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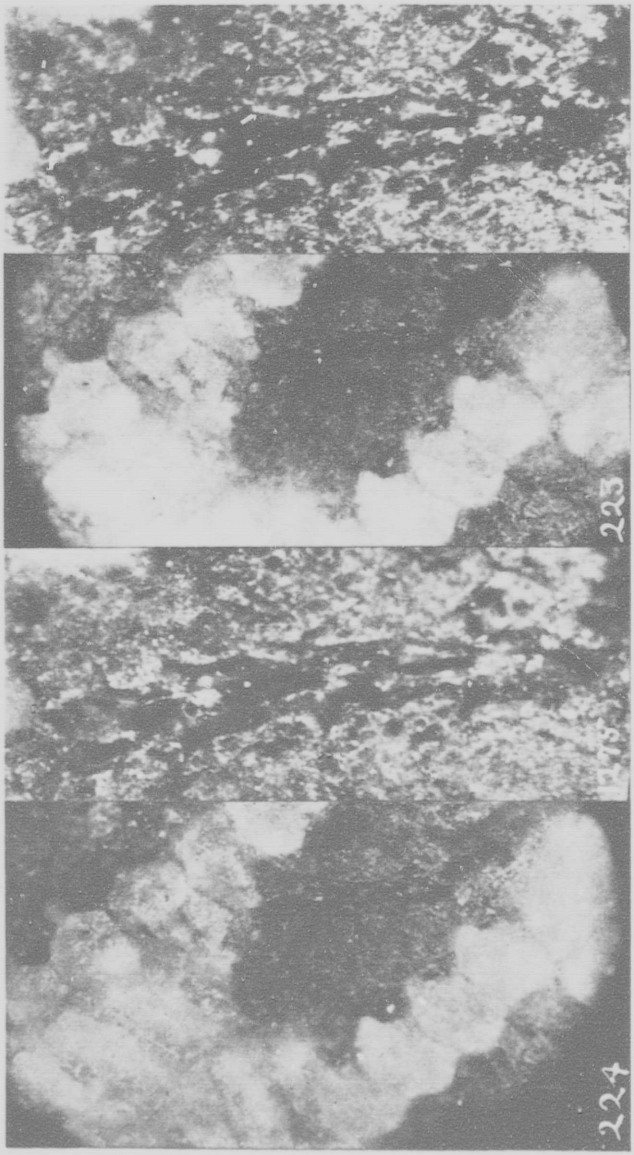

CERAMOGRAPTUS RUEDEMANNI, HUDSON.

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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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.

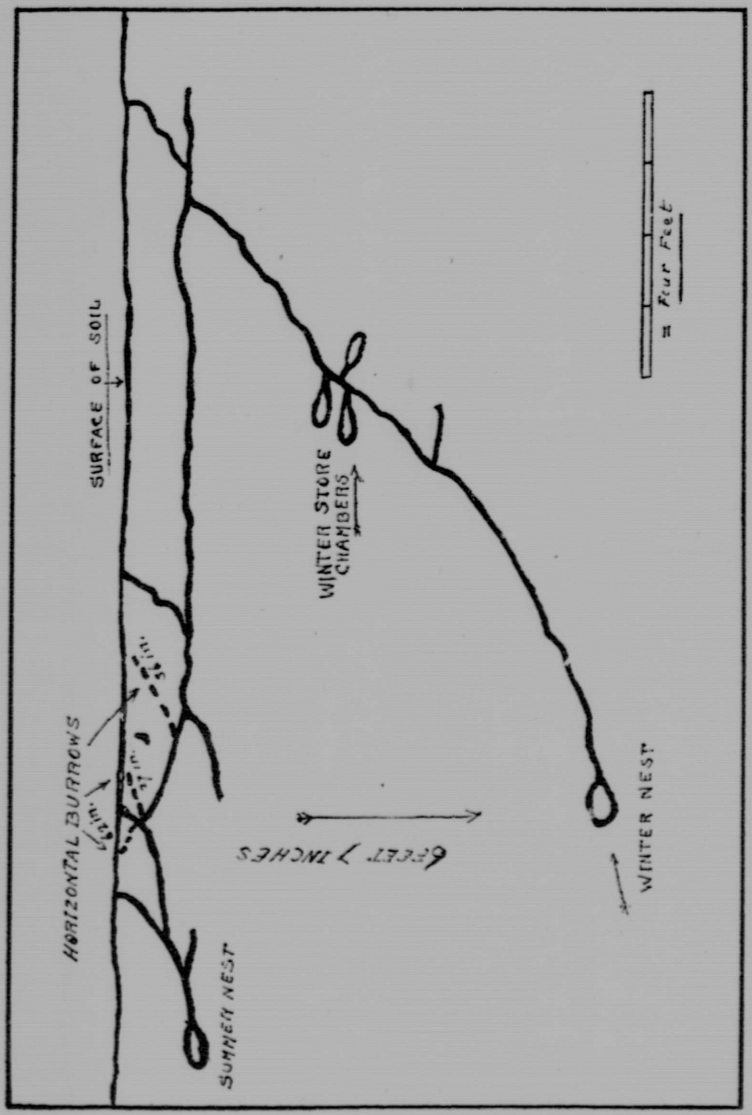
The mouse forming the title of this paper was discovered and described by Maximilian, Prince of Wied, in 1839. It was collected on the upper Missouri river near the mouth of the Yellowstone, North Dakota , and proved to be a new genus as well as a new species. It was, also, the first pocket mouse to 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, œsophageal 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* Protracheate 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 Faroes 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 ready 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.

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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