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1878.

TASMANIA.

HOUSE OF ASSEMBLY.

THE CODLIN MOTH:

REPORT OF SELECT COMMITTEE, WITH MINUTES OF
PROCEEDINGS.

Brought up by Dr. E. L. Crowther, and ordered by the House to be printed,
June 11, 1879.



SELECT Committee appointed on Thursday, 8th May, 1879, to enquire into the destruction of fruit by the Codlin Moth, Apocarpus Pomonella, with power to call for persons and papers; the Committee to make such recommendations as they may deem necessary in order to limit the action of so formidable a pest.

MEMBERS OF THE COMMITTEE.

MR. BELBIN.
MR. LETTE.
MR. RIDDOCH.

MR. GELLIBRAND.
MR. CLARK.
DR. CROWTHER. (*Mover.*)

DAYS OF MEETING.

Wednesday, 14th May.	<i>Present.</i> —Dr. Crowther, Mr. Lette, Mr. Riddoch.
Tuesday, 20th May.	,, Dr. Crowther, Mr. Lette, Mr. Riddoch, Mr. Belbin.
Tuesday, 27th May.	,, Dr. Crowther, Mr. Lette, Mr. Riddoch.
Thursday, 29th May.	,, Dr. Crowther, Mr. Lette, Mr. Riddoch.
Wednesday, 11th June.	,, Dr. Crowther, Mr. Lette, Mr. Belbin, Mr. Gellibrand.

R E P O R T.

Your Committee have the honor to report that they have had several sittings, and collected some valuable information.

At this late period of the Session, in the absence of most important information sought for by your Committee from America, and from the time of year not permitting the habits of either the moths or grubs to be observed, your Committee are only able at present to bring up a progress Report.

There are several points upon which, at this time of year, it is almost impossible to obtain information, which are nevertheless of vital importance in this enquiry; viz.—

1. At what exact time does the grub become a chrysalis? Would it be wise to attempt to remove the bark if, at the time, all that fall to the ground are able to seek a fresh shelter,—as even now the grub is still active?
2. What distance can the grub travel after it emerges from the fallen apple without being obliged to seek shelter?
3. Is it necessary for the fruit to fall before the grub seeks its winter quarters?
4. What class of shelter does the grub most readily take to? Would it not be practicable to trap most of them with but little trouble or expense, in the same manner as earwigs are destroyed amongst dahlias in England?
5. What class of fruit trees does it not attack?
6. Is there more than one generation of the moths in a season?

In order to ascertain the above it is proposed, if possible, to obtain the use of a portion of an infected garden, and arrange a series of experiments.

At this time, in the Port Wine District of Portugal, an enquiry into the *Phylloxera vastatrix* is being most carefully conducted; and your Committee think some valuable information will be obtained from that enquiry. In both cases insect life is to be attacked,—the difference being that, in the one case damage is done to the roots, while in the other it is to the fruit.

The following suggestions will mainly refer to the Codlin Moth as to its stage of life at the present time; not attempting to deal with the moth until the valuable American report on this subject has been received, and further information obtained on the points previously referred to in this Report.

Your Committee recommend that the following Suggestions be circulated amongst the principal fruit growers affected by the moth, with a request that they will carry them out as far as practicable, and report the result.

SUGGESTIONS.

Orchard to be kept scrupulously clean and free from stumps, old fences, and other dead matter. At the present time, or two months later if possible, (when it is presumed the grubs will have taken a chrysalis form,) all dead branches are to be removed from trees, and all old bark, especially in the forks or about the roots, should be carefully scraped off. This must be at once collected and burnt, or deeply buried in the earth: this should be done most carefully. As each tree is finished paint the trees with limewash, made out of—one peck quick-lime, one-half pound of glue, one pound of sulphur, one pint of linseed oil, the whole dissolved in a large bucket of boiling water. Powdered clay and coal tar have also been suggested; but as this is liable to kill the trees it must be carefully used.

In England, after scraping old bark off trees they are carefully painted with a solution of clay, sulphur, and soft soap: this is most effectual for the smaller varieties of insect life, but without some lime would not, it is feared, smother any chrysalis that escapes the scraping. The stem of the tree must be thoroughly done, and any clefts or cracks must be filled with the same solution.

Bind a hayband, gunny bag, or some such material round the butt of the tree, remove the same in the spring and burn it, this secures any grubs that may have fallen to the ground and which are making for fresh shelter. The ground should then be dug beneath the trees. New orchards are not much attacked, hence the reason for replacing old trees with young ones.

It is stated (*vide* Correspondence attached) that after careful bandaging in a systematic manner, and removing the same and destroying grubs therein contained, the destruction of fruit decreased from 75 or 80 per cent. to about 3.

Your Committee strongly advise that fruit cases should not be used a second time; but in the event of their being so used, then they should first be lime-washed or otherwise thoroughly disinfected.

Your Committee strongly advise the introduction of English insectivorous birds, especially starlings; for not only would they destroy the grub when leaving the apples and seeking shelter, but pick them out of holes and cracks in places quite overlooked by the gardener.

Native white magpies in quantity would be invaluable; but until they are protected at nesting time, they will never be in sufficient quantities to materially affect the result.

Appended is the main information from which your Committee have taken the suggestions; and they trust that the gentlemen who so kindly offered them will not relax their efforts, but one and all continue their observations, and in a few months compare notes again, so that eventually some practical legislation may be the result, and thus eradicate a pest that, if allowed to continue its ravages unchecked, bids fair to destroy the green fruit industry of Tasmania.

E. L. CROWTHER, *Chairman.*

MINUTES OF PROCEEDINGS.

