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REPORT OF OBSERVATIONS

OF

INJURIOUS INSECTS

AND

COMMON FARM PESTS

DURING THE YEAR 1888,

WITH METHODS OF

PREVENTION AND REMEDY.

TWELFTH REPORT.

BY

ELEANOR A. ORMEROD, F. R. MET. Soc., &c.,

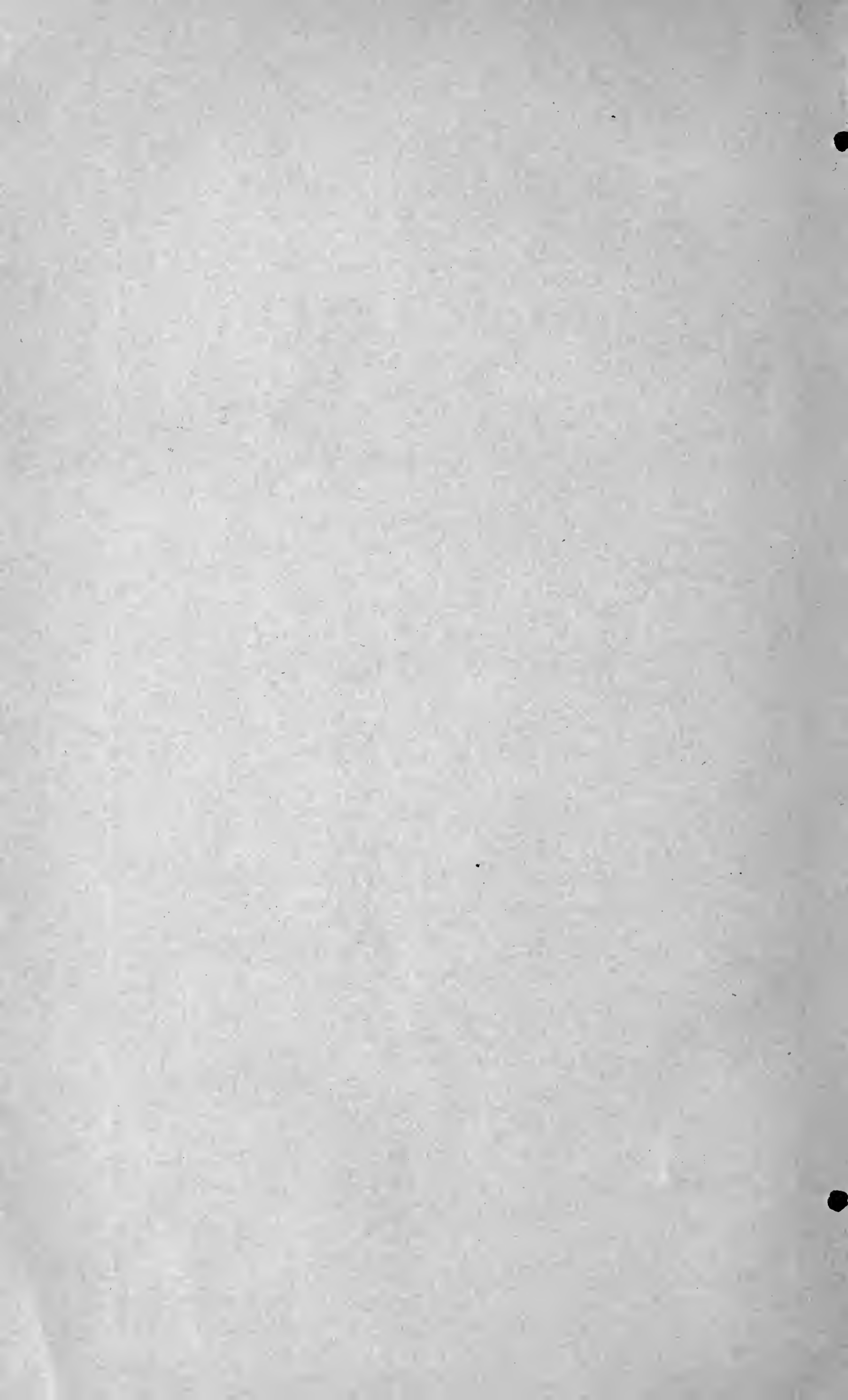
CONSULTING ENTOMOLOGIST OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND, AND HON.
MEMBER OF THE FARMERS' CLUB; HON. AND CORR. MEM. OF ROYAL AG. AND HORT. SOC.,
S. AUSTRALIA; HON. MEM. OF ENT. SOC. OF ONTARIO, AND CORR. MEMBER OF
FIELD NAT. CLUB OF OTTAWA, CANADA; MEMBER OF EASTERN PROVINCE
NATURALISTS' SOC., CAPE COLONY, &c.

LONDON:

SIMPKIN, MARSHALL & CO., STATIONERS' HALL COURT.

1889.

Price Eighteenpence.



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WEST, NEWMAN AND CO., PRINTERS,
HATTON GARDEN, E.C.

P R E F A C E .

DURING the past year reports have been forwarded regarding presence of almost all the ordinary crop attacks; but at the same time, excepting locally or here and there, few of these ordinary attacks have been to a serious extent.

With the exception of orchard caterpillars the worst attacks of last season were of unusual kinds, and occurred early in the year. The Corn-ground Beetle maggot at young Wheat plants, and the Beet Carrion Beetle, and its Woodlouse-like grub at Mangolds, have not previously been recorded, as far as I am aware, as injurious crop-pests in England. The Frit Fly maggot to young Oats, and the Wheat-bulb maggot were injurious to a quite unusual extent, and so were Bean-seed Beetles in the more southerly parts of England; and though the Winter Moth and other orchard caterpillars are no unusual troubles, they ravaged the trees in most of the chief fruit-growing counties to an unusually serious extent.

After the heavy midsummer rains serious injury ceased to be reported.

Hessian Fly was noticed at about from six to ten localities (six reports sent with specimens accompanying), and these mainly referring to one field or one farm, instead, as in the previous year, of about a hundred notices (with specimens, or from competent observers) being sent, referring in many cases to districts or large areas. The two common attacks—namely, Sawfly maggot in Wheat-stems, and *Chlorops* at the upper part of Barley—were also not nearly as much present as in the preceding year.

It may be worth notice that, while in 1887 some of the most widespread and injurious attacks were of those to the almost grown or ripening corn-straw, in 1888 some of the worst were to the quite young corn-plants in spring. Conjecturally this is attributable to the hot weather of 1887 being favourable for

insect propagation, and laying a foundation for the attacks which were found at work with the advance of the next year's spring. This would apply also to the unusual amount of orchard caterpillars.

To what extent crop insect-pests, not previously known or little known here, may be establishing themselves is a matter which appears to deserve some observation from agriculturists, and I would wish particularly to draw attention to the new Wheat-flour Moth (see pp. 66—72, and Appendix), and also that in case a *pale sea-green fly maggot* is found feeding in Wheat-stems (see p. 66) it would be desirable at once to report it.

How far some of the extra-British corn-pests may be spread abroad by the use of broken straw, infested grain, &c., screened out of foul corn-imports, is also a subject to which I have ventured to draw attention in the paper (pp. 56—66) headed "Screenings," and I have to express my sincere thanks to the Firms or personal friends who have been good enough to favour me with the information there given.

Warble prevention has advanced much during the last season, and it is still more clearly shown than before that where the maggots are destroyed (as may easily be done) the attack may be for all practical purposes stamped out.

For the statistics of loss on hides I offer my very best thanks to the Societies, Companies, and others who have done me the great favour to give me the returns published in my paper, and, whilst referring the reader to details in the reports (and estimates) quoted, by which he can judge for himself of how the matter stands, I may be permitted to note that in a country such as this it appears an evil crying for removal that the *ignorance of the uneducated* should be allowed to cause, year by year, such a demonstrable loss to the nation.

Besides my debt of thanks acknowledged as above, I have also cordially to express my obligation to Dr. E. L. Taschenberg, of Halle, Germany, for examination of the Corn-ground Beetle attack hitherto unobserved in this country, and to Dr. Jul. Kuhn, Director of the Agricultural Institute of Halle, for replying to my enquiries regarding the new Wheat-flour Moth; likewise to Dr. Fr. Thomas, of Ohrdruf, for drawing my attention to a Gall-mite infesting Red Currants,—a matter that might prove of

considerable importance to bush-fruit growers. To my good friends Dr. de Man, of Middleburg, and Dr. J. Ritzema Bos, of the Royal Agricultural College, Wageningen, Netherlands, I am again, as in previous years, indebted for kind assistance in identification and study of crop Eelworms; and to Dr. de Man more especially for the notes and beautiful figure (see pp. 76—79) of a species previously unobserved as infesting Oats.

To Dr. C. Lindeman, Prof. à l'Académie Agricole, Moscow, I am also much indebted for useful information regarding Hessian Fly; and likewise offer my best thanks to Dr. J. A. Lintner, State Entomologist of New York State, for prompt and full reply regarding a cattle fly (called the "Texan" or Horn Fly) newly observed in the U. S. A., which at the time appeared likely enough to be an additional trouble here.

Amongst unfailing colonial correspondents who by letter or publications aid me greatly, I beg specially to thank Mr. Frazer S. Crawford, Inspector under the Vine and Fruit &c. Protection Act, at Adelaide, S. Australia, and Mr. Albert Molineux, Member of the Royal Agricultural and Horticultural Society of S. Australia; and in England I should also mention the help kindly given me by Mr. R. H. Meade, of Bradford, in confirming my identification of Diptera, and also by Mr. O. E. Janson, London, in identifying species which I had not the opportunity of myself comparing with type specimens.

It is beyond my power duly to reciprocate the valuable donations of entomological books kindly sent me by their writers, especially from Canada and the United States. I can but express my hearty thanks for the valuable gifts, and especially to Prof. Saunders, Director of the Experimental Farm Stations, and to Mr. J. Fletcher, Entomologist of the Dominion of Canada; and likewise to Prof. Riley, Entomologist to the Department of Agriculture of the United States; but I may add that, whilst I always endeavour to forward a copy of my Yearly Report, on publication, to each of those who have kindly contributed and aided me, I should take it as a favour in case it does not reach them if they would let me know, as sometimes I am afraid copies have not been duly received.

I have also gratefully to acknowledge the kindly and important aid constantly given me by the co-operation of the Agricultural Journals, and often by that of the general Press.

With regard to illustrations, I beg to acknowledge with thanks :—

Winter Moth (side view), Figure-of-8 Moth caterpillar, and Mottled Umber Moth caterpillar, from 'Praktische Insekten Kunde,' by Dr. E. L. Taschenberg.

Joint-worm and injured Straw, from Report II. of Entomological Society of Ontario.

Also Lackey Moth, Small Ermine Moth, and Vine Weevils (*Otiorrhynchi*), from the 'Gardener's Chronicle'; Winter Moth, Mottled Umber Moth, and Figure-of-8 Moth, from Newman's 'British Moths.'

For most of the remainder, excepting such as have been specially drawn for these Reports, I am indebted, as in previous years, to the courtesy of Messrs. Blackie and Son, Glasgow, in permitting me the use of the beautiful figures from Curtis' 'Farm Insects.'

For the full-page figure of *Cephalobus rigidus* I am indebted to the courtesy of Dr. de Man, of Middleburg.

The steady increase of work has made it necessary for me to obtain more aid, and therefore, in addition to the constant assistance which has been rendered me now for many years by my sister, Miss G. E. Ormerod, especially in translation from foreign languages and by entomological work, I have now the additional help, as needed, of a lady amanuensis (Mrs. Hartwell), who acts as my Secretary and general assistant with great service to myself.

In the coming season I trust the friends and contributors by whose information the foundation of my Reports is year by year laid, will continue to favour me with the observations from real live field-work, by which alone information of practical use for counteracting farm pests can be accumulated, and on my side I will promise that, so far as in me lies, I will give my best attention to enquiries sent me, and also, as before, I shall hope to forward a copy of the year's Report when published to the acceptance of those by whose contributions of information it has been mainly formed.

ELEANOR A. ORMEROD,

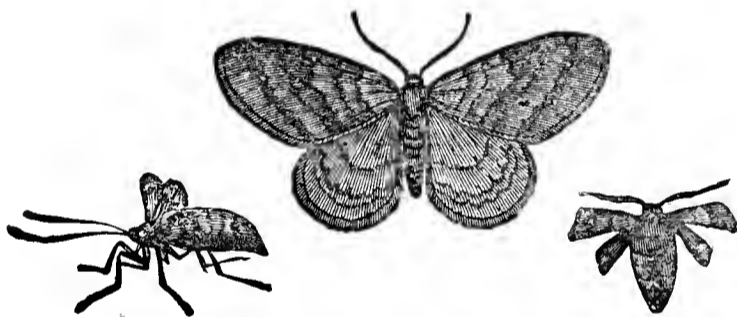
*Consulting Entomologist of the Royal Agricultural
Society of England.*

TORRINGTON HOUSE, ST. ALBAN'S,
March, 1889.

NOTES OF OBSERVATIONS
OF
INJURIOUS INSECTS
AND
COMMON CROP PESTS.

DURING 1888.

APPLE AND ORCHARD ATTACKS.



CHEIMATOBIA BRUMATA.

Winter Moth; male and wingless females.

During the last season enormous and quite unusual amount of harm has been caused by insect-attack to orchard fruit-trees of various kinds, namely, Apple, Cherry, Nut, and Plum. It is difficult to class these attacks either under the names of the insects or those of the trees, because, on one hand, different kinds of insects have often been injurious at one time to one kind of tree; and, on the other, different kinds of trees have been infested by one kind of insect, as, for instance, by the Winter Moth. I have therefore classed them under the general heading of "Apple and Orchard Attacks," and refer the reader to the index for guidance to special kinds. The inquiry, so far as was reported to myself, with specimens accompanying, was mainly caused by various kinds of moth-caterpillar, and two kinds of small beetles (weevils), of which one kind attacked orchard-leafage, and the other did damage, by means of its maggots, in Apple-buds. In some

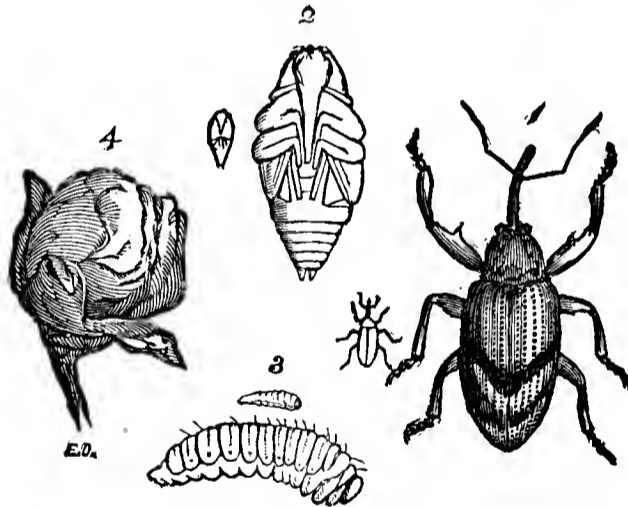
cases, as with regard to two kinds of moth looper-caterpillar, the life-histories are so similar that they fall under similar means of prevention; in two other cases, where the moth-caterpillar lives in companies, one method of lessening amount of attack is applicable (or desirable, so far as it can be carried out), in each case; but, so far as last season's experience shows, the only remedy which at present is usually serviceable when attack is going on, is shaking down the caterpillars, or beetles. This, it will be seen, has been largely practised with satisfactory results.

In arranging the following Report, where I have had distinct notes sent of one kind of insect, and its special method of injury, separately from others, I have given these separately, with the addition, so far as I was able, of a figure, and likewise an account of the habits of the pest. In other cases, where the mischief was caused by several kinds of insects, I have given the reports of damage, and placed the accounts of the insects, of which samples were sent, under their respective names in the following pages.

The notices of attack were (as might be expected) from localities or districts in some of the chief fruit-growing counties, namely, Worcestershire, Gloucestershire, Herefordshire, and Salop, and likewise Kent and Surrey.

The following note refers to Apple-blossom weevil:—

Apple Weevil. *Anthonomus pomorum*, Curtis.



ANTHONOMUS POMORUM.

1, Weevil; 2, maggot; 3, chrysalis, magnified and nat. size;
4, Apple-bud, injured by weevil.

Attack of Apple-blossom Weevil was one of those which caused serious loss to fruit-growers during the past season. On the 21st of May specimens of the maggots, well-advanced in growth, were sent me from Newlands, near Sittingbourne, Kent, with a note that the attack was then very prevalent on Apple-trees in East Kent. Mr. Lake, by whom the specimens were sent, mentioned that he was not aware

that it had prevailed to any extent before, but it was then very general in early blossom, and to be found in most trees to a greater or less degree.

The method of life of these small weevils is for the female to make a small hole in an *unopened* flower-bud by means of little jaws placed at the extremity of the long proboscis or snout, with which these "long-nosed weevils" are furnished. The beetle only lays one egg in each bud, so that the process of egg-laying goes on slowly, and may last as long as three weeks; and this point is of some importance practically. She cannot lay until the blossom-buds *are formed*, and as soon as the blossom-leaves *begin to unfold* egg-laying ceases.

We cannot alter the weather, but, by keeping the trees in such order as to ensure the greatest amount of sunshine reaching the flowers, rather than allowing an undergrowth of boughs touching the neighbouring trees, and thus giving a long successive time of opening to the flowers even on one tree (precisely suiting the beetles' needs for laying day after day), we cut short part of the beginning of the attack.

The weevil-egg hatches in about a week. The maggot is whitish and legless, and with a black, horny head; it feeds within the blossom-bud, and its presence is shown by the blossom-leaves, instead of opening, turning brown and remaining folded together. The maggot turns to chrysalis in the injured bud, and in about three weeks from the time of hatching of the maggots, the weevils come from the chrysalids, and disperse themselves over the tree. They are said to injure the leafage, but the great mischief they cause is that to the buds.

Prevention and Remedy.

During the winter the weevils shelter in chinks or crannies, or other convenient shelter on the trees, or under clods and stones near it; so that keeping the bark in good order, removing rough broken pieces, smoothing away rough projecting edges where there are deep cracks, cleaning off lichen from the boughs, and other similar plans to get rid of lurking-places on the trees, are measures which are sure to be useful. When it is wished to preserve the fruit of any especially valuable tree from coming attack, it would be a good plan to syringe a strong mixture of soft-soap (with just enough paraffin to give it a scent) on to the trunk and branches. This would lodge in the crannies, and, if done during early spring, just before the Apple-tree shows growth, would probably be very serviceable. Where trees stand in bare ground, stirring the surface and throwing a little quick-lime or gas-lime would be of use; in grass-orchards it is difficult to meet the point of harbourage in the ground, but sticky bands round the trees are of use in keeping the female weevils from creeping up. These *can* fly, but are considered not to do so customarily; so that, if

they are prevented by the above measures from lodging on the tree itself, and are prevented by sticky bands from crawling up the trunk, their attack is fairly kept in check.

Various sticky mixtures may be used. Of these Davidson's composition is perhaps the best; but various mixtures of tar, such as tar and cart-grease, or tar and oil, or tar by itself, would probably serve the purpose. It should, however, always be remembered that if the tar melts in hot sunshine, it may greatly damage the bark of young trees; therefore, it appears more desirable to twist a rough hay-rope or band of some sort, and dip this in the sticky mixture, and lay it close to, but *not touching*, the tree, when the bark is young and delicate. The weevils drop to the ground on being alarmed, so that, when bad attack is feared, it would be worth while to try whether it is really present by smartly jarring the boughs of a tree or two, and seeing whether weevils fall on a large cloth spread below. In case they *are* found, it would not be very expensive to have the trees well-shaken, and thus cleared of many of the pests, as they could not crawl back over wet tar-bands or Davidson's composition.

Green "Leaf" Weevil. *Phyllobius maculicornis*, Germ.

The following observations refer to damage caused near Sittingbourne, and especially to the fruit-trees of Mr. Faunce de Laune at Sharsted Court, by a small green weevil-beetle, scientifically, the *Phyllobius maculicornis* of Germar. These little weevils are only about a quarter of an inch in length, and very similar in shape to the *Otiorhynchus* weevils (see index for reference to figure).* The colour, unless the scales have been rubbed off, is of a bluish, golden yellow, or green tint, the feet and shanks yellowish, and horns of a red tint.

There are many species of *Phyllobius*, and they are remarkable for the great numbers in which some of the kinds appear from time to time on orchard-trees, and the mischief they cause by their attacks on leafage and buds, and also to young grafts.

The following clear observations of the attack were sent me, beginning on May 26th, by Mr. Arthur Rayfield, from Sharsted:—

“I herewith enclose some specimens of a green insect that I have observed on Mr. Faunce de Laune's fruit-trees for three or four years past. They come in larger numbers each succeeding year, besides spreading over a larger area. I notice this spring that they first made their appearance about the 20th of this month. I have succeeded in catching a considerable quantity by shaking the trees (standards), and holding a tarred cloth beneath, on which they fall and stick, until

* The *Phyllobius maculicornis* is about two-thirds of the length of No. 5 of figure referred to.

some fresh tar is put on; but it is impossible to *get rid* of them in this way, as they swarm over several hundred acres, settling on fruit-trees, —Cherries, Plums, Apples, and Nuts,—besides nearly all other kinds of trees and bushes, such as Thorns, Sloes, and even Firs. They appear to live on the leaves of what trees they alight on, but prefer those that have been newly planted. They take advantage of any shelter, and prefer the south side, in the sun, and out of the cold winds.”

On June 1st, Mr. Rayfield wrote further that he had succeeded in catching great numbers of the leaf-weevils “but there yet remain huge quantities. We are most successful in catching them in the morning and evening, when it is dull and not too much wind. They collect in larger numbers in sheltered places, but when disturbed by a sudden jar, while the sun is shining brightly, and in a warm temperature, some take to wing, and consequently avoid the tarred cloth held beneath.” A few days later—on June 4th—Mr. Rayfield reported that the beetles appeared to be diminishing in number, but, though he searched carefully, he could not make out where the eggs were laid, or the maggots lived.

Very little indeed, as far as I am aware, is known of this stage of life of most of these *Phyllobius* beetles, and we need to know it, to forestall coming attack; but, looking at the fact of the maggots not being reported as found in the buds, and also that one kind of *Phyllobius* passes its maggot-state and changes to chrysalis *in the ground*, I should think it very likely that this species did so too. It is stated (see reference below),* with regard to the *Phyllobius oblongus*, a species which is especially mischievous to Espalier and dwarf trees, and in nurseries, and also to grafts, that towards the end of June the beetles disappear; and “the females lay their eggs in the earth, where the maggots feed on the roots of various meadow-plants, and pass the winter, and appear thence as beetles in the following spring.” This matter would be well worth investigating with regard to the Kentish attack, and, by turning up sods in different places under some of the trees that were infested last year, there would be a good chance of finding the maggots. They might be expected to be whitish and legless, with a head furnished with jaws, and in general appearance, although much smaller, very like *Otiorhynchus* maggots.

At present the only remedy for attack of the beetles appears to be shaking them down, taking care (as Mr. Rayfield notices) that this should be done at such times, and in such weather, as will cause the beetles to be in some degree torpid. In warm sunshine, in the middle of the day, the beetles will be very apt to escape; and this point is particularly dwelt on in the German directions for prevention.

* ‘Die Pflanzenfeinde,’ von J. H. Kaltenbach, p. 180.

THE FOLLOWING OBSERVATIONS REFER TO ATTACKS OF MOTH-CATERPILLAR.

Of these the most important kind, of which samples were sent me, were caterpillars of the Winter Moth (Cheimatobia brumata); the Mottled Umber Moth (Hybernia defoliaria); the Lackey Moth (Clisiocampa neustria); Small Ermine Moths (Yponomeuta padella, and possibly Y. malivorella); and the Figure-of-8 Moth (Diloba cæruleocephala); though several other kinds were present.

The observations immediately following refer chiefly to injury from caterpillars of the Winter Moth, or Evesham Moth, as it is sometimes called in the West of England; and where other kinds were also present, the reader is referred to the full description of these, for which consult Index.

Winter Moth; Evesham Moth. *Cheimatobia brumata*, L.
(Figured p. 1).

Amongst the moth-caterpillars which have done most harm to Apple, as well as other fruit-trees, during the past season, those of the Winter Moth, the *Cheimatobia brumata*, stand first. These caterpillars vary a good deal in colour, and also change in appearance after moulting. When hatched they are greyish, afterwards of a yellowish green, faintly striped with white along the back, and with dark head and mark on the neck. Afterwards the dark colour is thrown off, the green is of a clearer tint, and the white stripes plainer, and after the last moult the caterpillars are of a yellower green, with a light brown shining head. A stripe of darker colour down the back is probably (or, at least, in part) from the food showing through the skin. When full-grown they are about an inch long. For general purposes they may be known by their greenish colour, and also by forming an upright loop when walking. When full-fed they let themselves down by a thread to the ground, and go into chrysalis-state a little below the surface, from which the moths begin to come out about the end of October. The moths are of the size and shape figured at p. 1, and of a greyish colour. The fact of the *female having only abortive wings* is important to be observed, as on this turns the best means of prevention.

With regard to amount of appearance of these serious orchard-pests during the last season, Dr. J. A. Chapman wrote me, on June 18th, from Hereford, as follows:—"This spring the larva of *C. brumata* has been vastly more abundant than usual, doing much damage, especially to Apple-trees, which are in some instances quite defoliated, and the chance of a crop nearly destroyed. The dry winter has been very favourable to this moth, and to others of allied habits. Curiously,

the peculiar cold spring has not retarded it as it has done nearly all other insects (lepidopterous, at least), so that it is now nearly all gone to pupa, whilst many species, usually its contemporaries, are still feeding."

On June 11th, Capt. Corbett (to whom I am also indebted for observations further on), writing from Toddington, Winchcombe, near Cheltenham, reported:—"The Winter Moth has, indeed, been bad here. We caught the moth by thousands, with the band of tar and grease put on in October, and by renewing it lately we have caught numbers of the caterpillars; but for all this the destruction is terrible."

Besides the Winter Moth-caterpillar mentioned above, Capt. Corbett forwarded specimens showing the presence of caterpillars of "Mottled Umber," "Lackey," "Figure of 8," "Small Ermine" moths, and also of one or two other kinds not specially destructive.

Mr. Robert Mercer, writing from Rodmersham House, near Sittingbourne, Kent, on Feb. 10th, mentioned that Apple-trees on his ground had suffered much from caterpillar of the Winter Moth in the previous spring, and added:—"I have followed your advice in using Davidson's composition, and all through the month of November the belt of mixture at the bottom of the trees were almost covered with the moths. I have also used a slight covering of gas-lime on the land."

The following note refers more particularly to Cherry attack.

On June 8th the Rev. J. Ayscough Smith, writing from the Vicarage, Tenbury, Worcestershire, forwarded me some specimens of Cherries,—fruit and leaves,—as samples of insect-injury, of which he had written a short time previously, and further mentioned that in the orchard he had visited, and some adjacent ones, more than half of what ten days previously promised to be an abundant crop was destroyed. In this case some of the specimens proved to be caterpillars of the Winter Moth, and some of a Green-leaf Weevil,—a *Phyllobius*,—apparently *P. maculicornis*, Germar, the same species noticed at p. 4 as doing much mischief in Kent. There were also two kinds of small caterpillars agreeing with the description given by Dr. E. L. Taschenberg of those of the Tortrix Moths, *T. ribeana* and *T. cerasana*, H. The first of these is noted as feeding on many kinds of leafage, both of orchard-trees and bush-fruits, and that it goes into chrysalis in similar places. The second as more especially feeding on buds and young leafage of Plum and Cherry.

The following note, sent me, on June 9th, by Mr. A. K. Hudson, of Wick House, Pershore, Worcestershire, shows the serious amount of attack in the orchards of the Vale of Evesham. In this case the accompanying specimens were of the Winter Moth, and likewise of Lackey Moth caterpillars.* Mr. Hudson wrote as follows:—"The

* For figure and account of Lackey Moth, see p. 10.

accompanying caterpillars are specimens of what has this season taken the form of a very serious blight on our Plum-trees. Many of the trees are entirely stripped of their leaves by these voracious pests, and the trees thus denuded either wither away and die, or else the fruit all drops off. I have forwarded these specimens for your inspection, as you might be able to determine their nature, and give the numerous fruit-growers in this Vale of Evesham (where the culture of the Plum affords a livelihood to many gardeners and labourers) a few hints for the prevention of these pests in the future." On June 15th, Mr. Hudson wrote further:-- "The ravages of these insects in this neighbourhood are very partial; a Plum-orchard may be attacked, and all the trees left leafless, and the next one to it will appear to be quite free." This observation is important, as it points to the attack of some of the kinds of insects being demonstrably so local that it may be presumed that local applications would be useful as preventives.

The same points, namely, very severe injury in some cases to several orchards (or even to one single tree) occurring whilst there was perfect freedom from blight on the trees around, and likewise *the trees themselves* being destroyed, even to the amount of several acres, by the "blight," are reported in the following observations, placed in my hands by Mr. Thos. Hyiatt, of Mickleton, Chipping Campden, Gloucestershire. These refer to insect-blight on thirteen orchards, respectively at Mickleton, and the neighbouring parishes at Aston Subedge, and Quinton. The attack was of green "looper" caterpillar, corresponding, both in appearance and colour, and in habits, with that of the Winter Moth. Of three orchards at Aston Subedge, planted with Cherries, Greengage, Plums, Apples, Pears, Walnuts, &c., Mr. Hyiatt reported that the blossom was a perfect picture, and the Cherries and plums were set before the attack (or "blight," as it is termed) began. The green caterpillar then appeared by thousands, and, after hanging by webs and floating from tree to tree, they made twenty acres as bare as in winter, neither fruit nor leaves remaining, and destroyed three-quarters of the trees in one of the orchards of $7\frac{1}{2}$ acres.

In another orchard, a quarter of a mile from the above, about half the sale was realised of what it ought to have been for the Cherries, and no second sale on account of the "Blenheim Orange" being blighted and fallen off. Two orchards adjacent, that is, about ten yards from the above, were free from blight. At Mickleton (of two orchards) one is noted as appearing burnt up by attack, whilst in the other, one tree only was attacked, and thus defoliated. At Quinton five orchards were reported as more or less blighted, one being, as it were, burnt up.

On June 16th, Mr. James Craig, writing from Weston-under-

Lizard, near Shifnal, Salop, regarding the enormous amount of caterpillar-attack on Oak-leafage, mentioned :—“ They are destroying many of the fruit-trees too,—Plums and Apples ; they gather a few leaves round the fruit, and eat it instead of the leaves. They are also on the thorn-hedges ; some of them are quite bare.”

Amongst various communications from the other side of the country to the above-named places, a note was sent, on June 1st, from Copal, Dorking, Surrey, by Mr. Goodchild, with moth-caterpillars accompanying, mentioning that they were “ specimens of kinds which infest our Apple-trees more especially ; but Pears and Quinces in the orchard also suffer.” The most hurtful of the kinds sent in this case also were of Winter Moth (which appears to have been by far the most generally distributed last year), the Mottled Umber, and the Figure of 8 Moth ; and all sent were taken off Apple.

Somewhat earlier, that is, on May 5th, Mr. Thos. Buss had written to me, from Haymans Hill, Horsmonden, Kent, regarding damage to his Apple-orchards from a “ looping ” caterpillar ; he mentioned :—“ Last year several acres of my Apple-orchards (and some Cherries) were severely attacked by ‘ looping ’ caterpillars, which cleared off nearly all the leaves. I find they are come again this year ; some of the small leaves, which have not opened from the bud, have one or two in them.” In this case more than one kind of “ looper ” moth-caterpillar was present, but part of the damage, of which specimens were sent, corresponded with that of the common Winter Moth-caterpillar. This begins its operations by fastening the parts of the leaf or blossom-bud which it infests together, with a web so fine that it is almost invisible, and as time goes on, in extreme cases, the caterpillars fairly clear off all that is eatable, and the brown remains give the tree the appearance of having been scorched.

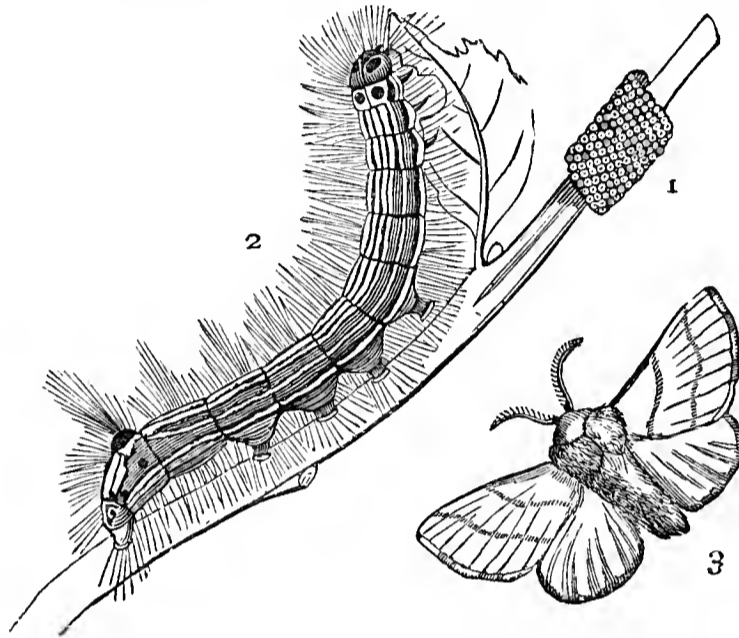
At Bexley Heath, Kent, the Lackey Moth-caterpillars also did harm to the Apple-trees (see Lackey Moth).

On June 8th, Prof. Thos. J. Elliot wrote me, from the Weald of Kent College of Agriculture, Hole Park, Rolvenden, Kent, regarding the needs of one of the staff, who occupies a large fruit-farm, mentioned that this year “ there is a plague of small green caterpillars on the leaves of the fruit-bushes, especially the Cob-nut bushes. So thick are these caterpillars, that five bushels a day can be gathered from the leaves. There is great danger of the timber being very much affected.”

In many of the cases above-mentioned the great damage was caused by several kinds of caterpillars feeding at the same time on the infested trees. As these are very similar in their method of injury whilst in caterpillar-state, but differ in many points of life-history (such as place or method of deposit of eggs, duration of chrysalis-state, or

locality in which this state is passed, and other points bearing on means of prevention), I have given the histories and also figures of some of the most important of those, of which specimens were sent me, in the following pages.

Lackey Moth. *Clisiocampa neustria*, Curtis.



CLISIOCAMPA NEUSTRIA.

1, cluster of eggs; 2, caterpillar; 3, moth.

The Lackey Moth-caterpillars have been one of the kinds most especially destructive in the last season. These are very easily known. They are about an inch and a half long when full grown, hairy, and partly of bluish-grey colour, striped with black, scarlet, blue, and white. They may be generally described as spotted with black on, and near, the head; on the rest of the body they are ornamented with a white stripe along the middle of the back, and three orange or red stripes along each side, between the two lowest of which on each side there is a blue stripe; these gaily-coloured markings being divided by lines of black, or black spotted with blue. They feed on various kinds of trees, but are especially injurious to Apple-leafage. The eggs are laid in the preceding year to that in which the attack takes place, and they may be found in winter and spring arranged in a compact mass, or rather ring-like band on the wings, exactly as figured above. The caterpillars come out from these about May, and at first are black. They live in companies of as many as fifty to two hundred, and spin a joint web, under the shelter of which they live in bad weather, or at night, and go out from their web-tent (which is enlarged as may be needed) to feed. When full-grown, which is about the middle of the summer, they scatter themselves separately, and *do not go down into the ground* to turn to chrysalids, but spin cocoons anywhere in reach of their food-trees, as on leaves, or in

hedges, under bars of railings, roofs, or anywhere, in fact, that they find convenient. These cocoons are of silky web, powdered with yellow or white dust, and from the brown chrysalis in this cocoon the moth comes out towards the latter part of summer.

The figure (p. 10) shows the shape and size of the Lackey Moth. The colouring is excessively variable, but the fore wings may be described as of some shade of rusty-fox, yellowish, or dark brown tint, with two transverse bars, these being sometimes of a pale tint on a darkish ground, or sometimes, on the contrary, the ground colour is the paler, and the bars dark; and in one specimen before me there is a transverse band between the two bars, of a deeper colour than that of the rest of the wings. The hinder wings are also of some tint of brownish colour.

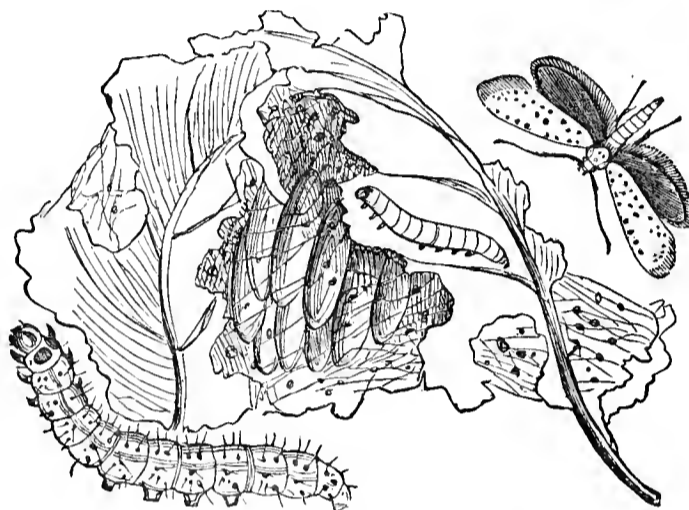
The best remedies for this attack are clearing off the webs *with the caterpillars within them*, or jarring the boughs so as to make the caterpillars fall to the ground. In the latter case some may escape, as they let themselves down by their threads on alarm, and some also may return up their own lines; therefore, when many are observed hanging thus beneath the lowest boughs, they should be removed by sweeping to and fro in the air with a birch-broom, or pole, or anything of this nature which may be at hand.

Where the plan of destroying the caterpillars in their webs is preferred, care should be taken that this is done when the caterpillars *are within them*. It should be done on an overcast, wet day, or early or late, and it is best for two people to carry out the work. One man should have a pail with some fluid in it,—water and paraffin, or fluid mud with a little paraffin, or anything, in fact, that will prevent the caterpillars that fall in, rambling away. If the pail is held by one man, so that the web-nest cut off by the other falls into it, this is an excellent remedy for such part of the attack as may be in reach. In any case, measures should be taken to prevent stray caterpillars returning up the stem of the tree to the leafage. When the rings of eggs are seen on the Apple-twigs, they should be cut off and destroyed wherever they can be reached. The Lackey Moths harbour in long grass and leaves on the ground, and, therefore, keeping the trees clear of a *neglected* undergrowth, such as is too often seen in uncared-for orchards, is an important measure of prevention. A word may also be said for the Cuckoo as a helper; this bird is particularly partial to *hairy* caterpillars.

The attacks of the Small Ermine Moth are placed next in order, as they lie to some degree under the same means of prevention.

Small Ermine Moth, *Yponomeuta padella*, Linn.; and Small Ermine Apple Moth, *Yponomeuta malivorella*, Westwood.

Caterpillars of the Small Ermine Moths swarmed to such an extent on the trees at Toddington, in Gloucestershire, that in the early part of the summer Capt. Corbett informed me they collected the cocoons by bucketsfull. As in the case of the Lackey Moth, the eggs are fastened to the twigs of the infested tree, and the caterpillars live in companies in web-tents amongst the leafage, on which they feed.



YPONOMEUTA MALIVORELLA.*

Small Ermine Apple Moth, and cocoons in web; caterpillar much magnified.

The eggs are laid in small patches, covered with gum, and caterpillars may be found in October; and, to continue the history without going into all the details of their early life, in the spring or early summer of the following year they appear on the leafage of the attacked trees (sometimes in vast numbers), and spin webs, where they live in large companies. Whitethorn hedges especially suffer from these caterpillars, and their leafless condition hung with dirty, ragged remains of web-nests is only too well known. Plum, and many other trees, including Pear and Cherry, are stated by various writers to be attacked by these caterpillars, and Apple-trees also, either by this kind, or one exceedingly like it, distinguished as the Small Ermine Apple Moth.

