

of the Crefell Range, west of Cromwell, to prove the existence of intrusive rocks in that locality.

7. "On the Growth of Ferns; and on a New Fern (*Lygodium*), now first reported," by H. C. Field. (*Transactions*, p. 446.)

Mr. Tanner wished to know if the fern referred to was edible.

Mr. Field replied that it was not.

Mr. T. Kirk did not think the fern new, and until further evidence is received we should not accept it: it is not even allied to the plant named. The variation in growth is interesting, but it is nothing new.

The following specimens were exhibited: (1.) Seven birds, chiefly petrels, presented to the Museum by Captain Fairchild, and mounted by Mr. Yuill. (2.) Minerals from Stewart Island and West Coast, by Mr. F. Walter. (3.) Maori adze, found in a drain in Willis Street, Wellington, by Mr. Mestayer, C.E.

TENTH MEETING: 14th November, 1894.

Major-General Schaw, President, in the chair.

New Member.—Dr. Anson.

Papers.—1. "Further Coccid Notes: with Descriptions of New Species from New Zealand, Australia, Sandwich Islands, and elsewhere, and Remarks upon many Species already reported," by W. M. Maskell. (*Transactions*, p. 36.)

2. "On the so-called Vegetable Caterpillar and other Fungi that attack Insects," by W. M. Maskell.

ABSTRACT.

Insects were much subject to attacks from many kinds of parasites, which might be either animal or vegetable. On the present occasion he confined himself to the vegetable parasites, which are all, or almost all, of the great class of Fungi. And these Fungi which prey upon insects are usually divided in the present day into five groups, of which the first includes the Bacteria; the second an obscure and peculiar family named Laboulbeniaceæ; the third a number of "moulds," of which the silk-worm disease is one; the fourth the family of Entomophthoræ; and the fifth some "ascigerous" fungi, including one so-called "vegetable caterpillar." He proposed to deal now only with the fourth and fifth of these groups, and proceeded to explain the mode of growth of some of them, illustrating his remarks with specimens in the natural state, specimens mounted and exhibited on a number of microscopes, and diagrams on the black-board. These specimens and diagrams included the common "house-fly fungus" (*Entomophthora muscæ*), and various fungi which, in the New Zealand forests, attack homopterous insects. Individuals of the genera *Ctenochiton* and *Lecanium* (Coccids), and *Rhinocola* (Psyllid), were shown infested with fungus, and the action of the parasite was explained. It was stated that in these last cases the fungi varied a good deal; though their action as regards the insects seemed the same. They took possession of the whole interior of the body, and, when at the ripen-

ing or fructifying stage, protruded through the skin in order to scatter its spores: a similar proceeding also characterizing *Entomophthora muscæ*. Passing afterwards to the "vegetable caterpillar," the speaker showed that the name was very appropriate, as the thing was partly caterpillar and partly fungus, although some writers (notably Mr. Pratt, in his "Travels in China and Thibet") spoke of it as "a plant which imitates a caterpillar." The grub itself was stated to be the larva of some large moth, probably of the genus *Hepialus*: and the fungus belonged to the genus *Cordyceps*, the specific name being *C. robertsii*. Here the action of the fungus on the insect was, practically, the same as that of *Entomophthora*, as it took possession of and destroyed all the interior organs; but, as the caterpillar was subterranean, the fungus, in order to reach the air and scatter its spores, pushed out a long stem through the earth, and at the extremity of this stem the "asci," or small bags containing the spores, were developed. Specimens of the caterpillar and of the *Cordyceps* were exhibited both in the natural state and under the microscope. The speaker concluded by expressing the hope that some of our young colonial students would take up the investigation of these insect parasites, which, over and above their scientific interest, had a very great economical value, inasmuch as they tended to decrease the enemies of the cultivator.

Mr. Hudson considered this a most interesting paper. The fly fungus referred to is found chiefly in autumn. It is a matter of opinion as to whether flies are injurious; they certainly are good scavengers, and it is a question whether they ought to be destroyed. There was not sufficient evidence to show that Mr. Pratt was wrong in his opinion as to the vegetable caterpillar. It is important to ascertain for certain what insect it would turn out to be if not attacked by the fungus. The larva of the *Porina mairi* was the only one large enough, and they were very rare, probably owing to the fact that they are so frequently attacked by *Cordyceps robertsii*. Of course it may be *Hepialus virescens*. If we could get the caterpillar free from the fungus we could ascertain what it was.