No. 1.—WEDNESDAY, 14 MAY, 1879.

Present—Dr. Crowther (Chairman), Mr. Lette, Mr. Riddoch.

1. Resolution appointing Committee. Votes 77, read.
 2. Letters put in and read from (1) Archdeacon Davies, (2) Mr. J. J. Hudson, Launceston.
 3. Mr. Wade, Gardener, St. John-street, Launceston, and Mr. G. B. B. Elliott, of Melbourne, to be written to for information. Also,
Mr. Wilson, Correspondent of *Tribune*;
Mr. Abbott;
Judge Dobson;
Mr. Cronly, Sandy Bay (specimens);
Mr. Maning.
 4. Adjourned to Tuesday, 20th May, at 12 o'clock.
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No. 2.—TUESDAY, 20 MAY, 1879.

Present—Dr. Crowther (Chairman), Mr. Riddoch, Mr. Belbin, Mr. Lette.

1. Minutes of former Meeting read and confirmed.
 2. Letters read from (1) Judge Dobson, (2) Mr. Johnson, Cottage Green; (3) Mr. Wade, Launceston. Papers received from Mr. Abbott, and Judge Dobson, as read before the Royal Society of Tasmania.
 3. After discussion Committee ordered communications requesting information to be addressed to Mr. Howe, Campbell-street; Mr. Wilson, Macquarie-street.
 4. Adjourned to Tuesday, 27th, at 12 o'clock.
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No. 3.—TUESDAY, 27 MAY, 1879.

Present—Dr. Crowther (Chairman), Mr. Riddoch, Mr. Lette.

1. Minutes of former Meeting read and confirmed.
 2. Communications received and read from (1) Mr. Cronly, (2) Mr. G. B. B. Elliott.
 3. After deliberation Committee adjourned to Thursday next.
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No. 4.—THURSDAY, 29 MAY, 1879.

Present—Dr. Crowther (Chairman), Mr. Riddoch, Mr. Lette.

1. Minutes of former Meeting read and confirmed.
 2. After short discussion Committee adjourned until Wednesday, 11th June, to bring up Report.
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No. 5.—WEDNESDAY, 11 JUNE, 1879.

Present—Dr. Crowther, Mr. Lette, Mr. Belbin, Mr. Gellibrand.

1. Minutes of previous Meeting read and confirmed.
 2. Draft Report read and agreed to.
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CORRESPONDENCE.

A.

13th May, 1879.

MY DEAR DR. CROWTHER,

THE Parliament has already passed an Act for the destruction of the Californian Thistle—which is an impossibility. I have had a small patch for years, and the more I attempt its destruction the more it spreads.

It is different with the Borer, which is easily destroyed, and at a small cost. Four years since I discovered the Borer in my garden, and had stone lime placed at the foot of the tree and slacked; when so hot that the man could not touch it with his hand, I directed him to throw the lime over the tree with a spade. Next morning all the apples affected with the Borer were lying on the ground; and the apples remaining on the tree, about three bushels, were the best I ever picked off the tree. About 3s. worth of lime would be sufficient for an acre of orchard.

It must be remembered that the export of fruit from Hobart Town amounts to £100,000 a year,—an important item in our exports which ought not to be neglected.

Yours sincerely,

R. R. DAVIES.

B.

Launceston, 16th May, 1879.

SIR,

FEELING honored by your application for information and suggestions *re* Codlin Moth, I hasten to reply.

Firstly, I may state that it is now over 20 years since I first discovered the grub in abundance on some trees growing in the ground then belonging to Government Cottage, which had been let to a market gardener. The Horticultural Society having obtained the use of it, I, being at that time their Superintendent, immediately discovered numerous apple grubs under the loose bark of some old trees, and made my discovery known through the Press, and urged the necessity of careful searching for the purpose of checking their increase, and predicting the present fruits of neglect; since which time I have been continually harping on the same string with, I fear, but little effect; and I, some ten or more years back, stated that, if the neglect was continued, legislative action would have to be taken, as in the case of scab on sheep. I for some years paid a very high rental for a fruit garden, and could not afford to allow the grub to destroy my fruit; I therefore took especial pains to destroy the grub. Thus the foregoing will show that my knowledge of the subject has been gained by actual experience.

As is generally known, the grub is now (winter) located under the loose bark or in any crevice of the tree or surrounding objects; it has there spun a small but close cocoon, in which it lays snugly ensconced until the spring, when it issues forth in the chrysalis state, and from that shortly proceeds the moth which deposits its egg in the fruit, which soon becomes a tiny grub that very soon increases in size and voracity until full grown, when it seeks a situation for winter quarters as before.

There are various means and methods of destruction which I have practised and advised, commencing at this season. The only plan is to search the localities above described, and of course to destroy all found; this must be done diligently, as I have frequently found them in very unexpected situations. This operation is rendered necessary owing to the absence of birds of the Treecreeper and Woodpecker type in our orchards: such birds may be seen daily throughout the winter in the orchards in England very busily employed in this very work; hence the pest has not increased to a serious extent there.

In the spring and early summer I have, on dark still evenings, used torches and bonfires, which attract many moths to self-destruction; this may be continued for some time, as I find the season of escaping from the chrysalis is an extended one, as some are on the wing as soon as the flowers expand, and deposit their eggs in them, especially in such varieties as close up their calyx on the fall of the petals (the Jargonell Pear for instance); later on the moth makes a slight puncture in the skin of the fruit, and there deposits an egg, the progress from which I have carefully watched on many occasions.

The next process is to pick off any fruit that shows the presence of grub; this must be effectually destroyed before the insect has time to escape.