Last summer, amongst various communications on orchard-attacks, specimens of cocoons of this moth were forwarded to me, on July 9th, from Withington, near Hereford, by Mr. John Watkin, with the observation that they were samples of the cocoons of the grubs which had been doing much injury to orchards in Herefordshire, some trees being completely stripped.

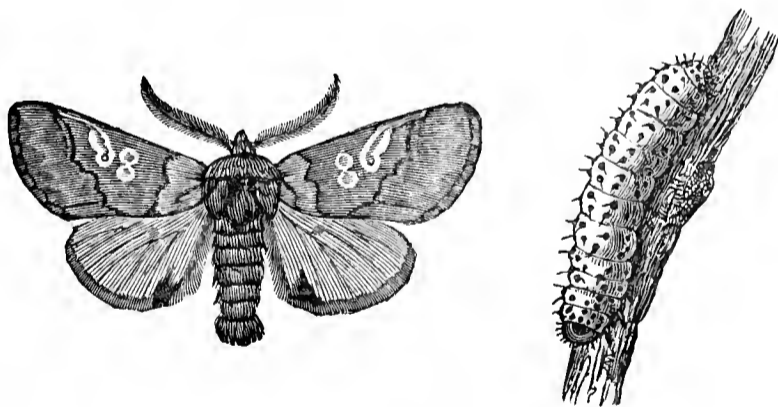
* The attacks of the two nearly allied moths, *Yponomeuta padella*, Linn., and *Y. malivorella*, described by Professor Westwood in the 'Gardeners' Chronicle' for 1849, p. 60, are so extremely similar that it appears to me very difficult to separate them with absolute certainty, unless by examination of the cocoons. I have, therefore, given Prof. Westwood's figure of the kind considered more especially to infest the Apple; but for all practical purposes the kinds may be considered together.

The Small Ermine Moth-caterpillars are of a dirty ash-colour, spotted with black. When full-fed they do not, like many (or perhaps most other) kinds, wander away and bury themselves or spin cocoons on twigs or in localities away from where they fed, but they spin them *in the web-nest*, which sheltered them during their feeding-time. Those of the Apple Ermine are said to be white and opaque. The little moths, which soon appear from the chrysalids, are only about three-quarters of an inch in full expanse of their wings. The fore wings are usually livid, or whitish dotted with black, and the hinder wings lead-colour; but they are very variable in appearance, and the Small Ermine Apple Moths are distinguishable by their fore wings having the black spots on a pure white ground.

Prevention and Remedy.

Shaking the caterpillars down appears the most effective remedy. Something may be done to check attack by cutting off the webs (where they can be reached), and if the webs containing the chrysalids *can* be got rid of, this necessarily is a great check to future increase. The little moths are sluggish by day, and, as they are fairly noticeable from their light colour, when hatching out (as is apt to be the case) in large numbers about the same time,—if the labour was thought worth while,—much egg-laying might be prevented by shaking them down on cloths beneath the trees and trampling on them.

Figure-of-8 Moth. *Diloba ceruleocephala*, Linn.



DILOBA CÆRULEOCEPHALA.

Figure-of-8 Moth, and ("Blue-head") caterpillar.

Specimens of this fine caterpillar, known in Germany as "Blue-head," were last summer forwarded both from Dorking, in Surrey, and Toddington, in Gloucestershire, amongst samples of the various kinds which were doing mischief in the orchards. The grub is very observable from its comparatively large size, being about two inches long when full-grown, and is also remarkable from the head having usually the bluish colour, whence it takes one of its names. The caterpillar is of various tints of green or smoky-green above, and

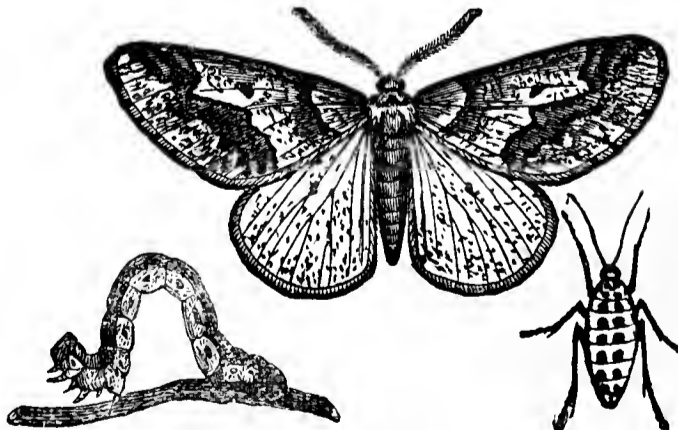
yellow-green below, with a small bluish head, and with three yellow stripes along the body, one along the back, and one on each side below the spiracles. The segment or rings of the caterpillar are spotted with black (see figure), the one immediately behind the head has eight small spots arranged (on the upper part) in a double transverse row, and the two segments immediately behind have one row of larger spots similarly placed. The following segments (till near the tail) have four spots above. The three pairs of claw-feet are also spotted with black, and the four pairs of sucker-feet beneath the body have two black spots on each. The caterpillars feed on various kinds of orchard-trees, especially Apple and Plum, and also on Whitethorn. When full-fed they spin cocoons formed of bits of bark, or apparently anything that may be convenient,—on twigs or stems, or even on neighbouring walls,—in which the caterpillar turns to a reddish-brown chrysalis, out of which the moth emerges about September, or possibly later on, in some cases not until the following spring. This is of the size and appearance figured; the fore wings are of a brownish ground colour, with, amongst other markings, two white spots bearing a resemblance to a figure of 8, whence the moth takes its common name. The eggs are green, and laid singly on the stems or branches of the trees.

Prevention and Remedy.

It is noted by Dr. Taschenberg that the caterpillars have such slight hold that in case of a storm occurring they fall off in great numbers. This fact of their loose hold may be very serviceably turned to account by shaking the trees well, and collecting and destroying the caterpillars that drop to the ground.

Amongst measures of prevention, scraping and cleaning the bark of the trees and branches would be serviceable here as with various other insect-attacks, as thus some at least of the cocoons which the blue-headed caterpillars form on the trees would be got rid of.

Mottled Umber Moth. *Hybernia defoliaria*, Linn.



HYBERNIA DEFOLIARIA.

The Mottled Umber Moth; male, female, and caterpillar.

The caterpillar of the Mottled UMBER Moth is (as shown in the figure) a "looper," like that of the Winter Moth, but is somewhat larger, and may be easily distinguished from it by its peculiar colouring; it is brown above, with a yellow stripe along each side, the brown and yellow being separated by a waved black line. Like others of the caterpillars specially known as "loopers," it has, instead of four pairs of "sucker-feet" below the body, only one pair besides the pair at the end of the tail; so that in walking it cannot progress forward continuously, but has to bring the sucker-feet and tail-suckers forward to where it is held firm by the claw-feet (as shown in the figure), and thus it forms an upright "loop," whence the name of "looper."

The caterpillars feed on various forest-trees, as Lime, Oak, &c., and it is noted by Kollar that they sometimes appear in great numbers, and do much damage to fruit-trees. They will also feed on unripe Cherries, gnawing away one side of the fruit. When full-fed, which may be during June, or even a little later, the caterpillars turn to chrysalis on or a little under the surface of the ground. From these caterpillars the moths come out in October or November, about the same time, that is, that the Winter Moths appear. Like them, the male moth only is winged. This is of the size and appearance figured, that is, about twice the size of the Winter Moth; the colour is usually of a pale brown or reddish yellow, with dark transverse bands, but sometimes the bands are absent.

The female moth has only abortive wings, and precisely the same methods of prevention of attack which serve for the Winter Moth are of use for this also. The sticky bands placed round orchard-trees towards the end of October or November will catch either kind as they attempt to creep up the tree. If not prevented taking possession the females lay from two to four hundred eggs on twigs towards the top of the tree, from which the caterpillars hatch in the spring; and when this has taken place, the only remedy appears to be shaking down the caterpillars and destroying them.

The two main points of prevention and remedy which have been brought forward last season as really practicable and useful, are shaking and jarring the infested trees, so as to make the pests, whether moth-caterpillars of various kinds, or beetles, fall to the ground; and also smearing the trunks of trees with a band of some sticky material (near the ground-level), so as to prevent wingless female moths making their way up the trunks for egg-laying. The first kind of treatment is applicable for attack of any kind of insect, whether moth, beetle, or otherwise, which will fall to a sharp shake or jar; the second is serviceable not only for preventing wingless moths crawling up the trees, but also for preventing caterpillars returning which have been shaken down.

In regard to shaking the trees as a means of getting rid of caterpillars, Capt. Corbett wrote me from Toddington :—" The only useful plan seems to be to shake the caterpillars into a sheet ; one man collected two gallons in this way." Prof. T. J. Elliott, of the Weald of Kent College of Agriculture, wrote me that on a large fruit-farm five bushels a day could be gathered of small green caterpillars : and, taking the above as samples of amounts which can be collected respectively by one man, or by as many as may be needed for the whole required work per diem, it shows that much good may thus be done. A difference is reported as to the extent to which different kinds of trees will bear the shaking. Mr. T. Buss wrote me, from near Horsmonden, Kent :—" The caterpillars are easily shaken off Cherry-trees ; then a band of gas-tar smeared round the stem prevents their reascending. Apple-tree buds break off more by shaking, and the caterpillars, being more enclosed in the leaves, do not shake out so well."

With regard to the very important matter of it being necessary to prevent the caterpillars, if inclined, going up the tree again, Mr. Buss wrote more in detail. The Cherry-trees were shaken early in June ; no sooner were the caterpillars on the ground than they at once headed for the tree (a distance of three or four feet), and ascended the tree in great numbers, until a band of tar was put round it.

In the exhaustive paper on " Canker-worms," by Professor Riley, Entomologist to the U. S. A. Department of Agriculture, published in 1883, every point appears to be fully entered on which can be of service for prevention of attack similar to that of our Winter Moth, and various sticky mixtures are mentioned and methods of applying them, but the principle is the same as that of our own treatment. Anything that is sticky enough to keep the moths from going up the tree will answer, whether it is tar, tar and oil, resin and oil, bird-lime, printer's ink, slow-drying varnishes, or anything else. Only, what is at hand, cheap, and has been proved to be effective, is best ; and when the need for it has passed, if it has been smeared in thick bands on the bark, it is desirable *to scrape it off*, lest it should presently be damaged by melting in hot sunshine. To avoid this difficulty, the tar, &c., may be applied by means of twisted hay-ropes laid on the ground round the trees, or on rings of clay-mortar, old sacking, or anything convenient. There are special kinds of metal rings or tin bands made which, when dressed with some preventive mixture, stop the ascent of the moths ; and little troughs, made to surround the tree, and filled with oil, or some oily substance, are also noted as useful ; but all this apparatus costs money, and the simpler plan seems preferable.

The great point appears to be to make the applications early enough and often enough, and thus be sure not to let attack begin,

and also to keep the application, whatever it may be, sticky, that the moths cannot pass over the bodies of those already stuck fast, nor the eggs which they lay on the tar remain unkilld. Also, the application should be put near ground-level, not at the base of the branches. The bark is harder and better able to bear application below than above, and also, if the moths are allowed access to the trunk, they will in all probability lay eggs there, and the caterpillars, when hatched, will have no difficulty in creeping up the tree over the band applied months before, over the dead moths stuck to it whilst it was wet. But even with the greatest care, if there is much attack about, probably shaking down will be needed in the summer, on account of the caterpillars being blown as they swing on their long threads from infested trees; and also from the male and female moths being transmitted together by flight.

Amongst various points of useful information, contributed by Capt. Corbett, relatively to prevention of Winter Moth-attack, he mentioned that tarred boards, with a lantern hung up, catch the male moths. I have also seen them caught in large numbers with the female moths on the sticky trees.

Amongst general remedies suited to destroy chrysalids are hoeing and stirring the earth under the trees. Where this can be done, it answers both by destroying some of the chrysalids and turning others out to the birds, and to weather influences. Various caterpillars, or chrysalids, will not suffer from cold, if left in their own self-chosen or self-made shelters, but will perish if thrown out to alternate frost and wet; and, as some proportion of the Winter Moth-chrysalids may possibly not develop with the greater number at the end of October, but remain in chrysalis-state until the following spring, the above treatment helps to clear out these stragglers.

Where orchards are on grass-land, any treatment which will prevent the herbage being long enough to give shelter (as, for instance, to the Lackey Moths) is of use. Also such measures as folding and hand-feeding sheep on successive portions of the ground, until they are bare and sodden and covered with the droppings, is an excellent way of getting rid of insect-pests that harbour on the surface.

But, besides treatment suited to cared-for land and trees, it would be well to give a thought to such a state of things as I have seen for a good part of my life in some places in the West of England, and which may exist still. In those parts it was thought desirable that Apple-trees should touch, so that the upper boughs made a superstratum, and the consequences were that the under boughs gave a shelter and a slow succession of opening to the buds, excellently suitable for insect-multiplication; and in the shade below, the grass grew long and dank, and nettles and weeds grew high and strong,

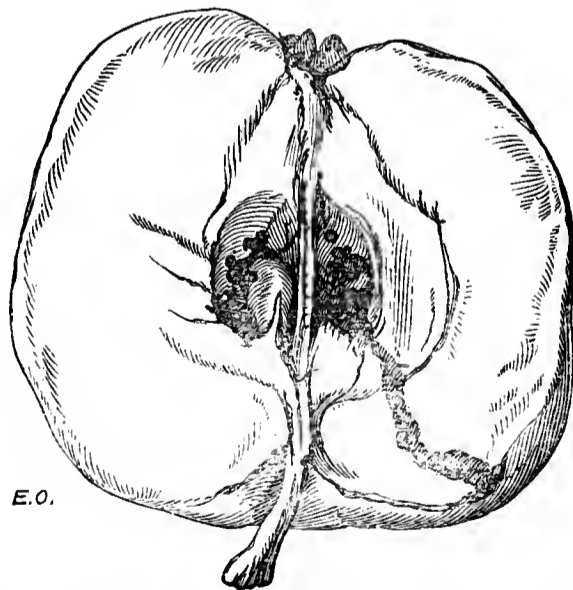
until nothing but the rough mowing, locally known as skirting, could be brought to bear on the disorder, and clear away what was not in those days suspected of harbouring presence that would lessen returns of orchard-crop.

To what extent birds should be encouraged is a matter for the consideration of the orchard-grower. I fully believe that some of the mainly insectivorous kinds will give help by clearing out eggs and small grubs from nooks which can be got at in no other way, and that these should to all reasonable extent be preserved; but by no means encouraged to such an overwhelming extent that they demolish the very crops they were meant to protect.

In the above notes I have endeavoured, as well as I have been able, to enter on the main points for consideration in orchard-attacks, excepting those of effect of dry dustings, or of washings, neither of which, as far as I know, were much tried for the caterpillar-attacks now under consideration. I wish also to add that, as in the course of last season's observations I found much difficulty in identifying specimens sent me from descriptions only (which often vary considerably from the writers' different views of colour, and other circumstances), that I have now procured type-specimens, properly prepared, and showing variations in colouring, of such injurious moth-caterpillars as may ordinarily be expected to occur, which, in case of recurrence of attack next year, will prove serviceable in identification.

NOTE.—As the attack of the Codlin Moth, *Carpocapsa pomonella*, was not reported to me last year, I merely add a short note regarding it, with figure of injured Apple.

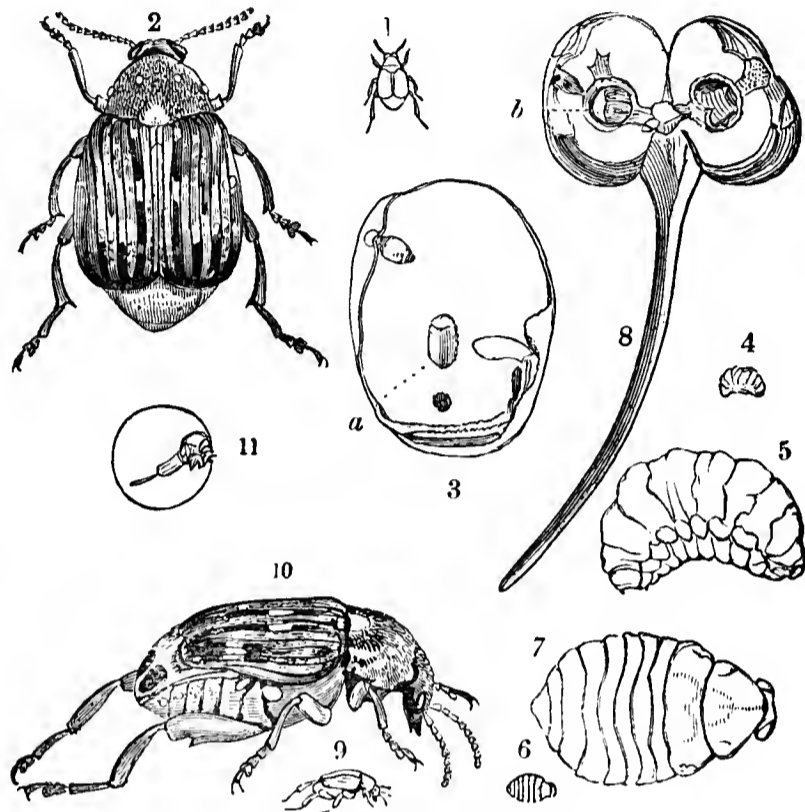
The caterpillars feed within the growing Apples, which consequently fall before they are ripe, and the caterpillars shortly afterwards leave the Apples, and either return to the tree to shelter themselves in the bark, to turn to chrysalids, or go down into the ground for the same purpose. For this attack, therefore, cleansing and scraping the bark, and syringing soft soap into the crannies, likewise stirring the soil round the tree, or poisoning it by sheep treading, are useful means of prevention. Also the fallen Apples should be collected and carried away very soon,—if possible every morning,—and used or destroyed, so that the caterpillars cannot get back to the trees.



Apple injured by Caterpillars of Codlin Moth.

BEANS.

Bean-seed Beetle. *Bruchus granarius*, Curtis; *Bruchus rufimanus*, Boh.



BRUCHUS RUFIMANUS AND B. PISI.

1 and 2, *Bruchus rufimanus*, nat. size and magnified; 3, infested Bean; 4 and 5, maggots; 6 and 7, pupæ, nat. size and magnified; 8, Bean injured by beetle; 9 and 10, *Bruchus pisi*, nat. size and magnified; 11, injured Pea.

Amongst the many insect-attacks which were unusually widespread and severe during the last year, that of the Bean-seed Beetle was one of the first to be reported. The mischief caused by this beetle is from the maggots feeding in the seeds of various kinds of Broad or Tick Beans, and thus lessening their value by weight for sale, and also their value for seed, as, where much is eaten away, the growing power of the young plant from the damaged seed is also lessened.

The method of attack is for the Bean-seed Beetle to lay its egg on the young seed-vessel in the Bean-blossom before this is large enough to be called a pod, and from these eggs the maggots hatch, which presently pierce into the growing Beans. Then each maggot gnaws a gallery for itself, and there, amongst the dust and dirt (consequent on results of its feeding) which remain in the closed-up tunnel, it turns to the chrysalis, and thence to the beetle-state.

The maggots are fleshy, wrinkled across, and with a small, horny, rusty-coloured head. As far as I am aware, they are legless, but in the case of some specimens of *Bruchus*-maggot which I took out of S. African Beans, I found the rudiments of feet on the front segments.

The beetles are only about the sixth of an inch in length, of the shape and pattern of marking figured at 2 (magnified); the colour black, with various markings of brown and white; and they are furnished with ample wings. Imported seed has long been known to be often greatly infested, and the beetles have been recorded as very injurious in our Pea and Bean fields, especially in Kent; but as a general thing (even if present), the attack has not been much brought forward until the present year, when serious damage was reported from various of the more southerly or easterly counties.

The first communication regarding last year's attack was sent me, on Feb. 16th, from Tenterden, Kent, by Mr. J. Ellis Mace, who mentioned, with respect to some Winter Beans, regarding which we had previously been in correspondence, as follows:—"The crop turned out fairly successful for a dry year, yielding from six to seven sacks per acre. . . . On threshing out the crop, we found numerous holes in the Beans, which were put down as the work of the maggots; but yesterday, on examining some crushed Beans, we found the work was done by a little beetle or insect of some kind, which I never recollect to have seen before. . . . The insects, being alive in some cases, I am afraid will get into other corn, and will necessitate immediate use of the Beans." These beetles I found, on examination, to be the kind of *Bruchus* now known as *rufimanus*, and, for further certainty, I submitted them to examination of Mr. Oliver E. Janson, who confirmed my identification as correct.

On Feb. 21st, Mr. Ellis Mace mentioned:—"I do not recollect to have noticed anything in the seed, but we unfortunately sowed some of these very Beans last autumn, and the men noticed, when drilling, that there were some cases, and put it down to maggot." On the 25th, Mr. Mace gave further notes as to unusually large amount of Bean-seed attack; also the history of the seed reported on; and likewise the deficient amount of germination which had been observed in the case of the infested seed. Mr. Mace mentioned:—"A large miller in this country tells me these insects are very common this season. He thinks nearly every sample he has seen since harvest was affected: he has often seen it before, but never to so great an extent. Last Tuesday, at Ashford, he says he bought a sample of 'ticks,' and directed the seller's attention to the fact that nearly every Bean was bored. He does not advise drying on oast-hair, but thinks great care should this year be exercised in selection of seed-samples. We unfortunately sowed ours in September, and the Beans not coming up evenly was attributed to the very rough state of the ground, which my men did not work sufficiently before the drill. I do not think I told you about the seed; it came from Wrotham, near Sevenoaks, and was

sown in Tenterden in the autumn of 1885. From that crop my seed was got, and sown at Benenden in 1886."

On March 2nd, Mr. F. W. Silvester (Recorder of Economic Entomology of the Herts Nat. Hist. Soc.), mentioned that he had been informed that the Bean-seed beetle was much more prevalent than usual in Buckinghamshire, and also on the lesser amount of land on which Beans are grown in Herts.

On March 1st, I was favoured by the following notes from Mr. E. A. Fitch, of Maldon, Essex, which are of especial value, from Mr. Fitch being not only an agriculturist on a large scale, but also a well-known entomologist, and for some years Hon. Sec. of the Entomological Society of London. Mr. Fitch wrote:— "*Bruchus rufimanus* has been *most* destructive this year: in Essex it is a most general complaint, and in my own case a most moderate computation of loss of weight alone of 2s. per quarter, would give £65 12s., *i. e.*, 164 acres \times 4 quarters the acre \times 2s. per quarter. *Bruchi* are always common with us, but seldom (if ever before in my recollection) to anything like the extent they have prevailed this year. I generally have heaps of Beans threshed in my granary for use (grinding for bullocks),—have over 100 quarters there now,—and every May and June they seem alive on the top, but we are used to that; this year, certainly, I believe I have as many *Bruchus* larvæ as I have Beans, and the wild oats sticking in the holes is a perfect nuisance. I am a clean farmer, and, perhaps, ought not to acknowledge wild oats; but they seem to a certain extent a necessity of our heavy land, and this year every oat has got into a *Bruchus*-hole, and nothing short of hand-picking would remedy the evil: this is *almost* impracticable. . . . I know *Bruchus rufimanus* but too well."

The following note from Mr. Fitch, which he also permits me to use, gives a somewhat more detailed report:— "The much-talked-and-written-of Hessian Fly has not been nearly as destructive in Essex last year (1887) as this small beetle. The complaint of holey or bug-eaten Beans comes from all over the country, and is by no means confined to the Bean-growing lands; where Beans have been grown on our light land, they have suffered equally with those usually grown on the heavy land. I have myself delivered Winter Beans in other years weighing 19 stone 4 lbs. ($67\frac{1}{2}$ lbs. per bushel), and this year none of mine have quite weighed 18 stone (63 lbs. per bushel); and I hear from the corn merchants that nothing over 18 stone can be expected this year; a year in which condition, and consequently weight, is exceptionally heavy, the loss being entirely due to the ravages of the *Bruchus*. Certainly, more than half the Beans I grew (produce of 164 acres), produced a *Bruchus*, some two and more; money loss was created from the fact that all the wild oats (*Avena fatua*) seem to have

taken possession of the *Bruchus*-holes, from which it is impossible to dislodge them. This spoiled the sample for sale,—was annoying for use, for grinding did not effectually destroy the oats; and I shall be obliged to purchase fresh and cleaner seed, if I can get it. My spring (May and June) Beans were bad, but the Winter Beans suffered immensely; and so it is almost everywhere.”

The following note from Manifold Wick, Kelvedon, contributed on June 11th, by Mr. J. J. Harrison, further shows the prevalence of the Bean Beetle in Essex, and the direct loss caused by the injury:—“I enclose you a sample of Beans grown on this land, which have been considerably depreciated in value for some years by beetles, some of which I enclose also. For some years they have been a pest, but never so bad as last year, when they perforated the Beans to such an extent as to make them unsaleable.”

The above notes show the prevalence of injury from the Bean-seed Beetle in Essex and Kent and in Buckinghamshire, and also to some extent in Herts; and the following note shows its presence at one locality in Bedfordshire:—

On April 4th, Mr. G. F. Street, of Maulden, Ampthill, in reply to my enquiries as to *Bruchus* in English Beans, forwarded me a sample of Beans that he had grown for four years, the seed of which originally came from Biggleswade. In the sample sent, which was of about thirty-five Beans, seventeen were still infested, the beetle in most cases showing close to the round hole in the Bean, from which the sound bit of skin had been pushed off; about nine or ten Beans had been infested, but the beetle-gallery or tunnel was now empty. The remainder were variously injured or deformed, but beetle-presence was not certainly observable.

Beans that are still infested by the beetle may be known by having a little round depression in the skin, which is also, at this spot, slightly yellowish or transparent. This appearance is caused by the substance of the Bean having been eaten away inside by the maggot, which gnaws its gallery in the seed up to the skin, so that this sinks a little into the hollow space. When the beetle emerges, it pushes this circular bit of skin off, and the round holes thus caused show that the seed *has been* infested. The above points are desirable to look to in choosing seed. Autumn-sown seed is most likely to be infested, as a large proportion of the beetles do not come out till the end of winter, or, in some cases, well on in spring.

In regard to methods for lessening amount of loss from this attack, one is, great care in examining samples of seed before buying. As the young plant, when first sprouting, lives much on the store of food laid up in the large seed-leaves, it would be expected that where much of these had been eaten away, this would weaken the young plant,

or prevent it starting; and the note of Mr. Ellis Mace at p. 20 shows such to have been the case with his crop from infested seed. It would be exceedingly desirable, if possible, only to buy seed which showed no signs of being infested; but next after this, to save future attack, it would be very desirable to kill the beetles in the Beans before they come out to fly abroad.

In experimenting on infested Beans, I found that, if placed for a short time to soak, the water passed through the thin film of coating of the Bean at the end of the gallery, and soddened the powdery dust and rubbish within, and thus choked the breathing-pores of the beetle lying within, and killed it. If simple wetting in this way would answer the purpose, this would save trouble, likewise the expense and some degree of risk in using chemical additions; but it is open to doubt whether, if weather was unfavourable for sowing, when the Beans had been wetted, they might not be harmed; and the two following notes mention successful use of Calvert's Carbohc Acid and McDougall's Sewage Carbohc. Mr. J. J. Harrison, in addition to the observations given above, mentioned:—

“In sowing this year I dressed all the seed with Calvert's Carbohc Acid, of such strength as to kill all the insects in the Beans without damaging the seed.”

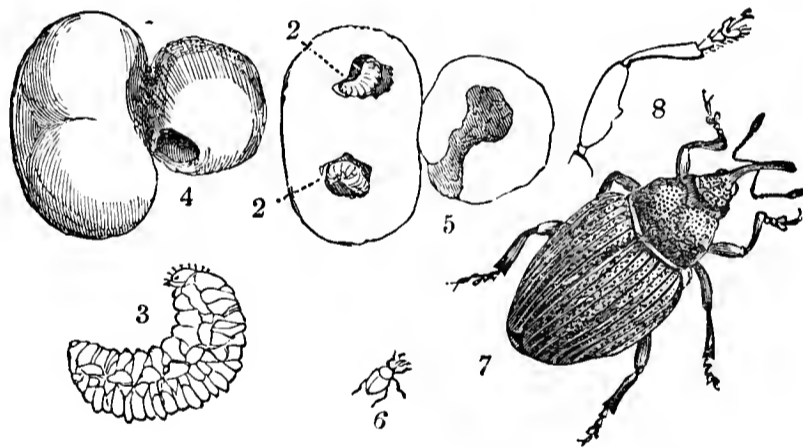
In the course of discussion on this subject, at the meeting of the Farmers' Club, at the Salisbury Hotel, on April 30th, Mr. Geo. Street, of Maulden, Ampthill, mentioned that he had found good results from dressing infested Beans with “blue vitriol” and McDougall's Sewage Carbohc. A great number of the beetles were killed; but, as all were not destroyed (at my request), he promised further information. On May 10th, Mr. Street wrote as follows,—and, firstly, with regard to whether the dressed Beans would be found to be injured thereby:—
“They were then only just coming up, and I wished to see the result before writing to you. They have made wonderful progress, and the result, as far as I can see, is so far perfectly satisfactory. The dressing applied to the Beans was used in a similar way to that used for seed-wheat. Formerly we used ‘blue vitriol’ only, but the addition of McDougall's Sewage Carbohc leaves a smell, which to some extent prevents birds eating the seed-corn. I am inclined to think the carbohc alone would be sufficient, if a larger quantity was used. We used 6 bushels of Beans, 6 quarts of water, 1 lb. of ‘blue vitriol,’ and 1 pint of Sewage Carbohc. I am inclined to think that Beans should be dressed some few days before they are sown (as the skin is thick), and turned over with a shovel every day. Those which escaped the liquid dressing might be killed by the strong dust which would be formed when the Beans were again dry.”

From the above notes of practical field experiments, it would

appear that this attack at least might be held in check. Where Beans or Peas are grown over large districts, as, for instance, in Canada, or other seed-supplying countries, the only real way to reduce infestation thoroughly, from time to time, is a change of crop to something that the *Bruchi* (or Bean- and Pea-seed weevils) will not attack. Also, it is a very simple and desirable precaution, on the part of seed-supplying firms in this country, in case they have reason to know that there is bad infestation in whatever part of the world they may usually procure their supplies from, to change, temporarily at least, to another. It is a powerful argument in inducing proper attention from their suppliers, and is but just to their customers; and I venture to draw attention to the subject, as I am aware of this being done by one at least of our most leading seed firms.

CABBAGE.

Cabbage and Turnip-Gall Weevil. *Ceutorhynchus sulcicollis*, Gyll.



CEUTORHYNCHUS SULCICOLLIS.

1—5, galls, with maggots (maggot magnified at 3); 6 and 7, weevil, nat. size and magnified; 8, leg of weevil, magnified.

The Cabbage and Turnip-gall Weevil does mischief by causing the growth of the smooth knobs, or clusters of knobs, often observable on the bulbs of Turnips and Swedes, and also on the underground part of the stem, or even the roots of various kinds of Cabbage. These galls do little harm in themselves, so far as Turnips are concerned,—that is, unless they are very numerous, or cause decay by wet lodging in the hollows in the galls, from which the maggots have escaped. But with Cabbage it is different. Here the gall-growths on the old stocks are not available for food as they are with the Turnips; they carry off the sap in the wrong direction, besides inducing decay.

Although the gall-swellings are different in their cause and nature from the disease known as “Anbury” or “Finger-and-Toe” in

Turnips, and as "Club" in Cabbage, which are caused by a fungus, yet the two attacks are often confused together, and, in the case of Cabbage, are often to be found on the same stock. As this point is often inquired about, and the same kinds of treatment and applications to the land are useful for getting rid of both the fungus and the insect-attack, the following remarks may be of some interest.

The notes on the gall-weevil are mainly from my own observations taken near Isleworth, where I have seen badly-infested Cabbage-stocks lying in cart-loads, where they have been thrown in heaps when the fields were cleared.

The Turnip and Cabbage-gall Weevil is a very small blackish beetle, about the eighth of an inch long, and of the shape figured (magnified) at p. 24, which shows the long fine proboscis, or snout, with the "elbowed" antennæ, or horns, placed on each side; also the channel along the middle of the thorax, and striæ, or furrows, along the wing-cases. The colour is black, with grey or white scales beneath, and sometimes a sprinkling of them above.

The method of attack is for the female either to make little holes with her proboscis, in which to deposit her eggs,—usually one in each hole,—or else simply to lay them on the surface of the Turnip-bulb, or Cabbage-stock or root, as the case may be. The maggots which hatch from these eggs are, as figured, thick and legless, very much wrinkled across, and white or yellowish. The head is furnished with strong chestnut-coloured jaws, darker at the tips, and armed (see figure, p. 26) with two teeth, and also sometimes with a third much smaller tooth on the inner side. The maggots, which I took from Swede-galls, differed slightly from those taken out of Turnip or Cabbage-galls in the two teeth being smaller, and the third, or tubercle, being absent (see fig. 1, A, B, C, p. 26); also, as might be expected, in being, like their food, of a more ochreous colour.

The gall-maggots are for some time hardly observable within the galls, which their presence has given rise to, but after a while, as they grow and eat out the centre of the gall with their strong jaws, they may be found either singly, in separate galls, or (where the galls are in clusters) there may be a group of little cells, communicating with each other inside, and each with a maggot within.

When full-fed the maggots leave the galls and make earth-cases, in which they turn to the pupal or chrysalis state. These cases they form by first securing a little bit of the material lying close to them with the tip of the tail, and then, with their jaws, and moisture from the mouth, fastening on to this beginning little morsels of pebble, sticks, earth, or whatever may be within reach, and so forming a solid case around themselves. If disturbed in this operation, the maggot will drag its partly-formed case with it, or if the case, when newly

made, is broken, I have seen the maggot complete it again. The quantity of moisture used in fastening the particles of earth together is so great, that wet patches can be observed inside the case as the work goes on. When complete the case, or earth-cocoon, is smooth inside, and lined with a kind of whitish or yellowish gummy material, and it lies (as figured below) in a hollow in the ground from which the

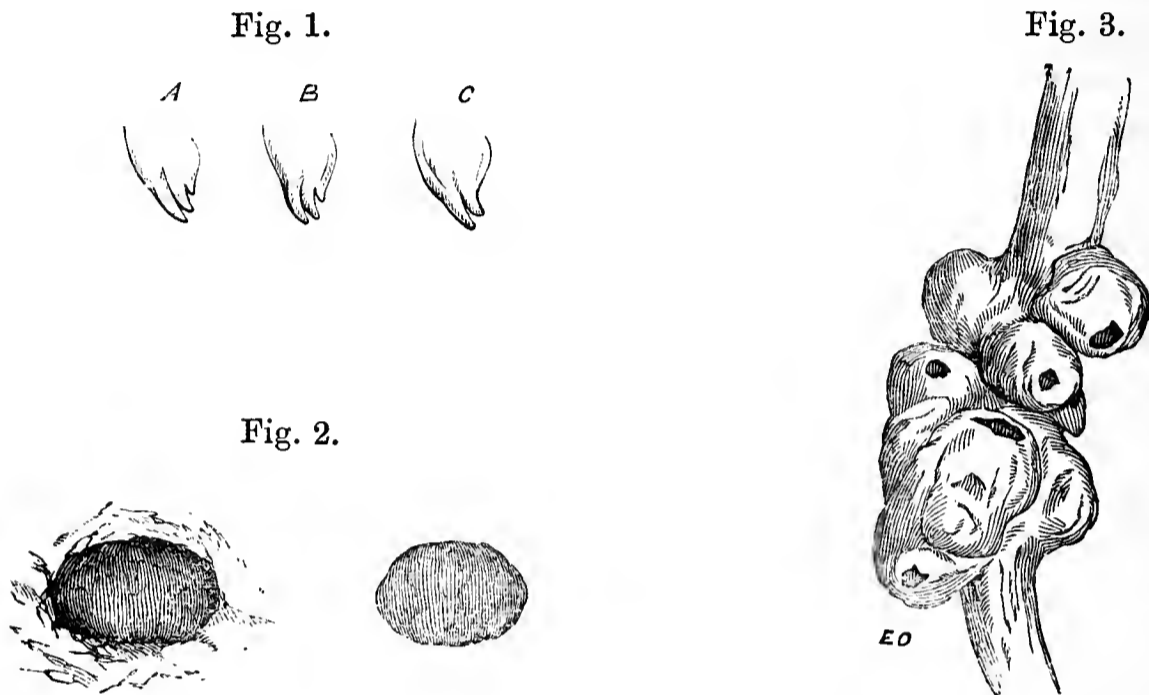


Fig. 1.—A, B, C. Jaws of Turnip and Cabbage and Swede-Turnip weevil larva respectively, magnified.

Fig. 2.—Earth-cocoon of the gall-weevil chrysalis, and chamber in which it lies, magnified.

Fig. 3.—Cabbage-root, with galls of the weevil *C. sulcicollis*.*

material was taken. The time occupied from the maggot going into the ground to the perfect beetle coming up from it was between fifty-four days and two months in the middle of summer, in the instances that I watched.

The beetles may be found from spring onwards during summer, and some maggots still in the galls in winter; and the maggots bear being frozen hard without the slightest apparent injury, for on being thawed they will at once go down into soft earth, and begin to build up their earth-cases.

Prevention and Remedy.

With regard to Turnips and Swedes, the simple fact that in common rotation the crop comes at sufficient interval to prevent the ground harbouring the weevils, or morsels of maggot-infested pieces from the preceding root-crop, is usually a great security; but where, in Cabbage-growing districts, one Cabbage crop may be put in after

* The above figure, from my paper on *C. sulcicollis*, in the 'Entomologist,' vol. x., p. 246, is inserted by kind permission of Mr. T. P. Newman.

another, with only interval enough to lay a heavy application of manure on the land, the weevils are likely fairly to swarm.

The following observation, forwarded on June 22nd last, from a Sussex correspondent, gives some idea of the manner in which infestation may remain from a preceding crop :--

“ I have just planted a rather large piece of ground with Brussels-sprouts, on land where sheep had fed off Rape this spring, and I find that many of the small Rape-stems lying in and about the ground have galls on them, evidently formed by the Cabbage-gall Weevil; some of these galls are empty, and some have maggots in them.”

These maggots would, of course, carry on infestation, and where Cabbage is a constant crop of the district, it is very important to burn all the old stocks, or, at least, so destroy them that there is no possibility of the maggots causing recurrence of the trouble. If the stems are only lightly buried, or thrown to rot-heaps,—this does no good; for it will not hurt the maggots, and in due time the beetles will force their way up again to start new attack.

Rotation with other crops is the best cure, but where Cabbage (including under this term Rape, Cauliflowers, Brussels-sprouts, or other plants of the Cabbage tribe, wild or cultivated, that are liable to this infestation) must be constantly grown, then the best application to the land appears to be gas-lime. This has been found useful for clearing infested ground, applied broadcast and pointed in, or as a dressing accompanied by deep trenching.* Where the area to be dealt with is not too great, trenching, if thoroughly done, is of great service in getting rid of attack, for if the top spit of land, with the maggot-cocoons or weevils in it, is turned down, and the lowest spit laid on the top, then the working part of the land (for a while at least) is purified from the infestation. Dressings of fresh field-soil are very useful in infested gardens.

In planting seedlings, those that are already galled should be rejected, or, if possible, the galls should be removed. Wood-ashes are said to be a good preventive for attack on the roots, and dressings thrown on of sand, or ashes, or dry earth, with paraffin added in the proportion of one quart to a bushel of the dry material, would be very likely to be of service in preventing the weevils going down for egg-laying.

The diseased growths known as “Club” in Cabbage, and as “Anbury” or sometimes “Finger-and-Toe” in Turnips, consisting of swollen masses and misformed roots, followed in bad cases by cracking and bursting of the surface, and putrefaction are only too well known.

* For method of application, see p. 30.

