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THE

OTTAWA NATURALIST

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TRANSACTIONS

OF THE

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The Ottawa Field-Naturalists' Club.

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SATURDAY SPRING EXCURSIONS, 1914.

The following spring excursions have been arranged by the Excursions Committee:—

May 2—Rockcliffe.
" 9—Above the Chaudiere Falls—north shore Ottawa River.
" 16—Britannia.
" 23—Ironsides.
" 30—Leamey's Lake.
June 6—Rideau Canal by motor boats.
" 13—Stittsville.
" 20—Fairy Lake *via* Chelsea Road.
" 27—Experimental Farm.

ANDREW HALKETT,
Chairman of Committee.

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THE OTTAWA NATURALIST

VOL. XXVIII. OTTAWA, APRIL, 1914 No. 1.

ANNUAL REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, 1913-14.

On the completion of the thirty-fourth year of the existence of The Ottawa Field-Naturalists' Club, the Council begs to present a summary of the work undertaken and accomplished during the past season.

Eight meetings of the Council have been held. The standing committees, the editor and associate editors of THE OTTAWA NATURALIST, the librarian and the excursion leaders were appointed at the first meeting.

The membership of the Club is now 311. During the year 14 members were elected, 11 resigned, 7 were removed from the list for non-payment of dues and there was one death, making a total loss of 19.

The Club was represented at the Jubilee Meeting of the Entomological Society of Ontario, which was held at the Ontario Agricultural College, Guelph, August 27th-29th, 1913, by Mr. Arthur Gibson, and at the meetings of the Royal Society, held in Ottawa, by the President, Mr. L. H. Newman.

The usual work under the direction of the various committees has been conducted along much the same lines as followed in previous years, and some new field operations have been commenced from which much is expected. Steps are being taken to interest the proper authorities in the preservation, in the natural condition, of certain areas in the Ottawa district which are especially valuable for natural history study, instead of allowing them to be subdivided into building lots.

PRESERVATION OF BIRD LIFE.

A prominent feature of the Club's work this year has been the attention given to the preservation of bird life, as a result of which bird sanctuaries will be established at Rockcliffe Park and the Experimental Farm. In the Rockcliffe sanctuary 250

nest boxes will be put up this spring and at the Experimental Farm 160, under the direction of the Club. The question of protecting birds, the economic value of certain common species and the proposal of the Club for the protection of the native birds around Ottawa were dealt with at one of the winter lectures by Dr. C. Gordon Hewitt, Dominion Entomologist. An abstract of this address was printed in the March number of THE OTTAWA NATURALIST.

THE OTTAWA NATURALIST.

Under the direction of the Publications' Committee, THE OTTAWA NATURALIST, the official organ of the Club, has appeared regularly during the year and Volume XXVII is now complete. Mr. Arthur Gibson has continued to edit it. The ten numbers issued (two of which were double numbers) comprise 180 pages, in addition to which 23 plates appeared. This large number of plates adds very much to the appearance of our journal, and, of course, increases its value very materially.

The following are the most important papers which have appeared in the volume:—

Notes on the Occurrence of Interesting Forms of Cyperaceae in Quebec. By Bro. Victorin, Longueuil, Que.

Preliminary List of Ottawa Sphaeriidae. By F. R. Latchford.

The Manus in a Specimen of Trachodon from the Edmonton Formation of Alberta. By L. M. Lambe.

The Shade Trees of Ottawa. By E. H. Blackader.

Useful Wild Plants of Canada. By J. W. Eastham.

Description of a New Species of Testudo, and of a Remarkable Specimen of Stylemys nebrascensis from the Oligocene of Wyoming, U.S.A. By L. M. Lambe.

The Broad-striped Skunk. By Norman and Stuart Criddle.

Does the Type of Protopalaeaster narrawayi Present an Oral or Aboral Aspect. By G. H. Hudson.

The Haunts of Some of Our Native Ferns. By A. Cosens.

On the Genera of the Eodiscidae. By P. E. Raymond.

A New Genus and Species of Ceratopsia from the Belly River Formation of Alberta. By L. M. Lambe.

New and Otherwise Interesting Lichens from Vancouver Island and the Rocky Mountains. By G. K. Merrill.

Some Rare Cases of Albinism in Animals. By E. E. Prince.

On the Fore-limb of a Carnivorous Dinosaur from the Belly River Formation of Alberta, and a New Genus of Ceratopsia from the Same Horizon, with Remarks on the Integument of Some Cretaceous Herbivorous Dinosaurs. By L. M. Lambe.

On Gryposaurus notabilis, a New Genus and Species of Trachodont Dinosaur from the Belly River Formation of Alberta, with a Description of the Skull of Protorosaurus belli. By L. M. Lambe.

Notes on the Apothecial Stage of Sclerontinia cinerea in Ontario. By J. E. Howitt.

The Protection of Birds In and Around Ottawa. By C. Gordon Hewitt.

THE LIBRARY.

Several new publications have been added to our exchange list during the year, some of which are valuable contributions to current scientific literature. There has been quite a demand for back numbers of THE OTTAWA NATURALIST, and in most cases the requests were for a number of volumes. The most important exchange was a shipment of 10 volumes to the Natural History Museum of Hamburg, Germany, for which we received a number of volumes of their Society Bulletin, which is an excellent one.

The Club Library at present contains a number of extremely valuable books, bulletins and periodicals, which, at present, are little used, owing to the lack of an index. It is hoped, however, that an arrangement will soon be made whereby a suitable cataloguing of the exchanges will be maintained.

EXCURSIONS.

The excursions arranged for by the committee in charge were all well attended, and much interest was taken in local natural history. The work accomplished at the various outings has been reported in THE OTTAWA NATURALIST. The following is the list of excursions held:—

Spring and Summer Series:

May	3	Rockcliffe and McKay's Lake.
	10	Leamy's Lake
	17	Britannia.
	31	Aylmer
June	7	Points along Rideau Canal by motor boats
	14	Stittsville.

Fall Series:

Sept.	20	Billings' Bridge.
	27	Experimental Farm.
Oct.	14	Beaver Meadow.

LECTURES.

The series of lectures presented during the winter was also very successful. The attendance was good and the subjects discussed of much interest. The following is the programme as carried out:—

Nov. 25—Open meeting, with exhibits and addresses by members.

Dec. 9—The Old Iroquoian Religion and the Handsome Lake Reform (illustrated). By C. M. Barbeau, Assistant Ethnologist, Geological Survey.

Jan. 13—Forestry and Conservation (illustrated). By Dr. Clyde Leavitt, Commission of Conservation, Ottawa.

Jan. 27—The Shedding of Leaves, Flowers and Fruits (illustrated). By Dr. Francis E. Lloyd, Department of Botany, McGill University, Montreal.

Feb. 10—Protection of Birds In and Around Ottawa (illustrated). By Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa.

Feb. 24—Views in the Dominion Parks (illustrated). By A. Knechtel, Chief Forester of Dominion Parks, Ottawa.

Mar. 10—Mackenzie River Region (illustrated). By Charles Camsell, Geologist, Geological Survey, Ottawa.

Mar. 24—Annual Meeting and Presidential Address on the Breeding of Economic Plants. By L. H. Newman, Secretary, Canadian Seed Growers' Association, Ottawa.

THE BOTANICAL BRANCH.

There have been six meetings of this branch during the fall and winter. The first two were held at the residence of Mr. R. B. Whyte, one at the University Club Rooms and one at the residence of each of the following members: Messrs. J. M. Macoun, G. H. Clark and A. E. Attwood. Synopses of the meetings were published in THE OTTAWA NATURALIST.

In the fall it was suggested that the members should bring specimens of botanical interest to each meeting for exhibition and discussion, but the number presented has been smaller than was anticipated.

At the first meeting the members present gave brief accounts of observations which they had made during the summer. The subjects presented at the other meetings are as follows:—

Some Results of the Summer's Work. By Dr. M. O. Malte.

Some Conditions affecting Organic Progress. By C. J. Tully.

The Clay Belt of Northern Ontario. By G. H. Clark and Mr. Honeyman.

A Review of Some Recent Work dealing with the Phenomenon of Variation in Plants. By L. H. Newman.

The Wild Fruits of Canada. By W. T. Macoun.

THE ENTOMOLOGICAL BRANCH.

Several meetings of the Entomological Branch have been held during the winter now drawing to a close. The attendance

at these meetings has been good and the discussions have been extremely interesting.

During the season of 1913 large collections of insects, particularly in the orders Hymenoptera and Diptera, were made, many additions being added to the local lists. The prospects are bright for successful field work during the approaching collecting season.

The tent caterpillars, which were referred to in our last report, were, also in 1913, the most abundant insects in the district. Although certain areas of forest lands, chiefly of birch and poplar, were again defoliated, the damage was not so widespread as that of 1912. The natural parasites and fungous diseases which control the tent caterpillars are increasing, and we do not expect to again see, for many years, such enormous outbreaks of these insects.

At the conclusion of the Club year, the balance on hand is $28.59.

For accommodation for lectures and Council meetings, the thanks of the Club are due to the management of the Carnegie Library, the Normal School and the Collegiate Institute, and to the press of the city for the free insertion of notices and the publication of reports of excursions and lectures.

Respectfully submitted,

E. D. EDDY, Secretary.

WINTER NOTES ON ALBERTA HAWKS AND OWLS.

There has been a noticeable absence this winter of the Great Gray Owl, American Hawk Owl and the Snowy Owl in this district. These birds are all irregular winter visitors, arriving from the North about the middle of November and remaining until the middle of March. Some winters they are comparatively plentiful, as many as one or two of each variety may be seen in a single day. In November, 1896, I counted a dozen Hawk Owls in a day's drive of thirty miles, while the following winter, very few, if any, were seen. Different reasons have been advanced for their irregular migration, the most likely of which is the supply of natural food. Hunters returning from the country away north of the Saskatchewan River say that the Rabbit is very plentiful this winter and this no doubt accounts for their not having to move South. I have never seen any of these birds in this locality in the summer.

3rd April, 1914. F. L. FARLEY, CAMROSE, ALBERTA.

TREASURER'S STATEMENT FOR YEAR ENDING 17TH MARCH, 1914.

RECEIPTS.

Balance from previous year		$ 9.79
Subscriptions:—		
Arrears	$ 39.00	
1913-1914	194.00	
1914-1915, in advance	31.00	
		264.00
Advertisements in OTTAWA NATURALIST		103.90
Authors' extras sold		225.31
Government Grant		200.00
		$803.00

EXPENDITURE.

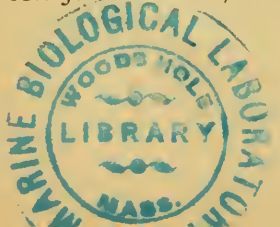
Printing OTTAWA NATURALIST, Vol. XXVII, 10 Nos., including cover	$362.00	
Illustrations	152.47	
Authors' extras	120.69	
Miscellaneous printing: circulars, mailing envelopes, etc	17.88	
Postage on OTTAWA NATURALIST	28.34	
Editor	50.00	
		$731.38
Lecture expenses		26.89
Sundry expenses, postage, bank exchange, etc		16.14
Balance		28.59
		$803.00

W. T. MACOUN, Treasurer.

Examined and found correct,
J. BALLANTYNE, } Auditors.
E. C. WIGHT, }

MEMBERSHIP FEES, 1914-1915.

Subscriptions for the Club year beginning April, 1914, are now due and should be made payable to the new Treasurer, Mr. J. F. Watson, Central Experimental Farm, Ottawa.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ON A NEW GENUS AND SPECIES OF CARNIVOROUS DINOSAUR FROM THE BELLY RIVER FORMATION OF ALBERTA, WITH A DESCRIPTION OF THE SKULL OF STEPHANOSAURUS MARGINATUS FROM THE SAME HORIZON.*

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

The osteological characters of one of the carnivorous dinosaurs of the Cretaceous are revealed in a wonderful manner by a nearly complete skeleton obtained last summer by the Vertebrate Palæontological expedition of the Geological Survey of Canada to Red Deer river, Alberta, where a magnificent collection of dinosaurian and other reptilian remains was obtained from the Belly River formation. The expedition was in charge of Mr. Charles H. Sternberg, and this skeleton was discovered by his son, Charles M. Sternberg, 3½ miles below the mouth of Berry creek (Steveville), on the south side of Red Deer river, near the prairie level.

The specimen includes the head, the greater part of the vertebral column, the pectoral and pelvic arches, one at least of the fore-limbs complete, both hind-limbs also complete, the ribs, and apparently the entire series of abdominal ribs. The cervical vertebræ appear to be missing, but as all of the sandstone matrix has not yet been removed, they, or some of them, as well as the other fore-limb, may yet be uncovered. The extreme end of the tail, back of the twenty-second caudal vertebra, was not found.

The mandible is present and all of the teeth, both upper and lower, are in place, giving the complete dentition. The writer has already published a short description of the fore-limb,** which has not hitherto been known in any of the Cretaceous carnivorous dinosaurs. Nor has a complete series of ventral ribs in any of these reptiles previously been discovered.

For the undescribed genus of Theropodous dinosaur, brought to light by this magnificent specimen, the name Gorgosaurus is proposed. The species may be called *libratus* in reference to the animal's probable well-balanced and easy gait.

GORGOSAURUS LIBRATUS, gen. et sp. nov.

Carnivorous dinosaur of large size, reaching a length of about twenty-nine feet; head narrow and moderately elongate;

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

** The Ottawa Naturalist, Vol. XXVII, No. 10, January, 1914.

trunk compact; fore-limbs minute; hind-limbs long and robust; tail nearly half the total length of the animal, tapering, and with only a slight lateral compression. In the skull there is a large antorbital vacuity, preceded by a very small opening in the centre of a depressed area. No triangular alveolar plates on the inner sides of the jaws. A foramen present in the surangular, far back and near its upper border. No presplenial. Teeth trenchant, powerful, 4 premaxillary, 13 maxillary and 14 dentary. First tooth of the maxilla similar in shape and size to those of the premaxilla. Vertebræ slightly amphicoelous, concave on the sides and beneath; 2 cervico-dorsals, 11 dorsals, 5 sacrals, and about 34 caudals. Neural spines short throughout the vertebral column. Chevron bones short, beginning with the first caudal. Transverse processes of the caudal vertebræ decreasing in size to and ending with the 14th vertebra. Anterior zygapophyses of the posterior caudals greatly lengthened. Scapula longer than the fore-limb. Humerus twice the length of the ulna. Two digits, Nos. II and III, to the manus, of which the phalangeal formula is 2 II, 3 III, the terminal phalanges being claw-bones. Metacarpal IV represented by a proximal vestigial bone. Ilium elongate, plate-like, with a flat upper outline and rounded ends. Preacetabular part shorter than the hinder portion, of which both are strengthened on the outer surface by a prominent, overhanging flange running horizontally at midheight. Ischium terminating narrowly below. Pubis ending in a horizontally expanded foot, of which the posterior extension is the greater. Femur about the same length as the tibia. Metatarsals II, III and IV elongate, of which III, the longest, is nearly two-thirds the length of the femur. Metatarsal I represented distally by a short vestigial bone, and metatarsal V represented in a similar manner proximally. Four clawed digits to the pes, viz.: Nos. I, II, III and IV, of which the phalangeal formula is 2 I, 3 II, 4 III and 5 IV. Ventral ribs composite, sixteen in number, overlapping at the longitudinal mid-line of the body, and bearing distally slender, closely applied supplementaries.

Gorgosaurus libratus, apart from its dentition, is remarkable for the extreme shortness of the fore-legs and the great length of the hind ones. The long, narrow ilium rises slightly above the short sacral spines, and, in addition to the horizontal flanges, already mentioned, there are two small strengthening buttresses running upward from the centre of the acetabular border. The length of the metatarsals is surprising. The close application of the vestigial distal end of metatarsal I to metatarsal II is indicated by a slightly concave surface on the latter bone, which

gives digit I a forwardly rather than a backwardly directed position in the foot, The vestigial proximal end of metatarsal V is in place in each leg, recalling to mind a similarly reduced bone in *Ornithomimus altus*, Lambe, also from the Belly River formation of Alberta.

Each abdominal rib consists of two well ossified, flattened lengths, which overlap at their inner ends. Outwardly, each lateral half is slightly grooved on its front margin for the reception of a slender rod-like bone (supplementary), which lies closely against the rib and projects but slightly beyond its outer end.

The four premaxillary teeth are remarkably long and slender, with a keel on each side of a slightly convex inner or lingual surface. They are latterly compressed to a slight extent, evenly rounded in front, with their fore and aft diameter a little greater than their breadth. The first or anterior tooth of the maxilla is similar to the premaxillary teeth, in which respect Gorgosaurus differs from other known genera of Cretaceous carnivorous dinosaurs. The other maxillary teeth are long and powerful, of the Megalosauroid type, with two serrated keels, one along the front edge, the other behind. In the second maxillary tooth the anterior keel in descending passes slightly toward the inner side of the crown, and this is seen in a lessening degree in the next two or three succeeding teeth. A similar slight variation is seen also in the more anterior teeth of the dentary.

The chevron bones are intervertebral, but with a greater surface of attachment to the front vertebra of the two, The more anterior ones are bent slightly backward from their mid-length. This angulation in succeeding ones becomes more pronounced until the lower edge of the distal half is parallel to the longitudinal axis of the tail. By a gradually increased development and prolongation forward of the anterior angulation at the mid-length of the bone, a "meat-chopper" shape is attained and adhered to with a gradual diminution in size, more apparent in the depth of the bone than in the length of its "foot."

The long and slender anterior teeth (premaxillary and first maxillary) of Gorgosaurus are very different in shape from the robust supposed anterior teeth of *Deinodon horridus* of Leidy. In all the large Cretaceous carnivorous dinosaurs, the majority of the teeth, apart from the more anterior ones, are remarkably similar in the different genera and do not afford data for generic distinctions.

Another large form of carnivorous dinosaur, having supporting alveolar plates on the inner sides of the jaws, occurs in the Belly River formation of Alberta and is represented in the collection of 1913.

MEASUREMENTS.

	Feet.	Inches.
Total length of specimen (estimated)	29	2
Skull, length to occipital condyle (approx)	3	2
" depth to lower border of maxilla, through middle of antorbital opening	1	0
" depth to lower border of dentary, through middle of same opening	1	$9\frac{3}{4}$
Mandible, length of	3	$2\frac{1}{4}$
Third premaxillary tooth,		
Length below alveolar margin		2
Breadth at midlength		$0\frac{3}{8}$
First maxillary tooth,		
Length below alveolar margin		$1\frac{7}{8}$
Breadth at midlength		$0\frac{3}{8}$
Second maxillary tooth,		
Length below alveolar margin		$2\frac{1}{2}$
Fore and aft diameter		$0\frac{7}{8}$
Transverse diameter		$0\frac{5}{8}$
Maxillary tooth, longest (6th), length below alveolar margin		$3\frac{7}{8}$
Dentary tooth, longest (5th), length above alveolar margin		$2\frac{5}{8}$
Cervical vertebræ (atlas, axis, 7 cervicals and 2 cervico-dorsals), estimated length	4	4
Dorsal vertebræ with sacrum (11 dorsal, 5 sacral)	7	6
Caudal vertebræ, 1st to 22nd, both inclusive	10	4
" " 23rd to 34th, both inclusive (estimated)	3	10
Scapula with coracoid, length	3	5
Humerus, length		$12\frac{3}{4}$
Ulna, length		$6\frac{1}{2}$
Radius, length		$6\frac{1}{8}$
Ilium, length (antero-posterior)	3	$3\frac{1}{4}$
Ilium, height above lower end of ischial peduncle	1	2
Ischium, length	2	$8\frac{3}{4}$
Pubis, length	3	$3\frac{1}{4}$
Pubis, fore and aft length of foot of	1	10
Femur, length	3	$4\frac{1}{4}$
Tibia (including astragalus), length	3	4

Tibia, length	3	3
Metatarsal, I, length		4½
" II, "	1	9½
" III, "	2	0½
" IV, "	1	10
" V, "		8½
Digit I of pes, length		8
" II " "	1	4¾
" III " "	1	8
" IV " "	1	4½
1st Dorsal vertebra, length of centrum of		3½
3rd " " " "		4
2nd Rib, length	3	9
Posterior sacral vertebra, length of centrum of		6½
1st Caudal vertebra, length of centrum of		6
" " " height of anterior end of centrum of		7½
5th Caudal vertebra, length of centrum of		6
" " " height of centrum of, × neural spine		11½
" " " length of chevron bone of		8
12th " " length of centrum of		5¾
" " " height of anterior end of centrum of		3½
22nd " " length of centrum of		4⅜
" " " height of anterior end of centrum of		1⅞
" " " fore and aft length of foot of chevron bone of		4
5th Abdominal rib, length of lateral half of	2	1¼
Outer supplementary of same, length of		9¾

STEPHANOSAURUS, gen. nov.

This genus is established for the reception of the species from the Belly River formation of Alberta, originally described, under the name of *Trachodon marginatus*, by the writer in 1902* from a ramus of a lower jaw and a maxilla, and from the remains of one individual. With the species were provisionally associated other elements, notably a slender footed-ischium, which associations have since been proved to be correct by further material included in the collection of 1913 from the Belly River formation of Red Deer river. These additional remains, discovered by

*Contributions to Canadian Palæontology, Vol. III (quarto), pt. II.

Mr. Charles H. Sternberg, are of two individuals to which the writer has lately referred† in describing the integument of the species. With one of these specimens the skull reproduced in plate I is preserved. Part of another skull (collection of 1913), found separately, assists in elucidating the characters displayed by the more perfect skull, and provides additional evidence regarding some of those elements to whose great development is mainly due the surprising shape of the head of this species.

The skull of Stephanosaurus rises to a great height in front of and above the eye opening. In recently describing Gryposaurus, also from the Belly River formation of Alberta, the writer commented on the anterior depth of the skull occasioned by the height to which the nasal rose. In the skull of Stephanosaurus, however, the height attained by the nasals is proportionately twice as great as in Gryposaurus; the depth of the skull above its midlength is equal to its total length. Viewing the skull from the side, the facial outline is sigmoid, at first concave, ascending rapidly from the front until it is vertical, whence it continues upward and reaches a point directly above by an even convex curve; this, the highest point preserved in the specimen, is vertically above the midlength of the skull. The general slope of the head behind is rapidly downward to the squamosal, but as this part of the specimen is imperfect, the exact outline is unknown. The almost vertical quadrate and the sinuous horizontal contour of the slender mandible below complete the profile of the head.

The orbit is small and its centre is below the midheight of the skull.

The enlargement of the skull in front of and above the orbit is due to the great development mainly of the prefrontal and nasal bones, the latter of which rises upward in front of the prefrontal and passes backward over it and beyond it. This extension of the nasal beyond the upper limit of the prefrontal appears to be supported from below by the frontal, although this last bone has not been satisfactorily recognized. Above the prefrontal and the supposed frontal, the nasal points almost directly upward. In the specimen its upper termination has been broken off, but it probably formed with the other nasal a stout spine somewhat of the shape suggested by the dotted outline in the figure.

The prefrontal is a large triangular bone with its base resting for the most part on the lachrymal, which latter is long and

† The Ottawa Naturalist, Vol. XXVII, No. 10, January, 1914.

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narrow, meets the jugal below, and posteriorly enters largely into the formation of the orbital rim.

By referring to the figure it will be seen that the maxilla, the jugal, the quadrato-jugal, the quadrate, and the mandible have much the same proportions as in Trachodon. The jugal is small, but it has the general shape characteristic of this element in all known members of the Trachodontidæ.

Anteriorly, the premaxilla is somewhat depressed, but laterally much expanded. Its upper surface, next to the median line of the head, is continued in a curve outward anteriorly and backward laterally as a marginal area enclosing a wide depression in advance of the long and narrow nasal opening. In the specimen, the outermost portion of the laterally expanded premaxilla is crushed down. The nasal opening is enclosed above by the nasal and below by a backwardly directed extension of the premaxilla. This extension, or lower limb, of the premaxilla passes along the upper front surface of the maxilla and abuts against the prefrontal. Above, posteriorly, it unites with the nasal behind the nasal opening in a short sutural contact. It is not known how far forward the nasal extends, as its suture with the premaxilla in front has not been detected.

The squamosal is preserved in part, as shewn in the figure. The postfrontal is probably represented toward its anterior end, but here its limits are not recognized, and posteriorly the bone is imperfect. As in other members of the Trachodontidæ, it no doubt contributed to the formation of the postorbital bar.

The orbital opening is narrowly elliptical, with its longer diameter directed obliquely downward and forward. It is more than twice as long as wide. The lateral temporal fossa is larger than the orbit and is also longer than wide, with a similar obliquity of length.

Detailed descriptions, with illustrations, of the maxilla, the mandible, the teeth, the ischium, the pubis, and the principal bones of the fore- and hind-limbs of *Stephanosaurus marginatus* were published when the writer established the species in 1902. The characters of the integument are known from the writer's recent description (op. cit.).

The nearest approach to Stephanosaurus is Saurolophus of Brown from a higher horizon of the Cretaceous of Alberta (Edmonton formation). In this latter genus the facial slope of the skull is about midway between that of Stephanosaurus and Trachodon. The upwardly directed nasal spine of Stephanosaurus may have heralded the backwardly sloping nasal crest

of the later Edmonton dinosaur. The two genera appear to be closely allied and in both the footed form of ischium is present.

EXPLANATION OF PLATE I.

Left lateral aspect of skull of *Stephanosaurus marginatus*; one-fifth the natural size.

Abbreviations.—*D*, lateral temporal fossa; *DN*, dentary; *J*, jugal; *L*, lachrymal; *MX*, maxilla; *N*, nasal; *NO*, nasal opening; *OR*, orbit; *PD*, predentary; *PF*, prefrontal; *PM*, premaxilla; *Q*, quadrate; *QJ*, quadrato-jugal; *S*, squamosal; *SA*, surangular.

THE LONDON BIOLOGICAL CLUB.

This club, which was formed on February 6th last, has twenty chartered members. It is the intention to hold monthly meetings and conduct field excursions. On March 6th, Dr. Hill, of the Institute of Public Health, gave an address on "Life", and on April 3rd Dr. Woolverton delivered a lecture on "The Mammoth Cave".

Recently the club presented a memorial to the Honourable Minister of Game and Fisheries, Toronto, which called attention to many native birds which have become seriously depleted in numbers, chiefly owing to shooting by sportsmen and others. Direction was drawn to the scarcity of quail in certain localities and the hope expressed that continuous protection be given so that the birds would have every chance to recover, in time, their former numbers. Other birds mentioned were the Eagle, Fish Hawk and Great Blue Heron, which have now become exceedingly rare. Many of the beneficial smaller birds are also in need of protection. In the opinion of the club, the easiest way to increase the amount of protection given by the present laws is to enact and enforce a license for all firearms except military rifles, which would prevent a great deal of the thoughtless slaughter at present carried on.

It was also suggested that the Government purchase abandoned woods and other cheap areas of land and marsh on which hunting could be prohibited, thereby forming breeding sanctuaries.

The officers of the London Biological Club are: President, Dr. H. W. Hill; Vice-President, Dr. S. Woolverton; Curator, Mr. J. F. Calvert; Secretary-Treasurer, Mr. J. W. Noble.

We extend to this new sister club our warmest greetings and best wishes for success in all branches of its work. The motto of the club, "Learn to live and live to learn," is an ideal one.

A. G.

N.
PF.
OR.
S.
D.
NO.
PM.
J.
MX.
PM.
DN.
PL.
SA.

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THE OTTAWA NATURALIST

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THE WATERWAYS OF THE MACKENZIE RIVER BASIN*

By Charles Camsell.

Introduction.

The Mackenzie is one of the great rivers of the earth, with a drainage basin covering about one-fifth of the total area of Canada, exclusive of the islands of the Arctic. The subject, therefore, is too big a one to discuss in all its details within the limits of a short paper such as this, and I will make no attempt to do so. I wish, however, to draw particular attention to what I consider one of the most important features of the region, and one on which, to a very large extent, its future development depends, namely, its navigable waterways. The importance of these waterways, first in the exploration of the region and later in its settlement and the development of its natural resources, cannot be overestimated, and these waterways can and will be used far beyond the limited extent to which they are used at present.

I have selected the Mackenzie river region for two reasons. In the first place, I am familiar with much of its geography, its natural resources and its inhabitants, and I am able to speak of them with some degree of knowledge gathered throughout many years of residence in the region. For many years I wandered over much of the northern part of the region, from the barren lands on the east to the Pacific coast on the west, travelling in summer by canoe and in winter on snowshoes. During these years I travelled over nearly all the main routes, besides some that had not previously been explored.

In the second place, the Mackenzie river region is at present beginning to attract a good deal of attention among men who are anxious to develop its natural resources in minerals

*Paper read at the meeting of the Ottawa Field-Naturalists' Club on March 10th, 1914.

and agriculture. The agricultural portion, namely, that within the basin of the Peace and Athabasca rivers, has been widely advertised as "The Last West," and is being gradually settled up. This portion of the Mackenzie basin, together with that immediately to the north of it as far as the Liard river, contains the greatest area of unoccupied agricultural country in Canada, and it is the direction in which Canadian expansion in agricultural pursuits is bound to take place.

The northern and eastern portion, however, is still largely unexplored and, while it is never likely to support a large agricultural population, offers a vast field of possibly great value to the prospector and the mining man.

To develop the Mackenzie basin, railway companies are building lines into it from the south, one going north-westward from Edmonton into the Peace river, and another down the Athabasca river, and still others are asking for charters to cross it from Hudson bay to the Pacific. Its magnificent system of waterways, with thousands of miles of river and lake navigation, combined with the transportation that will be afforded by the proposed railway lines, will make the development of the more accessible parts a quick and easy matter.

Although it is more than 100 years since the first explorer descended the Mackenzie river to its mouth, yet at the present time practically all we know of most of the region north of Athabasca lake is confined to the valleys of the main streams and the shores of the Great Lakes, and that knowledge is very imperfect. The vast extent of country lying between the river courses is still virtually unknown, except to the Indians. What those portions of the country contain in the way of mineral resources it is impossible to say and unsafe to hazard a guess, in view of the surprises we have already received in opening up similar country in northern Ontario.

Twenty-five years ago the basin of the Mackenzie was the subject of an investigation by a select committee of the Senate of Canada. The report of that committee summarizes the information that was available at that time on its climate, inhabitants and natural resources. That information is valuable to-day, but little new information has since been obtained on a great part of the region. The time is at hand, therefore, when we should endeavour to learn more about this region.

PHYSICAL FEATURES.

The Mackenzie river is on the Arctic watershed, draining an area of 682,000 square miles, a territory covering about one-fifth of the total area of Canada.

The basin of the Mackenzie comprises three main physical features: On the west is the great series of parallel mountain ranges known as the Rocky Mountain system, into which many of the stronger tributaries of the Mackenzie cut deeply. On the east is the low-lying, rocky, broken Laurentian plateau, which in its northern part is treeless and is known as the Barren Lands. Between these two strongly marked features lies the broad lowland, through which the Mackenzie flows northward to the Arctic. The Mackenzie lowland is the northward extension of our own Great Plains region. It is a country of numerous lakes and of rivers flowing in shallow valleys, and its general level is only broken by occasional low ranges of hills. It corresponds to a certain extent with the region to the south, through which the Mississippi flows southward to the Gulf of Mexico. In contrast to the Mississippi region, however, the Mackenzie lowland is forested northward to its mouth and it embraces also within its limits some of the largest lakes on the continent.

The physical features of the Mackenzie basin then are these: A mountainous highland on the west, a low-lying, rugged, rocky and partly treeless plain on the east, and in the middle a broad, almost level, forested lowland, with the trunk stream, like a great artery, flowing northward to the Arctic sea, fed on the one hand from the melting snows of the mountains and on the other hand from the numberless lakes of the plateau region on the east.

The Mackenzie ranks as one of the eight large rivers of the earth. It is exceeded in length, drainage area and volume by the Mississippi, but has a greater length and drainage area than the St. Lawrence. Its length is reckoned at 2,550 miles to the head of the Peace river and its volume at about half a million cubic feet per second, or nearly ten times as great as the mean volume of the Ottawa river.

It is navigated by river steamers for 1,300 miles without a break, from its mouth up, and above that again on the Peace, Athabasca and other tributaries for a total length of about 1,400 miles in three sections. If we include its great lakes and those tributary streams that have already been explored, it has an estimated length of navigable river and lake shore line of nearly 7,000 miles in length.

HISTORY.

The history of the Mackenzie river district is intimately bound up with that of the fur trade, and particularly with that of the Hudson Bay Company. Organized in 1670, under the name of "The Honourable Company of Merchant Adventurers

Trading into Hudson Bay," a charter was obtained from Charles the Second, which carried with it not only the right to trade, but the ownership of most of the region now included in northern and western Canada.

For 100 years after its formation, "The Company" as it is familiarly known all over this vast territory, confined its operations to the immediate shores of Hudson bay. In 1770, however, they were induced to send an explorer, Samuel Hearne, into the country west of the Bay for the purpose of finding the locality from which the Esquimaux obtained the native copper which they made into arrow heads and other implements. Hearne's first two attempts to reach the locality failed, because, as his Indians told him, he had no women on the party. "Women," they said, "were useful to draw the toboggans and carry the loads, while the men hunted; and, besides that, they could easily subsist on the bones from which the men had eaten the meat." On his last journey, Hearne discovered Great Slave lake, and explored the Coppermine river to the Arctic coast. His journey is one of the most remarkable that has ever been made in the history of northern inland travel, and for a year and a half he travelled with a band of Chipewyan Indians, living as one of themselves, under the conditions of the greatest hardship.

About this time other fur trading companies, financed from Montreal and Boston, began to enter the field in opposition to the Hudson Bay Company. Competition, however, soon became so keen that they had to unite under the name of the North-West Company. Between this and the Hudson Bay Company the rivalry was so fierce that it often led to bloodshed, but it greatly stimulated explorations in the Mackenzie basin.

The North-West Company was the more aggressive of the two and pushed their outposts far into the interior. In 1778 we find them establishing a post near Athabasca lake, and in 1785 they reached Great Slave lake, fifteen years after Hearne.

It was from Athabasca lake that in 1789 Alexander Mackenzie, an employee of the North-West Company, started on his voyage of exploration northward. On this journey he crossed Great Slave lake, and descended the Mackenzie to its mouth, the first white man to make the trip. He was six weeks in descending the river, and during this time he met with many discouragements. Meeting a party of Indians at the mouth of Great Bear river, he was told that it would still take years to reach the mouth, and they would be all old men before they returned.

Three years later Mackenzie explored the Peace river, and crossed over to the Pacific, being the first white man to cross the continent north of Mexico.

In 1821 the two fur trading companies, finding that their profits were being reduced by competition, amalgamated under the name of the older company, and thus was ended one of the most interesting chapters in the history of the Northern Interior of Canada.

In 1819 Franklin made his first journey into the Mackenzie basin, when he explored the Coppermine river and a part of the Arctic coast to the east, a journey which cost him the lives of many of his party. In 1825 he made a second and more successful trip to the mouth of the Mackenzie and along the coast to the east and west.

Franklin's journeys mark the beginning of much Arctic exploration, and in the succeeding years the Mackenzie was traversed by such men as Dease, Simpson, Rae, Richardson and many others. Many of these explorers were sent out to search for traces of Franklin's last expedition, from which neither he nor any of his party ever returned.

Much of the details of geographical work in the Mackenzie basin was filled in by the officers of the Hudson Bay Company, but few of them considered it worth while to record their observations in writing or were trained for that kind of work. In more recent times, Father Petitot did a great deal of unobstrusive exploratory work, and later still we have such men as Macoun, McConnell, Ogilvie, Russell, Bell, Preble and many others. The most important geographical and geological work in this field in the present generation is that of McConnell, whose expeditions in 1887-88 and later, added more to our knowledge of the geology and natural resources of the region than any other expeditions since.

There is still much exploratory work to be done, and there are many blank spaces on the map of the Mackenzie basin to be filled in.

UNEXPLORED AREA.

In 1890, Dr. George Dawson, in a paper before the Ottawa Field-Naturalists' Club, made an estimate of the area of unexplored territory in Canada, exclusive of the islands of the Arctic. His results were obtained in this way. All lines along which reasonably satisfactory explorations had been made, he gave a width of 50 miles, that is to say, he assumed that the explorer learned something of the country 25 miles on either

side of his route. The area between these lines was measured, and in this way he calculated that out of a total area of 3,729,665 square miles, there were about 1,000,000 square miles of unexplored territory in Canada. About 600,000 of this lay in western Canada, the rest being in what are now the provinces of Ontario and Quebec. No area less than 7,500 square miles was included.

Recently I had occasion to revise this estimate, but believing that the 50-mile strip was too wide, I took a strip 15 miles on either side of the explorers' route and reduced the explored lines to a width of 30 miles, which I think is quite enough. The result is that I find in western Canada there are areas aggregating 600,000 square miles in extent which must still be considered as unexplored. Of this area 240,000 square miles lie within the drainage basin of the Mackenzie river, an area which is almost equal to the area of the Province of Saskatchewan.

In commenting upon the area of unexplored territory that we have within the borders of the Dominion, Dawson remarked that it might be considered a reproach upon Canadians as indicating a lack of justifiable curiosity on what our country contains. That reproach still remains on us, and will continue so long as such a large proportion of our country remains unknown. Expeditions into the Arctic are useful in their way and add much to our knowledge of those little known regions, but it seems to me imperative that we should devote more of our attention to the more accessible parts of our unexplored region, on the chance of finding something on which to build productive industries and open fresh outlets for our national energy.

Every explorer, even at the present time, going into the north country, away from the regular lines of trail, takes a certain amount of risk, though that risk is not as great as it might appear to those who have no knowledge of that kind of work. Life, even for the natives, is a constant struggle, and the law of the survival of the fittest holds more rigidly in that region than in southern latitudes. It is not so much the severity of the climate and the intense cold of the winter season that take their toll of human life, but the uncertainty of the food supply. Game is very plentiful in certain parts and at certain seasons of the year, but the habits of some of the animals are migratory, especially the cariboo, on which such a large proportion of the inhabitants depend for food, and it is absolutely necessary to know those habits before one ventures without a sufficient food supply into regions distant from the few scattered trading posts.

A change in the course of the migration of the cariboo or the periodical failure of the rabbits has always been attended by starvation and hardship among the natives, and has, in the past, been the cause of occasional lapses towards cannibalism. If it were not for the food supply of fish, it would be exceedingly difficult for the natives to live at all, and it is safe to say that no country in the world has such a large quantity or excellent quality of food fishes as the lakes and streams of the Mackenzie basin.

INHABITANTS.

The population of the Mackenzie basin, at the present time, numbers only a few thousands, the larger proportion of which are Indians and half-breeds. Most of the white population is segregated on the southern fringe of the region. The widely separated posts in the central and northern parts of the basin average perhaps a dozen white people each, and these posts are usually about 150 miles apart. As far northward, however, as the Liard river and Great Slave lake, which might be considered the northern limit to which any considerable settlement of an agricultural population will take place, there is within the basin of the Mackenzie an area of about 200,000 square miles, which should be able to support a population of at least 2,000,000 people, or about ten persons to the square mile, and that mainly from agriculture.

WATERWAYS.

One of the most important features of the Mackenzie basin, and one on which to a very large extent the development of the region depends, is its system of waterways. These waterways are the main highways of the region, and except for the very southern fringe of the region, where railways and wagon roads are now being built, constitute the only routes of travel in winter as well as in summer. Until 25 or 30 years ago, the only craft plying on them were the York boats of the traders and the canoes of the natives. Since that time river steamers have been built and now run on all sections of the main waterway. At the present time steamers are running on the Athabasca, Peace, Slave and Mackenzie rivers.

The Mackenzie system of waterways, on which steamers can and do run, has a known length of river and lake shore line of 6,900 miles. This system is divided naturally into four sections, each section being separated from the adjoining one by natural obstructions of falls or heavy rapids which the steamers cannot surmount. These sections I have named for convenience:—(1) The Athabasca river section; (2) the Peace

river section; (3) Athabasca lake section, and (4) the Lower Mackenzie section. The navigable river and lake shore line of these sections have been arranged in tabular form in the subjoined table. The figures are given in round numbers.

NAVIGABLE WATERS OF MACKENZIE BASIN.

Lower Mackenzie river section:		
Mackenzie river, below Great Slave lake	1,000	miles
Peel river, to mouth of Wind river	250	"
Bear river	90	"
Shore line, Great Bear lake	1,360	"
Liard river	440	"
Shore line, Great Slave lake	1,440	"
Slave river, Fort Smith to Great Slave lake	200	"
Total	4,780	"
Athabasca lake section:		
Slave river, Athabasca lake to Graham landing	100	miles
Peace river, Slave river to Vermilion falls	220	"
Shore line, Athabasca lake	560	"
Athabasca river, Athabasca lake to McMurray	170	"
Clearwater river	80	"
Total	1,130	"
Peace river section:		
Peace river, Hudson's Hope to Vermilion falls	550	miles
Athabasca river section:		
Athabasca river, Grand Rapids to McLeod river	325	miles
Lesser Slave river and lake	115	"
Total	440	"
Total for whole Mackenzie basin	6,900	"

The Athabasca river section has a length of navigable river and lake of about 440 miles, on which steamers drawing two feet of water may run. This includes the distance from the mouth of McLeod river to the Grand rapids on the Athabasca and Lesser Slave lake and river.

This section is separated from the Athabasca lake section by 90 miles of rapids on the Athabasca river, extending from Grand rapids to Fort McMurray, which is navigable with difficulty for scows and canoes. Navigation of this section of waterways will soon be done away with on the completion of

the railways now being built to Fort McMurray and Peace River Crossing.

The Peace river section is 550 miles in length and extends from Hudson's Hope down to Vermilion falls, and is navigable for steamers with a 2½ foot draft. The Loon river, a tributary of the Peace, in this section is said by McConnell to be navigable for powerful river steamers for a distance of 150 miles, but is not included in the table.

This section is interrupted at its upper end by the Peace river canyon, where the river breaks through the Rocky Mountains, and is separated from the Athabasca lake section by the rapids known as Vermilion falls, where there is a fall in the river of about 25 feet. This obstruction could possibly be improved to such an extent as to allow steamers to pass from the Peace river section into the Athabasca lake section. The Peace river section will shortly be connected by railway with Edmonton on the completion of a line from that point to Peace River Crossing.

The Athabasca lake section has a length of navigable river of 570 miles for boats of 2½ foot draft, and a shore line on Athabasca lake of about 560 miles in length, making a total of 1,130 miles. This section includes the Athabasca river from Fort McMurray to Athabasca lake, 170 miles in length, 80 miles of the Clearwater river, the Slave river from Athabasca lake to Graham's landing, 100 miles, and the Peace river from its mouth up to Vermilion falls 220 miles. It is separated from the Lower Mackenzie section by a series of rapids on Slave river about 16 miles in length, where there is a total fall estimated at 250 feet. This break in navigation is now overcome by a wagon road of 16 miles from Graham's landing to Fort Smith, but scows and light craft are usually taken down through the rapids by making four short portages. On the completion of the Alberta and Great Waterways Railway from Edmonton to Fort McMurray, the Athabasca lake section will be directly connected with the main system of Canadian railways and there will not be the necessity for traversing the 90 miles of rapid, broken river which now separates it from the end of the railway at Athabasca Landing. Steamers are now running on this section throughout the summer season, which usually lasts about five months.