I now come to the most ready and effectual means of destruction, which I designate "trapping," and consists in providing artificial winter quarters for them when they leave the fruit. A variety of traps are necessary; the principal is a bandage of bagging or similar material round the stem of the tree, from one to three feet from the ground, and, in the case of large old trees, if such was put round some of the principal branches it would assist. The grubs when seeking for winter quarters, on coming to one of these

seek no further. One of my pupils in this has lately informed me that he has taken over 150 grubs from one bandage this season. Another kind of trap is formed by laying two or more shingles or palings together wherever there is likelihood of grubs crawling about; they are very partial to the shelter afforded by such, and particular care should be taken to intercept their reaching fences or buildings where they would be secure from molestation.

I am fully convinced that if the above means were generally carried out, the pest might be greatly reduced, and perhaps ultimately stamped out; but, to be effectual, it must be general,—hence the necessity of legislative action: and here the difficulties commence. I can only suggest a compulsory scraping off of loose bark and the bandaging, to be followed by the destruction of the bandages or their contents.

I remain, Sir,
Yours faithfully,

THOS. WADE.

E. L. CROWTHER, *Esq.*, *M.H.A.*

C.

DEAR SIR,

WITH regard to the Apple-borer, the produce of the Codlin Moth, I will give you what particulars I can. In the first place I noticed its ravages in the garden four or five years ago; at that time did not know what it proceeded from, as they did not destroy much fruit and were not numerous, but three years ago they were quite numerous. I enquired of gardeners and others about them, but no one appeared to be troubled with them. In usual seasons they begin boring in December, but this last summer they were about three weeks later owing to windy and cold weather, and then they appeared within a week all over the apples and pears.

I find when all sorts of fruit are grown in one garden that they do not take to the stone fruit, or when they do bore into it they come out again whenever they reach the stone, and the fruit still keeps growing until it ripens. Not so with apples or pears, when they get into the core they eat the pips and the fruit falls. Such apples as the Codlin, Pomme de Neige, or Ribstone Pippin suffer most; one Pomme de Neige tree of mine with nine bushels on had more than five bushels destroyed; my loss on the whole was about two-thirds of the apples and pears, and had the crop been light nearly all of them would have been destroyed. One garden in Sandy Bay had more than half of some sorts of apples unfit for sale through them. On making inquiry some two years ago where they had been introduced from, I was told that Messrs. Johnson Brothers had found large quantities of them in plums that they had from Launceston. They have had it there for about twelve years, and some of the apple orchards had to be destroyed. It would account for me getting them before any one else, as the moths had only to fly up the bank from the jam store. On mentioning this to Mr. Smallhorn, he told me that four years ago he had some empty cases sent for his fruit, they were put out of the way into a close room; wanting to use them, he took off the covers, and a regular cloud of moths flew out, most of which he killed, but some got away. As the borer made its appearance in his garden, Brisbane-street, next year, and none in his neighbours, on his making inquiry what had been in the cases, he was told that they came with plums.

With regard to the means of destroying it I can offer no suggestion, my attempt to catch the moths with a lantern, &c. was a failure, although there were hundreds of moths flying about. They have extended their circle very fast this last two years. I do not think eight miles would enclose them about Hobart Town.

Yours, &c.

THOS. JOHNSTON.

Dr. E. L. CROWTHER.

D.

Judges' Chambers, 14th May, 1879.

SIR,

I HAVE the honor to acknowledge the receipt of your letter asking me to afford the Committee on the Codlin Moth any suggestions on the subject.

I read to the Royal Society a paper on the moth in 1876. This appears in the Proceedings of the Royal Society for that year, which are, I presume, in the Parliamentary Library.

I read a supplementary paper last Monday evening. On enquiry from Mr. Roblin, I find that this paper is not yet amongst the Proceedings of the Society, but it was given to the Press, and appears in the *Tasmanian Mail* of this morning, with one or two evident typographical errors, which do not materially alter the sense. This paper contains all the useful information which I have to communicate.

The *Tasmanian Mail* also contains some valuable information from Mr. Abbott, of the Gardens, on the subject. I doubt there being *two broods* in one year. Even if there are, I do not see that this materially adds to the difficulty of destruction, for *during winter* it is agreed that there are *no moths*, only grubs in the chrysalis state, and it is then that they are most assailable.

A stout piece of iron hoop, about 15 inches long, is a far handier instrument for taking rough bark off a tree than a ship's scraper, as suggested by Mr. Abbott, and has the advantages of economy in its favour.

If I can give any further information than that contained in the papers referred to, I shall have great pleasure in doing so.

I have, &c.

W. L. DOBSON.

E. L. CROWTHER, *Esq.*

E.

PRACTICAL Suggestions for destroying the Apple Grub, by Mr. JUSTICE DOBSON.

THE Codlin Moth deposits an egg in the eye of the young apple; the egg soon hatches, and the young grub, at first not much thicker than a hair, eats its way through the tender skin at the eye into the substance of the apple. The gardener is not aware of its presence till he sees a dark spot on his apple, and then a hole, from which the creature expels small brown grains of excrement, which cover the orifice of the hole.

It feeds on the pulp, and attacks the pips, the most vital part of the apple, which falls, and the creature rapidly escapes through the orifice which it has made. The apple from which the grub has escaped can generally be distinguished by the brown grains having been removed from the orifice of the hole by the grub in passing out of it.

When the grub leaves the apple it usually makes for the stem of the tree, and ascends till it finds a crevice in the bark; there it eats its way between the outer and inner bark, and makes a smooth and rounded resting-place for itself. It then spins its web and becomes a chrysalis, waiting in that state for the warmth of the approaching summer, when the young moth comes out to pursue its destructive career amongst the young apples.