In Germany the disease is more or less known by a word signifying rupture or hernia, or in combination, a breaking or decay. These diseased growths are easily distinguishable from weevil-galls, which are only knobs, or clusters of knobs, with a maggot inside each, or an eaten-out cell with a hole in the side showing where the maggot has been. This "Anbury" or "Club" disease, caused not by insects, but by a kind of fungus known as "Slime-fungus," scientifically as the *Plasmodiophora brassicæ*, are not unfrequently sent me. I append a short note of its cause and the treatment for its cure, taken mainly from the chapter on this fungus given by Mr. Worthington G. Smith, in his serviceable volume on 'Diseases of Field and Garden Crops.'*

This peculiar slime-fungus was discovered, in 1876 by M. Woronin, to be the cause of "Club," and (without going into the minutiae of growth), may be generally described as a mass of matter which has a power of creeping onwards by what are somewhat like arm-like processes, into which the material of the central mass or *plasmodium* presses. This mass, outside its enclosing layer, has been observed to be further enclosed in a coat of mucilage, "which is sometimes left behind by the progressing *plasmodium*, like a trail of slime from a slug." This slime-fungus is stated to be often present in soil, but when infested pieces of root are left about, the fungus, or the composing parts of it called *plasmodia*, are washed by rain from the decaying "Club," or "Anbury"-diseased root, on to the ground where they live on in a condition in which the fungus will grow on so as to start attack on fresh plants of the kinds which it infests, which it may reach.

Details of experiments are given in which seedling Turnips on fresh soil remained *undiseased*, whilst those which were grown from seed sown amongst earth with broken-up "Club" in it, became *fatally diseased*.

It appears to be proved that the fungus in dilute condition is absorbed like any ordinary moisture or moist food by the rootlets of the Turnip or Cabbage, and thus the disease is conveyed into the plant-system. Further, it appears that the fungus may remain on from one year to another after bad infestation.

Some very important means of prevention and remedy turn on the above points, namely, not to allow Turnip- or Cabbage-roots diseased with "Club" or "Anbury" to remain on the land, or to be thrown to refuse or dung-heaps, whence the infestation is quite sure to be carried back to the land with the enrichment. Also on land which is known to be specially liable to suffer from this disease, the length of time in

* 'Diseases of Field and Garden Crops,' by Worthington G. Smith; with one hundred and forty-three illustrations. Macmillan, London.

the rotation before Turnips or Cabbage are admitted again should be increased. Where it can be done thoroughly, trenching so as to put the fungus-infested soil below and fresh above is good treatment.

Lime or manures, such as chalk, and others which contain lime, have been amongst the applications which have been advised for land subject to "Club" or "Anbury," and amongst these, as far as I can judge from such information as I have access to, and my own personal observations for several years, gas-lime stands first.

So long ago as 1859, the late Dr. Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society, noticed (in his paper on "Anbury," in the 20th volume of the Journal of the Society) a case in point. On a sandy field at Ashton Keynes, near Cirencester, Dr. Voelcker found the Turnips diseased with "Anbury" to such an extent that there was scarcely a sound Turnip to be seen, excepting on two spots. On one of these spots, not many yards square, the Turnips were nearly all sound, and bits of a whitish substance were on the surface, which, on investigation, proved to be remains from a cart-load of gas-lime which had been unloaded there in the year before. On the other spot likewise there was hardly one diseased Turnip to be found, and in this case the Turnips grew where a dung-heap had been set up in previous years; and to this Dr. Voelcker attributed the greater proportion of lime which was found in the soil at this spot to what was found in the field generally. The analysis of soil from the gas-limed part showed, as might be expected, presence of gas-lime.

In a note on the uses of gas-lime, published some time after (see foot-note, p. 31), Dr. Voelcker mentioned that at his recommendation the occupier applied a heavy dose of gas-lime, which completely cured the evil.

In my own garden near Isleworth, I found the Cabbages "clubbed" to a very serious extent, and, experimentally, I had the cleared ground in the kitchen-garden dressed throughout with gas-lime as a regular thing in the autumn. It was laid on so as to be a light sprinkling, if absolutely fresh, and more thickly if the gas-lime had been exposed to the air, and, in due course of winter working, it was forked in. Under this treatment the Cabbage ceased to "club," so that (as far as I saw or had means of judging) the disease, before I moved to St. Albans in 1887, had ceased to infest the soil. About the year 1874, when I went to live near Isleworth, I could have gas-lime for the asking at the Brentford works, but before I left its use had increased so much in that Cabbage-growing district, that Mr. Wilmot, well known as one of the leading market-growers, said that they should not know how to do without it; and personally I found that I had to pay from 6s. to 7s. 6d. a load for what previously had only cost cartage.

The following note, sent me by Mr. Herbert S. Daines, of Woolfall Hall Farm, Huyton, Liverpool, refers to use of "waste" from alkali works, which is employed very serviceably in the same manner as gas-lime. The analysis of the "waste" from the Widnes works, which I was favoured with a few years ago, showed what was submitted then to have rather a larger proportion of the lime constituents present in it than in ordinary gas-lime (each, of course, being presumed to be in fresh condition, and therefore it required greater caution in use at first). After exposure to the air, and thus being altered in chemical condition, it was found to answer well, as noticed below, when used in very large quantities. Mr. Daines' observation draws attention, amongst other points, to the method of exposure of the "waste" to the air (*i. e.*, oxidation) to turn it to a valuable manure.

"*Re* 'waste,' for use in product similar to the Widnes article obtained from St. Helens: our practice is to cart it in summer, lay it up in a huge heap, turn it over thoroughly to oxidise it, then, in autumn, spread on stubble, leaving exposed for several weeks in order that oxidation may still further be accomplished; the result is, we obtain a sulphate of lime, which, as you know, is a useful manure. If land be very foul, the 'waste' may be applied in a crude state, but care must be taken in spreading, and sufficient time allowed before ploughing in: weight per acre, ten to twelve tons."

Without going into the chemical questions involved, in consideration of the constituents of soil adapted for Turnip land, it seems to me that the gas-lime acts on both the fungoid and the insect-attack by its acrid and poisonous qualities.

The weevil-grub builds up its cocoon of little bits surrounding it, which it moistens from its mouth, and the dilute gas-lime may, I think, be very detrimental to it; and, in the case of the "Slime-fungus," the good which has been proved to be done appears likely to be caused by,—in some cases killing it downright with the gas-lime, which will kill much stronger vegetable organisms, and in others by giving food to the fungus, on which *it perishes*.

With regard to amount of gas-lime that can be safely used, and the time of application, it should be laid on arable land when clear of crop in autumn or winter, and allowed to be exposed to the air for at least four weeks before being ploughed in. Thus, by exposure to the air, the nature of the lime, which at first does good by its acrid properties, killing what is subjected to it, is so altered that it is changed to sulphate of lime, a manure suitable for all land on which gypsum is of use, and especially serviceable to many leguminous crops and Turnips.

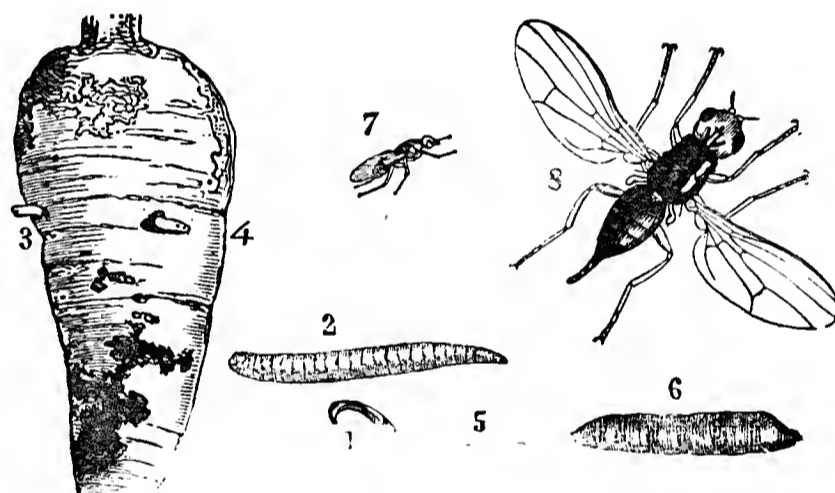
The quantity mentioned by Dr. Voelcker as safe is two tons per acre, applied as above; but the further amount that is desirable depends on the strength of the gas-lime, the nature of the soil, and

other points, as nature of succeeding crop, and time that can be allowed for the gas-lime or "waste" to be exposed. Those who wish to go into the nature and uses of gas-lime as an application to the soil will find excellent observations in Dr. Voelcker's four-page leaflet, of which the title is given below.*

I must also add on my own account that, although a fungoid disease and its cure do not lie in my own department, yet, as they have been constantly brought under my notice and study for years, I hope I shall not be considered trespassing out of due limits in giving the above notes much based on the observations of two such widely-known and eminent authorities as Mr. Worthington G. Smith and the late Dr. Aug. Voelcker.

CARROT.

Carrot and Parsnip Fly; "Rust." *Psila rosæ*, Fab.



PSILA ROSÆ.

1, 2, and 3, maggots, nat. size and magnified; 4, infested Carrot; 5 and 6, chrysalids; and 7 and 8, Carrot Fly, nat. size and magnified.

"Rust" in Carrots is so called from the peculiar yellowish or rusty colour of the parts injured by the Carrot Fly maggot. Whilst the Carrots are still young, the maggot-galleries are often, or most commonly, to be observed towards the outside of the lower part of the root; later on they may be found in any part of it, and sometimes penetrating to the middle.

The presence of the mischief may often be known by the yellow colour and the withering of the leaves, and, if a root is carefully withdrawn from the soil, the little maggots may be seen sticking (by

* "On the Composition and Use of Gas-lime in Agriculture," by Dr. Augustus Voelcker; four pages. Reprinted from the 'Journal of Gas-lighting,' &c. Printed by W. King and Sell, 12, Gough Square, Fleet Street, London. (Probably procurable on application, or through a bookseller.)

about half their length), out of their burrows, as figured above. The attack affects Parsnips as well as Carrots.

The maggot, when full-grown, is about a quarter of an inch long, whitish or yellowish in colour, shiny and parchment-like, cylindrical, legless, blunt at the tail, and prolonged at the head extremity, which contains the black, hooked tip, forked at the base, with which the maggot makes its way into the roots. When full-fed (in summer) the maggots leave the roots, and turn to rusty-brown or ochre-coloured chrysalids in the ground (see figure), from which the fly comes out in about three or four weeks; so that new attack may be constantly arising throughout the warm part of the year.

The fly (figured at p. 31) is two-winged, about a quarter of an inch long, shining black with a green tinge, and with roundish and rusty ochry head, and yellow legs. The two wings are iridescent, with yellowish veins.

Both chrysalids and maggots may be found in the winter, and the beginning of the year's attack is caused by the flies coming out of the hibernated pupæ, or chrysalis-cases, and laying their eggs by the Carrot-plants a little below the surface of the ground.

Last season application was made regarding the attack from Falconer's Hill, Daventry, on July 14th, as a small white worm, which was then found in multitudes, and "destroying Carrots and Parsnips with fearful rapidity. . . . The land is of excellent quality, well-manured and cleaned, one portion dressed last year with gaslime, the other with farmyard-manure, and both suffering alike."

A little later on, I had notes of the same attack from Mr. Cyrus Morrall, of Plas Warren, Ellesmere, Salop, who mentioned that "a good many in the neighbourhood have had their Carrots attacked. The ravages seem to have been worst where the Carrots were thinned early, or where (in one instance) they have been grown on the same ground as last year."

Prevention and Remedy.

The point immediately above is one of great importance in Carrot cultivation. Where Carrots have been grown (and at all infested) the year before, most of the maggots will have gone into the ground in autumn, and there, or possibly in stray bits of infested Carrot, they will have turned to chrysalids, from which the flies will come out to attack the new crop of Carrots. Where land is thus infested, trenching, so as to throw the top spit below and bury it down with the pests in it, is the best remedy, if the trenched-down soil can be left undisturbed; if it is brought up again before June, the trenching would be no use; but failing this, clearing away all the bits of decaying Carrot and forking the surface does some good. By this means many of the maggots or chrysalids are thrown on the surface,

and if a sprinkling (about enough to give the appearance of hoar-frost) of gas-lime, in absolutely fresh and caustic state, was thrown on the surface, it could not fail to kill those of the pests that it touched. Of course, as before mentioned (see p. 30), some weeks must be allowed to elapse before land so treated is safe for cropping or sowing. Where ground has been rough-dug at the beginning of winter, sprinkled with gas-lime, and the gas-lime then pointed in about four inches deep, this plan has answered; the Carrots have been found to escape "rust," whilst those not so treated were destroyed.

For prevention of attack generally, what is needed is a well-prepared soil which will push on good growth of the plant, and also not be liable to crack, and also such management of ground and plants at thinning-time as will not allow the Carrot Fly to get down to lay its eggs by the roots. *This point is the important matter in prevention of the Carrot-grub attack, commonly known as "rust."* If the fly cannot get to the roots to lay her eggs, obviously there will be no maggots to harm them, and the reason why Carrots which have done well up to thinning-time often fail afterwards, is *because the ground is thrown open* in the operation.

To get over this point, treatment which will close up the soil as much as possible after thinning is needed, and waterings, with an addition of something which will be deterrent to the fly, and also will push on vigorous growth (as guano or soot and water), are especially useful. I have myself stopped attack (which only commenced after thinning) by watering with a very dilute form of a preparation called Soluble Phenyle. The injury was stopped, and the plants thrown into vigorous growth. Paraffin has been found very successful in checking attack. If applied in fluid-state, care must be taken that it is not strong enough to burn the plants, and probably a little in a solution of soft-soap would be the safest form: 3 lbs. of soft-soap and one pint of paraffin in 25 gallons of water, raised to boiling-point in mixing, would perhaps be as good a proportion as any; but no rule can be given—trial must be made. Paraffin dressings would be of use, mixed with sand, dry earth, ashes, or other dry material. A proportion of a quart of paraffin to a bushel of the dry material has been found not to injure perfectly tender young shoots of other plants.

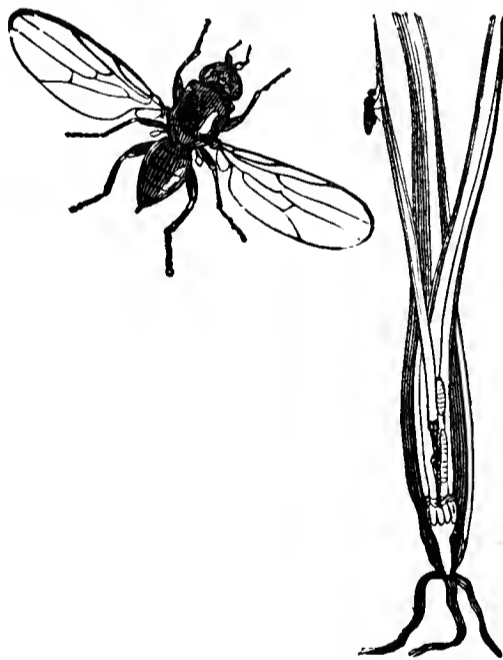
But the great point is to keep the Carrots protected from possibility of fly getting at them. In the heavy thunderstorm of June 26th, in 1888, a rainfall at the rate of nearly two inches an hour fell during about three-quarters of an hour at St. Albans, sweeping all that was movable before it in gardens or road, down the steep slope of Holywell Hill. In my own garden a bed of Carrots, upwards of 63 ft. long and about 4 ft. wide, lay across the slope, with plots of garden ground above, and a thick border of box varying from 3 to 4 ins. below it.

This border stopped the fine soil swept down the slope, so that the Carrots were thoroughly earthed up to the level of the top of the border with good soil fitted into every cranny. The result was satisfactory in the highest degree. The Carrot-foliage was luxuriant, and in autumn we have housed a crop of well-grown delicate roots without a taint of "rust." One cannot command the misfortune of a sweeping flood to help one's Carrots, but the unusual occurrence showed the success of the principle of thorough protection.

It does not appear desirable to enter on the methods of prevention at full length here, as I have previously given them elsewhere,* but the principle of prevention may be shortly described as sowing on land free of infestation, and so well prepared beforehand that the roots will have a good luxuriant growth; using all means at thinning-time to keep the fly from being able to get at the roots, amongst which watering with applications deterrent to the fly and stimulating to the Carrots are desirable, and, if it could be managed, earthing up the Carrots; also being careful to remove all drawn plants or broken pieces away from the beds at thinning-time, as these specially attract the fly.

CORN.

Frit Fly. *Oscinis frit*, L. (? *Oscinis vastator*, Curtis).



OSCINIS VASTATOR.

Perfect fly, nat. size and magnified; and attacked plant, with maggot inside.†

* See my 'Report on Injurious Insects for 1880,' and also 'Manual of Injurious Insects,' published by Simpkin, Marshall & Co., Stationers' Hall Court, London, E.C.

† The *Oscinis vastator* of Curtis bears such a strong resemblance to the *Oscinis frit*, which is the subject of the present paper—even if it is not absolutely the same—that I have used Curtis's figure to give the appearance of the insect and its method of injury.

During the early part of last summer much damage was done to young plants, both of Wheat and Oats, by fly-maggots feeding within the central shoot. No difference was observable in the method of injury to each kind of crop, but on microscopic examination of the small, white, legless maggots that caused it, these proved to be clearly distinguishable, one kind infesting the Wheat-plants, the other the Oat-plants. In due time the maggots went through their changes up to the perfect flies, showing the Wheat to be infested by the maggots of a small two-winged fly, scientifically the *Hylemia coarctata* (which is described further on in this Report under the heading of "Wheat-bulb Maggot"), and the Oat-plants to be infested by the maggots of the "Frit Fly," the *Oscinis frit*.

This is a small, very brightly shining, black, two-winged fly, rather under the eighth of an inch in length. "Legs black, the tarsi (feet) of the hinder pair, with the exception of the end joints, yellow; the fore feet brown-yellow, the midmost often much darker; the wings transparent, somewhat brown at the fore edge."* It is also distinguishable by its peculiar habit of dancing or skipping about, which has been very noticeable in the specimens I have reared. This fly is common in various parts of the Continent, and especially recorded as present in France, Germany, and Sweden. It attacks both Oats and Barley in the manner only too well known to us by last season's damages, when so much of the young Oat-plant was destroyed in May and June by the maggot feeding within the young plant. But besides this early attack, great damage was recorded formerly in Sweden from the second brood, the maggots of which fed on the soft grains in the ears of Barley, and thereby caused the light worthless development of the corn, known in Swedish as "frits," whence the name of the fly.

Up to the present year, I am not aware of this attack being prevalent to an observably injurious extent in Britain, although the presence of the *Oscinis vastator*, Curtis, which appears, as far as can be made out, to be the same as the *O. frit*, Linn., was watched and recorded in 1844 by John Curtis, in his 'Farm Insects.' In 1881 I was favoured, by Mr. R. H. Meade, of Bradford, with the information that the *Oscinis frit* had been observed in the autumn of that year in swarms in an outbuilding, in the lofts of which a lot of newly-threshed Barley had been stored; but it was not until last year (1887) that I was able to watch this attack throughout its course up to development of the fly as a regular field attack to young Oat-plants. To be absolutely certain as to the identity of the fly, I submitted samples of what I had reared to Mr. R. H. Meade, who was good

* For description of the "Frit Fly," see 'Fauna Austriaca die Fliegen,' by Dr. J. R. Schiner, ii. Theil, p. 224; and for description in all its stages, with life-history, see 'Praktische Insekten Kunde,' by Dr. E. L. Taschenberg, pt. iv., p. 151.

enough, both last year and again this year (with samples from the far worse attack of this season), to examine them, and confirmed my opinion that they were the true *Oscinis frit* of Linnæus.

The maggot is about the eighth of an inch long, whitish, legless, cylindrical, bluntly pointed at the head-end, which is furnished with a strong pair of curved mouth-hooks, and on each side near the head it has a branched spiracle. At the blunt hinder extremity it has two projecting wart-like spiracles.

The chrysalis is rather smaller than the maggot, cylindrical, and rather more pointed at the front than the hinder extremity, which, from the strong projection of the two wart-like processes, has the appearance of being cleft, or almost bluntly forked. In the specimens of empty chrysalis-cases now before me, I find the peculiar dark, somewhat star-like, marking, which is described by Dr. Taschenberg, and was also figured in a series of sketches of details of the puparium, with which I was favoured by Prof. Harker, of the Royal Agricultural College, Cirencester. In the early condition of puparium the branched external spiracle on each side near the head-extremity is very clearly observable. During the course of last year's attack, I have been able to secure specimens of the larva (or maggot) of the puparium or chrysalis, both with contents and empty, and of the perfect fly; so that I shall have no difficulty, if the attack should recur, in identifying it.

The injury is caused by the maggot feeding in the heart of the young corn-plant a little above ground-level, and eating away the centre, so that the shoot above the eaten part is destroyed, and the damage that is going forward then becomes noticeable from the injured shoots turning brown, and withering instead of continuing their growth. This was chiefly observed in last year's attacks at the end of June, and in the earlier part of July, at which time the maggots were leaving the inside of the infested young plants to turn to chrysalids in the dead or dying remains of the outside leafage: from these chrysalids the flies began to appear about July 9th. We had no notes of observations of the method of the beginning of the attack to the young plants, but this is stated by Dr. E. L. Taschenberg (see reference, p. 35) to be for the female to lay her eggs on the under side of a leaf, and for the maggots from these eggs to eat into the heart of the young plant, and then begin the mischief, which we know only too well.

On June 27th, I received the following communication from Mr. Geo. Thomas, of Coosenwartha, Scorrier, Cornwall, accompanied by specimens of yellow and diseased Oat-plants:—"There are great complaints in this neighbourhood of the Oat-crop being destroyed by a small maggot, which eats the centre of the stalk, and is perceived

when the corn is about a foot or eighteen inches high. It will then droop and decay, fresh shoots starting at the bottom. I enclose you samples of the damaged corn with maggot within. It is a peculiar fact that in 'dredge-corn' (*i. e.*, Barley and Oat mixed), the maggot will attack the Oats and leave the Barley."

At the same date I also received information, from Launceston, that much of the Oat-crop in that neighbourhood was badly affected, like specimen sent, and information was urgently requested, "as in the district of Launceston we are likely to get half our crop destroyed."
—E. J.

On June 29th a communication was forwarded me, on the part of Mr. Thos. Olver, of Truro, mentioning that there was a disease affecting the Oat-crop in the district, which in many instances threatened to destroy the whole crop, the cause of which was clearly an insect."

In these specimens I found the small white maggot, and also the pale brown, recently-formed chrysalis of an *Oscinis*, which, by rearing from various specimens, afterwards showed the attack to be of *O. frit*, the true Frit Fly.

At first I had great difficulty in identification of the attack, owing to the plants being often much dried in transmission, and also from the very small size of the white maggot, even if present in the stems, which in many cases it was not, as the maggots were then leaving the destroyed shoot to turn to chrysalids in the sheathing-leaves. I had therefore to judge of these specimens being damaged by "Frit Fly" from the resemblance in all points noticeable to specimens, of which only too many unfortunately a little later proved Frit Fly presence with certainty.

On July 2nd, Mr. Geo. Thomas, writing again from Scorrier, mentioned that he could not since the date (June 27th), when he had forwarded specimens with maggots in them, been able to find any. Rain had fallen, and Mr. Thomas observed:—"I have twenty acres of Oats now recovering; that means the maggot has stopped, and the attacked plants are now recovering, sending forth fresh shoots." May I suggest (say) 5 cwt. wet sea-sand, 3 cwt. salt, $\frac{1}{4}$ cwt. sulphur, to be sown per acre broadcast in rain or on a dew? If the land is poor, a little of Norrington's "Nitro" would be a great advantage.

Mr. Thomas also forwarded a note from the 'Western Morning News' of Saturday, June 30th, mentioning the fear that prevailed that the Oat-crops in N. Devon would prove a failure. The crops were reported to have then a yellow seared appearance from the number of dead stalks, and the destruction to be owing to a small white maggot secreted in the very heart of the stalk. This had been found, after

careful examination, by Mr. Thomas Andrew (a considerable farmer, residing in the parish of Clovelly).

On June 30th, I had specimens of chrysalis of Frit Fly from Allerford, near Taunton, Somerset. So far as was generally observable, the appearance of the pest in South Devon seems to have been just a little later, for, on July 2nd, I received specimens of injured Oats and small brown chrysalids of the Frit Fly from Mr. R. R. Velvin, of Upton Farm, Ivybridge, S. Devon, with a note that they were taken from a field of what at one time promised a splendid crop. "They were attacked in this way about a month ago, and now quite half of them are like the enclosed. I may say they are all over the field just alike. I see by the newspaper that the Oat-crop in N. Devon has been very generally attacked in a similar way, but, as far as I can hear, mine is a solitary case in this neighbourhood."

A few days later,—that is, on July 2nd,—I had a report from Mr. John Bulteel, of Painfleete, Ivybridge (S. Devon), showing that the Frit Fly attack had then become noticeable. He said:—"Nothing could have been more luxuriant than our Oat-crop at an early stage, but at present the whole aspect has changed, the fields being one mass of patches, getting worse and worse daily. I presume the crop is suffering in the same way as is going on in the north of Devon."

Specimens of diseased Oat-plants were sent with the white maggots, and some chrysalids, but the change from one condition to the other was now going on so rapidly, that when I received them all were in chrysalis condition. The plants were stunted in growth by the attack, and one had as many as twelve spindly shoots, some of them killed.

On July 8th a note was sent from Treluddra, Newlyn East, of the great destruction made on the Oat-crop in that part of Cornwall by what proved, from specimens sent, to be the same attack.

On July 17th I was favoured with a complete set of specimens, including maggot, chrysalis, and perfect Frit Fly, sent me from Bodmin by Mr. Richard V. Tellan. He remarked:—"A great deal of damage has been done this season to the Oat-crop in this district by a small insect, which has destroyed the young panicle before it has had time to develop. I should suppose that the egg was deposited as soon as the stalk began to spring from the roots." Mr. Tellan mentioned, with regard to the specimens enclosed, that he forwarded "the perfect insect and pupa" (chrysalis). "The insect was developed from the pupa in the glass tube, where I had placed them. They were taken from under the sheath of the Oat-straw. There is a single specimen of the larva (living) in the tube. Most of them had changed to the pupa-state before my attention was called to them."

The above communication is very valuable, as it gives the pest in all its stages of maggot, chrysalis, and perfect fly, and thus proves,

besides what was reared from other specimens, that the fly, which on examination was identified as the true Frit Fly, *Oscinis frit*, was the cause of the widespread loss.

The following communication from Tregaswith, St. Columb, Cornwall, is also valuable, as showing how, throughout a district, the crop showed no sign of what was going on till the mischief was done. Mr. James Stick, jun., observed:—"I am one of a great number of farmers who are suffering in this district through the failure of spring corn, chiefly Oats. The crop came up, and looked well until the latter part of May, when it appeared to be checked in its growing, and gradually wasted away, until what promised to be a heavy crop will only be a third. I have found, on examining the stalk, a very small maggot, one-eighth of an inch in length, in the centre of the straw."

The above notes refer to the Oat-attack in the South-west of England, in various localities from Taunton in Somerset to the western extremity of Cornwall. Besides the above, I had notes of the attack from near Reading, from Tetsworth, Oxon, from Cirencester, and also from a locality in Kent, and from Oakley, near Bedford.

On July 2nd, Mr. John Watson, writing from the Estate Office, Sherburn, Tetsworth, forwarded a plant of Oats as a sample of the condition of one field, with the mention that he had found about ten larvæ and pupæ in each of the plants which he had examined. He observed:—"The Oats were drilled about the middle of April on part of a field after roots fed off by sheep, the other part of the field being planted with Barley, which does not appear to have been attacked. . . . I may mention that the field is subject to annual attacks of 'wild' oats. Several pieces of Oats in this neighbourhood have partially failed, apparently in the same way, but I have not been able to examine them closely. I do not think the crops sufficiently injured to make me plough it up, and I suppose we cannot do anything now to prevent further damage."

The plants sent were mostly still of a good green, and from about two or three to four inches high, but had some pale, long, straggling shoots. The chrysalids, which were similar to the other specimens of *Oscinis frit* that were sent from many localities, were in the partly-decayed leaf-sheaths round the base of the small shoots. A few days after,—that is, on July 2nd,—Mr. Watson wrote further to mention that they had decided to leave the Oats alone, "as the last few days of warm showery weather have much improved them, and the larvæ have almost all changed."

On July 4th, Mr. Harker, Professor of Zoology at the Royal Agricultural College, Cirencester, wrote me that specimens had been shown him of Oat-stems infested by a small dipteron in the pupa-state, which, from microscopical examination, he conjectured would

prove to be *Oscinis*; and a few days later (on July 7th) he further wrote that he had then "larvæ, pupæ, and, I think, two imagines," and he considered the larvæ appeared to correspond with that of *Oscinis vastator* of Curtis, which remark is of a good deal of interest, as confirming the opinion of Dr. E. L. Taschenberg that the Frit Fly, the *Oscinis frit* (which our English specimens proved to be when the perfect fly developed) and the *Oscinis vastator* of Curtis are the same species.

Regarding amount of attack, Mr. W. McCracken, Professor of Agriculture, Royal Agricultural College, Cirencester, kindly favoured me, on July 4th, with the following useful note:—"I send you a few specimens of Oat affected by a small grub. I am sorry to say a very large area in this part of the country has suffered similarly. The crop from which these specimens are taken is practically destroyed, except for hay. Winter Oats and all early spring-sown fields seem to have escaped." And a few days later Prof. Harker wrote further on this point:—"Since writing you we have examined a field of Oats quite near to the College. The damage is quite appalling; Mr. McCracken roughly estimates 90 per cent. of crop gone."

The last report of damages which I received, with specimens in maggot and chrysalis-state accompanying, was forwarded to me, on July 9th and 12th, by Mr. W. Gostling, from Oakley, Bedford, with the observation that the maggot had injured several crops of Black Tartarian Oats in that neighbourhood. Likewise, that the whole of his own Oats—some sixty acres—were injured in a greater or less degree, although he had applied 10 cwt. of soot per acre to some, and 1½ cwt. of nitrate of soda to the rest in the early stage of growth. The plants forwarded were of a good green colour, and from about four to seven inches in height of shoot, but inside they were destroyed by the maggots. In some instances traces of the working, or even the maggot itself, was to be found in the forming (or what should have been the forming) stem at from three-quarters of an inch to an inch and a half from the surface of the ground. The peculiar branched spiracles were very noticeable. Chrysalids were present, similar in appearance to other specimens which I received of those of Frit Fly, as well as maggots.

Summary.—As injury from Frit Fly attack appears to be unusual in this country to the amount to which it occurred last year, a short summary of the above observations may be useful. Looking at the geographical distribution of the attack (so far as appears from the notes sent to me), it seems to have been most prevalent in Devon and Cornwall. It was reported from the neighbourhoods of Launceston, Bodmin, St. Columb, and Truro; from Scorrier, between Truro and Redruth; and also from Newlyn East, near Penzance, in Cornwall.

It was also reported from both North and South Devon, and from Taunton, in Somersetshire. More inland, I had notices of it from the neighbourhoods of Cirencester, Reading, Tetsworth, and Oakley, near Bedford; and, later on, specimens of the injury caused by it to Oats near Norwich.

It will be observed that in the case of the greater part of the attacks reported, that they were mentioned as occurring not merely to special fields, but over districts, or neighbourhoods, or that many farmers in the neighbourhood written from were suffering: near Launceston it was feared half the crop would be destroyed; another note from the neighbourhood of St. Columb mentioned that the crop, which promised to be heavy, would only be a third; and in a rather more detailed observation, with which I was favoured from the Royal Agricultural College, Cirencester, it was mentioned by Mr. McCracken, Professor of Agriculture, that a large area in that part of the country had suffered, and he roughly estimated the loss on one field near the College at 90 per cent. The first notice of something being amiss with the plants appears to have been taken about the end of May. One observation notes that the crops came up and looked well until the latter part of May, when growth appeared to be checked; another, that the injury was first noticed about the beginning of June, with special mention of the rapid change in appearance of the maggot-gnawed plants from their previously healthy or even luxuriant condition; and another observer reports the injury being first observed when the crop was from a foot to eighteen inches high.

About June 27th the maggots were turning to chrysalids amongst the outer leafage of the destroyed shoots, and towards July 9th, Frit Flies were appearing from the chrysalids. So far as appeared the attack only affected Oat-plants, and notably, not Barley-plants. It was noted in one case as "a peculiar fact that in 'dredge-corn' (*i. e.*, Barley and Oats mixed), the maggot will attack the Oats and leave the Barley": in another instance mention was made of the damage being "on Oats drilled about the middle of April, . . . the other part of the field being planted with Barley, which does not appear to have been attacked."

Relatively to time of sowing of attacked crops, alluded to above, I had very few observations; but it was noted by Prof. McCracken, in his letter from the Royal Agricultural College, that "Winter Oats and all early spring-sown fields seem to have escaped."

From reports sent in autumn, it appeared that in some instances the attacked Oat-crops recovered partially. In the words of one observer:—"The crop of Oats has proved heavier than was expected at one time. The wet weather was favourable to the growth of the straw, so the side-shoots came to maturity, though generally very

late, and the crop ripened very unequally with very varying sample." —(R. V. T.). This unevenness in ripening was specially reported from other localities.

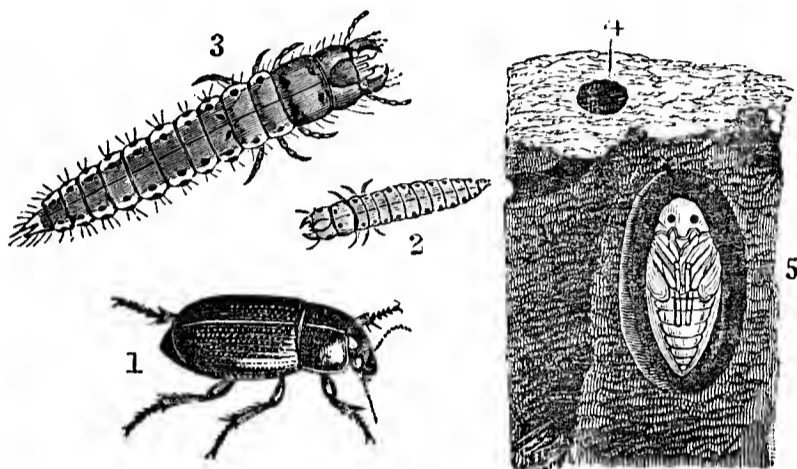
Looking at the point of bad Frit Fly attack being unknown before in this country, and that in Sweden and Bohemia respectively the maggots of the summer brood have been found feeding in ears of Barley, and amongst the grains in the Oat-heads, it appeared possible that the infestation might have been brought in foreign corn; but replies to enquiries did not bear this out. Information was given me that there was large importation of Swedish Oats into Bristol, from whence they are widely distributed; and a small quantity of Swedish Oats were sown near Bodmin in one instance, and conjecturally more, but there was no evidence given as to imported seed having been used where infestation occurred. The correspondents who favoured me with replies on the subject had used seed either home-grown or imported from Ireland.

Nevertheless, though as yet we have not had the summer attack in the Barley or Oat-ears reported in England, it might be worth consideration whether "pickling" seed before sowing would not be desirable, so as to guard against possibility of carrying eggs or chrysalids, which might furnish flies to renew attack, in it to the field. One means of probably lessening amount of loss is suggested by a remark in some of the foregoing observations. It is mentioned that, after the maggots turned to chrysalis-state, attacked plants (which had not been destroyed past all hope) threw out shoots, so that a crop was obtained, although, from inequality of ripening, it was very far from what was desirable. From this it would seem that, if a dressing of whatever nature was suitable to the kind of land, and also to Oat-crop generally, was given early in the attack, this would push on the uninjured shoot in time to give a fairly equal crop.

From the reports it appears that, if the growth had been brought about earlier, the damage would not have in some cases been great, and consequently that, if a stimulating dressing could be applied when the damage is *first beginning* to show, time enough in growth would be saved to have an even crop. When the damage is noticeable, the maggots that cause it have grown to such a size that it shows that the time of laying the eggs from which they were hatched has long been over, and that what shoots are not then infested will be safe. The nature of the dressing will be best judged of by agriculturists themselves; but in a series of experiments on Oats (noted further on under the head of "Tulip-root"), it has been found now for some years that sulphate of potash, or a mixture of sulphate of potash with sulphate of ammonia and phosphates, answer exceedingly well in bringing on a healthy crop.

Where it is possible, a rotation of crop which would leave out Oats for a while in the badly-infested districts, would be the surest method of all to prevent continuance of attack.

Corn Ground-beetle. (? *Zabrus gibbus*, Fab.)



ZABRUS GIBBUS.

1, beetle; 2, 3, grub, nat. size and magnified; 4, mouth of underground burrow of grub; 5, chrysalis.

The *Zabrus gibbus*, or gibbous "Corn Ground-beetle," does harm in both beetle and maggot-state. The beetle comes out at night, and, crawling up to the top of the corn-stems, eats the grain in the ears: the maggot feeds below ground, or near the surface on the young plant. Wheat, Rye, and Barley are recorded as being attacked on the Continent, but, although this species has been observed in various places in England, it was noted up to 1859 as *not* having been ascertained to have attacked the crops in England as it did on the Continent, and up to the past season I am not aware of it having done so. Then,—that is, about the end of January,—a beetle-grub was found to be doing great mischief to young Wheat-plants, something in the same way as wireworms, but variously described; sometimes the grubs were inside, sometimes they cut the plant through, and in one case I found the outer part frayed, as if chewed to pieces. Later on I had a note of the attacked Wheat appearing "*worried to death*," not cut off absolutely, which agrees with the excellent description by Dr. Taschenberg.

The beetle-grubs sent resembled the descriptions of those of the *Zabrus gibbus* very minutely, but I could not identify them with certainty, for if so, they were not nearly full-sized nor fully coloured. Still, after consultation, it appeared so unlikely that the grubs were of any other kind, that it seems desirable to give as much information as I could obtain, for reference in case of continuation of the attack.

The localities where most harm was done were in Hants, in the district of Lymington, and near Ryde, in the Isle of Wight. I had

also notes from Harlington, Middlesex; from near Bishop's Teignton, S. Devon; from near Ipswich; and I had also specimens brought me from a field near St. Albans. It is of some interest, in connection with the three first-named localities, to note that John Curtis mentions, in his 'Farm Insects,' p. 217, that he himself saw or was aware of the presence of the beetle in Hants, and the Isle of Wight, and near London, as well as in Norfolk and Kent.

The first communication I received on the subject of this beetle-grub was at the end of January, from Mr. Robert Newman, of the Church Farm, Harlington, Middlesex, accompanied by specimens of the grub, still too young to be fully coloured, and also a few blades of the injured corn. He observed:—"The smallest of them I found eating into the stalk; others were loose in the land."

On Feb. 7th, Mr. Edw. Carter reported, from Puckpool House, Ryde, Isle of Wight, with similar specimens accompanying:—"I send some grubs that are eating my Wheat; they have almost entirely destroyed three or four acres of Wheat of a tenant of mine,—oddly, they have attacked his red Wheat, but not his white, in the same field. I also send some plants that have been killed by the grubs."

In this case the plants were bitten through, or, in one instance, the outer leaf frayed out into long films.

On Feb. 11th, specimens of grubs damaging Wheat after "bent" were brought me from New House Farm, near St. Albans, by Mr. W. A. Dickinson. These beetle-grubs appeared like those from Harlington, and from near Ryde, excepting that they were darker. I placed them, and some from near Ryde, on turf in a flower-pot, and in a short time they all disappeared; some of them went down at once in the damp ground. About ten days later Mr. Dickinson called again with a few more specimens of the larvæ. He mentioned that almost the whole of the Wheat was destroyed, and they were ploughing it up. Also that there were few grubs now to be seen, but that the Wagtails followed the plough in such numbers, he thought most likely they were clearing these grubs away.

The two following letters, forwarded to me by the Editor of the 'Mark Lane Express' for reply (and which I give through his courtesy), are of much interest. It will be observed that they speak of the attack as being of a serious nature, and extending over some miles of country, and also of it not having been previously observed.

The following communication was sent by Mr. Geo. Marsh, from The Home Farm, East End, Lymington, on Feb. 15th, 1888:—

"I have enclosed two specimens of maggots, or small worms, found about 1½ in. deep in our Wheat-fields in this locality. As none of us here are able to identify them, it occurred to me that perhaps you could afford some information respecting them. Acres and acres

of young Wheat in this neighbourhood are seriously damaged, if not destroyed, by being bitten off in the soil; and, as far as I can make it out myself, the mischief is effected by the small brown worms, two of which I have sent in the box. The small white maggot was also found in the same position, and may also have had a share in the mischief. The brown ones are sometimes found partly inside the stalks, as if sucking the juices of the plant. As the effect will, I fear, be very disastrous, I thought it a matter of sufficient consequence to bring to your notice."