Sir James Hector considered the author had done great service by his interesting paper, and had opened a new field for preventive natural history by the discovery of fungi antagonistic to insect blights. The phenomena of the fly and of the caterpillar he considered very different. In the case of the first the perfect insect was destroyed; but in the case of the caterpillars the spores of the fungus were probably passed on by the perfect moth through the egg and grub, as in the case of the pebrene of the silkworm, the investigation of which was one of Pasteur's greatest researches.

Sir W. Buller said it would require a brave man to break a lance with Mr. Maskell on a field of which he was an acknowledged master, and he would therefore not attempt to criticize the part of his paper relating to scale-insects and fly-killing fungi. But he ventured to challenge Mr. Maskell's description of the vegetable caterpillar (*Cordyceps robertsii*), because he considered it unscientific and misleading. Mr. Maskell had described this natural object as a sort of compound caterpillar or animal at one end and fungus or vegetable at the other. He (the speaker) contended that, so far from this being the case, it was *Cordyceps*, or vegetable, from one end to the other. There had, of course, originally been a living caterpillar, of which the fungus-growth was an exact replica, but what he now held in his hand was in its entire tissue and substance, even to the covering cuticle, pure vegetable. The spores of the fungus, taken into the body of the caterpillar, which had gone underground for the purpose of undergoing its natural transformation, had germinated, and, rapidly filling the body, had absorbed or assimilated the whole of the animal substance, its growth or development being circumscribed by the outer integument or skin of the caterpillar, which it had only pierced at

one point—at the neck, for the purpose of sending up a shoot. Sir Joseph Hooker's theory was that the minute spores got lodged in the folds of the skin on the caterpillar's neck in the progress downwards, which appears to be always tail-first. Mr. Maskell had probably never examined any but hard and dry specimens like that now exhibited, but he himself had dug up hundreds of them. In the fresh state the body of the so-called vegetable caterpillar is a compact vegetable substance with a round passage or open canal down the centre. It has a fragrant woody smell, and to the taste is exactly like Barcelona nut. What had originally been the skin of the animal caterpillar had rotted off, and the outer brown skin on the specimen exhibited was the natural covering of the fungus—an extremely thin layer that could be scraped off with a knife, disclosing the white pulpy substance underneath. The Maoris, who make use of certain woods and vegetable products for procuring their tattooing powder, have discovered a valuable property of the vegetable caterpillar; for, reducing it by burning to a cinder, they crush it into a fine powder, and obtain a black pigment for their ornamental *moko*, rubbing it into the cuts on the skin. He agreed with Mr. Hudson that the caterpillar attacked by *Cordyceps robertsii* was not the larva of *Hepialus virescens*, as was generally supposed. Whether it was that of *Porina mairi* (Buller), as suggested by that gentleman, he could not say, but he thought it was quite possible. The only specimen of *Porina mairi* at present known was found by him in the Ruahine Ranges in a locality where the vegetable caterpillar was very abundant. The moth is supposed to be very rare, but that might be because it had not been properly looked for, and it certainly belongs to a group whose habits are strictly nocturnal. He had collected them in all suitable localities in the ranges, and had very seldom found them under those particular trees. They invariably have a single stem, with its fructification at the top and well out of the ground; but sometimes the fungus bifurcates less than an inch from the head, producing two stems. The body of the caterpillar is sometimes slightly curved or twisted, but in all his experience he had never known a specimen exhibiting the stem-growth from any other part of the body. He might here mention that there is an erroneous figure of the vegetable caterpillar in Mr. Edward Wakefield's "New Zealand after Forty Years" (p. 82). There the caterpillar is represented as lying horizontally, with the stems growing upwards at a right angle with the body. That never occurs in nature, and he supposed that Mr. Wakefield had been misled by having a damaged specimen with the stem detached.

Mr. Travers said he had found the fungi at the roots of birch-trees. He had found the beetle mentioned by Mr. Maskell, and it presented the appearance of the vegetable caterpillar. He differed from Sir Walter Buller regarding the vegetable caterpillar, and agreed with Mr. Maskell.

Mr. T. W. Kirk said that the white grub referred to had been tried here, but without success; perhaps it is not the right species. He had specimens of the *Hepialus*, and was quite sure that they do take to the ground. The stems grow from either end, and from both ends of the single specimen. The insect is not dead until it is quite taken up by the fungi.