The grub whilst in the apple is practically unassailable; its presence there is not even known till the mischief is done.

The moth is a night moth, and is less assailable than the grub after it has left the apple, or the chrysalis. The creature is most assailable in its chrysalis state, and the following seems to be the most effectual mode of destroying the chrysalis:—In winter, after the grub becomes a chrysalis, thoroughly scrape off all rough and loose bark on the stem of the tree. A piece of stout iron hoop, about fifteen inches long, is a useful, economical, and effectual implement for this purpose; a knife is too sharp, and is apt to cut the under bark. The roughest bark, and that best suited for harbouring the grub, is generally near the ground, and there (say within two feet of the ground) most are to be found. The chrysalis will generally come off attached to the pieces of bark, which should be carefully collected and burnt. Any chrysalis which remains on the stem is exposed to view, and can be easily killed by hand or other process. Where there are other than apple trees in the orchard they should be treated in the same way. In overgrown gardens with decaying fences and rubbish about them the grub will avail itself of the cover afforded by the negligent gardener, but in clean well-kept orchards the process suggested will go far to keep in check the ravages of the grub.

As an aid to the operation suggested, before the apples begin to fall, haybands may be tied around the trees near the ground, or strips of paper six to eight inches wide may be folded round the stem and tied tightly with string at the upper part of the paper. The grub ascends to the hayband or paper, and it finds a congenial resting-place in the hayband, or its progress is arrested under the paper, and there it spins and becomes a chrysalis. The bands and papers should in winter be removed and burnt. The tree should still be scraped and treated as recommended. After the tree has been scraped to prevent any larvæ which may be in any crack or fissure of the tree from escaping, the stem may be dressed with any mixture which will set sufficiently hard to prevent the moth obtaining an exit. Dry clay powdered and mixed with coal tar is a useful mixture for this purpose. It should be applied with a painter's brush. Young orchards are not affected by grub, presumably because there is no harbour for the larvæ in the smooth stems of the trees. The home of the grub in the trunk of the tree is so skilfully constructed that it is hardly possible for any external application of a liquid nature or in the form of powder to affect them. The only application that can be effectual is one of such a nature as will prevent the moth coming out from its chrysalis home.

One or two modes are used to destroy the moth. Fires are lighted about midsummer in England (say in November or early in December here) on still evenings. When the moths are about, and attracted by the light, they fly into the fire and are destroyed. It is also said that the smoke from a smouldering fire is distasteful to them, and will drive them away from its vicinity. Again, in England and Wales, lanterns are hung about the orchards. A simple frame is formed from willow or other twigs in the shape of a Chinese lantern, and a piece of clay is put inside at the lower end of the twigs to hold the candle; the frame is covered with cartridge paper. These should be well smeared with linseed oil or other glutinous

matter, or a saucer containing oil should be placed under the lantern. The moth is attracted by the light and flies against the lantern and is destroyed. All apples with the grub in them that fall should be picked up as soon as they fall—for the grub soon leaves them—and scalded, or otherwise treated, so as to destroy the grub that is in them.

Finally, do not overcrowd your orchard; do not let it get overgrown; keep it clean, and keep the hoe going; and you will yet find it a profitable industry, unless it is destroyed by the neglect of slovenly neighbours.

F.

THE CODLIN MOTH OR APPLE BORER.

The following paper was read upon this important subject at a meeting of the Royal Society held on 12th May, 1879, by Mr. Justice DOBSON.

SOME time ago I called the attention of the Society to the devastation created by the larvæ of the codlin moth in the orchards in the Northern parts of the Colony. It has appeared in the orchards in the vicinity of Hobart Town during the last year to an extent that must alarm all those concerned in apple growing, and this is an extensive industry representing an export trade of not less than £40,000 a year.

On the former occasion I pointed out something of the history and habits of the moth and its larvæ, but the all-important question now is, how it can best be destroyed?

After the moth has deposited an egg in the eye of the young apple, and it seldom deposits more than one egg in an apple, the egg hatches and the young creature eats its way through the tender skin of the apple at its eye into the substance. The orchardist is not aware of its presence till he sees a dark spot on his apple, and then a hole from which the creature expels small grains of excrementitious matter, which cover the orifice of the hole. It feeds on the pulp and attacks the pips, the most vital part of the apple, which then falls and the creature escapes through the orifice which it has made. Its exit is rapid, and many apples may be examined in the morning, which have fallen during the night, before one is found in which a grub remains. The apples from which it has escaped may be recognised by the orifice of the hole being cleared from the little brown grains which close it, the grub having cleared them away in coming out of the hole. The grub having thus passed through the luxurious period of its existence has now to consider the process of reproduction. It makes usually for the stem of the tree, and ascends till it finds a crevice in the bark; it there eats its way between the outer and inner bark, and makes a smooth and rounded resting-place for itself. There it spends its time in lining the hole with a web that it spins. It then becomes a chrysalis, and waits for the warmth of approaching summer, when the young moth comes forth to repeat the process.

The insect cannot be assailed when in the apple. Its destruction can, therefore, only be accomplished either in its moth state or after it has left the apple. It is a night moth, and in England and America attacks the apples in June. Here we may assume that it does so probably in November, or early in December.

The only known mode by which the moth can be destroyed is by lighting fires in the orchard, and in America the cuttings of the orchard are preserved to light fires for the purpose on still midsummer evenings. Possibly lanthorns or lamps might be used with effect. But, under any circumstances, the moth is less assailable than the grub or chrysalis. Several modes have been adopted for this purpose. Bands of hay are tied round the trunk of the apple tree before the apples begin to fall, and when the grubs ascend the tree they are said to find these bands a congenial shelter in which to form their cocoons and hibernate. These bands are, during winter, carefully collected and burnt, thus destroying all larvæ which may have taken up their abode in them.