The following note, referring to the widespread injury caused by the grub, was sent from Winchester, on Feb. 16th, by Mr. J. Gill Comely:—

"An immense number of the worms, of which I take the liberty of sending you a few specimens, having appeared in the Wheat-plant in nearly all the land extending from Lymington to Beaulieu, and threatening to destroy the same, I venture to send a small box containing the same, and with hopes that you may be enabled (probably through Miss Ormerod) to inform me what is their name, and whether you are aware of any means by which their ravages can be either stopped or checked; as otherwise they will have to be ploughed in, but with full expectation of appearing again in the following crop of whatever character. The appearance in the Wheat is the same as from the effect of Wireworm, but of which we do not find any; and it is the same, whether manured with farmyard-dung or any other manure. We have ring-rolled and heavily pressed the land, but only a few of them have been destroyed."

The specimens sent with the two preceding letters were certainly beetle-grubs, and of the class of ground-beetles (scientifically *Geodephagous larvæ*), and so much resembled those of the *Zabrus gibbus*, the Corn Ground-beetle, that it appeared almost impossible that they should be of any other kind; but as the *Z. gibbus* grub, when full-grown, is somewhat more than an inch in length, and the specimens sent me were then only about a quarter of an inch long, and (apparently from immaturity) still not fully coloured, they could not be identified with absolute certainty.

The specimens I examined were long and narrow, lessening in width towards the tail, and with chestnut-brown heads, and with strong sickle-shaped jaws, toothed within. Above, there was a mark like a depression from back to front on each side of the centre of the upper part of the head. The three succeeding segments were brown and of horn-like appearance above (the segment nearest the head being the longest). These three segments are each furnished with a pair of jointed legs, terminating in a point or claw. The following segments had a dark transverse patch on each above, divided into two parts by

a light line running down the middle of the back,* and beneath this transverse divided patch, on the side of each segment, there were two spots: all the segments, excepting that next to the head and the tail-segment, were of about one length, this being less than their breadth. The caudal segment was furnished above with two tubercular or spiny processes, and beneath with a sucker-like protuberance. The general colour of the grub, excepting in the patches, was whitish, and there were a few good-sized bristles on the body.

As it is next to impossible to identify an immature grub without personal knowledge of the kind, I ventured to write to Dr. E. L. Taschenberg, of Halle, Germany, as one of the highest authorities on Economic Entomology, and likewise as having especially studied and described the attack, as well as the larva, of the *Zabrus gibbus*. He was good enough to examine my specimen (which I had sent on a microscope-slide with a covering-glass over it), and replied to me that in the form of the fore part of the body, as displayed, and likewise the method in which the grub injured the young Wheat, it differed from that of *Z. gibbus*; but the arrangement of the plate on the back ("Chitin-shield"), and the form of the extremity of the body, exactly corresponded.

Dr. Taschenberg considered that the pressure of the covering-glass might account for the fore part of the body being somewhat altered in shape, and the method of life of the young larvæ might not be precisely the same as when full-grown; consequently he inclined to think my specimen was of immature *Zabrus gibbus* larva, but before speaking with certainty he wished for full-grown specimens. These, however, I was never fortunate enough to procure; but as this grub, unless killed, lives for three years, it may re-appear again on some of the infested localities, and if so, I should be glad of further specimens for identification.

Dr. Taschenberg was good enough to give me a type-specimen; therefore, I should hope to have no difficulty in identifying fully-developed samples.

The figures 2 and 3 at the head of this paper show the appearance of the larva. The habit of life is stated to be for the grub to go down beneath the surface of the ground in the day, and in the evening or night to feed on the young plant.

It is mentioned by Kollar that it eats into the stem at the surface of the earth, "and revels in the pith within." Dr. Taschenberg, in his more detailed description, notes that, from the small size of the mouth-opening, the grub lives rather by crushing the plant and

* It is noted by Dr. Taschenberg that after death the larva appears to have the stripe along its back uninterrupted, and this I notice to be the case here.

drawing in the juices than by biting it through. When about to turn to pupa they are stated to make long burrows from six inches to two feet in the ground with a cell at the end, in which they turn to the pupal or chrysalis-state, from which the beetle comes out (in about three or four weeks) about the beginning of July. The beetle is of the size and appearance figured, and of a black or blackish-brown colour.*

Later on further reports were sent of the damage caused by the same kind of grub.

At the beginning of April, Mr. W. S. Reading forwarded specimens from Shirley, Ringwood, Hants, as samples of a kind that was destroying the Wheat-crop in that neighbourhood. He mentioned:—“It appears to eat the stalk away down to the root, leaving nothing save a blade here and there. One farmer has ploughed up about twelve acres; another has some acres that are eaten pretty bare, but he notices this morning that a good many of the roots are putting up new shoots, so he has decided to let it remain awhile.”

A few days later, Mr. Reading wrote further, mentioning that his neighbour thought that “he would have done well to have dressed the land about Christmas-time, when he first noticed the injury the grub was doing”; and that at the time it had disappeared.

At the above date,—that is, April 9th,—a communication was also sent me from Akenham, near Ipswich, by Mr. J. A. Smith, who mentioned that the Wheat in his neighbourhood was going off terribly where it succeeded Clover and Rye-grass, but not after Peas and Beans. Specimens of millepedes, and of various insects in grub-state, were sent accompanying, and amongst these were grubs of the same kind as those above alluded to (that is, apparently, of *Z. gibbus*), one of these being more advanced in growth than any previously forwarded; and in his notes Mr. J. A. Smith said that “the Wheat seems *worried to death*,” not cut off absolutely. This remark is of considerable importance, as the crushing or chewing rather than biting off of the plant is one of the characteristics of the attack of the *Z. gibbus* grub.

From the different observations sent in, it is plain that much damage was done in various localities by the grub of a ground-beetle, of a kind which had not previously been noticed as destructive; but from the different methods of attack reported, and also the different kinds of pests sent accompanying, I do not attribute the whole of the damage to this special grub.

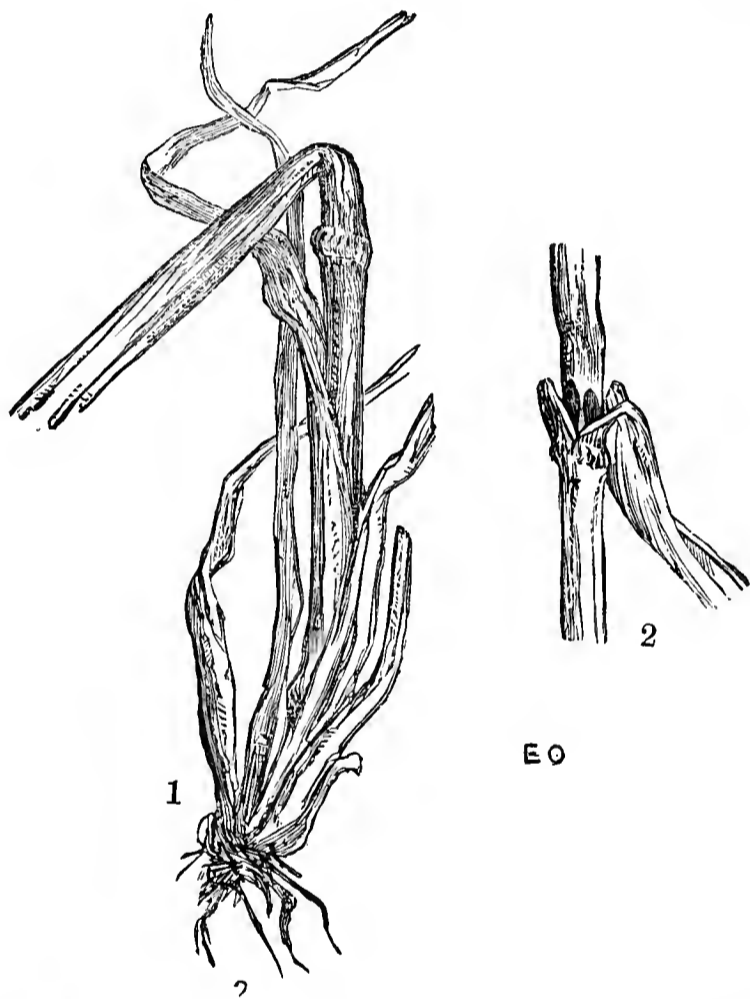
But whether it was *the* Corn Ground-beetle grub (as is possible), or the grub of another kind of ground-beetle not yet described, probably

* The above description is from Vincent Kollar's work on 'Inj. Insects,' Eng. trans., pp. 88—90. Those who wish to study the subject at length will find it excellently treated on in the 'Praktische Insekten Kunde' of Dr. E. L. Taschenberg, pt. ii., pp. 2—7, with minute description of larva.

no better remedy could be found than that applied by Mr. Dickinson, as mentioned at p. 44, of ploughing up the destroyed crop. Thus, throwing the grubs out to birds and weather influences, and likewise, in all reasonable probability; to *eating each other* for lack of the crop-food, would be measures likely to act extremely well.

It is earnestly to be desired that those whose crops suffered in the past season will be good enough to watch for any re-appearance of the attack, and, if it occurs, I should be greatly obliged by specimens which would enable me to identify it beyond doubt.

Hessian Fly. *Cecidomyia destructor*, Say.



Barley-stem injured by Hessian Fly maggot; 1, "elbowed" down; 2, showing the "flax-seeds."

So far as appears from the reports sent to myself during last summer regarding attacks of Hessian Fly, there has been a most marked and satisfactory decrease on the amount of presence of this pest compared to what it was in the preceding year. In 1887 it was reported (with specimens accompanying, or by contributors well conversant with the attack) from more than 72 localities in England, and about 20 in Scotland, these centres often representing districts and sometimes many miles of area of attack. This year only about six reports have been sent me, with specimens accompanying, and of these only one mentions the attack as being prevalent in the district; the

others only refer to it as respectively on single fields or on a farm. I believe attack was reliably reported in one or two other localities, but specimens were not sent me.

Doubtless other attacks may have occurred and not been mentioned at the time ; as, for instance, while writing this, on Dec. 26th, I have received the following note from Mr. Eardley Mason, of the Sycamores, Alford, Lincolnshire :-- "The Hessian Fly I find to be generally distributed in both Wheat and Barley in this district, *i. e.*, within a six miles' radius of Alford ; but the damage has not, in Wheat-crops, been appreciable, and in the Barley-crops not much of a measurable quantity.

On July 3rd Mr. Geo. Palmer, of Revell's Hall, near Hertford (the first observer of Hessian Fly in this country), forwarded some stalks of Barley infested by this pest, then in maggot condition, with the observation that the large amount of rain which had lately fallen had made the straw very weak, and a great number of the stalks were broken down from the second joint, and in nearly every instance these contained larvæ of the fly.

On July 4th puparia were sent on Wheat-stems (with the information that they were found on Wheat as well as on Barley) by Mr. F. O. Palmer, from Hale St. Nicholas, near Westgate-on-Sea, Kent ; and on July 7th a Hessian Fly puparium, from which the contents had emerged, was sent me by Mr. J. Eardley Mason, of the Sycamores, Alford, from a farm in the next parish.

The only information sent of Hessian Fly infestation occurring to any great extent was forwarded to me, on July 8th, from Temple Court, Clandon Park, Guildford, by Mr. G. P. Smithson. In this case specimens both of the maggots and puparia (or "flax-seeds") were sent. Some of the maggots were still white, or white with the green juice on which they feed showing through the somewhat transparent skin. Mr. Smithson mentioned that he had found the attack present in most of the Wheat and Barley fields in the neighbourhood of Guildford within the preceding few days, some being in the larva, some in the pupa-state ; and further observed that this year he had found every specimen to be at the first knot. Last year—that is, in 1887—he had found that in Wiltshire, also in the Richmond district of Yorkshire, and about Inverness, they were, as a rule, at the 2nd, but more often at the 3rd than the 1st knot. This he considered was most likely, because of late sowing, so that the second knot was not sufficiently developed when the fly laid her eggs.

The fifth report of presence of Hessian Fly attack was sent me, on July 14th, from Birchmoor, Woburn, by Mr. Edw. Blundell, with specimens of "flax-seeds" accompanying, taken from a Wheat-field, and the observation, "as there are a great many stalks broken, I have

but little doubt that the fly is abundant. I hardly expected to find the 'flax-seed' thus early, as the Wheat is so green and late this year." The specimens sent were on green Wheat-stems, which were thoroughly bent at the spot where the maggots had lain and fed.

The only other note of attack which I received was sent me somewhat later in the season—on Sept. 1st—from Lower Abbey Farm, Leiston, Suffolk, by Mr. A. M. Rosse. In this case it was a twelve-acre field of Barley that was infested, and the "flax-seeds," of which specimens were forwarded, lay at the 2nd knot of the straws. For some time previous the straws had appeared to leave off growing and dwindle away; the crop had promised very well in June and the early part of July, but was then a good deal laid by the heavy rains, so that it was difficult to say how much of the damage was to be attributed to the insect-presence. He had not observed the "flax-seeds" until the preceding day, and then, though there were many imperfect stems of Barley on almost every root (some with a few grains, and many with none, and most of them broken down), he only found four or five of the puparia or "flax-seeds" after searching a good while.

The above six notes were the only observations which I received of Hessian Fly presence last season. Of course the attack may very possibly have occurred in many places without any mention of it being sent to myself, but still, as it was not reported, and very little mention of it was made in the agricultural journals, save, as far as I am aware, one note (somewhat generally expressed), that it was all over one of the southern counties, I think there is great reason to hope that there has been a most satisfactory decrease of presence of the pest.

The points of prevention cannot be too strongly insisted on still, which have been before mentioned, and which are approved by the leading agricultural and practical entomological authorities in other Hessian Fly-infested countries. One of these is to sow Wheat no earlier *than is usually* the case in this country. In America it is called late sowing; but here sowing after September may be fairly expected to put the appearance of the young Wheat quite safely after the time when the Hessian Fly of the summer brood are abroad for egg-laying. Thus, so far we have escaped the winter attack to the young plant, which is a most important matter, and, in fact, at once saves half (and what, I am informed by Prof. Riley, Entomologist of the Department of Agriculture, U. S. A.), is considered the most important half, of the year's mischief caused by this pest. Another great point in prevention is destroying the light screenings from infested corn. These are of no value, being chiefly of dust, small weed-seeds, and the like; and, being thrown down together by the threshing-machines, there is little difficulty or expense in gathering them up and destroying them. If it

is troublesome to burn them, they may be thoroughly mixed in wet manure. If the "flax-seeds" in the rubbish are thus destroyed, there is an end of all damage from them; but if they are left,—thrown aside in any odd corner,—the Hessian Flies will come out just as the common British Wheat Midges will come out (as I have myself seen) in legions from heaps of chaff-rubbish; and in the two cases respectively, attack of Hessian Fly maggot, or of our common red maggot, will be the consequence of allowing the two sorts of Wheat-midge to go free. In this respect preventive treatment for *Cecidomyia destructor* and *C. tritici* are just the same.

Screenings and cleanings from imported corn, especially from Wheat or Barley imported from Russia or Eastern Europe, or any country infested by Hessian Fly, are to be looked on with great suspicion; this not only on account of the Hessian Fly chrysalids or "flax-seeds" which may be in them, but also because of the other kinds of injurious insect-attack which are extremely likely to be found in the short bits of broken straw, or are certainly found in injured grain or rubbish; and likewise on account of the weed-seeds, ergot, and other noxious pests, which are thus transported amongst us consequently on the grain being sent foul, and in some cases apparently deteriorated in quality purposely before shipping to this country.

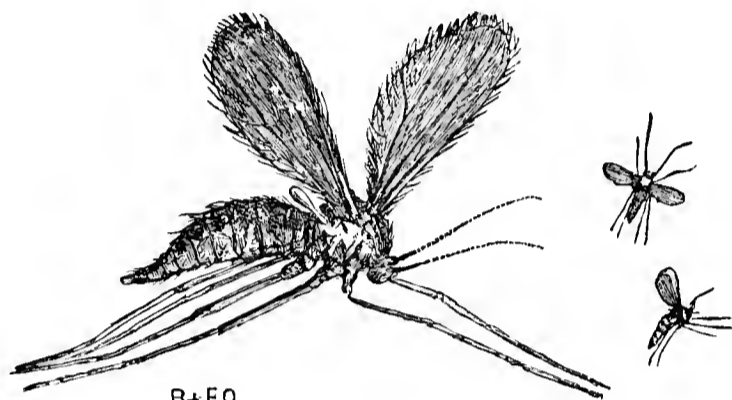
Rotation of crops and other means of preventing the Hessian Fly establishing itself, and of lessening the amount of mischief where it gains possession, have been already previously given; but observations with which I have been favoured by Dr. C. Lindeman, of Moscow, during the past season point to the importance of clearing the surface-rubbish of infested fields as thoroughly as can be done. There has been doubt and difference of opinion as to the kinds of wild grasses which were liable to infestation by Hessian Fly, but during the past season Dr. C. Lindeman has been good enough to send me information of "Timothy-grass," *Phleum pratense*, having been found during 1887 in one of the Russian Governments (that of Tambov) to be severely attacked by Hessian Fly, in corroboration of which many specimens of Hessian Fly puparia were sent to him.

In 1887 also Dr. Lindeman received specimens of stems of couch-grass (*Triticum repens*) sent from the Government of Tambov, and that of Woronetz, which were elbowed-down by, and infested by, puparia of the Hessian Fly; and communication was made to him at the same time that the couch-grass was so severely attacked, that in whole districts covered with this grass it was destroyed.*

We have not as yet had reports of the Hessian Fly being observed

* Leaflet on das Vorkommen der Hessianfliege an wildwachsenden Gräsern. Berlin: R. Friedlander.

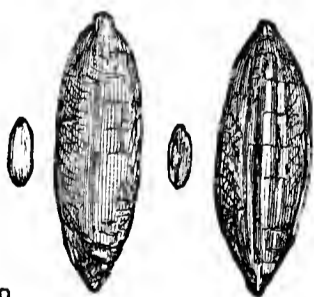
on the above grasses in Britain, but the fact that the "flax-seeds" may be there is another reason for at least doing all that can be done to clear the surface of infested fields. Skimming, and dragging the stubble and rubbish together and burning it, would get rid of some amount of "flax-seeds" which had not yet developed their contents, and also of some couch-grass which might have served as a nursery in that autumn, or in the following season; and ploughing with a skim-coulter, so arranged as thoroughly to bury down the skimmed upper surface, is a well-known preventive of attack.



B+E0
CECIDOMYIA DESTRUCTOR, Say.

Hessian Fly, natural size and magnified.

Full description of the Hessian Fly in its various stages, and also of the method of the injury and appearance of the injured straw, has been so often given, that it is unnecessary to repeat them again at length here; but the reader is referred to the accompanying figures for requisite representation. These show (at page 48) the shape, size, and position above a joint (usually the 2nd joint from the ground) of the *puparium*, or chrysalis-case, commonly known as the "flax-seed"; also the method in which the straw elbows down above the injured part, which is weakened by the sucking of the maggot at one spot.



E0
Puparia or "flax-seeds"
in different stages.

The maggot is legless, whitish (with sometimes a little green tint from the coloured juice on which it feeds showing through the skin), and in shape resembles the so-called "flax-seed," to which it presently turns. This gradually becomes of a deep chestnut-brown, and towards the time of maturity is striated longitudinally with fine ridges and furrows, as figured. The fly may be generally described as looking like a little brown gnat, about one-eighth of an inch in length, with one pair of smoky-grey wings.

For full technical description of the Hessian Fly in imago, or perfect condition, the reader is referred to the fully-detailed account given by Mr. R. H. Meade, of Bradford, from examination of living

specimens, published in the 'Entomologist' for July, 1887 (West, Newman & Co., 54, Hatton Garden); and for accounts of the attacks of Hessian Fly in this country, and means of prevention and remedy, I may refer to my own Reports on 'The Hessian Fly in Great Britain, 1886,' and 'The Hessian Fly in Great Britain, 1887,' published by Simpkin, Marshall & Co., Stationers' Hall Court, London, E.C.

Ribbon-footed Corn Fly; "Gout." *Chlorops teniopus*, Curtis.

During the past season attack of "gout,"—that is, of injury caused by the maggot of the Ribbon-footed Corn Fly,—was not much reported on, and, as this attack has been very fully entered on in previous years, I merely just mention it now, with a figure of an ear and stem of barley showing damage caused by the maggot, and a short description of the nature of the attack.

The fly (see figure in previous Reports)* is a thick-made, small, two-winged fly, black and yellow in colour, the body between the wings being very observably striped lengthways with black on a yellow ground.

The fly lays her eggs whilst the young Barley-plant, in early summer, is still young and tender, and the maggot hatching out of the egg attacks the forming ear at the base, or more or less above it, and then gnaws its way down one side of the stem within the sheath down to the uppermost knot. The consequence of this is that part of the ear is injured, and the stem often so checked in its growth that it is dwarfed, and also the ear is unable to free itself from the sheath, and the plant altogether acquires a swollen, unnatural form; whence the name of "gout" has been given to the attack.

The figure shows a common amount of injury, in which the ear is a little damaged and the stem (which is sketched with the sheath torn away so as to show the black furrow gnawed down it by the maggot) is a little distorted.



H. K.—E. O.

Stem of Barley attacked by *Chlorops*.

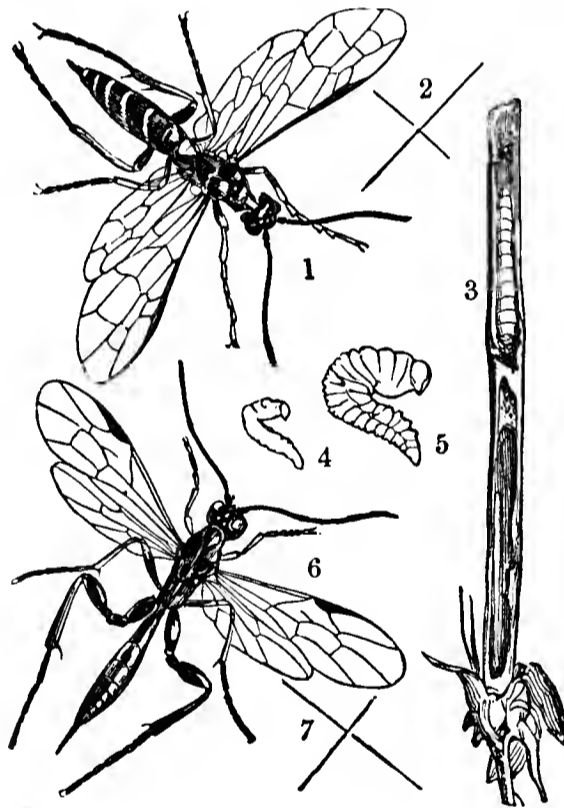
* See Ninth and Eleventh Reports on Injurious Insects.

The maggot turns to a small brown chrysalis on the injured stem beneath the sheathing-leaf. From these chrysalids the flies come out in autumn, and sometimes may be found in vast numbers in newly-stacked Barley.

From German observations it appears that the flies lay their eggs in the young autumn-corn plant, and in these the maggots feed, the flies from these coming out at the right season to start the summer attack on the growing corn, as mentioned above.

We much need more observations as to where the winter brood lives in the country, as it is this which mainly keeps up the pest to attack the summer crops. We should then know how to check attack. At present, as we do not know of its presence till the mischief is begun, but little can be done in the way of prevention.

Corn Sawfly. *Cephus pygmæus*, Curtis,



CEPHUS PYGMÆUS.

1, 2, Sawfly, with nat. size ; 3, stem containing maggot ; 4, 5, maggot, nat. size and mag. ; 6, 7, parasite fly, *Pachymerus calcitrator*, mag., with nat. size.

Some amount of attack of Corn Sawfly occurred last year, but not enough to require any very special mention, as the subject has often been entered on before in these Reports.

The fly is of the shape figured above, with four wings, and of a yellow colour banded with black. The injuries it gives rise to may be easily known by looking within the attacked straw. Here the small legless, or almost legless, pale yellowish-coloured maggot, with its pale brown head armed with minute jaws, will be found feeding within the

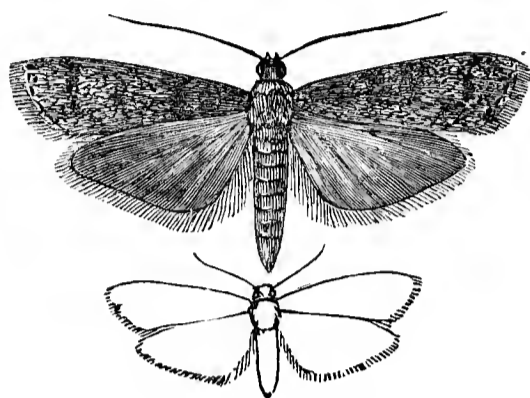
tube, which is often partly filled with maggot-dirt. It makes its way along the whole of the inside of the straw by cutting a passage through the knots, and about harvest-time, when it is full-grown, it goes down the straw (always inside) to ground-level. There, with its jaws, it bites a ring round the straw (on the inside), so that presently the straw breaks and falls; but the maggot lies secure in the short stump of stubble remaining in the ground, where it protects itself for the winter by spinning a covering, in which presently it changes to the chrysalis-state, from which the sawfly comes out early in the following summer.

Much damage is sometimes caused by the attack, as the maggot gnawing within the straw injures the progress of the ear, and when the straw at last falls, this, of course, is hurtful to the harvest.

Nothing at all can be done when attack is set up to remedy it, but recurrence (from obvious infestation) may be prevented by scuffling the surface, and dragging the stubble together and burning it. Ploughing the stubble under will destroy the maggot within, or at least prevent it coming to maturity and spreading infestation, if the stubble is well covered down, and not turned up again until July of the following year, when the time for the flies to come out is past; but as this is difficult to ensure, the simplest and safest plan is collecting the stubble and burning it.

SCREENINGS.

Corn and Flour Insects, &c.



EPHESTIA KUHNIELLA.

Flour Moth, magnified; outline showing nat. size.

In the summer of 1886, when Hessian Fly attack first appeared in this country, one of the first ideas connected with it was—how and whence did it come? Imported straw was obviously a possible means of transmission, but long watch carried on in the most careful manner at various ports failed to show presence of more than a single “flax-seed” (that is, chrysalis of the Hessian Fly), this adhering to a straw from Belgium.

Another possible method of introduction was transmission in chaff and rubbish from foul corn imports, and this probability was greatly strengthened when we found that the “flax-seeds” were detached from the straw in great numbers by our threshing-machines, and that, in the process of cleaning the corn, these “flax-seeds,” or chrysalids, were thrown down with the light weed-seeds and rubbish. We thus learnt that they *could* be detached, and thus we arrive at the point that where corn is sent over foul, with the chaff, dust, rubbish, &c. still in it, to the amount to which it often comes, that it is highly probable that if the crop out of which the corn was threshed was infested by Hessian Fly, that the infestation will be imported, and will be spread abroad by distribution of cheap screenings.

But beyond what may happen as to introduction of this one special crop-pest, in addition to the weevils, beetles, &c., which it has long been known infest imported cargoes, as well as granaries on land, it appeared that in what may be called the “crop rubbish” thus imported there was broken straw, masses of caterpillar-workings, and bits of broken ears, with other impurities quite suitable for transmitting crop-insect infestation, besides other matters, such as ergot, weed-seeds; infested crop-seeds, as Maize, Beans, &c.; besides a large admixture of bits of dry dirt and stones, and also some amount of coal, iron, or large nails, and wire.

By the courtesy of the heads of some of our large mill-firms, I have been furnished from time to time with samples of the various kinds of the above waste products, many of which are, or certainly may be, vehicles for transmission of attack when spread over the country for feeding-stuffs, or bedding for pigs, &c., as now happens from the cheap rates at which they are purchasable.

But as, in drawing attention of agriculturists to the danger run in using these screenings, there might be blame attached to myself in venturing to bring forward a point which (if followed up) might interfere with due and proper profit to millers, I have made inquiry on the subject of various well-known firms, and it will be seen by the replies with which I am favoured that the dirt and dangerous rubbish sent over is *not* desired by them (as, amongst other reasons, it involves the use of expensive machinery which would not otherwise be requisite); also it is shown that the corn *could be transmitted* either clean or much cleaner than it now comes. I venture therefore to give some of the notes with which I have been favoured in reply to my inquiries on this important matter, by which it will be seen what countries the foulest imports are sent from; various causes for the presence of impurities; some amount of statement of percentage of these in adulterated or not cleaned Wheat imports, and price at which these waste products are sold; also of treatment requisite to clear the corn; and also measures of protective co-operation which are now taken to some extent, and which are open to much wider adoption, by importers at their own pleasure, to guard themselves against unlimited impurity of cargoes transmitted to them.

To these notes I have added descriptions of various kinds of waste products screened, or removed by various means from foul corn, of which I have been favoured with samples, and also figures and observations regarding some few of the insect-pests which either do or may easily come in these uncleaned cargoes, and which it would be well for agriculturists to be on their guard against, and report on their first appearance; and also a short account of a small moth (figured at p. 56), which appears to have been introduced from the South of Europe during the last few years, and of which the maggots are excessively troublesome by choking the working of apparatus in flour-mills.

The following communication, with which I was favoured on June 1st, is from Mr. Hibbard, of the firm of Messrs. J. Reynolds and Co., Albert Flour Mills, Gloucester, on introduction to him of my request for information by Mr. Marshall Sturge, of Gloucester. After mentioning that my letters *re* Russian grain, shipments, Wheat, and Barley, had been handed to him by Mr. M. Sturge, Mr. Hibbard wrote as follows in reply to my inquiries:—

1. *Is grain sent now in worse condition than formerly?* I do not think

so ; there seems always to have been a selection of cargoes for the English market, containing an undue proportion of impurities, and it has generally been considered that we have more impurities in our Russian Wheats than was grown with them,* while Marseilles at the same time was getting choice quality and clean Wheat.

“ 2. *Could the sending of foul grain be stopped?* Certainly. The Bristol Channel merchants have stopped the excessive adulteration of Russian Barley by only buying Barley subject to analysis, and stipulating that there shall not be more than 3 per cent. of impurities. To enforce this they have become liable to each other in a heavy bond of £500 for each infraction. Since the agreement has been in force the Russian shippers have been able to ship to comply with above. No comment is necessary.

As regards Wheat, the lower qualities, we suspect, are made by mixing fair qualities of Wheat with Rye, and separations from other Wheats, such as Cockle, Oil-seed, &c.†

“ Generally, with all Russian Wheats, there is a great amount of impurity. This impurity consists of pieces of dirt, Rye, Cockle, Oil-seed, Vetches, thin shrivelled grains of Wheat, and frequently stones, &c. If the Wheat was ever winnowed, the out-siftings and separations must have been carefully put back again. It is perfectly impossible to get a sample of Russian Wheat quite clean ; there is always some hard dirt and Rye in it. Thus Russian can never be depended on as a basis for first-class flour. It is a great pity that it is so, because, if the English miller could get Russian Wheat clean, America would not injure him so much by her shipments of flour.

“ *Average weight and value of screenings from Russian Wheat.*

Reckoning a quarter of Wheat as 500 lbs., and worth 35s.		per qr.		
		£	s.	d.
1 ^o / _o	thin shrivelled Wheat at £3 10s. per ton	0	0	1 ³ / ₄
1 ^o / _o	cockle and other seeds	0	0	1
5 ^o / _o	Rye and small Wheat at £4 per ton	0	0	10 ³ / ₄
1 ^o / _o	large and small impurities and dust at £2 per ton .	0	0	1
<hr/>		<hr/>		
8		0	1	2 ¹ / ₂
	8 ^o / _o of Wheat as above value	0	2	9 ¹ / ₂
	Nett loss	0	1	7

“ The lower qualities of Odessa and Azov Wheat would contain not less than 40 per cent. of impurities, mainly Rye.”

For the following communication I am indebted to the courtesy of Mr. H. C. Woodward, of the firm of Messrs. H. C. Woodward and Co., Corn Brokers, Liverpool :—

“ I have been requested by Mr. Capper to send you a line in reply to your letter to him of the 11th of May, in reference to the foul state

* See observations, p. 64.

† Id.

in which large cargoes of foreign Wheat and other grain are imported, leading to the risk of propagation of obnoxious insect-life, such as Hessian Fly, &c.

“ I think there is no doubt that both merchants and millers would very much prefer that such cargoes should arrive perfectly clean, and free from dirt, straw, seeds, &c. ; and Wheat that does so arrive always commands a better price in the market. But you are probably unaware of the very primitive modes of harvesting Wheat in some of the countries whence large supplies come. The poverty of the growers will not allow them to use expensive cleaning machinery, while again the keen competition among shippers tends frequently to the receiving grain direct from the grower in bags, and shipping it right on by vessel, instead of, as formerly, taking their purchases into warehouse, and cleaning and mixing the various small lots into one uniform bulk. This especially applies to California, where much of the Wheat, if not all, is threshed off the field and bagged at the same operation, shipped in same bags of various qualities, often full of straw, &c., and then piled on the quays and bulked in Liverpool on arrival.

“ Here the straw is not liked, but put up with, as it does not weigh much, and the Wheat, being very dry, has a tendency to absorb moisture, and thus gains in weight as much as it loses in straw, or probably more. What is more objectionable to a miller is the large quantity of earth or soil mixed with Indian Wheat. This partly arises from its being stored in pits in the earth, and then, when opened, the earth gets mixed in. Sometimes this is purposely done to gain weight. Again, in the River Plate, some of the Wheat is actually trodden out by horses instead of properly threshed ; hence you have impurities, and soil, stones, &c., often mixed, and the samples are valued according to percentage of these impurities. In the case you mention of a sample containing bits of coal, iron, nails, &c., it is more than likely that this contained part of the sweepings out of the hold of the ship or of the quay. These vessels often take coal for outward cargo and bring home grain, and, if not swept perfectly clean, some of the coal, &c., get mixed. Other samples often contain bits of wire, &c., arising from a wire-tie used for binding sheaves ; so millers mostly have large magnets set with their screens so as to catch iron-wire, nails, &c., and prevent damage to stones or rollers used in milling.

“ Strong representations are made (especially to Bombay Chamber of Commerce) with a view of checking large dirt admixtures, with only partial effect so far ; but you see, with such a variety of causes, it is not so simple a matter as it might appear to any one not in business. A discrimination in price has some effect, and is fully practised.”

In the following notes, with which I was favoured by Mr. Thomas

Rigby, of Sutton Weaver, near Warrington, Secretary of the Royal Liverpool, Manchester, and North Lancashire Agricultural Society, he mentioned from operations at his own mills:—

“We are not using any Russian Wheat just now. It is a very poor Wheat, and very dirty and ill-cleaned at home, as also is the Indian Wheat, and the River Plate Wheat; the latter is better Wheat than Russian, but comes in quite as dirty, and as full of straws in short pieces, and of chaff from the grains. We find the Indian Wheat has most heavy rubbish in it, consisting of small, hard lumps of dirt and clay.

“We have to wash and to soak sometimes this sort of Wheat (to soften the lumps and so wash away the earth) and the other hard kinds. Little flies often come out of the grains when it is being damped, and when it is passed through strong currents of air that we put it through to draw out the chaff and straw.

“Your correspondent says rightly, ‘millers would rather have clean cargoes,’ for it requires both very expensive and complicated working machines to clean Wheat fit for use, and is great loss. We have just been putting in some new machinery, and are now taking out six separate sorts of rubbish that had very little money value.”

On August 28th, Mr. Rigby further favoured me with the following information regarding Barley:—

“In answer to your query about Barley importation: We do get large quantities into Liverpool from Sweden, Norway, Germany, Russia, Egypt, Australia, and the River Plate. The Egyptian is the poorest; I enclose you a small sample. It often comes full of weevils and mites, and is sometimes not so well cleaned as this sample, being more ‘taily,’ or having the tails broken off it in abundance, and sometimes particles of straw.

“The *débris* taken out of Indian Wheat is the chief source of danger of carrying insect-life or spreading it . . . ; it is of little value, and is used for feeding poultry, and in some cases pigs pick up what grain there is in it. The manure of said pigs is a fruitful source of weeds afterwards.”*

From Hull I was favoured both by information and by samples of different kinds of waste products removed from foul Wheat (described in detail further on), and have to express my thanks both to Mr. Ellis and Mr. Kirby for the assistance kindly given me.

At my request Mr. Edm. Riley, of the Weir, Hessle, near Hull (who assisted me for many months in investigations relatively to importation of Hessian Fly in imported straw), was kindly favoured by

* The above remark as to spread of infestation is well worth observation regarding all animals, including poultry, which feed on the infested screenings.

permission to go over two of the large corn-mills at Hull, and also to forward to me samples of the different kinds of screenings; and I was also favoured by the following information in a letter from Mr. Kelsey, of the firm of Castle, Kelsey and Son, Hull:—

“In answer to your inquiries, all foreign grain imported into this country now comes in a much cleaner state than formerly. Egyptian grain still contains a large admixture of soil, stones, and dust, but their finest quality of Wheat now comes much clearer, and makes correspondingly higher prices; and there is no reason that this country should still continue to ship their ordinary or fair average quality of Wheat and Beans in such a dirty state, as they could dress the same before shipment, and receive better prices on our markets, if the dust and dirt were kept in Egypt.

“The same remarks apply to Indian Wheats. Both these exporting countries give us sufficient proof that they can ship their grain in a good, clean state, if they like to be at the expense of using the machines they possess for the purpose. Shipments from these countries realise comparatively low prices, owing to their dirty state, with which importers and millers are well acquainted, and protect themselves to a certain extent by contracts containing full description of quality, &c., and an arbitration clause if any dispute between sellers and buyers should arise respecting the same.

“Indian shipments are now considerably better cleaned, and of better quality, than used to be the case some years since; while Egypt seems to prefer shipping as much soil and dirt with their grain as they think it probable importers in this country will submit to, although they frequently contract for the bulk not to contain more than 7 per cent. dirt, and if more is found they have to pay an allowance in accordance with the analysis and arbitration award.

“Considerable loss is often experienced by importers in this country when grain is shipped in such a dirty state; owing to the length of passage the grain becomes very warm (especially in summer time), and weevils often exist to a very serious extent, doing great injury, and causing great waste and heavy loss to importers.

“Millers in this country, with their greatly improved machinery, easily wash and clean such descriptions of grain, and are, by their practical knowledge, well able to protect their own interest in what they buy from importers, the latter running the great risk of the evil effects of weevils, &c., while in passage. Millers would much prefer having to deal with good, sound, sweet, clean grain, and pay extra prices for it.

“Shippers do not take into sufficient consideration that they pay freight and charges for such large percentage of dirt that they ship, or that they would get much better prices for their corn if they kept at home all the soil and extraneous matter alluded to.

“Russia ships much cleaner than formerly, but South Russia still continues to send many cargoes of Barley especially with large percentage of admixture of dust, dirt, and seeds.

“At all principal ports in the United Kingdom corn-trade associations are established, or are being established, for protecting the interests of importers and millers, and are doing more than anybody else can do to teach foreign shippers that it is to their own interest to cease their old custom of shipments in such unclean state as your correspondent alludes to.”

I was further favoured with a note from Mr. Riley, after going over two of the large corn-mills in Hull, that in both cases any assistance in investigation would be gladly given, as the dirty state in which the Wheat comes in was much complained of, it being thus so much more liable to breed weevils, “especially the late shipments, which are sometimes nearly alive with them”; and also I was supplied with samples of the different kinds of screenings, of which Mr. Riley wrote as follows:—

“I have sent you several samples of rubbish taken out of the Wheat; it is from Californian, Indian, and Russian Wheats; they are all mixed in certain proportions, and taken to the top of the mill and put through several screens, brushes, and exhausts. The bags are numbered. No. 1 is principally short straw, and sold for pig bedding, &c.; No. 2 (screenings) is sold for hen-corn; No. 3 is small, broken corn and seeds (for which there is a market, as also for No. 4, but the uses of these were not named); No. 5 is not of much use, as it is generally stones and lumps, and larger things than corns of Wheat, &c. I also send samples of Indian Wheat, which, if not now, will soon be full of weevils, as that class of corn gets warm on the passage.”