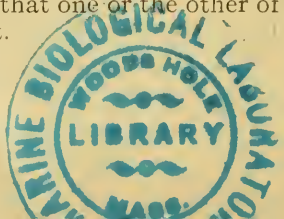
The Lower Mackenzie section is by far the most important of the whole system, covering as it does about 4,780 miles of known river and lake shore line, on which a depth of water, ranging from two feet to six feet, may be found. This section

embraces the trunk stream from Fort Smith down to the Arctic coast, a distance of 1,300 miles, over which a depth of five feet of water can be obtained. This, with the shore line of Great Slave lake, 1,440 miles in length, and the small part of Peel river, is the only part of the section that is now being used by steamers. The remainder of the navigable waters of the section are only available for light draft steamers and cannot be navigated by the deeper draft steamers that now ply on the portion previously mentioned. The Liard river is obstructed on its lower part by a strong rapid which, however, could be ascended by powerful light draft steamers with the aid of a line, making the navigable water on this stream 440 miles in length. Great Bear river, 90 miles in length, also has a shallow rapid about half way up its course which could be ascended in the same way. With this obstruction removed or overcome, the whole of Great Bear lake, with a shore line of about 1,360 miles, becomes connected with the Mackenzie system. Peel river is navigable for shallow draft steamers from the Mackenzie to the mouth of Wind river.

The Mackenzie has a number of other tributaries about which little or nothing is known, but which, on exploration, might prove to be navigable for certain distances. Among these are Little Buffalo river, Willow river, Hareskin river, Arctic Red river and some others.

The Lower Mackenzie section is navigated at present by a few small steamers that are operated solely for the benefit of the fur traders and the missions. In spite of its greater length and the depth of its channel, it is, however, used less than any of the other three sections. This, because of its remoteness.

Taking the Lower Mackenzie section and the Athabasca lake section together, it will readily be understood how important they become in connection with the exploration and development of the whole Lower Mackenzie region and a great part of the region to the east, which cannot easily be reached from Hudson bay. These two sections of the waterways are to-day suffering from the handicap of being separated from railway connection by obstructions which are not easily surmounted. This handicap will, however, be removed when the promised railway to Fort McMurray is built. It would greatly increase the value of these waterways if the obstruction of 16 miles at Fort Smith could be overcome, either by a tramway or a system of locks, and it is probable that one or the other of these projects will one day be carried out.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It is difficult to over-estimate the value of the waterways of the Mackenzie basin, not only to the region itself but to Canada as a whole. They constitute an asset of the first importance in the development of the natural resources of the region. Not only have they been the channels of trade and exploration in the past, but they will continue to be in the future the means by which further exploration, settlement and development will be carried out. In the early history of the region the waterways formed the routes by which the explorers traversed the country, and while, at the present time, most of the main streams have been explored, yet there are vast areas between these main streams, aggregating 240,000 square miles in extent, that are still unknown and the smaller streams and watercourses constitute the easiest and only natural means by which these areas are to be explored. To-day, with hardly any exceptions, the settlements of the region are situated on the waterways, and for a long time to come these waterways will determine the location of the centres of population in the region. No doubt, in the future, mining camps may be opened up in the interstream areas and agricultural communities formed in sections where the land is suitable, as is now being done in the south-western portion of the region, but in the early stages of development and growth of either of these two classes of communities, the watercourses must be used before other routes of travel are opened up.

Railways will eventually be built into the region from the south, and this period is now beginning for the extreme southern fringe of the Mackenzie basin, but unless there is some extraordinary mineral development in the northern part of the basin, the limit northward, to which the future railways will extend, will be determined by the limit at which successful farming operations can be carried on, for, except in certain exceptional cases, the products of agriculture furnish the bulk of the traffic for the railway lines.

Until these railways are built, however, water transportation must be practically the only means by which the traffic of the region is handled, and, indeed, the building of railway lines will by no means do away with the navigation of the lakes and rivers, when there is such a magnificent system of waterways, because of the difference in the cost of the one method of transportation over the other.

Of course, on account of the climate, it is not possible to navigate the lakes and rivers of the region for a longer period than four to five months of the year. On the other hand, how-

ever, the winter routes, at the present time, all follow the river courses, either horses or dogs being used, in different parts. The winter mail that is sent down the Mackenzie valley by the Government to the various posts eventually reaches Herschel island, in the Arctic ocean, and for the whole of the distance from the end of the railway line at Athabasca landing—a distance of about 2,000 miles—the route is over the ice of the Athabasca, Slave and Mackenzie rivers, and the conveyance in toboggans drawn by dog teams.

Again the waterways are of importance, because the natural resources that are known to exist on them, and those which will in the natural course of events be developed first, are to be found along them. The best agricultural land, and that which will be first utilized, is situated along the banks of the streams where the drainage is good. There is undoubtedly much that lies back from the stream courses, but this will not be taken up and worked until the available area along the valleys is occupied. The best timber also is situated on the banks of the streams.

Not only are the waterways of the Mackenzie basin important from the point of view of navigation and transportation, but because of the quantity and variety of food fishes which they contain.

The fisheries of the Great Lakes of the Mackenzie basin—namely, those of Athabasca, Great Slave and Great Bear lakes—are among the most valuable of the assets of the region. Hundreds of thousands of excellent whitefish are caught in Athabasca and Great Slave lakes every year. A great many more were caught annually a few years ago, when the trading posts were more dependent on the native food supply than they are now, and McConnell's estimate of half a million pounds of whitefish being taken from Great Slave lake in the autumn fishery of 1887 is not too large. The fisheries of Athabasca lake are equally good in proportion to its size, but both of these lakes are outdone by Great Bear lake in the size, quality and variety of its fish. Whitefish there go up to 12 pounds in weight and trout to 50 pounds or more, besides which there is the herring, which is not found in either of the other lakes. Even at present, whitefish form a very important item in the diet of the natives, and it has been proved by long years of experience that a man can live and thrive on a diet of whitefish, and whitefish alone. He will tire of any other kind of fish, even of trout, but the whitefish never. In fact, the taste for whitefish increases with the use of it.

Other natural resources which will be developed by means of the water routes are the minerals, among which are oil and

gas, coal, iron ore, salt, gypsum, and gold, silver and copper ores. The best known of these, and possibly one of the most important, is the oil, which is known to occur as seepages at points from one end of the region to the other. With the exception of placer gold from the Omenica and Cassiar districts, however, no production has yet been made of any of these minerals.

Furs are the chief products of the region at present exported, and the Mackenzie river region is considered by the Hudson Bay Company to be the best fur-producing portion of Canada.

LICHENS FROM VANCOUVER ISLAND.

By G. K. MERRILL.

The lichens here commented upon were collected by Prof. John Macoun in the vicinity of Sidney, Vancouver Island. With two exceptions, the plants are new to the Canadian flora, and several are recorded as hitherto unreported from the North American Continent. Other interesting discoveries of Prof. Macoun await future comment.

CLADONIA FURCATA var. CONSPERSA Wain. Mon. Clad. I., p. 335 (1887).

Thin earth over rocks, Beaver Lake and Fowl Bay.

Podetia erect, colored above is in the var. *palamaea*, below glaucescent, above more or less densely squamulose and isidio-squamaceous, cortex continuous below but above rimose-diffract. Unreported previously from America.

USNEA CAVERNOSA Tuck. in Agass, L. Superior. Appendix (1850).

Branches of trees, Sidney.

Remarkable because of the main branches showing articulations in the manner of *U. articulata*, and from the fact that the cortex here and there is papillose or papillose-scabrous.

LECANORA (ASPICILIA) GIBBOSA var. ZONATA Wain. Medd. Soc. pro F. at Fl. Fenn. t. VI (1881), p. 168.

Rocks, Sidney.

This is a remarkable condition of the species characterized by a sub-effigurate thallus, which is zonate toward the circumference.

New to America.

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LECANORA (ASPICILIA) GLAUCOMELA Tuck. Gen., p. 118 (1872).

Alder trunks, Beaver Lake.

Spores rounded, short-ellipsoid or ovoid, serially disposed in cylindrical asci, hymenium and hypothecium without color, the paraphyses distinct and lax.

The thallus varies from greenish-ashy in the specimens from Prof. Macoun to sordid-greenish-brown in examples from Washington collected by Mr. A. S. Foster. Tuckerman was inclined to make the present a sub-species of *L. oculata*, an assumed relationship that no one but an arrant Sporologist may assent to.

BIATORA ATROFUSCA Flot. in Hepp. Exs. p. 268 (1857).

Bark of maples and Douglas fir, Sidney.

Spores oblong-ellipsoid 15–19 x 7–8 μ, hypothecium brown, paraphyses distinct but coherent, tips thickened and brown, hymenial gelatin with I + intense-blue.

Thallus less developed than in the muscicoline conditions collected in Maine, where it was found over rocks and about the base of trees. Without question, Tuckerman united the present with *B. sanguineoatra*, and the distribution cited for that species must, in some part, represent the plant of this note.

Biatora (Biatorina) lenticularis (Ach.) comb. nov. forma nigricans Arn. in Flora 1860, p. 14.

Rocks, Sidney.

Spores ellipsoid or variously difform, bilocular, the epispore distinct, 10–12 x 5–5.5 μ, hymenium and hypothecium hyaline, paraphyses distinct, more or less discrete, tips enlarged and black, asci inflated-clavate or oblong, hymenial gel. with I + sordid-blue.

Previously unrecorded from America.

LECIDEA LATYPEA Ach. Method. Suppl., p. 10 (1803).

Fragmental rocks, Sidney.

Spores ellipsoid 15–18 x 8 μ, hymenium colorless, hypothecium brown, paraphyses distinct, slightly discrete, tips blue-green, asci ventricose, hymenial gel. with I + intense-blue.

Thalline reaction K +, C + orange-red.

While resembling forms of *L. parasema* externally, the internal characters preserve specific distinctness.

Macoun's Canadian list cites the plant from Newfoundland, and it has since been collected in Alaska, California and Washington.

LECIDEA LATYPIZA Nyl. Obs. Pyr. Orient, Bull. Soc. Linne. de Norm. 2 serie VII, p. 201 (1872).

Rocks, Sidney.

Differing from *L. latypea* only in the absence of reaction with Ca Cl.

It has also been collected in California and Washington.

LECIDEA CONFLUENS forma OXYDATA Leight. Lich. Fl. G. Brit. Ed. III, p. 304 (1879).

Schistose rocks, Sidney.

Spores ellipsoid, 16–18 x 8–9 μ, hymenium hyaline, hypothecium dark-brown, paraphyses distinct, compacted, tips brown, hymenial gel, with I + deep-blue.

Hypothallus little visible in our specimens.

Unreported from America previously.

LECIDEA (RHIZOCARPON) DISTINCTA Stiz. in Lich. Hyperb., p. 47

Rocks by the roadside, Sidney.

Spores colorless, 4-loc. halonate 25–29 x 10–12 μ, eight, or fewer, in the ascus, hypothecium and tips of the paraphyses purplish-brown, hymenial gel, with I + blue or here and there violet.

This is one of the multifarious exhibits of the section *Rhizocarpon* of *Lecidea*. In thalline characters it is similar to many other species of the section and depends for its specific standing wholly upon the hymenial characters. Unreported previously from America.

XYLOGRAPHA HIANS Tuck. Syn. II, p. 113 (1888).

Dead wood, Sidney.

Hymenial gelatine with I + faint blue.

Also detected in material sent by Mr. A. S. Foster from Washington.

OPEGRAPHA BETULINA Sm. Engl. Bot. t. 2281 (1811).

Young trees, Sidney.

Spores 2–4 locular, typically 4, halonate, 22–28 x 8–10 μ, hypothecium brownish, paraphyses distinct, slender, not coherent, tips brown, asci oblong or inflated-clavate, hymenial gelatine with I + wine-red.

Under the synonym of *O. atrorimalis* Nyl., reported from California, but little is known of the species in America.

OPEGRAPHA VARIA forma DIAPHORA (Ach.) Nyl. Scand., p. 253 (1861).

Various rough barks, Sidney.

Occurs in Washington on both smooth and rough barks.

Arthonia (Arthothelium) Macounii sp. nov.

Thallus hypophloedes albus vel cinereo-albidus effusus; apothecia .10–.05mm. lata orbicularia et elliptica vel angulosa plana vel leviter emersa nigra; sporae hyalinae cylindrico-abovoideae 40–47 x 13–14 μ muriformi-multiloculares, loculus superior reliquis multo major; hypothecium hyalinum, asci saccato-abovoidei 8 spori; gelatina hymen. iodo vinose-rubens.

Est valde affinis *A. ampliatae* Kn. et Mitt.

Ad corticem Abietum juniorum. Sidney.

Young spores 4–loc., cells of those mature commonly once divided, but sometimes twice, the large cell at times irregularly septate. Proportion of the large cell to remainder of the spore 3-10 of its length.

VERRUCARIA AETHIOBOLA var. ACROTELLA (Ach.) A. L. Sm., Brit. Lich. II, p. 282 (1911).

Rocks, Sidney.

Thallus a filmy dark stain, spores 22 x 9 μ, agreeing well with the measurements given by Nylander. The relatively feeble development of the variation prevents its easy recognition.

Unrecorded from America.

LIST OF PLANTS IN FLOWER IN THE VICINITY OF SIDNEY, VANCOUVER ISLAND, MARCH, 1914.*

BY JOHN MACOUN, M.A., F.R.S.C.

The following is, I believe, the first list of Vancouver Island spring flowers that has been published, and as most of the genera and some of the species are also found in eastern Canada, it may prove of interest to readers of THE OTTAWA NATURALIST. Fifty-seven species of phanerogams were noted in bloom during the month. It may be said that a visit to Victoria during the last week in March would probably have added ten or more species to the list.

March 1—Alnus oregana, Nutt.
" 2—Stellaria media, (L.) Cyrill.
Brassica campestris, L.
Taraxacum officinale, Weber.

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March 4—Claytonia spathulata, Dougl.
" sibirica, L.
Salix Scouleriana, Barratt.
" " var.
Senecio vulgaris, L.
Ulex Europaeus, L.
" 6—Shepherdia canadensis, (L.) Nutt.
Paspalum?
Spergula sativa, Boenn.
Lysichiton kamtschatcensis, Schott.
" 13—Sisyrinchium grandiflorum, Dougl.
Saxifraga integrifolia, Hook.
Mimulus alsinoides, Benth.
Collinsia parviflora, Dougl.
Erodium cicutarium, (L.) L'Her.
Draba verna, L.
Barbarea vulgaris, R. Br.
Brassica arvensis, (L.) BSP.
Ranunculus occidentalis, Nutt.
Pachystima Myrsinites, Raf.
" 16—Erythronium giganteum, Lindl.
" 17—Stellaria nitens, Nutt.
" 18 Berberis Aquifolium, Pursh.
" nervosa, Pursh.
" 21—Dodecatheon latifolium, (Hook.) Piper.
Lithophragma parviflora, (Hook.) Nutt.
Sanicula Menziesii, Hook. and Arn.
Arbutus Menziesii, Pursh.
Arctostaphylos Uva-Ursi, (L.) Spreng.
Arenaria macrophylla, Hook.
Fritillaria lanceolata, Pursh.
Collinsia grandiflora, Dougl. var. pusilla, Gray.
Aira praecox, L.
" 23—Fragaria cuneifolia, Nutt.
Acer macrophyllum, Pursh.
Pseudotsuga mucronata, (Raf.) Sudw.
" 24—Ribes Lobbii, Gray.
" 25—Cardamine oligosperma, Nutt.
Dentaria tenella, Pursh.
Cerastium viscosum, L.
" 26—Equisetum arvense, L.
" 27—Petasites speciosa, (Nutt.) Piper.
Rubus spectabilis, Pursh.
Ribes divaricatum, Dougl.
Cytisus scoparius, (L.) Link.

March 28—Populus trichocarpa, T. and G.
" 30—Nemophila pustulata, Eastw.
Fragaria bracteosa, Heller.
" 31—Claytonia perfoliata, Don., var. depressa, Gray.
Acer Douglasii, Hook.
Rubus macropetalus, Dougl.
Populus vancouverensis, Trel.
Equisetum Telmateia, Ehrh.

BOOK REVIEWS.

CHECK LIST OF THE FISHES OF THE DOMINION OF CANADA AND NEWFOUNDLAND.—By Andrew Halkett, Naturalist, Dept. Marine and Fisheries. C. H. Parmalee, King's Printer, Ottawa, 1913.

A sumptuous quarto volume in grey art cloth and gold, bearing the above title, has been issued from the Fisheries, Museum, O'Connor Street, under the Marine Department. It consists of 138 pages of text, introduction, and indexes, with fourteen heliotype plates of a costly character. The author, it will be recalled, is a former President of the Ottawa Field-Naturalists' Club, and is engaged in the Fisheries' Museum, and, as stated in the introduction, his object has been to supply a complete list of the fishes of Canada. Such lists as that of the Fresh-Water Fishes of Canada, printed in Montreal in 1864 for the author, Mr. H. Beaumont Small, a former active member of the Ottawa Club, and the excellent little volume by Mr. C. W. Nash, a check list of the fishes of Ontario, issued in 1908, are the only existing lists, apart from some New Brunswick, British Columbia and Manitoba lists, which cover the fresh-water species, while the lists of Kendall, Eigenmann, and, above all, of Jordan and Evermann, include marine fishes, but do not profess to treat specially of Canadian species, excepting Kendall's Labrador list. Mr. Halkett has drawn upon these authorities freely, and as the printer has excelled himself, the paper is thick plate paper with wide margins, and as the plates are costly heliotype reproductions, the result is a very striking publication. The value of such a check list, however, is not in plates or costly paper, but in completeness of matter, handy form and size, and compact description and arrangement. In these respects the

work will be disappointing to some, and the figures, 181 in number, are in very many cases from defective coloured casts, not from the actual specimens, and details, such as the plates in the gill-cover, and especially the fin-rays, are without exception, absent or blurred. The value of this check list would have been very substantial had each species been represented by an actual drawing instead of a very indistinct protographic effigy. The State of New York, some years ago, issued some plates, in annual reports, with details most perfectly delineated, and the colours accurately reproduced. Such drawings a large number of working naturalists have found most useful, and plates of that valuable character are far less expensive than costly heliotypes, such as the present volume contains. It is to be regretted that some figures show nothing at all. Thus, figures 151 and 152 Plate XIII, resemble figures of policemen's batons, but really are photographs of the Californian hag-fish. If the two figures of the pickerel or pike-perch in Mr. Nash's Check List be compared with the four very indistinct figures 112 and 113 (*Stizostedion vitreum*) and figures 114 and 115 (*Stizostedion canadense*), the contrast will be appreciated, and the lack of scientific value in the latter realized. Very few of the figures in these costly plates are of any scientific or practical utility. The compiler is not to blame for this. Photography in such cases is the worst method to adopt. As to the work itself there is evidence of painstaking industry, and, on the whole, much accuracy. Occasionally a slip occurs, as, for example, the note on page 55, which suggests that the fish called grayling in southern Alberta is *Thymallus tricolor montanus*. It is nothing of the kind, but is the active, gamey little whitefish, *Coregonus williamsoni*, as the Commissioners of the Alberta Fishery Commission (Marine Department, Ottawa, 1912, page 19,) distinctly stated. The value of the work would have been greatly increased had the author followed the plan of the Rhode Island Commission's Check Lists and given some details, wherever possible, of the spawning period and the nature of the eggs. Much information has been recently accumulated in regard to that important phase of fish life, and it is stated that a forthcoming Check List, to be issued by the Biological Board, will include such valuable scientific information. Mr. Halkett must, however, be congratulated on completing a very handsome volume, involving much thankless drudgery and consultation of authorities, and the book fills a vacant place, much needing to be filled.

C.

FODDER AND PASTURE PLANTS. By Geo. H. Clark, *B.S.A.*, and M. Oscar Malte, *Ph.D.*, with water colour illustrations by Norman Criddle. Available at the office of the Superintendent of Stationery, Government Printing Bureau, Ottawa; price 50 cents.

This admirable work is a valuable contribution to our knowledge of fodder and pasture plants in Canada. It has been several years in preparation and may be described as a companion volume to "Farm Weeds in Canada," a work which, upon its appearance several years ago, called forth very favourable comment because of the excellence of the matter and the effective method of its presentation.

In "Fodder and Pasture Plants," the authors have succeeded exceptionally well in treating a technical subject in language intelligible to the general reader. Without sacrificing scientific accuracy, they have presented, in a popular way, the essentials in the successful production of fodder and forage crops adapted to general growing in Canada. The information relative to these crops has been presented in concise, yet sufficiently comprehensive, form. The practices advocated by the authors have behind them the sanction of accepted good farm practice, supplemented by the results of recent experimental research.

In addition to containing forty coloured drawings of the seeds of grasses and legumes of greatest economic importance in Canada, the volume contains twenty-five full-page illustrations, in natural colours, of the principal crops under consideration. These artistic reproductions are from the work of Mr. Norman Criddle and contribute much to the attractiveness and value of the text. With the exception of the root systems represented, the illustrations are remarkably true to life.

The quotations from early agricultural writers are, in the main, apt. In a work of this character, the wisdom of quoting so freely from such sources leaves room for difference of opinion. Since, however, the arrangement of the plates determined the paging of the text, this departure is perhaps justifiable.

This publication has been issued under the direction of the Hon. Martin Burrell, Minister of Agriculture for the Dominion. Copies may be had from the Superintendent of Stationery for the nominal sum of fifty cents. Farmers, students and teachers alike will find in this excellent work much valuable information relating to fodder and forage crops the value of which, in the economy of general farming, agriculturists have been slow to appreciate.

L. S. KLINCK.

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ABSCISSION.[1]

By Francis E. Lloyd.

Among the ever recurring phenomena which characterize the lives of plants, perhaps none is more impressive than the usually sudden and complete loss of foliage by trees and shrubs on the approach of winter, unless it be the untimely occurrence of the same change ensuing upon an untoward drought or some equally unfavourable climatic disturbance. The uncouthness and semblance of death attaching to a leafless tree when it should be enfolded in a robe of verdure strikes a sad note, however little one may appreciate the exact nature of the importance of leaves in the economy of the plant. And, when one enters a tropical region, it is the everlasting verdure which at once wakens the interest.

But the fall of the leaf is only one of a series of similar behaviours, in many instances leading to an increase in individuals rather than a mere riddance of parts which are unable longer to resist the conditions imposed upon them. The multiplication of simple plants, such as the algae, by a separation between contingent cells, the breaking away of pieces of stem, of leaves, brood-bodies and the like, so commonly occurring, but usually unobserved, in the mosses (Correns, 1); the shedding of leaves in plants which, like *Bryophyllum* and *Begonia*, use them as a means to propagation by the growth of new plantlets from the leaf-margins or elsewhere; the separation of staminate

[1]The text of a lecture delivered under the little "Abscission in Flowers, Fruits and Leaves" before the Ottawa Field-Naturalists' Club, Jan. 27, 1914. Although of a general nature, it includes the results of original observations on a series of about 30 species, with especial reference to the mechanism of abscission. The details of this phase of the work are reserved for another paper, and a brief preliminary account only is given here. All the work on the cotton, (*Gossypium herbaceum*), here reported was done at the Alabama Polytechnic Institute (account of Adams Fund) or at West Raleigh, N.C., (accounts of Bureau of Plant Industry, U.S. Dept. of Agric. and of McGill University).

flowers in the hydrocharids in order to effective pollination—these exemplify the same activity leading to renewed life rather than to the mere sloughing of parts moribund or dead.

The processes by which these results are brought about and the conditions leading to them constitute the subject of this essay. There is also the purpose of presenting a general summary of the problem of abscission as at present understood. It will be deemed unnecessary to make an extended historical review of the development of our knowledge, which, from lack of space, must in any event be excluded.[2] Only pertinent references, therefore, will be made during the progress of this discussion. Unless specific mention is made, it will be understood that the more highly organized plants are meant.

THE PARTS OF PLANTS WHICH MAY BE SHED.

Aside from the outer layers of the stem, namely, the epidermis and dead cortex, with included tissues, the parts of the plant which may be shed by the process of abscission are transverse segments of the stem, including one or more internodes, either with or without attached flowers; or any lateral organs, either foliar or floral.

Beginning with leaves as the most familiar examples, we notice further that either the leaf as a whole falls away from the supporting stem, or, when compound, the individual leaflets fall separately (Ash, Horse Chestnut, Boston Ivy, etc.). The instances of *Ampelopsis Veitchii* and *Citrus* sp. may be especially mentioned since in these forms the apparently simple leaves are separated both at the base of the leafblade and at the base of the petiole. *Ampelopsis Veitchii*, however, produces trifoliolate leaves on older shoots, and certain *Citrus* sp. have also compound leaves, so that the single blade may be regarded as a terminal leaflet or as a fusion product of three. In the cases which I have studied (*Ampelopsis*, *Vitis*, *Fraxinus*, *Aesculus*, *Negundo*) leaves and leaflets present no difference in the method of separation, in concurrence with earlier students (Tison, Loewi, (3) in *Citrus*), so far as attention has been paid to the matter.

The position of the plane of separation varies, but is to be found near the base of the organs in question. In the case of the petiole, it may occur at a point further removed from the stem, and thus leave the leafbase clasping more or less completely the axillary bud (*Smilax*, *Philadelphus*, *Platanus*). In *Smilax*, the leaf is cut off above the tendrils, so that, although these are of foliar origin, they are allowed to remain supporting

[2] This material may be in large part found in the detailed paper of Tison (2).

the plant. Aside from special cases of this kind, there is some variation of position, as noted by Loewi (3, page 998) in the leaf of *Cinnamomum*, in which the abscission plane was found, in a very few instances, to lie in the neighbourhood of 2 mm. above the expected position. In *Hamamelis* there are two parallel separation zones a short distance apart. The leaf is first set free by the upper one in the autumn, and in the early spring following a short segment is thrown off (Tison 2). Practical identity of position is attained only in those forms possessing a differentiated layer of tissue, such as that in *Polygonum*, *Syringa* and *Ziziania*, in which it happens that the abscission plane lies, but why it should do so is not clear. On the other hand we can very surely say that in many, if not in most instances, there is no slightest suggestion in the histological structure of the organ of a specialized abscission layer (*e.g.*, *Vitis*, *Spiraea*, *Philadelphus*, *Hydrangea*), and we may say, with Loewi, that abscission is a physiological response, adaptive if you please, to stimuli, and is not conditioned by a predetermined structure.

The falling away of the leaf, far from being an economical process, is a necessary response to conditions imposed. To be sure, acids of silica and lime usually assumed to be useless, occur in double the usual quantity in falling leaves, while there is a decrease, due to movement into the stem, of nitrogen salts. The conclusions of Ramann, (4) do not, however, accord wholly with those of Combes (1911), who has held that a migration of substances prior to leaf-fall does not occur, nor are those remaining in the fallen leaf to be considered *a priori* as non-utilizable. Much, he maintains, remains which might have been used. The leaf may in this respect be compared to dead and exfoliated bark, which also is not devoid of useful materials. Foods (starch, sugar) are certainly lost in floral parts and in fruits which have suffered abscission—*e.g.*, starch is lost with the corolla of *Gossypium*.

The abscission of cotyledons normally occurs in the aroid *Cryptocoryne ciliata* and in the mangrove (*Rhizophora*) (Goebel, 6). These plants are viviparous; their embryos withdraw the overplus of foods from the cotyledons, which, after abscission, remain within the fruit. The seedling then shifts for itself, finding anchorage in the soft mud of the shore line habitat. There are, however, other viviparous seedlings which are released from the parent plant without separation of the cotyledons (*Podocarpus*, Lloyd, 7).

Such adaptive behaviour may be matched by examples of disharmony. The "calamander," a sort of teak (*Diospyros ihrsuta* L.), of Ceylon, is one such. Abscission of the cotyledons

intervenes so constantly during the earlier stages of seedling development as to make it very difficult, if not impossible, to grow the tree from the seed.[3] The usefulness of the seed is thus defeated.

Again, many plants are unable to shed their leaves at all. *Eupatorium adenophorum*, like a multitude of others, does not do so in nature, nor, as found by Wiesner (1905, through Loewi), even under experimental conditions. This disharmony is not confined to herbaceous plants, as I have found it to occur in the perennial shrub *Parthenium argentatum*. This plant, neither in its native health nor under a variety of experimental conditions, is found to lose its leaves save by a long delayed method of wear and tear, somewhat hastened it may be by a clumsy development of corky tissue continuous with that of the stem, but developing first from a centre at the leafbase. (Lloyd, 8).

ABSCISSION OF SHOOTS.

Not a few trees are able to shed, by a process similar, if not identical,[4] with that in leaves, their smaller, and in some cases, even their larger branches. The Central American Rubber Tree (*Castilloa elastica*) is a striking illustration, and has been described by O. F. Cook (9). The young tree produces no permanent branches till the third or fourth year. Those which develop before that time are long and semi-pendulous, measuring scarcely one inch in diameter at the base and reaching a length of ten or twelve feet. These are all shed, being released by a softer layer of tissue, arranged in the form of a socket, quite at their basal extremities. The loss of twigs by poplars, willows and other trees is comparable with, if not as striking as, that of *Castilloa*. The shedding of twigs produced from axillary buds which grow at once, instead of entering a resting condition, occurs in the camphor tree (in Alabama), which, in respect of general appearance of the abscission, is very similar to *Castilloa*. The mechanism of abscission in its living tissues (cortex) is identical with that of the leaf, as v. Hoehnel observed in *Populus*, *Salix*, beech, etc., and as Loewi also found to be the case in *Cinnamomum Camphora*. *Euonymus atropurpureus*, which is grown in this part of the world as a small ornamental tree, also sheds its twigs, more especially those which happen to be exposed to the denser shade of overhanging branches. Loewi observed this behaviour in potted plants, attributing it to too

[3] My attention was drawn to this instance by my colleague, Professor Willey. See Wright, H., Ann. Roy. Bot. Gard. Peradeniya, vol. 2 (?).

[4] It is obvious that when large masses of wood, etc., are involved, some sort of fragmentation must take place, but a really satisfactory account of the underlying causes is not yet available. See, however, v. Hoehnel, 10, 11.

high a relative humidity, though it occurred also in cut branches, but more slowly, when exposed to drier room air.

The abscission of internodes and of shoot-tendrils (such as those of *Vitis*, *Ampelopsis*) offers another case in point. The tendrils may either persist and serve as a permanent mechanical support for the plant, or they may be shed from the more distal portions of the new stems, as occurs at the end of the growing season. The behaviour may be very well observed in *Ampelopsis Veitchii*. The internodes of the apparently chief shoots are equally marked in this respect. In both ordinary shoots and in tendrils, the plane of abscission lies near, but not precisely at, the base of the internode affected, and is not marked by any histological differentiation. In certain instances the abscission-plane is oblique, or even decurrent, such deviations being found where morphological displacement has occurred. According to the more generally accepted view, the tendril in *Ampelopsis* and *Vitis* is a chief shoot. Its normal position is therefor directly opposite a leaf, from the axil of which the supplanting shoot of the second order arises. However, the tendril frequently, and even usually may, in particular individuals (*Ampelopsis quinquifolia*, according to my observation), suffer an upward displacement of as much as 20 mm., and in such event the abscission plane of the internode above the secondary shoot will be oblique in a degree commensurate with the amount of displacement of the tendril. (Figure 1.) The fact of this morphological disturbance is of great importance in understanding the position of the abscission-plane in the cotton peduncle, as we shall presently see.

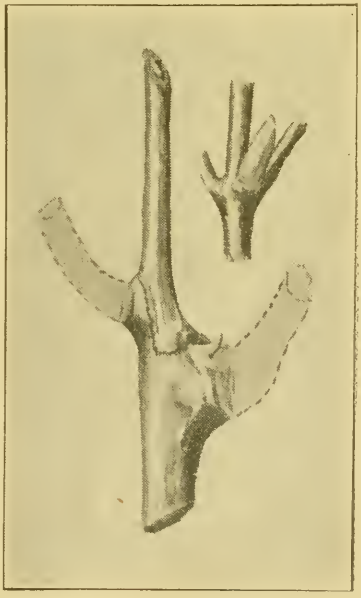


Figure 1. Oblique abscission of an internode in consequence of the upward displacement of the tendril which normally occurs directly opposite a leaf. The normal relation is shown in the upper figure. (*Parthenium argentatum.*)

The only other further example of shoot abscission to be here cited is that of the clumps of spines in certain cacti, of which *Cereus Thurberi* serves as an excellent example. The fleshy fruits of this species are covered by

an armour of spines arranged in clusters, and, as the fruit matures, they are sloughed off. The mechanism involved has not, to my knowledge, been studied. It would be useless to speculate on the "biological significance" of this procedure.

THE ABSCISSION OF FLOWERS AND FRUITS.

The structure aggregates which, specialized with reference to reproduction, take the form of flower-shoots, and, with the progress of events, of fruit shoots, simple (supporting a single flower) or compound, may or may not normally be shed.[5] The cotton, peach and tomato, under, at present, little understood conditions, sometimes lose a very large proportion of their flowers before anthesis, to the great prejudice, as it is assumed, often not out of harmony with the facts, of the expected crop. Farmers and horticulturists frequently lose 50 per cent. or more of the theoretical returns for the labour expended.

Abnormal shedding of the entire and perfect flower *while open* is, for reasons not comprehended, relatively rare, though it is known to occur in cotton, as I have myself observed. *Mirabilis jalapa*, the well known Four-o-clock, does so phenomenally under untoward conditions, and has been studied particularly by Hannig (12), who furnishes in his paper a list of some twenty or thirty other species which may behave similarly. On the other hand, normal abscission intervenes, to remove staminate flowers after pollination has occurred, in the cucurbits, and before, and as a *conditio sine qua non* to it, in the hydrocharids. The eel-grass is a classic example, whose staminate flowers are loosened in the morning (Wylie, 13) and, floating on the surface of the water, open and bring their pollen by the chance of currents and surface tension into contact with the stigmas of the pistillate flowers. A still more remarkable behaviour is that of the closely related *Enalus acoroides*, of the eastern tropical shores. This has been more fully studied by Nils Svedelius (14), who points out, however, that Zollinger was the first to record the floating of the staminate flowers. These, according to Svedelius, are released at low tide. Having come into contact with the pistillate flowers, which reach to the surface only at this time, they are grasped by the petals, and in spite of the rise of the tide, are held firmly, and pollination proceeds below the water surface.

Just as abscission occurs before and during anthesis, conditions may be such as to induce the shedding of the developing fruit. The "boll-shedding" of the cotton intervenes chiefly during the earlier stages of development of the fruit or "boll,"

[5] With various form of dehiscence this paper has nothing to do.

as it is acceptedly called, as shown by figures derived from a study of Egyptian cotton by Balls (15) and of the Alabama upland plant by myself. Balls found that upwards of 90 per cent. of the bolls shed did so within three of four days after flowering. From a statistical examination[6] of 579 shed bolls at Auburn, Ala., it emerged that the distribution of shed bolls, according to age, shows that the vast majority of bolls are shed at the ages of from three to seven days inclusive, and have at shedding a diameter of 12 mm. or less. In fact, 95 per cent. are shed before the end of ten days. (Figure 2).

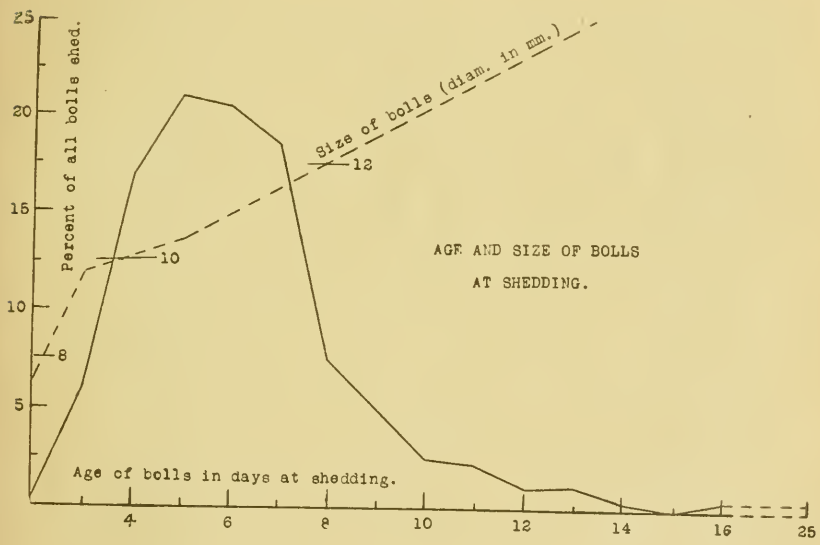


Figure 2. Graphs for age and size of bolls at shedding in percentage of the total shed. (*Gossypium herbaceum*).

The so-called "shelling" of grapes, which may greatly reduce the crop just at the period of maturation, appears to be the result of a definite abscission process comparable to the shedding of the cotton boll, except that the plane of separation occurs at the base of the ripened ovary and not at the base of the pedicel.

There are instances of indehiscent fruits in which exceptional behaviours may be seen, of which that of *Polygonum virginianum* and of the wild rice (*Zizania* spp.), may be quoted.

[6] Based upon data collected by my then assistant, Mr. C. S. Ridgway, who has kindly referred them to me.

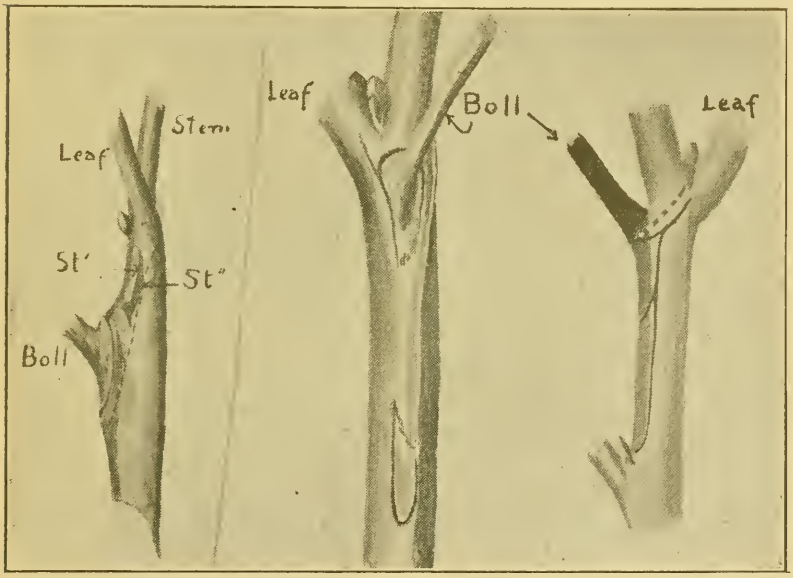
The former, according to Reed and Smoot (16) is peculiar in having a layer of compressed pith cells enclosed in the vascular cylinder which remains unbroken until touched, although the cortex already shows complete abscission. Impact sufficient to break the vascular tissue allows the expulsion of the fruit, to a considerable distance. Those who have become familiar with the wild rice recall the fragile character of the stem below the spikelet, which breaks away at a slight touch. It needs not to do more than recall the various behaviours of plants which, like the compositae, set free their one-seeded fruits, sometimes singly, as in *Adenostemma* (Yapp, 17) and indeed in the majority of the family, and sometimes in groups, as in *Parthenium*, in which each of the five achenes is accompanied by two sterile flowers, while all the remaining staminate flowers are set free *en masse* (Lloyd, 8).[7]

Since the abscission of flowers and fruits results from a transverse or oblique cutting off of the stem, we should expect that the plane of separation would fall at or near the base of an internode. According to Hannig, however, this takes place immediately beneath the flower at the top of the pedicel in several species (*Nicotiana*, *Salvia*, etc.), and in the middle of the pedicel in others (*Solanum*, etc.). In still other species, the abscission plane falls just above a very small bract, these, therefore, according with the general rule. It may be mentioned in this connection that while separation near the base of the chief axis of the inflorescence may take place (*Mirabilis* and *Oxybaphus*, Hannig; *Impatiens Sultani*), it is no less worthy of note that, in many plants, even after the usefulness of the inflorescence has passed, their chief axes remain as permanent encumbrances. I have been able to find the traces of them in *Parthenium argentatum* after the passage of five years or longer. Among our own plants one easily finds similar examples, *e.g.*, *Rhus*, *Negundo*, *Syringa*, etc. And there are very many plants (palms, agaves, ferns, etc.) to which the leaves cling indefinitely, until they are worn or rotted away.

A case requiring special explanation is to be found in the Cotton (*Gossypium*), in which the plane of abscission may pass transversely through the base of the pedicel, or may extend downwards along the internode below, even as far as the next node. The diagram (Figure 3c) presents these diversities in graphic form. It has long been a puzzle to those concerned with this plant to account for this peculiarity, recorded in a bulletin on the diseases of the cotton by Atkinson (18) in 1897. To

[7] The separation of such parts may be passive and involve no special abscission mechanism of living cells.

understand it, the morphological character of the flowering branch, as modified by dorsiventral development and by disharmonic growth in a longitudinal sense as between the upper and lower moieties of the axis, must be comprehended. The flowering branch is sympodial, but this is frequently much masked by displacement due to elongation of the nodal segments. That such elongation occurs is proved by the position of the stipular ridges[8] and occasionally by the actual longitudinal renting in twain of the stipular blade, and the distant separation of its two moieties by intercalary growth in the axis. In



A B C

Figure 3. (a) The position of the abscission layer in the peduncle of cotton when it is downwardly displaced; (b) the same when, instead of total displacement, the base of the peduncle is elongated; (c) diagram to indicate possible positions of the abscission layer as determined by the elongation of the peduncle base. In (a) and (c) the stipule of the hidden side is indicated by a broken line. (*Gossypium herbaceum*).

extreme cases of this kind, what appears to be an internode is really a much extended node, in which event the peduncle, which is the chief shoot, will be downwardly displaced as a whole (Figure 3a) (it may be to the lower limits of the stipular ridge), or its base will be correspondingly drawn out (Figure 3b). If

[8] Cook, O. F., (20) has discussed this point, but does not draw any unequivocal conclusion, inclining the view that the flowering branch is monopodial, which myself found it difficult to avoid, until the evidence forthcame.

this displacement does not occur, the abscission plane of the peduncle is transverse through the base; if displacement has intervened, the abscission plane runs down the false internode, as it may be called, and, in extreme instances, as far as the node below. It should be stated that the displacement in question is always greater on the upper side of the dorsiventral shoot in such a manner as to cause a slight axial rotation of the peduncle. We must, therefore, conclude that abscission in the cotton is always through the base of the peduncle, and when it is decurrent it is so because the base of the peduncle is stretched out in consequence of the extension of the nodal zone. The position of the plane of separation is marked by a low ridge. There is, indeed, especially visible in flower buds and quite young bolls a slight groove parallel and close to the base, but this has no constant relation to abscission, contrary to Ball's statement.