Another mode is by folding a strip of paper six or eight inches wide round the trunk of the tree, and then tying it tightly round with string at the upper part of the paper. The grub ascends the trunk, gets under the paper, and when it reaches the upper part where the string is tied round its ascent is arrested, but it has a hiding-place formed between the paper and the bark, and there rests and spins, and on removing the paper can be destroyed.

There remains one other mode which I believe to be the most effectual. The grub does not, as a rule, ascend higher than its necessities drive it. Most trees have the roughest bark, and consequently the best and least laboriously attained shelter for the grub, near the ground. There most of the grubs are to be found on removing the rough pieces of bark. This is best done with a piece of iron hoop; a knife is too sharp and is apt to cut the under bark of the tree. The trunk of the apple tree is their natural abode, and there in their chrysalis state they are most easily destroyed. The chrysalis will gradually fall with bark when rubbed off, and this should be burnt or dug deeply into the ground. The grub will, especially in crowded and overgrown gardens, occasionally go up other trees or even hibernate in crevices in the wood of fences, but if all those in their natural abodes in the apple trees were destroyed, much would be done towards keeping under this scourge of the orchard. The grub is at present (May 10) spinning its web in its home in the apple bark, and it is much more likely to escape if it is disturbed now than if it is left till becoming a chrysalis, when it loses its powers of locomotion, and then has its home broken into by the careful gardener.

In America it appears that the grub is not dreaded in young orchards, presumably because the bark of the tree is smooth and affords no shelter for the grub.

The grub so skilfully excavates its nest and surrounds itself with a web that it appears to me that it would be impossible by means of any ordinary external application of lime water or other liquid to destroy it. Slacked lime or flour of sulphur applied by bellows could not reach it in its secure and cunningly devised abode. The fumes of burning sulphur, if this could be confined round the trunk of the tree by some form of petticoat, would, no doubt, be as destructive to these creatures as it is to all animal life, but I am not aware that this has ever been tried.

Apples which fall should be picked up as soon as possible, as the grub rapidly escapes, and they should be put into water, or other means should be taken to destroy the grub when it makes its exit from the apple. The moth deposits its eggs in others of the pyrus family as well as in the apple.

It is, however, of little use for any one person to attempt to destroy the insect, unless his neighbours are also equally determined in their exertions to suppress this pest. One careless and slovenly gardener will afford a breeding ground for this creature, whence its progeny will carry devastation into the orchards of his neighbours.

The following paper was also read by Mr. F. ABBOTT, Junr., Superintendent of the Botanic Gardens, at the same meeting of the Royal Society.

WITH reference to this moth I would offer a few remarks, with a view to disseminating information not readily accessible to many readers.

The moth has been so long known that the details of its operations may be found in any work on gardening or horticulture, and it will not be necessary for me to repeat them here, but there are some points on which a difference of opinion exists, that it would be well to call attention to, with a view to having them cleared up. The first and most important is the belief held by many that there are more than one generation of the moth during the season: the basis of any operations conducted for the suppression of this pest will be materially affected by the truth or otherwise of this statement.

The following extract from Mackintosh's Book of the Garden, Vol. II., p. 345, may assist in throwing some light on the subject. After describing the moth, he goes on to state that "it invariably selects the finest apple in which to lays its eggs, knowing instinctively that these will be most palatable to its future progeny. (In Tasmania the Golden Harvey is most affected.) In favourable weather the little grubs are hatched in a few days, so that in May apples and pears may be found infested by them. At first the grub is white with black head and collar, and black slanting double dots which run in four rows from the head to the abdomen, it afterwards becomes more of a flesh colour, the head and collar turning brown, the dots grey and indistinct. It is fully grown in 3 or 4 weeks as its food never fails. It now leaves the fruit, whether it is hanging on the tree or has fallen off, and selects for itself a secure place on the stem of the tree to spin its cocoon and become a pupa. It usually chooses the rents and seams of the loose bark, hollows itself out a chamber, and spins a white web over itself, intermixing some of the loose bark with it. The little grub becomes a pupa immediately in the web, and in a few days the moth comes out, which shortly afterwards pairs and deposits eggs on the fruit. In this way in July and August, and partly in September, much sound fruit will again be pierced and infested with the caterpillar of this moth, which are then numerous in proportion to the number of eggs of the first generation which were laid and hatched in May.

In the year 1822, which was warm and dry, more than the half, particularly of the choice fruit, was grub-eaten, and moths were still seen laying their eggs till the end of September. Fortunately the caterpillars which are so late in laying their eggs seldom arrive at maturity, as the fruit is taken off the tree at that time."

If the above extract states the case correctly, it unquestionably shows that there is more than one generation of the moth during the season.

The following from Johnson's Gardener, Vol. III., p. 103, Book II., Apples, in part bears out the statement, as it shows that in some cases if not in all the larvæ remain in the pupa state for a short time only.

After describing the moth, its transformation and ravages, and declaring an experiment where the larvæ had gone through the various transformations while confined in a box, the author goes on to state that "our specimens did not appear in the winged state until July of the following year; but Reaumur says that they assumed the perfect state on the 15th of August, having been only a month from the time of their quitting the apples."

With a view of setting this point at rest it is very desirable that all having an interest in the matter should conduct experiments and make observation on it during the coming season, as it is only by united action that any definite conclusion can be arrived at.