Of the above samples, No. 1 (now before me) proved to be composed mainly of broken bits of straw running up to about $2\frac{1}{2}$ inches long, bits of the stem of the ear from which the Wheat had been detached, and likewise morsels of the Wheat-ear with the grain still adhering, and grain with and without the chaff. There was a slight admixture of small sticks, bits of wood, and a little Maize, Pea, and weed-seeds.

By means of pieces of straw such as these it is perfectly possible that corn-stem attacks may be transmitted in maggot or chrysalis-state, either within the tube of the straw or outside it, secured from injury by the sheathing-leaf.

No. 2, hen-corn, was chiefly of small or shrunken Wheat, with broken grain and chaff, together with some amount of weed-seed, &c.

No. 3 was (as mentioned above) composed of broken corn, with small grains, and much small roundish black or dark brown weed-seed intermixed.

No 4, mainly of dust, with some admixture of bits of straw, chaff light grain, &c.

No. 5, composed of bodies larger than the corn-grains, is sometimes known under the name of "rubble," and consists of dirt and rubbish of all kinds that chance may have brought together. In the mass before me are bits of straw, and of ear of Wheat, grains still in the chaff, seeds like misshapen peas, a large proportion of stones and hard bits of dirt, also some amount of such matters as sticks, string, potsherds, leaves, &c.

From the Isleworth Mills (Messrs. Samuel Kidd and Co., Limited, Isleworth, near London), I have been permitted occasionally to have samples of the screenings from imported corn, and information on the subject, both whilst resident in the neighbourhood and since I removed to St. Albans, and have recently been favoured by the following letter from Mr. Perry, director of the mills:—

"We are in receipt of your favour, and so far as possible we reply to your queries.

"The practice of sending foreign Wheat mixed with rubbish has certainly increased of late years, and we find it particularly so in that coming from Australia, East Indies, and Russia. It would be a great advantage to millers to have the Wheat shipped clean, or free from admixture of foreign substances other than Wheat.

"We could not give a reliable estimate of the quantity removed in cleaning per ton. It varies considerably, according to the country from whence it came, and the particular shipments received. The value of the rubbish removed is *nil*. The value of screenings, which includes small defective corn unfit for flour, cockle, seed, &c., is about £3 10s. to £4 per ton.

"It is not in the power of the importers, unless by combination together, to insist on getting Wheat shipped free of impurities, and it is a well-known practice on the part of foreign shippers to add in mixture of Rye with Russian Wheat, and with Indian Wheat to mix seeds and dirt. We should be desirous to procure our Wheat clean, as it would save us from loss and expense in cleaning; we have in this process to use expensive and powerful machinery."

One set of samples of refuse (removed from Wheat imported from various countries and mixed at the mills), with which I was obliged in 1886, were of four kinds. One known as "rubble," of much the same nature as No. 5, above mentioned, consisted of bodies larger than the Wheat-grains, as lumps of earth, Maize, Beans, &c.; first and second screenings composed of broken corn, bits of straw, chaff, &c., and other bodies smaller or of less diameter than the Wheat-grains; and (fourthly), black dust, which consisted almost wholly of mere dust driven by a blast from the grain in process of cleaning, and which, until the Thames regulations prevented, was formerly got rid of by being floated away down the river.

More recently, as occasion in my insect-work required, I have been obliged with more samples of refuse, one especially showing (like No. 1, from Hull, above mentioned) the quantity of bits of broken straw which are removed from imported grain, and another of "rubble" from mixed corn from Germany and Russia.*

* In regard to possible method of adulteration of S. Russian Wheat (although it is probable that all this is much better known than by myself); nevertheless, it may be permissible to add that in the course of last year, on showing samples of impure Wheat to an English correspondent, formerly resident, and engaged in practical farming in South-eastern Russia, he offered the following observations, remarking at the same time that he wished specially to mention that it was now some years since he had been resident in Russia. I have therefore inserted "was" for "is,"—that is, past for present tense,—in description of operations:—

"The very dirty state in which the Russian grain reaches England is, in my opinion, due to two causes. Firstly, to the very primitive method adopted by the peasantry and others for threshing the grain; secondly, dishonest practices.

"When grain had to be threshed out, the usual plan was to clear, by sweeping, a space of hardened ground, either out in the fields, or more frequently in the village street. The crop was then laid down, and horses driven round and round, which by their trappings effectively separate the grain out of the ear. The straw was then removed, and the grain swept up into a heap; chaff, bits of straw, pieces of earth, and horse-droppings were thus naturally all swept into the heap.

"To separate the grosser particles of foreign matter this mixture was put through a sieve with very big meshes, and then what had passed through the sieve was tossed into the air by means of wooden shovels; the grain and other heavy particles fell into one heap, while the chaff was carried by the wind to a slight distance. But as the whole operation was of the crudest nature, you can well conceive that, after all is said and done, the grain was in a very dirty state when it came to be sold."

My correspondent further stated that if the supply came short, it was then a common practice adopted by the merchants' agents to mix rubbish with good, clean samples, in order to increase the bulk; and that he was personally aware of the siftings being sold to these men for the purpose of mixture.

For obvious reasons I do not give my correspondent's name. If any point of interest occurred on which further information was wished, I would forward application; I have no doubt he would enter on all details.

The following published observation of what went on some years ago is of interest, as, judging by what is received at the present day, similar arrangements may be continued:—

"Grain, and more especially Linseed, comes to England full of weed-seeds. Here is an explanation. At Timashevo last year some well-dressed Linseed was sold in town at 1·40 roubles per pood; the weed-seeds extracted by the cleaning and dressing, consisting of all the worst annuals that grow here, were sold at 75 kopecks per pood, the merchants having applied specially for them in order to remix with the better-dressed Linseed and Wheat."

'A Sketch of the Agriculture and Peasantry of Eastern Russia,' by Henry Ling Roth, 1878. Bailliere & Co., King William Street, Strand. (Paris and Madrid).

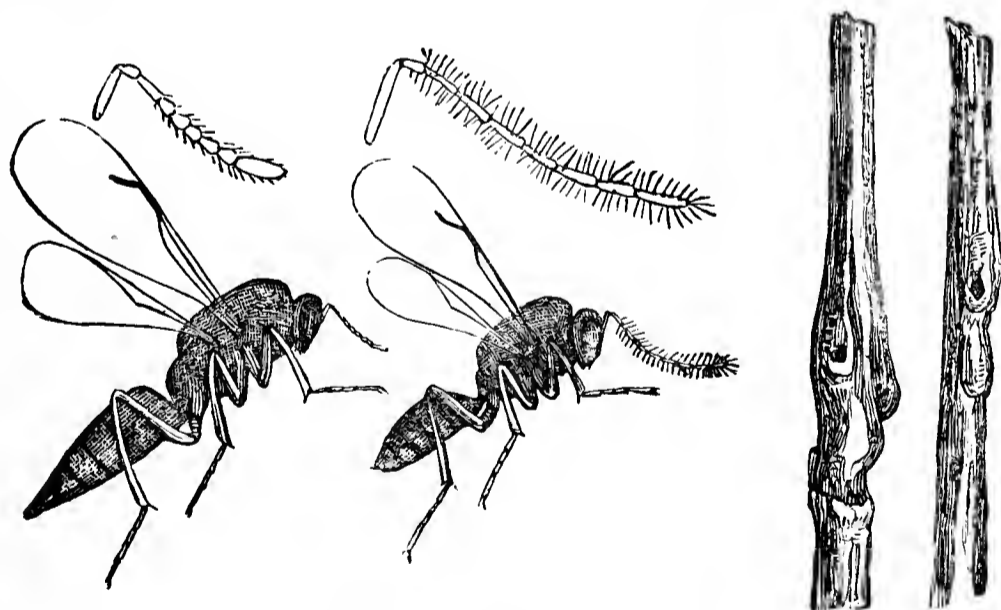
(The 1·40 roubles per pood mentioned above equals about one penny and a sixth per English pound, and the 75 kopecks rather more than one halfpenny. —H. L. R.)

From the foregoing observations it appears that a great deal of impurity is shipped with the Wheat; also that these refuse accompaniments are quite unnecessary to the extent to which they come; also that their presence to a great extent may be prevented by joint action of importers, excepting, of course, where a stated amount of adulteration is permitted; and further, that these refuse-matters are not desired by millers, as their presence entails necessity for expensive machinery which would not otherwise be wanted.

Therefore, as it appears that the absence of refuse in the corn-cargoes would not injuriously affect the importers or millers, but, on the contrary, that clean cargoes would be preferred, it is allowable to draw attention, agriculturally, to the great risks that are run by purchase of what is (or in all probability may be) infested refuse, and thus in various ways allowing noxious insects, eelworms, fungi, or weeds to gain a footing.

The great hope that we may not suffer in field produce from this cause lies in the notable fact that imported field-pests (at least as far as America is concerned) have not taken hold here to any degree; compared, that is, to what our pests do in America; and therefore we may hope to continue to be tolerably free. Still, Hessian Fly, though probably derived from Europe, has made good a footing, and there are two or three other attacks which, under present circumstances, it would be well to be on the watch for.

One is the "Joint-worm" of North America, the *Isosoma hordei*,



ISOSOMA HORDEI, Harris.

Female and antenna; male and antenna (all much magnified). Nat. length of fly about one-tenth of an inch or rather more. Galls on straw caused by Joint-worm.

Harris (figured above), together with some bits of straw showing the galls by which this attack may be recognised. This joint-worm lays its eggs in summer in the stalk of the growing plant of Wheat, Barley,

or Rye. The footless yellow maggot, which soon hatches, feeds in the kind of gall-growth which it causes by its presence (see figure), and remains in the ripened straw, where it turns to the pupa-state, from which the fly comes out during June of the following year. It appears, therefore, that the attack may be easily carried on to our farms (if in the straw) by the short morsels sold for bedding.

The "Wheat-stem maggot" of the small two-winged fly, the *Meromyza Americana*, is another kind of serious corn-stem attack, for which I am on the watch, because in 1888 I had a specimen sent me out of Kent, resembling this very destructive maggot both in size, shape, and its peculiar green colour. In descriptions of this attack the ear is stated to be destitute of grain, and the stem shrunk for about three or four inches above the joint. The maggots are described as about a quarter of an inch long, tapering to the head, blunt at the other end, and of a watery green colour, one in each stem, feeding a little above the joint, so as to cause the stem to be utterly shrivelled and worthless for conveying the sap, and the chrysalis to be found at the same spot on removing the sheathing-leaf.

The minute two-winged fly is only about a quarter of an inch across in spread of the wings, with a black spot on the top of the head; the body between the wings, and likewise the abdomen, marked with three black stripes running lengthwise, and the eyes are green.

There are other field and corn-attacks which might apparently be transmitted in refuse, but I mention the above as more especially likely, as far as I can judge, to be found present, and, if observed, I would at once give my best attention to any communication on the subject.

The attack of the caterpillars of a Flour Moth can perhaps scarcely be included amongst those of crop insects; but as in this case the very injurious moth (scientifically the *Ephestia Kuhnella* of Zeller) has but recently established itself in this country, and its first observation on the Continent of Europe took place no further ago than 1877, it may be of service to give a few notes of some of the successive trustworthy reports of its appearance, as well as a figure from life, and some observations of its history and habits.

The first European observation of this Flour Moth was made in the summer of 1877, when, as recorded by Prof. P. C. Zeller, of Grunhof,* specimens were placed in his hands by Dr. Kuhn (Director of the Agricultural Institute of the University of Halle, Germany) of moths which had been very troublesome in the bolting-cloths during the grinding of a quantity of American flour, with the request that Prof. Zeller would ascertain their names. These moths proved to be of a previously undescribed species of *Ephestia*, which was named (after its

* Ent. Zeit. Stettin, 1879.

observer, Dr. Kuhn) *Kuhniella*; and in Prof. Zeller's excellent paper referred to, full description is given of the moth, and the differences between this and other species of *Ephestia*, also descriptions of the caterpillar, and much useful matter regarding habits, &c.

The first recorded observation of the appearance of the attack in this country was, as far as I am aware, made by Mr. W. Thompson, of Stoney Stratford, Bucks, who reported in the number of the 'Entomologist' for May, 1887,* that the moths bred from "Rice cones," regarding which he had previously written, had been identified by Mr. Barrett as a species new in this country—namely the *Ephestia Kuhniella*, which had been (as above noted) recorded some years before in Germany by Prof. Zeller.

In June of the same year larvæ were exhibited (at the South London Entomological Society) from a cargo of flour which was reported to be partly destroyed by the above-named kind of caterpillars, from which, during July, moths hatched, which were identified as of the above species, *E. Kuhniella*.

Later on (that is, on Nov. 2nd, at a meeting of the Entomological Society of London), Mr. Sidney J. Klein read some notes of his observations on the habits of this *E. Kuhniella*, in which he mentioned that in the preceding May he had "discovered a colony of this scourge of the Mediterranean ports in some large warehouses in the east end of London. There were over a thousand tons of flour stored in close proximity;" and "the attack spread with great rapidity, until one entire warehouse was literally smothered with larvæ, and several hundred pounds' worth of damage was done." Some interesting observations were given as to attempted remedial measures, also regarding habits of the caterpillar, and benefit expected from the presence of a parasitic ichneumon fly.†

Some observations on this attack, and some which appeared to refer to it, were sent to me, but it was not until the autumn of last year (1888) that a complaint was made to me of it as a very serious flour-mill pest, with specimens of infested flour accompanying, from which I was able to study the attack myself, and also to rear the moth.

On Sept. 15th the following communication was sent me by the owner of steam mills in the North of England ‡:—"I have got quite a plague of moths in the mill, some of which, and worms, I send you; they get into the spouts and machinery, and do no end of mischief both by destroying the silks and stopping the flow of flour, &c., in the

* The 'Entomologist,' No. 288, p. 139. Messrs. West, Newman & Co., Hatton Garden, E.C.

† 'Trans. of Entomological Society,' Part IV., Dec. 1887, p. lii.

‡ For obvious reasons, as well as by special request of my correspondent, I do not give name or locality.

spouts by spinning thin web and hanging there. The mill is in constant work, and I should have thought this would have prevented them from lodging, but it does not seem to affect them at all. You will perceive the difficulty there is in putting anything in the spouts that would affect the flour."

The flour sent showed the great difficulty of the case, for it gradually became spun together, and also to the sides of the box in which it was placed, by the caterpillars' webs, so tenaciously that it could be lifted in lumps, and only a little flour let fall; whilst some still clung to the sides of the box, almost as if in sticky lumps. From the specimens sent I reared a few moths about the end of November, which proved on comparison (for which I am indebted to Mr. O. E. Janson) with type specimens, which had been compared with those of Prof. Zeller, to be true *Ephestia Kuhnella*, Zell. One of these specimens is figured at p. 56, magnified, with natural size given accompanying. The colour of the fore wings may be generally described as of rather pale grey, with darker transverse markings, and the hind wings are peculiar for their whitish semi-transparency, with a darker line from the point along a part of the fore edge.

On examining the infested flour early in January the mass was so completely spun together that, after pulling some lumps of it away, I found that the rest hung down in ragged lumps or clots so felted together by the caterpillars' web that but little flour remained in loose state. From a small mass of these clots, little less than two inches and a quarter, by two inches across, and half an inch deep, I could only by repeated shakings get about a teaspoonful of flour. The spun-up masses were occupied by live caterpillars, some chrysalids living and dead, and remains of dead moths.

The caterpillars varied in size from two-eighths up to five eighths of an inch in length, and correspondingly in colour, the younger ones being of flesh or pale red colour, and the largest almost white; the shape cylindrical, somewhat slender, with 16 feet, that is, three pairs of claw-feet, four pairs of sucker-feet, and a very well-developed pair besides beneath the tail, by the help of which, although the largest of the larvæ were sluggish, the younger travelled nimbly, and could move backwards or forwards at pleasure, or were able to attach themselves at once to a foreign substance, as the finger or hand. The head yellowish brown, darker in front, and with dark brown jaws; a transverse patch on the segment next the head, this rather pale yellowish brown, with a faint pale central line dividing it from back to front, and (in the oldest specimen) a small brown spot on each side of the segment below the patch. Along the back, excepting towards the head and tail, were four small dark dots on each segment, above, two on each side the centre. On the segments near the head the spots

were arranged more transversely, and at the tail, immediately above the sucker-feet, was a brownish, oval or somewhat triangular patch (the anal plate). On the preceding segment the transverse row of spots varied somewhat in different specimens; the largest was in the middle, with a smaller one on each side, occasionally one below, which would make five altogether; but sometimes the lowest pair was absent, sometimes the middle large spot was not entire; conjecturally the marking differed with the age of the caterpillar. On the preceding, that is, the eleventh segment, there were two clearly-defined brownish spots, and along each side of the caterpillar was a row of dark dots, one on each segment.

The caterpillar was slightly sprinkled with pale hairs or fine bristles, and had such a capacity for catching and retaining a covering of flour that I was obliged perpetually to remove it with the moistened tip of a finger to obtain a clear view of the markings.

The chrysalis, which was lying in a silken cocoon of spun-up flour, showed the chief points of the form of the coming insect plainly—the colour bees-wax below, shading to reddish brown on the back, and reddish brown also at the end of the somewhat prolonged, slightly-curved tail, which ended bluntly or cylindrically; the eyes of a darker shade of red. There were remains of dead, partly-developed moths or chrysalids in the box, but I could not make sure whether, as thought not unlikely by Prof. Zeller, these had been destroyed by their caterpillar brethren—the size and power of their jaws make the cannibal habit appear very probable. I had not opportunity of observing how long the chrysalis state lasts before the moth appears from the chrysalis condition, but this time is given by Prof. Zeller as three weeks.

The attack may be considered as going on constantly where temperature is suitable, for we have notes of appearance of the moths in May, June, July, November, and December; and intermediate observations of larval or pupal presence point to this, which, when once established, is indeed a mill or flour *scourge*, as being a year-round pest.

With regard to measures of prevention or remedy. In the application made to myself, the difficulty was (as mentioned at p. 67) the extent to which the caterpillar working clogged the apparatus, and I suggested the possibility of destroying the caterpillars by turning on hot steam from the engine, a plan which I knew had been perfectly successful in clearing a cheese-factory of maggots which had spread into chinks and crannies to a most inconvenient extent; and on Nov. 8th the following report was sent me by my correspondent as to the (so far) satisfactory progress of the work of getting rid of the moths:—

“I am beginning to hope I have almost seen the last of them; at

any rate, they are nothing like so numerous and troublesome. Acting on your suggestion, I stopped the mills for a week, and had all the machines cleaned through, and then went over them and the walls with steam; and now we are whitewashing the walls and underneath all floors with fresh-slaked lime and paraffin."

On Nov. 20th my correspondent further reported that he had not written sooner, wishing to record a positive clearance of the pest:—"Unfortunately I cannot say that, just yet, though I have reason to hope that our continual exertions will prove successful; there are comparatively but few moths about, and I rather think the paraffin and soft soap is not very agreeable to them. The way I applied the steam was by carrying about forty yards of half-inch piping into the mill from the boilers, and attaching an india-rubber bore to it for the men to work about on the walls, floors, spouts, and machines, blowing the steam into all the crevices and holes.

"I think I told you I stopped the mill for a week whilst this was being done; it has rusted all the shafting, &c., but this is quite a secondary matter: it can soon be cleaned again. After blowing the steam, which took two or three days, I set the men to work to wash the walls (and everywhere that they could without fear of affecting the flour) with paraffin; inside the machines I had washed with a strong solution of boiling water and soda. I find that strong soda and water is effectual in destroying the maggots when it can be got on them. I still continue washing and *syringing* all likely places for them to settle with paraffin, and keep a lad or two going about brushing up and killing all the moths they can see."

The preceding observations given *verbatim* point out, I think, more strongly than any description the serious nature of this attack, which, even by such stringent, well-conducted measures, *cannot be entirely got under*.

The great point in the habits of this pest which we need to meet is its custom of infesting every nook that it can reach, and also its power of forcing itself into or out of the most apparently secure spots. This is noted by various observers.

In Mr. Klein's observations (previously quoted) he mentions that his specimens, which had been placed "under a large glass shade on a polished wooden surface, with no perceptible outlet," conveyed themselves out in some way so that the corners and ceiling of his room were within a week studded with their cocoons," and specimens were every day discovered about the house from top to bottom.

In my own observation I placed one caterpillar about a third grown under a small cardboard case on a woollen tablecloth, so that there were no spaces for exit, and on the top I placed a 1 lb. weight, but before long the creature was on the outside.

In my own experiments I noticed the caterpillar could on *dry* annoyance let itself down by a thread, but on moist application I did not see that it attempted it, and this might possibly point to syringing down being serviceable (as noticed in foregoing observations).

At present one *most important* point on which we need information is—where from, and in what manner, do these pests travel to us; and next, how are they transmitted now that they are with us?

In the very first record of their appearance they were found in grinding American Wheat; this was in 1877, and Mr. Klein (see paper referred to in 1887) mentions them as “a scourge of the Mediterranean ports.” On enquiry I find the *Ephestia Kuhnella* not included in Grote’s list of N. American Lepidoptera for 1882, so that investigations point rather to Europe or the East as the exporting centres.

Regarding this, I enquired of my correspondent whether there was reason to suppose they had come in Russian Wheat. He replied:—“Though I had been a large user of that for the last twelve months, I scarcely think they have come in it, or other millers would have found them in their mills. Moreover, they do not seem to trouble us at all in the warehouse where all the grain is stored, but only in the flour, and especially in any light fluffy or branny stuff. My impression is that they have come to me from some baker in returned empty sacks. Is it possible that they could have spread in this way from the flour in London, as recorded in the pamphlet you sent me?”

Nothing is more likely than that such should be the case. Mr. Sidney Klein, in his paper read before the Entomological Society (referred to at p. 67), mentioned that the eggs which seemed to be laid by the moths “generally upon the top of the sack hatched within a few days of being laid, and the larvæ (caterpillars) at once burrowing through the sacking, commenced spinning long galleries in the flour, seldom, however, going more than three inches from the exterior.”—S. T. K.

Relatively to this matter, perhaps safety could be secured as to sending on the pest from infested centres by baking the sacks; a warmth far below what would do any harm to the sacking would probably destroy all vitality of the pest from egg up to moth state, and it would be very useful to know whether, excepting the single observation of the infestation being found in “Rice-cones,” the caterpillars affected other flour than that of wheat. Prof. Zeller mentions they are considered by millers to reject Rye-meal; and at a glance this suggests that if Oat or Barley-meal were similarly obnoxious to caterpillars, something might be done by temporary change of corn ground to clear out the pest. But on inquiry the different nature of machinery introduced largely for flour-milling in

England during the last ten years, instead of the old system of grinding by millstones, appears to preclude this plan of remedy.

Any information which would throw light on reasons for the presence of the moth, or means for prevention of its attacks, would be very desirable.

“Tulip-root” and Segging; Eelworms. *Tylenchus devastatrix*, Kuhn.; and *Cephalobus rigidus*, Schneider.



“Tulip-rooted” Oat-plant.

The diseased growth in Oat-plants, known from its peculiar bulb-like form as “Tulip-root,” is caused (as has now been shown by the repeated observations of several years) by the presence of multitudes of minute Eelworms within the plant, these being much too small to be seen by the naked eye, though, where there is bad attack, their presence may often be guessed by the kind of whitish or pale brown powdery appearance of the inside of the infested plant.

The kind which causes the “Tulip-root” disease is scientifically the *Tylenchus devastatrix* of Kuhn, formerly known as the *T. dipsaci*, from its being then considered especially to infest Teazles; but latterly (since its history has been taken up), from the great number of plants it has been found to attack, and the great mischief it has the power of causing, amounting sometimes to devastation of whole districts on the Continent, the special name has been changed to *devastatrix*.

As the history and treatment has been given in my previous Reports, it does not seem desirable to repeat them here; but it may just be mentioned that the two British crops which it especially affects are Oats and Clover, producing in the latter the form of “sickness” often known by swollen, distorted shoots. Barley appears not to be liable to infestation, and Wheat but little; Rye worse than any other plant in continental growth, but not, as far as reported, in Britain.

Two practicable measures of prevention of recurrence of the attack on infested land are avoiding crops that can be affected in the rotation, and to give deep ploughing; the Eelworms often leave the Oat-plants as the plants die, or dry from maturing, and lie in the upper surface of the soil; and if they are well turned down, especially if circumstances allow of a dressing of gas-lime in caustic state being put on, much of the infestation will be got rid of.*

Special applications which have been found to do good, as manure in preparation of the land, or as dressings to bring an infested crop over attack, are sulphate of potash alone, or as a mixture with sulphate of ammonia and phosphates.

In the following observations notes are given of these applications having again been found serviceable in the past season, and also a few notes of presence of the infestation in various localities sometimes to a troublesome extent.

On March 29th I was favoured, by Mr. Richard Brown, of Hillhouse, Kirknewton, Midlothian, N.B., with the following note of the previous season's observations regarding use of sulphate of potash:—

“ I regret that I neglected to inform you last year that the field of Oats which, in the beginning of June, showed every sign of being badly affected with ‘ Tulip-root,’ and from which the specimens sent you were taken, received shortly thereafter a top-dressing of about 1 cwt. per acre of sulphate of potash, with the result that the disease entirely disappeared, and at harvest an excellent and thickly-planted crop was cut. It is right to state, however, that the season seemed to have been unfavourable for the spread of ‘ Tulip-root,’ as comparatively little was seen in the district.”

The following observations, sent me on June 15th by Mr. John Elder, of The Holmes, Uphall, Linlithgow, N.B., are in continuation of observations of careful experiments made by him in the preceding year, of which he kindly gave me full details, and of which I published the main points in my Eleventh (1887) Report.

The following note shows the benefit of the dressing given, excepting on a badly-drained part of the field, and on a sandy knoll, and on this sandy knoll the portion to which stimulating manure was applied before ploughing was promising well:—

“ The following is my experience regarding ‘ Tulip-rooted ’ Oats as far as this season has gone yet. They are sown on the fields from which my specimens of sick Clover-plants were taken last year. The manure applied consisted of phosphates, ammonia, and potash when sown, 3 cwt. per acre. The whole has a very luxuriant growth, with the exception of the sandy knoll, from which last year's No. 1 specimen

* For method of safe use of gas-lime, see pp. 30, 31, and Dr. Aug. Voelcker's leaflet on gas-lime there referred to.

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was taken, and which shows a good deal of 'Tulip-root' this year too. The other portion of the same knoll, from which No. 2 was taken, had an application of town-manure before ploughing, and, though a few plants show the symptoms of 'Tulip-root,' the general luxuriance is so good that a full crop is promised. The only other portion showing damage is where No. 8 was taken from (the portion not very well drained). It is not so bad as No. 1, and is now mending every day."

The following detailed note of experiment on special Oat-plants, also sent me by Mr. Elder on June 15th, shows that, at that date, the unmanured land was giving the most unhealthy crop; that with steamed bone-flour came next; the plot treated with sulphate of ammonia had a number of unhealthy plants, but was better than what was unmanured; and of the two others, both were doing very well on the whole, but that treated with the mixture of sulphates and phosphates was better than that treated with sulphate of potash alone.

"No. 1. *Steamed Bone-flour, 3 cwt. per acre*, got very yellow for a while, but has now taken on a growth; a number of unhealthy plants on this plot.

"No. 2. *Sulphate of Potash, 55 per cent., 3 cwt. per acre*, was always fresh and green, and not an unhealthy plant on the whole plot; it is now, however, losing growth a little.

"No. 3. *No manure*, has always been the worst, having a great number of unhealthy plants, and a sickly yellow appearance. It is now mending a bit.

"No. 4. *Sulphate of Ammonia, 1½ cwt. per acre*, has also a number of unhealthy plants, though not so bad as No. 3. It has now taken on a luxuriant growth.

"No. 5. Mixture applied to general crop without top-dressing after" (the mixture consisted of about 2 parts of sulphate of potash, 55 per cent.; 3 parts of sulphate of ammonia, 25 per cent.; and 4 parts of phosphates, 48 per cent.) "has been similar to No. 2 all spring, perhaps not quite so dark a green. Plants healthy, with few exceptions. Gives promise of being the largest crop of any of the plots."

On July 14th Mr. Elder, according to promise, wrote me a further report, and mentioned—" 'Tulip-root' appears to be more widespread this year than ever, a very great deal of fine land between this and Edinburgh being infested, probably causing a loss of hundreds of acres of Oat-crops.

With regard to his own farm, Mr. Elder mentioned that it was not free from this attack, but that he appeared to have lessened it very considerably on one field which suffered very badly two years ago, which now had a very fair crop; and also that he had a fair crop on

the field mentioned (p. 73), excepting on a low-lying part round the knoll, which was bad with “Tulip-root,”—to which part a less quantity of manure was given.

Mr. Elder further added :—

“Regarding the prevention of this pest, I would suggest the following precautions, as the result of my experiments and observations this and past seasons :—

“1st. The land to be maintained, in as high a state of fertility as possible, with farmyard or town manure.

“2nd. Alternate with Barley or Wheat when practicable.

“3rd. Sow along with the Oats a manure containing phosphates, ammonia, and potash (the two latter in considerable quantity).

“*Note.*—The plant appears to require more potash in its early stages than the majority of soils can readily supply it with, where the land is constantly under tillage : from one to two cwts. per acre of sulphate of potash, applied when sowing the Oats, will be found to keep the plant green and healthy, when without the potash it would become yellow after the supply of food from the grain was exhausted. This is the stage of growth when the *Anguillulidæ* make their attack, and, if the plant is carried on through this stage in a healthy growth, comparatively little danger may be apprehended afterwards. The ammonia would now step in, and carry on the plant during the remainder of its growth, the phosphates improving the grain.

“The above is not only theory, but it is the actual results of my experimental plots this season, as far as it has gone.

“4th. I observe this year that, wherever the broad-wheeled carts have crossed the Oat-fields, in carting out grain or manure or carting off stones, the plants in the track are extra strong and healthy, showing that perhaps my soil is too loose for Oats, and that the crop would be much healthier if rolled with a heavy stone roller, or some other contrivance, to consolidate the land.

“5th. Variety of Oats appears to have a marked effect. A field of ‘Sandy’ Oat is a fine level crop, Two bushels of . . . * Oat sown alongside, to finish the field, getting the same manure, &c., is very bad with ‘Tulip-root.’

“Hamilton Oat appears to be more affected than Sandy and Victoria, or Polish Oat worse than either.”

Specimens of Eelworm attack were also sent me from various English localities.

On June 11th Sir Francis Geary, Bart., of Oxon Hoath, Tunbridge, forwarded Oat-plants affected by “Tulip-root.”

The following note, sent me by Mr. James Rawlence, of Bulbridge, Wilton, Salisbury, on July 12th, with specimens of bad attack of

* For obvious reasons I omit name of Oat.

“ Tulip-root ” accompanying, well confirms the observations of Barley not being liable to this kind of infestation :—

“ There is a large area of the Oat-crops on our Wiltshire hills which have failed in different parts of the fields so cropped. I have a field sown with a mixture of Oats and Barley, which we call ‘ Dredge. ’ I noticed that the Barley was good, and the Oats almost a failure. I told my bailiff to ascertain the cause ; yesterday he brought me what I herewith send you. ”

Besides the above, specimens of Eelworm-infested Oats were sent me from two localities, with much more of the reedy or sedgy form, to which the word “ segging ” or sedging is applied, than the peculiar “ Tulip-root ” swelling.

Specimens of Black Oats were sent me from Sapcote Fields, near Hinckley (on the edge of Leicester- and Warwick-shires), by Mr. W. Nurse, with the following note :—

“ They are grown upon a black soil (bog) ; some of the Oats are looking well and are in ear, and others are as the sample I have enclosed. Last year they went the same upon the same piece of land ; I thought then it was from the dryness of the season. ”

These Oat-plants were about six or seven inches high in the leafage, and mostly of a deep green colour, although some of the shoots were yellowish. The shoots were thin and rushy looking (sometimes about six to a root),—not “ Tulip-rooted, ” but having just a small quantity of wrinkled shoots round the base.

On July 5th, Mr. Geo. L. Purchase wrote to me, from Chichester, regarding injury to Oat-plants in the district, and a few days later forwarded specimens and the following note :—

“ The attack is very general in this district among spring-sown Oats. Autumn-sown Oats are not attacked. Those sown in April are the worst ; those sown earlier are not so bad. In a case of Barley sown with Oats, the Barley is not attacked. ”

In this instance, as well as the preceding one, the plants were much more rushy than “ Tulip-rooted ” in appearance, and with very little of the pale yellow doubled and crinkled shoots round the base of the stem which often, or usually, are found round the swollen “ Tulip-rooted ” base. I therefore, as Dr. J. G. de Man, of Middleburg,—who is one of the leading authorities on *Anguillulidæ*,—was then in England, submitted specimens to him, in order to be certain that the attack was caused by the same kind of Eelworm, namely, the *Tylenchus devastatrix*,—and such proved to be the case.

Cephalobus rigidus, Schneider.—The following observations refer to Eelworm attack found in Oat-plants grown near Milford Haven, in which the plants were found to be infested *not* by the common “ Tulip-root ”

Eelworm, the *Tylenchus devastatrix* of Kuhn, but by a kind which had not previously been recorded as being found in England, known scientifically as the *Cephalobus rigidus* of Schneider.

The first note of observation of this attack was sent to me on June 28th (with specimens accompanying), from Newton House, Milford Haven, S. Wales, by Mr. Roch Davies, who wrote as follows :—

“ I send you a few roots of Black Tartarian Oats for your inspection. The Oats were sown the last week in March ; all came up and looked well for a week, when I perceived that large spots in the field seemed to change colour, which I put down to wireworm, but strange to say the plant did not die out, nor could I find any worm. I rolled heavily twice, and at an early stage dressed with one cwt. of nitrate of soda per acre ; still there seemed no growth of the spots affected.

“ The above was done on April 15th ; no other manure was used, and it was rolled again about ten days after, where affected : the plants assumed a dark rich colour, but did not grow, and up to July 5th the affected crop remained (though of a rich colour) only about six inches high. The other portion of the field in a heavy crop, and in bloom. The land is light, rather brashy, and in the old red sandstone formation.”

On examining the plants sent me on June 28th, I found them as described by Mr. Davies, very short and of a deep green colour, and, although there was not the decided swelling at the base of the stem which gives the name to “ Tulip-root ” disease, there was the peculiar plaited or waved appearance of the edge of the leaf which is to be found accompanying Eelworm attack,—in fact sufficient alteration of growth to make me suspect that the injury was due to the action of the Eelworms which I saw were present.

I therefore availed myself of the skilled assistance of Dr. J. G. de Man, of Middleburg, Netherlands, well known for his especial knowledge of this class of nematode worms, who identified the specimens for me as being the *Cephalobus rigidus* above named, and was also good enough to draw from life, and present to me for use in this Report, the figure from which the accompanying excellent plate is taken ; and further, at my request, wrote the following account of the attack for the ‘ Agricultural Gazette ’ (for July 16th, 1888), in which some of the specially distinguishing points of the attack are scientifically noticed :—

“ Miss E. A. Ormerod, Consulting Entomologist to the Agricultural Society, sent me, not long ago, some specimens of Oats, requesting me to inform her whether they were affected by ‘ Tulip-root,’—*i. e.*, by an attack of *Tylenchus devastatrix*. These specimens presented no more

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than a slight enlargement of the base of the stem, but (as she wrote me) some of the leafage had the peculiar plaited appearance at the edge which accompanies this attack, and in one case the plant had distorted, pale, wrinkled shoots, growing in a knot under the plant itself. The sender had reported that the growth appeared quite checked.

“ The examination of these plants proved *the complete absence* of *Tylenchus devastatrix*; but I discovered in the very first plant examined, and then, further, also in the others, the *occurrence* of *another species* of *Eelworm*, *viz.*, of *Cephalobus rigidus*, Schneider. Similarly to what is the case with *T. devastatrix*, large numbers of individuals of this *Cephalobus*, both males and females, adult as well as young ones, and also free eggs (some of which contained living embryos), were found by me in partly-decayed stems, presenting a brownish powdery appearance. In some cases many individuals were also observed on the inner surface of the lower sheaths of the leaves. The Eelworms evidently lived in these plants quite in the same manner, and in the same number of individuals, as does *T. devastatrix* in those plants that are affected by true ‘ Tulip-root.’ As far as I am aware, this remarkable fact has hitherto never been observed.

“ But further, according to my opinion, there can now be little doubt that this species ought to be regarded as the cause of the disease from which these Oats were suffering, and that, at least in this country, *Cephalobus rigidus*, Schn., as well as *T. devastatrix*, is injurious to the Oat-fields. *Cephalobus rigidus*, Schn., with which *Cephalobus oxyuris*, Bütschli, is identical, hitherto was only known as occurring in the soil about the rootlets of plants, like the other land nematodes. The *Cephalobi* may be easily distinguished from the *Tylenchi* by the absence of a knotted spear, and by the œsophagus terminating in a rounded swelling (bulbus), containing a simple valvular apparatus. Whereas some species of *Cephalobus* have a bluntly rounded posterior extremity, in *C. rigidus* it is sharply pointed. This *Cephalobus*, therefore, much resembles another form of the same genus, that is also very common about the rootlets of plants, and which I have described under the name of *Cephalobus oxyuroides*; but *C. rigidus* attains a larger size, and presents, moreover, some anatomical differences.

(Signed)

“ Dr. J. G. DE MAN,
“ Of Middleburg, Netherlands.

“ Penzance, July, 1888.”

The figures on the accompanying Plate will explain the scientific terms in Dr. de Man’s description. Fig. 1 shows the female Eelworm, of which the natural size is little more than one millimetre (that is, little more than one twenty-fourth part of an inch in English



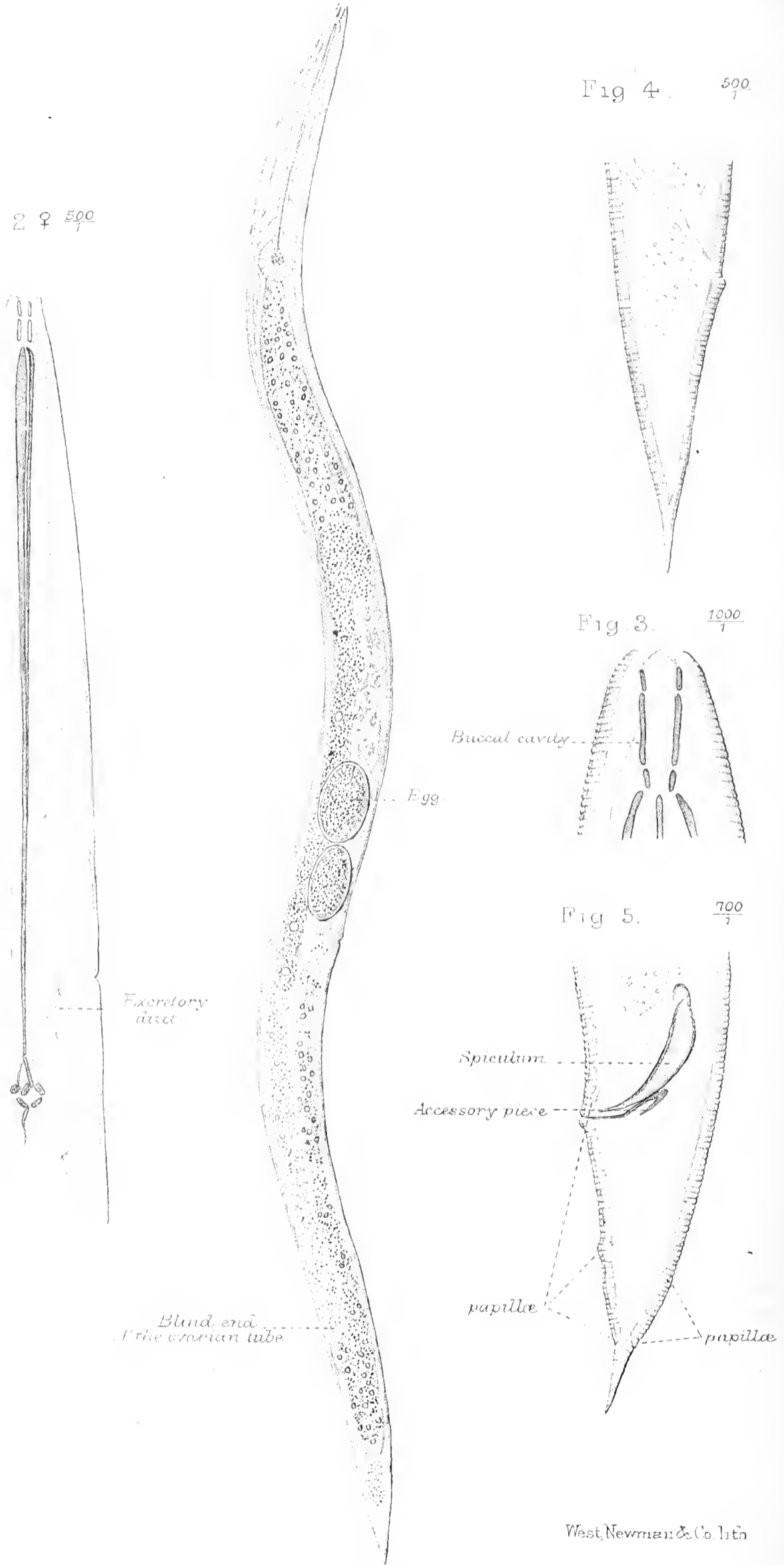
Fig 1. ♀. $\frac{170}{7}$. lateral view.
 Length, nat. size = 1.13 mm.