THE ABSCISSION OF FLORAL PARTS.

The separation of the parts of the flower may, on similar grounds, be compared with that of the leaf. It occurs normally toward the close of anthesis, and, indeed, may be taken as its index, just as the unfolding of the flower-bud marks the beginning of this critical period. The whole matter is too complex and varied for brief presentation, so that it must suffice to make a mere summary. With the culmination of flowering, any of the organs taken separately, or any structural segregate of them, may be found to fall away. The sepals (*e.g.*, in *Sanguinaria Impatiens*, *Cruciferae*, etc.), petals, stamens, anthers or styles may do so, or the corolla as a whole in the sympetalae, or the corolla and androecium in one piece (*Malvaceæ*) synchronously with, but independently of, the style, and so on. Conversely, these parts may be variously adherent, and wither *in situ*, affording another case of disharmony. Witness the frequent adherence of the calyx (Rosaceae), of the androecium (Leguminosae) and even the corolla (*e.g.*, many Orchids, etc.), specific instances being afforded by the previously cited *Cereus Thurberi* by *Echinocactus Emoryi*, and by *Habenaria* among the orchids.

The position of the abscission plane, as in the leaf, is near the base of the organ or complex of organs involved. Its direction is, however, subject to more variation than it is in the leaf, and may run much more obliquely. For example, this direction in the corolla of the cotton flower varies from transverse (which is rare) to an obliquity of 45 per cent., which is usual. The style of this plant calls for special notice in this connection. Separation of this organ begins during the second afternoon of anthesis, and may usually be detected at about 3 o'clock. But instead of being confined to one level, it occurs at several, so

that one may describe the process as a fragmentation of the lower part of the style. In the course of a short time, the raw edges of the fissures become brown by oxidation, thus discovering them to the eye. The separation of the corolla proceeds at the same time, although the actual cadence is evident only on the following morning. The abscission plane in the tobacco corolla is irregular and lies a millimeter above the base of the tube (Kubart, 19), while in the epigynous forms it is found above the ovary, and so not at all near the morphological base of the elements of the corolla.

It is only rarely that in leaves there is any externally visible structural indication of the position in which abscission will ensue, and it frequently happens that grooves which are sometimes taken for such indications bear no relation at all to the process. It is probable that in the case of the corolla, or of the individual petals, it is more frequently the case that a more constricted region is made use of. Fitting points this out especially in *Geranium*, *Erodium*, etc., describing it as an extremely narrow, isthmus-like reduction of the blade—a very usual condition. Nevertheless, such a reduced region is entirely wanting in many other species, so that it seems hardly probable that there is any necessary connection between the two phenomena.

PERIODICITY IN ABSCISSION.

We consider, under the head of periodicity, more especially that of leaf abscission. It is true that external conditions affect also that of floral organs, and, to the careful studies of Fitting (20) and Hannig (12) more especially, reference will be made beyond. The apparent synchrony between the fall of the leaf and the end of the growing season being the most widely recognized, it is convenient to discuss this especially.

I say apparent, since, in a large measure, we are deceived in temperate and boreal regions, as well as in the tropics, by the continuity of verdure in its entirety. The constant dying-off of leaves escapes attention, albeit a little careful observation will discover the fact. During, or soon after, the unfolding of the buds in spring, the bud-scales suffer abscission, and as the new shoots advance in age the earlier formed leaves in their turn drop off. Nevertheless, the majority of the leaves produced during the season are, under normal seasonal conditions, shed within a rather short space in the autumn, the exceptions to this rule being the so-called evergreens, in which the life of the leaf is extended over a longer period, namely, two seasons or more. Obviously, in these the longevity of the leaf is predominant, seasonal responses being seen in the growth of stem

and new leaves in the spring. In the tropics various factors may be effective at various times, which may also be said of the warmer desert regions, where rain may induce the production of foliage at any time of the year. (*Fouquieria*, Cannon, 22).

The loss of foliage in areas of marked seasonal change is a response to environmental stimuli, found in conditions which are usually and on the whole unfavourable for growth or for the physiological processes which take place in the leaf. If it happens, as in exceptional years it will, that such or analogous unfavourable conditions intervene at unusual times, general defoliation will ensue just as promptly and completely as at the usual time. Only last year (1913) in Nebraska, an almost unprecedented period of high temperatures and meagre rainfall, together with low relative humidity, caused, in addition to a far-reaching prejudice to crops, a marked shortening of the usual vegetative period. Herbaceous plants hastened to fruitage, and "early leaf maturity and leaf fall was common among native and exotic forest trees." During the late summer, after the drought had been broken, refoliation occurred, but the new leaves were small (Pool, R. J., 23). Klebs (24), cites a similar occurrence in Germany during the summer of 1910, caused by dryness in July and August, followed by refoliation, and speaks of the case as a natural experiment on a large scale to support his contention that the periodicity of trees expressed in leaf-fall is a response to external conditions, and not, as Volkens (25) has argued, especially in regard of tropical plants, a periodic phenomenon independent of the external environment, and dependent on inherited and inherent causes. The basis for this view was Volkens' failure to observe any relation between the march of climate and defoliation, as, *e.g.*, in *Ficus fulva*. Klebs insists, however, that the time of defoliation may be shifted by disturbance in surrounding conditions, and cites, among others, the fact that tropical plants could be made to shed their leaves in the very short time merely by a reduction of light.

However the attack on this problem may turn out, it is worth while to indicate that a conclusion, such as Volkens arrives at, is a sort of mental anæsthetic, which, like the vitalistic theory, lulls the mind and inhibits vigorous and critical attack. As Klebs very rightly puts it, every life-process depends in some degree upon the external world, and it is only by experimental methods that we can hope to come at a right analysis of this complex relation.

(To be continued)

A PLEA FOR THE PUBLICATION OF A NEW ILLUSTRATED FLORA OF THE PROVINCE OF QUEBEC.

In the annual report of "The Quebec Society for the Protection of Plants" for 1911-1912, the following statement appears: "Many years ago Abbé Provancher published a work entitled '*Flore du Canada*' in two volumes, which has been out of print for some years, and is now very difficult to procure. No work on systematic botany has taken its place in Quebec, consequently this phase of the study of plant life has been, to a large extent, neglected in the French schools of the province. I would, therefore, suggest that the society request the Government of the province not only to reprint a revised edition of Provancher's work, but also to publish a school edition of the same. The publication of these two editions would give a stimulus to the study of plants, and indirectly would tend to a better knowledge of weeds on the part of the rising generation."

As an admirer of Abbé Provancher, and one who, moreover, has followed closely in his footsteps for the past ten years, I beg leave to express an opinion on the matter.

There is no doubt that the name of Provancher has a prominent standing in the history of Canadian science. Under struggling circumstances, without special training or laboratory facilities, far from technical libraries, he, however, accomplished a stupendous amount of work and cleared the ground most efficiently for future workers.

The "*Flore Canadienne*" was a most extraordinary achievement for the time, and, although fifty years have passed,—fifty years of feverish activity—even though it is now largely obsolete on account of the steady advance in botanical studies, we must admit whatever our language is that no other book, as yet, has attempted to displace it.

Nevertheless, the proposal of reprinting Provancher's work is a rather sad acknowledgment of inability; to state my opinion briefly, I consider that such a reprint, if the essential features are preserved, would be a step backwards.

In the course of the last half century the systematic botany of North America has benefited by the labour of a host of serious workers. Unknown regions have been penetrated, thousands of new species established and the nomenclature more than once disturbed and subjected to new investigations.

Mentioning only the Province of Quebec, the careful survey of Prof. M. L. Fernald and his Harvard friends has shown, in the Gaspé Peninsula, the existence of an altogether unknown flora akin to that of the Rockies. Of this fact, of course, Provancher had no suspicion.

Such genera as *Isoetes*, *Potamogeton*; *Juncus*, *Carex*, *Rubus*, and especially *Crataegus*, have revealed an amazing wealth of species. Everybody knows the hawthorn, and appreciates it more or less, but very few would suppose that the American species now number about 1,000. The joint work of C. S. Sargent and J. G. Jack have shown the limestone ridges of Montreal and the contiguous shales to be one of the richest regions in the whole world in forms of *Crataegus*. Although there is much yet to do in the genus, it can already be foreseen that the new Flora of Quebec will be bound to include as many as 60 or 70 species.

I do not wonder now about my perplexities while first trying to separate the Longueuil *Crataegi* with Provancher as a guide. It was only when I opened the pages of the seventh edition of Gray's Manual, and when I was made acquainted with Mr. C. S. Sargent, that I began to understand something regarding them.

Provancher believed the distribution of plants in Canada to be zonal, according to latitude, and, consequently, to be approximately identical from the Atlantic to the Pacific; this belief he had in mind when he entitled his work "Flore Canadienne." This generalization has not proved successful. We know to-day, by the collections of Macoun and others, that the prairie region, the Rockies, the Pacific slope, have each a distinct flora, and a "Canadian Flora" embodying the whole of the territory, would be an immense enterprise.

Properly speaking, Provancher covers but the central portion of the Province of Quebec. The list, with analytical keys, annexed by Abbé Moyen to his own "*Traité de Botanique*," though more complete, is yet fragmentary, and must undergo the very serious criticism of lacking the descriptions necessary to every one except the trained specialist.

I think that the demand is for a new "Flore Illustrée de la Province de Quebec," embodying the Ungava territory, and brought up to the present state of botanical science.

Such a publication is no easy task. Difficulties are numerous, and foremost among them would be the cost of production, including the necessary illustrations. These latter alone would cost a large sum. I hardly think that any private enterprise in this line would be possible. It seems that the Provincial Government should take charge of the work, through one of its departments, subsidizing it as the work goes on.

BROTHER M. VICTORIN,
of Christian Schools.

Longueuil College, P.Q.,
March 24th, 1914.

PUBLICATIONS OF THE CARNEGIE INSTITUTE OF WASHINGTON LATELY PLACED ON THE SHELVES OF THE REFERENCE ROOM, CARNEGIE PUBLIC LIBRARY, OTTAWA.

Botanical Features of the Algerian Sahara. By Wm. A. Cannon.

Handbook of Indians of Canada. Ed. by F. W. Hodge.

Determinate Evolution in the Color-Pattern of the Lady Beetles. By R. H. Johnson.

Studies in Heredity as Illustrated by the Trichomes of Species and Hybrids of Juglans, Oenothera, Papaver and Solanum. By Wm. A. Cannon.

The Conditions of Parasitism in Plants. By D. T. Macdougal and W. A. Cannon.

Studies of Inheritance in Rabbits. By W. E. Castle.

Distribution and Movements of Desert Plants. By V. M. Spalding.

THE CARDINAL GROSBEAK IN WINTER IN NORTHUMBERLAND COUNTY, ONTARIO.

A specimen of the Cardinal Grosbeak was observed at Brighton, Northumberland County, on the morning of February 22nd last. The day was very cold, with strong wind and snow-drift. The bird was quite tame, and was evidently a female on account of lack of bright plumage. Those who called my attention to the bird did not recognize it, neither did I at first, never having seen one alive in a wild state. I suspected the species, however, on account of the large, ivory, reddish beak and a red cast in the plumage and in the tail feathers. On my return home I looked up the description of the species, and was at once satisfied that I had diagnosed it correctly. I suppose this is about as far east an Ontario record as we have.

I may mention that the migration of Warblers in this section this spring has been an exceedingly slim one. I have seen scarcely any in their usual haunts—only the yellow and one other.

C. J. YOUNG,
The Rectory, Madoc, Ont.

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REVIEW OF A REVIEW.

To the Editor of THE OTTAWA NATURALIST:

It is to be regretted that the *slips* alluded to in a review of the "Check List of the Fishes of the Dominion of Canada and Newfoundland," in the May issue of the NATURALIST, are not pointed out by the reviewer. In the *introductory remarks* of the book it is stated that "it is subject to amendment in regard to species to be added to the list as records or discoveries reveal them; and not only so, but in regard to species, and such are apparently few, to be eliminated from the list as having no right there." But that given by "C," as an instance of an *occasional slip*, can hardly be regarded in that way, because the occurrence of *Thymallus tricolor montanus* is queried in the text, and the foot-note does not suggest that the so-called grayling *is*, as "C" puts it, that species, for the words are these: "A little salmonoid in rivers of southern Alberta, locally called the grayling, *may be* this sub-species." Besides, even if this salmonoid turns out to be a species of whitefish (*Coregonus williamsoni*), as "C" says the Alberta Fishery Commission stated distinctly, and not a grayling at all, yet as *Thymallus tricolor montanus* occurs over the Albertan border, in Montana, its mention in the list, with a query, is quite in keeping with what the list purports to be, as is explained by the following remark in the introduction: "Species which occur close to our borders . . . . although not actually recorded from our waters, are provisionally admitted." This is what has been done sometimes in other lists of the kind, and thereby a purpose may be served in stimulating research on the part of any who seek to ascertain what the entire geographical range of a species in particular may be. It might then be hazardous for "C" to state positively that the Montana grayling does not occur in southern Alberta lest it might be found there, and its provisional mention with a query in the list does not, therefore, appear to be amiss. Indeed, it is quite likely to be found north of the United States boundary, for it is doubtless a post-glacial survivor, and the clear, cold streams of southern Alberta, flowing down as they do from the mountains, seem well adapted for the requirements of this little fish as a habitat. If, then, *slips* occur in the list, that singled out by "C" as an *example* does not seem well chosen.

The book itself must stand or fall according to its merits, and if it is lacking "in completeness of matter" and in "compact description and arrangement" it has, nevertheless, been complimented by eminent authorities and has been applied for widely by naturalists. In point of fact, it was never meant to

be descriptive, so that to dispute its value because it affords no information concerning "the spawning period and the nature of the eggs" is surely beside the mark. The aim of the book is uniformity in its subject matter, not description, and its object is clearly stated in the introduction as the following quotation will show: "The technical name, governed by the rules of priority; the vernacular name when the fish has one . . . .; the environment concisely, and the geographical distribution of each fish are given."

Concerning the figures, if "C" had examined the specimens in the Canadian Fisheries Museum, from which the photographs which he criticizes were taken, he would have seen that the majority of the figures are from mounted specimens of the fishes themselves—a minority only being from casts (which, moreover, are actual impressions of specimens), viz.: the steelhead salmon and the five species of *Oncorhynchus* of the Pacific slope; whereas "C" says they "are in *very many cases* from defective coloured casts." [*Italics mine*].

ANDREW HALKETT.

A WELL-EARNED HONOUR.

Many members of the Ottawa Field-Naturalists' Club learned, with much pleasure recently, that the University of Toronto had conferred upon Mr. F. T. Shutt, M.A., F.R.S.C., Assistant Director of the Experimental Farms and Dominion Chemist, the degree of Doctor of Science. Mr. Shutt has always taken a keen interest in the work of our Club, being for many years a valued member of the council. From 1892 to 1895 he was vice-president of the Club, and during the years 1895 to 1897 he occupied the office of president. It was with appreciation, therefore, that notice of such honour reached us early in the present month (June). The degree was conferred on June 5th.

Such an honorary degree, when it comes to one who has really accomplished valuable results in science, is indeed worth having, and not only honours the one receiving it, but also honours the seat of learning conferring it. In the present instance, we think the University of Toronto has chosen wisely. Dr. Shutt, during the last 27 years, has given the best part of his life to a study of the science of chemistry in relation to agriculture. His researches towards the economic maintenance of fertility of soils and the factors that influence their nitrogen content; in the composition and relative values of Canadian grown fodders and feeding stuffs; on the influence of environ-

ment on the composition of cereals; on the nature and values of insecticides and fungicides; on the suitability of various districts throughout Canada for the growth of sugar-beets; on the quality of Canadian waters as occurring in lakes, streams and springs, etc., have given results of far-reaching importance.

Dr. Shutt has published many papers of a scientific character in various journals and publications and has lectured before many important societies. The results of much of his work has appeared from year to year in the annual reports of the Experimental Farms and in special bulletins which he has prepared.

In 1885, Dr. Shutt received the degree of Master of Arts from Toronto University, and for about two years was Demonstrator in Chemistry at his alma mater. In 1887, he was appointed chemist to the Dominion Experimental Farms, and in 1909, owing to the widening field of work, his title was changed to Dominion Chemist. In 1911, the added responsibility of Assistant Director was given him.

Dr. Shutt enjoys fellowship in the Institute of Chemistry of Great Britain, the Chemical Society of England and the United States, the Royal Society of Canada and the American Association for the Advancement of Science.

The members of the Ottawa Field-Naturalists' Club, who have the privilege of knowing Dr. Shutt, will feel a deep sense of pleasure in the conferring of this well-earned honour, and we take this opportunity of extending to Dr. Shutt our congratulations and best wishes for a continuance of the very useful work he is doing in the upbuilding of Canadian agriculture.

A. G.

EXCURSION TO ROCKCLIFFE.

The first excursion of the season was held at Rockcliffe on Saturday afternoon, May 2nd. Mr. Arthur Gibson, President of the Club, presided, and the following leaders of branches were in attendance:—Entomology, Messrs. Gibson and Sladen; Geology and Ornithology, Dr. Williams; Zoology, Mr. Halkett; whilst the Botanical Branch was represented by Mr. Carter, a member of the Council. After exploring the park, the excursionists assembled at the log-cabin, where short addresses were delivered by the leaders.

Dr. Williams told about the bird-boxes which have been placed in trees of the park for nesting purposes by the Ottawa Improvement Commission, under the direction of the Club.

He then spoke of the birds which had been observed, which were these: A sharp-shinned hawk, a northern flicker, a herring gull, numerous examples of the American crow, several American robins, and presumably a pair of song-sparrows, the observation of which was not favourable enough for definite determination. Judging from the size of the sharp-shinned hawk, Dr. Williams considered it to be a female, and that it evidently was hunting for small birds. It flew past the party several times and, according to him, its speckled brown breast, short wings and comparatively long tail were sufficiently well noted to identify the species. He remarked also on the perching habits of the flicker (an unusual thing among woodpeckers), and the example seen alighted on a dead branch near the top of a tree and afforded an opportunity to several members of the Club to observe it carefully through field-glasses. Other names applied to the northern flicker, given by Dr. Williams, are: The golden-winged woodpecker, the high-holder and the yellow-hammer; and besides the birds, he also spoke about the geological features of the park.

Mr. Carter spoke about certain of the trees in the park, viz.: White pine, hemlock spruce, balsam fir and white cedar. He described the leaves of the trees, remarking that those of the white pine are long and needle-shaped, five in number, and spring from a common centre; those of the white spruce are short, stiff, needle-like, four-sided, pointing in all directions; while the leaves of hemlock spruce are flat, lighter in colour beneath, and pointing in two directions only. The leaves of this latter are quite soft and are often used by campers and hunters to make camp beds. Unlike the white pine and the white spruce, the cones of the hemlock spruce are persistent. The leaves of the white cedar are in four rows on the two-edged bracklets and so closely packed and overlapping each other as to resemble shingling. The cones are persistent, with the scales pointless and seeds broadly winged all round.

Mr. Sladen, followed by Mr. Gibson, spoke of the insects observed during the afternoon, the former chiefly of a specimen of solitary bee, and the latter of two species of butterflies, the Mourning Cloak and the Large Tortoise-shell, both of which hibernate beneath logs, flat stones, or other objects which afford shelter during the winter months. Specimens of the Hedgehog Caterpillar were collected and the life habits of this arctian, or woolly-bear, described. Interest was also shown in the young tent caterpillars, which were about to hatch from the egg-clusters on the trees.

A. H.

BOOK NOTICE.

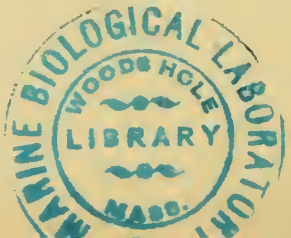
ANIMAL COMMUNITIES IN TEMPERATE AMERICA. A study in animal ecology—designed to serve as a reference work and text-book. By Victor E. Shelford, Ph.D., of the Department of Zoology of the University of Chicago. Illustrated with 300 figures, maps and diagrams; 380 pages, 8 vo, cloth; price, post-paid, $3.22. University of Chicago Press, Chicago, Ill.

A copy of this recently published book has been received. Following the introduction, the work is divided into fifteen chapters, in addition to which there is an Appendix (methods of study), a Bibliography, an Index of Authors and Collaborators and an Index of Subjects. The chapters are again divided into sub-sections, as, for instances, Chapter I on "Man and Animals"—i, Introduction; ii, The Struggle in Nature; iii, Man's Relation to Nature; iv, The Economic Importance of Animals. Chapter II on "The Animal Organism and the Environmental Relations"—i, Nature of Living Substance; ii, The Relation of Form or Structure to Function; iii, The Basis for the Organization of Ecology; iv, Scope and Meaning of Ecology; v, Communities and Biota; and so forth.

The book, which is designed to serve as a reference work and text-book, is indeed a most valuable contribution to the subject of field ecology. The material used by Dr. Shelford in the preparation of the volume has been accumulated during ten years of field-study, from the view-point of modern ecology, in various parts of the United States, though most of the material is drawn from the Chicago region. The habitat records include: Lower Invertebrates, 32 species; Mollusca, 95 species; Crustacea, 54 species; Spiders and Arachnids, 80 species; Insects, 457 species, divided as follows: Aquatic Insects, 52 species; Orthoptera, 53 species; Hemiptera, 100 species; Coleoptera, 175 species; Lepidoptera, 30 species; Diptera, 47 species; Fishes, 75 species; Amphibia and Reptiles, 27 species; Birds, 85 species; Mammals, 28 species.

Much care has been exercised by the author in choosing good illustrations to represent the various types of animal communities and their characteristic modes of life. The printing and the paper used in the book are excellent and the whole subject matter presented in a most interesting manner. Canadian students should find this book of much value in connection with their work.

A. G.



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THE OTTAWA NATURALIST

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ABSCISSION.

By Francis E. Lloyd.

(Continued from page 52)

This dependence upon external conditions is frequently illustrated by the behaviour of plants in temperate and boreal regions. The weather conditions about Montreal during October and November of the year just past (1913) were peculiar, and they were reflected in the behaviour of shrubs and trees. Many of them began to push out their spring flower buds, and in some instances (*Hydrangea*) partially opened their flowers, while the usually prompt disappearance of foliage in many trees and shrubs was much delayed. The poplars were especially noticeable, retaining their leaves even in exposed situations so that many were retained far into November, while a few still remain at the present writing. *Ampelopsis Veitchii* was also noteworthy in this respect, the conditions having been such that, in some cases, a full half or more of the leaf complement still remains adherent, though dry and dead (February, 1914). I examined these plants and found that the process of abscission had been started, but had been prevented from completion.[9] Perhaps, having been delayed by the unusual prolongation of warm weather, the abscission was overtaken by a sudden change and stopped by killing the leaves, whereas, normally, the abscission would have been completed before such intervention. It is possible that an examination of such trees as the black-jack oak, which often fails to shed its leaves, would throw light on this habit. A red beech, planted on the campus of McGill University, constantly retains its leaves, but those especially on the shorter lateral shoots. According to my late colleague, Professor Alcock, this tree shows each year an increasing

[9] Tison found that the marcescent leaves of Hamamelis differed from the normally caducous in having an incomplete abscission mechanism or it is not even initiated.

tendency in this direction. I am able to confirm this observation as regards 1912 and 1913. This last year, the plant has retained practically all its leaves except those on the outermost new shoots. It would have occasioned less surprise if the change in tendency of leaf shedding has moved in the opposite direction. I find in this plant also, that a partial abscission layer was formed.

The indefinite prolongation of green foliage in plants which show definite periodicity in temperate regions is not difficult to attain under experimental conditions. Flammarion (26) caused seedlings of *Quercus robur* to retain their leaves by transfer to a greenhouse. By removing the lower leaves from a shoot, Dingler (27) was able to postpone abscission of its upper leaves The age of the organ thus enters in as a factor. The cotton plant in the open field begins to show a decreasing activity in mid-summer, even in mid-Alabama. The exact date in 1911 at Auburn was August 14th. When kept under constantly favourable conditions, as in a greenhouse, its period may be prolonged very greatly. I have grown it for over a year, without any evidence that it could not have been kept in activity for a still longer period. The guayule, *Parthenium argentatum*, and its congeners, *P. hysterophorus*, *P. lyratum* and *P. incanum*, may be similarly controlled. The shrubby species show a periodicity related to rainfall in their natural habitat (the Chihuahuan Desert), but it was found possible in the driest part of a very dry year to stimulate the plant to renewed growth by cutting back the branches, thus showing that the moisture supply alone was the limiting factor, and when the balance between outgo and income was disturbed in favour of the latter, growth became possible. *Ampelopsis Veitchii* normally sheds tendrils only at the close of the season, but I found them being shed during dry weather from plants which spread over boulders (New York Botanical Garden, July, 1913) and were so exposed to high temperature and isolation. Such examples very much strengthen the view that the periodic phenomena of growth and leaf-fall stand in a delicate relation to the environmental factors, a disturbance in any one of which is sufficient to induce a change in behaviour. The analysis of this relation is possible only, as Klebs has said, by experimental means. We may, therefore, profitably examine this aspect of our problem, in order to see what results are at present available.

THE RELATION OF ABSCISSION TO EXTERNAL FACTORS.

The intricacy and much detail of the work which has been done, far too little as it, at present, may be, will prevent more than a rather curtailed summary, but sufficient, it is hoped, to direct attention to the chief results.

Transpiration. It has been a readily attained and rather generally accepted view that the abscission of leaves may be induced by disturbances in the water relations. The promptness with which many desert plants lose their foliage with approaching drought and their readiness to refoliation, even though stimulated thereto by such moisture as might be absorbed by their branches from rain (Lloyd, 28), as I have shown experimentally to be the case in *Fouquieria*; the dropping of leaves by houseplants on too meagre or too generous watering, both go to show that, directly or indirectly, such conditions may induce abscission. The early shedding of tendrils in *Ampelopsis*, above cited, may have been due to excessive transpiration. That merely reduction of water content of the leaf is, however, inadequate, in itself, to produce the result is shown by the fact that daily "incipient drying" and actual wilting, which we know from observation (Lloyd, 29), (Livingston and Brown, 30) to occur, is not followed by any such result. Desiring to produce abscission by reducting the water supply to organs known to be able readily to be caused to shed, I did the following experiments: A large sector (90°) of tissue was removed in a dozen cases from the stem below the insertion of the tendril in *Ampelopsis Virginiana*, and it was found impossible to induce abscission, although it will occur in cut branches in 36 or 48 hours in a moist chamber, without measureable loss of turgor, though doubtless there was some. The wounds healed, and they were later examined microscopically, and all the vascular supply to the tendrils was found to be extirpated for a distance of 5 to 10 mm. The water supply must then have passed around the wound, travelling laterally below and above it, yet either without the least prejudice to its movement or quantity, which is difficult to believe, or, if such prejudice obtained, without inducing abscission.

For some time I held the view that the peculiar anatomical relation in the flowering branch of the cotton was responsible for much of the boll-shedding. The view had been expressed that the shedding of fruit by orchard trees, said more often to occur near the ends of the branches, is due to the more favourable position of the proximal, since these are nearer the source of supplies.[10] The occurrence of the vascular tissue in an organ of limited secondary thickening (the flower-stalk) alongside that in one of unlimited secondary thickening, namely, the functionally chief axis, seemed to supply a possibility for an increasing prejudice to the water supply of the boll as growth of the whole

[10] Sorauer, P. Abwerfen der Früchte. Handbuch der Pflanzenkrankheiten.

shoot proceeds. Indeed, the much more restricted secondary thickening of the vascular tissues to the boll strengthened my belief. But experimental evidence is all against it. I removed large sectors of tissue from the axis below leaves and below bolls, in twenty cases[11] on August 19th. On the 21st one boll was shed, but the injury had been made beneath the corresponding leaf. On the 22nd one, and on the 23rd two bolls were shed, the injury having been made beneath them. After this there was no shedding till the 28th, when two more bolls fell, beneath which the operation had been done. In no case was the leaf affected, and the shedding of bolls later than August 23rd must in any event be excluded. The bolls were all small when shed, as the operations were done when the flowers were open. It can be shown that the number of losses is accountable for in other ways, and we must conclude that disturbance due to wounding is absent.

On the other hand, Balls (33), working in Egypt, was able to cause practically complete shedding of leaves, flower-buds and bolls within four days by pruning the roots, and so limiting the ability of the plant to take up water. I have repeated the experiment with positive, but less striking and perhaps not unequivocal results, in North Carolina. Cultivation, which unavoidably causes some damage to the shallower lateral roots, is believed by planters to be responsible in part for shedding. Such treatment as root-pruning is certain, if at all extensive, to cause visible wilting in an unusual amount, and too great a loss in this manner may interfere with the mechanism of abscission. It would seem that, if a reduction of water activates the process it must be when only in a small measure, such as we may suppose happens in cut branches when kept in a moist chamber, a method which was used even by von Mohl (34) in his studies. The relation is, at the present moment, a puzzling one. In the case of flowers, Hannig was unable to find any effect on the rate of abscission beyond that of ordinary laboratory air, buds, open flowers and young fruits falling away equally rapidly in both. Fitting arrived at the same conclusion, from which we may argue that the greater loss of water by evaporation, supposedly attributable to drier air, has no effect on the abscission of the corolla. This organ is, however, especially resistant, as is shown by the fact that a cotton flower-bud, removed on the evening before opening, will open and remain turgid on a laboratory table for an entire day, even though the bracts and calyx wilt and even wither. And I have observed that the petals of desert plants (*e.g.*, *Sidalcea*) remain turgid while the whole plant shows marked wilting during the hottest period of the day. The fact

[11] Exp. 11, West Raleigh, N.C., Aug. 19th, 1913.

that abscission may occur under water (poplar, maple, horse chestnut, etc.) is, of course, to be accounted for in some other way than reduction of water.

In general, therefore, we must conclude, in view of the effects of drought upon trees and shrubs, that there is a relation between lack of water and defoliation, but it is not possible to attribute abscission directly to a reduction of water content, such as may be measured. It may, however, result indirectly by the disturbance of some other relation. As we shall see, very slight departures from the normal condition of the environment in other regards are sufficient to cause or to hasten abscission.

MECHANICAL CAUSES OF ABSCISSION.

This apparently indirect effect is further exemplified in the abscission response to mechanical stimuli. For convenience we regard as mechanical, stimuli such as shaking and wounding, though we cannot consider these as working directly.

Shaking. It is to Darwin (35) that we owe the observation that, if the flower stalk of the mullein (*Verbascum*) is sharply jarred the corollas will presently fall off. Fitting, having satisfied himself that the falling of the corolla was not due to accident or to the movement of the calyx, as held by Devaux, found by repeating Darwin's experiment, that separation was consummated in from 45 seconds to 5 minutes, but for the most part in from 1 to 3 minutes. This is equally true of young and older flowers, so that it is not due to their age. He found a similar behaviour in *Geranium pyrenaicum*, with a reaction time of from 30 seconds to 6 minutes. This phenomenon has been little studied, and only few plants are known to show it.

Wounding. The importance of the effect of wounding on abscission will at once be realized in view of the great economic losses occurring each year from the dropping of buds, flowers and fruits from the plants of our orchards and gardens, as a result of insect and other injury in the form of wounds. Young peaches, when wounded by curculio, drop. The great loss to cotton growers in Alabama, Louisiana and Texas, and the great financial disturbances accompanying it, caused by the boll-weevil, to which must be added the immense expenditures involved in scientific research in finding a way out of the difficulty, have caused a highly dramatic interest to attach to the problem. This case will serve, therefore, as a good example for the present discussion.

The boll-weevil lays its egg in a young "square" or flower bud. In from 1 to 22 days[12] the square falls to the ground, the

[12] I am indebted to the United States Bureau of Entomology, through the courtesy of Dr. L. O. Howard and Dr. W. D. Hunter, for the use of valuable data on the shedding of bolls after weevil injury.

average time being from 8 to 10 days. A very peculiar feature, but following also on other causes, occurs in squares just previous to falling, namely, an outward movement of the bracts (flaring). Sometimes, if abscission does not intervene, the bracts will move inwardly again. This movement is of very great theoretical interest, since it indicates that there is no lack of turgor (though it does not prove it), and, if this be true, an undue loss of water, it is probable, is not a factor. It is evident, from the data which are at hand, that there is some relation between the amount of injury and the time which intervenes between the first insect puncture and the final separation, since, by means of other experiments, I have found that it is possible to cause the abscission of 100 per cent. of young bolls by means of suitable injury (a transverse cut across the ovary), within 48 hours, and 90 per cent. have been shed within 24 hours in one series. "Squares" (flower-buds) are not so sensitive, shedding 35 to 55 per cent. in 36 hours; 40 to 75 per cent. in 48 hours, and the rest later.

Larger bolls respond only after a longer period, namely, in from 3 to 6 days, or not at all if too large, though they may die without becoming detached. From this we see that a point of development and induration of the tissues of the peduncle may be reached when abscission is not more possible.

Shedding of the very young bolls may also be caused by cutting off the style before pollination, but this, as Fitting found in *Geranium* and *Erodium*, depends on the absence of pollination. In *E. Manescavi*, the petals fall away much sooner after the style was injured than in the uninjured flower. Hannig also found that cutting off the petals, stamens or stigma, from unpollinated flowers, and still more readily by removing the ovary, before or after pollination, caused abscission of the whole flower. Wounding of the peduncle did not do so if a portion of the tissue was left, indicating, as I have above shown, that a reduced amount of vascular tissue was able to carry on the function of the whole.

Much has been said about the effect of the wounding of leaves by cutting off the blade, and it is generally believed that such injury causes abscission. The results thus obtained are, however, very inconstant and uncertain, as I have found in my own experience. Only a single example. I cut off the petiole (in *Ampelopsis*) from one leaf 10 mm. from the base, and allowed the next lower leaf to remain. The latter separated in 24 hours (in a moist chamber), while the stump of the cut petiole remained attached. I have done similar experiments with other species with like results, and I have observed injured leaves in nature, finding them to adhere just as long and firmly as un-

injured, in many cases. We must therefor say, as Hannig has, that wounding as such does not induce abscission, but works in a round-about way.

The Effect of Temperature upon Abscission.

The occurrence of abscission at the time of the year when the cold is increasing, and the dropping of leaves in great numbers on frosty mornings, must not be thought to indicate that low temperatures cause abscission. Fitting found that *Geranium pyrenaicum* sheds its petals in a much shorter time (2.5 minutes) only when the temperature is raised to over 40° C. Lower temperatures, but yet as high as 33° to 34° were necessary, for certain other species, and in all cases the rapidity was greatest in a saturated atmosphere. Some species have their reaction time reduced from 25 seconds to 60 seconds (*Linum*, *Verbascum*, etc.). Hannig also found that temperatures higher than the normal laboratory ones caused a more abundant shedding of flowers and that sudden change was more effective than gradual. On the other hand, a lowering of temperatures inhibited it. That the higher, more effective temperatures increased the rate of abscission, and even cause them, as Wiesner (35) has suggested in the case of inner leaves, which may become over-heated does not militate against his explanation of abscission in consequence of frost, which may be procured, according to him, by the macerating (hydrolysing) effect of organic acids escaping from the frozen cells of the abscission layer or by the differences of tension produced at the limits of the dead leaf-stalk tissues and the still living and turgescent cells of the leaf-base. Entire killing of both leaf and abscission layer may be followed by the rotting away of the tissues, and thus ending in separation. High osmotic pressures, held by Wiesner and his pupils to be important in the case of ordinary abscission, have no place in frost defoliation.

The Effect of Chemical Agents.

The air and soil of cities and in the neighbourhood of certain kinds of mills and factories is usually more or less contaminated, and, as a result, there is much detriment to the health of vegetation. Among the first symptoms to be noticed is the shedding of leaves, and this is doubtless a sensitive, and perhaps a very sensitive, indication of an abnormal condition. Harvey (36) found, for example, that one part of ethelene in 1,000,000 of air was sufficient to cause abscission of the cotyledons of the castor-oil plant (*Ricinus*), which is perhaps a more delicate reaction than would be observed in trees. It is significant, however, and we may expect to find similar behaviours in many plants. Even the small amount of illuminating gas found in the ordinary air

of the laboratory was sufficient, according to Fitting, to produce abnormally quick shedding of petals, this result following dosage with carbon dioxide, tobacco smoke, chloroform, ether, and other agents. Brown and Escombe (40) found that other organs are similarly affected by disturbance of nutritive relations. Hannig got similar results, except in the case of carbon dioxide. 0.00002 vol. per cent. of illuminating gas caused the abscission of flowers (*Mirabilis*, etc.). A high concentration did not cause this directly up to 14 hours exposure, but indirectly after removal from the gas. Carbon dioxide, in concentrations up to 10 per cent., produced no effect, in accord with experiments of Demoussy (1903, 1904, see Hannig). On the other hand, leaves are shed if kept in air free of carbon dioxide (Loewi). It is evident that more work on this point, as indeed on all others, would be welcome.

Light. Light is the source of energy for green plants, so that much disturbance of this relation would be expected, indirectly at least, to lead to abnormal behaviours. It would be expected that changes in light intensity would have less effect on floral parts than on green parts, but Hannig and Fitting came to different results. Wiesner (39) believes that leaf abscission occurs in early summer in the leaves less favourably exposed to light because of the reduction of the absolute available light supply. I may observe that this kind of leaf-fall, as regards the time of occurrence, takes places whether shade is present or not. I have seen it on young plants of *Negundo*, which were completely illuminated, in which it seems more in accord with the appearances to recall Dingler's paper, earlier cited. Leaves shaded by the outermore foliage nevertheless do become yellow and fall (*Vitis*, *Ampelopsis*, *Euonymus*, etc.), and the earliest leaves in the White Birch in the autumn are those on the inner branches, irrespective of their age. In the climate of Quebec the question of high temperature is probably not important, and in such cases it seems quite proper to explain this, in the absence of more exact experimental observation, as due to the reduction of light.

THE TIME REQUIRED FOR THE ACT OF SEPARATION PROPER.

By this is meant the time occupied by the process of separation itself to the exclusion of the period required to institute it (latent period). It would seem on general grounds that when cell division is involved, the process would require more time than otherwise. In some organs (petals) in which no cell-division occurs, the evidence (Fitting) shows that it may be quite brief, less than 30 seconds indeed, but we cannot say in any case exactly what it is.

There can be no doubt, furthermore, that the age of an organ has some influence. In the small cotton boll (8 mm. diam.) no evidence of separation (following injury) can be seen at the end of 16 hours, but at 20 hours the process is practically complete, as shown by the ease of removal of the peduncle. In larger ones cell-divisions in the separation layer can be seen for a day previous. However, the act of cell-division is not necessarily a precursor of separation, since in the young bolls above mentioned no cell divisions are to be seen at the moment of separation of the cells concerned, there being only a slight elongation of them, accompanied by a chemical alteration of the cell walls, causing the loosening. The essential phase of the process of abscission may, even in older as well as younger cotton bolls, be of much shorter duration than above indicated, less, namely, than four hours.

With reference to petals, Fitting found that in the dark, at temperatures of 31°-32°, they are shed earlier than normally, and the older the more quickly. On the other hand, petals of younger flowers were found by Fitting to be less sensitive than older, an apparent reversal of things which may be regarded as a "phenomenon of interference," between increasing adaptability and shortening of reaction time.[13] In petals, however, there is no development of mechanical elements, such as quickly appear in many leaves, to increase the amount of preparation before separation may become effective. Early in the season I have observed that abscission (in a moist chamber) will overtake older leaves frequently more rapidly than younger. The slowness of separation in indurated organs may simply mean interference by tissues or mechanical elements in which separation takes place only passively or not at all, as, *e.g.*, in the non-living or moribund pith in older cotton peduncles.

THE MECHANISMS OF ABSCISSION.

By "mechanism" is meant that histological behaviour resulting in the separation of one organ, or a part of it, from another organ or part. To the best of our present understanding it may be purely mechanical, either by a break (a) passing directly across the tissue irrespective of the position of the cell walls (rhexolysis, according to Correns 1, 372, *e.g.*, *Dicranum scoparium*), or (b) passing along the middle lamella, causing separation of entire cells (schizolysis, Correns). In the latter alternative the separation is believed by some to result from a marked increase in turgor, the pressures causing the cells to

[13] The character of the behaviour of petals under various stimulants has led Fitting to insist on a conception of abscission as an active separation of an entirely living organ in response to stimulation, quite analogous to movements, etc. He proposes the term "chorism" for this phenomenon.

become spherical and thus reducing their contact surfaces to nearly nil (Loewi, Fitting, Hannig). Or it may be a result of chemical alteration (a) of a part or (b) of the whole of the cell wall. The middle lamella may be dissolved, in this way loosening the secondary walls from each other; or the whole or part of the secondary membrane may be altered (Tison). Such chemical alteration may or may not be preceded by cell-division in the cells directly involved. Even in species in which this usually takes place, it may be omitted (Tison, Loewi) either entirely or in a part of the separation layer, as I have myself observed. When cell-division does occur, it is an expression of a resumption of growth (secondary meristem of previous authors), but as cell growth obviously does not necessarily lead to cell-division, this may be absent. The amount of growth may vary with external conditions, and it is usually much more marked under water or when high relative humidity prevails, and may lead to callus hypertrophy (Kuster, 40, p. 289). And in species where growth is usually omitted (*e.g.*, *Ampelopsis*, *Impatiens*) cell-division accompanying separation is still occasionally observable.

Rhexolysis, while frequent in the mosses, is, so far as I know, generally quite rare, and its precise nature and the causes leading up to it need investigation. Tison believes it to occur in *Aristolochia Sipho* (leaf), but Loewi questions the accuracy of Tison's observations, basing his criticism on the similarity of Tison's description and drawings to appearances seen by him (*Laurus*, etc.), and leading to separation by the joint action of chemical alteration in the cell-wall and turgor. In view of my own work, Loewi's criticism is justified.

An apparently true case of rhexolysis, however, occurs in the style of *Gossypium*. Several minute transverse fissures appear at different levels somewhat above the apex of the ovary. These deepen and gape. Microscopically, they are seen to pass transversely through the tissues without relation to the position of the cell-walls, and without any evidence of separation of entire cells. The protoplasts, with their inclusions, are found *in situ* and the protoplasm torn through. Experiments indicate that external mechanical relations (pull or pressure of the staminal tube) are not factors. The fissures are not to be discovered before the latter half of the second day of anthesis.