Although the presence of this moth in the southern parts of the Island is of recent date, it has been in the northern for more than 20 years; its prevalence in Hobart Town is attributed by many to some infected plums which were received from the North a few years ago. If this is really a fact it is a curious one, for I am not aware that the codlin moth is known to attack plums in England or America; there is,

in both countries a special moth, *Tortrex* or *Carpocapse Nigricana*, which attacks plums to a serious extent, eating nearly into the stones and causing the plums to fall prematurely. Whether it is possible that the two are present in Tasmania and are confounded together in our orchards I am not prepared to say. It is a point that can only be satisfactorily determined by securing some of the infected plums next season, and confining the larvæ till the moth appears, when it would be easy to determine to what species they belong.

Perhaps the information that would be most acceptable just now to the majority of readers would be such as would enable them to subdue or check the spread of the moth. I am conscious of being unable to suggest anything new on this head, and can only repeat such as are well known to most cultivators.

Perhaps the most effectual is that of attacking the larvæ in their homes. This may be done in the winter months, by thoroughly scraping (with some blunt instrument, such as a ship's deck scraper) all the loose bark and effete matter from the trees; this should be thoroughly done, using actual force in some cases to tear off the old bark; when this has been done, the loose bark should be collected and burnt to make sure of destroying the larvæ. The tree should then be dressed, on such parts of it having cracks or fissures, with some mixture that will set sufficiently hard to prevent any larvæ that may have escaped from obtaining an exit. There are many mixtures that may suggest themselves, but perhaps the following is as good as any:—Mix powdered dry clay with sufficient coal tar to form a thick paint, and work this mixture well into all cracks or crevices with a painter's brush. If this operation is properly performed there will be very few larvæ on the trees that will escape.

A method commonly adopted in the spring or early summer months for destroying the moths is that of suspending lanterns in various parts of the garden with a view of decoying the moths. The lanterns should be smeared with some glutinous substance such as linseed oil, or have a saucer of the same suspended beneath them.

In England and Wales lanterns for this purpose are often constructed by tying a few willow or other twigs into a frame resembling in shape a chinese lantern, placing a piece of clay in the angle of the willows just above the bottom ties in which to stick a piece of candle; the frame is then surrounded by a sheet of cartridge paper which is kept smeared with oil during the season the lanterns are in use; the moths attracted by the glare become immersed in the oil, and are thus destroyed.

A third well-known method is that of gathering up without delay the fallen apples, and scalding or otherwise destroying any larvæ they may contain. This method, to be of any use, should be persevered in at very short intervals, as the grub, if indeed he has not already done so, quits the apple almost simultaneously with its fall, and if any delay takes place the operation will be futile.

Although it is generally supposed that the larvæ select the stem of the tree on which to secrete itself and become a pupa, yet this is by no means essential; they will crawl into any crevices affording the requisite amount of shelter, and thus old fences and pools are often thickly studded with them. I have with me a portion of an old post cut recently from the fence of a garden in town, in which several larvæ may be plainly seen, and such places should not be lost sight of when steps are being taken to destroy and lessen the evil.

In America various kinds of collar are placed round the base of the trees with the view of intercepting the caterpillar when in search of a safe resting-place, sometimes a simple hay-band is used, the object in every case being to encourage the larva to locate itself within the collar, where it can easily be destroyed.

G.

CONCERNING THE APPLE GRUB (*Carpocampa Pomonella*).

By EDWARD NEWMAN, F.L.S., F.Z.S., &c.

[From *Field*, February 5th, 1870.]

THE apple moth itself is a beautiful little creature, it is indeed the most beautiful of the beautiful tribe to which it belongs; yet, from its habits not being known, it is seldom seen in the moth state, and the apple grower knows no more than the man in the moon to what cause he is indebted for his basketfuls of worm-eaten windfalls in the stillest weather. To find the moth in the day-time the trunks of the apple trees should be carefully looked over; or if the orchard is surrounded with a wooden fence, the moth may often be found sitting against it, with its pretty wings neatly folded round its body.

The body of the moth is three-eighths ($\frac{3}{8}$) of an inch in length, and the wings are three-quarters ($\frac{3}{4}$) of an inch in their expansion; the head and thorax are brown; the body, where covered by the hind wings, is paler brown, with a silky gloss; the fore wings are of that colour which the Germans well express by the compound word grey-brown; they are delicately barred, with dark purple transverse lines, and have on the hind margin a large dark blotch, and within this another blotch almost circular, and bordered with scales of glittering fiery copper colour.

Towards evening—in fact at sunset—the moth begins to move, and may then be seen hovering about the little apples, which by the time it leaves the chrysalis (the middle of June) are well knit, and consequently fit for the reception of the eggs, which it generally lays in the eye of the apple, one only in each. This is effected by introducing its ovipositor between the leaves of the calyx, which, closing over the eye, form a tent that effectually shields the egg from the inclemency of the weather or any other casualty. The act of oviposition is not, however, always confined to the eye. When the apple stands with the eye uppermost, I believe this is invariably the case; but when it hangs eye downwards, as though regarding the earth, the other end of the apple is used as a receptacle for the egg, which is then dropped into the cavity surrounding the footstalk. Neither is this the only alternative the moth possesses, for its eggs may sometimes be found glued to the rosy cheek of the Quaranden, an apple which seems a favourite with our *carpocampa*. I have not, however, found a single worm-eaten apple in which the grub had entered from the cheek, a fact that leads me to suppose that eggs so deposited must miserably perish.