Fig 2 ♀ $\frac{500}{7}$

Fig 4. $\frac{500}{7}$

Fig 3. $\frac{1000}{7}$

Fig 5. $\frac{700}{7}$



J.G. de Meillon del.

West, Newman & Co. lith

Cephalobus rigidus, Schneider.
 Found in Oat plants at Milford Haven, July 1888.

measurement), magnified to a hundred and seventy times the original size.

Fig. 2 represents the front part of the same female specimen seen sideways, magnified five hundred times: the “knotted spear,” the absence of which is noted by Dr. de Man as one characteristic of the *Cephalobi*, is a sharp process or instrument at the commencement of the *œsophagus*, by which it is supposed that such kinds of Eelworms as possess it prick their food, and thus are able to suck the juices.

Fig. 3 is a side view of the head, showing details of the mouth-opening, and magnified a thousand times.

Fig. 4 is a side view of the tail-extremity of the same female specimen, magnified five hundred times.

Fig. 5 is a side view of the tail extremity of a male specimen, with details magnified seven hundred times.

Dr. de Man gives the description in technical terms in the following

“EXPLANATION OF THE PLATE.

“Fig. 1. *Cephalobus rigidus*, Schneider, female specimen, 1·13 millim. long, in a lateral view $\frac{1}{7}^{\circ}$. The ovarian tube extends till near the anus.

“Fig. 2. Anterior part of the same female specimen, in a lateral view, showing the *œsophagus* with its posterior swelling containing a valvular apparatus, $\frac{5}{1}^{\circ}$.

“Fig. 3. Lateral view of the head, presenting three out of the six lobes at the anterior extremity and the buccal cavity, $\frac{1000}{1}^{\circ}$.

“Fig. 4. Posterior extremity of the same individual, in a lateral view, $\frac{500}{1}^{\circ}$.

“Fig. 5. Posterior extremity of the male, in a lateral view, presenting one of the two spiculæ and their accessory piece. Some papillæ are also visible on the tail.

“The transverse striæ of the integument have only been figured on the figures 3, 4, and 5.”

The above notes appear to me of great interest: of course in the first observation of a new kind of attack it is of the utmost importance to be certain that the newly-observed insect or worm is the cause of the evil noticed on the plant; and in this case, after very careful consideration, looking at the details of growth of the Oat-plants from about a week after their appearance above ground, and the obvious signs of Eelworm attack present, when sent to me,—together with the fact that this *Cephalobus rigidus* was present in great numbers, and no other kind to which attack could be attributed,—from all this it appears to me, as well as to Dr. de Man, that the attack may be referred to this cause.

Practically considered, the peculiar form of diseased growth which the Oats showed would be well worth looking for in the coming season, for it may turn out that the attack is more present than has been generally known; and if some of the simply "singed" Oats are infested by this Eelworm, and not by the "Tulip-root" Eelworm, it may give a clue to clearing out the attack in these cases, or to it dying out, without requiring anything to be done to prevent its recurrence on other crops, which might save a deal of trouble.

Wheat-bulb Maggot. *Hylemia coarctata*, Fallen.

The attacks of the maggots of the Wheat-bulb Fly and those of the Frit Fly (noticed at pp. 34—43) are much alike so far as method of injury is concerned. In both cases the maggots feed in the centre of the young growing shoots, and thus destroy them, and the two kinds of whitish maggots also look very similar to the naked eye, but when examined with even a moderately powerful glass the differences may be clearly distinguished. The Wheat-bulb maggot thus seen is whitish, legless, cylindrical, and somewhat lessened towards the head end, which is furnished with two black mouth-hooks. The tail extremity is furnished above with two black spots, which are the *spiracles* (or breathing-pores), by which air is drawn into the very observable *tracheæ* (or air-tubes). Beneath, that is at the lowest part, the tail segment projects, and ends in two square teeth placed centrally, with one pointed tooth, and sometimes more on the outside of the central square pair. These teeth and the *absence* of a little bunch of stalked spiracles near the head appear to me to be the simplest way of knowing the Wheat-bulb from the Frit maggots, but as it may be desirable to have the scientific description I append it below.*

The chrysalids were somewhat oval or spindle-shaped, of a medium shade of brown, with the two spiracles still projecting, and always very plainly noticeable at the tip of the tail, in the form of two little knobs.

The flies are two-winged, and not altogether unlike the well-known Onion Fly in general appearance.

More particularly noticed, they are as described by Mr. R. H. Meade: males with the thorax grey, the sides lighter, and the *dorsum*

* *Hylemia coarctata*, Fall.—"The maggot is cylindrical, a little narrowed in front, glassy and shining. Both the mouth-hooks of equal length." The caudal segment is described as having below four fleshy projections, those in the middle four-cornered with flat borders, the side ones tooth-like; the slope ("abdachung") is similarly set with little teeth of variable form."—'Praktische Insekten Kunde.' By Dr. E. L. Taschenberg. Pt. IV. p. 119.

(back) indistinctly striped; the abdomen hairy, oblong, narrow, flat and cinereous, with an indistinct narrow dorsal stripe; anal segment grey; subanal appendages hairy, with two black lamellæ; wings with narrow veins; legs black, with pale *tibiæ*. The females have both the thorax and abdomen pale ash-grey and immaculate, and the four posterior femora, as well as the *tibiæ*, pale.*

The injury to the plants was caused by the maggot feeding within the young stem, and thus causing the death of the infested shoot from the joint effect of the gnawing of the maggot and the consequent decay of the attacked part. The damage that was going on was observed, or at least began to be reported, first, with specimens accompanying, about May 7th, when I found that the maggots, being full fed, were leaving the infested shoots; from this time to May 30th, I received daily, or almost daily, packets of infested plants. Towards the latter part of the month the maggots were turning to chrysalis condition, but the Fly itself did not emerge until the beginning of July from chrysalids which were being kept under observation, though, judging by dates given in German observations, it is likely that it took a much shorter time to develop when in natural circumstances. The first communication on the subject was sent me on May 7th, by Mr. Joseph Drewer, of Weston-on-Avon, Stratford-on-Avon, with the remark—"The wheat-plants I am sending you are taken from a field the entire crop of which is taken by a small grub which you will find in the stem of the plant." These maggots corresponded exactly with the description of those of *Hylemia coarctata*, and were apparently full fed, as I secured the infested plants with some earth, and on May 10th, on examining the earth, I found a good many maggots in it.

On May 10th Mr. D. Tompkins, of Aveley Hall, Romford, reported that he had a field of Wheat which had gone off very much lately, and on examination he found in the thick part of the stalk a small white maggot. These Wheat-plants were about four and a half inches high, and the injury was caused by the maggot feeding in the stem a little above the root.

On May 15th specimens apparently just turning to chrysalids were sent me by Mr. Jos. Paisley, from Waresley, near St. Neots. One of the maggots was slightly changed to a brown tint, and they lay as usual,—that is, in the Wheat-shoot a little above the root, the centre of the shoot being severed and the inside decaying.

On May 14th Mr. Drewer sent further notes regarding the presence of attack, nature of preceding crops, and date of sowing of attacked Wheat. He mentioned that on going over a different part of Warwickshire, on Saturday (May 12th), he found a great number of fields

* "Annotated List of British Anthomyiidae," by R. H. Meade. 'Entomologist's Monthly Magazine,' March 1882.

infested in the same way as his own from which he had sent specimens. He mentioned that he had just sown Barley on his field, as the Wheat was all taken in some places. "The preparation on my field was vetches, fed off with the sheep, and kept ploughed up close to them; and the last week of July mustard was sown, and this also fed off with the sheep. The Wheat was planted the last week in November. As soon as I found it looking bad in February, I well rolled it, then gave it a good dressing of soot, and three-quarters of a cwt. of nitrate of soda per acre. I find this maggot more or less in all my Wheat but that after Beans, and, as far as I am able to tell you, all the farmers about here say the same." "I have a few places attacked in a field of Wheat planted after the middle of December." "Some Wheat I have, after Cabbage planted at Christmas, is quite free from them."

On May 15th specimens of the same kind of grub were sent by Mr. John Saul, from Wainfleet, Lincolnshire, with the note that they were "doing prodigious harm to the Wheat-plant growing in this neighbourhood."

On the following day (May 16th) Mr. Frederic Street, writing from Somersham Park, St. Ives, Hunts, forwarded me specimens of this same kind of Wheat-bulb maggot, some of which were then turning to chrysalids, with the observation that he had been to March, in Cambridgeshire, where Mr. W. E. Russell, of Granford, near March, had given them to him, with the information that "*hundreds of acres* of Wheat were being eaten off by them in the Fens." "The Wheat-plant from which they were taken was growing on fen land after Early Rose Potatoes." In this case the widespread area of attack was shown by the application for information being made by request of a large number of farmers who were suffering serious loss.

On the same day (May 16th) Mr. A. L. Wells wrote from Warren Farm, Witton, near Birmingham, with specimens of Wheat with the maggot beginning to turn to chrysalis inside the stalk. He mentioned that some ten or twelve years before he had suffered very serious loss from similar attack, but had not done so again lately until this year. He also mentioned that one field, sown after Swedes, was "an entire failure, every plant being destroyed for yards together." In reply to my enquiries Mr. Wells further mentioned that the Wheat was sown on December 10th. "Another field, sown after Potatoes, is very thin along one side where the potatoes were got up before they were ripe. The maggot nearly always takes the Wheat much worse after Swedes, and where the potatoes are got up before being ripe; it stands best after Mangolds."

At this date I received daily applications regarding the attack, from correspondents who, it will be seen, speak generally of the serious

injury caused by the maggot. On May 17th Mr. Michael Ellison, of Barber Woodhouse, near Rotherham, Yorkshire, enquired regarding the same maggot, which, he noted "you will find inside the stem of the young Wheat enclosed. I took it this morning from a field belonging to a farm tenant near here, which a fortnight ago was as flourishing as possible, and is now vanishing away owing to the attack of this maggot." In reply to my enquiries Mr. Ellison kindly informed me that the injured Wheat which was on the farm of a tenant, about two miles on the south side of Sheffield, was sown at the previous Martinmas; the land was well farmed, and the tenant gave it half a ton of salt per acre last February. He (the tenant) also said that he had two other Wheat-fields which were much worse, and which were sown the first week in October. Mr. Ellison further observed that "the maggot appears now (May 22nd) to be changing, and the ravages of the insect to be ceasing; so that I hope that the Wheat that does remain will bear more abundantly, as some compensation for that which is lost."

Mr. Ellison's observations are very valuable with regard to the precise life-history of this Wheat-bulb Fly, as he gives the date of sowing of the attacked Wheat, the date when the maggots were turning to the chrysalis state, and in the following letter he reported the appearance of the Fly (which proved to be the *Hylemia coarctata*) from these chrysalids.

On July 7th Mr. Ellison wrote:—"I have now much pleasure in sending, according to promise, a few specimens of the Flies which have hatched from the chrysalids of the maggot that I have previously written to you about, and hope they may reach you safely and well, as I am sending them from here alive." These Flies I identified myself as being *Hylemia coarctata*; but for absolute certainty in the matter, as it is of practical importance, I submitted specimens for examination to Mr. R. H. Meade, of Bradford, that we might have the benefit of his valuable opinion, and he confirmed my view that they were specimens of *Hylemia coarctata*.

Reverting now to reports of observations of the attack in the order in which they were received, on May 17th Mr. Francis Wells, writing from King's Vale Farm, New Oscot, near Birmingham, forwarded me specimens of the same kind of maggot, with the note that it was a sample of a grub which was playing sad havoc in his Wheat. He mentioned—"I must tell you it is Wheat after Swede Turnips, and each year I have sown this succession it has always 'gone off' as it is doing now. One field of mine is a complete failure, and the land is in high condition. The soil here is of a light sandy nature, and if not farmed extra well would soon degenerate into common." The specimens of Wheat sent were about six inches high, and very healthy

in growth. On enquiry Mr. Wells mentioned that it was drilled on January 10th. "The field was manured all alike, and where Swedes grew I think at least three parts of the Wheat is destroyed, and where there were Mangolds and common Turnips it is very little injured." The field was very highly manured for Mangolds, which were eaten on the ground by the sheep. The Wheat was not through the ground until about March 20th. "I quite think with you that the extreme heat of last summer is the cause of the extra devastation."

On May 19th Mr. James Davies wrote me from Hollinfare, near Warrington, with the mention that for several miles around, both in Cheshire and Lancashire, the Wheat-crop in some fields had been greatly damaged, and on some had been entirely destroyed by the attack of which he forwarded specimens, which proved to be again *H. coarctata*, in maggot and chrysalis state. Mr. Davies mentioned that one of his own fields had suffered severely on that portion of it where Potatoes grew last year, while the portion that was cropped with Swedes and Mangolds had escaped. The maggots and chrysalids were found in the very bottom and right in the centre of the stems of Wheat. With regard to the date of sowing and observation of mischief being in progress, Mr. Davies mentioned that his Wheat was sown about the middle of November, and that his fields were very late in showing attack, as he perceived nothing of it until about the last day or two in April, and then not much. Another field in the neighbourhood was sown in October, and the attack was in it earlier and more severely, as the field was resown with Oats in April, all the Wheat being then gone. With regard to succession of crops, Mr. Davies mentioned that in one case a small part of the field that escaped carried Swedes and Mangolds last year, whilst the Potato plot of last year suffered severely.

The following notes from Mr. W. Parlour, of Middle Farm, Dalton-on-Tees, Darlington, are of interest as giving date of sowing of the attacked Wheat, and some special points as to preceding crop or treatment of ground; and also in this case, as well as in Mr. Ellison's, the observation was made complete by the perfect Fly, the *Hylemia coarctata*, being reared from the maggots:—

On May 24th Mr. Parlour wrote me that he had taken the maggots (enclosed), and the accompanying Wheat-plants which had been attacked by them, from a Wheat-field in which they had done considerable damage. This field was sown about October 18th, and the following notes of difference of treatment and amount of attack in the three plots into which it was divided are worth notice:—

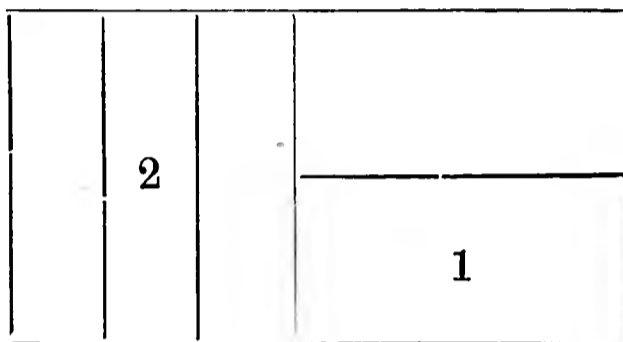
The first plot was sown on Bean-stubble, and was not attacked.

In the second plot nearly the whole of the Wheat was killed by the maggot. This plot had been worked for Turnips, but they were not

sown owing to the drought. It received about four tons of lime per acre, and a large pond that had gone dry was cleaned out, and the mud spread upon this plot.

The third plot was prepared for Turnips in the same way as the second, and received the lime, but, instead of the pond mud, was manured with farmyard manure. Considerable damage was done on this plot, but not half so much as on the second plot.

Mr. Parlour's note of attack on one of his own fields shows such a marked difference in amount on portions differently treated that I give his note *verbatim*, with the accompanying sketch plan of the field:—



“The field was fallow last year, sown with Wheat on Oct. 20th and 21st. All the field was manured with town manure except the corner marked 1; this was covered with mud from a pond that had gone dry. It has suffered much more from the attack than any other part of the field; *it is clearly defined to a yard where the pond mud has been put.* The plot marked 2 has scarcely suffered at all; three years ago it was sown in Tares when the rest was fallow, and in consequence there was a large quantity of couch grass on it at the beginning of last summer, but of course it is all killed now. All the rest of the field *except the headlands* is thinned by the attack.” “It rather appears as though the finer and looser the soil at the time of sowing, the more severe the attack, as shown by the Bean-stubble escaping, and also that part of our field which was rough and full of sods owing to the dead couch grass. It also appears that the pond mud has either attracted the Flies, or it has not contained sufficient manurial properties to push on the plant out of the way of attack.” Mr. Parlour further noted, “I have examined several fields in the district, and find that *almost all fallow fields have suffered more or less.*” “In no case, so far as I can find out, has any Wheat been attacked where the land was cropped last summer.”

On July 2nd Mr. Parlour forwarded me specimens of Flies hatched from the chrysalids of the maggots that attacked the Wheat as above mentioned, with the observation that he had “many more chrysalids and they were hatching every day.” And a few days later—that is, on July 9th—he sent a further supply of the Flies hatched from the

same set of chrysalids, which I identified as male and female specimens of *Hylemia coarctata*. This observation, joined to Mr. Ellison's, shows the beginning of July to be the time when the Fly comes out. Mr. Ellison's specimens were sent me on July 7th; those from Mr. Parlour on July 2nd and 9th. Amongst these there was a slight difference in colour, some being rather dark-legged varieties of *H. coarctata*.*

The following report from Major H. Salmon, of Tockington Manor, Almondsbury, Gloucestershire, shows the recurrence of this attack on land which had been infested two years before by this Fly;—

On May 24th Major Salmon wrote:—"In May, 1886, you were good enough to investigate an attack on young Wheat which occurred on land in the occupation of tenants of mine in this parish, and to print a notice of the case in your 'Tenth Report on Injurious Insects' (pp. 49 and 50), and I think it may interest you to know that the same attack has reappeared this month in Wheat sown on part of the same large field which is described on page 50. On the part now in Wheat there were *Swedes last year*, and the Wheat is most seriously attacked by these maggots precisely on those spots where the *Swedes* were observed last year to be very badly attacked by grub or caterpillar under their leaves; in parts where the *Swedes* were not affected, the Wheat is not affected now. In another field of wheat (on the same farm), but not adjoining the one above mentioned, there were patches of Wheat badly affected by the same maggot (*Hylemia coarctata*). In this field there has been clover for two years, now ploughed up and sown to Wheat." "I also hear of similar attack on another farm more than half a mile off." In the paper referred to Major Salmon gave details of nature of soil and cultivation, from which it appeared that the maggot attack was not found on any part of this field excepting *where Swedes were grown in the previous year*, and that the maggots were incomparably more numerous and destructive in those parts of the field where the *Swedes* failed last year.

The first certain observation of attack from this Fly which was reported to me was in 1882, when young Wheat-plants were sent me at the end of March by Mr. W. Creese, from Teddington, near Tewkesbury, with maggots then feeding inside the stalk, just above the bulb. These larvæ were watched, up to their development to *H. coarctata* Fly, by Mr. R. H. Meade. Mr. Creese then reported that the Wheat-bulb maggot was entirely absent in some seasons, but was very destructive in about three years out of four; that it attacked plants on land that *had been fallowed* in the previous summer, but does

* Mention was made to me that some specimens of *Hylemia* had been considered to be *H. paralleliventris*, but, as I am not aware of this species having been recorded as British, I conjecture that the specimens so named were only dark-legged varieties of *H. coarctata*.

not appear on land ploughed for the first time in the autumn; also that it leaves a belt of four or five yards near the edge untouched.

SUMMARY.—*The result of the above observations appears to be as follows:—*That this Wheat-bulb maggot attack, which was first certainly identified in 1882, though it was apparently present to a serious extent before, occurred last year (1888) at a good many localities mainly in the Midland or Eastern Counties; notes were daily sent reporting attack on fields or districts, respectively in the neighbourhood of Romford (Essex), St. Neots (Hunts.), March (Cambs.) and the Fens in the neighbourhood, Wainfleet (Lincs.), Sheffield in the South of Yorkshire, and Darlington in Durham, but just beyond the northern border of Yorkshire; and somewhat more westerly, from near Warrington, on the border of Lancashire and Cheshire; from two localities near Birmingham, and from Stratford-on-Avon in Warwickshire; and from near Almondsbury, near the Severn, in South-west Gloucestershire, a locality in which the same attack was recorded in 1886.

The amount of injury is mentioned by various correspondents with regard to fields, as all taken in some places; as an entire failure, every plant destroyed for yards together; “as a complete failure; and, on a larger scale, as a great number of fields infested”; “prodigious harm to the Wheat-plant growing in the neighbourhood”; and in the Fens as “hundreds of acres being eaten off”; also that near Warrington, for several miles around, both in Cheshire and Lancashire, the Wheat-crops in some fields had been greatly damaged, and in some entirely destroyed.

The dates of sowing, which were only given in some cases, were as follows:—Last week in November, and crop looked bad in February; a few places attacked where sown after middle of December; first week in October; Jan. 10th (Wheat not through the ground until about March 20th); middle of November, attack not observed till April; October, and crop destroyed; resown with Oats in April; about the 18th of October; October 20th and 21st; and at Christmas, planted after Cabbage, free from attack.

Previous crops and treatment of ground.—After Vetches followed by Mustard, both eaten off; after Early Rose Potatoes; after Swedes: nearly always takes the Wheat much worse after Swedes, and when Potatoes are got up before being ripe; “it stands best after Mangolds.”—A. L. W. “After Swede Turnips, and each year I have sown this succession, it has always gone off.”—F. W. Attack after Potatoes, a small piece after Swedes, and Mangold escaped. On a field worked for Turnips, and treated with lime, part was likewise dressed with mud from a pond, part with farm manure, much damage was done to this latter; but on the former, that treated with pond mud, nearly the whole of the Wheat was killed. On another field, treated with town

manure, excepting the square cornered portion marked 1 (see plan, p. 85), which was dressed with mud from a pond gone dry, this portion suffered so much more than any other part of the field that it was plainly observable to a yard where the mud was put.—W. P. Headlands not thinned by attack (and in 1882 it was observed that it left a belt near the hedge untouched). “Almost *all fallow fields* suffered more or less.” After Swedes that had been badly attacked by caterpillar.

As the attack of *Hylemia*, or “Wheat-bulb maggot,” is one which appears often to be locally troublesome, though rarely—if ever before—to the serious extent to which it occurred in last year (that is, in 1888). I have given the accounts received in almost full detail, as I believe that it is only from notes taken by agriculturists themselves of what occurs to their crops under special circumstances, that we can hope to work out practicable measures of prevention.

Last year was exceptional in its first half regarding many kinds of insect appearance, which may conjecturally be attributed to the peculiar summer season of 1887, peculiarly favourable as it was for multiplication of many kinds of insect. But in ordinary seasons (it appears) that not putting in Wheat after summer fallow—or perhaps one might state it, not putting in Wheat until the summer brood of this *Hylemia coarctata* has passed away—is one means of prevention of this attack; it also appears especially to infest land where Swedes have preceded Wheat, and to be especially likely to occur on land where pond manure has been spread; but with this attack, as well as with the Frit Fly, we need to know where and how the summer brood lives. If we knew where the Flies which we see emerging from the chrysalids about the beginning of July laid their eggs, and where and how the maggots from these fed, we should know how to get rid of the nurseries of the autumn or winter egg-laying, which produces the troubles of the following spring and early summer.

“White-eared” Wheat.

During the middle of the summer—that is, at intervals from about July 6th to August 10th—enquiries were sent regarding the cause of a peculiar attack, which was observed in so many places that it soon was described under the special name of “White-eared Wheat.”

The injured heads, of which many specimens were forwarded, usually seemed at first sight to be all right, excepting being prematurely ripened; but on examination the ears were totally barren, and the top of the stem was usually severed across about three or four inches above the uppermost knot, so that though the injury did not show externally, yet, by holding the lower part of the stem and gently

pulling at the ear, the stem came out of the sheath, leaving a stump behind of a few inches long attached to the highest knot. This stump looked flaccid and shrunken, and at the point of severance, in almost all the specimens sent, the straw was shrunk (and also often brownish, as might naturally be expected from decay taking place at a dead point).

There was no obvious cause for the injury,—neither signs of insect nor of fungoid origin, so far as I could myself make out, or as far as I could learn by consultation, British or Foreign,—nor, although “white ears” are often noticeable in summer in ripening Wheat, could I find that this peculiar fractured stem attack had been recorded before.

In the only instance in which I had a specimen with the attack still in progress, the stem cracked asunder on being pulled (was not already parted), and I found that at the point of fracture the straw tube had an irregular swollen growth within,—what might be described as a granulated growth partly filling up the tube; so that whereas a section of the straw an inch above would have shown a clean, even, fine ring, the section at the point of fracture showed a much thicker ring, smooth and even outside, but inside irregularly swelled or granulated.

The cross section also showed small open cells which had been cracked across in severing the straw. From this appearance it seemed to me that the attack was some kind of vegetable disease, and perhaps due to the wet season acting on local causes.

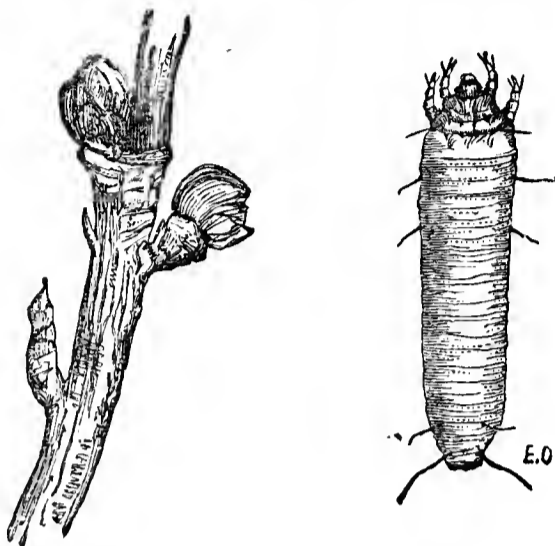
From some of the reports it might be inferred that the diseased Wheat occurred generally, more or less, in the field from which the specimens had been taken, but in some cases the attack was quite local, only affecting a patch or portion of a field.

In one note the attack was stated to be confined to a spot about ten yards in diameter, near an elm tree; in another, only on one land in the field, and that the outside land. In the instance of the attack extending to Barley which I saw samples of, the attack was said to be confined “pretty much to one side of the field.” From these circumstances the disorder whatever it may be, does not appear to have come in the seed; and it certainly cannot be transmitted from seed of the injured plants, as the barrenness of the head is one characteristic of the attack.

But it would be desirable to ascertain what the cause of the disease may be; and if I could have specimens sent to me in the coming season, gathered as soon as the Wheat-ears begin to show the very first signs of (apparently) premature ripening, we could probably very easily make sure of the cause of the injury.

CURRENT.

Current Gall Mite. *Phytoptus ribis*, Westwood.



PHYTOPTUS (? species).*

Black Current shoots with infested buds. Gall Mite enormously magnified, nat. size invisible to naked eye.

During the past season (as in previous years) notes have been sent of the mischief caused to Black Current Growers by the attack of the small Gall Mite, of similar nature to that figured above, which injures the Black Currents by causing a swollen and diseased, or totally abortive, condition of the buds.

This *Phytoptus*, or "Gall Mite," multiplies from eggs and increases enormously, and is very infectious, as the Mites can crawl over any part of the bush, or harbour in the rough bark and down at ground level, or may crawl over the ground, or may be carried on leaves by the wind to neighbouring bushes. They are so excessively small that they cannot be individually distinguished by the naked eye, but with a strong magnifier may be found in great numbers in the infested and distorted buds.

The best way to stop attack where it is still slight is to prune off all galled shoots,—that is, those with swollen buds,—and to burn them; also an application of lime and sulphur syringed on the infested bushes has been found of use.

The easiest way to prepare this is to take four ounces of sulphuret of lime and two ounces of soft soap to every gallon of water. The sulphuret and soap should be well mixed together, and the water poured on at *boiling heat*, the ingredients being stirred to make them all mix well together. This mixture may be used (when cool) at any thickness preferred, either for syringing or to run thickly down and

* The above figure is of the Birch *Phytoptus*, and shows the general appearance of the *Phytopti*. I am not aware that distinctions between the form of the *Phytopti* infesting Birch and Current have been observed.

choke the Mites sheltering amongst the crannies of the branches at ground level.

But where the bushes are much galled it is almost impossible to restore them to healthy growth, and for the sake of saving spread of infestation I believe the most saving course is to root them up and *burn them*, and fill in the holes temporarily with gas-lime or quick-lime, so as to kill any of the Gall Mites which may very likely be lying on the earth.

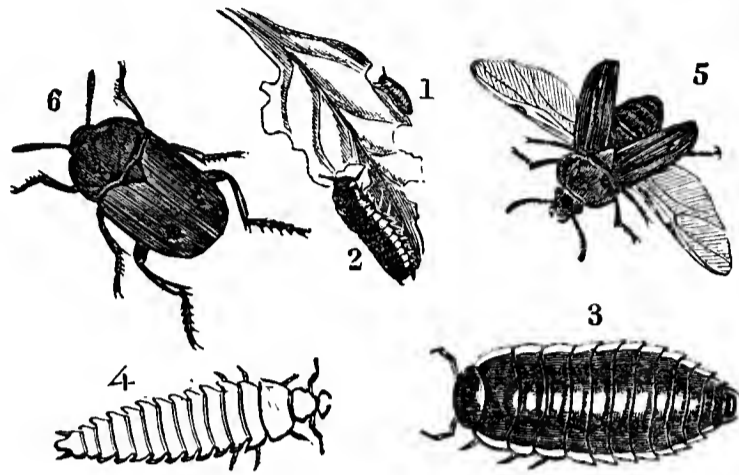
Change of bush crop to something that the Gall Mites will not attack is obviously the best course to adopt, and up to the present time I had no information of the Gall Mite attacking other kinds than the *Black Currant*. This morning, however (January 15th), I am favoured by a letter from Dr. Friedrich Thomas, of Ohrdruf, Gotha, Germany (a most eminent authority on Phyto-pathology), in which he mentions that the *Ribes rubrum* (that is, the Red Currant--E. A. O.) also is injured by *Phytoptus* bud gall occurring on the stem. Dr. F. Thomas forwarded me, accompanying, a specimen of a stem infested by bud-galls, just in the same way that we know only too well on our English Black Currants, and mentioned that he had observed them for many years in his own garden, but up to the present time no notice of the attack had been practically taken in Germany; likewise that as yet the *identity* of the species of Gall Mites which cause the respective attacks on the Black and Red Currants had not been made out. However this may be, it is quite certain that the Mites are very nearly related, if not of the same kind, and there is no difference observable in swollen bud growths; therefore the information from Dr. Thomas is very valuable as a hint for watching whether the infestation may appear on Red and White, as well as on Black Currants; and also, in case of importation of Currant-plants from Germany, care should be given to this point.

MANGOLDS.

Beet Carrion Beetle. *Silpha opaca*, Linn.

The Beet Carrion Beetle is very common, and often to be found in small carcasses,--as dead birds, rabbits, garbage, &c.,--and until rather more than forty years ago it does not appear to have been known that its maggot was at times a vegetable feeder. About that date it was first observed as feeding on Beet-leaves in France, and from this circumstance--namely, from its double method of feeding--it takes its common name of the Beet Carrion Beetle. Since then it

has been recorded as doing harm to Mangolds in Ireland, and in 1884 specimens were sent to me from Mageney, Co. Clare, of this Beetle, which was then eating away the Mangold-leaves down to the stems.



SILPHA OPACA.

1, 2, Young grubs feeding; 3, 4, grubs, differing in shape, somewhat magnified; 5, female Beetle, flying; 6, male Beetle, magnified.

Up to this year, however (though the Beetle is common here), we have no records, as far as I know, of either this Beet Carrion Beetle or its maggot being a crop pest in England, and it would be very serviceable if we could make out the cause of its appearance in three widely separated localities in England, as well as of the greater amount of its presence in Ireland.

The first note of the presence of the attack in England was sent me on June 13th by Mr. John H. N. Walford, Ruyton Towers, near Shrewsbury, as follows:—

“ I enclose you some specimens of insects that have entirely eaten bare about three acres of Mangolds for me. They eat the young plants as soon as they appear above ground, and at the same time have destroyed all the annual weeds, which consist largely of chickweed.”

The specimens sent proved to be grubs of the Beet Carrion Beetle. The rounded edges of the first three segments of the larvæ, as contrasted with the sharp hinder edge of those immediately following, were particularly noticeable. A few days later, in reply to my enquiries, Mr. Walford mentioned that he was not aware of anything to account for the attack. The land, which is light and sandy, had been well cultivated in the preceding autumn, and ploughed at the beginning of March. No farmyard manure had been used (because it happened there was not enough), but the manure applied was entirely artificial “bone manure,” a mixture of superphosphate and dissolved bones. Both Mangold-seed and manure were procured from the firms usually dealt with.

With regard to safety of other crops put in on the infested ground, Mr. Walford wrote further that he had drilled Swede-seed since on the

Mangold ground, but did not plough up or cultivate the old ridges. The ground was perfectly bare, and after drilling the Swedes it was rolled with a heavy roller; this operation and trampling killed many of the insects. The Carrots that adjoined the Mangolds on one side were untouched by the grubs, and a small quantity that was eaten off in a crop of Swedes on the other side was considered on investigation to be taken by Flea Beetle, not Beet Carrion Beetle.

On June 15th further specimens of the same kind of grub were forwarded me (by the courtesy of the editor of the 'Agricultural Gazette') from Cwmbran, near Newport, Monmouthshire, with the mention that it was an insect new to the sender, and which was destroying what promised to be a very fair crop of Mangolds. On July 12th specimens of the same grub (namely, that of the Beet Carrion Beetle) were sent me by Mr. Edmonds from Wiscombe Park, Honiton, Devon, with the information that it was doing considerable damage to the Mangolds of some farmers near.

The above observations, it will be seen, refer to attack in England at three places respectively, in Shropshire, Monmouthshire, and Devon; the following refer to attacks in Ireland, respectively in Kilkenny and Tipperary. On June 28th Mr. J. Loftus Bland wrote me from Blandsfort, Abbeyleix, regarding attack to his Mangolds, some part of which was caused by grubs of Beet Carrion Beetle, of which a little later he sent numerous specimens of different ages; one of them (which he mentioned as the largest grub which he had been able to secure) was about five-eighths of an inch long.

Mr. Loftus Bland reported:—"I am at a loss to account for the presence of the Beet Carrion Beetle in my land; the manure used was half farmyard, made in covered yards, and half the cleaning of a pond that had not previously been cleaned for over thirty years; also superphosphate (26 soluble) and agricultural salts spread broadcast. No bones, no decaying animal matter."

There is a graveyard (very ancient), in constant use now, on the farm, perhaps some five hundred yards distant from the Mangold fields,—that is the only way I can account for the presence of animal matter to any great extent.

On or about June 19th Mr. D. Sym Scott, of Ballinacourte, Tipperary, Ireland, also forwarded specimens of the Beet Carrion Beetle (*Silpha opaca*) with the following note:—

"From many quarters complaints are rife with regard to a maggot having destroyed large breadths of Mangolds: it is a black maggot, nearly three-quarters of an inch in length, and to the writer a new enemy of that plant."

These grubs were forwarded on to me, and by that time some of them had (as with another consignment sent me) been apparently

exercising their cannibal propensities by feeding on each other, as there were broken remains of skin of other *Silpha* maggots in the box. At this date, on examining some of the specimens previously sent me, I found they were looking in extremely good health, and of a bright shiny black, and, as the Beet-leaves enclosed with them were faded, and I usually found some of the grubs under, or by the portion of a chicken's leg which had become partially putrid, I conjectured that—as they had no longer Beet- or Mangold-leaves in a state suitable for food—they were feeding instead on the putrid meat (or “carrion” from which they take a part of their name. Five days later one or two of the grubs were dead, but others, which were not observable until I stirred the soil, were lively and apparently thriving.

The following notes, also by Mr. D. Sym Scott, convey information regarding the time of attack,—namely, that it is chiefly carried on at night, and the plant-feeder consequently not at once observable; also that the later-sown Mangolds were not so badly injured as the others, by reason of the grubs being at that time nearer the date of their change to chrysalis state; and also full notes are given of the method in which the grub attacks leafage.

As we were not fully informed on these points, I requested information on them from Mr. Sym Scott, as a well-skilled and long-accustomed observer, and in reply he favoured me with the following useful notes:—

“With regard to injury done to Mangold-crop by larvæ of *Silpha opaca*, several farmers in this locality have suffered, myself among them. For some time I could not make out what was wrong with the plant, and (with others) blamed frost at night; but one morning before the dew was off I detected the insect at work, and reported this to others, who also found them. This confirmed my suspicion about an insect, and I also saw that the insect *fed only during the night, or when the leaves were moist*; when the sun was up strongly they buried at or near the root of the plant, which accounted for my not seeing cause of failure sooner. The attack only affected the early sown, which leads me to believe if we do not sow till May, the season of attack will be over before the plant appears above ground. It was on the most sheltered side of my field the attack was most severe. On this side of the field the crop is ruined, but on the more exposed part the plants are recovering.

“No bone or any artificial fertilizer were used, either here or elsewhere, in this part, nor have any been used for years past, so that bone manure is not the cause. I use only farmyard, and that of good quality, same as used for years. I have further to say that the soil on the different farms is in each instance different; the treatment here

same as for past years; the seed was even got from separate firms,—mine was got in Plymouth, the other Dublin and local.

“I was at one time inclined to think the cause lay with the manure from fattening houses, as it sometimes contains ill-digested Indian corn meal, which might attract the maggot, but on a neighbouring farm where they use similar food no attack was found. I have taken some pains to find out a cause, but failed, unless we take climatic influences; last summer was the driest on record within sixty-one years,—it was followed by a remarkably mild winter and spring. Could this have anything to say to their presence? It might, as I remarked the Turnip Fly much earlier than usual this season; others have made the same remark. If spared next year I will knock about the Mangold a few wild pigeon, rooks, hawks, or similar vermin, which we generally shoot in spring, and try what effect feeding will have. I hope, however, I shall have no more of them, as my Mangold are entirely ruined this year.”

In reply to my enquiry whether he could give me a precise account of the method of the attack, Mr. Sym Scott wrote me, on August 13th, as follows:—

“I have too good reason to be able to say how they attack the plant, as they left me but a sorry show for a crop of roots. The maggot attacked the young leaves much in the same way as the Turnip Sawfly, eating them completely down to the surface of the soil. They fed mostly during the evening and early morning, burying at the roots of the plant during the heat of the day. When the leaves were eaten off, the maggot attacked the tender root, and on the part of the field here first attacked the root was gnawed off about a quarter of an inch beneath the surface of the drill. On this portion of the Mangold not one escaped. On the upper part of the same field the leaves only were eaten, so that most of the plants, though late, are growing. My opinion of this is, the lower part of the field being attacked early, the maggot completed the destruction of the entire plant, but *the season of attack was over before the leaves on the upper part of the field were all eaten*. I could pull up a handful of short stumps of the plant on the badly affected portion, clearly showing that the plant was eaten down to the ground, and the root under the surface. I used to dig up numbers of maggots to show to interested parties, from the holes where the plant grew.”