Schizolysis is, on the other hand, general, but presents widely divergent appearances. The simplest cases (primary meristem) are those in which, by the solution of the primary membrane (middle lamella), the involved cells—usually occupying an ill-defined and irregular zone—can fall apart. Loewi, assigning to alteration of the membranes a very minor rôle, believes that separation, as exemplified in *Ampelopsis*, is accom-

plished chiefly by turgor increase, the greater surface curvatures reducing the contact areas and so setting the cells free. Kubart ascribes to chemical alteration a larger share in the process, still attributing, however, the chief place to turgor, *e.g.*, *Syringa*. Fitting excludes such alteration in the case of petals studied by him and sees, in a general sudden increase in volume of the cells, the active cause. I find in *Ampelopsis* and in *Impatiens* positive evidence against Loewi's view of the matter, separation not being found to involve any change in the shape of the cells, while evidence of chemical alteration, involving both primary and secondary membranes, has been clearly seen. Similarly, abscission of the corolla in *Gossypium* is without doubt accompanied by a decrease in turgor, being otherwise similar in operation to *Ampelopsis* (leaf, tendril, internode). But in this form the primary membrane dissolves first, and this is not preceded, at any rate to an appreciable extent, by alteration of the secondary membrane. Hannig's explanation of the process in *Salvia*, etc., and Kubart's in part of that in *Nicotiana* accord with my own, the latter finding in the organic acid released from the cells involved the agent of dissolution.

Different are, *e.g.*, *Lonicera*, *Syringa*, *Hydrangea*, and a number of others, chiefly, however, in that the secondary membranes are also attached, but more vigorously, and showing marked and measureable swelling. The collenchyma behaves peculiarly—the thickened walls resisting attack and lying free in the mucilaginous matrix. Aside from the last mentioned observation[14] Tison recognizes, in essence, this type of abscission. Kubart would designate it as "maceration."

Finally, abscission may be accompanied by growth, usually longitudinal, but, as regards the axis of the organ, may be more or less oblique. The growth (under special conditions very limited in amount) may or may not be accompanied by cell divisions, the occurrence of which has impelled earlier observers to regard the separation tissue as a secondary meristem. Before growth sets in, however, the cell walls are altered chemically (but only slightly) often in a restricted transverse zone about the cell, and the elongation of the wall takes place here (Loewi). But this chemical alteration may not be so restricted, but may rather be very general, as in the collenchymatic region of the leaf of *Populus* and of *Euonymus*, producing a condition directly comparable with that in the leaf of *Lonicera*, above cited, so that we may agree with Loewi in saying that there is no sharp line of demarkation to be drawn between these processes, the one

[14] Hannig (12, p. 428) appears not to have observed this peculiar behaviour, and no one else, so far as I can determine, has done so.

being supplanted by the other even in the same organ. Thus, in *Gossypium* (the flower-peduncle), normally one to three divisions occur, previous to separation, but they may be quite absent in the peripheral tissues; and when rapid abscission follows a suitable stimulus, none at all are to be observed.

The cells of the abscission layer may separate from their secondary walls at their distal extremities, and, in addition, the outer daughter cells may separate also from each other, one clinging to the distal rejected wall, but from which it is usually free, and one (or more) remaining permanently incorporated with the proximal wall. The separation in younger or thin-walled tissues may follow the plane of the middle lamella, but more frequently it occurs between a very thin innermost membrane (*i.e.*, that which immediately surrounds the lumen) and the earlier formed secondary membranes; or this membrane may have been laid down anew, during growth, against, but not incorporated with, the earlier formed secondary membranes. The evidence favours the former alternative; but this I cannot at present decide.

The crux of the problem of abscission lies in the manner of separation. It is conceivable that the mere increase of turgor is sufficient to cause separation along the place of the middle lamella. The smaller the cells, the more efficient can the energy at the disposal of the cell be applied; and small cells are found to characterize the abscission layer in many cases. Fitting favours this view in the light of the rapidity of reaction which, he believes, allows too short a time for swelling of the membranes, and because he could not see any such change in them. Renewed growth in these and increased turgor he regards as the responsible factors. (Fitting 21, p. 244-5). Strasburger (41), Tison (except in cases of rhexolysis) Lee (42) and others have taken a quite different position, seeing in the chemical alteration of the membranes a factor of primary importance. Tison calls the product of this change a pecto-cellulosic mucilage. The membrane lining the cell lumen does not take part in this. Growth contributes a relatively small part to the process. Hannig, too, takes the same position, except in the case of the peduncle of *Mirabilis*, in which occurs what he considers to be an undescribed method—a lysigenous one, involving the total destruction of the membranes. The appearances seen by him could, I believe, be reconciled with a method already known. This will, however, be discussed elsewhere.

Between these extreme views lie those of Wiesner, Kubart and Loewi, who, without denying a rôle to chemical alteration (by the excretion of organic acids, or perhaps enzymes), see in

turgor changes the more important factor. They believe, indeed, that in some instances chemical change is absent.

The study of about 30 odd species leads me to the conclusion that chemical change is always present to some extent whether growth and turgor changes intervene or not. I found that under the influence of a hydrolysing agent (5% KOH) the walls of the abscission cells break down more readily than those of the neighbouring tissues above and below (*Cheiranthus*), and may be so treated as to stimulate advanced autolysis, both in the swollen condition of their walls and in their behaviour toward stains.

Concerning turgor effects it may be said that in such forms as *Ampelopsis* and *Impatiens*, which present ideal material for study, the abscission cells show a no higher osmotic equivalent at the time of abscission (of floral parts, peduncles, leaves) than others. In the case of the axis, the cells of the cortex and epidermis are pulled apart, apparently by elongation of the central tissues, since in partially wilted peduncles the faces of the abscission-wound remain juxtaposed, although abscission actually takes place.

Before, during or after abscission, secondary changes in neighbouring tissues take place. They consist of suberization, sclerification and lignification in various degrees, and all are either extensions of periderm or are of the nature of wound responses. This phase of the subject, beyond this very general statement, lies beyond the present purpose. Numerous details have been worked out by Tison and by Lee. It is, however, pertinent to indicate that, on the abscission of decurrent peduncles in *Gossypium* there may follow an extensive sacrifice of tissues, including all the living element of the stem, resulting in the formation of a wound-cavity of sometimes large extent, and not unlike gum pockets in appearance. Some of these phenomena recall the abnormal behaviours seen by Loewi, which, however, may readily occur in other species* (Ash, Poplar, etc.) under special conditions.

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GALL MIDGES AS FOREST INSECTS.

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The minute gall midges or Itonididae have been practically ignored by the forester and, taken as a group, little is known of their economic importance under average woodland conditions. The larger, frequently abundant deformations produced by the gall-making wasps, Cynipidae, and the sawflies, Tenthredinidae, are relatively much better known, though it is probable that they are of less economic importance.

Numerous gall midges, referable to the Lestreminae and Heteropezinae, live as larvae in decaying woody tissues and materially hasten the process of disintegration. Species of *Miastor* and *Oligarces* inhabit the inner bark of various trees in incipient stages of decay, while some species of *Monardia*, such as *M. lignivora* Felt have been reared from the fungous affected heart-wood of pine and undoubtedly hasten decay. Some Epidosariae inhabit dead, mostly dry, woody tissues.

All of the foregoing species are of less importance than the gall-making forms infesting living trees. The deformations of the latter may be conveniently classified according to the part affected.

Seed of fruit-inhabiting midges, such as *Dasyneura canadensis* Felt, may destroy a considerable proportion of seed in spruce cones. The same is true of *Oligotrophus betulae* Winn. and birch seed, while *Itonida catalpae* Comst. infests Catalpa pods and is a pest of some importance. Whitish, flower-shaped, fungoid galls, probably a bud and possibly a fruit deformation, are numerous in some parts of the South on Bald Cypress, *Taxodium distichum*, and are caused by *Itonida anthici* Felt. The extent to which fruit infestation may go in this group is shown by the rearing of seven species from the fruit of various wild cherries.

Bud galls are produced by many species and usually mean the death of the affected part, or at least a resultant deformation. The Catalpa midge, mentioned above, not only infests the seed pods but destroys the greenish tips and produces stunted, comparatively worthless trees. *Phytophaga ulmi* Beutm. and *Dasyneura ulmea* Felt infest lateral and terminal buds of elm sprouts and occur somewhat abundantly, though their injuries have not as yet been considered of much practical importance. The Box Elder in the West suffers from the attack of two gall midges, namely, *Cecidomyia negundinis* Gill., a bud-inhabiting

form, and *Contarinia negundifolia* Felt, a species which attacks the leaves while still within the bud. *Contarinia coloradensis* Felt infests and destroys the terminal buds of *Pinus scopulorum* in Colorado and occasionally appears to be somewhat abundant. Spruce buds are destroyed in Canada and probably in the Adirondacks by *Phytophaga tsugae* Felt and the terminal ones in part by *Rhabdophaga swanei* n. sp.

RHABDOPHAGA SWAINEI n. sp.

The midges described below were reared by Mr. J. M. Swaine, Ottawa, Canada, the latter part of May, 1914, from spruce bud galls. This species apparently confines its attack to the terminal bud. It is easily differentiated from other known species of *Rhabdophaga* by the characters given below.

Gall. The enlarged bud has a length of about 7 mm. and a diameter of 4 mm., the lateral scales being somewhat reflexed and the apical portion of the gall loose and open. It contains a central, oval cell about 1.5 mm. long.

Male.—Length 2.25 mm. Antennae probably nearly as long as the body, dark reddish brown, presumably with 14, and possibly with more, segments, the fifth with a stem about $\frac{1}{2}$ the length of the basal enlargement, which latter has a length $2\frac{1}{2}$ times its diameter. Palpi: first segment ovoid, the second $\frac{1}{2}$ longer than the first, moderately stout, the third $\frac{1}{2}$ longer than the second, more slender, the fourth $\frac{1}{3}$ longer than the third, slender. Mesonotum shining dark brown, the submedian lines sparsely gray-haired. Scutellum, postscutellum and abdomen dark brown, the latter sparsely haired. Genitalia reddish brown. Halteres, coxae and femora basally reddish brown, the distal portion of femora, tibiae and tarsi mostly dark brown; claws moderately stout, curved, minutely unidentate, the pulvilli $\frac{1}{2}$ longer than the claws. Genitalia: basal clasp segment moderately stout; terminal clasp segment rather short, swollen near the middle; dorsal plate deeply and triangularly emarginate, the lobes divergent, the outer margin tapering roundly to a narrowly rounded setose apex; ventral plate rather long, broad, deeply and roundly emarginate, the lobes short, stout, sparsely setose. Harpes broad, broadly rounded and thickly setose apically; style short, tapering, narrowly rounded distally.

Female.—Length 2.25 mm. Antennae probably extending to the second abdominal segment, sparsely haired, light brown. Mesonotum dull dark brown, the submedian lines sparsely fuscous haired. Scutellum dark brown, postscutellum a variable yellowish and dark brown. Abdomen dark brown, the margins and ovipositor reddish orange, the venter reddish brown. Halteres yellowish orange. Coxae yellowish brown; femora and

tibiae dark yellowish brown, the tarsi darker, almost black. Ovipositor moderately stout, as long as the body; terminal lobes broad, the length thrice the width and thickly setose. Other characters practically as in the male. Type Cecid a2520.

LEAF GALLS. The primary infestation, as we have shown elsewhere, frequently begins in the bud. Deformations belonging in this class are not very important, though *Thecodiplosis liriodendri* O. S. is responsible for serious disfiguration, and probably some weakening of tulip leaves, particularly in the latitude of North Carolina. The recently established box leaf miner, *Monarthropalpus buxi* Lab. of Europe, appears to be a serious pest of the highly prized ornamental Box. The young leaves of the Black Locust, *Robinia*, may be seriously deformed by the larvae of *Dasyneura pseudacaciae* Fitch, or the margins rolled by those of *Obolodiplosis robiniae* Hald. *Contarinia canadensis* Felt, the probable producer of the midrib gall on ash, is so abundant locally in the Hudson valley as to seriously affect the foliage of saplings. The extent to which leaf infestation may go is shown by the fact that some 22 species of gall midges are known to infest the leaves of hickory and about 20 those of oak. Most of these, as well as numerous other leaf-inhabiting forms, are of comparatively little importance.

STEM GALLS. Irregular, subcortical galls are produced in living tissues by species of *Rhabdophaga* and *Lasioptera*, the former being confined mostly to willow. The European *Rhabdophaga salicis* Schr. has become established in some localities where basket willows are grown and causes considerable loss by ruining the shoots for both basket work and the binding of bundles of nursery trees. Willow twigs are attacked by 21 American species of gall midges. *Lasioptera querciperda* Felt lives in the subcortical tissues of white oak twigs, producing gnarly areas and, presumably, defects in the wood. Several species of *Itonida*, *I. resinicola* O. S. and *I. resinicoloides* Wlms. attack the inner bark of young pines, and in some instances considerable pitch exudes and rather serious injury may result in the case of individual trees. *Itonida inopis* O. S. is a subcortical form, the larvae producing a swollen, gouty condition of the twigs and a marked lowering in the vigor of badly infested trees.

Root galls are known in only a very few cases, probably because of the difficulty of discovering them, and, so far as forest trees are concerned, none of importance have been recorded.

A general survey of the gall midges known to infest forest trees, shows that the hickories, the oaks and the willows, and to a less extent the poplars, all representing genera with a number

of closely allied species, are subject to attack by numerous gall midges, indicating an extremely close relation between the infested plant and the insect dependent thereupon. The bud-inhabiting gall midges are potentially the most destructive, and, owing to the known prolificacy of certain gall midges, it is to be expected that injuries by species referable to this group will become more, rather than less, apparent with the advance of time.

EXCURSIONS.

The second excursion of the season was held on the afternoon of Saturday, May 9th, the locality visited being the north shore of the Ottawa River above the Chaudiere Falls. The rock formations were rich in fossils; the trees and general vegetation, at this season, were assuming their spring verdure, and the pools by the banks of the river contained a variety of forms of life. A large attendance of members was present and much interesting material was examined and collected. The President, Mr. Arthur Gibson, was in charge of the party. At the close of the outing addresses were delivered at the side of a grassy knoll close to the river, and the first leader called upon to speak was Mr. Halkett, of the zoological branch. Specimens of two kinds of small crustaceans—one an amphipod (*Gammarus*) and the other an isopod (*Asellus aquaticus*), as well as several kinds of fresh water pulmonate gastropod mollusks were passed around and points explained regarding their life-habits.

Miss Fyles spoke of the plants which had been observed or collected. Several specimens of *Geaster hygrometricus* were found. It was pointed out that the Geasters were distinguished from the puffballs by the outer coat, which breaks and spreads out in the form of a star, whence the name Earth-star. This odd and interesting fungus is very sensitive of moisture, spreading out its star-like coat in wet weather and folding in its points when the atmosphere is dry. Miss Fyles also gave an interesting account of the life-history of the Horse-tails (*Equisetum* spp.)and of many other plants which were handed to her to name.

A very interesting account of the herbs used by the Iroquois medicine men was given by Mr. Waugh, a leader of the archæological branch, the substance of which he has since supplied in manuscript notes, which, given in his own words, are as follows:—

"A large number of animal and vegetable materials are used in the Iroquois medicines. Although many of the herbal or vegetable preparations are most effective from a therapeutic standpoint, a great deal of reliance is placed in sympathetic

magic or the idea that like cures like. For instance, bloodroot is used to purify the blood because the juice is red. This idea is at the bottom of a large percentage of Iroquois remedies. A decoction of stoneroot is given to children in the belief that it will make them hardy. Quite a number of effective laxatives and emetics are known where barks are used. These are scraped up or down according to the action required. Among the laxatives are mandrake root, also a decoction of butternut bark. A hunting medicine is made of the early leaves of *Prenanthes* or lion's foot, from a fancied resemblance of these to the heads of a buck and a doe. A decoction is made and the rifle-barrel washed with it inside and out. The small spherical bulb found attached to the dwarf ginseng is crushed and tied to fishing tackle to give luck in fishing. A selling medicine is obtained by chewing a small wood anemone (*Anemone quinquefolia*) and rubbing the juice on the hands when about to offer anything for sale. The person to whom the articles are offered will not be able to resist buying. A medicine to give speed in running is derived from the toad rush (*Juncus bufonius*). A decoction is made and the body and limbs washed with it, the idea being that, as the plant grows beside the runner's pathway, it will assist him in running. Love medicines are very common. Every native medical practitioner has several. These are also usually based on sympathetic magic. For instance, two leaves of *Aster cordifolia*, which lean one upon the other, are taken, and a decoction made and rubbed upon the face and hands. A remedy for snake-bite is obtained by finding a root of the white ash which sticks up like a snake's head. This must be kicked off with the foot. A decoction is made of this and applied to the bite. Among the most important medicines are a couple of secret preparations belonging to medical societies. These are found to consist largely of a number of fanciful or mythical ingredients. These medicines are considered the most effective of any and their administration is connected with a series of ceremonies."

The next speaker, Dr. Williams, spoke of the birds, observed, viz.—the herring gull, the spotted sandpiper, the ruffed grouse, the northern flicker, the American crow, and the tree swallow.

This last-mentioned useful little bird is very common in the vicinity of Ottawa this spring, and it is to be hoped that some may take possession of the nesting boxes either at Rockcliffe or at the Experimental Farm.

In addition to the above, brief addresses were also delivered by the President and the Rev. Seymour Bullock.

A.H.

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THE PROBLEM OF BIRD ENCOURAGEMENT.

By W. E. Saunders, London, Ont.

The question is, *How* to increase the number of our birds. Hardly anyone doubts the statement that "More birds would be a benefit to mankind," and the popularity of the efforts being made in that direction speaks volumes for the state of public sentiment; but "*How*" are we to do it?

The people to whom such encouragement will mean the greatest financial return are the farmers, and not only have they the best opportunity of producing an increase in bird numbers, but all the expense called for is the rental of an acre or two of ground, and the labor of fencing and planting it with the proper trees, shrubs and vines. From such an outlay, the revenue returned should be a good one, and the results are liable to be better if the planting is of the most attractive character than if it is done in a haphazard manner.

In a general way, the principle may be stated that most of our insectivorous birds like a little fruit at times, and the best way to provide this for them is to plant little shrubs bearing the native fruits in their little jungle, rather than to attract them to the orchard and there feed them with high-class grapes, English cherries, etc.

The size and location of such a bird reserve will vary according to the enthusiasm and ability of the owner. An acre or two would make a splendid jungle, and in southern Ontario would probably be used even by the quail, which is one of the most useful of all insect eaters.

In the bulletin on the chinch bug recently issued by the Division of Entomology, at Ottawa, the quail is given credit for being the only bird that is specially useful in fighting this particularly injurious insect. Those farmers near London, whose crops suffered so severely, in 1913, from this insect, would probably be willing to give serious consideration to the question

of bird reserves, realizing that such reserves would have meant money in pocket if they had been established years ago.

The area selected for the jungle should be well fenced, preferably with heavy netting at the bottom. Dogs, and if possible, cats should be excluded, as well as rabbits. The experience of the western sheepmen who fenced a large section of land to exclude coyotes, should be remembered; after the fence was completed they found they had fenced some coyotes in.

A few clear spaces among the planting are desirable, but the bulk of the ground might be thoroughly covered to good advantage. Shrubs and vines of rapid growth should be introduced even if they are not so desirable for permanent use: most essential, however, is the planting of fruit-bearing trees and shrubs, which will be used as food by such species as desire it.

Almost every kind of tree has some features that are desirable from the standpoint of the birds; for instance, the foliage of basswood is subject to aphis, which makes it very attractive to warblers and other small insect eaters. As supply of insect food of some sort, however, is found on every tree and shrub, in these trees only those that are especially adapted in some way to the purpose of bird encouragement, are here recommended.

In the list should be a couple of hemlocks at good distances apart. These trees are the most attractive of all to the crossbills in winter, hemlock seeds being their favorite food. Six Manitoba maples are recommended because the fruit hangs all winter, and when the rare Evening Grosbeak visits us it is very fond of it. This tree varies a great deal in its seed producing qualities, and for that reason six are recommended, but only two ought to be left and those two should be selected for their seed bearing qualities. A few mountain ash trees will provide berries for the late fall and winter birds, while mulberries and the native shadbush are needed for summer fruits.

In an investigation by the U. S. Biological Survey, Washington, a very few years ago, it was found that the berry which was most widely esteemed by the birds was the elder; therefore it would be well to plant a number of these. Thorn bushes make excellent bird covers and the fruits are used by some birds in the autumn. The native Viburnums, with berries varying from white to black, are also used by the thrushes and other birds. The wild blackberry should be planted for the purpose of making a tangle, which the birds delight

in, and as they have long been accustomed to it, it will be specially acceptable. The wild red raspberry is much frequented and desired by some birds. Currants, while not particularly desirable would doubtless add to the general attractiveness of the jungle. Then there should be climbers, particularly the two bitter sweets, the climbing bitter sweet and the annual one. But the best and most useful climber of all is the wild grape. Plant these beside a brush heap and they will soon cover it and make ideal protection for many of the seed eaters, and food for larger birds. Small willows are not only desirable as providers of insects, but also because of the ease with which they take root and grow.

There is no good reason why some ornamental shrubs should not be used, particularly on the sides facing the house and road. Spirea Van Houtte, (the Bridal Wreath) Lilacs, Philadelphus or Mock Orange, Exochorda, and others, could be used with advantage and beautiful effect, moreover, many of these are already popular with the birds we are trying to attract. And while some objection may be raised to them on the score of expense, yet that objection does not apply to lilacs, which sucker freely; so that one can obtain a hundred small plants by digging and dividing a single old one.

Consideration should be paid to the future appearance from the farm house; the tallest growing plants should be farthest away, the height graduating down, with only very dwarf things on the side next the house. This plan will give a much more extended view from the house, than if high vegetation is placed on the side next the house.

All these trees and shrubs should be planted not closer together than ten feet, unless enthusiasm and opportunity are unusual, and if so planted, it will be five to ten years before any require to be taken out. When they grow into one another, it would be well to remove some of them, as by that time the birds would have ample cover.

At first there will appear to be a great deal of unused space, and such might be planted to millet and buckwheat. This would of course apply only to the first season as after that it should be left so that the shrubs could have their own way.

Two weeds whose seeds are very much admired by winter birds are ragweed and pigweed. If a patch of these weeds is planted, it should be on the house side and not closer than twenty or thirty feet from the edge of the jungle, so as to prevent the weeds from spreading into the neighboring cultivated land. When the first year's growth has taken place there is little danger of the spreading of such weeds over what will then be uncultivated ground.

The above list contains most of the plants that are specially suitable for the purpose, but while endeavoring to procure as many of them as possible, the planter will of course use largely the shrubs that happen to be most available, employing also such wild perennials as golden rod, aster, etc.

Old stumps will prove an attractive addition to the reserve and will be an attraction to the chickadees in the nesting season. If these birds can be induced to locate there, they may be easily held for the whole year by a little feeding in winter, and no bird is more useful in the orchard than this species.

For the first few years there will be no place in this plot where robins can rest. This lack will seldom be very noticeable, as most farms have already some old trees in which they may nest, but, if there is absolutely no opportunity for them the need may be easily supplied, by a piece of 2 x 4 scantling driven into the ground, with two cross pieces near the top, forming a suitable nest foundation, the whole to be covered with a collection of dead vines, etc., leaving space for the birds to enter. If some wild cucumber is planted at the base of this, it will cover the post after a few weeks of growth.

A few nesting boxes stuck up on posts or on large trees would serve to attract bluebirds, tree swallows and house wrens, but care must be taken to keep down the English sparrows by means of trap and gun, or else these native species that nest in cavities will be unduly harassed and prevented from breeding.

It is well worth while to put up on a pole a house for the Purple Martin. If these birds can be induced to come, they will form a very important addition to the ranks of insect destroyers.

On May 24, 1913, I saw a little home-made Martin house on a pole in a farm yard about 25 miles north-west of London, and it had three or four pairs of Martins domesticated in it. What one farmer has accomplished, another may do.

Red squirrels should be persistently destroyed. These animals are second only to the domestic cat as bird exterminators, and will devour every available brood of nestlings unless they are prevented.

A path winding through the jungle would be no detriment and may often be a convenience. It should go near the trees, and as these will prevent any thick growth coming beneath them, wild flowers can be added to the collection when they are partly grown.

During the first year or two, the occasional use of the hoe around the newly introduced plants will hasten growth, but during the season of bird nesting, from May 1st to July 1st, too frequent presence on the reserve is not desirable until the birds have become thoroughly at home.

A plot of ground set apart for a bird reserve and treated as described above ought to begin to show practical results in the second year, and it will be surprising what a tremendous difference in bird numbers can be made by a little attention to their needs.

That this attention will give a substantial return in dollars and cents cannot be gainsaid, while for those fortunate country residents who already love the birds, and desire their presence, the results will be a constant joy.

Personal inquiries on this subject are invited by the writer.

MYOSURUS IN CANADA—I.

BY EDWARD L. GREENE.

Throughout the whole of Eastern North America the genus *Myosurus* is very scantily and feebly represented, and that too, in as far as our knowledge goes by the single species, *M. minimus*, an old world plant and the type species of the genus; and this is so great a rarity here at the east as to have been observed hitherto in no more than two localities, east of the Ohio river. One of these stations is Belleville, in southeastern Ontario, the other Norfolk, in the extreme southeastern corner of Virginia. The two stations are about 500 hundred miles apart in linear distance. For none of the intervening states of New York, Pennsylvania, Maryland, or for any of those of New England or the Maritime Provinces of Canada, is there any record of Myosurus; and for further demonstration of the complete isolation of the plant at Belleville, let it be taken note of that from that point southwestward to south-central Illinois, where it occurs again, the distance is some 750 miles. Then measuring the distance westward and within the Dominion, to where it occurs again in Assiniboia, we have 950, if not a round 1000 miles.

At the time when the plant was first detected at Belleville its isolation there would have appeared still more pronounced if the matter of its very sparing occurrence in North America had been taken into consideration; for in 1878, when Professor John Macoun brought forward specimens from there, the Virginian habitat was not yet known, and the nearest known stations for it eastward and southward were as very far away as Georgia, Tennessee, and Kentucky. At Norfolk, Virginia, it was not detected until 1893, or fifteen years later than Professor Macoun's obtaining it at Belleville.

Mr. F. V. Coville, the discoverer of the Norfolk habitat, remarked that the plant had the appearance of a recent arrival there; but in the case of the station in Ontario, Professor Macoun registers no supsicion that it is other than indigenous there. Indeed, he took it to be native, as we shall see later; and in this he may have submitted to the opinion of authors within the United States, not one of whom, in writing of *M. minimus* as occurring with us here, and there southwestward and far westward, expresses a doubt about its being native. Accepting this doctrine, there was, with the discoverer of the Ontario station, no occasion to question how the plant came there, however strangely isolated it was. But here I must reproduce his very interesting first notes about it in the first volume of the Catalogue of the Plants of Canada, P. 15.

"On ground subject to overflow and on limestone shingle at the ferry house opposite Belleville, Ontario; rocky pastures west of Albert College, Belleville, Ontario."

Here are given as many as three different kinds of environment for the plant as it was found growing in the vicinity of Belleville, now almost forty years since; and I know of no other more recent mention of Myosurus as being there. Results of a diligent, renewed investigation of the locality after so long a lapse of time would be very interesting, whatever they might be. One thing, however, which the language of Professor Macoun suggests to me is the possibility of there being in the Belleville neighborhood more than one species of the genus. I refer to the different kinds of environment, in each of which he found the plant growing. The expression, "ground subject to overflow", though not very definite, implies the prevalence of a good degree of moisture; but whether some stretch of low plain be meant where a temporary pool is formed after every good rain, or whether it were a stream bank where waters rise and fall at intervals—all these are uncertainties. But the European plant is said to grow there nowhere but in low, moist lands. This is not, however, true of all the

several Myosurus species native to America in the Great Basin and on the Pacific slope of the continent; and when "limestone shingle" is named as another environment of the Belleville Myosurus, the mind of the widely travelled student of these plants is reminded of the habitat of certain far western members of the genus. So also does the Belleville rocky pasture locality; for that should mean on the rocks themselves, either in their seams and crevices or on top of them, where there is little depth of earth, and some considerable degree of aridity; for as far north as eastern Ontario, all, except the rocks of a pasture, is occupied by perennial grasses, into the sod of which no Myosurus or other annual finds a foothold. In a word, the whole story of the Ontario locality for these plants points to the derivation of this colony from the far westward. Moreover, between the northwestern shore of Lake Ontario and those far-away Myosurus stations of the Southern States, there is practically no commercial traffic at all; whereas, by means of the Canadian Pacific Railway System, there is a very direct and constant inter-communication between all British Columbia and even eastern Ontario.

Long after his having discovered that Belleville colony of these plants, Professor Macoun found Myosurus on Vancouver Island, and I find his remark on this also very interesting It occurs in his supplement to the volume already quoted, page 479. Listing it there, still under the name *Myosurus minimus*, he says: "It is extremely probable that the British Columbia form is a distinct species." This is a plain intimation that while still regarding the eastern plant as the real original *M. minimus* and native there, he saw discrepancies between the two, and suspected the Vancouver Island plant to be really new and nameless. Into these matters the present writer intends making further and critical research, the results of which may be presented later.

THE GENUS *ANTENNARIA* IN GREENLAND.

BY MORTEN P. PORSILD.

The Antennarias of Greenland have for a long time—by Joh. Lange and later authors—been determined as (1) *A. alpina* (L.) Gaertn., (2) *A. alpina* var. *glabrata* J. Vahl, (3) *A. dioica* var. *hyperborea* Don, to which L. K. Rosenvinge has added (4) *A. alpina* var. *intermedia* Rosenv. A closer study

of the forms and their occurrence in the field has shown, that the last mentioned three are hereditary constant and hence probably distinct species, the hitherto called *A. dioica* var. *hyperborea* from Greenland being in some details different from all specimens seen by me of *A. dioica* from Europe or Asia. Having, however, a very restricted access to literature and a still lesser one to collections, I am at a loss to give full particulars concerning the synonymy and distribution of some of the species, and allow me to invite the attention of American botanists to them, as most likely one or another of the species here considered as new may also occur in the eastern parts of arctic or subarctic America.

A more detailed study of the species together with full diagnoses and figures will soon appear in the "Arbejder fra den Danske Arktiske Station paa Disko."

SYNONYMY AND DISTRIBUTION OF THE GREENLAND SPECIES OF ANTENNARIA.

1. ANTENNARIA ALPINA (L.) GAERTN.

West-Greenland: common to about Disco Bay, hence becoming scarcer and confined to well exposed lowland stations, collected however at Cape York, 76° 07' and in Hayes Sound, on Grinnell Land, 79° 04'.

East-Greenland: from the south to about 72°, common in the better investigated places, but *not found in North-East Greenland.*

America: Arctic Archipelago up to Melville Island, arctic, subarctic and alpine continental North America, Rocky Mountains, American and Asiatic coasts of Behring Strait, arctic and subarctic East-Siberia to Lena River, whence it seems to be replaced by *A. carpathica*, Altai, reaching the coast again in arctic Russia, Kolgujew, arctic and alpine North-Europe, Iceland, *wanting* on Jan Mayen, Spitsbergen, Nova Zembla, Franz Josef Land and New Siberian Islands; in other words, an arctic alpine, nearly circumpolar species, however, not reaching the northernmost limits for plant-growth.

A. alpina var. *Frieseana* Trautvetter: Act. Hort. Petropol. VI. 1879, page 24. *A. monocephala* (DC.) Ledeb. Fl. Ross. II, page 611. *A. alpina* var *monocephala* (DC.) Torr. & Gray: Fl. of North America II, page 430.

In East-Siberia the commonest form, but connected with the main form by numerous transitions; also found in Greenland and America.

2. ANTENNARIA GLABRATA (J. VAHL) PORSILD n. sp. Syn.: *A. alpina* var. *glabrata* J. Vahl: Flora Danica tab. 2786, fig. 4. Joh. Lange: Conspectus Florae Groenlandicae, Meddelelser om Grönland III. 1880, page 100.

West-Greenland: between 64° and 72° 20'.
East-Greenland: between 66° and 72°.

Not rare on Disco Island, although much rarer than the preceding. Probably often overlooked, although it is very conspicuous. Not found in the southernmost parts of Greenland by collectors knowing the plant very well (Vahl, Rosenvinge, Hartz, Kruuse).

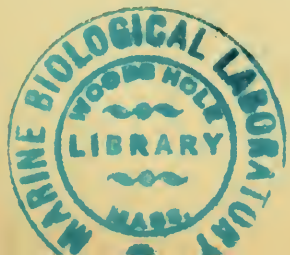
3. ANTENNARIA GROENLANDICA PORSILD nom. nov. Syn.: *A. dioica* var. *hyperborea* Lange l. c. but probably not *A. hyperborea* Don: Edinburgh Philosophical Journal, 1834, (a paper not accessible to me), more probably—*A. hyperborea* Fernald & Sornborger: Some recent additions to the Flora of Labrador, The OTTAWA NATURALIST, 1899, page 106.

West-Greenland: 60° and 67°, commonest in the South.
East-Greenland: twice collected, at 61° and 66°.
Labrador?

On Iceland neither is *A. groenlandica*, nor *A. dioica* nor any other of the nearest allies of this species found.

4. ANTENNARIA INTERMEDIA (ROSENVINGE) PORSILD n. sp. Syn.: *A. alpina* var. *intermedia* L. K. Rosenvinge: Andet Tillæg til Gronlands Fonerogamer og Karsporeplanter.. Meddelelser om Grönland III. Forts. 3. 1892, page 698. *A. alpina ô* Th. Holm. Beiträge zur Flora Westgrönlands, Engler's Bot. Jahrb. 8, 1887, page 310.

West-Greenland: hitherto only found a few times between 61° 45' and 70° 05'. On South Disco, near Godhaven, several stations are known to me. The plant flowers here much later than do *A. alpina* and *A. glabrata* on the same spots, whence I suppose that it here is near its northern limit and should be searched for in more southerly latitudes.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	(1) *A. dioica* (L.) GAERTN. from Europe and Asia.	(2) *A. groenlandica* PORSILD	(3) *A. intermedia* (ROSENV.) PORSILD	(4) *A. alpina* (L.) GAERTN.	(5) *A. glabrata* (VAHL) PORSILD
Caudex	with rosulate clusters and with prostrate, apically upward bent stolons	=1.	=1	=1, the stolons are, however, relatively shorter	cespitose, stolons wanting, with densely aggregated clusters of rosulate leaves
Rosulated leaves	lanceolate-spathulate, ordinarily with small apiculus, 15-30 (-45) mm long, 5-9 mm broad	=1, but smaller and narrower, 10-24mm long, 2-5mm broad	=2	lanceolate-spathulate, often without apiculus, 10-20mm long, 2-4mm broad	narrow lanceolate, apiculus ordinarily distinct, 10-20 mm long, 1-3 mm broad
Tomentum of rosulate leaves	ordinarily only on the underside, in the var. *hyperborea* on both sides. Tomentum dense, but thin, snowy white, almost shining, reminding one of napless, worn out cloth.*	equally on both sides. Tomentum dense and thick, not snowy white, but with a faint gray-greenish tint, reminding one of nappy, not worn cloth.	=2	varying much, nearly always densely tomentous on the underside, often on both. Sometimes the felt is with interstices, floccose, grayish white, not shining	ordinarily tomentum quite absent, with isolated rudimentary hairs, rarely with small isolated floccose tufts
Flowering stems	12-20 (-25) cm high tomentous	10-16 (-20) cm high tomentous	=2	5-12 (-18) cm high, tomentous	8-10 (-12) cm high, slender, without hairs
Inflorescence	cymose with 3-7 brevipedicellate heads, rarely corymbiform (var. *corymbifera* HARTM.	=1	subglobose, heads 8-12 small nearly sessile	=1, the var. *Friesiana* only with 1-3 heads	ordinarily one large head seldom two.
Length of flowering heads	10-12 mm	6-8 mm	4-6 mm	6-8 mm	8-12 mm

Involucral bracts	obtuse, entire or faintly crenulate, the scarious parts bright purple or white, the basal parts tomentous	=1	obtuse, entire or faintly crenulate the scarious parts dark greenish brown, basal parts tomentous	acute, irregularly lacerate the scarious parts with various tints of brown, European forms often redbrown, basal parts tomentous	acute, the scarious parts irregularly lacerate, dark greenish brown, basal parts green without tomentum
Flowers and propagation	dioicous, pistillate and staminate flowers, fertilization normal.	only with pistillate flowers, apogamic	=2	=2	=2
Pappus bristles of pistillate flowers	slender, 20-30 μ thick, rather faintly denticulate	somewhat coarser, 30-40μ thick, denticulate, teeth of upper parts faintly curved upwards	still coarser, 40-50μ, basal parts squarrosely denticulate, teeth of the upper parts larger, erecto-patent	coarse, 50-60μ, especially in the upper parts densely denticulate, teeth patent, up to 50μ long	=4

*Through the courtesy of the Botanical Museum of Copenhagen, I have had dried specimens of *A. dioica* and its variety *hyperborea* from some 18 different parts of Europe and Asia for examination. The localities range from Kolgujew to Southern France, and from Scandinavia to Western Siberia. Besides, I have seen a good deal of *A. alpina* from various parts of the world, and all the material of the genus from Greenland, preserved in the named Museum.

All species of *Antennaria* in Greenland produce well developed fruits having the power of germination. As staminate flowers are totally wanting, the propagation of all species must be apogamic, as for a long time such has been known to be the case with *A. alpina*. The *A. glabrata* and *A. intermedia*, as they are growing near my home, are without doubt hereditary constant. They often form extended pure patches, the form of which depends on the circumstances of local wind or the outlet of melting water in the spring.

If my understanding of the species be right, *A. alpina* must be regarded as an old species that found its way to Greenland after the glacial period, probably over Smith Sound, where the crossing may have taken place during an epoch with milder climate than now rules in Greenland. *A. groenlandica*, however, belongs to the large contingent of American plants of South Greenland, that cannot have immigrated by this way. *A. glabrata* and *A. intermedia* are undoubtedly young species, or perhaps species *in statu nascendi*, the former developed from *A. alpina*, the second from *A. groenlandica*.

We have thus in the Greenland species of *Antennaria* a new example of polymorphy in apogamic genera (cfr. *Alchimilla*, *Taraxacum*, *Hieracium*).

Disko, Greenland, Dec. 1913.

EXCURSIONS.

The third excursion of the season was held at Britannia, on the afternoon of Saturday, May 16th. The party walked to a wooded grove, and the time was mostly engaged in botanical observations. At the addresses leaders spoke of the plants, birds, insects, and batrachians observed or collected, and information along general lines of natural history was imparted.

The fourth excursion was held at Fairy Lake. This was on the afternoon of Saturday, May 23rd. After leaving the electric cars, the party walked for a distance, until this ideal spot, known as Fairy Lake, was reached. The excursion was of the nature of a saunter, and the usual addresses were purposely dispensed with, this leisurely walk homewards through the woods of the Beaver Meadow taking for this occasion their place.

The fifth excursion was held at Leamy's Lake, on the afternoon of Saturday, May 30th. Although there was only a party of nine, the occasion proved to be most enjoyable and profitable. Mr. Gibson, the President, drew attention to a carabid beetle devouring a tent caterpillar; a partridge's nest, containing a set of twelve eggs, was found, and the woods were profuse with flowers and ferns.

The sixth excursion was held at Ironsides, on Saturday afternoon, June 6th. The train left the Broad Street Station at 1.40 p.m., and, on arriving at the destination, the party walked along the railway track until reaching a woodland, where it dispersed its minor parties, according to the phase of nature each desired to study. Mr. Sladen gave his attention to bees and captured a goodly lot. A wood-chuck or ground-hog was seen by several persons, and as it remained all the time beside its burrow, a fine observation was had of it. At the short addresses, which were interrupted by the arrival of the homeward bound train, Mr. J. W. Gibson, whose new professional duties have called him to British Columbia, spoke a few appropriate and appreciative words in the interests of the Club.

The seventh and final excursion of the season was held at the Experimental Farm, on the afternoon of Saturday, June 13th, and was well attended. Mr. Arthur Gibson, the President, Mr. W. T. Macoun, and other representative officials of the Farm, escorted the party through the arboretum, the greenhouses and the insectary. The horticultural observations of the trees, hedges and flowers were inspiring. A number of the bird-nesting boxes placed on the trees were observed, and a few birds were seen. The display of grapes, tomatoes, cucumbers and melons seen in the greenhouses was an interesting sight, and the visit to the insectary was also interesting. Towards the close of the afternoon a visit was paid to the Entomological Museum, where Mr. Gibson exhibited a portion of the collection of mounted insects. This collection is so vast that a whole afternoon would require to be devoted to its inspection in order to get any adequate idea of its significance and value.

ANDREW HALKETT,

Chairman, Excursions Committee.

BOOK NOTICES.

BIRDS OF NEW YORK.—By Elon Howard Eaton. Part 2, General Chapters; Land Birds. New York State Museum, Albany, N.Y., Memoir 12.

In the June, 1910, issue of THE OTTAWA NATURALIST, we noted the appearance of Part 1, a volume of 390 pages, of the Birds of New York, which volume discussed the Water Birds and Game Birds. Part 2, as above mentioned treats of the Land Birds and is truly a magnificent contribution to American ornithology. It is a much larger volume, consisting of 543 pages. In Part 1, there are 42 full paged coloured plates, whereas in Part 2, there are no less than 106.

With the presentation of Part 2, the entire field of work as originally planned by the author is covered. Students of birds everywhere will be delighted at the completion of this exhaustive memoir. The coloured plates, which are from drawings by Mr. Louis Agassiz Fuertés, are indeed excellent in every way.

The introductory charter of Part 2 discusses Bird Ecology (pp. 5-46.) This is followed by a chapter on The Economic Value of Birds (pp. 46-51.) In the author's own words "the main value of birds is in holding tree and crop enemies in check. Modern methods of fighting injurious insects seem, in some cases, to render the aid of birds unnecessary, but the special value of the bird's work consists in attacking insect pests which are not reached by poison spray and at seasons of the year when spraying is not practised, thereby preventing outbreaks which otherwise would cause great destruction and expense." In this chapter the value of birds as weed seed destroyers is also discussed. Other chapters which follow are "The Status of our Bird Laws," "Special Measures for Increasing Bird Life," "Bird Refugees" and "Private Preserves." These are all of extreme interest. Then follows the main portion of the work, viz., the description of genera and species of the land birds. This occupies pages 61-541. Many text figures appear in this part. The Birds of Prey are first treated of. Each species is discussed under sub-headings, such as description, distribution, habits, etc. These are followed by an account of the Paroquet, the Cuckoos, Kingfishers, etc., the Woodpeckers, the Swifts, etc., etc., until a complete treatment of the land birds is given.

Canadian students will indeed welcome the final part of this magnificent work on the Birds of New York. The New York State Museum is to be congratulated in issuing such a beautiful and useful memoir. To the author every credit is due for the final appearance in such delightful form of years of labour. The plates by the well known artist, Mr. Fuertés, will certainly be admired by all bird lovers. The cost of issuing such volumes is, of course, extremely high and for this reason personal copies will be expensive and possibly difficult to obtain. The chief public libraries, however, in Canada should endeavor to obtain these two volumes for use in their reference reading rooms. Owing to the large number of persons interested in our native birds there would undoubtedly be many applications for the use of the books.

A. G.

HANDBOOK OF THE ROCKY MOUNTAINS PARK MUSEUM.—By Harlan I. Smith. Canada, Department of the Interior, Dominion Parks Branch.

