stocked during June, grazed down during the first half of July to secure the feed that would otherwise be frosted, and again unstocked till the middle of August, or later, every day at this period producing three times as much growth as a day in July. Such a method of winter feeding will, of course, necessitate some large fenced-off yards and plenty of artificial food; but it will secure a fairly maximum yield from pasture, and I see no theoretical objection to it save one. It appeared that a shoot of grass grows only at its youngest blade, the second youngest growing very slowly indeed, and the others not at all, so soon as a new blade appears and begins, as it does, to rush ahead. It may be, therefore, that a mature blade gives up its nutritive substance more or less to the youngest blade; so that when it is liable to be frosted it has already become of poor value as feed; and its loss is not of much consequence. Should this surmise prove correct it seems to me that to keep pastures wholly unstocked during winter is a necessity for sound scientific grazing. Should the surmise prove incorrect it would be sound policy to graze the pastures to a considerable extent once in the winter—that is to say, at the commencement of the frosting of the old blades.

In conclusion, I find by inquiry the opinion is very common that grass grows from the root rather than from the blade; and, of course, such an opinion is in accord with bare grazing. On the other hand, the botanist asserts that grass grows from the blade rather than from the root, and he considers, therefore, that bare grazing is thoroughly unscientific and unprofitable.

Postscript.—Since this paper was read I have noticed that the clipped tuft of rye-grass had its vitality so impaired by the clipping that it was unable to stand the slight drought of early summer, and almost completely died out.

Art. LXII.—*On Moth-destruction.*

By Coleman Phillips.

[*Read before the Wellington Philosophical Society, 11th November, 1891.*]

I have for a long time been struck with the vast number of moths which swarm in our gardens, orchards, and fields during the spring, summer, and autumn months of the year, and I have regarded any reduction of their numbers as almost hopeless. The year before last I lost a large area of swede turnips in consequence of caterpillars which I supposed came

from the diamond-back moth (*Plutella cruciferarum*); but as the larvæ of these moths only attack the leaves, and my swedes were bored through and through the bulb, the damage must have been done by the caterpillar of the common dart moth, *Noctua* (*Agrotis*) *segetum*, or of the heart-and-dart moth, *Noctua* (*Agrotis*) *exclamationis*, or, rather, of moths similar to these, as Mr. Hudson tells me that the exact English species of these moths are not in New Zealand.

Swarms of little white moths rise about February from our hedges, trees, and even tussocks in a day's ride across the plains. But this is a day moth, and may have to be trapped in the day-time like a butterfly. In September and October our rooms at night are inundated with *Porina cervinata*, or some such moth of the Hepialidæ family, the larvæ of which feed on the roots of grass. Every settler knows how much grass he annually loses from what he calls the wire-worm. I have seen patches of grass many acres in area entirely destroyed for a season by this or a similar caterpillar.

Then, there is the caterpillar from the moth (*Plutella cruciferarum*, I suppose) which bores through the leaves of nearly all our garden vegetables; also cankerworm moths, which destroy our fruit; also the dreaded codlin-moth, for which some friends of mine have tried growing a moth-catching plant, the flowers of which certainly entrap a number of moths very nicely, but its eventual utility I should much doubt. Nevertheless, the catching of twenty or thirty moths each day or night may be very beneficial in reducing the codlin-moth in our orchards not much troubled with the pest as yet. And even this slight reduction may prevent the pest from spreading to clean orchards.

For the diamond-back moth, Mr. Bidwill, of Pihautea, Wairarapa, many years ago tried large bonfires at night; and, for the large moths, he destroyed a number by placing a looking-glass at the back of a lighted candle in an open window. The moth dashed against the glass and fell disabled.

For codlin-moth, I have read in an agricultural paper of a plan of hanging a lamp in the apple-trees with wings of tin covered with some sticky material. The moths would fasten themselves upon the wings like flies upon treacled paper. I have also read of the manner in which the electric arc lights in New York and London attract the different kinds of moths. Eventually the sparrows have found this out. They are observed chattering around the globes at daybreak, waiting until they cool, and then these little scavengers slide down into the globe by way of the carbons and get a good breakfast; as many as half a dozen birds clambering into one globe. Entomologists have consequently to be up very early to secure good specimens. The attraction of the arc light is only

another form of the simple attraction of a lamp upon a drawing-room table. (The arc light also appears to draw the large earth-worms out of the ground, so that lads in New York now collect them for fishermen.)