SUMMARY.—Looking now at the main points of information to be gathered from the above reports, it appears, first, that the dates of attack ranged from before June 13th (when the grubs had already eaten off three acres in one locality) to July 12th, but by June 19th many of the grubs had attained almost their full size; somewhat under three-quarters of an inch in the Tipperary district. Secondly,

the grubs feed on the leafage, but, failing this, go down and feed on the roots, gnawing them off about a quarter of an inch below the drill. Where this happens of course the plant dies, but where the leaves were only eaten back (it was observed by Mr. Sym Scott) most of the plants, although late, recovered. This point is very important practically, and attention was drawn to it some years ago by John Curtis, as a reason for *not clearing off a damaged crop over hastily*, for as soon as the grubs are full grown they stop eating, and if the plants have life in them they will at once make growth. Also (as noticed by Mr. Sym Scott) attack will suddenly cease on a crop simply from the time of *change of the grubs to chrysalis state being come*, and all the damage consequently being over.

As the grubs go down into the ground to about three or four inches below the surface for the change to the chrysalis state, it would be a good means of preventing recurrence of the attack to disturb the surface, so as to throw these chrysalids out to be killed by exposure or by the birds. If all goes on naturally, and the grubs are left undisturbed, the Beetles would come up from the ground in about three weeks after the maggots went down. There appears not to be always a clear idea with regard to this insect as to whether it is a Beetle or a grub : this probably arises from its dark colour in grub as well as in beetle state, but a glance at the figures at the head of this paper will show the very different form. The grubs sent me mostly resembled the figure in outline at 4 ; they were as they reached me not so broad as 3, and were chiefly of a deep blackish tint. They have a pair of horny jaws, and three pairs of small legs.

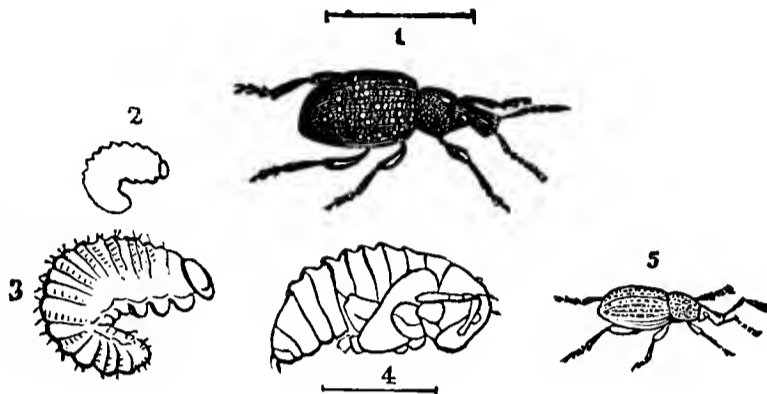
The Beetles are flattish, brown-black, slightly downy, and have three raised lines along each wing-case, and are to be found (as I mentioned in my Report for 1884, p. 61) during winter or early in the spring, sheltering under clods or stones, or in moss and rotten wood, and are common in April in dead animals.

There does not appear to be any reason to suppose that this attack affects other field-crops than Beet or Mangold, although in one instance weeds appear to have been attacked in the infested field. Turnips and Carrots on the two sides of infested Mangolds escaped injury, and, judging from what has been recorded before, there would be no reason to fear danger to other crops put into infested ground, even when attack was known to be present, or *immediately* after attack. Besides Turnips and Carrots above mentioned, Parsnips, Potatoes, Peas, Beans and Cabbage have been recorded as all succeeding perfectly on land where the Mangolds had been destroyed.

RASPBERRY.

Black Vine Weevil, *Otiorhynchus sulcatus*, Fab.

Clay-coloured Weevil, *O. picipes*, Fab. (*septentrionis*, Steph. Man.)



O. SULCATUS and O. PICIPES.

1—4, *O. sulcatus*, maggot and pupa, nat. size and magnified, or with lines showing nat. length ; 5, *O. picipes*.

The two kinds of Weevils—scientifically *Otiorhynchus sulcatus* and *Otiorhynchus picipes* of Fabricius, figured above, have an enormous capacity for doing mischief. In beetle state they feed on leaves and shoots of various plants, amongst which Vines, Raspberries and Strawberries may especially be mentioned, though unfortunately the list might be much lengthened, and sometimes includes field root-crops, of which an especial instance came under my notice in 1885, when the two above-mentioned kinds greatly injured twelve acres of Mangolds.

Their habits and means of prevention and remedy have been so often entered on that they are only now mentioned again relatively to a particularly bad attack of the smaller kind, the “Clay-coloured Weevil” (*O. picipes*), which occurred in a Raspberry plantation in Kent, and of which mention was sent to me, with specimens of the Weevil accompanying, on May 28th, by Mr. Arthur Beale, from Covent Garden Market.

Mr. Beale wrote :—“ I enclose herewith some specimens of a Beetle that does considerable damage to Raspberry-cane, in some instances completely killing the plant by biting out the buds and young shoots. I brought the enclosed specimens from a plantation in Kent on Saturday, but omitted to bring any of the plants ; I could get them if you wished it, but expect it is sufficiently common to be well known. We have been killing great numbers by smoothing the ground round the plants, and then laying a few large clods about, under which we usually find large quantities the next day, and so destroy them ; but this we find a costly and tedious cure, and wish to know if any other remedy can be suggested.”

The habit of life of these Weevils is to lay their eggs a little below the surface of the ground ; from these eggs there hatch legless, whitish, fleshy, and somewhat hairy maggots (see figure), with yellow or ochrey heads and jaws, by means of which they do great damage to the roots of the plants at which they are found.

The maggots may be found in the ground, as in Vine borders, or at the roots of Raspberries for instance, from August onwards, and in the spring—that is about April—they turn to chrysalids in the ground not far from the surface, the depth probably varying with the kind of soil. From these chrysalids, which much resemble the beetles in shape, but have the limbs folded beneath them, and are whitish or yellowish, and without power of movement until fully developed into Weevils, change to this state soon takes place.

In some cases attack may be checked by disturbing the soil in the winter, so as to turn the maggots out, or at least break up their shelters ; for though it does not hurt them to be frozen hard in their own chosen sheltering-places, exposure both to wet and cold will get rid of many.

The Beetles, or Weevils, are of the shape and size figured at 1 and 5. *O. sulcatus* is of a dull black, the fore body granulated ; the wing-cases furrowed and spotted with pale hair-tufts. *O. picipes* is smaller, and more of a reddish brown or clay colour, whence its name. These Weevils are wingless, which is an important matter in getting rid of them. They feed at night, and when out on the shoots of Vines, &c., if a light is suddenly flashed on them they drop to the ground, and for in-doors prevention—as in vineries—this plan may easily be carried out.

With regard to out-of-door plants it is more difficult ; but with regard to Raspberries, where they are arch-trained, the Beetles may be got rid of by sending men into the plantations at night, furnished with lanterns and light wooden trays smeared with tar. One man holds the tarred tray beneath the arch, and the other carrying the lantern gives the bush a smart tap, and thus the Weevils fall on the tar (which of course needs frequent renewing) and are caught and killed. This plan has been found to answer excellently on a large scale, but to carry out it is necessary that the plants should be arch-trained.

Where this cannot be done, the plan mentioned by Mr. Beale of laying clods or anything under which the Weevils will shelter, and which thus can be used as traps, seems, though expensive, almost the only remedy practicable.

SPARROWS.

The observations of the "Sparrow nuisance," as it is well described, continue to show the same points which are observed year by year,—namely, loss from depredations of this bird on fruit-tree buds, &c., to fruit farmers; on young crops or vegetables, as peas, &c., in gardens; and deplorable loss where the birds flock to the standing corn in autumn; and, further, the increasing and widespread evil which is threatened through Sparrow persecution of our most valuable insectivorous birds.

As every farmer throughout the country is well aware of the damage done to his crops, it does not appear necessary to go over details again which have been so often given, though they are not wanting both from farmers and fruit-growers, and in my own garden I have had full opportunity of watching the feathered pests doing damage, whilst at the same time they left the insect pests unharmed on the plants amongst which they—the House Sparrows—were feeding.

But independently of all this serious loss, it is very important to draw attention to the increasing evil of *truly* insectivorous birds being driven away by the Sparrows. Personally, whilst I still lived near Isleworth, I found the Martins which had built plentifully under the eaves were driven off, so that nesting ceased consequently on the increase of Sparrow presence.

Mr. Reginald W. Christy, of Boyton Hall, near Chelmsford, wrote me last year (1888) on this subject:—"The effect of Sparrows on our Swallows and Martins is very marked here: the latter seldom or never bring off young ones. As soon as they have built their nests, the Sparrows come and drive them out and lay their own eggs in them. Both Swallows and Martins are pretty plentiful at first, but they go elsewhere to breed, and as a consequence, we swarm with all kinds of noxious gnats and flies."

Relatively to this point of trouble, caused by Sparrows driving away insectivorous birds, Mr. Ralph Lowe, of Sleaford, who for years attended to the subject, wrote me, in 1885, that at the Moat House, Leake, Boston, Lincolnshire, flies were a pest to such a serious extent that the occupier took my advice *literally*, and *pretty well destroyed the Sparrows*; the Swallows and Martins consequently established themselves in large numbers, and the *pest of insects ceased* to be destructive in garden and orchard.

In June of last year Mr. Champion B. Russell, of Baldwins and Stubbers, Essex, continuing communication with which I had been favoured by the late Col. Russell, of Stubbers, for some years, sent the following observation, which, it will be seen, shows presence of

Sparrows in droves, but *not of Martins*, at Baldwins, where Sparrows had *not* been looked after, and, on the other hand, *presence of "hundreds" of Martins* at Stubbers, where, as is well known to all interested, Sparrows had been kept in check for a long series of years:—

Mr. Champion Russell wrote:—“When I came to my farmhouse (Baldwins) last autumn there were thousands of Sparrows.” . . . “I have not yet persuaded any Martins to come here, although I have put up foundations to look as if Martins had been there before. This is curious as Stubbers is scarcely a mile away, where there are hundreds.”

In answer to an enquiry which I wrote to Mr. J. H. Gurney, Jun., of Keswick Hall, Norwich, as an ornithological observer, he mentioned that he could testify, from personal observation, that the Sparrows drive away the Martins, and that he considered the undoubted decrease of this species in the British Isles to be due to their being prevented from nesting by the Sparrows.

I have other notes sent in as to Sparrow mischief, but it is perhaps better to use space, in a short account of what is happening, where these destroying birds have reached the unbearable amount of increase to which they appear to be quietly advancing here.

In the Report of Dr. C. Hart Merriam, Ornithologist to the Department of Agriculture, U. S. A. (published in 1887), he gives details of the spread and baneful effects of the presence of this bird,—which are well worth studying,—and he officially recommends the immediate repeal of all existing laws which afford protection to the English Sparrow, and, amongst other helpful suggestions, advises the enactment of laws making it a misdemeanour punishable by fine or imprisonment, or both, to intentionally give food or shelter to the English Sparrow, except with a view to its ultimate destruction; to introduce or aid in introducing it into new localities; or to interfere with persons, means, or appliances engaged in or designed for its destruction, or the destruction of its nest, eggs, or young.*

* What may be desirable in this country as to legislation is equally beyond my knowledge or wish to express opinion on, but it certainly would make a difference if heads of families would interfere regarding the widespread habit of specially feeding these birds. As well said by Prof. W. Fream, of the College of Agriculture, Downton, in his paper on Bird Pests, given in the ‘Mark Lane Express’ for November 12th, 1888,—If the winter should be severe “many humane hearts will feel for the birds, but unfortunately it is the ‘poor Sparrows’ that usually come in for much misplaced commiseration, and for liberally scattered crumbs. The small insectivorous birds, true farmer’s friends, are not thought of. If they were, then some shreds of meat might be strewn for their benefit, and so they might be helped through a season when their natural food is almost unattainable. It is true that the Sparrow would appear at this feast, because he is an impudent, greedy, bullying little creature, who will eat anything, whilst the useful insectivorous bird has no palate for bread-crumbs.”

I have also received from Prof. Riley, Entomologist of the Department of Agriculture, U. S. A., a paper published by him in the 'Northern Tribune' (April 26th, 1888), containing the substance of a communication submitted to the Biological Society of Washington, regarding contents of stomachs of Sparrows.

Under this description "is included not only what is taken from the crop, but that taken from the gullet and mouth."

From the length of the paper—which, besides the anatomical investigations, includes a very large amount of careful scientific and practical observations—I cannot give it here; but the result of the whole is conveyed very plainly in the title under which the paper is published:—

“THE BRITISH PEST.

“Worthlessness of the Sparrow as an Insect-killer.” By Prof.
C. V. RILEY, Entomologist Agricultural Department.

In Canada, at the Annual Meeting of the Entomological Society of Ontario at Ottawa, Mr. J. Fletcher, the Dominion Entomologist, took occasion to refer to the injuries inflicted by the English Sparrow, whose *destruction he strongly advocated*; and the Hon. C. W. Drury, Minister of Agriculture, who attended the meeting as head of the Agricultural Department of Ontario, expressly to show the importance attached by the Government to the work of this Society, stated in reply to Mr. Fletcher “THAT THIS DESTRUCTIVE BIRD WAS NO LONGER UNDER THE PROTECTION OF THE ACT OF PARLIAMENT RESPECTING INSECTIVOROUS BIRDS, AND THAT EVERYONE WAS AT LIBERTY TO AID IN REDUCING ITS NUMBERS.” This on October 6th, 1888.

In South Australia, where the Sparrows are a grievous evil, the Royal Agricultural and Horticultural Society are taking the matter up by offering prizes and rewards for its wholesale destruction. On November 12th, 1888, Mr. Albert Molineux, Member of the Society and Editor of the 'Garden and Field,' and a valued correspondent of my own, forwarded the following note of arrangements:—

“SPARROW DESTRUCTION.—At a meeting of the Sparrow Destruction Sub-Committee of the Royal Agricultural Society, held on Wednesday, November 7th, it was resolved to supplement the already liberal prizes to be offered at the Autumn Show for Sparrows' heads and eggs. The prizes consist of £2, £1 10s., £1, 15s., 10s., and 5s., for the largest number of heads, and the same amount for the largest number of eggs. The Sub-Committee having received a sum of £5* from Miss Eleanor A. Ormerod (Consulting Entomologist to the Royal Agricultural

* I am unwilling to publish my own name connected with any trifling contribution in furtherance of any object, but in this case I have done so, as the strongest way in which I could show my belief of the urgent need of action,

Society of England), in aid of what she terms the laudable object of destroying this crying pest, and having also resolved to collect a fund by public subscription to effect this purpose, if possible, have determined to give 2s. 6d. to each competitor who fails to secure one of the above prizes and yet brings not less than 100 heads or eggs, and to all others who bring in not less than 50 heads or eggs they have decided to give a reward of 1s. In all cases they demand that the heads shall be on strings or wires, of twenty-five each, and must have been put into a strong brine of salt and water."

Mr. Molineux, who is himself a member of the Sparrow Destruction Sub-Committee, informed me further that now attention was roused, and the boys were routing out the nests and killing the Sparrows "wholesale," and it was believed that a great number would be got rid of.

The above notes give some idea of what is going on about this well-called "nuisance" the *Passer domesticus*, or "House Sparrow," and it might lessen the difficulty of getting the matter attended to if it was fully understood that under this name no other kind of bird is included, and that it is distinctly different from the "Hedge Sparrow." There are some very vague ideas abroad on this subject, and so much communication is sent to me on the matter of Sparrow mischief that I feel bound to point out—besides the grievous waste to our crops, gardens, and fruit farms—how serious a matter it is that, whilst the increase of kinds of fly pests of our corn-fields is so observable as it has been in 1887 and 1888—a regular means of lessening the number of our best and most helpful insectivorous birds should go unchecked.

Space does not allow me to go into anything like the detail which would be of service in this matter, so I therefore append a list of publications in which information of a sound, well-founded, and serviceable nature, from trustworthy writers, is given.

I also take leave to add that, through the kind courtesy of Mrs. Russell, widow of the late Col. Russell, I have been presented with the series showing (in preserving fluid) the contents of the Sparrows killed for examination during many years, the dates of examination (showing the steadily continuous method of observation, month by month and year by year) being often given; and to those interested in the subject the series affords a very instructive general idea of amount of grain consumed.

References to Works where information will be found on Habits of the House Sparrow.

“ Report of Committee on the House Sparrow rendered to Council of American Ornithologists' Union, April 21st, 1885 ; being Report of Results of Investigations over allotted sections of the entire United States and Canada.” Procurable also in the Number of ‘ Forest and Stream ’ for August 6th, 1885 ; published at 39, Park Row, New York, U. S. A., or through English booksellers.

“ Report of the Ornithologist to the Department of Agriculture, U. S. A. (Dr. C. Hart Merriam) for the year 1886.” Published at Washington, Government Printing-Office, 1887.

Paper by Prof. C. V. Riley, Entomologist to Department of Agriculture, U. S. A., on “ Contents of Stomachs ” of Sparrows submitted to Biological Society of Washington. Substance given by Prof. Riley in the ‘ Northern Tribune,’ April 26th, 1888.

“ Observations by Lieut.-Col. Russell, J.P., D.L., of Stubbers, Essex.” Read before the Essex Field Club, and published by that Society in their volume for 1882. Buckhurst Hill, Essex.

‘ The House Sparrow.’ Published by Messrs. Wesley and Son, 28, Essex Street, Strand, London, W.C. This is a small 8vo. vol. of 70 pages, containing excellent information, with tables of food of adult Sparrows during each month of the year ; also up to the time of leaving the nest, and other serviceable matter.

In my own Eighth and Ninth ‘ Reports on Injurious Insects ’ (Simpkin, Marshall and Co., Stationers' Hall Court) I also give reports on this bird.

WARBLE.

Ox Warble Fly. *Hypoderma bovis*, De Geer.



HYPODERMA BOVIS.

During the past season the subject of Warble prevention, both as a matter easily carried out and also as one of serious importance, has made great advance. The leading Agricultural Societies, Societies and Companies more especially concerned with the sale of hides, land-owners and cattle-owners, and the agricultural and also the general and local press, have all helped heartily, and the result has been excellent and not confined to this country.

Here I have had communication from every one of the English counties, and likewise from various localities in Wales and Scotland, and especially from Ireland; and information has been sought from various localities on the Continent and from N. America. Besides much information asked for by letter, which I have always endeavoured to attend to as promptly and as fully as I could, I have distributed somewhere about 23,000 of my four-page leaflets with life-history and method of prevention and remedy of Warble attack, in addition to about 40,000 previously distributed: and Messrs. W. Murray and Sons, hide factors of Aberdeen, N. B., also made arrangements to have 15,000 of this leaflet printed at their own cost, and distributed free to all the agricultural servants and those interested in cattle management who entered the show-yard at their Annual Show at Aberdeen on July 19th. The Exhibition by the Newcastle Hide Inspection Society (Mr. J. McGillivray, Sec.), at the Royal Agricultural Society's Show at Nottingham, did much good, as well as that at Newcastle-on-Tyne in the previous year.

The plan adopted of displaying badly-infested hides when newly removed from the animal, so as to show the under surface and its horrible condition with the great maggots working in their putrid cells, has proved to be one of the best methods of drawing attention to the great injury caused to the living animal. Besides these, tanned hides were so shown that visitors might see how they were riddled by the maggot holes, and the maggot and fly were also exhibited, and all

necessary information given to visitors by a member of the Inspection Society, or one of their *employés*. The Nottingham Hide Market Co. (Mr. W. Welbourn, Sec.) helped cordially and most serviceably by supply of fresh hides, and also by distribution of posters and hand-bills with short and clear directions for Warble prevention. The same kind of arrangements were adopted at other agricultural shows with excellent effect, and the great thing now needed is to carry on the work so that those not yet reached may be *obliged* to know the nature of the attack, and that it can for all practical purposes be stamped out by *each man amongst his own cattle*.

Last year was an excessively bad one for Warble attack where cattle had not been looked to, but (as will be seen by the reports sent in) even under these circumstances it was slight where preventive measures had been taken.

In the following pages I give (mostly in my correspondents' own words) notes of the applications which have been used, and results also of the continued benefit to the cattle in Bunbury district, Cheshire, where preventive measures have been carried on now for several years; some notes showing sickness and death where cattle were neglected; and also returns with which I have been favoured from leading Societies, Firms, Hide-market Companies, and others, showing amount of hides passing through their hands in the course of one year, with estimates of the proportion amongst these that have been warbled, and consequent depreciation in value. These are given by permission, with the names of the senders, to whom I am greatly indebted for their courtesy in furnishing me at my request with such valuable help towards forming an estimate of the amount of money lost yearly on hides only by this quite needless pest.

The following notes refer to various kinds of treatment and applications found serviceable, during the past season, in destroying the maggot or preventing summer galloping, — with observations of the senders both as to the satisfactory effects of treatment and to the great need of it.

On May 26th Mrs. Holford, of Castle Hill, Cerne, Dorchester, wrote as follows:—

“I can now give you the results of following your directions last season about the Warble Fly. In the dairy herd of thirty-two cows we have only found seven maggots; in the other, forty-one head of all ages, only three animals have any, though I expect to find more after a few days of this warm weather. Needless to say I shall continue your treatment.” Mrs. Holford further mentioned:—“I have said nothing of our short-horn herd as they are quite free, and, having sheds to go into when the fly is about, do not run the same risk.” This point is very important because (as I have noted on the fourth

page of my Warble leaflet) "Warble Flies are most active in heat and sunshine," but commonly the shelter of trees is the best that can be hoped for.

On May 26th Mr. James Phillips wrote to me from Carse, Kirkcudbright, N. B., regarding the application of McDougall's dip:—

"I think the remedy you recommend in McDougall's dip must be effectual. This last spring I had a bullock infested with lice, and to rid him of the vermin I had his back completely washed with the said dip, about the end of March. Since receiving your advice I have examined him carefully, and find that I have 'killed two birds with one stone,' as on him neither maggot nor cell is to be found, although on the backs of his neighbours in the same field there is abundant evidence of the pest being still in winter quarters, or in some cases signs are not wanting that the unwelcome guest has lately taken his departure."

The following report from Mr. F. C. Smith, of Clayton Park Square, Newcastle-on-Tyne, who bestowed much time and trouble on drawing attention to the subject of Warble prevention, was sent me on June 4th:—

"I lately met Mr. James Renton, tenant of North and South Brackley farms, near Blagdon, to whom I gave a copy of your notes about a year ago, and who then told me that his stock—numbering about forty head—were infested with Warbles. He forthwith commenced to use a dressing* composed of train oil and sulphur, of the consistence of thick cream, which he applied to the Warbles with most excellent results; and later on, in August, he dressed them with the same preparation,—over the shoulders, and along the spine, and down to the hocks."

He reports that *no* Warbles are upon stock of his own breeding, although he has had much trouble with *Irish* stock brought to fatten off; and that many of his neighbours are in a bad way with their stock suffering from Warbles, and these people are now going to adopt the same remedial measures as my informant has proved to be so effectual. "Mr. R. in the future intends to dress his stock in May and August, and blesses the day upon which he got your 'Notes,' as his stock are now undisturbed by Fly and thriving apace."

On June 14th Mr. Ernest Mead, who had communicated with me before on the subject of Warbles, from 1, Western Road, Tring, wrote as the result of his application of oil and sulphur to the back of cattle in the previous summer:—

"As regards some three-year old bullocks that were dressed, I have

* Mr. Renton says that a gallon of train oil, costing three shillings, and sulphur, costing say threepence, was sufficient to dress thirty-two head once.

kept some of them till quite recently. After examining them several times I have not seen a trace of Warble."

At the same date as the above Mr. John L. Hewer, of Copthorne Villa, Dymock, Gloucestershire, favoured me with the following note regarding effects of squeezing out the maggot, and also of application of the dip:—

"I followed your instructions with the two worst cases,—squeezed the grub out where possible, and put some dip on the remainder, and am very pleased to tell the result is quite satisfactory. My impression now is that I used the dip last year much too thin; this time I have used it very much thicker, and the cattle are quieter and do better than last year."

Mr. D. Sturdy, of Trigon, Wareham, Dorset, writing on June 16th about Ox Warble Fly, mentioned that—

"As it has been continually persecuted here from the time you first wrote about it, there are very few to be seen. My men have become very expert at pricking the maggot with a needle, and we depend more on that than dressing, which is rather a business with 150 head of cattle. At the same time I found the various dressings very effective in years gone by."

Of course whatever is the cheapest and surest way of getting rid of the maggot is the best, but I have been afraid of advising pricking them, as it takes some care and practice to perform the operation dexterously. I have known the cattle to be put to pain when the prick was not quite properly given.—ED.

The following observations, with which I was favoured on June 5th, by Mr. Gerard Meynell (of the Norfolk Estuary Company), writing from 20, Whitehall Place, London, S.W., refer to the successful use of Calvert's carbolic sheep-wash for destroying Warble-maggot:—

"For some years past the sheep on this Company's farm at Lynn have been dipped in a solution of Messrs. F. C. Calvert & Co.'s carbolic sheep-wash,—80 to 100 of water to 1 of the carbolic wash supplied,—which has effectually kept them free from all scab, lice, ticks, fleas, &c. Last week I examined the Company's herd, and found some of them affected with Warbles. I had a somewhat stronger solution of the carbolic sheep-wash applied to the parts affected. On the following day all the Warbles appeared to be dead; the more mature ones certainly were so."

Mr. J. Stewart Peter, of Calley, Bridge of Calley, Perthshire, on June 20th sent me the following note, suggestive of dilute carbolic acid being in some cases better than greasy applications:—

"I have dressed a number of short-horn crosses as directed, and feel sure that they will derive great benefit from it. I rather object to dressing my West Highlanders, though, with an oily or greasy

mixture, as it will mat their shaggy hair and prejudice the English buyers against them when they come north in October. I think for them carbolic acid and water ought to suffice."

This point, that is, effect of different treatment on the very shaggy breeds of cattle, would be well worth special observation, for besides notes received from Mrs. Holford, of Cerne, Dorsetshire (p. 105) of treatment of her different herds, she mentioned a case to me of two Highlanders, of which one was treated for Warble by the maggots being removed; this when killed (three weeks after) was found to have the hide healing quite satisfactorily. The other, which had the maggots destroyed in the hide, when killed (six weeks after) was found still to have some amount of inflammation present. It occurred to me as possible that the shaggy hair might clog together into a mass over the Warble-hole, and so prevent the proper discharge of the putrid contents.--ED.

On June 26th the Hon. G. E. Lascelles, of Sion Hill, Thirsk, wrote me :—

"I have tried paraffin and sulphur on my milk cows (twenty-five) last summer, and this year have hardly any Warbles amongst them, and am now dressing with cart-grease, McDougall, and sulphur, with a little spirit of tar, every beast on my farm,—about a hundred, some twenty brought in being very full of Warble."

Mr. Lascelles added, that strongly pressing the importance of the matter upon all stock-owners was doing good service to the agricultural interest.

About the same date (June 27th) Mr. Saml. R. Sherwood, of Hazlewood Hall, Friston, Saxmundham, wrote :—

"I caught all my cattle a few days since and dressed them with McDougall's smear for bots, and only wish I had done it before;" and on the same day Mr. G. Thomas, of Coosenwartha, Scorrier, Cornwall, wrote that, "thanks to the advice and use of preventives," my cattle are entirely free from Warbles, and I shall never allow them to go undressed again.

"I found wheel-grease too strong, as it blistered. McDougall's dip proved excellent, but it is difficult to procure here as there are no agents."

The following note, sent me on July 5th by Mr. John Watson, jun., from the Estate Office, Sherburn, near Tetsworth, also mentions serviceableness of McDougall's smear :—

"I have been making use of your advice about Warbles with most satisfactory result. McDougall's smear is an excellent cure as well as preventive, and I am sure the trouble and expense is well repaid by the increase in the animals' comfort."

Mr. John Bulteel, of Painflete, Ivy Bridge, Devon, also mentioned

that, by following the advice given, "the Warbles in the skin of my cattle have quite disappeared, and fifteen cows are now grazing in the meadows without a symptom of discomfort."

The two following observations refer to successful use of ointment prepared by the Dee Oil Company, Chester. The first was forwarded to me by Sir James T. Stewart Richardson, Bart., of Pitfour Castle, Perth, N.B. :—

"I have been trying a new Warble ointment this summer, from the Dee Oil Company, Chester, and the effect on the maggots in the Warbles was marvellous, and I am now dressing all my cattle to prevent the Fly striking next month."

Miss Lyle Smith, writing from Barrowmore Farm, Chester, also sent the following note :—

"You may be interested to know that the Dee Oil Company, in Chester, prepare a kind of grease of which they send samples gratis to any farmer who will try it. I found it most efficacious, as did also a neighbour, who had lost a heifer simply from attack of this creature [Warble-maggot—Ed.] in the spring."

The two following letters refer especially to the benefit of the applications in preventing summer galloping, and thus allowing the animals to rest in peace.

Miss Lloyd, writing on August 6th from Hengwrt, Dolgelley, N. Wales, reported that in her own case, and that of two of her neighbours "whose cattle had been driven wild with the bites of the flies which seem to abound in the estuary of the Mowddach where our meadow pastures are, the smear was thoroughly efficacious, and allowed the animals to be peaceably grazing, while other farmers complained bitterly of the risk and loss of condition caused by these pests in their stock."

The Ven. J. C. Archdall, Archdeacon of Ferns, writing from the Parsonage, Newtown, Barry, Ireland, on June 30th, regarding the leaflets, mentioned he had delayed reply in order first "to try the effects of the suggested remedy, and I am happy to tell you with the best results.

"I have in my hands fifty acres, surrounded very much with wood; I have thirteen head of horned cattle, and I used to be obliged to bring them into the house to keep them on the land: there is abundance of water, but they were literally hunted off the pasture by the Fly. I have applied sulphur, spirit of tar, and train oil, and after one dressing the animals were freed from all persecution. I intend to apply it again in the coming week. One of my neighbours, to whom I gave a leaflet, stopped me in the street a few days since to thank me for putting him in the way of showing mercy to his cattle."

The following returns are given in tabulated form, to show the continued success of the treatment of the cattle in the district round Bunbury and Tarporley, Cheshire, by the boys of the Aldersey Grammar School. This was begun at first under the suggestion and instruction of the Head Master, Mr. W. Bailey, but now continued also from the benefit accruing to the cattle and thence to their owners. By the end of 1887 the progress was considered so satisfactory that a letter from Mr. Bailey to His Grace the Duke of Westminster, giving an account of the work of the boys, was read before Committee on December 6th, 1887, at the Royal Agricultural Society, and directed to be published, and the work since has been equally satisfactory.

The majority of the boys of the school are sons of farmers, and the returns therefore show the benefit of the treatment, whether on the broad scale of the many head of cattle owned by tenants of large farms under the Duke of Westminster or other great landowners, or to the one or two cows of a small holder, to whom the health of his animals is even more important.

In the following table I give the names of the boys, both for exactness of record and also as a little encouragement to them in good and useful work, and likewise the number and kind of stock examined, and the number of Warbles and kind of stock on which they were found, and also whether on home cattle or on stock brought in; and it may be remarked that these returns are from a district where a few years ago Warble were, as it was phrased, as plentiful as blackberries.

The following short table was sent to me by Mr. Bailey, on March 20th (1888), as the result of examination by the boys named, on the preceding Saturday:—

NAME.	STOCK EXAMINED.	NUMBER OF WARBLER FOUND.
A. E. Willis	32 cows	1 Warble on 1 cow, and 10 on newly bought cow.
T. Jones	39 cows & 11 heifers	1 on each of 4 cows, and 15 on heifers.
C. Palin	25 cows	2 Warbles.
A. Jones	1 cow	None.
J. Williamson	2 cows	None.
C. Matthews	2 cows	1 Warble.
F. H. Willis	40 cows	Only 3 Warbles.

The following table shows results of examination a month later, on April 17th, and was also forwarded to me by Mr. Bailey:—

NAME.	STOCK EXAMINED.	NUMBER OF WARBLES FOUND.
Percy Willis J. R. Nield	32 cows and 1 heifer 86 cows	4 on one newly bought cow. 20 Warbles, <i>viz.</i> , 3 on one cow, 2 on another, and 1 on each of 15 other cows.
Percy Allwood	57 cows	10 Warbles on four recently bought cows, <i>viz.</i> , 4 on each of two cows, and 1 each on the other two.
Alick Dale John Wilson	57 cows & 15 calves 66 cows & 13 heifers	14 Warbles, all on calves. 18 Warbles: 3 on cow, the rest on heifers.
Thomas Y. Willis Ernest Jones	8 cows 39 cows, 11 heifers, and 6 calves	17 Warbles. 4 Warbles on cows, 15 on heifers, and 139 on calves.
Henry Garner J. H. Kirkham	2 cows and 2 heifers 3 cows, 2 heifers, and 1 calf	4 Warbles on heifer. 2 Warbles on cow, 30 on two heifers.
George Whittle	4 cows and 3 heifers	3 Warbles on one cow, and one on each of two heifers.
Joseph Proctor	3 cows, 1 heifer, and 4 calves	None on cows or heifer, 8 on one calf, and 4 on another.
Ernest Pickers Frederick Dutton Thomas E. Willis	2 cows 27 cows 25 cows	2 Warbles on one cow. 3 Warbles. 7 Warbles, all on newly bought cow.
Enoch Hunt	5 cows and 2 heifers	2 Warbles on one cow, 26 on one heifer, and 5 on the other heifer.
Joseph Stanyer	38 cows	2 Warbles on one cow.

The above total of stock examined is 515 head; the total of Warbles, 341. Looking at details, on 454 cows there were only 79 Warbles, and of these 21 were on newly bought animals; but even taking these in, if the Warbles could be divided pretty evenly it would give only one Warble and a small fraction to be divided amongst about every six cows.

On the heifers and calves the average is higher; a total of 35 heifers to 97 Warbles gives 2 and a fraction of a Warble to each heifer.

The amount on calves cannot be fairly averaged, as in one case there were 139 Warbles on 6 calves on one farm; but excluding this exceptional case, and taking the total at the other farms of 20 calves to 26 Warbles, this gives an average of 1 Warble and a fraction to each calf. The above result cannot, I think, but be regarded as highly satisfactory.

The larger amount of Warbles on the heifers and calves is presumably from the greater difficulty of application. In a note from one of the lads—Thomas Jones, of Saughton Lane, near Chester—to Mr. Bailey, he mentioned—“The heifers, through not having been tied up last year, were very difficult to hold, and therefore they were only imperfectly dressed. However, the dressing has taken some effect, for upon the backs of the eleven heifers I only found fifteen Warbles.”

The following are some of the communications which have been sent me regarding serious injury to the condition of the animal, in some cases ending in death, occurring from Warble attack.

Early in May Mr. Charles Magniac, of Colworth, near Bedford, wrote me :—

“Your Lecture at the Farmer’s Club suggested to me that a young steer I saw lately on my farm was dying of Warbles. I have examined him to-day, and have no doubt of it. His back is like a newly-metalled road.” On May 8th I received a note from the bailiff (from the Colworth Estate Office) that the animal was dead.

On June 9th Mr. G. E. Phillips, Treriffith, Moylgrove, near Cardigan, reported without doubt of the serious nature of the attack, and I give his precise wording, as I do not know that any would be more appropriate to the misery of the feeding of more than two hundred maggots on one wretched animal :—

“These infernal maggots are something abominable this season. I and my man actually squeezed 210 out of the back of a yearling beast, and had to leave many behind; the poor creature was nothing but a mass of corruption.”

Mr. M. Johnson, writing from Varmontly Hall, Whitfield, Langley-on-Tyne, mentioned :—

“I live where it is all grazing farms, and the good work has not begun yet. Several of the cattle which were grazed on our highest land did very badly through the winter, and I could only keep them up with very good feeding. These turned out to be totally covered with Warbles. Some of the lumps when squeezed out contained nothing but a lot of sticky matter; they have got the turn now, but I firmly believe it was nothing but the Warble attack that was killing them.”

I should like particularly to draw attention to the following as well as the foregoing observations, which show presence merely on *two* miserable beasts of scores more of Warbles than were found on the 515 head of cattle previously noticed (see line 9 from foot, p. 111), in the neighbourhood of Tarpurley, which had been for the most part duly attended to. I can confirm the serious extent to which the attack runs on, by state of hides now before me, one of which, from a two-year old heifer, has 300—the other, from an animal which died of consequent mortification of the back, more than 400—Warble-holes in it.

On May 28th Mr. Francis Drawfield, Alton Manor Farm, Wirksworth, Derbyshire, sent me the following account :—

“In the beginning of April I had a heifer that began to lose flesh (of course she was in calf), and all the good keep and care would not prevent the flesh from going.

“She went on till the beginning of this month, when she got down and could not get up, but still kept on eating as usual.

“I had her removed into a warm paddock ; I set a trough in front of her with bran, linseed-cake, and malt, which she continued to eat ; I mashed her malt and put gentian root in the mash, and she drank the liquid from the mash. We left her at night to all appearance as lively as usual, but the next morning we found her dead.

“When taking off the skin, I found from the shoulders to the hips bored one complete riddle with Warble maggots.

“In counting, I found no less than 310 holes ; on taking it to the tan-yard, they pronounced it good for nothing.

“There is no doubt the Warbles were the cause of death.

“It will be a great blessing for the poor cattle if something is found out to remove the pest.”

On June 16th the following note was sent me by Mr. John R. Golding, of Baunmore, Clare, Galway, Ireland, regarding serious amount of injury from Warbles :—

“Owing to the prolonged excessive heat last summer, the Warble-pest has done great injury to young cattle in this district, causing death in some instances by their numbers, from March last up to this.”

Another note on the same subject was sent me on May 15th, by Mr. Thomas Barrett Lennard, of Horsford Manor, Norwich, who wrote :—

“Many of my beasts have bumps, but one—which is so thin and wretched that he seems not long for this world—is one mass of bumps.”

The above returns are a portion only of the information sent in during 1888.

Besides the letters above quoted, I had communications weighing over five pounds with requests for the four-page leaflet, which often also conveyed accounts of the suffering, or illness, or inconvenience, or consequent money loss, caused by the Warble attack. Frequently, also, the application for information was followed after a while by another letter, with the mention that reply had been delayed until the success of the treatment advised had been proved, and now more of the leaflets were desired for circulation in the neighbourhood.

I do not claim for the treatment that absolutely no Warbles at all are to be found where care is taken, but, as will be seen by looking over the return (pp. 110--112), the amount of these on the cattle of a widespread district may be reduced, with very little trouble and expense, to no more in the total than may now be found only too often on a couple of beasts where no care has been taken.

Amongst the many reports which I have received, I am not aware of more than three in which the kind of treatment which was applied, as being *supposed* to be what is advised, failed to have good effects, and in these cases I do not feel sure that the dressing was well applied.

Where the maggots are either removed by squeezing, or by choking them with external applications (as advised in the leaflet), I am not aware of any case in which satisfactory results have not followed.

Also, so far as reported to myself, the recipe given at page 3 of my leaflet for preventing Fly attack in summer answers well; but I think it should be carefully kept before the minds of herdsmen, with regard to dressings to keep Fly off, that—though the effect of some kinds lasts a long time—it is often waste money just to run the animal over with some wash of which the effect soon goes off, especially if this is done weeks or months before Fly time.

I know, with absolute certainty, that a little dab of McDougall's smear properly applied on the tip of the tail of the maggot in each Warble-hole will kill the maggot; but I am very far from supposing that a dressing of dilute smear or dip,—either of Messrs. McDougall's or of any other firm,—if just only run over the coat in May or June, will either choke the maggots then or prevent attack later in the summer, when the time comes for the Fly to hatch out of the chrysalids.

The treatment is very simple, but it needs that the material to choke the maggot should be applied quite certainly *to it*, and also that the dressing to prevent Fly striking should be of a kind of which the effect lasts for a while, and should be applied when Fly is (or is likely directly to be) about.

Train oil (without any addition), applied by being rubbed down the spine and a little along the back and ribs, has been found very useful as a dressing to cattle when turned out into the fields in summer.

A mixture of sulphur 1 lb., soft soap 1 lb., and boiling water 3 pints, applied when cold with a brush to the animal's back, has also been found useful; as well as sulphur $\frac{1}{2}$ oz., prepared lard $1\frac{1}{2}$ oz., tar 1 oz. But so far as I can judge, the mixture of train oil, sulphur, and spirits of tar, noted on page 3 of my leaflets, has been found to answer best of all.