This very useful handbook of 126 pages has recently been received. It has been prepared with the intention of giving to the public now a reference guide to the natural history of the whole region in and around the Rocky Mountains Park, at Banff, Alta. In Chapter 1, on the "Geography of the Rocky Mountains Park, a list of the important mountains, with their altitude is given, as well as a list of the living animals in the Zoo and the Paddock. Under Chapter 2 on Mammals," the different species are discussed in an interesting manner. Chapter 3 treats of the Birds, Chapter 4 the Fishes: Chapters 5, 6, 7 and 8 discuss Reptiles, Amphibians, Shellfish and Insects. These latter chapters are brief and do not mention any of the species. Chapter 9 describes many of the Trees found in the Park. Chapter 10, on "Minerals," 11, on "Rocks," and 12, on "Fossils" are also brief. Chapter 13 is on "Weather," 14 on "Antiquities," 15 on "Indians" 16 on "History" and 17 on "Literature of the Rocky Mountains Park."

The handbook will doubtless be well received by many visitors to the Banff Museum and Park. A. G.

THE BURDOCK GELECHIID

AN INSECT SEED-DESTROYER.

A very common but useful little insect which occurs in eastern Canada is the Burdock Seed Gelechiid, *Metzneria lappella* L. In the Ottawa district there is no difficulty whatever in finding in autumn and during the winter months, the curious little larvæ snugly concealed in the seed heads of the Lesser Burdock, *Arctium minus*. So abundant has the insect become that it is the exception to find a seed head in which the small caterpillar is not wintering. Oftentimes two larvæ are found in the same head. If a seed head is examined several of the seeds will be found to be fastened together and if these are separated the white larva, with a brown head, will be seen in its hibernaculum. It is a short, plump caterpillar and when mature is about three-sixteenths of an inch long. In spring it transforms to the pupal state and the moth emerges towards the end of May or during June. On one occasion I reared from a small handful of heads, nearly one hundred of the moths. The moth is a delicate little species, expanding when the wings are spread about half an inch, the females being slightly larger than the males. The front wings are pale brownish, with darker markings of brown; the hind wings are of a slate-colour and bear long fringes.

The Burdock Gelechiid, a native of Europe and Asia, was first discovered in Canada by the Rev. Dr. Fyles, at Levis, Que., in September, 1898. Since, it has spread considerably throughout the Provinces of Quebec and Ontario. The species is abundant at Toronto, where Dr. A. Cosens has noticed the larvæ since 1904.

Regarding the introduction of the insect into Canada, Dr. Fyles, in the Annual Report of the Entomological Society of Ontario, 1899, states: "It may well be asked, How was this European insect advanced to Canada?" This probably is the correct answer: at Point Levi there is a quarantine station for cattle; and old country hay and straw are often landed with the cattle; and burs containing larvæ of the species have, at some time, been landed with the fodder. The Burdock is plentiful on all our roads."

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY MASS.

ARTHUR GIBSON.

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THE OTTAWA NATURALIST

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GEOLOGICAL SURVEY MUSEUM WORK ON POINT PELEE, ONT.*

By P. A. Taverner.

In following out a scheme for illustrating the various faunal areas of the Dominion in the Museum of the Geological Survey, Ottawa, by large landscape groups showing the characteristic plants, animals, etc., of each marked division, it was decided to begin the work in southern Ontario, which from its striking characteristics and accessibility was obviously a natural starting point for the work.

Point Pelee, Essex County, near the western end of Lake Erie, was the chosen point of operation and on May 15th a Museum party, composed of Messrs. C. H. Young, C. L. Patch, and the writer arrived on the Point. Delayed by unavoidable circumstances our arrival was too late to catch the early migrants but, as the season was cold and the migrations delayed, this was not as serious as it might have been in a more normal year.

A considerable amount of work has been done and results published† relative to this region, by various ornithologists, mostly since 1905, but no continuous series of observations have been carried on there hitherto in summer months.

Owing to the fact that our attention had to be turned principally to collecting, for our exhibition group, a great amount of strictly scientific work was precluded, but general conditions proved so interesting that the most salient features seem worthy of record.

*Published by permission of the Deputy Minister of Mines.

†See P. A. Taverner and B. H. Swales—Birds of Point Pelee, Bull. Wilson Ornithological Club, 1907-08. Nos. 59-62, and various notes and short papers by the above and W. E. Saunders, in the pages of the Ottawa Naturalist.

We remained until July 24th, when the fall migrations were just commencing. We regretted greatly not being able to continue our observations during the early part of the fall migrations, as they would have completed and rounded out the work previously done in the locality in a most satisfactory manner.

The most striking feature of the summer bird population was the scarcity or total absence of several species common in the surrounding country and of expected occurrence here.

Some of the most noticeable of these species were:—

Wood Thrush, Wilson's Thrush, Ovenbird, Least Flycatcher, Scarlet Tanager, Rose-breasted Grosbeak, Warbling Vireo, White-breasted Nuthatch, Blue-grey Gnatcatcher.

All these species are conspicuous either by their plumage or notes and could scarcely have been overlooked by us. The cause of their absence raises an interesting question, as there are seemingly good habitats for them on the Point, and no obvious reasons for their absence.

On the other hand, the breeding populations of Chipping Sparrow, Wood Pewee and the Baltimore and Orchard Orioles were unusually large. Chipping Sparrows haunted almost every corner of the dry land of the Point throughout the summer and constituted perhaps a quarter of the total bird population. Wood Pewees could be heard nearly every minute of the day in every suitable locality. The two Orioles, Orchard and Baltimore, were more than common, approaching abundant. Their rich varied songs made every daylight moment delightful.

From reports received we had been prepared for a large falling off in the number of Cardinals, but were agreeably surprised to find them in their old numbers. Like reports of the Carolina Wren, however, were only too true. This species, after being common ever since regular study has been given to Point Pelee bird life, i.e., since 1905, have, apparently at least, succumbed to the rigors of the climate and not one was found or heard during our stay*. This species is resident wherever found and undoubtedly the past winter or the past two winters were too severe for it. Its loss will be keenly felt by those who remember its far carrying liquid notes that added such a charm to the locality. The writer remembers one 22nd of February, a bright sunshiny morning, the ground white with snow, but the air carrying the greatest flood of bird music he ever heard.

*Mr. W. E. Saunders tells me that since our visit a few Carolina Wrens have again put in an appearance and promise to rejoin their old numbers.

Cardinals and Carolina Wrens answered each other back and forth in almost continuous strains to a running melodic background from flocks of Purple Finches and underlying all, a low, sweet monotone accompaniment from the combined efforts of innumerable Redpolls. It is to be hoped that the Carolina Wren will re-establish itself on the Point.

Though the Carolina Wren has gone we were delighted to find the Mockingbird still doing well. We failed to either see or hear them for a considerable time after our arrival, but on June 13th one lit in the top of a red cedar in front of the camp and serenaded us for several minutes. Later we found that a pair had established themselves in the vicinity of a farm house not far away and, as the local inhabitants are beginning to take pride in having the only genuine wild Mockingbirds in Canada, they undoubtedly had favorable conditions for raising a nestful of young.

Among other interesting nestings was that of the Lark Sparrow. There were at least three pairs established not far from our camp, at least one of which raised a brood, as we saw the fledglings just after they had left the nest.

The Dickcissel was also observed after many years of absence from Point Pelee notes. About half a dozen pairs were found on the reclaimed ground at the base of the Point. They were evidently breeding in the clover fields but the rank luxuriance of the growth prevented our finding the nests.

On June 5th, two Least Bitterns got up from the edge of a small pond in the marsh and crossed together to the far side, where they were both, shortly after, secured by Mr. C. H. Young. One proved to be a Cory's Bittern, *Ixobrychus neoxenus*, female. In view of its apparent close association with an individual of the closely allied species, from which there is even yet some doubt as to its specific distinction the bird's genitalia was examined with some interest. The ovaries were but slightly developed and there could be no question as to its non-breeding condition. The specimen under question is a normally colored individual showing the usual albinism of the species in but a single white feather on the left leg close to the joint.

Lincoln Sparrow has been taken regularly enough at Point Pelee to be classed as a regular migrant, but the great number of this usually rare bird that were present on May 23rd and 24th warrants special mention. These two days we positively indentified 15 and 10 specimens respectively and then gave up scrutinizing the omnipresent Song and other ground

sparrows. Without doubt, careful attention to this one secretive species would have revealed several times as many more.

May 29th was notable for the number of Philadelphia Vireos; twelve were positively separated from the Warbling Vireo also present, after which no special pains was taken to distinguish the species. They were too common to arouse interest.

The taking of a male Prothonotory Warbler, *Prothonotoria citrea*, on May 19th, was one of the events of the season. There are some few records of the species for Canada but they are poorly supported by extant specimens. This appears to be the third record for the Dominion, the first being Boardman's New Brunswick record and the second McIlwraith's, Hamilton, Ontario, bird.

The Orange Crowned Warbler is one of the rarest of the regular warblers in Ontario. Though the past few years has seen more of this species taken at Point Pelee than, perhaps, all the remainder of eastern Canada together, it was a matter of some congratulation to secure one on May 16th.

The last record of the Short-billed Marsh Wren at the Point was May, 1905, when a small colony of them were observed near the base of the Point. It was, therefore, with considerable pleasure that we located several pairs of them, along the west side of the marsh not far from camp. On May 29th and June 2nd they were again observed; though we searched carefully no nest could be discovered.

It is to be regretted that circumstances recalled us to Ottawa when they did as we missed the early part of the fall migrations thereby. The waders were just returning as we left and the following return species were noted, Least Sandpiper, Semipalmated Plover, Yellow-legs and Hudsonian Curlew. No one has so far recorded the opening days of the fall migrations at this famous migration station and we regretted not being able to take advantage of the opportunity.

Among the plants a number of interesting species were collected for reproduction in the intended group. Not quite all species required were to be found on the Point itself and some searching of the adjoining main land was necessary to secure them.

Near Leamington were found considerable numbers of Sweet Chestnuts, *Castonea dentata*, and some magnificent specimens of Tulip Tree, *Liriodendron Tulipifera*. It was a little late in the season before we found these latter and it may be of

interest to state that we were forced to shoot with a rifle the blossoms we wanted from the tips of the high branches.

The Pawpaw, *Asimina triloba*, also required some searching for but at last was found on the main land nearby. The trees found were, comparatively speaking, small saplings, but we heard of one, not far away, with a trunk eight inches in diameter.

Sycamore, *Platanus occidentalis*, also grows to great size on the Point, but the gnarled state of the branches show that it has reached the northern limit of its range. An occurence just before we arrived showed the cause of the dense clumps of twisted twigs, withches brooms, and the strange irregular twists and angles of growth, that adorn the branches of most of these trees on the Point. A frost came after the first leaves had opened, blighting them and the delicate twigs they were giving rise to. For some time thereafter all appearance of terminal growth stopped but later shoots were thrown out at the sides, which being in new directions, formed fresh angles in the crooked growth of the limbs and bunches of bushy sprouts about the joints. This injures the appearance of the trees but evidently has but little effect on its general health. From the appearance of most of the trees it would seem that these late frosts blight the sycamore, on Point Pelee, in this manner most years.

One of the most common trees is the Hackberry, *Celtis occidentalis*, which grows to great size. Its bark is deeply and closely longitudinally ribbed. The ribs sometimes being an inch high, and a quarter of an inch apart. It has a small fruit, black when ripe, much liked by birds, especially the Evening Grosbeak and the Waxings.

The Poison Ivy, *Rhus Toxicodendron*, var. *radicans*, is also interesting to the visitor from other parts of Canada who knows the plant only as a low growing or trailing vine. Here it assumes great size and we brought home a trunk four inches in diameter and fourteen feet long. In one case we saw where an ivy vine had grown to even larger proportions about a tree which subsequently died and rotted away, leaving the clinging vine standing like a tree with great forked branches reaching out in true limb-like pose.

The Wild Grape, *Vitis bicolor*, grows to great size. One old and decayed vine measured eight inches in diameter at base, and must have run up thirty feet from the ground without branch or foliage.

In the marsh grows the Marsh Mallow, *Malva moschcutos*, a pink hybiscus of hollyhock-like aspect and striking beauty. Another plant not growing on the Point but found in some of the streams emptying into the Detroit River nearby is the American Lotus, *Nelumbo lutea*, a plant of such tropical characteristics as to seem quite out of place in our Canadian flora. Its leaves stand up some eighteen inches or more from the water on stiff round stems, each surmounted with a circular pad nearly two feet in diameter, balanced in the center like a spinning plate on a juggler's wand. The flower is like a large water lily six inches in diameter and of a rich cream color, having a yellow green seed pod in the center, of curious form, studded with the projecting heads of acorn-like seeds.

The Red Mulberry, *Morus rubra*, is not an uncommon tree and occurs in scattered individuals throughout the hardwood section, growing in some instances into large forest trees. Evidently they do not bear fruit every year, as some that we were informed bore profusely the previous year were this season barren and others were well laden that had not been observed fruiting before. Though the habit of growth at the ends of the branches of large trees makes the fruit difficult of gathering, we secured several lots of berries for the table and found them delicious. The great variety in shape of the leaves is surprising and seems to be largely characteristic of individual trees, though partially an effect of age. Young trees always show much variety of leafage shape, and old ones frequently do so.

Sassafras, *Sassafras voriifolium*, is very common and occurs to considerable size. A like variation of leaf shape is shown in the species, variation always appearing in young shoots and frequently in the old trees.

The most striking plant on the Point, however, is the Prickly Pear, *Opuntia Rafinesquii*, a cactus growing low on the ground, but of typical cactus form and shape and more than usually well armed with many clusters of minute hair-like prickers and a few scattered thorns of heavier growth. It occurs in more or less circular beds on the driest soil and blossoms profusely. The flowers are some two and a half inches across and of a bright lemon-yellow color. A bed in full bloom is a most striking sight. The plant is very hardy and can stand the extremest aestivation. Bits and lobes that we brought home without earth and never watered remained fresh and solid looking for several months, and some belated blossoms opened out nearly seven weeks after being collected.

We also found some interesting reptile life. Melanism, the occurrence of black individuals in a species normally otherwise colored, and the opposite of albinism, occurs in many species, but is usually very rare. There appears, however, to be on Point Pelee a race of Garter Snakes specially prone to this color aberration. We have taken black Garter Snakes here on other visits and obtained several this trip. On our return to Ottawa we brought with us quite a number of live snakes. Among them was a normal colored Garter Snake which shortly afterwards brought forth 35 young. Of these two were perfectly black or melanitic specimens, all the rest being of the usual striped coloration of the mother.

The Hognosed snake, *Heterodon platyrhinus*, is common on the dunes of east beach, where it usually spends the day under drift wood and logs, coming out at night to forage. The species seems to occur in two forms, a bright yellow and black one, and another form dusty gray with the bright yellow and black markings, veiled and but dimly visible. Though the most harmless of reptiles it has a most venemous aspect when aroused and cornered. It is popularly called "Blowing Adder" and generally regarded so deadly that even its breath is poisonous. When unable to escape an enemy, it coils at bay with its head and body raised from the ground about one-third its length, the head flattened and the chops protruded. Gradually the flatness and protrusion extends down the sides until the whole upraised portion assumes a ribbon-like aspect, perhaps an inch and a half across and less than half an inch through at the center, thining out to almost nothing at the edges. In this attitude, as it faces its enemy, it is indeed a threatening sight, the more so as it "blows" with a distinctly obvious sound and makes passes, as if to strike with wide open mouth. But, to use a colloquial phrase, this is but a bluff, and if the enemy stands its ground the strike so determindly initiated ends with a futile stroke of a soft mouth that can not scratch the tenderest skin.

An occasional individual will carry the game into a still higher form of deception. Finding that its threatenings fail to alarm the aggressor it falls into an apparent fit. Writhing and squirming on the ground, it twists and bites the dust, filling its mouth with sand as it bores its head helplessly into the ground. Gradually the writhings grow fainter and weaker until they cease and the snake lies, belly upward and to all appearances dead. The simulation is close but careful examination shows it slightly over done; for instance, the snake refuses to lie right side up and every attempt at making it do so calls forth a weak spasm which throws it on its back again. Also the limp body will

not balance over a stick or on the hand, however carefully the adjustment is made as to weight; unless it is forcibly held, one end always seems a little heavier than the other and the body slides off to the ground. This comatose condition lasts until the snake thinks the coast clear, when with a sudden jerk it rights itself and if not again molested glides off quickly to the nearest safe retreat; but should it find that the attack is renewed it goes through the whole process of dying over again.

Fox Snakes, *Elaphe vulpinus*, were also common on the same sand dunes. They are colored much like the Adder, but are a slenderer and more gracefully-shaped snake. We found them easily by following up their winding tracks in the sand from willow clump to willow clump, and at last usually discovered them under rotten logs. About the middle of July we found three females under one log with almost a peck of eggs. The eggs are elliptical in shape and covered with a tough leatherly shell that seems to stick together as fast as laid, making clusters like bunches of grapes.

In turning over the logs on the beach for snakes and mice we also found considerable numbers of Blue-tailed skinks, *Eumeces quinquilineatus*. These are locally called Swifts and on a bright warm day the reason of this name is obvious, for they run very rapidly, and it takes considerable agility to catch them, especially as care must be taken to grasping them by the body and not by the tail for the latter breaks off at the least strain, leaving the tailless lizard free to vanish into the debris. The young and half-grown individuals are most beautiful little creatures. All are of the most clean and shapely form with pointed head, slender body, dainty limbs and long, gracefully-tapering tail, but the younger ones have the added beauty of color. The body is coal-black with bright yellow stripes, hence another popular name—and one from which its scientific cognomen is derived—Five-lined Skink. The tail at these ages is a bright sky blue almost irridescent in tone. The adult animals are much soberer, a dull olive-green, with slight bronze reflections to the scales and vague yellowish stripes along the back and sides.

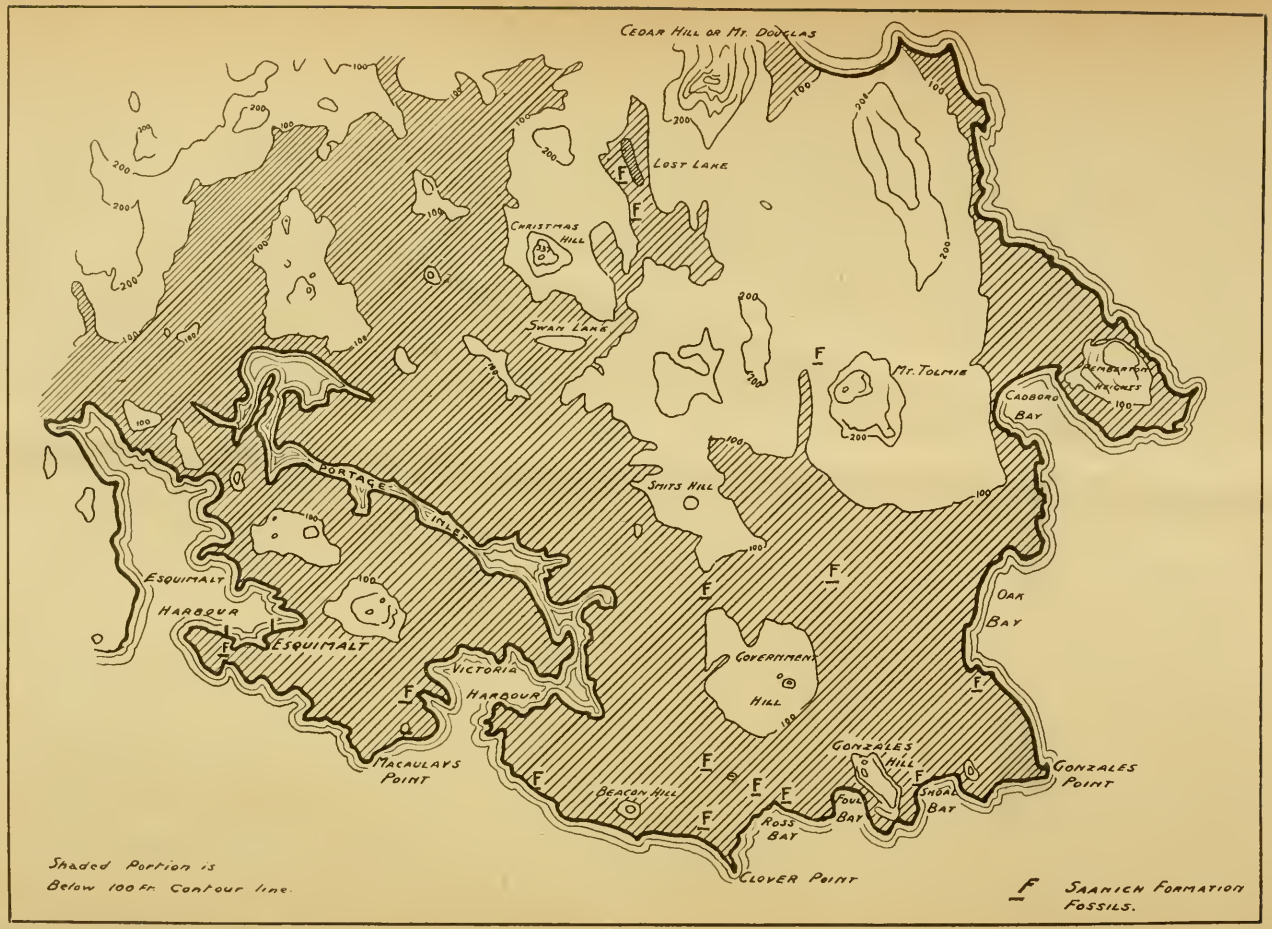
We found several sets of eggs in the cavities of well rotted logs. In all cases an adult was present with them, so it is likely that the mother takes more care of her young than is common among the reptilia. Other specimens captured alive laid eggs in captivity and we managed to hatch out a number of them. Our captives ate ant pupae and flies greedily, which gives us a suggestion as to the nature of their food.

With fish very little was done but to collect some Gar Pike, *Lepidosteus osseus* and *L. platostomus* and Dog Fish, *Amia calva*. We found an adult of the latter in shallow water at the end of the drainage ditch with a school of young.

They schooled close together and occupied a space when closely massed about the size of a bushel basket, while the old one swam about near by, occasionally vanishing for a few minutes but always reappearing again shortly. The Dog fish is one of our most interesting forms, being a survival of a very ancient type with the tail formed from the ventral fin. This peculiar tail formation shows very plainly in the young, of which we collected quite a number.

Among insects a little more was done. The beautiful Olive Hair-streak, *Thecla damon*, was very common the latter end of May on the Red Cedar and a considerable series was collected. One of the most interesting occurrences, however, in this line was the comparative abundance of *Papilio ajax*. The commonly given food plant for this showy butterfly is the Pawpaw. This, however, does not occur on the Point and the nearest clump of it is more than six miles away across a wide marsh, yet we saw the species nearly every day and often from two to six. They flew swiftly and were difficult to capture. Those we managed to take were in almost unworn condition and the majority of those seen were perfect even to the ends of their long swallow tails. It hardly seems possible that all of these should be wanderers from the little clump of Pawpaw in the main land and probably the species has another food plant on the Point. *Terias lisa* was quite common, *Colias eurytheme* was seen several times and taken once. Specimens of *Libythea bochmanni* and *Junonia coenea* were observed and indentified as certainly as possible by eye sight, but no specimens were taken.

Among the mammals of course the work was limited, by the species remaining after many years of hunting and extermination. All the larger land forms have disappeared, even to Skunks and Raccoons, and at present the Muskrat is the largest native mammal inhabiting the Point. We trapped mice extensively, and found the rare Michigan or Baird's Deer Mouse, common on the beaches. The Common Mole is abundant everywhere in the sandy fields. The Flying Squirrels taken proved to be of the small southern form, and the rabbit is the common Cottontail of southern Ontario, and no hares are to be found.



From Topographical Map 20A., Geol. Sur., Can., Victoria Sheet.

Illustrating article on Pleistocene Raised Beaches at Victoria, B.C., by C. F. Newcombe.

PLEISTOCENE RAISED BEACHES AT VICTORIA, B.C.

BY C. F. NEWCOMBE, VICTORIA, B.C.

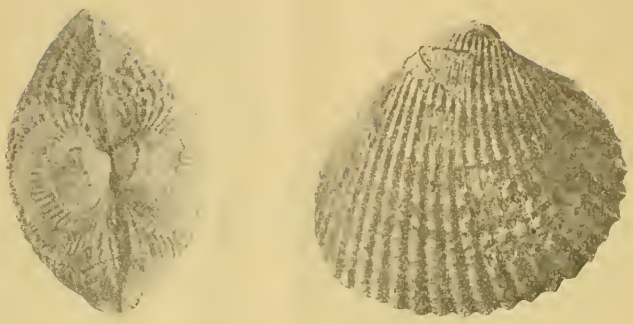
Dr. C. H. Clapp's recently issued article on the Geology of the Victoria and Saanich Map-Areas, Vanc. I., B.C., Memoir No. 36, of the Geological Survey of Canada, includes a very notable contribution to the classification of the superficial deposits in the district treated of.

He makes no distinct mention, however, of certain features which have long been of great interest to local amateur geologists,—the numerous deposits containing marine shells found near the present surface, but usually underlying a peaty layer of no great depth. These, so far as I can make out, are superimposed on the Maywood clays of Clapp, lying in shallow depressions in places where, at the time of their deposition, they were little exposed to disturbance by tides or storms.

The peaty layers contain freshwater shells of species still living in this neighborhood, and some of the localities have only been drained quite recently, and are margined by swamps with sphagnum, *Betula glandulosa*, *Ledum*, etc. The marine shells frequently retain their valves in apposition, and in many cases even the cartilaginous hinge is entire.

The earliest notice I can find of these interior raised beaches is a note by Mr. James Richardson in the Report of the Geological Survey for 1871-2, p. 94, where he reports a shell-bed to the east of the Saanich road, at a height of about three hundred feet above the sea.

The first beach of the kind examined by the writer was one to which attention was called by Mr. F. Pemberton, of Victoria in 1889. He told me that during the removal of black soil from the family estate, near Ross Bay Cemetery, for the late Mr. Robert Dunsmuir's new grounds at Craigdarroch, a large quantity of shells were being exposed under the peat. I found that under a foot or two of decayed vegetable matter containing freshwater shells were the following marine species: *Cardium corbis* Mart., *Macoma calcarea* Gmel., *Mya truncata* L., *Mytilus edulis* L., *Saxicava arctica* L., and *Saxidomus giganteus* Desh.



Cardium decoratum Grnk.

Three years later, in company with Dr. Hasell, of Victoria, I collected at Mount Tolmie all of these species and an additional *Cardium* now no longer living in these waters, *C. decoratum* Grnk. (My diagnosis was confirmed by Dr. Dall, of Washington). The first locality is at an elevation of about thirty feet above present sea-level; that of the second at about one hundred and ten, according to the new contour map of the Saanich Peninsula, —the greatest height at which I have found similar marine shells.

Passing over many minor localities mention may now be made of a typical one at the shallow and much diminished Lost Lake, near the foot of the prominent monadnock called Cedar Hill or Mount Douglas.

This lake lies at an elevation of eighty-three feet at a distance of about four miles from the Victoria post office. In 1894, when Mr. Nicholson, the owner of a large farm bordering on the lake, was extending his drains, a typical condition of things was found, as described at the beginning of this note, with all of the species of marine shells mentioned, lying under a thick layer of imperfectly formed peat.

At the present time the Canadian Northern Railway is endeavoring to find a footing for their road-bed through the lake by driving piles through the shallow bottom. At the last time of my visit they had reached a depth of more than one hundred feet without finding sufficiently firm ground. On the side of a shallow cut here I noticed *Macoma nasuta* and *inquinata*, in addition to the species already noted. It was in this region, though not clearly identified, that Mr. Richardson collected his specimens referred to.

But the most productive area that has come to my notice is one much nearer to Victoria, and which I explored early in this year on behalf of General de Lamothe, of Paris, who visited Victoria in company with several Canadian geologists last year after the meeting of the International Congress. Following along the line of a hollow between Spring Ridge and the Protestant Orphanage, where I had previously made many finds, I at length found a recently constructed main sewer passing through an abandoned vegetable garden, bounded on the west by Cook Street.

Again, after digging through an extensive peat bed, containing freshwater shells in perfect condition, at about four feet from the surface vast quantities of marine shells had been exposed, together with two species of barnacle and a few fragments of elk-horn, apparently cut by a blunt instrument.

Here I added to my list the following Gastropods: *Natica clausa* B. & S. (of immense size), *Natica pallida* B. & S., *Margarita pupilla* Gld., and *Acmaea alveus* Conr., a species which lives on eel grass growing in shallow, quiet waters. To the bivalves were added a *Macoma* like *balthica* L., *Paphia staminea* Conr., *Schizothaerus nuttallii* Conr., and *Zirphaea crispata* L.

About three years ago Mr. Harold Hannibal, of Stanford University, Cal., visited Victoria and accompanied me to the Pemberton locality first noted above, and, later, examined alone, the Lost Lake region. The results of these examinations and of explorations in the Puget Sound country is given in a report by Dr. Ralph Arnold and himself entitled "The Marine Tertiary Stratigraphy of the North Pacific Coast of America," contributed by them to the Proceedings of the American Philosophical Society, Vol. LII, No. 212, 1913. To the raised beach formations just mentioned and to similar ones in Puget Sound and the Strait of Georgia, the authors, on page 597, apply the name The Saanich Formation (Pleistocene).

A partial list of fossils collected by various geologists and by myself in Victoria, and on the shores of various places to the north and east was published by me in the Catalogue of the Provincial Museum, Victoria, in 1898. This list will require considerable revision in the light of later knowledge. The species named include many which were found in the lower clays forming steep cliffs here and near Comox, and islands in the Strait of Georgia, and also from the sandy layers superimposed on Cretaceous rocks at Sucia Island. Mr. Bauerman, Dr. G. M. Dawson and Mr. Lamplugh, of the Geological Survey of Great

Britain, were the most noteworthy collectors, and I was able to add a few species to their lists in after years. The relationship of these clays, in which are *Ledas*, *Buccinums* and other species indicating deeper water than those noted in the Saanich formation, has not, to my mind, been satisfactorily determined.

THE SNOW-FLEA.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

In this part of Canada the coming of winter practically marks the seasonable close of visible insect life, and with the first snow most collectors put up their nets, forceps and bottles. But to this general rule there are exceptions, and occasionally one finds on the snow a torpid fly or spider that the winter winds have blown out of some crevice, or sometimes on a mild day a woolly-bear caterpillar is seen hurrying along as if late for an appointment. These, however, are merely accidental apparitions, and the only insect that can be said to occur regularly during the winter months is the springtail.

These tiny insects belong to the order Thysanura, and form the sub-order Collembola. They are the most widely distributed hexapods in the world, having a range from the Arctic to the Antarctic and are found high up on mountains and down in the deepest caves. Excluding parasites on penguins and seals, which may be regarded as importations, the only indigenous insect in the Antarctic continent is said to be a springtail. Only in view of their absolutely wingless condition, the wide distribution of these small and delicate insects points to the great antiquity of the order, and they are thought to represent a very early offshoot of the ancestral stock of Hexapoda. All the species are very small, ranging from one-half a millimeter to five millimeters in length, but those of the latter size are the giants of the race; most of them are from one to two millimeters long. They frequent dark damp places, as under moss and rotten wood, and owing to their minute size are difficult to discover.

They gain their common name from their peculiar springing organ. Towards the caudal end of the abdomen are attached a pair of tail-like appendages, together called the furcula, which are normally bent forward, under tension, beneath the insect, and the ends are held in a little catch known as the tenaculum. When released from the tenaculum, the furcula kicks forcibly downwards and backwards and jerks the insect into the air. Anyone who remembers the goose bone jumping-jack—a homely toy unknown, I fear, by the present sophisticated generation of children—will readily understand the springtail's leaping apparatus.

At least four species of Collembola occur in the vicinity of Arnprior during the winter:—*Isotoma nigra* Macg., *Achorutes nivicola* Fitch, and two unidentified species. *I. nigra* is fairly common, and sometimes forms the majority of the springtails found on the snow, but generally *A. nivicola* is in excess, and towards spring often appears in such vast numbers that the most casual observer cannot fail to notice it. From its jumping habit it is popularly known as the "snow-flea," although, of course, it is not related in any way to the real fleas, (Siphonaptera).

A. nivicola, which Dr. J. W. Folsom identifies with the *A. socialis* of Europe, may be described untechnically as a blue-black insect two millimeters long by one-quarter millimeter wide at its broadest part. It has a well marked head, bearing two somewhat divergent short antennae which it keeps in constant motion. Its mouth parts are sunk in the head, a peculiarity characteristic of all the Collembola. Its sixteen simple eyes are arranged in two groups of eight each on either side of the head. It has an elongated but stout segmented body, the thorax consisting of three segments each bearing a pair of short legs on which the insect runs very actively. The abdomen has six segments and tapers rapidly towards the tail. The jumping apparatus is as already described. The whole insect is sparsely covered with short fine hairs.

Any day of the winter, from November to March, when the temperature is not below 30° F., *A. nivicola* can be found on the snow near old log fences, and along roads and clearings. They seem always to occur along the edge of open spaces of some kind, and I have never observed them in the middle of a wood of any extent. Although they sometimes come out in considerable numbers in November and December, the really great swarms do not appear until the first mild days of spring. Towards the end of March one often sees them like thickly

scattered grains of gunpowder on the snow near the foci from which they spread. They tumble into every slight depression, and as their movements are rather aimless they do not readily escape from such situations, and every little hollow in the snow is black with them. A friend tells me that he once saw them near the Deschenes Rapids in such quantities that they could have been scooped up in spoonfuls. Of course, as they spread out they become much more thinly scattered. Their progress is slow and apparently rather haphazard, and their distribution is influenced a good deal by the wind, but their general movement is always towards open spaces. A day or two of favorable weather enables them to spread over a large area of country. I have seen them extending to a distance of a half mile from the shore on the ice of the Ottawa River, and on an eight-mile walk on the 26th March, 1914, they were found scattered everywhere over fields, clearings, beaver-meadows and lake.

The object of these migrations is not very apparent, and there is no doubt that the vast majority of the migrants perish in the snow before reaching any goal; but possibly inter-breeding is thus prevented and the racial benefit so derived more than counterbalances the immense destruction of individuals.

On the 24th April, 1914, by which date the snow had all gone, I found large numbers of *A. nivicola* under chips in a damp place on the shore of Chats Lake. The insects were gathered in masses, and to the naked eye, looked like patches of dark blue powder. I collected some in a vial, loosely filled with damp moss, and on the 27th, they laid from seventy-five to one hundred tiny, spherical, yellowish, eggs in lots of fifteen or twenty, something like bunches of grapes. These hatched out on the 9th May, an incubation period of twelve days. The young emerged perfect, (none of the Collembola undergo any metamorphosis), but instead of the blue-black of the adult, they were yellowish-white in color with conspicuous dark eye spots. They were exceedingly active, and kept continually running and jumping about in their bottle. The adults all died about this time and the young survived them only a few days. *A. nivicola* disappears from its winter haunts during the summer, and is very hard to find between May and November, but this is not surprising, as the insect is so small that unless it occurs in very large numbers, it is difficult to discover without the white background of the snow to betray it.

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THE OTTAWA NATURALIST

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LIST OF TACHINIDÆ FROM THE PROVINCE OF QUEBEC.*

By J. D. Tothill.

The following list contains 49 species of Tachinidæ from the province of Quebec. A number of the species were captured at Ottawa, but as this place is only separated from the province of Quebec by the Ottawa river, it is certain that all these species must occur in the neighbouring portions of Quebec and for this reason it seems advisable to include them in the present list.

It is certain that this list represents only a very small proportion of the Tachinidæ that must occur in this large province. Many of the most common species, for instance *Tachina mella* Walk. and *Frontina frenchii* Will., do not appear in the list. This means that collectors in this province, either amateur or professional, would be well repaid by turning their attention to the group.

The list has been compiled from two sources: (1) the collection of the Entomological Branch at Ottawa, and (2) records contained in literature. In the case of records from the former source the precise locality is stated and this is followed by the collector's name in parenthesis. In the case of records from the latter source the name of the person responsible for the original record is given; in all cases where the record appears in Aldrich's Catalogue of N. A. Diptera (1905), reference is made to the original publication containing the record. The references are made by a letter index.

The majority of the species in the present list were originally recorded by Mr. G. Chagnon in his "List of Canadian Diptera" which appeared in the *Entomological Student*, Philadelphia, Vol. II, 5-8 and 13-15; and by Dr. T. W. Fyles, in his "Quebec Diptera," which appeared in the *Canadian Entomologist*, XXXV, p. 234, August, 1903. These records are embodied in Aldrich's "Catalogue," so that in the present list no specific reference has been made to the above two papers.

*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

The order adopted is that of J. M. Aldrich.

Cistogaster immaculata Macq. P. Q.—Fyles (*a*).

Gymnosoma fuliginosa Desv. Montreal—Chagnon (*a*) Ottawa, (Col. by W. Metcalfe).

Alophora æneoventris Will. Ottawa, (Col. by J. D. Tothill).

Alophora diversa Coq. Montreal, (Col. by Beaulieu)—Gibson (*c*) 1911, p. 17.

Alophora magnipennis Johnson. Ottawa—J. Fletcher (*b*) St. Hilaire, P. Q., (Col. by Beaulieu)—Gibson (*c*) 1911, p. 17.

Alophora nitida Coq. Sherbrooke, P. Q.—Aldrich (*a*).

Cryptomeigenia theutis Walk. Montreal—Chagnon (*a*); Ottawa, (Col. by A. Gibson).

Eulasiona comstockii Town. Chelsea, P. Q., (Col. by J. Fletcher).

Admontia degeerioides Coq. Montreal—Chagnon (*a*); Ottawa, (Col. by J. Fletcher).

Clausicella johnsoni Coq. Ottawa—J. Fletcher (*b*) 1906, p. 102.

Hypostena variabilis Coq. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe).

Polidea areos Walk. Montreal—Chagnon (*a*).

Œstrophasia calva Coq. Ottawa—Harrington (*b*) 1902, p. 101.

Cyrtophlœba horrida Coq. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe).

Plagia americana Van der Wulp. Ottawa, (Col. by A. Gibson).

Ocyptera dosiades Walk. Montreal—Chagnon (*a*).

Varichæta aldrichii Town. Ottawa, (Col. by A. Gibson).

Linnæmyia picta Meig. Rigaud P. Q.—A. Gibson (*b*) 1911, p. 17.

Exoristoides harringtoni Coq. Ottawa—Aldrich (*a*).

Exorista cheloniæ Rond. Chelsea, P. Q., (Col. by J. D. Tothill).

Exorista eudryæ Town. Ottawa, (Col. by J. Fletcher).

Exorista futilis O. S. Ottawa, (Col. by J. Fletcher and A. Gibson).

Exorista nigripalpis Town. Ottawa, (Col. by J. Fletcher); Chicoutimi, P. Q., (Reared at Ottawa from larvæ of *Tortrix fumiferana*); Maniwaki, P. Q., (Col. by A. Gibson and G. E. Sanders).

Exorista pyste Walk. Chicoutimi, P. Q., (Reared at Ottawa from larvæ of *Tortrix fumiferana*).

Exorista vulgaris Fall. P. Q.—Fyles (*a*); Maniwaki, P. Q.,

(Col. by A. Gibson and G. E. Sanders); Chicoutimi, P. Q., (Reared at Ottawa from larvæ of *Tortrix fumiferana*); Ottawa, (Col. by H. Groh.)

Phorocera lophyri Town. Ottawa—Aldrich (*a*).

Phorocera saundersii Will. Ottawa, (Col. by J. Fletcher).

Frontina tenthredinidarum Town. Ottawa, (*a*).

Sturmia albifrons Walk. Ottawa, (Col. by J. Fletcher).

Sturmia inquinata V. d. W. Ottawa, (Col. by A. Gibson).

Sturmia nigrita Town. Rigaud, P. Q.—A. Gibson (*c*) 1911, p. 17.

Masicera eufitchiæ Town. Ottawa, (Col. by A. Gibson).

Masicera myoidea Desv. Ottawa, (Col. by C. H. Young). Meach Lake, P. Q.,—J. Fletcher (*c*) 1907, p. 21.

Tachina simulans Meig. Ottawa, (Col. by W. Metcalfe)· Montreal—Chagnon (*a*).*

Tachinomyia robusta Town. Ottawa, (Col. by J. A. Letourneau).

Blepharipeza adusta Lœw. Ottawa, (Col. by A. Gibson).

Blepharipeza leucophrys Wied. Meach Lake, P. Q., (Col. by A. Gibson).

Winthemia quadripustulata Fab. Ottawa, (Col. by W. Metcalfe and Bro. Germain).

Metachæta helymus Walk. Montreal—Chagnon (*a*), Ottawa, (Col. by A. Gibson).

Phorichæta sequax Will. Ottawa, (Col. by A. Gibson).

Gonia capitata DeGeer. P. Q.—Fyles (*a*); Ottawa, (Col. byW. Metcalfe and J. Fletcher).

Spallanzania hesperidarum Will. Montreal—Chagnon (*a*),

Cuphocera fucata V. d. W. Montreal—Chagnon (*a*).

Peleteria prompta Meig. Montreal—Chagnon (*a*); Ottawa, (Col. by A. Gibson); Aylmer, P. Q., (Col. by H. Groh.)

Archytas analis Fab. Montreal—Chagnon (*a*); Ottawa, (Col. by J. Fletcher).

Echinomyia algens Wied. Quebec—Van der Wulp (*a*); Ottawa, (Col. by J. Fletcher and A. Gibson).

Echinomyia florum Walk. P. Q.—Fyles (*a*).

Saundersia signifera Walk. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe and J. D. Tothill). Dr. Fletcher, in 1904, reported the species as "unusually common at Ottawa" (*b*) 1904, p. 78.

Bombyliomyia abrupta Wied. Quebec—Van der Wulp (*a*);

*In Aldrich's Catalogue of N. A. Diptera this species is recorded from Ottawa, and, for the record, reference is made to Coquillett's 'Revision' p. 119. In this 'Revision' the only Canadian locality given is Toronto so that an error has evidently been made in transcription.

Montreal—Chagnon (*a*); Meach Lake, P. Q.,(Col. by A. Gibson); Ottawa, (Col. by J. Fletcher).

Literature cited:

(*a*) Aldrich, J. M., Catalogue of North American Diptera, 1905.

(*b*) Reports of the Entomological Society of Ontario.

(*c*) James Fletcher and Arthur Gibson. "The Entomological Record" to 1912.

BOOK NOTICES.

THE HOUSE-FLY, MUSCA *Domestica* Linn. ITS STRUCTURE, HABITS, DEVELOPMENT. RELATION TO DISEASE AND CONTROL. By C. Gordon Hewitt, D. Sc., F. R. S. C., Dominion Entomologist. Cambridge: at the University Press, 1914. Price 15 shillings net.