As soon as the egg hatches the little grub gnaws a hole in the rind of the apple, and buries itself in the substance; and it is worthy of remark that the rind, as if to afford every facility to the destroyer, is thinner in the eye than in any other part, and consequently more easily pierced. The apple most commonly attacked is the codling, a large early sort, which ripens in July and August. The grub, controlled by an unvarying instinct, eats into the apple obliquely towards the centre, thus avoiding the core and pips so essential to the apple's growth; at first it makes but slow progress, being little bigger than a thread, but after a fortnight its size and operations have much increased. Up to this period, the grub has availed itself of the very restricted gallery it has made in its devouring career as a channel through which to force its excrement; and this may always be observed in a little brown heap or mass, either concealed by the leaves of the calyx or around the base of the footstalk, according as the egg has been laid at the eye-end or stalk-end of the apple. But when it has eaten half way down the apple, and the position of the hole at the top, if the apple continue upright or nearly so, is inconvenient for this purpose, another communication with the outer air becomes requisite; and it must be constructed so as to allow the power of gravity to assist in keeping it clear. It is accordingly made directly downwards towards that part of the apple which is lowest, and thus the trouble of thrusting the pellets upwards through the eye of the apple is avoided, and a constant admission given to a supply of air without any labour. The hole now made is not, however, sufficiently open for an observer to gain by its means any knowledge of what is going on within; this is only to be obtained by cutting open a number of apples as they gradually advance towards ripeness. The hole is, however, very easily seen, from its always having adhering to it on the outside an accumulation of little masses of excrement which have been thrust through. Having completed this work, and having reached the core, the grub turns towards the cheek of the apple and makes a third gallery, through which he eventually makes his exit, but not at present; for as soon as he has thus made sure of a means of escape he returns towards the centre of the apple, where he feeds at his leisure. When within a few days of being full-fed, he for the first time enters the core through a round hole gnawed in the hard, horny substance which always separates the pips from the pulp of the fruit; and the destroyer now finds himself in that spacious chamber which apples generally, and codlings in particular, always possess in their centre. From this time he eats only the pips, never again tasting the more common pulp which hitherto had satisfied his unsophisticated palate; now nothing less than the highly flavoured aromatic kernels will suit his tooth, and on these for a few days he feasts in luxury. Somehow or other the pips of an apple are connected with its growth, as the heart of an animal with its life. Injure the heart, an animal dies; injure the pips, an apple falls. Whether the fall of his house gives the tenant warning to quit I cannot say, but quit he does, and that almost immediately; he leaves the core, crawls along his lateral gallery, the mouth of which, before nearly closed, he now gnaws into a round smooth hole, which will permit him free passage without hurting his fat, soft, round body; then out he comes, and for the first time finds himself in the open air. He now wanders about on the ground till he finds the stem of an apple tree; up this he climbs and hides himself in some nice little crack in the bark. . . . I have said that the moth, in the selection of a nidus for its egg, exhibits a preference for the early varieties of apple; but when these are not at hand it by no means denies itself the agreeable duty of billeting its destructive progeny on others.

Having now followed the grub until he is full-fed, it seems desirable to describe him entomologically; it has taken him three or four weeks to eat up to his full stature. The body consists of twelve segments besides the head, which is obtusely triangular, shining and nearly black; the body is dingy white, with the slightest possible tinge of pink, except on the second and thirteenth segments, the backs of both of which are nearly black. It should here be observed that entomologists now properly consider the head as the first segment, hence the first segment of the body is the second segment of the insect; it is needful to bear this in mind, or some numerical confusion may occur in counting. Every segment of the body after the second has eight very small black warts, and these are arranged somewhat in pairs, and each wart emits a slender hair or bristle, which are too small and fine to be represented in a woodcut; the very pale colour of the body, and likewise the black warts, are more observable before the grub has quite attained its full size, after which period the colour of the body is slightly darker, and the warts are less distinct.

I ought here to remark, that the fall of the apple, the exit of the grub, and his wandering to a place of security, usually take place in the night time.

When safely ensconced in the "nice little crack in the bark" I have described above, he remains without stirring for a day or two, as if to rest himself after the uncommon fatigue of a two yards march, then gnaws away the bark a little in order to get further in out of the way of observation, and having made a smooth chamber big enough for his wants he spins a beautiful little cocoon or case, and within this changes to a chrysalis, which may be described as a mahogany brown colour, and as having on each segment of the body a transverse double series of minute warts; these, although so small, are rough to the touch, and may be distinctly felt by passing the finger along the back of the chrysalis. The length of time that elapses

between the spinning of the cocoon and the transformation from a grub to a chrysalis does not seem to be very constant, for I have found the grubs unchanged even as late as March. Be this as it may, it is quite certain that the creature, whether changed or unchanged, remains in the cocoon eight or nine months of the year, and always during the winter months."

H.

THE CODLIN MOTH.

IN a discussion on orcharding and the subject of the Codlin Moth and other insects injurious to fruit trees, which took place at a Horticultural Conference held at Rochester, U.S. America, in January last, Professor Lazenby said that the Codlin Moth lays 200 eggs, each by itself, directly in the calyx. Apples with small closed calyces are not so universally infested. The egg hatches in three to four days; twenty-one days completes the growth of the maggot. There are two broods each season. Poisoned bands repel the maggots, and are not successful. Mr. Woodward gave an instance of the effect where trees were bandaged. Previously 75 to 80 per cent. of the apples were infested; after three years of careful attention only 3 per cent. were infested. Where all growers bandage the trees the results are much more marked than where only a few fight the battle alone. Mr. Brooks said, insects are taught by instinct to avoid trees frequented by animals; where sheep or hogs were given free access the damages were lessened more than by the mere destruction of the insects; though, by admitting animals which eat the grubs in the fallen fruit, the number of insects was greatly lessened.