Mr. T. Kirk said that Mr. Maskell, in his interesting remarks on the "fly fungus" (*Saprolegnia ferox*), had omitted mention of the most important fact connected with it—namely, its identity with the fungus that attacks fresh-water fish in various countries. Ten or twelve years ago it committed great ravages amongst the trout in the Otago lakes, numbers being diseased and unfit for human food. It was supposed that flies infested with the fungus in its rudimentary stage were swallowed by the fish, when the mycelium speedily developed, until it permeated its muscles and formed white patches on the external surface, the fin being often found completely rotten from the effects of the parasite. Vast

numbers of spores would also be discharged in the water, and would germinate whenever they came in contact with healthy fish, so that an immense amount of injury had resulted from an apparently insignificant cause. He had paid considerable attention to the fungi infecting certain Coccidæ, but had never succeeded in obtaining perithecia; it was, however, clear that more than one species was to be found, although hitherto nothing had been done in the way of identification. He could not accept Mr. Maskell's opinion that the vegetable caterpillar of New Zealand (*Cordyceps robertsii*) had been found in other countries, but believed it to be endemic. The *Cordyceps* which attacked the larvæ of Cicada was a smaller species, much-branched, and of a pale-red tint. A Chinese species (*C. sinensis*) occurs in such large quantities as to form an article of food. It is tied up in small bunches and sold in the markets. Perhaps the most striking of the fungi growing on large caterpillars is the *Cordyceps taylori* of Australia, a rare species, with several flattened branches, resembling a miniature stag's horn: it is a prince amongst its congeners. He had seen other kinds of fungi attacking the larvæ of beetles, and obtained a large moth infested by a *Sphaeria*, which had filled the abdominal cavity with mycelium, and produced a double or triple row of stipulate perithecia along the entire extent of the abdomen. Mr. Maskell had drawn attention in an interesting manner to a neglected group of curious organisms. He would like to add, with regard to Mr. Maskell's complaint concerning the small amount of attention paid to the study of microscopic plants and animals by the younger members of the community, that a decided impetus would be given to work of this kind by the reintroduction of biology into the course of study at Wellington College. That institution was furnished with good microscopes and a considerable amount of accessory apparatus, as well as with collections of plants, minerals, &c., all of which had been lying idle since the College had ceased to be affiliated with the New Zealand University.

Mr. Maskell replied briefly to the remarks made, and, in answer to Sir W. Buller, said that, after all, the objection raised by that gentleman was only a splitting of hairs. The thing, for at any rate ninety-nine hundredths of its life, was a caterpillar attacked by a fungus, just as the fly on the window-pane was a fly which the fungus had killed. To say that when it was dried up and rotten there was then no caterpillar left, seemed to be simply a piece of dialectic distinction, which would have been more valuable if Sir W. Buller had been accustomed to microscopic investigations. He had himself clearly seen the skin of the caterpillar, even in an old specimen, and it appeared to him quite certain that, if that skin was destroyed by a fungus, that fungus was not *Cordyceps*, but some form of mould. The question raised by Sir W. Buller had absolutely no economic importance, and at its best was an objection so fine-drawn as to be not even important in a scientific sense.

Mr. Maskell then exhibited specimens under the microscope.

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#### ELEVENTH MEETING: 28th November, 1894.

Mr. W. T. L. Travers in the chair.

It was announced that, in conformity with the Act, Major-General Schaw had been elected Governor of the New Zealand Institute to represent the incorporated societies for the year 1895.

*Papers.*—1. "Observations on some peculiar Maori Remains, with Remarks on the Ancient Institution of Tapu," by Sir W. L. Buller. (*Transactions*, p. 148.)

Sir J. Hector said that the specimen of the cranium exhibited was a very interesting one, and was thicker than usual. He thought, however, that the condition of the bone might be due in some measure to the deposit in which it had been preserved, and he would like to know what the nature of the deposit was. As to the Mallicolo skull, he was of opinion that the form was entirely due to artificial compression in youth. It was unlike the skulls of the flat-headed Indians, the effect there being produced by pressure during infancy by a board on the head. Instead of a board the Mallicolo may have used a swathe of cocoanut fibre. He had examined seventeen Mallicolo skulls in a collection at Sydney, and no less than seven of them presented the remarkable feature of a suture down the centre of the frontal bone. He exhibited a Maori skull, collected by himself at Parapara, in which this feature was present; but he had never met with another case among Maori skulls. No doubt artificial pressure had something to do with this.

Mr. Travers suggested that the abnormal position of the tooth in the Opotiki specimen might be due to a blow at some time.