This book of 382 pages which has just been received, is undoubtedly the most comprehensive and complete volume which has yet appeared on the extremely common insect, which is abundant, unfortunately, everywhere, *viz.*, the House-fly. No insect of late years has received such world-wide attention as has the species here discussed. This, of course, has been owing to its relation to the spread of disease. The book is not intended as a popular treatise on the subject, but it has been prepared largely for the use of entomologists, medical men, health officers and others who would be interested scientifically in the matter presented. The volume is divided into six parts, *viz.*, Part I—The Structure and Habits of the House-fly; Part II—The Breeding Habits; Life-history and Structure of the Larva; Part III—The Natural Enemies and Parasites of the House-fly; Part IV.—Other Species of Flies Frequenting Houses; Part V—The Relation of House-flies to Disease; Part VI—Control Measures. Three full page coloured plates and 104 text figures illustrate the volume. Students of the subject, everywhere, will welcome the appearance of this important book. It will undoubtedly be a valuable work of reference for many years to come.

BIRD HOUSES AND HOW TO BUILD THEM. In view of the interest which is now being taken in the protection of our native insectivorous birds in various parts of Canada, the United States Department of Agriculture, Farmers' Bulletin No. 609, bearing the title, "Bird Houses and How to Build Them", will prove of much interest. This bulletin of 19 pages, prepared by Mr. Ned. Dearborn, Assistant Biologist, discusses briefly many forms of bird houses, nesting boxes, etc. Food shelters are also described. Forty-eight illustrations are given.

COMMISSION OF CONSERVATION; FIFTH ANNUAL REPORT. This very useful report was recently issued.

In his annual address, the Chairman of the Commission, Hon. Clifford Sifton, discusses the Commission's activities with respect to waters and water-powers, minerals, public health, agriculture, fisheries and fur-bearing animals and forests, indicating clearly and succinctly a number of the problems that had been grappled with and the advances that had been made in their solution.

Several articles appear in the report which are of special interest to naturalists. Mr. J. Walter Jones treats in detail of the progress in fur-farming in Canada during the past year. The work of the Committee on Fisheries was confined, during 1913, chiefly to the development of the oyster industry. Hon. A. E. Arsenault describes the new method of leasing oyster beds in Prince Edward Island. This method was advocated by the Commission two years ago, and will do much to regenerate the oyster industry in the Maritime Provinces. An exceedingly interesting paper on the "Protection of Migratory Birds" is given by a leading American authority, Mr. W. S. Haskell, who urges Canada to join with the United States in providing sanctuaries for these birds.

Considerable advance has been made in the conservation of forests during the year. The Commission has co-operated with the Board of Railway Commissioners and the several provincial and Federal forest services concerning the prevention of forest fires, with the result that much has been done to prevent forest fires along railway lines, especially in Western Canada. In addition to the report of the chief forester, Mr. Clyde Leavitt, there are addresses on forestry by Dr. B. E. Fernow and Mr. R. H. Campbell.

The report contains a number of splendid illustrations and gives in concise form much information that is of value to all Canadians interested in the conservation of our natural resources.

MEETING OF THE BOTANICAL BRANCH.

The Botanical Branch held the first of its bi-monthly winter meetings at the residence of Mr. R. B. Whyte, on Saturday evening, November 14. The meeting was in charge of Mr. W. T. Macoun, Dr. M. O. Malte, and Mr. G. H. Clark. There were also present the following members: Messrs. Attwood,

Ami, Buck, Criddle, Davis, Fryer, Gibson, Macmillan, Newman, Tully and the host, Mr. R. B. Whyte.

The subject dealt with was "Possibilities for Home Grown Seed in Canada" with particular reference to root and vegetable crops.

Mr. Macoun in opening the discussion stated that both Mr. Clark and Dr. Malte, as well as himself, had already given the subject considerable attention, having prepared articles, etc., for the press in which attention had been drawn to the point that there was a strong probability that shortages of certain seeds would be felt in Canada for at least the two following seasons, owing to the fact that Germany and France, the regular sources of supply, would not be able to fill orders as heretofore.

Summarizing the pros and cons of the case for Canadian grown seed, and other interesting points relating to the plants the seed of which, could or could not be grown to advantage, it was noted that (1) Home grown seed often produced more vigorous plants; (2) earlier fruits; (3) the suitability of localities for certain crops was an essential factor; (4) the question of the high cost of labour militated somewhat against home production; (5) about one dozen of the important plant families were represented by the most important of the popular garden and field vegetables; the asparagus and onion for instance, representing the Lily family; (6) nearly all of the present vegetables have been cultivated for a long time, and in some cases it was possible to trace modern species to a common origin. The modern cabbage, kale, and cauliflower were known to have come from one original type. Mr. Macoun in closing, again referred to the question of proper locality and stated that while he thought certain seed, like that of melons, might be produced most profitably in sections of the country, like British Columbia, yet he felt confident that in time most seeds now raised in Europe could be raised to advantage in Canada.

Dr. Malte dealt more particularly with forage roots such as mangels, turnips and sugar beets. He pointed out that the original wild form of such root crops consisted of a creeping form found on the sand of the coastal regions of Europe. This, without doubt, accounted for the fact that such crops possessed a liking for alkali soils and flourished in coast districts. In raising beet seed it must be kept in mind that different varieties cross fertilize very freely. Mangels too, in most cases were not yet fixed in types. When swedes and white turnips are grown side by side, it has been found that cross fertilization will influence the resultant roots, and that as a result many malformations of the roots follow. In some instances such malformations have been mistaken for the effect of Club Root.

Plasmodiophora brassicæ.

From certain experiments which had been carried on at Yarmouth, N. S., it has been found that excellent seed of roots can be grown there. Eleven hundred pounds of seed per acre is about the average for mangels.

Mr. Clark discussed the methods adopted by the seedsmen in buying and distributing seed. He also stated how it was that seed-growing in such places as Waterloo County, Ontario, came to be started in Canada some years ago. It was a result of judicious help given by the federal Government. He further pointed out the fact that the sub-vention offered this year by the Government should help in the production of more home grown seed. The last few years over 1,200,000 pounds of mangel seed have been imported into this country, each year, much of which might be grown here. The subject provoked considerable discussion by the members.

F. E. B.

THE VALUE OF SOME MAMMALS AND BIRDS AS DESTROYERS OF NOXIOUS INSECTS.*

BY NORMAN CRIDDLE.

In these days of specialization, we are apt to overlook the close relationship that other classes or orders hold in the economies of nature. Yet, as our work proceeds we find that its scope must of necessity be widened to take in, at least, an elementary understanding of other things. The student, for instance of lepidoptera will find it necessary to learn something of botany so that he may recognize the various plants acting as unwilling hosts, or being fertilized through the agencies of the insects visiting them. He will also require some knowledge of hymenopterous insects and of diptera, which in their larval life sometimes live as uninvited guests within the caterpillars.

Then again, there are the birds and mammals which often play a not unimportant part in the control of insect outbreaks. As these last seldom receive their due in entomological journals, I have decided to select them for my theme, trusting that the outcome will not prove altogether without interest.

In the year 1913, being busily engaged in the task of collecting June beetles (*Lachnosterna* spp.) for breeding purposes, I had occasion to visit nightly a favourite locality for those insects, the time being from dusk to midnight. Here, lantern in hand, I examined the various trees for specimens and often sat watching the insects' habits, collecting such individuals as seemed desirable.

*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

It was not long before I became aware that I was not alone in my searches, and soon it was discovered that another, equally keen in collecting and more expert in discovery, was keeping me company.

To begin with, this companion was only suspected by strange noises among the bushes, but one night hearing the usual snapping of twigs and characteristic *jump, jump,* among the leaves, approaching nearer, I waited silently out of sight, and then what should appear within a few feet, but a fully mature female skunk. She was startled, as I flashed the lantern light into her face, and made off, but afterwards, in the course of a few weeks we became more friendly, and I was privileged to watch her work. It was interesting too, to see how she jumped at the clumsy, buzzing beetles, either knocking them down with her front feet, or securing them before they had time to rise. Of course, I only saw her now and then, and that was generally while I was sitting or standing still, but I gained sufficient insight into her ways to see that she made a very fair meal of the beetles, and that without very much trouble. From the fact that she came back nightly, for several weeks, I fancy she too recognized the value of the vicinity as a collecting ground.

Later, when the beetles had vanished for the season, she still returned frequently. Now, however, paying all her attention to the grubs, which in searching for she seemed just as successful as she had previously been with their parents, though I was obliged to dig haphazardly to gain the same ends.

This was, by no means, my first experience with skunks as destroyers of insects, but I had never before watched one so closely in the field or realized how much good they could do. Since then I have had occasion to come into close contact with their work as destroyers of white grubs on a number of occasions, to say nothing of their love for grasshoppers, upon which they turn most of their attention during the summer months. As soon as the grasshopper season slackens, however, they return once more to the white grubs and continue feeding upon them until the insects, feeling that winter is approaching, make their way below the skunks' reach.

On a field near Aweme, Manitoba, badly infested with white grubs, two or more skunks were in the habit of visiting each evening to make their customary meal. One of them was probably my old friend, while the others doubtless constituted her family. I only saw odd individuals once or twice, but the evidence of their work was unmistakable. Here over an area approximating eight acres, were found little holes, without doubt the work of skunks. They usually only went to a depth of a few inches, but that was sufficient for the purpose. Making

an estimate of the number of holes to a square yard, I found these to approximate slightly more than three. Supposing that each hole represented a white grub, and there is little doubt about this, then the total grubs destroyed, to an acre, would be 14,520. That is to say, 116,160 in the eight acres. To anyone not accustomed to skunks' habits, the discovery of white grubs under ground many seem questionable, but not to those who know, as a matter of fact these animals collect practically all their food by scent.

Naturally skunks, like many other animals, do some harm by eating useful insects, in fact they will even relish a *Calosoma* beetle. They also destroy some birds' eggs and occasionally raid a poultry house, but their value cannot, I think, be questioned.

Writing of white grubs reminds me of another enemy they have to contend against and that is our old and cheery friend the robin. In the east robins are industrious workers on our lawns, the food they seek there being largely earthworms. In Manitoba, however, and westward to the Rockies, earthworms are scarce, but in places at least, there are lots of white grubs, which though located below the ground are, as a rule, discovered with comparative ease by the robins. How they manage it I do not know, but that they do so I have seen demonstrated on a number of occasions, when a small flock made a badly infested field their daily feeding ground before the breeding season commenced.

Flickers and crows also rank high as white grub destroyers in late May. The former, however, do not trouble themselves so much about white grubs when other insects, such as grasshoppers and ants, are available.

It is, however, by following the plough and picking up the grubs exposed that the work of the crow ranks highest. In the open wooded districts preferred alike as breeding places by crows and June Beetles, one will often turn up the grubs in large numbers, but in my experience seldom in quantity too numerous for the birds following the plough. A flock of twenty-five or more crows following diligently behind in the furrow, have been my companions through many a day's ploughing in early summer, while in their company were the usual blackbirds and grackles, all occupied in the same task.

A little friend of mine, with, I am sorry to say, a bad name, is also very evident, I refer to the cowbird, with whom, in cheerful impudence, there are few to compare. They have no more fear of sitting upon an animal's back to pick off the flies than they have of running beneath one, or being shoved out of the way by its nose. As destroyers of grubs, they are excellent,

but do not eat the larger ones when smaller are available, instead merely squeezing their heads as if desirous that they should be killed at all events.

These are the ploughman's more constant company, but occasionally he will have a graceful flock of gulls as his guests—voracious feeders upon every insect exposed, and a large flock will soon devour all specimens in sight.

In my personal experience, however, I have found crows to be by far the most persistent in their search for insects. They will literally live and feed their young upon cutworms from a badly infested locality, locating the grubs by means of the upheavals so characteristically left when one is working near the surface. Another favourite diet is made up of army-worms when present. During a local outbreak near my home, in 1913, I found that of all birds, crows were most in evidence at this time (August). As is well known, crows in autumn generally collect into large flocks, often of many thousands. One such flock, estimated at 3,000, visited the army-worms daily, particularly when they were crossing a road. Several infested fields were also located by the crows' guidance, the birds having forsaken all other food and flown several miles to partake of these caterpillars. The birds remained on the fields for some weeks after the larvæ had pupated, undoubtedly picking up these latter from beneath clods of earth, etc., which they are experts at turning over and habitually do so in search of insects. How many army-worms a flock of 3,000 crows would devour in two weeks, I will leave my readers to judge.

In describing some of the good qualities of crows, I do not wish it to be thought that I thus acquit them of all crimes. The crow is often a thief, helping himself to a farmer's corn, as readily as he will to eggs or young poultry when opportunity offers. To those of us who have watched his habits carefully, however, the good deeds seem to far outweigh the bad. And, therefore, I include him as an undoubted friend.

Another type of birds, frequently overlooked as destroyers of insects, but preserved at certain seasons on account of their food value and the sport they supply to hunters, are the various species of grouse.

To those who have lived in their breeding areas, it is noticeable that the yearly increase of Prairie Sharp-tailed Grouse (*Pæpediœcetes p. campestris*) in the prairie provinces fluctuates from year to year, the variation in numbers, apart from the devastation caused by gunners, being largely due to the food supply, the food in question consisting chiefly of grasshoppers.

Observation shows that an outbreak of locusts is nearly always followed by the successful maturing of a large number

of young grouse. Hence, apart from the evidence acquired through the examination of stomachs, we are led to believe that the young subsist very largely upon such insects. They do not, however, by any means confine themselves to locusts. Caterpillars having smooth skin are consumed, from the largest sphinx larva, to cutworms, army-worms. etc.

As the season proceeds, however, the diet of the Sharp-tailed Grouse changes and while they still regard insects as luxuries, they now turn their attention to various grains, particularly wheat, which they occasionally damage to a small extent, though the damage as a rule does not extend over more than a month, while the injury itself consists of the birds resting upon the stooks and picking out the grains from the heads. By far the greatest portion of the grain eaten at this time, however, is gleaned from the ground, being waste material, and therefore of no value. This grouse is also troublesome sometimes before harvest, when it learns to break down the stems of grain to get at the heads. It is conceivable that if very numerous they might cause considerable damage by this habit, a contingency that does not seem likely to occur, however, under present conditions. They are also objected to occasionally by farmers through choosing one of their fields for a "dancing" ground in the spring months, when perhaps half a hundred males will collect for their morning and evening manœuvers, thoroughly trampling down an acre or more of land.

Of course, all there little depredations are insignificant when compared with the birds' usefulness as destroyers of noxious insects, and their value for food purposes.

The Pennated, or Square-tailed Grouse (*Tympanuchus americanus*) is another with habits very similar to those of the Sharp-tailed. It, however, chooses the open country for its home, whereas the latter prefers open woodlands.

The food habits of the Ruffed Grouse (*Bonasa* sp.) are much more in question than those of the species mentioned above, for while they undoubtedly devour many caterpillars and other noxious insects during summer time, they feed very largely upon buds in winter, often almost stripping trees, particularly those of poplar, besides badly damaging lilacs and other shrubs. It may be said, however, that the buds eaten are usually flowering ones which in poplars are larger than leaf buds, thus the trees suffer to a comparatively small extent. This argument cannot be used, however, in the case of lilacs, which should be protected by wire netting.

Naturally such injury is confined to the vicinity of wood lands which are the birds' natural homes. Probably the summer food taken fully compensates in value for the damage

done in winter time, but more definite evidence is required to make sure. Of course, the bird is much relished as food and on this account alone is well worthy of being preserved.

There is one thing that may be said in regard to the status of birds as destroyers of insects. A great many useful insects are very minute and would thus escape detection. Others have stings or look so like bees or wasps as to readily pass for them. On the other hand a great many pests are large, such as orthoptera and lepidoptera and are thus more likely to attract attention. Of course a bird in seizing a grub may unwittingly destroy half a hundred parasites and so do harm, on the other hand it may go further and kill hyperparasites which prey upon true parasites.

There is no doubt that many bird lovers go too far in their claims of bird usefulness just as some entomologists go to the other extreme in minimizing their usefulness. As a matter of fact many of our worst pests are hardly influenced at all by birds. I may cite as an example the Hessian-fly, and other small insects. It is also generally a mistake to consider birds of first importance in the suppression of severe insect outbreaks. They doubtless help, the cases cited above beinga few examples, but they are far behind predaceous and parasitic insects in such work. Their aid, however, is far greater when pests exist in normal numbers. Then, by keeping them so, by picking off the surplus, they are accomplishing much in retaining the balance of nature.

NOTES ON THE QUAIL.

A reference to quail in Mr. Saunder's article in the October issue on bird preservation, noticed during an enforced confinement to the house, is responsible for these few items about the doings of a very gallant little gentleman. The remarks are only scientific in being accurate, but spending each winter on a club property of some hundred thousand acres in South Carolina, with a naturalist for a manager, a crowd of observant darky guides, and a changing group of guests, talking game and game habits every evening, *Colinus virginianus* has become a familiar friend.

Our American Quail, so called, is an Englishman in his courtesy to his woman kind, his bulldog fighting powers and his clinging to customs, that, in a new country with progressive neighbors, might well be changed. He takes his turn sitting on the eggs; if weather conditions are favorable to a second brood, fosters the first chicks until the two bevies unite into the families of twenty odd that sometimes gladden our eyes,

and, it is said, should the better half be taken away, never remarries. A hen quail just outside the Oakland house fence was eaten by a rattlesnake. The cock remained there, single, two seasons, although charmers in quantity piped their notes a few hundred feet away.

An abundance of quail in a suitable country depends on four main factors—food, cover, water and, probably, grit. This last is important only in a delta section like Oaklands, where a morning search after a pebble for rasping a turkey call ended in breaking up a scythe stone; and food might perhaps be modified to winter food. Bevies with us do not break up before May, and they find then a plentitude of grass and insects everywhere. During the winter months in the south, quail live principally on pine mast, but lespedeza, "benny" wild helianthus, in fact any suitable sized weed seed, is acceptable

On plantations lately grazed by cattle, birds practically disappear—no cover.

Quail can stand a *short* cold spell, with snow, better than many other genera. They roost always in a close circle, heads out, in patches of low stubble, and remain there, dormant, until the weather improves or starvation scatters them.

Artificially increasing stock is a facinating but little understood subject. It is only within a year or so that hatching in confinement has succeeded at all. The mere dumping of unmated birds in pairs or quantity seems a waste of time. At Camden thousands of quail were imported from the west without permanent results, and we ourselves have often tried the thing on a smaller scale.

Beyond dispute, at the beginning of the breeding season, the strongest cock left by the sportsmen drives away all rivals, whistles a mate provided he is a young bird, and then, with the tenacity of the anglo-saxon, pre-empts such territory, be it one or twenty acres, as seems necessary for the welfare of his family, defending this while life lasts against all trespassers. The writer firmly believes that by judicious planting and observance of the other conditions, his majesty will be contented with merely enough land to secure happiness, leaving the extra room gained for new comers. But much better authorities say not, he wants what his father, grandfather, and great grandfather owned. Certainly at the Oakland Club we find, year after year, only the same bevies, though food has been provided, vermin trapped and a breeding stock carefully preserved.

What comes of the vast surplus thus driven away is an enigma. Quail are undoubtedly migratory in the small isotherms between northern and sub-temperate regions. Probably

these southern birds drift north to fill the areas depleted by snow, but nobody knows.

It seems cruel to kill quail when so many less interesting and useful game birds exist, but the harder, in reason, land is shot over, the better. Otherwise the parent birds live to become barren,or one only of the original pair dies by accident. Districts that never see a gun, deteriorate and a single healthy young bird alive at the beginning of the mating season means a full sized brood at that place in the autumn. In Europe, however, eggs are taken from one nest to another, to provide change in blood.

Cats and cur dogs are the worst enemies. As farmers learn to appreciate the good birds do, it may become illegal to own or harbor pussy.

D. B.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1914.

Some Personal Impressions.

To one who has not previously taken part in gatherings of that character, the meeting of the Entomological Society of Ontario held at Toronto, Nov. 5th and 6th, were of unusual interest. To begin with, there was the mixing with kindred spirits from all parts of the country, not forgetting our neighbors and co-workers from the south; for in the broad realms of science boundaries present little significance and those in its pursuit come as near to the ideal of universal brotherhood as any class I know of. This mixing, then, of men from all parts having similar aims, was by no means the least profitable of the proceedings and certainly not the least enjoyable.

To me, of course, many of the faces were new, though the men were in other ways old friends. It would be difficult to enlarge upon the characteristics or qualities of some without neglecting others equally worthy of note and yet it would be equally impossible to enumerate all in this short paper. I will, therefore, briefly touch upon a few picked out almost at random from those who were present.

Mention should first be made of our worthy President, Dr. Hewitt, who presided over the meetings, and whose presidential address, an exhaustive account of the rise and progress of Economic Entomology in Canada, was much appreciated by the audience. Dr. Bethune, an old and prized correspondent, and Dr. Fyles, another veteran, were present, the latter presenting a paper entitled "Mountains and Hills," written in his

usual characteristic style and read in a manner which many of our younger generation might imitate to advantage. Prof. Comstock, fittingly described by our President as the father of modern entomology, delivered the public lecture, his subject being "The Habits of Spiders," and delighted his listeners by a magnificent collection of lantern slides displaying the web-spinning characters of various genera and species.

Prof. Lochhead, another old friend to all who have read the Annual Reports of the Society, enlivened the meetings by many a cheery remark, besides presenting us with matter of a more serious nature. An address that will long be remembered was his light touches and extracts from the works of the famous French naturalist Fabre. Professor Cæsar provided both papers and spontaneous material characteristic of the man and of undoubted value to the farming community. Among his contributions may be mentioned "An Imported Red Spider Attacking Fruit Trees" and "Cherry Fruit Flies"

Nor must I leave out my colleagues in the Entomological Branch, Messrs. Gibson and Swaine. The former's paper, entitled "Outbreak of the Army Worm in Canada in 1914", in which the writer depicted the insect's habits and showed that its depredation amounted to a loss approximating $300,000, was listened to with much interest, and in company with a paper by Mr. A. W. Baker, of the Ontario Agricultural College, entitled "The Army Worm in Ontario," was the prelude of a lively discussion.

Another paper by Mr. Gibson, entitled "Locust Control in Eastern Canada," was also of special interest to the writer of these notes.

Mr. Swaine's contribution on "Forest and Shade Tree Insects on the Farm," contained a special warning to citizens to be on the watch for pests now making their way towards our borders. He also gave an interesting talk upon Forest Insect Conditions in British Columbia.

In the discussion that followed the reading of all these papers, most of the members took part, and in this connection I would specially mention Prof. Crosby, of Cornell University, Prof. Brittain, of Truro, N.S., Father Leopold of Oka, and Messrs. Chapais, Dearness, Ross, King, and Hudson. The remarks of whom, together with the various papers, will appear in due course in the Annual Report of the Society, which should be in the hands of all interested in entomology.

Lastly, there was the smoker at our headquarters, of which only those who were present could form an adequate idea of its interest. Nor must I forget the hospitality of the Toronto branch who, headed by Dr. Walker, did much towards making the meetings a success. N. C.

THE OTTAWA FIELD NATURALISTS' CLUB.

PROGRAMME OF WINTER MEETINGS.

November 23rd, 1914, (Monday), open meeting. Exhibits and Addresses by Members. (Normal School Assembly Hall).

December 8th, 1914, (Tuesday). "The New Zealand Peripatus—The most ancient and wonderful of living animals." (Illustrated with living specimens). Prof. E. E. Prince, Dominion Commissioner of Fisheries, Ottawa. (Normal School Assembly Hall).

January 12th, 1915, (Tuesday). "The Royal Botanic Gardens, Kew." (Illustrated with lantern views). Prof. R. B. Thomson, Botanical Laboratory, University of Toronto. (Normal School Assembly Hall).

January 26, 1915, (Tuesday). "The Indians of the West Coast." (Illustrated with lantern views). Dr. Edward Sapir, Department of Anthropology, Geological Survey, Ottawa. (Normal School Assembly Hall).

February 9th, 1915, (Tuesday). "Fossils." (Illustrated with lantern views). Mr. L. D. Burling, Geological Survey, Ottawa. (Carnegie Library Assembly Hall).

February 23rd, 1915, (Tuesday). "Milk." (Illustrated with lantern views). Mr. J. H. Grisdale, Director Experimental Farm, Ottawa. Carnegie Library Assembly Hall).

March 9th, 1915, (Tuesday). "Some Interesting Canadian Birds." (Illustrated with lantern views). Dr. M. Y. Williams, Geological Survey, Ottawa. (Carnegie Library Assembly Hall)..

March 23rd, 1915, (Tuesday). Annual Meeting and Presidential Address, "The Habits of Insects in Relation to their Control." Mr. Arthur Gibson, Entomological Branch, Department of Agriculture, Ottawa. (Carnegie Library Assembly Hall).

Meetings commence at 8 p.m.

HARLAN I. SMITH,
Chairman Lectures Committee.

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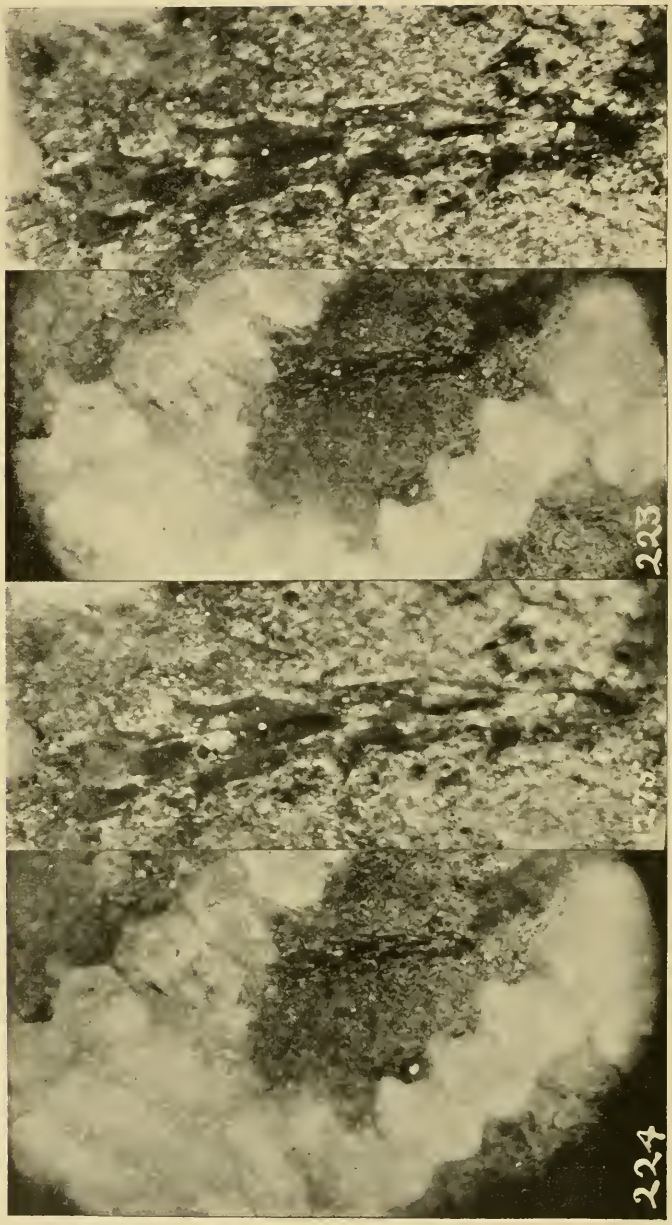

CERAMOGRAPTUS RUEDEMANNI, HUDSON.

Left figure in each half of stereogram x 20 dia. and from a mounting under gum,—right figure an enlargement from same negatives to 60 dia. The plate numbers are those of the original negatives.

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THE OTTAWA NATURALIST

VOL. XXVIII JANUARY, 1915. No. 10.

CERAMOGRAPTUS RUEDEMANNI

A New Genus and Species of Graptolitoidea, and Notes on Urasterella pulchella, Billings. Plate II.

By George H. Hudson.

The holotype of this species is the fragment of a rhabdsome lying across the weathered base of an arm of the holotype of *Urasterella pulchella*, Billings, in the Victoria Memorial Museum, Ottawa, Canada. Horizon—Trenton at Ottawa, Canada.

This species seems allied to *Cactograptus*, Ruedemann, but the difference in form and arrangement of the denticles entitles it to generic distinction. Until new material is discovered the diagnosis of the genotype must answer for that of the genus.

Ceramograptus ruedemanni, sp. nov.

The branch measured across from apparent spine tips of oppositely placed denticles is 0.26 mm. wide. The denticles are 0.37 mm. long, placed nearly parallel with the main axis, and but slightly overlapping. The lower half of the outer margin of each denticle makes an angle of about 21 degrees with the axis of the branch. The middle is gently convex and on this ventricose portion there seems to be a short angular or spiny process. The upper half of this marginal line is at first slightly concave and subparallel with the axis but soon swings out in a graceful curve to the point of a short apertural spine. The apertural opening is slightly concave and from the tip inward measures 0.08 mm. in diameter. These margins appear to be slightly thickened or keeled and the apertural margin near the axis is slightly folded or vertically ribbed, presenting three short ridges which have strongly reflected the light and appear as white spots in the photo-micrographs from which our plate was made. The appearance of these denticles is that of slender and graceful vases with a pouring lip, each vase set with its back to the main axis. Hence the generic name from *Ceramos*, a pitcher or vase.

A study of this plate with a stereoscope seems to show that the denticles were arranged in double pairs, *i. e.*, with four denticles arising from each node. In the lowest group there seems to be a denticle occupying a middle position between the pair at the sides, but its apertural margin and parts of its ventral surface are lost. In the next group above, the gum mounting allows us to look deeply within the branch and see (from the inside) the ventricose portion of a denticle on the distant side of the axis. Above this opening there remains a portion of a denticle facing the observer. The next group above also shows portions of a third denticle. The fourth or topmost group has been cut across diagonally by weathering. The openings on this surface present additional evidence that each node bore, at least, four denticles.

The plate shows clearly the value of mounting with gum damar, for such mounting not only served to render the surface more transparent and increase the contrast between the black remains of the chitin and the matrix, but it also aided in securing that sharpness of outline which still appears in the subsequent enlargement to 60 diameters.

The specimen is named in honor of Dr. Rudolf Ruedemann, to whom the writer, and the world as well, is deeply indebted for his work on this interesting group of fossil organisms.

The detail of *Urasterella pulchella*, Bill., which is reproduced on this plate, shows some of the flooring ossicles (ambulacra) of the arm, a number of arm marginals with spine bases, and an apparently double interradial marginal. The ambulacral plates, here lost, are elsewhere present and functioned as true covering plates. That is they could be closed so as to meet each other over the food groove or they could be held in a widely open condition and the five interradial pairs could function as jaws. More complete details of this species will be given in another article.

THE BANDED POCKET MOUSE, *PEROGNATHUS FASCIATUS* WIED.

By Stuart Criddle, Treesbank, Man.

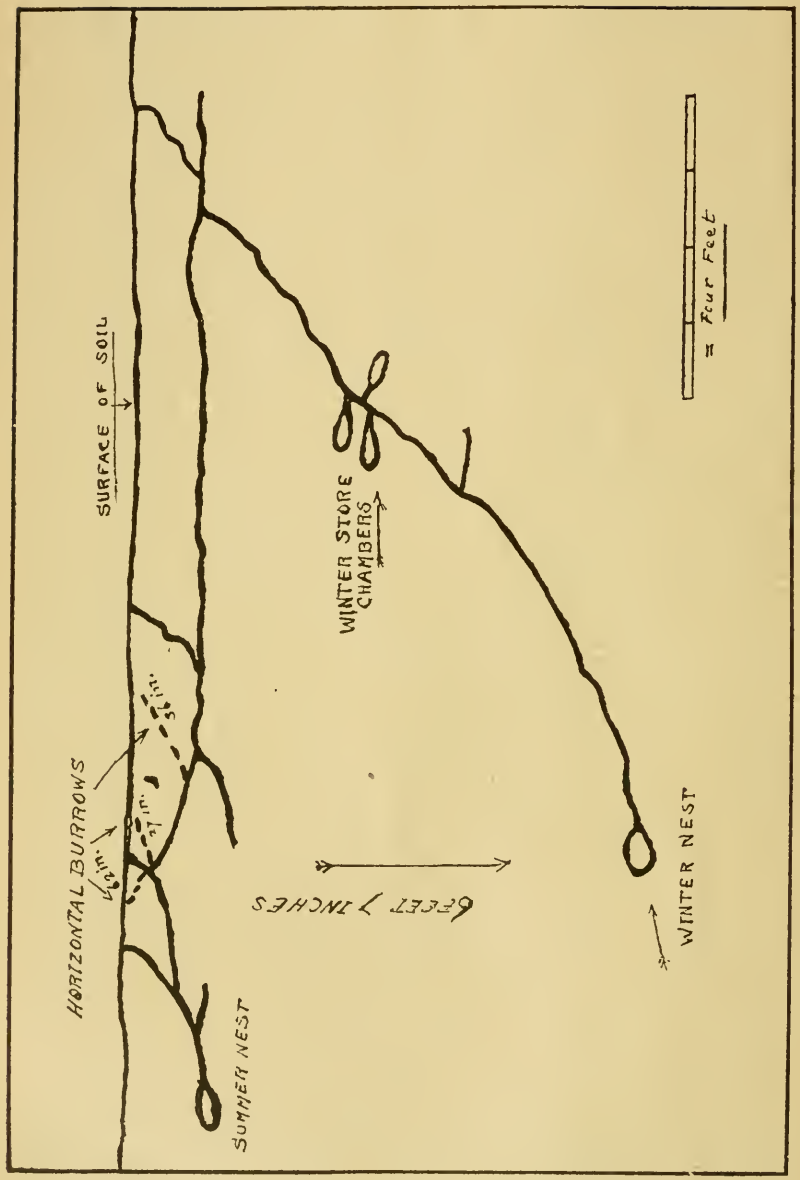
The mouse forming the title of this paper was discovered and described by Maximilian, Prince of Wied, in 1839. It was collected on the upper Missouri river near the mouth of the Yellowstone, North Dakota , and proved to be a new genus as well as a new species. It was, also, the first pocket mouse to be found in North America. Since the original discovery of pocket mice on this continent, however, the number of known species

has increased rapidly. In 1889, Merriam* described no less than twenty-one species and sub-species while since then, and up to the publication of Miller's List† the total number of recognized kinds has increased to eighty. Most of these species, however, occur south of the Canadian boundary, and so far as known to me, but two have been taken north of latitude 49°. One of these, *Perognathus lordi* Bird, is a native of southern British Columbia, the other, *P. fasciatus*, probably occurs over much of the territory of southern Manitoba, Saskatchewan and Alberta, but as yet, has only been recognized in the neighbourhood of the writer's home, where it was first recorded several years ago. Since the time of its original discovery in Manitoba, and up to about three years ago, this pocket mouse was comparatively rare, but of late it has greatly increased in numbers and can be said to be moderately common at the present time. So far as I can see the Manitoba examples seem to be considerably lighter in colour than the type which is described as between an olive-green and an olive-gray above. In my specimens the hairs are a light slaty-gray at their bases, fading to a light tawny colour higher up, and are tipped with black, these black tips, however, giving place to light tawny or pinkish along the sides, forming an indistinct band from which the animal gets its name. Below, the hairs are entirely white. The measurements of six specimens are as follows: three males; average length, 129 mm., tail 56 mm., hind foot 17 mm.; three females; average length, 126 mm., tail 56 mm., hind foot, 17 mm: Dr. Merriam, in the publication before mentioned, gives the total length of one specimen as 136 mm., so that typical specimens are somewhat larger than the Manitoba examples. As apparently no information of the animal's habits are available, the following, from my own experience, may prove of interest.

The young are born about the middle of May. In the only instance of which I have record the number of young were four. As the female has but six teats, four young would probably be an average litter. Taking into consideration the various habits, such as the early storage of food and retirement below the ground and also the fact that all the young appear to be fully developed by the first of October, I am convinced that but one litter is produced yearly.

In their general habits these pocket mice are solitary, never gregarious, in consequence seldom more than one or two are met with at a time, either above or below the ground. They seem to have a preference for sandy soils in which to construct their homes, but sometimes wander far afield in their search for food.

*N. A. Fauna No. 1. U.S. Dept. Agr., 1889.
†N. A. Land Mammals, U.S. N.M., 1911.



Showing Burrows of the Banded Pocket Mouse, (original).

The habitations consist of a number of burrows, many of them running close to the surface, and often extending over an area of, at least, 20 feet across. From these burrows there may be several entrances or exits, as the case may be, as well as numerous blind runways. One burrow somewhat deeper than the rest is enlarged at its lower extremity to form a summer resting place. All these burrows twist about in a most intricate manner, and, as a rule, have their entrances hidden in a clump of weeds or grass, well away from the piles of sand thrown out in excavating.

At the approach of winter the pocket mouse becomes still more industrious. Two or more chambers are constructed at a depth of about three feet and in these are stored various seeds for winter use. Then having finished the task of providing food, the burrows above the stores are tightly closed from below and a much deeper hole commenced, which is doubtless intended to take the mouse below the frost line. At the end of this burrow, which is about six and a half feet below the surface, a winter home is constructed by digging out an enlarged chamber and lining it with a scanty supply of Green Foxtail heads. In this home the pocket mouse passes the winter, probably much of it in sleep, as those kept in captivity became very sluggish when exposed to even a moderately cold atmosphere.

The method of constructing a winter home, after the mouse has retired for the winter, wants confirming. As further evidence, however, to indicate that the winter home is constructed in the manner described above, I may mention an instance in which I dug out a burrow in late October before the mouse had retired, when no burrow occurred below the store chambers, though just above them was the material that would afterwards form the winter nest. Thus there is every reason to believe that the mouse gathers all that is necessary, in the form of food and nest-making material before winter commences and constructs the true winter home after retiring from above ground for the winter.

A remarkable fact about the two fully constructed burrows dug out on November 10th, was the finding of a dead pocket mouse at the entrance of the lower store chamber in each instance, the dead animal being presumably the owner of the home. Both these mice had been dead several days and each had a hole eaten in its head, and the brains extracted. Both these mice were males. Thinking that perhaps a female, or whatever the kind of animal was that killed them, might be hiding in an unobserved chamber, I made a very careful search for any hidden hole, but without avail. I am still of opinion, however, that there must have been some hidden burrow that I failed to

find, in which the slayer was concealed. At this time the ground was frozen to a depth of six inches and all exits were closed. Of the three winter stores examined, No. 1 contained about three-quarters of a pint of the following seeds: Green Foxtail, *Setaria viridis*, 66 per cent.; Bugseed, *Corispermum hyssopifolium*, 34 per cent., both plants being abundant in the vicinity. Nos. 2 and 3 were close together and contained in all about the same quantity of seeds as No. 1, made up of Wild Buckwheat, *Polygonum convolvulus*, 48 per cent., *Panicum wilcoxianum*, 30 per cent., Blue-eyed Grass, *Sisyrinchium angustifolium*, 4 per cent., and *Lithospermum angustifolium*, 18 per cent. Green Foxtail, Wild Buckwheat and Bugseed are all weeds, the first two causing much loss to farmers by starving out various crops, while the other three are wild prairie plants of small economic significance.

None of the cultivated seeds occurred in these mouse's homes, nor in their pockets, but I have twice discovered locust eggs in the latter and have besides, observed many places where locust eggs had evidently been dug out of the ground. As a matter of fact, I believe that further evidence will show that these pocket mice live very largely upon insects during ths summer months. One I kept in captivity preferred meal worms, (*Tenebrio molitor*) to any seeds, but when the latter were alone available it selected Green Foxtail and Wild Buckwheat in preference to cereals, Lamb's Quarters, Redroot, Tumble Weed and *Cycloloma*.

From the evidence depicted above it would seem that the Banded Pocket Mouse does little harm, while on the other hand the consumption of weed seeds, combined with the destruction of noxious insects speaks wholly in the mouse's favour. It would appear, therefore, that unlike most rodents, we have here an example that is useful and it is a pleasure to me to believe that this pretty little animal is worthy of protection.

THE NEW ZEALAND PERIPATUS.

By Professor Edward E. Prince,
Dominion Commissioner of Fisheries, Ottawa.

During my recent visit to New Zealand for the purpose of making an official survey of the fishery resources of that Dominion, I spent a day in the dense, almost tropical forest, so characteristic of beautiful Maoriland, with the object of seeing, in its native haunts, that wonderful yet insignificant little creature, *Peripatus*, about which almost a whole library of

memoirs and books has been written, and upon the study of which animal, several great scientific reputations have been largely built. Francis Balfour, H. N. Moseley, Adam Sedgwick, and others no less eminent, owed much of their fame to researches on *Peripatus*. Yet, few zoologists have ever seen *Peripatus* "at home", and I believe that I am the first to bring living specimens to Canada. I had many memorable experiences in New Zealand; but I count it one of the greatest privileges of my life to have seen this "very beautiful looking animal" (as Dr. Arthur Shipley rightly styled it) creeping about in the moss-grown decaying logs of the primeval forest, amidst giant gum-trees, great tree ferns, and tangled creepers. Professor Kirk, of the University of New Zealand, Wellington, N.Z., kindly took me to the "hunting grounds", not far from Parirua Harbour, on the coast north-west of the capital city. With Dr. Kirk's experienced help I secured about a dozen specimens, varying in size from 2 inches up to about 3 inches in length. I kept them in a small vivarium which was maintained in a cool and damp state by sprinkling the moss and pieces of wood daily with water. The war conditions on the Pacific delayed my return so seriously that my specimens were confined in their close quarters for over 10 weeks, and many were quite moribund by the time I reached Winnipeg, in the last week of October. During their long journey of over 14,000 miles by sea and land they did well, in spite of the constant noise and vibration on steamers and cars, and they fed readily upon flies and particles of raw beef. A number of young about $\frac{3}{4}$-inch in length, were produced viviparously on the journey. During the last stages of my homeward journey I forebore turning them out of their mossy hiding place, and I fear that none actually survived until I reached Ottawa. All were, unfortunataly, dead when I examined the vivarium just before the meeting of the Ottawa Field-Naturalists' Club on December 8th.

As Professor Moseley said, *Peripatus* resembles a black caterpillar, with a pair of anterior antennæ, like the mobile horns of a snail. Some of my specimens were of a deep velvety brown, not velvety black, and they are such soft, elastic creatures that they are able to stretch almost double their usual length. If touched they shorten and pull in their antennæ, and if they fall over, they writhe back, bit by bit, and regain their feet (17 pairs in *P. novæ zealandiæ*) and glide off rapidly with a most graceful movement, waving the antennæ from side to side. On exposure to light they hasten, like slow-moving shadows, to the nearest shelter, and hide away. They are very soft and sensitive and easily injured by handling, or by pressure. I was surprised at the rapidity with which they discovered house-flies placed

alive in their box. Within a very short time I always noticed such flies either glued to the side of the box or the glass-lid, or creeping slowly with wings or legs glued together. On touching *Peripatus* it usually shoots out a delicate spray of gummy material from two apertures on the pair of oral papillæ under the head. This gum or slime is so tenacious that it is difficult to remove from the hand, and one of its uses is to capture active prey like flies, etc.