I therefore determined to experiment with the lamp with wings. I write now in October, and I began the experiment last month. I had a lamp constructed with movable wings. I then covered the wings with castor-oil, and placed the lamp upon the verandah of my house. The large moth *Porina cervinata* came and duly fastened itself on to the wings, and then carefully wriggled off on to the floor, where it crawled about apparently not much hurt, but, in my housekeeper's opinion, doing much harm to the clean appearance of the boards by covering them with oil-tracks.

Next night I determined to give up the sticking process, and see how a milk-dish containing a little kerosene placed beneath the lamp to catch the moths as they fell would answer. I must say this plan worked like a charm. The moths dashed themselves against the lamps, and fell into the kerosene and were immediately killed. I should think I destroyed eight hundred to one thousand moths that night. I have also tried soap-and-water, which acts excellently, but it is as well to grease the top-sides of the dish with castor-oil, and the wings as well. Treacle, soap, honey, castor-oil, and kerosene can each be tried at will. You will see by the apparatus on the table that the dish, wings, and lamp are fixed together, so that they form one machine, easily hung in any tree. Two such machines, shifted from tree to tree, should clear an ordinary-sized orchard of moths. As the apples are now forming, the machines should at once be made use of, as I am not at all sure but that the codlin-moth begins to lay its eggs in the eye and on the skin of the apple as soon as it is fairly formed.

I have caught two to three thousand different-sized moths in one night, but this only rarely. The best nights are dark damp nights. On bright moonlight cold nights in September and October moths do not come out. Many of the moths were very small, and great numbers settled about the verandah in the vicinity of the lamp; these we killed the next morning. As these moths would have laid about five hundred eggs on the average, to develope hereafter into grass-eating worms or caterpillars, I calculated that I had destroyed in that one night 1,250,000 worms. Let us say that two hundred of the apparatus are exposed in the Wairarapa district for thirty nights during spring, summer, and autumn, and five hundred moths are caught each night. This, at an average of five hundred eggs, would give $200 \times 30 \times 500 \times 500 = 1,500,000,000$ eggs destroyed. After this field-moth has laid

its eggs it dies, and myriads of the dead moths cover the paddocks. With regard to orchards, it will be sufficient if fifty to a hundred moths are caught each night. Such a slaughter for a few years would have a very considerable effect upon all moth life in the district. The lamps would act like poisoned grain upon the rabbit-pest. Not that poisoned grain conquers the rabbit-pest, nor will this apparatus conquer the moth-pest. It will only sweep off excessive increase—perhaps free our gardens and orchards. Nature has its own proper check for all living things, and I hope Mr. Koebele will be able shortly to introduce the proper natural enemy for the codlin-moth.

This being the case, what harm am I likely to do by promulgating this plan of moth-destruction? I shall be glad to hear from our worthy Director, Sir James Hector, Mr. Maskell, Mr. Hudson, and other members of the Society their opinions, as I should not like to adopt any wrong measure of clearance. My own opinion is that we have introduced many harmful grubs into the colony without their natural enemies, and that I should do no harm by clearing off excessive increase in the moth stage.

I shall try the apparatus among my turnips and cabbages, and see whether the orchard, garden, and turnip-fields cannot be cleared from night-moths of all descriptions. Day-moths will require a different treatment; but it is the moth stage of all caterpillars or worms that I propose generally to attack.

I may not be able to do much good myself, but other persons may assist me towards the object in view. The task is a gigantic one, but we may succeed in assisting Mr. Koebele's action in introducing the natural enemies. Man being the highest check, this apparatus may always be of use as one method of reduction. As different kinds of moths come out in succession during the summer, the apparatus should be always ready for use. It should be kept well oiled, to prevent the tin from rusting. The dish should be hung to the tree by four strands of wire, and the lamp suspended in the centre. The lamp will not attract the little beetles, which sometimes swarm in such vast numbers in spring, producing a curious humming noise on a dark night, in any oatfield or where ground has been freshly ploughed; but I hope to devise some plan for reducing their numbers also. Entomologists may not approve of this kind of destruction, but agriculturists must protect themselves.