquired is of use in the ordinary walks of every day life. A nature study may be defined as an educational exercise consisting of a careful observation of some common natural history object, together with a conscious mental effort to learn as much as possible of its nature and uses : —what it is, what it does, why it does it, how it does it, and what its relation is to man or more directly to the observer himself. In such an exercise it is convenient and often necessary to preserve specimens both of the objects under consideration and of similiar and allied forms, so as to have these at all times easy of access for study and comparison. This means to make a collection. In doing this, it is soon noticed that each kind of plant has its own habitat or special locality where it finds conditions most suitable to its highest development, and that, to find it in the best state for study, it must be sought for in those localities. For the

thorough understanding of a species, it is necessary to know the plant in all its parts and in all its different stages of development. Specimens should be collected illustrating all these points, and should be chosen, first of all, with an idea of presenting the average development and typical form of the species. Dwarfed or gigantic specimens should be shown only as indicative of the range of variation. There seems to be a tendency with beginners to collect specimens with unusually large leaves or flowers, which specially strike them, or dwarfed or imperfect specimens, "chips," which are easy to preserve and mount, but which give little information when referred to in a collection. Separate leaves or plants without flowers or fruit should not be included, unless these parts are otherwise shown. Each species should be represented, if its average size will permit of this, by a specimen showing the root, the stem, the leaves both from the root and on the stem, the flowers and the fruit. In large plants, as in the case of coarse-growing herbaceous plants, shrubs and trees, portions must be selected illustrating the various parts. In order that the collection may be of the greatest use, it is necessary to label carefully and neatly every specimen, giving the name, the habitat or nature of the place where found, the exact locality, so that if necessary further specimens may be collected, and the date of gathering, so that the time of flowering and seeding may be known. Valuable additions to a collection of plants are specimens of the seeds and of seedlings showing the seed leaves. In the matter of mounting and labelling, neatness and uniformity are very essential. Specimens should be dried quickly, so as to preserve the colour as much as possible, and in a natural manner, so that the flowers may take the same positions as when the plant was growing, and so that the undersides of some of the leaves may be seen. In preserving a plant, it should be neatly arranged, when first pressed, between the folds of a single sheet of thin paper, once folded. This should then be placed between driers of absorbent paper, which for a few days must be changed every day, and dry sheets substituted, without disturbing the plant in its folder. On the second day the specimens should be examined to see that all the characters of the plant are shown, and, if they are not, parts may be moved a little to improve the arrangement; but after that the specimen should not be disturbed until it is quite dry, when it may be taken out and mounted permanently on paper thick enough to allow of examination without breaking the specimen. Each plant should have a separate sheet to itself, and all the mounting paper in a collection should be of the same size and labelled in the same

place. The specimens may be attached to the mounting paper either by narrow strips of paper neatly stuck over the stems, or with liquid glue placed at several points on the firm parts of the underside of the specimen. The different sheets should be placed together in their botanical families in accordance with some recognized list. The "Catalogue of Canadian Plants" by Professor John Macoun, our highest authority, is universally followed in Canada. This catalogue can be procured from the Geological Survey Department at Ottawa. The sheets should always be kept separate and for a reference collection for a school, after being displayed at the local exhibition, should be carefully put away in a neat box made a little larger than the size of the mounting sheets. Specimens of plants should never be put in bound books, nor should the sheets be caught together at the edges, with cords as is sometimes done. In both of these ways, the specimens are easily broken, there is no way of interpolating in their proper places species subsequently collected, it is inconvenient to examine and compare the species, and, when the collection is required for an exhibition, it cannot be displayed in an attractive manner, which is an important point with the exhibition authorities.

In order that these collections may be of the greatest educational value, the specimens should be gathered as much as possible by the students themselves, and the name of the collector should appear on the label. The teacher should merely help in identifying and comparing the plants with related forms and also in showing how to prepare the collection for exhibition.

Collections of the seeds of weeds make an attractive and useful exhibit. Owing to the good work of the Seed Branch of the Department of Agriculture under the direction of Mr. G. H. Clark, great interest has been recently developed in recognizing the various weed-seed impurities in crop seeds offered for sale. Farmers are now alive to the importance of knowing the appearance of the seeds of these enemies which in the past they so often carried on to their land, mixed with the seed they sowed for crop. All of the weed seeds have characteristic shapes, colours and markings, by which after a little practice they are just as easily recognized as the crop seeds among which they occur. In making collections of weed seeds, the appearance of those of the worst pests is soon learnt, and the boys and girls of Canada have a grand opportunity of using their sharp eyes to the advantage of their fathers, by examining the seeds bought for sowing and finding out whether any weed seeds are included.

Seed collections should be exhibited in small bottles, all of the same size, neatly labelled in the same place on each bottle. Well cleaned seed, as well as some in the husk should be shown.

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