Why is it that *Peripatus* is of such surpassing interest that Professor Moseley declared it to be an animal of great antiquity and my friend Dr. Shipley, Master of Christ's College, Cambridge, pronounced it "one of the most interesting animals known," from a morphologist's standpoint?

Its distribution indicates its ancientness. It is nowhere very abundant, but it occurs in New Zealand, Australia, the Cape, South America, St. Thomas and the West Indies, Panama and possibly Sumatra. To the naturalist such a sparse but widespread distribution means that it is a dying type, once abundant and of former wide occurrence. But it is a stem form, or connecting link, and just the kind of animal so rare, and yet so eagerly looked for by the evolutionist. It seems to be the very form from which the two vast animal Phyla, the Annulata and the Tracheata, have sprung. Nay, even the Echinodermata and the Mollusca seem to have features which they may have derived from *Peripatus*; and forms like the ancient Crinoids and the Xiphosuran, *Limulus*, or King-crab, though so ancient, possess features less ancient and more specialized than *Peripatus*. Its archaic generalized features are so many and so striking that it is impossible to treat them adequately in this brief note. To refer only to two salient points, it may be mentioned that the Echinoderms, though radiate, have essentially a right and left half in the form of the body; and in larval stages the symmetry of the body is most strikingly bilateral: but this is disguised later by the radial arrangement of parts. In the King-crab the compound eye is not a primitive feature, and the presence of internal skeletal elements (endosternite) a complete capillary system in the blood-vascular arrangements, the specialized nephridium, or kidney, in the shape of the coxal gland with attached lobes, and the massed nervous system (brain, oesophageal collar and reduced ventral cord) are all far less primitive than the annulate *Peripatus*. Indeed as one facetious observer says, *Limulus* must be later than the Annulates, for it fed upon them, the food of the King-crab being various marine annelids. *Peripatus* is an annulate in many features, being like a chætopod or worm in its cylindrical, bilaterally symmetrical, body, its anterior nerve ring and pair of

widely separated ventral nerve cords, without serial ganglia, and especially in the paired sympathetic nerves on the pharynx and œsophagus, the pharynx being markedly muscular. The simple eyes (one pair), the numerous paired segmental organs or nephridia, of which the outer and the internal vesicle are really cœlomic, while the first pair become the large salivary glands, as in some Oligochætes; the short stomodæum and proctodæum (or anterior and posterior sections of the alimentary canal), the hollow, sac-like limbs, and the soft, delicate integument, without a dense, hard exoskeleton and the presence of cilia are all worm features.* But *Peripatus* is also a Tracheate, for like insects it breathes by tracheal tubes opening by external stigmata, its limbs show slight segmentation and some are modified as mouth-organs, it has antennæ, and the heart and the generative organs are cœlomic, the ova and sperms being derived from the walls of the cœlom. All these features are in contrast to the Annulates and connect *Peripatus* with the Tracheates, and therefore the Insects. "I believe it to be," said Moseley, "a nearly related representative of the ancestor of all air-breathing Arthropoda *i.e.*, of all insects, spiders and myriapods. It is impossible here to consider the profoundly interesting nature of the body-chamber, which is a hæmocœl, and not a cœlom or true body-cavity at all, certain portions of the true cœlom alone persisting as in the segmental or nephridial spaces, and the generative glands. The study of *Peripatus* throws a flood of light upon the origin of many of the most important features in the Tracheates, it is indeed *the* Prototracheate and forms an entire class to itself, a class with one genus only. But on the other hand it is an Annulate and has features in common with Molluscs and Echnoderms. There is probably no more generalized type of animal living and it may be justifiably maintained that it is therefore the most interesting and possibly the most ancient of metazoan stem-forms. If *Peripatus* preceded the Annulates and Tracheates and was the ancestor of all the worms, insects, spiders and myriapods, why have we not some fossil remains in some of the early fossiliferous strata? *Peripatus* is such a frail, soft creature that excepting for the hard jaws with four sickle-shaped cutting blades; the chitinous jaw-levers or so-called buccal tracheal pits, first correctly described and interpreted by Dr. C. Gordon Hewitt; the minute occelli or simple eyes, the chitinous claws, minute external spines and the tracheal tubes, no remains could be readily preserved

*The two muscular layers, circular and longitudinal and unstriped, are worm features; the fibres of the jaw-muscles are, however, striped (see Dr. C. Gordon Hewitt "Buccal Pits of Peripatus" Proc. Manchester Lit. and Philos. Soc., Vol. 50, Oct. 21, 1905).

permanently, and the structures referred to are too insignificant to be easily discerned in the rocks, if they have been preserved. Moseley went so far as to say that were the foot-jaws only larger they would, no doubt, occur in strata as old as the "Old Red Sandstone." Phylogeny or the study of the pedigrees of animal types, has available no generalized stem-form more interesting than the Prototracheate *Peripatus*.

A NOTE ON THE COLOURS OF TUMBLING MUSTARD SEED.

To those of us who have had to do with the seeds of Tumbling Mustard (*Sisymbrium altissemum*) it is well known that these are nearly always met with in mixtures of two distinct colours, one kind being light-yellow, and the other dark-greenish. As a rule the latter predominate to the extent of about three to one, but occasionally the proportions are the other way about, while still more rarely one colour may entirely dominate. Two or more instances of the last condition were brought to my attention during the winter of 1913, while I was with the Dominion Seed Branch, at Ottawa. In these cases, samples of flax harvested in Saskatchewan contained light coloured Tumbling Mustard Seeds only, their purity being so unusual that some doubt was thrown upon the authenticity of the determination, thoug the seeds did not differ in other respects. The only objection being, therefore, that they were all of one colour instead of being mixed.

During the autumn of 1914, my brother Stuart had occasion to collect a quantity of Tumbling Mustard seed, and in doing so visited a situation where the species had only recently become established, probably not more than four or five years. By that time, however, the plants had spread over a considerable area and were sufficiently numerous to provide more than a pint of seed. On examining the seed thus collected, it was at once observed that all were of the light yellow variety, thus establishing the fact that they had evidently bred true to type, and were therefore a distinct strain.

This at once led to further investigation, and it was then discovered that both colours were never met with together on individual plants, but that one plant would produce only yellow seeds and another only greenish . We have as yet found no exception to this rule though plants of both types are frequently met with growing side by side; in fact, they are seldom found otherwise, which would, of course, account for the two kinds being nearly always mixed in samples of cultivated seeds.

As the plants producing both kind of seeds are generally

growing together and are moreover visited by various insects, particularly bees, it must naturally be supposed that they are readily cross-fertilized. It is, therefore, interesting to know that this crossing does not apparently affect the colour of the seeds on individual plants, which are still either all yellow or all greenish.

No attempt has been made to breed the plants to ascertain whether the resulting seeds confirm to the usual Mendelian law, when yellow and green producing seed plants are crossed, though doubtless this is the case.

NORMAN CRIDDLE.

MEETING OF THE BOTANICAL BRANCH.

Held December 19th, at the home of Mr. G. H. Clark, 501 O'Connor Street. Dr. M. O. Malte had charge of the meeting and exhibited many fine specimens of Canadian grasses, a collection of which he is preparing for exhibition at the Panama-Pacific Exhibition at San Francisco in 1915.

The remarks of Dr. Malte dealt with "Climatic and Soil Conditions as they influence Plant Life." Many of the specimens which he exhibited demonstrated in a very forceful manner how extremely powerful such influences are. It was stated that during the four months of collecting during the past summer he had brought together about two hundred distinct species of grasses. Of these about one hundred and seventy were native to Canada. The other thirty odd were probably originally imported from Europe, but could be now found wild in many places in Canada. These European grasses, he stated, did exceptionally well in the coastal regions, such as those of Nova Scotia and British Columbia. In this connection, he exhibited and discussed the awnless Italian Rye grass of which about fifty distinct forms could be found. Such forms being to a large extent the result of climatic and soil conditions. Moreover, the influence of such conditions also accounted for the fact that while this particular grass was an annual at Ottawa, in other parts of the Dominion it took on a biennial form, while in British Columbia, it became a true perennial. His remarks in this connection, that is, as to why a plant changed its seasonal habits, provoked some interesting remarks from other members of the club, who held different opinions on this point. This grass, he said, had been known to yield as high as eighteen tons to the acre, where the area it occupied had been irrigated by flooding it from a city sewerage system.

An interesting fact mentioned was, that out of the two

hundred species he had collected, not more than from six to ten were of any commercial value. This was largely due to the fact that many wild grasses are bunchy, produce few leaves, and their seed cannot be profitably harvested. The varieties which had the greatest value were those related to the Western Rye grass, and to Kentucky and Canadian Blue grasses. He thought that about fifty more species might yet be collected in Canada, making a total of some two hundred and fifty species independent of the varietal forms of such species.

The value of having such a collection of grasses, and having one set of the same splendidly mounted in a rather striking manner for exhibition at Panama, was emphasized. In 1898, the late Dr. Fletcher, Dr. Malte said, made one of the first collections of grasses ever made in Canada and these grasses were grown at the Central Experimental Farm. The purpose of the two collections were somewhat different, however, with the former the purpose was to find out species useful for Canada. The work at present dealt also with the systematic botany and biology of native grasses. Foreign countries, even to-day, thought of scientific work along such lines as being unknown in Canada, and hence the exhibition of such a collection at Panama would do much to align Canada with other countries as one in the van in the matter of profitable scientific research, in the field of applied botany, etc. The collection would be subsequently used at many of the Provincial Fairs. All specimens are to be clearly labelled in both Latin and English. The collection at Panama will occupy eight hundred square feet of wall space.

In the matter of drying the collection demonstrated the skill of the collector. Each specimen was changed twice within the first twelve hours after collecting. Strong felt paper was used for the drying process. Dr. Malte mentioned his indebtedness to the Messrs. Criddle and Mr. W. Herriot for help in making the collection.

Those present at this meeting of the club were: Messrs. Attwood, Blackader, Buck, Campbell, Clark, Criddle, Dymond Fryer, Honeyman, LeLacheur, Macoun, Macmillan, Tulley and Whyte.

F. E. B.

DR. JOHAN HJORT ON "NORSE FISHERIES".

The Ottawa Field-Naturalists' Club has rarely been favoured with a scientific address more original and fascinating than that on the "Fisheries of Norway" by one of the most eminent of

European experts and scientists, Dr. Hjort, Director of Norwegian Fisheries, Christiania.

Dr. Hjort, who speaks very perfect English, illustrated his remarks by a fine series of stereopticon views, including Norwegian coast scenery, fishing fleets, catches of fish, and charts and diagrams. He began by showing how the quaint fishing boats of the ancient Viking type have been replaced by decked vessels, and later by large steam "drifters". Fishermen had, said Dr. Hjort, a general idea as to the dates, each season, when schools of herring and other fish appeared, and the grounds usually frequented by them. But there was always uncertainty and the varying abundance or scarcity of fish were regarded as a mystery. The causes were unexplained To remove this uncertainty scientific researches of a systematic nature were commenced 12 or 15 years ago. The result has been that the causes of the fluctuations has in many ways been determined, the migrations and resorts of the fish ascertained, and a number of splendid new fishing areas discovered.

By means of townets, the floating eggs of fishes like the cod, haddock, torsk, and ling, and the myrials of surface-haunting young fry, have been captured in varying quantities. It was found that the number of eggs and young fish, per square metre of water, most accurately indicated the quantity of adult fish in the deeper waters below. If 4,000 eggs were counted, in one square metre, in one locality, and only forty eggs in one square metre in another locality, the fish were approximately ten times more plentiful in the former locality. This quantitative method has proved most reliable. Vast numbers of eggs and fry were taken in localities, not regarded by the fishermen as good fishing grounds; but on operating there these new fishing areas yielded great catches.

The study of the races, and what are called "year classes", as well as the discovery of the age of fish by the means of rings of growth on the scales, had given most valuable and striking results. By using "drift nets" of various meshes herring, for example, had been obtained showing great differences. The herring of Norway, on the whole, is a larger fish, at the same age, than the Scottish and English herring, and there was practically no intermingling, a diagonal line drawn from a point east of the Farœs down to the middle of the North Sea, separating the two race types. But local varieties also occurred. Large herring, fat herring and small herring, as experience showed, occur with great regularity. Thus from January to April, large spawners occur off the south-west coast of Norway, whereas a little further north such large herring occur from October to January. Fat, immature herring and small herring

abound along the whole coast, increasing towards the north (Nordland and Tromso). Study of the scales proves that the large and spawning herring are four to eight years old, some being even sixteen to eighteen years old, while the "fat" herring, as Professor G. O. Sars long ago opined, are two to four years old, some being one year, while others are six to seven years old. To determine the age-composition of the whole herring tribe along the Norse coasts, the proportions of small, of fat, of large and of spring herring would require to be ascertained, but science has found a far more neady and easy way. Dr. Hjort stated that 15,000 examples of herring had been carefully examined in one year (1910), and it was found that in successive years, the fish of one year predominated. Thus the herring hatched, in 1904, exceeded other year-classes, in 1907 (as three-year olds), in 1908 (as four-year-olds): but in 1909 and 1910, they formed a less predominant portion of the "fat" herring schools: because they had joined the large and spring herring schools and could still be identified by their scales. Indeed in 1911, they formed, as seven-year-olds, 70% of the large herring schools. 1904 must have been a more favourable year, for the herring spawning and hatching, than the years before and after. The 1899 year class, being eight-year-olds, in 1907, were traced through 1907, 1908 and 1909 among both the large herring and the spring herring, and were far more abundant than the older and younger year-classes in the same schools.

These researches have shown that it is possible to ascertain how numerous the year classes are in relation to each other in successive years, if the specimens be sufficiently numerous to be representative. The schools live under such diverse conditions in the waters from 58° to 71° North Latitude, that the rate of growth locally differs. The growth each year being shown by the rings upon the scales, a broad ring means rapid, favourable growth, a narrow ring means less favourable growth, and local races are recognized by special year rings, either broad or narrow. 1904 herring taken in 1909 show five rings, the first, second and third year rings being fairly equal: but the fourth and fifth are very narrow in some samples: but in others, the third-year ring is narrow. Thus these two types (representing local schools) of the same year can be recognized with facility. The latter are of "Nordland" origin, and migrated south to join the southern 1904 schools, of which they formed 26%. Results of a similar character are shown by the study of the cod, the age and local origin being shown by the study of the scales, and a key is thus afforded to the growth, migration and distribution of valuable food fish.

MARINE BIO

At the close, Professor Prince proposed a vote of thansk appreciatory of the treat Dr. Hjort's lecture afforded, and he expressed the hope that Dr. Hjort would be able to continue his work in Canada for another year. Dr. C. Gordon Hewitt seconded the motion and pointed out that an illimitable market for fish food would arise as a consequence of the present war, and Canada should prepare to supply the vast demand that would arise. Professor Macallum, of Toronto, added a few words of commendation, and the President (Mr. Arthur Gibson), in putting the motion added his own appreciation of Dr. Hjort's valuable address. The stereopticon, it may be added, was skilfully operated by Mr. J. S. Harterre.

E. E. P.

NOTES ON THE PREPARATORY STAGES OF *PROSERPINUS FLAVOFASCIATA ULALUME* STRH.*

By Arthur Gibson.

In 1905, eggs of this sphingid moth were received from Mr. J. W. Cockle, of Kaslo, B.C. Oviposition took place at Kaslo, on May 30, and the eggs hatched at Ottawa, on June 12. In 1904, Dr. Dyar published† descriptions of the egg and the five larval stages. My notes agree on the whole with such descriptions, but as further information is given on certain points, it seems excusable to present them in their entirety. They are as follows:

Egg.—Elliptical in shape, size 1.2 mm. by 1 mm. by 1 mm.; pale green, shining, smooth; length of egg state as above indicated 12 days. In 1910, a female of *ulalume* was received from Agassiz, B.C. During the journey to Ottawa, seven eggs were laid. These hatched on May 25, but unfortunately the larvæ died soon afterwards.

Stage I.—Length at first 4 mm. Head pale greenish, mandibles brownish. Body pale greenish, cylindrical, plump; segments of body wrinkled (8 wrinkles); no markings on body. Caudal horn 0.5 mm. long, pale at base, darkened towards and at tip. Feet concolorous with body.

Most of the specimens moulted on June 16 and 17.

Stage II.—Length 8 mm. Head slightly bilobed, with a yellowish tinge; ocelli black. Whole body washed with white, giving the larva a glaucous-green appearance. Dorsal vessel showing down the centre of the dorsum as a narrow dark line, from the head to the base of the horn. Subdorsal stripe white,

*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

†Proc. U.S.N.M., XXVII, 790.

conspicuous, narrowly margined above with yellowish-green. Horn black, like body washed with white. Spiracles very small, dark, in a pale ring. Thoracic feet and proleg concolorous with body.

Three specimens moulted the second time on June 19.

Stage III.—Length 17 mm. Head rounded, slightly bilobed. Whole body pruinose, as though powdered with flour. Dorsal vessel inconspicuous. Subdorsal stripe white, broadly margined above with clear green. Caudal horn nearly 2 mm. in length, black, reddish at base, lined with black in front. Spiracles pale yellowish, inconspicuous.. Feet concolorous with head.

Two specimens passed third moult on June 21.

Stage IV.—Length 23 mm. Almost the same as Stage III. Head 2.5 mm. wide. Body pale green thickly dotted with white, pruinose as before—a bluish-glaucous shade. Dorsal vessel hardly distinguisable. Subdorsal stripe clear white bordered above with dark green, almost as wide as the white stripe. Caudal horn 3 mm. long from front edge to tip, very wide at base, the upper half black, the lower half about equally divided in colours, yellowish-white at the base and above ringed with orange; ornamented in front with a black rather oval-shaped spot, the whole base of horn being broadly ringed with black. On segments 5 to 13 inclusive is a medio-ventral series of dark gray, almost black, elongated blotches, one in the middle of each segment. Spiracles yellow, very narrowly ringed with black. Feet paler than body.

Larvæ moulted for the fourth time on June 27 and 28.

Stage V.—Length 33 mm. Head 3.8 mm. wide, rounded, slightly bilobed, blackish-brown, clypeus rather paler; mouth parts pale yellowish-white. Body blackish-brown, bearing innumerable small black dots, particularly on sides and dorsum. A series of much larger subdorsal spots are also present on segments 3 to 11 inclusive. Midway between these latter spots and the spiracles is a rather indistinct, broken, black band more apparent on the middle and posterior segments. A rather inconspicuous dorsal stripe is also present. Spiracles bright and conspicuous, yellow-ochre rimmed with black. Caudal horn much reduced, now being a blunt wart-like elevation about 0.5 mm. high posteriorly, shining black in colour, the base bordered with a bright ring of yellow and a wider ring of velvety black. Thoracic feet and claspers of prolegs pale greenish.

One larva in this stage which moulted at 10 a. m. was green rather densely dotted with black. The dorsal vessel was almost obscure, but the subdorsal band was wide, even, and very distinct. The head was green washed with black. By noon, however, the specimen was blackish-brown.

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HYBRIDIZATION IN THE GENUS VIOLA.

By M. O. Malte and J. M. Macoun.

Certain sections of the genus *Viola*, as is well known, are characterized by that wonderful biological peculiarity, generally termed cleistogamy. The showy flowers of our spring violets generally live but a short time. Although being sexually perfect, i.e., having stamens and pistils normally developed, they generally wither down without producing any seed and the propagation of the individuals and the maintenance of the species are secured through the cleistogamous flowers. These generally appear comparatively late in the season and reach their fullest development after the showy spring flowers have disappeared. As a rule, the cleistogamous flowers are without petals or have them incompletely developed, for which reason they are often in descriptive botany, termed apetalous. The whole flower has the appearance of a half-grown bud arrested in its development. It is often inconspicuous to the eye because of its lack of attractive colours, or even wholly invisible to the casual observer because not rarely it reaches its full development hidden among the decomposed or half-decomposed remnants of plants which cover the ground, or it even flourishes beneath the surface of the soil.

These cleistogamous flowers, however, play the most important part in the life history of the individual as well as of the species. In spite of their seeming incompleteness, they produce, without being aided by outer agencies, all the seed needed for the maintenance of the species. Their pistils are automatically fertilized by the pollen shed from their stamens, the result being the production of an abundance of seed.

This mode of seed production, so different from the ordinary way, did not fail to attract the attention of botanists at least as far back as the 18th century. It was thought to be strange and inexplicable in times when sexuality in plants was still disputed and when the importance of sexual organs as foundations for a scientific plant system was first being discussed.

Linnaeus, in his *Species Plantarum*, described dozens of violets, giving their characters from the shape of the leaves and their general appearance. In only one case, however, did he mention the flower and fruit, and this was done solely because of the extraordinary biological feature encountered in a species which he called *V. mirabilis*. This species, which is found from Southern Sweden to the Alps of Switzerland, was described as follows:— "Viola caule triquetro, foliis reniformi cordatis, floribus caulinis apetalis." To this description was added especially: "Viola floribus radicalibus corollatis abortienatibus, caulinis apetalis seminiferis."[1] The mere description of this violet, which is now known as *V. mirabilis* L. indicates that Linnaeus considered it one of the wonders of the plant kingdom just because of its peculiar mode of fructification. Its showy spring flowers, proving themselves perfectly useless for the propagation of the species, contrasted singularly with the inconspicuous and seemingly imperfect flowers, which were developed later in the season from special shoots. But these inconspicuous flowers, although in their general aspect not betraying their importance, proved themselves capable of safeguarding the existence of the species. Small wonder that the name *V. mirabilis*—The Wonderful Violet—was given to this species.

In North America little attention seems to have been paid to the morphology and the biological and systematical importance of cleistogamy in violets by the early botanists. Its general occurrence in acaulescent violets, as far as the authors have been able to ascertain, was first accentuated by Dr. Edward L. Greene, whose observations dating from 1896, shed much greatly needed light on the morphology and biological relationships of North American violets. In the year 1896 Dr. Greene stated (according to extracts from *Cybele Columbiana* Vol. I, No. 1, 1914, p. 7) that "the very most common of our so called acaulescent violets, continued long after their short season of showy vernal flowering to put forth apetalous flowers from which are produced all or nearly all the seeds by which individuals are multiplied and the species perpetuated."

As the production of seed in the capsules of the apetalous flowers is the result of a process of self-fertilization and as furthermore the flowers in which this takes place, never open, it is evident that the seed developed in the cleistogamous flowers necessarily is perfectly pure, i.e., that it gives when sown a progeny of plants having the characters of the parent plants. In other words, through cleistogamy the pure lineage of the various species is infallibly upheld.

[1] Linnaeus, Sp. Plant. 2, 936. 1753.

Although much more conspicuous and pretentious in aspect the ordinary showy petaliferous flowers of our violets are of far less importance for the propagation of the individuals than are the cleistogamous ones. This is evident from the fact that only in few cases do they produce any seed. Their life generally ends with the withering of their petals, shortly after which all traces of the whole flower are gone. In most cases, there is no postfloral maturing of capsules because the ovules are incapable of developing into germinable seeds. The reason for this sterility is simply that, as a rule, the petaliferous flowers are not fertilized. They lack the ability of self-fertilization and are consequently dependent for their fertilization on outer agencies. Furthermore, special arrangements and morphological peculiarities of the sexual organs, the nature of which need not be described in this connection, tend to make self-fertilization extremely difficult, if not wholly impossible.

Under these circumstances it is evident that when seed is found developed in the capsule of a petaliferous violet flower, it must be regarded as the result of a cross-fertilization between two flowers. These two flowers may belong to the same individual, to two different individuals of the same species or to two individuals of distinct species. To which one of these three possibilities the development of seed in the capsules of petaliferous flowers is to be attributed in individual cases can only be determined by a study of the progeny raised from this seed.

That the capsules of petaliferous flowers in most species of our violets frequently produce germinable seed, is beyond doubt. Actual observation supporting this statement are, however, rather scant. Brainerd[2] states that though the infertility of the petaliferous flowers has often been observed, he has "during the past season (1903) found these capsules to be usually fertile." In the vicinity of Ottawa the same observations have been made on *V. Macounii* Greene and the writers believe they could be easily made on practically all species of acaulescent violets were these more closely observed.

That fertilization of petaliferous flowers really often takes place, is demonstrated beyond a doubt, by the frequent occurrence of hybrids between different species of violets. As the formation of hybrids through cross-fertilization of the cleistogamous flowers is wholly out of the question the mere fact of their occurrence must necessarily prove that fertilization of and seed formation from petaliferous flowers often occur.

[2] Rhodora, Vol. 6., p. 10.

In this paper the authors will endeavour to give a brief account of the general characteristics of violet hybrids and also a list of the hybrids recorded from the North American continent.

To the amateur botanist who has neither time nor inclination to study with earnest perseverance the multitude of violets occurring in our woods and meadows, the existence of intermediate forms between different species is at first apt to provoke confusion and discouragement. A closer study of those intermediate forms which at first may seem to blur the systematic boundaries between well defined extremes belonging evidently to different specific units will, however, instead of causing confusion, help most comprehensively to avoid it. In other words, the recognition of certain intermediate forms as casual hybrids will prove one of the most helpful means to the botanist endeavouring to arrive at a well founded understanding of the systematic value and relationship of our violets.

The hybrid nature of puzzling forms, apparently intermediate between two species, can be most easily determined.

The general appearance of hybrid plants, their vigorous vegetative development, their bright and abundant flowers and, generally speaking, their air of strength and splendour is often very characteristic. When odd plants displaying these marks are found in violet colonies composed of two or more species, they very often prove to be typical hybrids between well defined species.

The vegetative superiority of hybrids in plants is, however, a too well known feature to warrant a lengthy discussion. It is sufficient to say for the sake of illustration, that for instance hybrids in the genus Epilobium and in grasses are always characterized by their conspicuously vigorous vegetative organs. Not only do they display a most luxuriant growth as far as foliage and profusion of shoots are concerned, but their ability to survive and hold the ground is far more pronounced than that of any of their parents. Several observations have thus been recorded to the effect, that hybrids between species of Epilobium, originating in a ditch or any other area of limited extension, are able on account of the superior strength of their vegetative organs, after a few years, to take possession of every inch of the ground, killing every plant of the species from which they originated. Similar observations have been made on violet hybrids. In botanic gardens, where several species of violets are grown in close proximity, it has been recorded that species, after a few years, often have been killed and replaced by more vigorous hybrid plants.

The conspicuous vegetative development of certain wild violet forms, the systematic value of which may at first seem difficult to understand, may therefore often indicate, to the student of violets, their hybrid value. It must be understood, though, that however helpful be the general characteristics briefly hinted at above for the recognition of hybrids, the decision as to whether a suspected form be really a hybrid or not can be satisfactorily reached only through a minute study of its morphological and sexual characteristics. This means not only that a violet in order to be classified as a hybrid, should be intermediate between supposed species as far as vegetative characters are concerned, but also, and particularly, that the morphological and cytological development of its sexual organs should most strongly support its supposed hybrid nature. In doubtful cases, the functional capacity of the pollen and the ovula must really furnish the final decision on the question whether a certain individual should be regarded as a hybrid or not. Space will not permit that in this article European literature bearing upon the subject of hybridization as influencing the development of sexual organs in violets be quoted. This is also, in fact, unnecessary as numerous observations relating to the subject have been recorded in North America. This is especially true as far as the development of seeds in hybrid violets are concerned, in other words, as far as the development of, or rather the failure of development of the female organs is concerned.

Strangely, but as a matter of fact most naturally, contrasting with the luxuriant growth of the vegetative organs of a violet hybrid stands its more or less marked sexual impotence, i.e., its incapability, to a greater or less degree, of reproducing itself sexually. Generally a violet hybrid is markedly barren and although developing numerous capsules and ovules fails to produce an adequate number of germinable seeds.

A few quotations from one of the excellent papers of Dr. E. Brainerd[3] on the subject will suffice. Thus, describing the hybrid plants between *V. septentrionalis* and *V. fimbriatula* Dr. Brainerd says that "in the late summer they produce numerous cleistogamous flowers and fruit, but nine-tenths of the ovules remain unfertilized."[4] Observations on hybrid plants of the combination *V. cucullata* x *fimbriatula* also reveal the fact that specimens of the same in their cleistogamous flowers, develop capsules which either contain only a few ripened seeds or even become "brown and withered as though

[3] Rhodora, Vol. 6. pp. 213–223.

[4] l.c. 216.

entirely unfertilized."[5] The hybrid *V. fimbriatula* x *sororia*, according to Dr. Brainerd, is less sterile than most hybrids, but never was a capsule found that contained more than half the normal number of seeds.[6] Also in other hybrids, the characteristic sterility of the capsules is most typical. Thus, *V. cucullata* x *septentrionalis* was found to bear only from one to six seeds[7] and, in the hybrid *V. septentrionalis* x *sororia*, "the uniformly stunted and often distorted capsules containing mostly aborted ovules"[8] clearly betrayed its mongrel origin. In *V. affinis* x *sororia* the capsules of the cleistogamous flowers were found to be small and often one-sided and relatively infertile[9] and in *V. cucullata* x *sororia* although numerous, proved to be all small, imperfect and few seeded."[10]

The above quotation will suffice to substantiate what was stated without confirming evidence on a previous page, namely, that in a hybrid between two violet species, the faculty of producing the normal amount of germinable seed is most conspicuously reduced. To avoid misconception, it may be pointed out, especially, that the degeneration of the sexual organs mentioned above refers to the cleistogamous flowers, that is to say the flowers, which in specimens belonging to a "good" species normally produce an abundance of well developed seed. As the cleistogamous flowers are always self-fertilized this failure, in hybrid plants, to bear seed of normal reproductive vigour, cannot be explained by assuming that the pollen necessary for the fertilization of the ovules has not been available. It can be explained only by recognizing the fact that the mixing of and unnatural union of sexual units, belonging to distinct species, in the reproductive organs of the hybrids, is causing a disturbance of the functions of the sexual cells which manifests itself in partial or total sterility.

The inability of the cleistogamous flowers of hybrid plants to produce seed of normal vitality is thus very pronounced. This being the case, it is evident that when violet plants are found having sterile cleistogamous flowers they may be looked upon as possible hybrids. In fact, such plants in most cases are really hybrids. The sterility of the capsules of the cleistogamous flowers in violets is therefore a character which will prove most helpful for the identification of critical forms as hybrids.

[5] l.c. 217
[6] l.c. 218
[7] l.c. 220
[8] l.c. 221
[9] l.c. 222
[10] l.c. 222

(To be continued)

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY MASS.

FAUNA OTTAWAENSIS.*

Order Lepidoptera: Family Noctuidæ; Subfamily Phytometrinæ.

By Arthur Gibson.

In a study of the species of moths of this subfamily occurring in Eastern Canada as classified by Hampson in Vol. XIII of the Catalogue of the Lepidoptera Phalaenæ in the British Museum (1914), I have been interested in listing the species which have been found in the Ottawa district. This list is presented herewith, together with some larval notes on certain species. These latter add to our knowledge of the early stages of these insects. Many of the moths in this subfamily were formerly classified under the generic name *Plusia* and more recently under the genus *Autographa*. The former generic name, however, has now gone into the synonomy, while only one species of the latter genus occurs in Canada, namely, *Autographa parilis*, which has been collected in British Columbia.

The letter "G" following the records indicates that the specimens were collected by me, the letter "F" by the late Dr. James Fletcher, and the letter "Y" by Mr. C. H. Young.

Syngrapha falcifera Kirby. 18, 30, 31 May, 1899; 1 June, 1900; 6 June, 1901; 7 June, 1899; 10 June, 1902; 12 June, 1901; 15 June, 1904; 16 Aug., 1900; 11 Sept., 1902; 25 Sept., 1899; 26 Sept., 1903; 1 October, 1900, (G).

In 1901, I secured eggs of this species from a living female and the larvæ were reared on common plantain. Some were mature and spun cocoons on June 27, and moths emerged on July 8, 10 and 12. During the same year I received a larva from Toronto which was found feeding on wild lupine, *Lupinus perennis* L. This specimen pupated on July 1, the moth emerging on the 18th idem.

Syngrapha epigaea Grt. 6 Aug., 1901, (Y); 22 Aug., 1904, (F); 27 Aug., 1902; 30 Aug., 1899, (G).

Snygrapha selecta Walk. 18, 22 Aug., 1900, (Y); 27, 28 Aug., 1902, (G).

Syngrapha rectangula Kirby. 30 July, 1902, (Y); 11 Aug. 1902, (G); 18 Aug., 1900, (G); 19 Aug., 1900, (Y).

Syngrapha octoscripta Grt. 26, 29 June, 1903, (Y); July, 1886, (F); 21 Aug., 1902, (G); 21 Aug., 1900, (Y); 23 Aug., 1902, (Y); 30 Aug., 1899, (G).

*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

Eosphoropteryx thyatyroides Gn. 2, 6, 19 Aug., 1905, (Y).

Pseudeva purpurigera Walk. 12, 19 July, 1902, (Y); 20 July, 1905, (G); 21 July, 1903, (Y); 28 July, 1904, (Y); 29 July, 1906, (Y).

Phytometra brassicæ Riley. 10 Aug., 1911, (G); 16 Aug., 1900, (G); 31 Aug., 1900, (Y); 3 Sept., 1900, (G); larva on cabbage 5 Sept., pupated 13 Sept., moth emerged in cellar 26 Sept., 1908, (F).

This is a common economic pest of cabbages in the United States, but fortunately it has not as yet appeared as a very destructive species in Canada. In 1907, the larvæ were found rather commonly in a large greenhouse in Toronto where lettuce was being grown. Specimens forwarded to me changed to pupæ on Jan. 27, the moths emerging at Ottawa on Feby. 23. In the Ottawa district I have occasionally found the larvæ on cabbage.

Phytometra rubida Ottol. 5 June, 1905; 13 June, 1906; 17 June, 1904, (Y).

Phytometra putnami Grt. 6, 12, 15 June, 1901, (G); 14, 21 June, 1899, (Y); 23 June, 1908, (G); 26 June, 1905, (F); 28 June, 1899, (G); 14 July, 1899, (G).

Phytometra contexta Grt. 1, 2, 5, 12 June, 1899, (G); 7, 12, 13 June, 1901, (G); 18 June, 1904, (G); 8 July, 1905, (F); 11 Aug., 1903, (Y); 12, 29 Aug., 1902, (G); 13 Aug., 1904, (G); 21 Aug., 1904, (Y); 25 Aug., 1899, (G); 23 Sept., 1911, (Beaulne).

In 1901 eggs were secured from a captive female. Oviposition took place June 14, and the larvæ hatched June 19, the egg stage being thus five days. The larvæ fed readily on Kentucky Blue Grass.

Phytometra biloba Steph. 29, 30 June, 1903, (Y); 2, 3 July, 1903, (G); 2 July, 31 Aug., (Y); 3 Sept., (G); 24 Sept., 1900, (F); 22 Oct., 1903, (G).

Mr. Young has found the larvæ at Ottawa on clover.

Phytometra oo Cram. 25 May, 1903, (G).

This specimen was named *rogationis* by Ottolengui. This however, is placed, by Hampson, as a synonym of *oo*.

Phytometra precationis Gn. 25, 30, 31 May, 1899, (G); 2, 7 June, 1899, (G); 5 June, 1894, (F); 10 June, 1902, (G); 18 June, 1904, (G); 25 July, 1900, (Y); 12 Aug., 1904, (G); 24, 26 Aug., 1899, (G); 30 Aug., 1900, (G); 10 Sept., 1908, (G); 15 Sept., 1899, (G); 24 Sept., 1900, (G).

Common around flowers in late May and June. Many specimens have been seen frequenting the flowers of *Cara-*

gana and other shrubs in the arboretum, Central Experimental Farm. In 1905, eggs were secured from a captured female. They were laid on July 1st and hatched on July 7th. The larvæ in Stage I were pale greenish, skin smooth and shiny, the segments rather deeply divided. Tubercles small, black, each bearing a blackish bristle. Head semi-translucent with a brownish tinge; mouth parts yellowish-brown; ocelli black. Thoracic feet concolorous with head; prolegs concolorous with body. Moulted 14 July. My note on Stage II reads: Length 6.5 mm., pale greenish cylindrical larvæ, with black tubercles, each with a rather long stiff black bristle—much the same as Stage I. Head paler than body. No further notes were taken owing to pressure of other work. The mature larva has been described fully by Chittenden.*

On July 8, 1901, specimens of the larvæ of this species were found at Ottawa feeding on common plantain, *Plantago major*. Pupation took place on July 12, and the moths appeared about a fortnight later. In 1912, I found a larva on cabbage, which changed to pupa on July 30, the moth emerging on Aug. 19. Mr. C. H. Young has found the larvæ feeding on grass and clover.

Phytometra bimaculata Steph. 30 July, 1906, (G); 23 July, 1904, (Y); 6 Aug., 1902, (Y); 11 Aug., 1901, (G).

Phytometra mappa G. & R. 26 June, 1904, (Y).

In addition to this specimen Mr. Young collected a female moth from which he secured eggs. The young larvæ were fed on dandelion and by autumn had grown to rather more than half an inch in length. They stopped feeding and acted as if they wanted to hibernate. They died, however, before winter.

Phytometra ampla Walk. 13 June 1899, (G); 19 June, 1901, (Y); 20, 29 June, 1903, (Y); 23 to 28 June, 1903, (Y); 23 June, 1908, (G); 7 July, 1903, (Y); 6, 9 Aug., 1901, (Y).

Phytometra æreoides Grt. 24, 30 June, 1904, (Y); 7 July, 1899, (G); 7 July, 1899, (Y); 7 July, 1902, (Y); 8 July, 1905, (F); 24 Aug., 1904, (Y).

On May 28, 1901, I found the larvæ fairly aeundant, on a hillside near the Rideau Canal, feeding on *Solidago canadensis*. The larvæ were nearly full grown and it was extremely difficult to see them on the food plant. They were nearly all collected by "beating." The following descrip-

*Bull. 33, U.S. Div. Ent., p. 71.

tion was taken: Length when mature 34 mm., cylindrical in shape, tapering towards the head, which is slightly smaller than segment 2. The whole of the body is pale green, the dorsal vessel a darker green. The dorsum is covered with short, whitish, crooked lines, which slope from about 1 mm. above the stigmatal band to a faint, whitish crooked line which borders the thin median skin through which the dorsal vessel is seen. Stigmatal band yellowish-white; spiracles whitish, ringed with black. All the feet concolorous with body. Head slightly paler than body, no markings; ocelli black; tips of mandibles blackened. The larvæ spun cocoons and pupated soon after collection, and the moths emerged on June 9 and 10.

A very brief description of this larva was published by Thaxter in 1876.*

Phytometra ærea Hbn. 18 July, 1899, (G); 18 July, 1899, (Y); 12, 19, 22 Aug., 1900, (Y); 16, 24, 30 Aug., 1900, (G); 15 Sept., 1899, (G); 1 Oct., 1902, (G).

A single larva of this species was found on mint at the Central Experimental Farm, on May 9, 1901, from which the following description was drawn: Length 31 mm. Head 2 mm. wide, rounded, slightly indented at vertex, lobes full; concolorous with body excepting antennæ, which are paler and slightly brownish at tips; mouth parts also slightly brownish; ocelli black; hairs on face slender. Body cylindrical, plump, tapering towards extremities, light green on dorsum, dark green on sides and venter, the whole body spotted with white dots. From centre of dorsum to spiracles are five stripes, all white with exception of spiracular stripe, which is yellow. Spiracles faintly orange, ringed with black. Tubercles normal, white, setae dark, tubercle IV in a line posterior to lower end of spiracle. Thoracic feet and prolegs concolorous with venter. On May 13 the larva began to spin its cocoon, and by the 16th had changed to pupa. The moth emerged on June 4. In 1899 a cocoon was found on a celery leaf, the moth emerging on Aug. 10.

Phytometra balluca Geyer. 7 July, 1899, (G); 7 July, 1903, (Y); 9, 14 July, 1900, (Y); 20 July, 1904, (G); 9 Aug., 1900, (G).

Mr. Young has found the larva on cabbage, from which he reared the moth on 13 Sept., 1906. Fletcher, in 1878, found the larva at Billings' Bridge feeding on Red

*Psyche, vol. 1, p. 188.

Raspberry, and in 1880 on mint. The pupa is a striking object, being of a cream colour beautifully marked with a wide, irregular, broken, black band on dorsum and a row of lateral black spots. In length it is about 20 mm.

Palæoplusia venusta Walk. 2 July, 1899, (Y); 24 Aug., 1900, (Y); 27 Aug., 1902, (G); 30 Aug., 1899, (G).

Abrostola urentis Gr. 19 Aug., 1900, (Y).

The moths have also been reared by Mr. Young from mature larvæ collected on 15 Aug., 1898, 15 Sept., 1899, and 8 June, 1905. The larvæ were found on nettle. I have recently had an opportunity of examining two inflated specimens. The caterpillar is a rather handsome one, being pale green in colour or pale brownish, with whitish V-shaped marks on dorsum, one on each abdominal segment, the sides of which inwardly are bordered with pale brown in the green specimens and darker brown in the pale brownish variety. On segments 5, 6 and 12, the lower portion of the V-shaped mark is filled with brown, an indistinct whitish dorsal stripe is present, and a wide white stigmatal band bordered above with brown. On either side of each abdominal segment is a wide oblique dark dash. Head pale green, reticulated with brown. Down the centre of each cheek is a darker band of brown and on either side a wide margin of the same colour. In the brownish larvæ the head is of a much darker brown, the reticulations being very distinct. The thoracic feet are pale brown, the prolegs being concolorous with the body. The posterior half of the anal feet are brown.

RANDOM BOTANICAL NOTES FROM PORTNEUF COUNTY, QUE.

By BRO. M. VICTORIN, of the Christian Schools, Longueuil College, Que.

Botanically speaking, the Laurentian area of Quebec is very nearly untrodden ground. It has been the good fortune of the writer to spend a full week on the upper part of the River Ste. Anne, Portneuf Co., towards St. Raymond and the vicinity, and to observe some of its prominent floristic features.

As could be expected we find that the flora of the district, though not differing essentially from that of the Laurentian zone north of Montreal, exhibits, nevertheless, a somewhat more pronounced boreal aspect.

The whole valley is densely drifted with heavy sand and clay deposits, obliterating the underlying crystalline rocks.

Getting in the field at the end of July, we are at first impressed by the local abundance of *Habenaria clavellata* (Michx.) Spreng., an orchid very little known in this province. Evidently it is the leading *Habenaria*, thriving in every mossy corner. On the scanty sandy covering of the rocky slopes, it is interesting to note a peculiar grass, *Danthonia compressa* Aust., the range of which as given in Gray's Manual, "Maine to New York and southward" should be thus considerably extended.

Kneeling to drink from a drying spring we come by a tiny *Sparganium* which turns out to be *Sparganium acaule* (Beeby) Rydb., a critical species we will meet under various puzzling forms later in the season, in the Temiscouata region. The ponds swarm with *Sagittaria latifolia* Willd., and *Calla palustris* L., while *Carex trisperma* Dewey is a common sedge in sphagnum swamps. Characteristic enough of the open-ground flora are *Galium asprellum* Michx., *Comandra livida* Richards, *Veronica officinalis* L., and *Hieracium scabrum* Michx.