What is now needed to be done to stamp out this attack for all practical purposes is to get knowledge spread abroad of what Warbles *really are*, and what their effects are, so that, amongst other benefits, cattle buyers in country districts should not be imposed on by old-fashioned tales, long since disproved, about boils and humours, and action of the grasses, which can in a second be proved false by applying a finger and thumb to the Warble and squeezing out the great maggot.

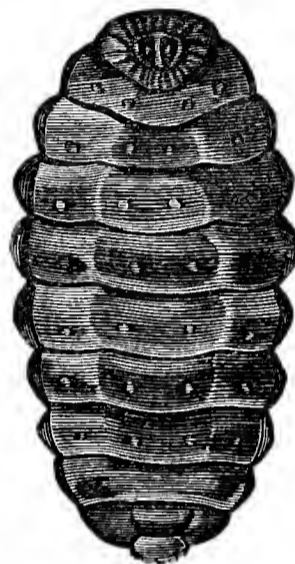
Every man, however ignorant, has sense to know, when it is put before him, that though he may have a boil on his neck or spine he has not a great maggot in it, and if this could be impressed all round the country it would make a deal of difference.

I am not aware of anything that brings the knowledge of the mischief that is going forward home to all minds better than showing the *inside* of a badly-warbled hide. Outside, the hair, &c., prevent the mischief fully showing; but when the inside is seen with the great maggots wriggling in their cells, showing their shape through the thin film to which they have worn down the lowest tissue, and the putrid matter breaking out in places, this brings conviction home that all is not "as well as could be wished."

The two accompanying figures (see p. 116) show the powerful basketwork-like coating of muscles with which the maggot is furnished after its last moult within its thick skin, and the external bands of prickles. By means of the first it can wriggle itself perpetually about in its cell, and thus with the help of the prickles—which it possesses more or less through life—it keeps up a perpetual irritation.

It may be of some interest, as a specimen of how this attack is misunderstood through sheer want of information, to mention that I have a note before me of Warbles being rubbed with whale oil to bring them to a head, and then *burnt off with hot tar*. Where a man would go to this trouble and expense, and labour, to torment and injure the unlucky beast, he would have been thankful to know better.

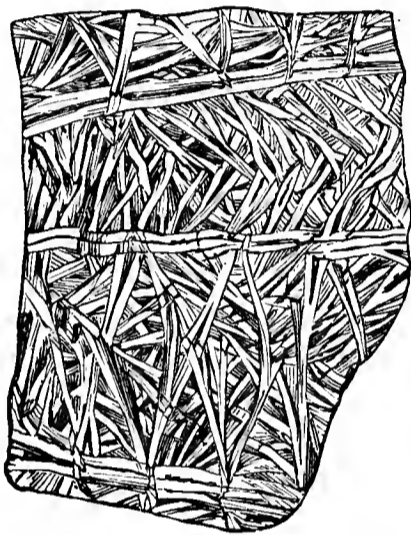
The great points of national loss are on loss of health, and



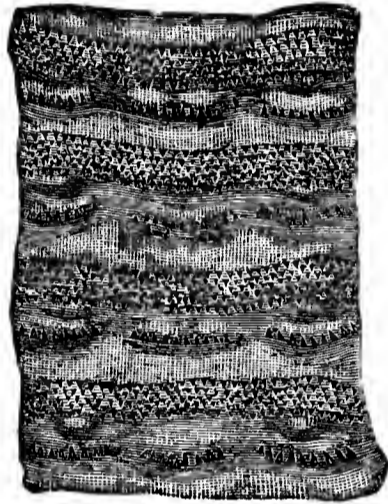
Maggot, nat. size
about 1 in. long.

sometimes death of the beasts, loss of milk, injury to produce in the herd, and loss of flesh in the fattening beasts. All this falls on the cattle owner, but also there is enormous loss running through all classes concerned on the warbled hides.

This strikes first, of course, where the Warbles are first observed: it may come, like the rest, on the cattle owner or farmer; or it may come on the butcher or tanner; or further on it comes on the many trades in which leather, discovered after purchase to be pierced, is useless for its purpose,—a loss to the manufacturer; or a loss, or even a danger, to the wearer or user.



Muscles of maggot, much magnified.



Prickles of maggot, much magnified.

The following notes give amounts or approximate estimates of number of hides passing through various markets (specified) in the course of one year; also amounts or approximate estimates of the proportion warbled and loss thereon.

The first I was favoured with was from Newcastle-on-Tyne:—

“Last year (ending May, 1888) 102,877 hides passed through our markets, and of these we estimate that 60,000 were more or less warbled. Taking an average of five shillings each, which is rather under than over the mark, this gives a loss of £15,000 on our Newcastle hides from this cause for the year.”—J. MCGILLIVRAY, Secretary, Newcastle-on-Tyne Hide Inspection Society.

“Warbles begin to show in March and continue until October. Out of 35,000 hides passing through this market within this period, I should say that one-fourth, or say 8500, would be more or less warbled, and I should estimate the money loss at from £1500 to £2000.”—W. B. WELBOURN, Secretary, Nottingham Hide, Skin and Fat Market Co., Limited.

“Number of hides passing through our market in one year, about 80,000. Number of these that are warbled, fully one-third, or 10,000. Loss on these warbled hides, at least three shillings per hide, or a total loss of £1500 per annum. We believe the above to

be fairly near, and rather under than over the mark.”—JOHN CHILD, Managing Secretary, Leeds and District Hide, Skin and Tallow Co., Limited.

“We should say that during the months of March to August inclusive there will be fully 60 per cent. of the hides more or less affected, with an estimated loss of 2s. 6d. per hide average.”—JAMES WATSON & SONS, Hide Market, Whitehall Road, Leeds.

“The delay in forwarding this letter has been due to my ascertaining from our local tanners the effect of Warbles on our supply of hides.

“I have no means of ascertaining definitely, and can only approximate the following results :—

“The hides suffer most severely from March to the end of August in each year; they are slightly damaged during the months of February, September, and October; whilst during the other three months of the year they show slight traces, after tanning, by the marks left after the Warble holes have closed up.

“Taking our supply of 50,000 hides (excluding odd numbers) sold during 1888, the amount of damage on the following basis would run thus :—

	£	s.	d.
2s. 6d. per hide on 9000 hides, being one-third received from March 1st to August 31st ...	1125	0	0
1s. 6d. per hide on 2500 hides, being one-fourth received during February, September and October	187	10	0
9d. per hide on 3000 hides, being one-fourth received during November, December, and January	112	10	0
Total	1425	0	0

“Adopting another basis of calculation, taking the average to be 25 per cent. from March 1st to October 31st, and 12½ per cent. for the remaining portion of the year, and taking the damage at an average of 2s. 6d. per hide, the result would be £1250.

“I am inclined to think that both these estimates considerably under-rate the mischief done, and would especially point out that these figures refer only to the deterioration to the sale of the hides in a green state, and do not take into account the loss to the tanner on the finished article being depreciated in value, or the cost of labour and materials expended in producing leather which when finished is found to be unfit for the purpose intended.

“Another very important matter is the deterioration of the animal

whilst living," &c.—W. H. HILL, Manager to the Sheffield Butchers' Hide and Skin Co., Limited.

"I should say" the Warble "makes from a farthing to sometimes a penny per pound difference to the butcher (about four or five shillings each hide difference)."—From a communication on the general bearing of the subject, by Mr. JOSEPH WING, Hide, Skin and Fat Broker, 16, Pen Street, Boston.

"*Re* Warbles, we give you particulars as far as possible. The number of hides sold in the Hide-market in Liverpool and the American Lairage in Birkenhead is about 130,000 per year: this is exclusive of hides under 30 lbs., which we call Kips.

"We reckon the warbled hides to be—in the month of February, 20 per cent.; in March, 45 per cent.; in April, 30 per cent.; and in May, 20 per cent.

"The average weight of the above 130,000 we calculate at 65 lbs. each, and the loss in price at three farthings per pound."*—MESSRS. WHINYATES, WEBSTER, McNAUGHT & Co., Hide, Skin and Fat Brokers, The Market, Gill Street, Liverpool.

"I regret I am unable to give you any *reliable* information respecting warbled hides, as in this neighbourhood we have never kept a separate class and account of them.

"Here we have thrown them into the same class as cut hides and damaged hides, and previous to some years ago we passed them as sound hides unless they were badly warbled.

"The Bristol slaughter of beasts would be about 700 per week, and during the summer and autumn months fully one-third of this number would be warbled. Some of the heavier hides would lose in consequence ten shillings per hide, and even more; but taking the heavy hides and light hides together, their average loss would be not less than five shillings per hide."†—WILLIAM WILLIS, Bristol and Western Counties Butchers' Hide and Skin Co., Limited, 88, Thomas Street, Bristol.

"In our market we have a system of inspection for all market hides, being hides of cattle slaughtered in Glasgow and neighbourhood for food purposes only. Under this system the hides are classified,—first and second classes, the latter being faulty flayed, and warbled hides.

* "We handle large numbers of horse-hides, and we never saw a warbled horse-hide."

† "Taking the above estimate of 700 hides per week, would give 36,400 in the year, and 12,133 for four months (say) May to August inclusive. One-third of this amount, that is 4044 hides, estimated to be warbled at a loss of five shillings per hide, would show a loss of £1011."

“ Referring to enclosed sheet you may note that in 1888 the total number of such hides have been 104,551.

Total Market Hides.

1888.	Firsts.	Seconds.	Totals.
January	5820	3361	9181
February	5476	5892 ...	11368
March	3541	4559 ...	8100
April	3582	3922	7504
May	3229	5618 ...	8847
June	3144	3770	6914
July	3283	3231	6514
August	5020	3728 ...	8748
September	4857	3084 ...	7941
October	7228	3451 ...	10679
November	6747	2647 ...	9394
December	6811	2550 .	9361
Total	<u>58738</u>	<u>45813</u> ..	<u>104551</u>

“ Taking the Warble months as February to May inclusive, we find the proportion of second class to be 56 per cent., while from June to December the proportion is only about 36 per cent., being, on a fair calculation, an increase of 20 per cent. on account of Warbles.

“ If we then take the number slaughtered in February to May as about 36,000, we find 20 per cent. on that number yield 7200 warbled hides: damaged by Warbles to the extent of (say) one penny per pound, at an average of 60 lbs. per hide, shows £1800 as the loss thus incurred.

“ Further, we may legitimately add that, as the cost of manufacture is the same as for sound hides, the loss to the community or national wealth will show double the amount, or in round numbers a loss of £4000 annually in the district.

“ No account is here made of Irish and country hides, of which we pass about 50,000 annually, and among which the damage is probably in a higher ratio than the others.”—Messrs. ROBERT RAMSEY & Co., Auction Brokers, Hides, &c., Greendyke Street, Glasgow, N.B.

The following Table, with which I am favoured by Messrs. W. Murray and Son, of Aberdeen, gives the number of sound hides, and number of warbled hides, and estimated loss per week thereon from February 3rd to June 29th inclusive, and includes all the hides in Aberdeen, *viz.*, those of Messrs. Murray and those sold by the Cooperative Company.

*Estimated Loss by Warble on Hides passing through Aberdeen Market
from February to June, 1888, inclusive.*

Week ending	Number of Sound Hides.	Number of Warbled Hides.	Estimated Loss per Week.		
			£	s.	d.
February 3 ...	2344	418	80	19	9
„ 10 ...	2300	443	85	16	7½
„ 17 ...	2454	473	91	12	10½
„ 24 ...	2374	501	97	1	4
March 2 ...	2641	569	110	4	11
„ 9 ...	2124	611	118	7	7½
„ 16 ...	2249	602	116	12	9
„ 23 ...	2137	719	139	6	1½
„ 30 ...	2095	718	139	2	3
April 6 ...	2181	750	145	6	3
„ 13 ...	2207	755	146	5	7½
„ 20 ...	1699	705	136	11	10½
„ 27 ...	2021	640	124	0	0
May 4 ...	2308	755	146	5	7½
„ 11 ...	2257	754	146	1	9
„ 18 ...	2076	875	169	10	7½
„ 25 ...	1660	664	128	13	0
June 1 ...	2091	916	177	9	6
„ 8 ...	1981	747	144	14	7½
„ 15 ...	1943	771	149	7	7½
„ 22 ...	1685	751	145	10	1½
„ 29 ...	1446	693	134	5	4½
Total for 5 months ...	46273	14830	2873	6	3

“ Being about 25 per cent. of total number of hides affected by Warble.

“ Average depreciation calculated at $\frac{3}{4}d.$ per pound. Weight of hides principally affected, 50 to 70 pounds.”—MESSRS. WILLIAM MURRAY & SON, George Street, Aberdeen, N.B.

To the above returns I append the following Tables, with which I was favoured respectively in 1884 and 1885 through the courtesy of Messrs. Fry & Co., Leather and Hide Factors, of Moor Street, Birmingham, which show how the amount of loss may be calculated to a nicety at markets where warbled hides are “ outclassed.”

The following Table, it will be seen, does not include the three classes known as “ heavy ” and “ light ” cows’ hides, and bulls’ hides which also were warbled. In this Table the results of calculation of loss on the six classes of hides only are given; in the succeeding Table the cows’ hides are included, and the particulars are given week by week in detail from February 14th to September 19th.



“Particulars of seven weeks’ supply of six classes of hides, being the total of each class of sound and warbled sold at two markets in Birmingham, commencing May 3rd up to and including June 14th, 1884, and showing the actual loss of each class of warbled hide:—

*Hides.**

Six Classes of Hides, Weight from—	No. of Sound.	No. of Warbled.	Sold at, less than the Sound—		Loss on each Class.		
			Per lb.	Per hide.	£	s.	d.
95 lbs. and upwards	286	67	$\frac{3}{4}d.$	or 6s. 3d.	20	18	0
85 lbs. to 94 lbs. ...	446	222	$\frac{7}{8}d.$	„ 6s. 7d.	73	1	6
75 „ 84 „ ...	754	373	1d.	„ 6s. 8d.	124	6	8
65 „ 74 „ ...	881	579	1d.	„ 5s. 10d.	168	17	6
56 „ 64 „ ...	629	441	1d.	„ 5s.	110	5	0
55 lbs. and under...	283	224	1d.	„ 4s. 3d.	47	12	0
Totals ...	3279	1906			545	0	8

“It will be observed that of the total number of hides (*viz.*, 5185) over one-third were warbled; and looking merely at one line of the figures, it shows that out of 1460 hides, ranging from 65 to 74 lbs. weight, 579 were lessened in value at the rate of 1d. per pound, or 5s. 10d. per hide, giving a total loss on these of £168 17s. 6d.”

The accompanying Table, with which also I was favoured by Messrs. Fry & Co., of Birmingham, gives particulars of the numbers of sound and warbled hides sold at one of the Birmingham markets, and the price each parcel sold at, from the beginning of the warbled season, *viz.*, February 14th, to the end, September 19th, in 1885.

“These details, it will be seen, extend over a duration of thirty-two weeks, and include price per pound of “ordinary” and “extra flayed” hide (marked down the third column as “o” and “x” respectively), as well as of those which are warbled.

“By casting the eye along the columns it will be seen that the first three heavy classes, namely, those of 95 lbs. and upwards, 85 to 94 lbs., and 75 to 84 lbs., which are all or nearly all ox-hides, do not suffer as much as the three following. These last—that is, the classes weighing 65 to 74 lbs., 56 to 64 lbs., and 55 lbs. and under—are principally heifer-hides, and are the greatest sufferers. Bulls’ hides are stated, as a rule, to be also very much warbled, but as these are not what is

* The above Table was given in my Eighth Annual Report of Observations of Injurious Insects, and the Table next following in my Report of the succeeding year (Ninth Report; Simpkin, Marshall & Co., publishers); and with these, as bearing very practically on the subject, I reprint some parts of the explanation of the Tables, and information with which I was then kindly favoured by Messrs. Fry and Co., Birmingham.

termed "thrown out," but sold (sound and warbled) together, the proportion of warbled hide could not be given.

"The following abstract of the larger Tables is given for convenience of reference. The amount sold during the thirty-two weeks of sound and of warbled hides may thus be conveniently compared, together with the highest and lowest prices per pound of each. The sound hides include both the ordinary and the extra flayed.

Abstract of Table overleaf, with particulars of different classes of Hides sold during warbled season of thirty-two weeks from February 14th to September 19th, 1885.

Weight and Description of Classes of Hides.	No. of Sound Hides.	Highest and Lowest Prices per lb.	No. of Warbled Hides.	Highest and Lowest Prices per lb.
95 lbs. and upwards	621	5d. to 6d.	68	4½d. to 5¼d.
85 lbs. to 94 lbs. ...	911	4¾d. ,, 5¾d.	138	4¾d. ,, 4¾d.
75 ,, 84 ,, ...	1495	4½d. ,, 5¾d.	306	4d. ,, 4¾d.
65 ,, 74 ,, ...	1789	4d. ,, 4¾d.	541	3½d. ,, 4½d.
56 ,, 64 ,, ...	1692	3¾d. ,, 4¾d.	497	3½d. ,, 4½d.
55 lbs. and under ...	873	3¾d. ,, 4¾d.	305	3½d. ,, 4½d.
Heavy cow-hides ...	1193	3¾d. ,, 4¾d.	140	3½d. ,, 4d.
Light cow-hides ...	1382	3¾d. ,, 4¾d.	151	3½d. ,, 3¾d.
Totals ...	9956		2146	

"Careful study of the detailed (folding) Tables is well worth while for those practically interested. They show the different time over which attack extends from February 14th, and that it certainly cannot be considered as stopping in July. We find it in the three lighter classes of hides as still present on September 19th, but it is worth some notice that three heavy classes did not contain warbled hides at a much earlier date. The heaviest ox-hides, 95 lbs. and upwards, were free after May 30th, and the two others of these heavy classes were free (save two hides in one class and one in the other) respectively after June 27th and July 18th.

"It may also be seen that sometimes, at what may be called the height of the warbled season, the number of warbled hides exceeds that of the sound in some of the classes. On April 25th entries occur amongst the "65 to 74 lbs." and the "55 lbs. and under" hides respectively, of sales of 42 warbled to 38 sound, and 25 warbled to 9 sound."

The above returns convey information, more or less full as the case may be, from Hide-markets at Aberdeen, Birmingham, Boston, Bristol, Glasgow, Leeds, Liverpool, Newcastle-on-Tyne, Nottingham and Sheffield;* and a glance at the sum totals of warbled hides, and

* That from Manchester is appended at p. 125 for reasons there given.

calculations of loss thereon, will give some idea of the loss and waste of material that is going on, but very far from a full one. The returns show depreciation of market value, but it should also be considered (as pointed out by Messrs. Ramsey, of Glasgow, and Mr. Hill, Manager of the Sheffield Butchers' Company) that this loss is quite independent of the subsequent waste of money consequent on the expenses of manufacture of damaged material, which, when finished, may be useless for the purposes needed.

Messrs. Ramsey's approximate estimate of this gives about double the original loss on the injured hides as the amount thus wasted to the community,—that is, to the national wealth.

But further, although the bulk of the English hides are distributed from the Hide-markets to the Tanneries, there is still no small amount received directly by tanners, from local farmers or butchers.

On my application to Messrs. C. & H. Hatton, of the Barton Tannery, Hereford, as to their estimate of the loss suffered by themselves from Warble injury, they drew my attention to this point, and added:—

“ We venture to think it would be sufficient to state that one-half of the hides taken in by tanners direct from the butchers are warbled, and show an average loss of 5s. to 6s. each: this would, of course, show a rough estimate of some thousands of pounds in the United Kingdom, independently of the numbers declared from the markets, and we regret to say that many hides which are classed as perfect on the market prove to be covered with minute Warble-grubs when the flesh and hair are removed by the tanner.”

The reason of the high estimate of loss on local hides is obvious, as it includes those of animals which have died from various causes, amongst which in spring there is a coincidence of such great amount of Warble presence as to point to this being often the real cause of death.

From Hereford Messrs. Hatton have sent me reports of the horrible state of Warble infestation in hides brought in of cattle *stated* to have died of “black-leg,” but which they considered to have died from Warble attack. On one occasion five of these hides were brought to them in four or five days, all *stated* to have died of “black-leg” or “quarter evil,” and all similarly warbled. One piece of hide sent me as an example, measuring 28 inches long by about 8 inches wide, contained 72 Warbles.

From Mr. W. Williams (tanner), of Haverfordwest, I have recently heard (when writing regarding distribution of leaflets):—

“ I should make a point of giving a copy to each farmer when paying him for his dead hides, of which great numbers come in every spring with their backs in a mass of jelly from Warbles. I have

sometimes pointed out cases where the Warbles were sufficient to cause death, but the farmers will not believe it, and say it was inflammation of the kidneys."

It is not for me to offer an opinion on veterinary points, but it appears to me that such coincidence of a deranged state of system with the existence of the great amount of inflammation, and also of putrid matter, in the hide, is a matter asking for investigation.

I have by me a hide of a yearling that was known to die clearly from mortification caused by Warbles; also last summer, through the courtesy of Prof. Wortley Axe, of the Royal Veterinary College, Camden Town, who at my request examined for me the heart of a runt which was warbled (not specially largely, but just along the course of the spine), it was found that blood-poisoning was certainly coincident with the sudden death of the animal; and I have many other notes showing the illness, even up to death, in bad cases of warbles.

Loss on the hides is a very serious matter, but it should be remembered that this is only a part of the loss caused by Warble attack: in the words of Mr. R. Stratton, of the Duffryn, Newport, Monmouthshire, "it is as pennies to sovereigns" compared to the loss on the animals.

The Hide returns show the effect of *one season's* attack, but the animal has suffered, according to its age, repeatedly, as in an instance lately sent me by Messrs. Thomas & Sons, of Llandilo, who reported that on one old cow-hide "there were 500 scabs," these showing the injuries of Warble in former seasons.

No one who gives a little thought to the subject can fail to see that the attack is a very bad thing to allow, in whatever way it is looked at. It is bad *for the animal* that it should be in pain, both for itself and because this prevents its thriving; and it is *very bad for the owner* that the running sores in the hide, which serve to support maggots an inch long, which may be counted often by scores and sometimes by hundreds, should draw away a percentage of the returns of the food meant to support the animal on whose juices they feed; and no one connected with cattle will doubt that for the herds to tear about the fields full drive in the summer heat, is very bad indeed for profit to the owner, whether in meat, milk, or coming produce.

The point we need to undermine, to get proper attention paid, is mainly IGNORANCE, and especially we need to show that the attack is *not* "boils"! but a swelling as big as a bad boil, with the addition of a great maggot screwing itself about by its rings inside; and it might fairly be put to any man who upholds the benefit of the attack, how he would feel if he had even only a score of large boils along his back, even without a maggot (a worm as it is sometimes called—a very type of utter misery) feeding for months on his living frame.

The thing of all others that we find answer to bring conviction is just to let all concerned *see for themselves* what is going on. When the hide is on the animal the mischief is very much hidden by the hair ; but when the hide is displayed after death, then its loathsome condition, with the maggots working in it, shows the state of the case, and removes all possibility of it being considered either to be good for the animal, or to be caused by "boils" !

Another point needed is distribution, in short plain form, of information as to the nature of the attack, and also as to how easily it may be checked. During the last few years many thousands of the four-page leaflet, of which a sample is given following this Report, have been distributed, and I should be happy to continue to send them gratuitously to all interested in prevention of Warble attack, and also to endeavour to give all information in my power to those who may apply to me on the subject.

ADDENDUM.

When this sheet was in type I was favoured by the following valuable information from Messrs. Richard Markendale & Co., Manchester. I therefore place it separately as an addition to the preceding returns of loss on warbled hides, given at pp. 116--124 ; but in any case I think it would have been well that it should stand alone as an especial example of the serious amount of the loss which is now going forward. A return showing over 83,000 hides damaged by Warble, and loss thereon of over £16,000 in one year, is a matter for serious consideration.

The return I am favoured with is as follows :—

“ March 6th, 1889. Further to yours of January 14th, 1889, *re* numbers warbled, and loss of hides passing through this market in one year. We now have much pleasure in sending you the information.

“ 1888. Jan to Dec. Number of hides, 250,740 total.
 ” ” ” ” 83,580 warbled.
 “ Loss on same, £16,716 for one year.”

—MESSRS. RICHARD MARKENDALE & Co., Limited, Hide, Skin and Fat Market, Manchester.

APPENDIX.

TURNIP FLEA-BEETLE AND STRAWSON'S AIR-POWER DISTRIBUTOR.

DURING the past year much attention was drawn by the Agricultural Journals to the implement known as "Strawson's Air-power Distributor," or "Pneumatic Drill," which, so far as experimental trials showed, and especially those made at the College of Agriculture at Downton, appeared likely to be serviceable for various farm purposes, and, amongst others, likely to meet a great need as a means of distributing dressings obnoxious to insect life, over a larger area, more rapidly and far more completely than could be done at a paying rate by hand.

The experiments showed the methods of application to be very excellent; but with regard to the practical effect in checking attack of Turnip Fly or Flea Beetle (which is one constantly recurring summer want), as this could only be judged of by field-work, I made enquiry as to where Turnip-crops infested by "Fly" had been subjected to the action of the dressings thrown by the Distributor, and was favoured, on my request for information, with the two following notes of successful work on badly infested fields,—one by Mr. W. Geo. Mount, M.P., of Wasing Place, near Reading; the other from Mr. Geo. Budd, of Mousefield Farm, near Newbury.

In the case of Mr. Mount's Turnips I am informed that the dressing was given early, about 3 a.m., or earlier; and regarding results Mr. Mount was good enough to reply to my enquiry, on January 28th, from Wasing Place, as follows:—

"I understand that you wish to know the result of a trial of the air-power machine invented by Mr. Strawson, of Newbury, in checking the ravages of the Turnip Fly. I sowed some Swedes on nine acres of land in May last year. Early in June the Fly was strongly upon them. I obtained the use of Mr. Strawson's machine, and dressed part of four acres in the field with lime, part with paraffin; both remedies seemed to be equally efficacious, and I shall certainly use it again this year if necessary."

At Mr. Budd's farm the dressing was applied in the evening, and was, as above, of paraffin, also of paraffin mixed with lime, the Fly attack being very bad at the time. Regarding success of this application Mr. Budd replied to my enquiry as follows, on January 25th, from Mousefield Farm, Newbury:—

"I beg to inform you that I found great benefit from Strawson and

Co.'s Distributor, as where I had not used it I had to drill for Turnips again: it was a great prevention to the Fly, and enabled me to feed off a very early crop."

The great point in method of distribution of dressing which makes the apparatus (as far as is at present shown) appear likely to meet many insecticide needs is, that, by means of a tremendous blast of air obtained by a gearing from one of the driving-wheels of the machine, the dressing, whether dry or wet, can be sent up in a cloud-like smoke or mist, of such fineness that when it settles on the leaves it covers the surface completely and delicately, like a fine hoar frost or fine spray. Thus all the exposed surfaces can be lightly and thoroughly covered, and the insects also struck much more effectually than in hand-dressing; and further, I am informed that the underside also of the leaves may be reached by the powerful current of air (and whatever the air is made to carry with it) which can be thrown from the Distributor.

The machine is drawn by one light horse, and is stated to be worked easily and without troublesome details, and if on continued trial it should be still found as successful in checking Turnip Flea Beetle it would be of great service; but I particularly mention the subject here as it appears possible that some form of the application might be brought to bear on the Aphis attack (sometimes known as 'Green Fly'), which often in autumn destroys whole fields of Turnips by coating the leaves with myriads of these 'Aphis Flies' or 'Lice' in all stages, and making the plants one mass of filth.

Hitherto it has appeared totally impossible to clear the plants; but if only the matter could be arranged of possibility of the implement being drawn to and fro amongst the Turnips, then there would be every hope of clearing the insects. According to description of the action of the implement the usual insecticide dry-dressings could easily be given, or, if desired, a good current of moist dressing or of water (which in the case of this Aphis attack would be very effective) could be driven at the plants, and the masses of filth be cleared away.

All details of the action of the implement have been placed before the public in the Agricultural Journals, but notes of practical results of trial on infested land would be very desirable, and might prove of much agricultural benefit.

WHEAT-FLOUR MOTH.

"WHEAT-FLOUR MOTH," *Ephestia Kuhlmanniella* (pp. 66—72). — On making further enquiries relatively to the presence of this flour-pest at the Mediterranean ports, I am informed that it is prevalent there

where the highly "glutenous" Russian and Hungarian Wheats are used. My correspondent, who has had much experience in watching the workings of the caterpillar, considers its presence in these to be attributable to a great amount of gluten suitable for the food of the larvæ being present in these Wheats. I cannot myself say how this may be, but as—at first sight at least—the presence of the caterpillar might appear attributable to its being exported from the country where the Wheat grows which it frequents, I wrote to Dr. Charles Lindeman, of Moscow, who is excellently acquainted with the crop-pests of Russia, to enquire whether he could favour me with any information as to presence of this attack in Russia or Hungary.

Dr. Lindeman was good enough to reply at once that he was not aware of its presence in Southern Russia, but that in Central Russia he could take upon himself to state that this insect had not up to the present time been observed. Further, Dr. Lindeman informed me that Dr. Sorhagen, of Hamburg, and other Lepidopterists (*i. e.*, observers of this order of insects), consider this moth has been imported to Europe from America.

As it might prove of great service in preventing this pest settling in our Wheat-mills, or stores, to know from what country to look for its transmission, I have, on receipt of Dr. Lindeman's information, written to Prof. Riley, Entomologist to the Department of Agriculture, U. S. A., requesting him to let me know whether he was acquainted with it as a flour infestation, and if so whether any means were found available for prevention or remedy of its ravages, and powers of clogging mill-apparatus.

From Prof. Riley's immense information and great courtesy I have no doubt he will favour us with as full a reply as may be in his power, which, with his permission, I shall at once give all serviceable points of for public use.—E. A. O.

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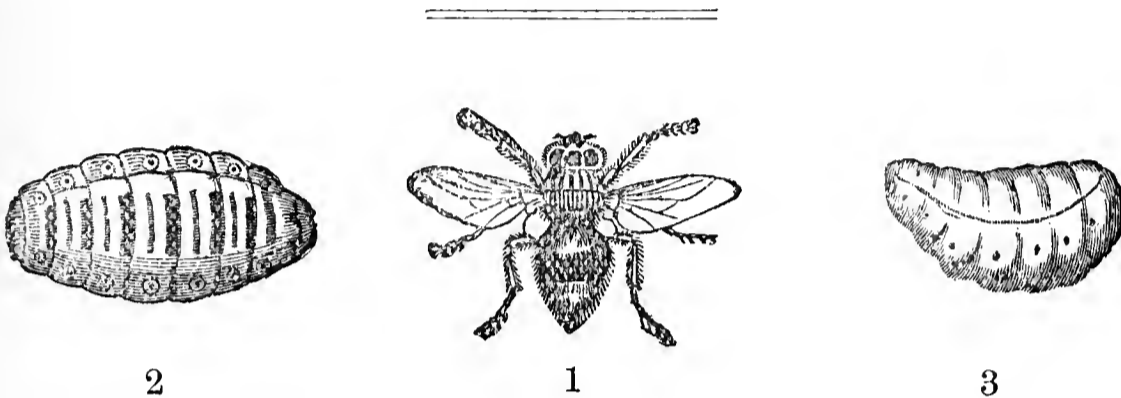
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NOTES

ON

OX WARBLE FLY, OR BOT FLY,

Hypoderma Bovis, De Geer.



1, OX WARBLE FLY; 2, maggot; 3, chrysalis.

THE OX WARBLE FLY, or BOT FLY, is a two-winged fly, upwards of half-an-inch in length, so banded and marked with differently-coloured hair as to be not unlike a Humble Bee. The face is yellowish; the body between the wings yellowish before and black behind: and the abdomen whitish at the base, black in the middle, and orange at the tip. The head is large; the wings brown; and the legs black or pitchy, with lighter feet.

The female is furnished with a long egg-laying tube; but whether she inserts her eggs into the hide or lays them on it has not been made out with certainty.

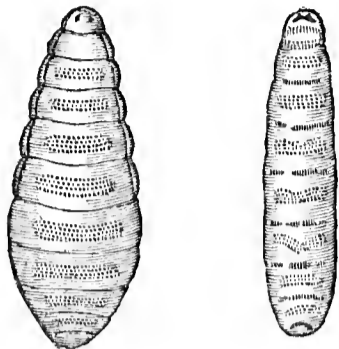
Egg-laying takes place *during the summer*; it may begin in the month of May, but the time varies with the weather, and with the cattle being on low land or hill pastures, and other circumstances. The egg is oval and white, with a small brownish lump at one end.

When full-grown the Warble-maggot is the shape figured above.

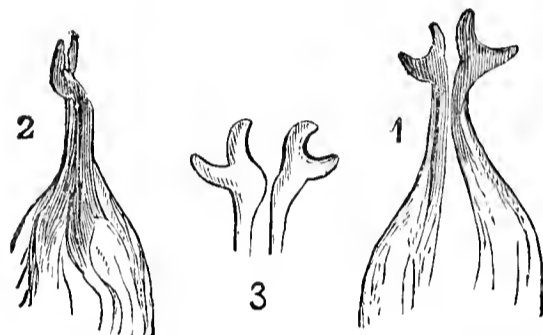
The mischief may first be found on the flesh side of the hide early in the winter. Specimens received from Messrs. Hatton, Hereford, on November 13th, showed the first appearance as small swellings bluish in colour, as if half a large shot was under the skin, and much inflamed round. The maggots were very minute and blood-colour, and lying free (not in a cell) with a fine channel down through the hide to where they lay.

The open Warble was first found towards the end of January, and by the end of February open Warbles were noticeable in many places, and the maggot was now white (not being feeding in bloody matter), worm-like, and with strong mouth-forks; in its next stage it was club-shaped, and had a power of inflating itself by drawing

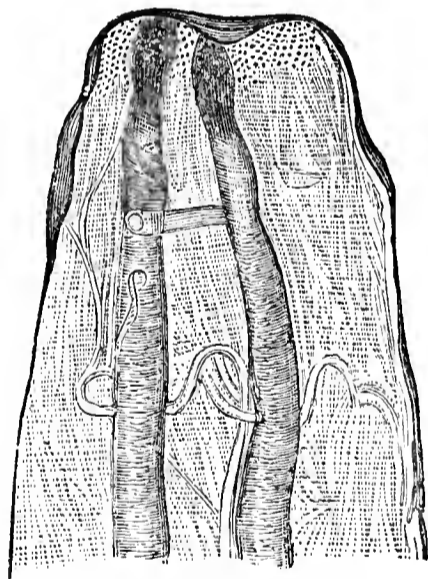
in fluid until it was almost as hard and transparent as ice, and, lying small end uppermost, thus kept pressing the opening through the hide larger. In its next stage it gained its well-known shape, with a thicker and more prickly skin, the Warble-cell at the same time gaining its membranous coating.



Maggots.
Club-shaped. Worm-like.
Magnified.



Mouth-forks of young maggot,
much magnified.



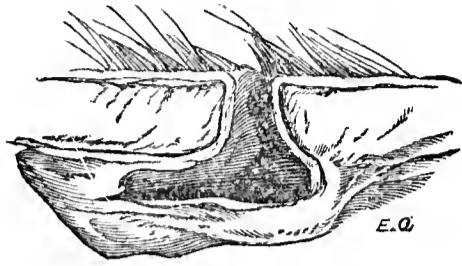
Breathing-tubes of maggot,
magnified.

The maggot can move up and down, but commonly has its brownish-tipped tail at the opening, and it draws in air through breathing-pores in these brown-black tips or spiracles. The mouth-end is down below, feeding in the ulcerated matter caused by irritation from perpetual suction of the mouth parts. The maggot cannot protect itself from the effect of applications, therefore anything put on the opening where the breathing tips show will choke the breathing apparatus, or run down into the hole and poison the maggot. The earlier this is done in the season the better it will be for the animal, and the less difficulty there will be in the Warble-holes healing.

Whilst the maggots are in the Warbles, though a skin-like membrane forms round the surface of the perforations (see figure, page 3), they cannot heal up because the maggot lies within; and when the Warble-grub has fallen out, though the hole contracts, the surfaces, being already covered with a film of tissue, are slow to unite; and, as may be seen in warbled hides, union is often prevented by this skin-like film shelling off, and laying with dried matter in the perforation. On

the under side of the hide, though the surface may not be broken, yet the subcutaneous tissues are often left as a mere film of no strength, which injures the surface of the leather.

When the maggot is full-grown it is about an inch long and dark grey; it presses itself out of the opening *tail foremost*, and falls to the ground, where it finds some shelter, either in the ground or under a stone or clod, where it changes to a chrysalis. The chrysalis is dark brown or black, much like the maggot in shape, only flatter on one side; and from this brown husk the Warble Fly comes out in three or four weeks, but this length of time is *increased by cold weather*.



Section of Warble, after soaking in water.

With regard to methods of remedy, there does not appear to be any difficulty of getting rid of the Warble-maggot easily and cheaply, when the Warble has "ripened"—that is, opened so far that the black end of the tail is visible. *Then* it may be destroyed cheaply and quickly. From special observations, taken during the last three years, it has been found that where the Warble-maggots have been destroyed before they drop from the cattle, there is little if any summer attack of Warble-flies. Consequently the cattle can rest in peace, and, as there is very little egg-laying on them, there are scarcely any Warbles in the following spring.

Squeezing out the maggots is a sure method of getting rid of them, but they may be destroyed easily and without risk by dressing the Warble with a little of McDougall's smear or dip, or by a little cart-grease and sulphur, applied well on the opening of the Warble. Mercurial ointment answers, if carefully used—that is, in very small quantity, and only applied *once* as a *small* touch on the Warble; but where there is any risk of careless application it should not be used. *Any* thick greasy matter that will choke the breathing-pores of the maggot, or poison it by running down into the cell in which it lies and feeds, will answer well; and lard or rancid butter mixed with a little sulphur has also been found to answer. Tar answers if carefully placed, so as to be absolutely on the hole into the Warble. Bought cattle are often badly infested, and need attention.

To prevent fly attack in summer, train-oil rubbed along the spine, and a little on the loins and ribs, has been found useful; so has the following mixture:—4 oz. flowers of sulphur, 1 gill spirits of tar, 1 quart train-oil; to be mixed well together, and applied once a-week along each side of the spine of the animal. With both the above applications it has been observed that the cattle so dressed were allowed to graze in peace, without being started off at the tearing gallop so ruinous to flesh, milk, and, in the case of cows in calf, to produce.

A mixture of spirit of tar, linseed oil, sulphur, and carbolic acid, has also been found useful; and anything of a tarry nature is useful, as sheep-salve (or bad butter and tar mixed with sulphur), or Stockholm or green tar, rubbed on the top of the cows' backs between the top of the shoulder-blade and loins. Washes of

a strong pickling brine, applied two or three times during the season, are very useful. Paraffin and kerosine are useful for a time, but the smell goes off before very long.

Where cattle are suffering badly from Warbles, so that the health is clearly affected, and the animal wasting, the use of the well-known old "black oils" has been found to do much good.

Mr. Hy. Thompson, M.R.C.V.S., of Aspatria, Cumberland, gives the following recipe used for a bad case:—"Turpentine, 1½ oz.; sulphuric acid, 1 drachm (here a chemical action sets in and must be done with caution). To this I added 10 oz. raw linseed oil, and rubbed the cow's back once a-day with the mixture. . . . In a fortnight the back was cleaned and all the maggots destroyed."

There are many other points that bear on prevention, of which one is--noting that Warble Flies are *most active in heat and sunshine*, and appear *not to pursue cattle over water*; consequently allowing the cattle the power of sheltering themselves, and access to shallow pools, is desirable. Likewise with regard to pastures, or standing-ground of infested cattle, it is matter of course that where the maggots *have fallen from their backs the Flies will shortly appear to start new attacks*.

Warble attack is one of the few in which each owner benefits surely by his own work.

The attack of Warbles is now grown to be one causing enormous annual national loss, estimated by practical men at sums from *two millions to seven millions pounds sterling per annum*, at the least. There is no sort of reason why we should suffer it to go on; and the reports sent in from cattle owners in Great Britain and Ireland during the last three years show the ease with which the attack may be checked, and the great consequent gain to owners. Any applications to myself on the subject will receive immediate and most careful attention, and any information would be gladly received.

ELEANOR A. ORMEROD,

*Consulting Entomologist
to the Royal Agricultural Society.*

TORRINGTON HOUSE, ST. ALBANS,
May, 1888.

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