The importation of apples and pears was also discussed. One speaker, Mr. Barry, said the shipment of apples had just begun; he expects it will greatly increase. As yet there is no system of sorting or packing for European markets; nor is there any system of selling there. It has been all experiment thus far. Low prices do much to introduce the fruit abroad. Paris and Glasgow are good markets. Newtown Pippin, Baldwin, and Northern Spy are in demand. He has had no trouble in sending the Spy all over Europe, by wrapping each specimen in paper before being packed.

Another speaker said, growers must produce a better quality of fruit, and establish a reputation. Certain growers sell apples at paying prices, because their brand is known; while others, unknown, only help to make the average better. Orchards pruned severely, and well cultivated, do the best,—a fact which we have often urged on cultivators in Victoria. It was shown that it pays to thin many species of fruit, especially the peach and the grape. A bushel of small fruit exhausts the tree much more than a bushel of large fruit,—it being the production of seed that exhausts, not the pulp. There is little danger of thinning too much. Thinning one-half, or less, as the case requires, does not lessen the yield in pounds,—the fruit that is left being larger, in consequence of the thinning.

I.

20, King-street, Melbourne, 19th May, 1879.

SIR,

I HAVE the honor to acknowledge the receipt of your letter of the 14th instant, requesting me to afford you any information that would seem useful to the Committee on the Codlin Moth.

Some years ago I observed grub in my orchards at the Cam. The season following its first appearance it became more prevalent. It occurred to me then that the moss and parasitic growth, induced by our long wet winters, on the boles and branches of the trees, served as a shelter for the chrysalis during the winter. I therefore caused the boles and main branches of the trees to be whitewashed, about June or July, with newly slacked lime mixed with boiling water. This causes the lime to remain in a thick solution longer than cold water; and, when thus applied, will remain a long time on the bark of the tree. This operation destroys all growths giving shelter to the larva of insects, and gives the tree a clean healthy appearance. They are dug around at the same time. This remedy has, so far, been effectual. There has been no appearance of grub since; and last year it was admitted by the fruit dealers that my apples were in the finest condition of any in the market.

I have, &c.

GEO. B. B. ELLIOTT.

Dr. E. L. CROWTHER, M.H.A., Chairman Codlin Moth Committee.

J.

Lord-street, Sandy Bay, 24th May, 1879.

GENTLEMEN,

THE following is from this season's observations of the Codlin Moth and grub amongst the fruit.

I first observed affected apples in my garden early in January. I took the affected ones off and examined them minutely. At this time there was on some of the affected apples a red spot, with a brown speck in the centre, which I supposed to be the egg; at this stage I could not find any grub. Next

stage, a small hole covered with excrement, and I found the grub, but very small, about one eighth of an inch under the surface of the apple. I found some near the core of the apple, and able to crawl about lively when taken out of the apple. If not taken out the grub will eat its way into the core of the apple, and in most cases will eat the pips; then it will bore its way out through the side, or along the core through the eye of the apple. I am told that they weave a web by which they descend from the apple to the ground: I have not seen them doing so, but I have found the web attached to the apple and floating in the air. The apples so pierced by the grub generally fall to the ground: they are sure to do this if the core is eaten away, and very often before the grub leaves the apple.

The moth is a night moth. I have seen them in an empty room in which there were apples the previous year, and in which empty cases remained, showing clearly that the grubs will live and come to maturity in any sheltered place, then the moth does its work of destruction by night. I have seen the egg when recently laid, and have marked it by sticking a gooseberry thorn in the apple near the egg and watched it until I cut the grub out full grown. I have not seen any recent traces of the moth after about the middle of March, at which time we had a little cold rain, which rain, I believe, destroyed the grub in the apples by filling the holes with water.

Pears and plums are also affected by the grub.

I here beg leave to make a few suggestions. I believe the present time is a very good time for destroying the grub, as in many gardens they can be found in great numbers under the old bark that is on the trees. I have taken as many as twenty-seven from under the old bark of one tree, and I believe there were many other such trees in the garden. The old bark (every crack and crevice) should be searched for the grubs. As soon as the apples are seen affected on the trees they should be taken off and destroyed. A good large hay-band tied round the trunk of the tree while the apples are growing, say one foot from the ground: the grubs will shelter in this, which should be taken off every two or three weeks and burned. I believe they will be lessened very much by this means, as they certainly make for the tree for shelter. I believe it would be a good way to burn naked lights on a fine night in the garden,—see how many moths are destroyed by rushing into the flare of a candle.

I know from visiting many gardens about Hobart Town that some men have lost one-half, and many have lost one-third of their crop of fruit this year by the grub. I know one man who I believe had fully one hundred bushels of apples destroyed by the grub: one half of these or more he gathered off the trees or the ground, and threw them on the street; the remainder he put in a heap in an adjoining paddock. Now this is not the way to keep the grub under. I asked another man why he did not get those grubby apples off the trees? He said, "I don't keep them as a source of revenue." Another man, in answer to a similar question, said, "I could not bother with them—if they leave me enough for my own use I don't care."

Now these are the kind of men that the industrious fruit grower seeks protection against. If the grub gets to the Huon it is my opinion the Huon people will never rid themselves of it.

I have, &c.

JOSEPH CRONLY.

To the Committee on the Codlin Moth.

P.S.—I put several grubs in a flower-stand, under a glass shade. I examined them this morning, and found some of them dead: others in exactly the same state as those to be found in the fruit trees.

J. C.

(Mr. Cronly also forwarded specimens of the grub.)