We notice with considerable displeasure very extensive patches, where the hirsute rosettes of *Hieracium Pilosella* L., check all other vegetation. We have elsewhere (1) drawn attention to this dangerous invader from the Maritime Provinces which spreads with alarming rapidity.

Going down the river to "Chute à Panet," where an important pulpmill dams the waters, we make a find of more than ordinary interest. *Aster linariifolius* L. was of doubtful record in Quebec, its supposed northern limit being latitude 45 degrees. It was therefore a surprise to see that beautiful blue-rayed Aster covering the exposed gneissic rocks in the river, just below the dam. But the plant, though belonging undoubtedly to *A. linariifolius* L., differed from the typical form in its less rigid leaves and shorter oblong-linear, mostly round-tipped, ascending leaves, and in having the oblong-linear obtuse bracts of the involucre more hebaceous. It then proves to be a well-pronounced geographic variety, which through the courtesy of Professor M. L. Fernald, of the Gray Herbarium, now stands thus: (2).

Aster linariifolius L., var. *Victorinii* Fernald (nov. var.) Humilis 1-1.6 dm. altus; foliis adscentidibus vel patentibus confertis viridibus oblongo-linearibus, longioribus 1.3-1.8 cm. longis 2-4 m.m. latis, apice rotundatis vel obtusis, Quebec:

(1) Naturaliste Canadien, XL : 86
(2) Rhodora, XVI : 192

MARINE BIOLOGICAL LABORATORY WOODS HOLL LIBRARY MASS.

Aster linariifolius L., var. Victorinii Fernald.

1. The plant—natural size
2. A leaf—x 4
3. Akene with pappus—x 4
4. Outer bract of the involucre—x 8
5. Inner bract of the involucre—x 8

On rocky banks of River Ste. Anne, St. Raymond, Portneuf Co., August, 1914, Bro. M. Victorin, No. 618. (Type in Gray Herbarium).

While travelling on the Canadian Pacific Railway between Montreal and Quebec, we noticed that a small blue-rayed Aster occupied an extensive tract of sandy ground between Trois-Rivières and Champlain. We are quite convinced it is *A. linariifolius* L., but whether it is the typical form or the variety *Victorinii*, or an intermediate between them, is yet to be determined.

Before leaving "Chute à Panet," *Gentiana linearis* Froel., a lover of the near-by moist thickets must be mentioned.

Some ten miles north of St. Raymond the country becomes thoroughly wild, and partly cultivated land gives way to fish and game territories, dotted with innumerable lakes.

If we go up the so-called main branch of the River Ste. Anne, we enter a most picturesque region, well-known to sportsmen under the self-explanatory name of *Pique-Mouche*. There begins the famous Tourili Club Territory. From the Club-House, a *Chemin de Portage* takes us to 1000 feet over a hill before we tramp to the grassy shores of the first of a magnificent series of lakes, Lake Ouastaouan. This small lake looks much as if artificially induced by the industry of beavers. It is quickly disappearing owing to the deposition of mud, and a vigorous growth of carices and water-lilies.

We were pleased to record here the presence of a much critical plant whose distribution is little known with us: *Nymphaea rubrodisca* (Morong) Greene, a probable hybrid between *N. Americana* (Prov.) Miller & Standley, and *N. microphylla* Pers. The numerous uprooted rhizomes indicate that the beavers of the Ouastaouan rely on this plant for food.

The shallow ends of the lake maintain a hydrophytic association of some interest: *Myriophyllum Farwellii* Morong, *Myriophyllum verticillatum* L., var. *pectinatum* Wallr., the loose submerged form of *Hippuris vulgaris* L., and *Utricularia macrorhiza* Le Conte.

Though very little attention was devoted to cryptogams, we noticed *Icmadophila ericetorum* (L.) Azahlbr., a crustose lichen expanding its thallus horizontally on tight dying sphagnum hummocks; *Dicranum longifolium* Ehrh., a frequent moss in the Laurentides grows in high situations.

Perhaps the most pleasant outing a nature lover can make in this part of the country is to take the "Little Saguenay" trip. You go up the Bras du Nord to a distance of about

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY

fifteen miles, entering gradually into a canyon well deserving the name it bears: "Little Saguenay." The scope of these notes does not permit us to dwell on the most interesting remains of the glacial period to be observed there. Let it be sufficient to say that the glacier has passed through that narrow valley, has notched some of the peaks in odd fashion, and left numerous kames and moraines.

A relatively good *Chemin de Portage* begins on the right bank of the river, and ascends very quickly to a height of 1100 feet where Lake Hauteur sleeps on the edge of the cliff with a bald, notched and grim looking gneissic peak, sitting on its silent shores. A little vigorous paddling brings us to the opposite shore, where another *Chemin de Portage* starts. This, roughly laid on the rich humus carved by the royal hoof of the moose, winds for miles through the magnificient northern forest, until we reach another small sheet of water, Lake Epinette. Our aneroid now shows 1300 feet above the level of the river, and the herbaceous vegetation becomes more typically boreal, as it appears by the growth of *Luzula parviflora* (Ehrh.) Desv., nodding its dishevelled heads over cold springs, and especially *Galium Kantschaticum* Steller, an arctic-alpine species hitherto unknown from the Laurentian district. Very common is *Epipactis tessellata* (Lodd) A. A. Eaton, all along the *Chemin de Portage.*

Numerous mosses, lichens and hepatics thrive in these essentially mesophytic conditions. Sloping down damp rocks are thick cushions of *Sphagnum Girgensöhnii* Russ., and *Sphagnum quinquefarium* (Lindb.) Warnst., with stiffer groups of *Polytrichum Ohioense* R. &. C. framing the reddish masses of *Scapania nemorosa* (L.) Dum., while the pallid *Trichocolea tomentella* (Ehrh.) Dum., creeps in magnificent attire.

In every fresh spot, *Mnium affine* Bland., *Plagiothecium Ruthei* Limpr., *Brachythecium rivulare* B. & S., *Drepanocladus uncinatus* (Hedw.) Warnst., are to be found.

The shallow margin of Lake Epinette is strewn with the black alga-like masses of the hydrophytic *Fontinalis Novae-Angliae* Sulliv. But much more interesting is the fact that the line brings from a bottom of fifteen feet a compound of *Drepanocladus capillifolius* Warnst., and a submerged form of *Sphagnum subsecundum* Nees., which, according to Dr. A. Leroy Andrews, has been made a Warnstorfian species, namely *Sphagnum obesum* Wils.

To close these notes we will only mention a visit to Lake Sept-Iles, which gave us *Glyceria Torreyana* (Spreng.) Hitch., with the usual *Eriocaulon septangulare* With., and *Lobelia Dort-*

manna L. Moreover in a corner of that lake which has developed into a peculiar type of peat bog, and has received the name of "Lac des Bouleaux," we find, extremely abundant, *Nymphaea rubrodisca* (Morong) Greene, already mentioned from Lake Ouastaouan. We are, therefore, led to the conclusion that this hybrid water-lilly is very common with us, and generally overlooked. We are satisfied also that, fragmentary as they are, these observations lead to extend considerably northward the range of such interesting species as *Aster linariifolius* L., *Galium Kamtschaticum* Steller, *Danthonia compressa* Aust., etc.

BIRD NOTE.

The present winter, thus far, has been a comparatively mild and open one, the recent thaw having laid bare the hillsides and reduced the lower levels to small ponds. I covered eight miles to-day cross-country on Isle Jesus without the use of snowshoes.

In a farming district, where decayed vegetation and other refuse was lying about, I observed a flock of 25 crows, the birds passing and chasing one another as they moved in a southerly direction. The familiar caws reminded one of days in March when migration is at its highest. Crows seldom remain with us during the winter and whether their presence now indicates a continuance of mild weather and an early spring, remains to be seen.

WESTMOUNT, QUE.
January 17th, 1915. W. J. BROWN.

ERRATA.

In the account of the meeting of the Botanical Branch, held on Nov. 14, 1914, published in the December issue of this volume two slight errors occurred which should be corrected.

On page 118, it is stated that "Dr. Malte dealt more particularly with forage roots such as mangels, turnips and sugar beets. He pointed out that the original wild form of such root crops consisted of a creeping form found on the sand of the coatal regions of Europe." The wild plant referred to, is *Beta maritima*, from which our cultivated mangels and sugar beets have been developed. This plant has, of course, nothing whatever to do with the turnip varieties which have been developed from species of *Brassica*.

On page 119, it is further stated that, in the district of Yarmouth, N.S., "eleven hundred pounds of seed per acre is about the average for mangels." This statement should not refer to mangels, but to turnips.

MARINE BIOLOGICAL LABORATORY WOODS HOLE LIBRARY MASS.

THE OTTAWA NATURALIST

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HYBRIDIZATION IN THE GENUS VIOLA.

By M. O. Malte and J. M. Macoun.

(Continued from page 150).

As, however, the cleistogamous flowers are developed comparatively late in the season, their failure to produce normal seed can be utilized as a means of determining the hybrid nature of critical forms only by those students who have the opportunity of studying the violets after the showy petaliferous flowers have wholly or mostly disappeared, i.e., at a time when the amateur botanist generally considers the violet season a matter of the past.

Early in the season, before the capsules of the cleistogamous flowers are beginning to ripen, the hybrid nature of suspected plants can be most satisfactorily ascertained through an examination of the pollen of their showy, petaliferous flowers, as it is not only the sexual cells of the cleistogamous flowers which are affected by hybridization, but also those of the petaliferous ones. In other words, the whole sexual apparatus of a hybrid plant, including both male and female organs, is conspicuously deteriorated and incapable of normal functions.

The stamens of a violet flower have, as is well known, very short filaments, sometimes hardly visible to the naked eye. Their anthers, on the other hand, are broad and composed of two cells, separated by a rather conspicuous connective. The latter carries on its top a peculiar appendage which is generally brown or reddish brown. The anthers proper, that is to say, the portion of the stamens below the appendages, are placed close together and have the appearance of a cupola, from the centre of which emerges the pistil. In their cells they carry numerous pollen grains which, when normally developed, appear more or less triangular, quadrangular, or elliptic, depending upon the species and also on from which side they are viewed.

The pollen grains of a stamen taken from a plant belonging to a good species, are all uniform as to size and general appearance. When examined in a drop of water under a microscope magnifying 200 to 500 times they appear opaque and of a dull grayish colour, owing to the fact that they are filled with a rich and slightly granulated protoplasma.

The opaque appearance of the pollen grains and also their uniformity are characters which can be observed not only on living plants but also on pressed material which has been kept dry for many years.

The appearance of the pollen, developed by a hybrid plant, is quite different. In the first place, the pollen grains are far from uniform in size and shape. Only a few reach the size of those of a good species, the majority being much smaller. They appear irregular in outline, are often shrunken and always of a bright colour. Examined under a microscope with a low magnification, say 100 times, the pollen from a hybrid violet gives an impression of emptiness and sexual incapacity. Examined under higher magnification, most of the pollen grains prove really, to be empty or filled with a watery content. Even those grains which, under lower magnification, appear to be fairly normal, prove to be filled with a very poor and watery protoplasma, and are therefore almost transparent.

The percentage of good sized grains in pollen of violet hybrids varies with the combination of the hybrid. The closer the species from which a hybrid has been formed are related to each other, the less degenerated becomes the pollen of the hybrid. Those hybrids, however, which are formed from systematically widely separated species, have an extremely poor pollen, the percentage of evidently wholly useless pollen grains often running as high as 95 per cent or more.

The sterility of the pollen in the petaliferous flowers of hybrid violets is, briefly, just as marked as the sterility of the capsules of the cleistogamous ones and consequently furnishes an equally excellent means whereby, in doubtful cases, the hybrid nature of violet plants can be ascertained.

The fact that hybrids between distinct species of violets show reduced sexual capability, should evidently be of great assistance to students endeavouring to reach a clear understanding of the systematic relationships of closely allied forms, inasmuch as the sterility or fertility of intermediates between such forms may decide whether the forms in question represent distinct specific units or merely are varieties of one species.

This question will, however, not be further discussed in the present paper.

The following is a list of violet hybrids which so far have been recorded in North America.

V. affinis x *Brittoniana* Dowell, Bull. Torr. Bot. Club. 37, 169.
" x *cucullata* Brainerd, Rhodora 8, 49.
" x *fimbriatula* Dowell, Bull. Torr. Club. 37, 170.
" x *hirsutula* Dowell, Bull. Torr. Bot. Club. 37 171.
(= *V. affinis* x *villosa* Brainerd, Rhodora 8, 56.)
" x *nephrophylla* Brainerd, Rhodora 8, 50.
" x *palmata* Dowell, Bull. Torr. Bot. Club. 37, 171.
" x *papilionacea* House, Rhodora 8, 119.
" x *sagittata* Brainerd, Rhodora 8, 55.
" x *septentrionalis* Brainerd, Rhodora 6, 219.
" x *sororia* Brainerd, Rhodora 6, 221.

V. Brittoniana x *cucullata* House, Bull. Torr. Bot. Club. 32, 255.
(= *V. notabilis* Bickn. Torreya 4, 131).
" V. *cucullata* x *septemloba* Brainerd, Rhodora 8, 52.)
" x *emarginata* House, Rhodora 8, 120.
(= V. *emarginata* x *septemloba* Brainerd, Rhodora 8, 53.)
" x *fimbriatula* Dowell, Bull. Torr. Bot. Club. 37, 172.
(= *V. Mulfordæ* Poll. Proc. Soc. Biol. Wash. 15, 203).
" *V. fimbriatula* x *septemloba* Brainerd, Rhodora 8, 51.)
" x *lanceolata* Forbes, Rhodora 11, 15.
" x *palmata* nom. nov.
(= *V. palmata* x *septemloba* Brainerd, Rhodora 8, 55).
" x *papilionacea* Dowell, Bull, Torr. Bot. Club. 37, 173.
" x *sagittata* House, Rhodora 8, 120.
(= V. *sagittata* x *septemloba* Brainerd, Rhodora 8, 51.)
" x *sororia* Dowell, Proc. Staten Isl. Ass. 3, 162.

V. cucullata x *fimbriatula* Brainerd, Rhodora 6, 217.
(= *V. Porteriana* Poll., Bull. Torr. Bot. Club. 24, 404).
" x *nephrophylla* Brainerd, Rhodora 8, 50.
" x *palmata* Brainerd, Rhodora 15, 115.
(Not *V. cucullata* x *palmata* Brainerd, Rhodora 8, 56. which is *V. cucullata* x *triloba* Brainerd, Rhodora 15, 115.)
" x *papilionacea* Brainerd, Rhodora 8 ,56.

V. cucullata x *primulifolia* Brainerd, Rhodora 11, 115.
(= *V. lavandulacea* Bickn. Torreya 4, 130, *V. cucullata* x (?) *emarginata* Brainerd, Rhodora 8, 52.)

" x *sagittata* Brainerd, Rhodora 8, 52.

" x *septentrionalis* Brainerd, Rhodora 6, 220.
(*V. melissaefolia* Greene, Pitt. 5, 103.)

" x *sororia* Brainerd, Rhodora 6, 222.

" x *triloba* Brainerd, Rhodora 15, 115.
(= *V. cucullata* x *palmata* Brainerd, Rhodora 8, 56.)

V. emarginata x *hirsutula* nom. nov.
(= *V. emarginata* x *villosa* House, Rhodora 8, 120.)

" x *papilionacea* House, Rhodora 8, 120.

" x *sororia* Dowell, Proc. Staten Isl. Ass. 3, 162.

V. fimbriatula x *hirsutula* Dowell, Bull. Torr. Bot. Club. 37, 175.
(= V. *fimbriatula* x *villosa* House, Rhodora 8, 121.)

" x *palmata* Brainerd, Rhodora 15, 114.
(Not *V. fimbriatula* x *palmata* Brainerd, Rhodora 8, 51, which is *V. fimbriatula* x *triloba*, Brainerd, Rhodora 15, 114).

" x *papilionacea* Brainerd, Rhodora 8, 54.
(= V. *papilionacea* var. *aberrans* Stone.)

" x *septentrionalis* Brainerd, Rhodora 6, 215.

" x *sororia* Brainerd, Rhodora 6, 218.

" x *triloba* Brainerd, Rhodora 15, 114.
(= *V. fimbriatula* x *palmata* Brainerd, Rhodora 8, 53.)

V. hirsutula x *palmata* Brainerd, Bull. Torr. Bot. Club. 39, 96.
(Not= *V. palmata* x *villosa* Brainerd, Rhodora 8, 56, which is *V. hirsutula* x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 95.)

" x *papilionacea* Brainerd, Rhodora 9, 98. (= *V. villosa* var. *cordifolia* Nutt., *V. papilionacea* x *villosa* House, Rhodora 8, 121.)

V. hirsutula x *sororia* Dowell, Bull. Torr. Bot. Club. 37, 176.

" x *Stoneana* Brainerd, Bull. Torr. Bot. Club. 39, 96.
(= *V. Stoneana* x *villosa* House, Rhodora 8, 121.)

" x *tribola* Brainerd, Bull. Torr. Bot. Club. 39, 95.
(*V. palmata* x *villosa* Brainerd, Rhodora 8, 56.)

V. lanceolata x *primulifolia* Dowell, Bull. Torr. Bot. Club. 37, 176.
V. latiuscula x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 94.
V. nephrophylla x *pedatifida* Brainerd, Bull. Torr. Bot. Club. 39, 94. (= *V. Wilmattæ* Poll. and Cockerell, Proc. Biol. Soc. Wash. 15, 178.)
V. oconensis x *sagittata* House, Torreya 7, 136.
V. pallens x *primulifolia* Dowell, Bull. Torr. Bot. Club. 37, 177.
V. palmata x *papilionacea* Dowell, Bull. Torr. Bot. Club. 37, 177.
" x *sagittata* Brainerd, Rhodora 15, 115.
(Not *V. palmata* x *sagittata* Brainerd, Rhodora, 8, 54, which is *V. sagittata* x *triloba* Brainerd, Rhodora 15, 115.)
" x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 88. (= *V. Angellae* Poll., Torreya 2, 24, *V. palmata* var. *Angellae* (Poll.) Stone, Proc. Acad. Phila. 1903, 678.)
V. papilionacea x *pedatifida* Brainerd, Bull. Torr. Bot. Club. 40, 249.
" x *sagittata* Brainerd, Rhodora 8, 54.
" x *sororia* Dowell, Bull. Torr. Bot. Club. 37,178.
" x *Stoneana*, Brainerd, Bull. Torr. Bot. Club. 39, 93.
" x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 90.
V. pedatifida x *sagittata* Brainerd, Bull. Torr. Bot. Club. 40, 252.
" x *sororia* Brainerd, Bull. Torr. Bot. Club. 40, 253.
V. sagittata x *triloba* Brainerd, Rhodora 15, 115.
(= *V. palmata* x *sagittata* Brainerd, Rhodora 8, 54.
V. septentrionalis x *sororia* Brainerd, Rhodora 6, 221.
V. sororia x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 92.
(= (?) *V. populifolia* Greene Pitt. 3, 337.)
V. Stoneana x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 93.

Of the above hybrids, totalling not less than sixty, only two have been recorded from Canada.

These are *V. cucullata* x *septentrionalis* and *V. fimbriatula* x *septentrionalis*.

V. CUCULLATA X SEPTENTRIONALIS.

This hybrid was first described by Dr. Greene[11] as *V. melissaefolia* from specimens collected in 1902 by Mr. L. W. Watson on Prince Edward Island. Its hybrid nature was, however, later recognized by Dr. Brainerd, who also states that plants belonging to the same combination, have been collected by Dr. J. Fletcher at St. Stephen, N.B.[12]

[11] Pittonia, vol. 5, p. 103.
[12] Rhodora, vol. 6, p. 220.

In the Geological Survey herbarium of Ottawa there is a specimen collected by Mr. J. M. Macoun at "Billings' Bush near Ottawa, May 18th, 1898," which puzzled the collector. It is mounted as No. 18761 with two specimens labelled *V. septentrionalis* Greene. The collector, however, was in doubt whether it should be referred to *V. septentrionalis*, and therefore wrote on one side of the specimen "*V. cucullata*?" In other words, the collector was in doubt as to whether it should be considered a form of *V. cucullata* or whether it should be referred to *V. septentrionalis*. In some respects it shows the characters of one of these species, in others it comes close to the other one.

There is no doubt, however, that the specimen in question represents a true hybrid between the species mentioned. The authors have had the opportunity to revisit the locality and have observed and collected many specimens of the hybrid, growing with their parent species.

V. cucullata x *septentrionalis*, as it occurs in the vicinity of Ottawa, reminds one at a superficial glance, very much of *V. cucullata*. It forms dense and very vigorous bunches and develops an abundance of beautiful sky-blue flowers which, like those of *V. cucullata* are borne on pedicels much surpassing the leaves and which, therefore, are very conspicuous. The exposed position of the flowers is, however, not the only thing which makes them so conspicuous. They are, in addition to being numerous and of a very rich colour, surprisingly large, in fact much larger than the flowers of either *V.cucullata* or *V. septentrionalis*.

A closer examination of the specimens collected reveals the fact that as far as their morphological characters are concerned, they represent undoubted itermediates between *V. cucullata* and *V. septentrionalis*. It is true that their pedicels are much longer than those of *V. septentrionalis*, but on the other hand they are decidedly shorter than those of *V. cucullata* and though soft and weak, are not slender as is the case with the pedicels of *V. cucullata*. The herbage of the hybrid plants differs from that of the glabrous *V. cucullata* in being very sparsely and obscurely hirtellous-hairy, and by the very same character from *V. septentrionalis*, which is rather conspicuously hairy, especially on the petioles.

The characters of the sepals in the hybrid are also intermediate between those of the parent species. In *V. cucullata* the sepals are perfectly glabrous, i.e., are not at all ciliolated

along the margins, whereas the sepals of *V. septentrionalis* are strongly and very conspicuously ciliolated. In the hybrid the sepals have rather sparsely ciliolated margins.

The conclusive evidence showing beyond doubt that the plants are forms of neither *V. cucullata* nor *V. septentrionalis*, but hybrids between those species, is, however, furnished by the pollen. An examination of the same proves this without doubt. A large number of pollen grains are perfectly sterile, as a matter of fact not less than about 95 per cent, whereas pollen from specimens of *V. cucullata* and *V. septentrionalis*, collected with the hybrid, shows one hundred per cent perfect grains.

V. FIMBRIATULA X SEPTENTRIONALIS was collected at Charlottetown, P.E.I., by Mr. L. W. Watson.[13] As specimens of this hybrid have not been seen by the authors of the present paper, it will not be discussed here.

In the spring of 1913 the authors made a joint excursion to Chats Falls, Ont., situated on the Ottawa River, and only about 20 miles from the Capital. Among other interesting finds was a violet hybrid which is of special interest not only because it has not been recorded before from America, but also because the species from which it had been formed belonged to a group in which hybrids, so far, have never been observed on the American continent. The hybrid in question is

V. CONSPERSA RCHB. X ROSTRATA PURSH.

The occurrence of this hybrid in the Ottawa district is furthermore of interest, because *V. rostrata* is a comparatively rare plant in these latitudes. As a matter of fact, its occurrence at Chats Falls was a very agreeable surprise to the authors as so far, it had been recorded only from three localities in the vicinity of Ottawa. The occurrence of the hybrid between *V. rostrata* and *V. conspersa* was, as a matter of fact, less surprising than the occurrence of *V. rostrata* itself. The two species grew mixed together and blossomed at the same time. Consequently as hybrids between allied species of violets are very readily formed—a fact that is most emphatically demonstrated by the list of hybrids, given on previous pages—the discovery of the combination *V. conspersa* x *rostrata* was really only a matter of diligent search, it being quite a natural consequence of the parent species growing together.

[13] Brainerd, Rhodora, vol. 6, p. 217.

The most conspicuous difference between *V. conspersa* and *V. rostrata* is, as is well known, that the spur of the former is less than 8 mm. long and comparatively stout, whereas the spur of the latter species is 10-12 mm. long and slender. The hybrid found at Chats Falls is characterized by having a spur the size and shape of which is just intermediate between those of the parent species. All other morphological characters, which it is hardly necessary to describe in detail, are also intermediate between those of *V. conspersa* and *V. rostrata* making it quite certain that the plants referred to are natural products of a spontaneous cross-fertilization between the species in question. That this really is the fact, is furthermore proven beyond doubt by the condition of the pollen as developed in its petaliferous flowers. Ninety-five to one hundred per cent of the pollen grains are imperfectly developed, shrunken, deformed and empty. Consequently they are sexually impotent and incapable of fertilizing the ovules of either the hybrid itself or of the parent plants.

What has been written must be considered as only an introduction to a more complete and detailed study of the genus *Viola* but it is hoped that enough has been said to encourage local botanists to undertake similar work in this genus within easy walking distance of their homes.

AUGUST BIRD LIFE AT PLEASANT POINT, ONT.*

BY MELVILLE DALE.

During the past three summers it has been my privilege to spend part of the month of August at a little summer resort called Pleasant Point, situated on Sturgeon lake, some ten miles from Lindsay, and some seventy miles north-east of Toronto. The Lake is one of the Kawartha group and is part of the Trent Valley canal system. It is about fifteen miles long and from one to two miles wide. A dam at Bobcaygeon has raised the level of the lake to some extent, and formed a considerable area of "drowned land" at the mouth of the Scugog river. This marsh is composed of the usual growth of wild rice, bulrushes, pickerel weed, white and yellow pond lilies, etc., while many lagoons both large and small are found within its confines. In certain localities numerous stumps rise a foot or so above the water and form a favorite roosting place for the gulls, terns and herons.

*Read before the McIlwraith Ornithological Club of London.

The land is quite rocky and the soil in the immediate vicinity of the lake poor. Farther back, however, the farms are excellent. The trees are the usual ones found in the north country, white birch, cedar, balsam, pine, maple, red and white oak predominating.

As already mentioned my observations have all been made during the month of August, so that the records kept include both summer residents and early fall migrants. In fact, if it were not for the small birds, particularly warblers, which arrive in great hosts about the middle of the month, August would be a rather unprofitable and uninteresting time for the bird student in this district.

From the camp at Pleasant Point, walks are taken up country in different directions for the study of land birds, while canoe trips are made to various points of interest along the lake shore or up the marsh. Probably the most interesting excursion of all is the one up the north arm of the lake in the direction of Fenelon Falls. About half way to the Falls a number of stumps are located along the west shore, some of them a few inches or a few feet above the water, others just below the surface far enough to make navigation dangerous in any but very calm weather. It was here the Caspian Tern was first observed in the summer of 1912. Identification was easy as the birds allowed a very close approach before taking flight, and even then they circled back and forth over the canoe, strongly voicing their displeasure at being molested. On August 22nd, 1914, a census was made of the birds found here, which showed Herring Gull 40, Ring-billed Gull 60, Caspian Tern 15. The difference in the color of the feet, even more readily than the difference in size, distinguishes the two gulls as they stand around on the stumps, but any differences which might be apparent then are immediately lost as the birds rise and fly screaming through the air.

The following list of species observed does not, of course, pretend to be a complete one, but will show to some extent the variety of birds to be found in this district.

PIED-BILLED GREBE, *Podilymbus podiceps*†—Common. Breeds in large numbers in the marsh.

LOON, *Gavia imber*—Tolerably common. Often seen disporting themselves in the lake in front of the camp.

HERRING GULL, *Larus argentatus*—Common.

RING-BILLED GULL, *Larus delawarensis*—Common. Above census would seem to indicate that they are more numerou than the Herring Gull.

†Scientific names supplied by Associate Editor—P. A. T.

BONAPARTE GULL, *Larus philadelphia*—A small flock of ten or fifteen usually to be found during August, feeding in the middle of the lake.

CASPIAN TERN, *Sterna caspia*—This rare species is one of the notable birds of the lake. Their favorite roost seems to be the stumps half way to Fenelon Falls, but later they were discovered in similar stumpy areas in the marsh. They are also to be found fishing singly or in pairs up and down the lake, and may be distinguished from the gulls even at a distance, by the characteristic, down-pointing head and bill. The identification is made doubly sure when one drops into the water with a great splash to secure some luckless minnow.

BLACK TERN, *Hydrochelidon nigra surinamensis*—Fairly common. Breeds in the marsh. Early migrant. Nearly all gone by the middle of August.

BLACK DUCK, *Anas rubipes*—Flocks, sometimes numbering hundreds, seen in the marsh.

AMERICAN BITTERN, *Botaurus lentiginosus*—Common.

GREAT BLUE HERON, *Ardea herodias*—Very common.

GREEN HERON, *Butorides virescens virescens*—Along the river in the marsh. Somewhat rare.

VIRGINIA RAIL, *Rallus virginianus*—The only one observed was on August 19th, 1914, but no doubt there are numbers of them throughout the marsh.

SORA RAIL, *Porzana carolina*—Several records for this bird. Also no doubt quite common.

FLORIDA GALLINULE, *Gallinula galeata*—Very abundant. One of the most interesting birds of the marsh.

AMERICAN COOT, *Fulica americana*—A few seen each year. Not nearly as common as the Gallinule.

LEAST SANDPIPER, *Pisobia minutilla*—A small sandpiper observed from the deck of the steamer en route from Lindsay to the Point. It flew up as the boat approached and identification, of course, is not positive.

SOLITARY SANDPIPER, *Helodromas solitarius*—During the wet summer of 1912 several were noted alongshore and in a pool in a clearing in the woods. None seen in 1913 or 1914.

SPOTTED SANDPIPER, *Actitis macularius*—Common.

BLACK-BELLIED PLOVER, *Squatarola squatarola*—August 9th, 1912, one seen in a wet field three miles from the lake —a rather unusual place. Identified by the white rump and black patches under the wings.

KILLDEER, *Oxyechus vociferus*—Common.

RUFFED GROUSE, *Bonasa umbellus*—Found in swampy places.

MARSH HAWK, *Circus hudsonius*—Not very common.

SHARP-SHINNED HAWK, *Accipiter velox*—One seen some distance up country.

RED-TAILED HAWK, *Buteo borealis*—A pair bred in a big woods half a mile from camp.

SPARROW HAWK, *Falco sparverius*—A few seen up country.

OSPREY, *Pandion haliaetus carolinensis*—One fishing near Bobcaygeon, August 12th, 1912.

KINGFISHER, *Ceryle alcyon*—Very common.

HAIRY WOODPECKER, *Dryobates villosus*—Common.

DOWNY WOODPECKER, *Dryobates pubescens*—Common.

YELLOW-BELLIED SAPSUCKER, *Syphrapicus varius*—Rather numerous. Breeds.

RED-HEADED WOODPECKER, *Melanerpes erythrocephalus*—A number at the Point. Much more numerous up country.

FLICKER, *Colaptes auratus*—A few observed each summer. Not common.

NIGHTHAWK, *Chordeiles virginianus*—Flocks of fifteen or twenty seen during migrations.

CHIMNEY SWIFT, *Chætura pelagica*—A few always flying around.

HUMMINGBIRD, *Archilochus colubris*—One or two seen each year.

KINGBIRD, *Tyrannus tyrannus*—Quite common and as usual very noisy.

CRESTED FLYCATCHER, *Myiarchus crinitus*—To be seen or heard every day.

PHOEBE, *Sayornis phœbe*—Plasters nest under the rocky ledges in Fenelon river.

OLIVE-SIDED FLYCATCHER, *Nuttallornis borealis*—This rare species is one of the features of Pleasant Point bird life. It is quite a common breeder and may be seen almost any time of the day sitting on the top of some dead tree watching for passing insects.

WOOD PEWEE, *Myiochanes virens*—Heard calling from the deep woods.

ALDER FLYCATCHER, *Empidonax trailli alnorum*—Heard one calling from a swampy thicket.

LEAST FLYCATCHER—*Empidonax minimus*—Fairly common.

PRAIRIE HORNED LARK, *Octocoris alpestris praticola*—Found in fields a short distance from the lake.

BLUE JAY, *Cyanocitta cristata*—Only one or two seen each year.

CROW, *Corvus brachyrhynchus*—Ever present.

BOBOLINK, *Dolichonyx oryzivorus*—Found up country.

COWBIRD, *Molothrus ater*—Quite rare. Only two or three records covering the three years, one of them, unfortunately, being that of a young bird fed by a red-eyed vireo.

RED-WINGED BLACKBIRD, *Agelaius phœniceus*—Great flocks in the marsh.

MEADOWLARK, *Sternalla magna*—Not very common.

BALTIMORE ORIOLE, *Icterus galbula*, —Rather rare.

BRONZED GRACKLE, *Quiscalus quiscula æneus*—Quite numerous up country.

PURPLE FINCH, *Carpodacus purpureus*—Rather rare.

GOLDFINCH, *Astragalinus tristis*—Common everywhere.

VESPER SPARROW, *Poocætes gramineus*—A few along the roadside near the lake.

SAVANNAH SPARROW, *Passerculus sandwichensis savanna*—Not singing in August and therefore difficult to locate. Positively identified once, and suspected frequently.

WHITE-THROATED SPARROW, *Zonotrichia albicollis*—Common.

CHIPPING SPARROW, *Spizella passerina*—Common.

SLATE-COLORED JUNCO, *Junco hyemalis*—One might expect this sparrow to be common but only two or three seen each summer.

SONG SPARROW, *Melospiza melodia*—Common.

SWAMP SPARROW, *Melospiza georgiana*—Found in the marsh.

ROSE-BREASTED GROSBEAK, *Zamelodia ludoviciana*—Quite rare.

SCARLET TANAGER, *Piranga erythromelas*—Also rare.

PURPLE MARTIN, *Progne subis*—Heard near Fenelon Falls.

CLIFF SWALLOW, *Petrochelidon lunifrons*—Common.

BARN SWALLOW, *Hirundo erythrogaster*—Common.

TREE SWALLOW, *Iridoprocne bicolor*—Rather rare.

BANK SWALLOW, *Riparia riparia*—Common.

CEDAR WAXWING, *Bombycilla cedrorum*—Very common.

MIGRANT SHRIKE—*Lanius ludovicianus migrans*—Quite common up country.

RED-EYED VIREO, *Vireosylva olivacea*—Very common.

BLACK AND WHITE WARBLER, *Mniotilta varia*—Probably the most numerous warbler.

NASHVILLE WARBLER, *Vermivora rubricapilla*—A few seen each year.

TENNESSEE WARBLER, *Vermivora peregrina*—August 21st, 1914, one seen.

PARULA WARBLER, *Compsothlypis americana*—A number seen each year.

CAPE MAY WARBLER, *Dendroica tigrina*—1914 the first year this bird was recorded. Twelve seen in one day.

YELLOW WARBLER, *Dendroica æstiva*—A few seem to breed in this locality, but not at all common,.

BLACK-THROATED BLUE WARBLER, *Dendroica cærulescens*—Also breeds in small numbers.

MYRTLE WARBLER, *Dendroica coronata*—Common.

MAGNOLIA WARBLER, *Dendroica magnolia*—Quite a common migrant.

CHESTNUT-SIDED WARBLER, *Dendroica pensylvanica*—Common.

BAY-BREASTED WARBLER, *Dendroica castanea*—Common during migrations.

BLACKPOOL WARBLER, *Dendroica striata*—August 21st, 1914, one seen.

BLACKBURNIAN WARBLER, *Dendroica fusca*—Very common during migrations.

BLACK-THROATED GREEN WARBLER, *Dendroica virens*—Very common.

OVEN-BIRD—*Seiurus aurocapillus*—Common.

WATER-THRUSH, *Seiurus noveboracensis*—Numbers breed in the swampy places. In August they may be seen feeding in the open along the shore among the drift wood and other debris.

MOURNING WARBLER, *Oporornis philadelphia*—Keeps to the swampy thickets and rarely seen in August.

MARYLAND YELLOWTHROAT, *Geothlypis trichas*—Quite a common bird.

WILSON WARBLER, *Wilsonia pusilla*—August 19th, 1914, adult male seen. Only record.

CANADIAN WARBLER, *Wilsonia canadensis*—Common, especially during migrations.

AMERICAN REDSTART, *Setophaga ruticilla*—Very common.

CATBIRD, *Dumetella carolinensis*—Common.

HOUSE WREN, *Troglodytes aedon*—Fairly common.

WINTER WREN, *Nannus hiemalis*—Nests in swampy places. Not singing in August and therefore hard to find.

LONG-BILLED MARSH WREN, *Telmatodytes palustris*—Abundant in the marsh. Their nests are to be found all over, and the birds scold the intruder as his canoe is pushed among the reeds.

BROWN CREEPER, *Certhia familiaris*—Only one or two observed.

WHITE-BREASTED NUTHATCH, *Sitta carolinensis*—Very common.

RED-BREASTED NUTHATCH, *Sitta canadensis*—A few seen each year. Breeds.

BLACK-CAPPED CHICKADEE, *Penthestes atricapillus*—Around the camp all the time.

RUBY-CROWNED KINGLET, *Regulus calendula*—One or two seen in 1912.

VEERY, *Hylocichla fuscescens*—Common.

ROBIN, *Planesticus migratorius*—Common.

BLUEBIRD, *Sialia sialis*—A number seen each year.

The discovery of this bird and its use of the Trent Valley as a migration route adds considerably to our knowledge of its distribution in Canada. About five years ago Mr. John Firth, Durham, was authority for the statement made to Mr. W. E. Saunders, that a mounted specimen in his collection came from an island near Parry Sound "where they were breeding." Mr. Saunders had no opportunity of investigating this matter for himself but at his request, Mr. Guy A. Bailey of Geneseo, N. Y., went to Parry Sound about 1911 to investigate the matter and found, sure enough, that the bird nested in considerable numbers on at least one of the islands in that district. He returned with photographs of the eggs and young.

Prior to this discovery the only place where these birds were known to nest in the Great Lakes was a little cluster of islands in Lake Michigan and now, following the addition of this bird to the Canadian breeding list comes this definition of its migration route.

This bird is seen in both spring and fall migrations on Lakes Huron, St. Clair, Erie and Ontario, but nowhere has it been reported in anything like the numbers that have been seen on Sturgeon lake.

Mr. Saunders and his friends, who make such frequent visits to Point Pelee, have always found this species to be rare; and its size, coupled with its peculiar call, almost dog-like in tone, together with the fact that Terns are usually noisy, renders it likely that very few pass unnoticed within the range of the observer.

BOOK NOTICE.

NERVES—By Professor D. Fraser Harris, M.D., D.Sc., F.R.S.E., Etc., Professor of Physiology, Dalhousie University, Halifax, N. S.

This most admirable handbook on "Nerves" belongs to that excellent series, "The Home University Library of Modern Knowledge," published by Williams and Norgate, London. The series ranges over such diverse fields as Literature, Art, History, Philosophy and Science, and the authors include some of the most eminent specialists of our time. Professor Fraser Harris's little treatise of nearly 250 pages will rank among the best, for it is brightly written, full of interesting matter, thoroughly up to date, and as clear and concise as could be desired. The book has a distinct literary flavour, as might be expected from a writer who has the distinction of being a member of the exclusive "Authors Club" of London.

Nobody, in these days of stress and strain, needs to be told that he possesses nerves. Most people are only too painfully aware of the fact, and like James David Forbes, the Scottish physicist, compelled to confess "I am laid on my back, and unable to revolve through the smallest aliquot parts of a right angle without a tremendous twitch."

A clearer description of the nerves, and of nerve functions, than Dr. Fraser Harris gives in his first two chapters cannot, we feel sure, be found, though a few good figures of the brain, spinal cord, and of actual preparations, not diagrammatic, would have been helpful to ordinary readers. Many curious facts are detailed in the earlier chapters, such as the ascertained speed of nerve impulses, viz.: 180 feet per second in man's motor nerves. These nerve impulses are not the same as electrical waves, though all neural activity, as of all muscular activity, is accompanied by electrical disturbances. The continuity of the neuraxone is carefully explained and in Chap. III the nature of nerve centres, or specialized groups of nerve cells, are admirably elucidated. The nerve centres are a "hierarchy," the lower centres obey the higher, says the author, there is no equality, but there is co-operation, surely an object-lesson for some politicians! Curiously enough nerve activities are not specific for experiment shows that a nerve for inhibiting the heart was grafted on to the nerve for dilating the pupil of the eye, and on being stimulated the heart-nerve actually dilated the pupil (p. 78). The character of nerve activity depends upon the tissue or organ in which the nerve ends. Habit or the forming of nerve-paths, individual susceptibility or the truth that "what is one man's meat is another's poison," and other interest-

ing topics are all admirably treated. The importance of inhibition is revealed, and the most recent views on fatigue, sleep, and nerve restoration, set forth. Professor Fraser Harris's views on sleep attracted wide attention, when he delivered his remarkable Midland Institute lecture, in Birmingham, some years ago. It is here shown that sleep results normally from a kind of poisoning of the brain cells, decreased brain circulation, and diminished sensation. Sleep may be prevented by too energetic brain circulation, excessive mental occupation, etc., and the paragraphs are most valuable upon the causes of "insomnia," that dread calamity, which is well-nigh the worst of human ills. The author gives some curious examples of sleep under difficult circumstances, but these are even surpassed by the recorded instance of a naval captain during the last attack on Rangoon (in the Indian Mutiny), when, worn out by constant overstrain, he fell into a deep sleep on deck, and slept for two hours though he lay within a yard of one of the largest guns, which was being energetically fired the whole time. The author does not shrink from postulating a "nerve force" as a scientific fact, in spite of its psychological and metaphysical dangers, and he declares that our nervous system is "dynamogenic." The tremendous muscular power of maniacs, must be attributed to abnormal production of such nerve force. In Chap. IX on "Nervousness" Dr. Harris describes the Nissl granules. In the cell rested and fresh the granules are well-formed, but in overworked cells they become irregular and indistinct, hence they must be the physico-chemical basis of nerve energy. Gland cells are similarly crammed with minute granules in the rested condition, but are deficient in granules after active glandular secretion. High phosphorus (lecithin) is beneficial for nerves in a starved, fatigued condition, and fatty food, under proper conditions, is valuable. The pages on fussiness, irritability or "bad temper," neurasthenia and other troubles are scientifically described. Bodily health and nerve health are vitally connected, and the power of inhibition is a supreme blessing, this power of control being the expression of nerve vigour, it is "Knowing when and where to stop, when not to act and not to speak."

A useful glossary of terms, and a brief bibliography of "nerve" books, and a very concise index complete a model guide upon a subject of universal interest. Professor Harris is, we notice, the only Canadian author who has written a book for this "Home University" Series, which the London "Daily Telegraph" affirms gives "the world's learning in little."

E. E. P.

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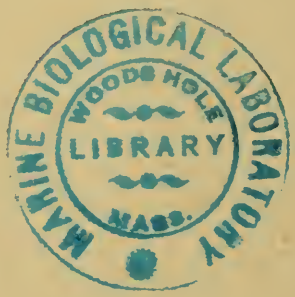

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