Sir W. Buller, in reply, explained that the human remains on the Papaitonga Island were merely covered with rank vegetation, and had not been imbedded in any deposit. As to the frontal suture, he thought that feature was quite independent of the shape of the skull. It was admitted to be very rare. The Maori skull exhibiting it was a remarkably well-formed one, whilst in the Mallicolo skull now before the meeting there was not the slightest trace of a frontal dividing suture. He believed it was still a moot point with Sir James Paget, and others who had studied the subject, whether the form of the Mallicolo skull was natural or artificially produced. It had been argued that if pressure had been applied there would have been a bulging of the parietal bones; but, although there was practically no forehead, there was a certain amount of symmetry in the skull, which was produced backwards. There were several specimens in the Museum of the Royal College of Surgeons, and, so far as he could remember, only one of these presented the frontal suture. As to Mr. Travers's suggestion about the tooth, he thought it highly probable that the abnormal growth was originally caused by a blow or some other external injury. He had submitted the specimen to Mr. Rawson, the dentist, who said he had never met with a similar case in the whole of his experience.

2. "A Revision of the New Zealand Gentians," by T. Kirk. (*Transactions*, p. 330.)

3. "On the New Zealand Species of *Gunnera*, L.," by T. Kirk. (*Transactions*, p. 341.)

Sir James Hector said these were very valuable papers. The remarks regarding the gentians were most interesting. It was hardly safe, from our present knowledge, to give the exact localities where these plants are to be found. He thought he had seen them in the Kaimanawa Ranges as early as 1866.

Mr. Hudson said the remarks regarding the prevailing colour of the flowers being white in New Zealand were interesting. Insects seemed to be attracted by these white flowers.

Sir W. Buller asked whether Mr. Colenso had not explored the Kaimanawa Ranges.

Mr. Harding did not think this locality had been examined botanically.

Mr. Travers said he was quite familiar with these beautiful plants in Nelson. He had seen them in great profusion on the Hanmer Plains, and extending up the Clarence Hills as high as 4,000ft. It was almost impossible to cultivate them.

4. "On Oyster-culture in New Zealand," by Sir James Hector.

ABSTRACT.

The paper is a summary of investigations which are being made for Government. The oysters in New Zealand by their shells may be distinguished as many varieties, but are clearly divided into two groups by their habit of propagation. Outward form of shell goes for nothing as a distinguishing mark, except that heavy, dense shells without outward markings predominate in the south and in deeper waters; but occasional exceptions occur. The form of the shell is chiefly determined by the nature of the surface to which it is attached. Reproduction, which is the chief factor in the distribution of the oyster, is controlled by the temperature of the sea. In the north of New Zealand, where for a short season the temperature of the sea with inflowing tide reaches 70° Fahr., oysters which are not strictly hermaphrodite, but only seasonally so, have an advantage. As the tide flows, at the proper season the valves open, and the ova and milt of different individuals are together swept up the tidal creeks, there fertilize and develop, and, settling, cling to their final resting-place between tide-marks, where they grow a close-fitting shell that enables them to withstand the tidal periods of drought. The other extreme is controlled by the more rigorous conditions of Foveaux Strait, where the winter cold and the insufficient summer temperature of the sea prevent the survival of intertidal oysters, so that the oysters that survive are those in deep water, which do not shed the male and female elements of the spawn at different seasons but at the same time and within the shell, and there nurse the spawn until they complete the larval stage and acquire rudimentary shells. In this form they are discharged from the parent oyster in thousands, and after a very brief independent existence they assume a sedentary life. Between these, the extreme forms of habit, there are in New Zealand an almost unlimited variety, and even that must vary with the seasons. But this very variability affords a good opening for the oyster-cultivation; and for the development of oyster-culture as a great national industry New Zealand enjoys very prominent natural advantages.

Mr. Richardson said he was glad to hear that we are likely to have a good supply of oysters in New Zealand.

Mr. Travers said it was disastrous to draw altogether on the natural beds for supply, and dredging should not be allowed. Properly-supervised cultivation should be carried out, and inspection. Skill as well as capital was required in this industry. Many of our natural productions have, owing to the absence of proper supervision, been destroyed; and now, when almost too late, they are found to have been valuable.

5. "Further Contribution to a Knowledge of the Sponges of New Zealand," by H. B. Kirk, M.A. (*Transactions*, p. 287.)

Sir Walter Buller exhibited twelve specimens of the beautiful land-shell *Paryphanta hochstetteri*. Referring to Mr. Travers's proposed discrimination of two species—one distinguished by its black undersurface, whilst in the other it was yellow—he desired to point out that in the present series there was a perfect gradation of colour. One of those exhibited was from