Ormerod, Eleanor A.
Observations on warble fly or ox bot fly,..1894.

OBSERVATIONS

ON

WARBLE FLY OR OX BOT FLY,

HYPODERMA BOVIS, DeGeer.

An Abstract of Information

CONTRIBUTED MAINLY BY BRITISH OBSERVERS IN THE YEARS
1884—1894,
ON THE HISTORY AND HABITS OF THE WARBLE FLY,
AND
MEANS OF PREVENTION AND REMEDY.

BY

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LONDON:
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STATIONERS' HALL COURT, E.C.

1894.

TO

THE MANY COLLEAGUES

IN THE WORK OF WARBLE PREVENTION,

FROM WHOSE INFORMATION

THIS ABSTRACT

OF MANY YEARS' JOINT WORK HAS BEEN COMPILED,

THIS ENDEAVOUR

TO GIVE THE MAIN POINTS OF OUR UNITED LABOURS,
IN CONNECTED FORM,

IS GRATEFULLY AND RESPECTFULLY INSCRIBED

BY THEIR OBEDIENT FRIEND
AND SERVANT,

THE WRITER.

Torrington House, St. Albans,
November, 1894.

OBSERVATIONS

ON

WARBLE FLY OR OX BOT FLY

Œstrus bovis, Clark; *Hypoderma bovis*, DeGeer.

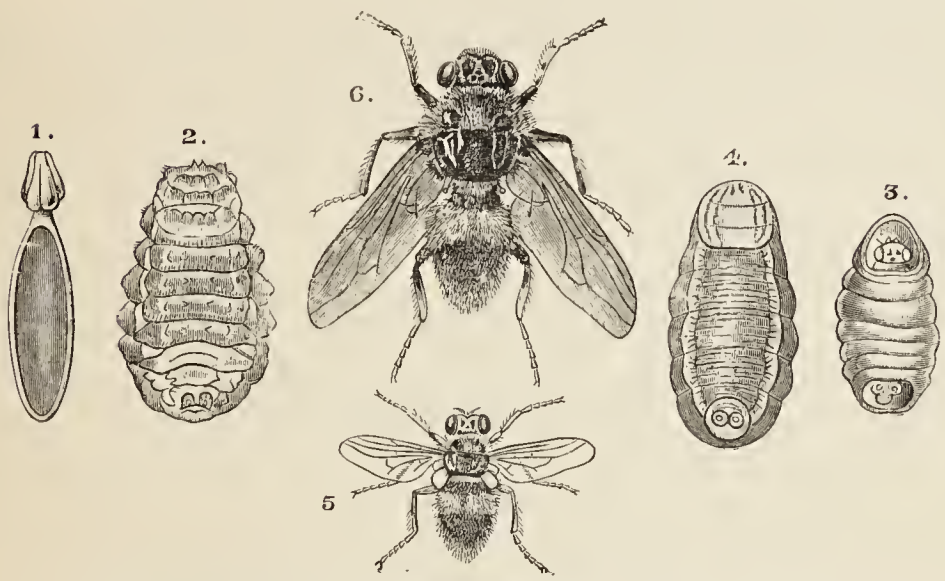


Fig. 1.—*Hypoderma bovis*. 1, egg; 2, maggot; 3 and 4, chrysalis-case; 5 and 6, fly; 3 and 5, nat. size, after Bracy Clark; the other figures after Brauer, and all magnified.

Nearly two hundred years have elapsed since the first noticeably recorded observations were made on what we now know as the Warble Fly, scientifically the *Hypoderma bovis* of DeGeer. Those who wish to work up the early notes on this infestation, which, though often uncertain in identification, and dealing partially and incompletely with the subject, still lead on towards what we now have advanced to, will find a list of the chief writers, beginning with Vallisnieri in the year 1710, in Friedrich Brauer's invaluable book on the *Œstridæ*.* Passing onwards down the list,—by the names of Reaumur, Linnæus, Geoffroy, DeGeer, Fabricius, and other well-known writers,—we arrive (at the date of 1797) at Bracy Clark, the eminent Veterinary Surgeon, of whom Prof. Westwood, the late Life-President of our own Ento-

* 'Monographie der Œstriden,' von Friedrich Brauer, pp. 124—126; Wien, 1863.

mological Society, wrote that to him "we are indebted for a history of many species of this family which leaves nothing to be desired"; and Prof. Riley (late Entomologist of the U. S. A. Department of Agriculture) remarked,—relatively to information given by him on Warble Fly,—"One of the best accounts appeared nearly one hundred years ago in the *Transactions of the Linnean Society of London*, 1797, vol. iii. p. 289, in a paper read by Mr. Bracy Clark entitled 'Observations on the genus *Œstrus*,' in which the habits and means against the Ox Bot were detailed practically as they are known to-day."

This is not to be quite literally taken now, for in recent years information has been gained, and advance has been made in kinds of applications serviceable for dressings; but still, Bracy Clark's observations—whether known, and acknowledged as his, or not—stand as our centre of serviceable knowledge for practical farm use.

Since his day, as well as before it, much has been given by such eminent writers as Latreille, Meigen, Westwood, and others enumerated in the list before mentioned, including many papers by Dr. Brauer. But these are not easily accessible, and in many cases are simply technically entomological, and as it was very desirable to place before those practically interested in the subject some amount of information in a form easy of access, regarding the history of Ox Warble attack, and means found practicable and serviceable for its prevention in this country, at the present time, by our own agriculturists and cattle owners, I undertook in 1884, whilst Consulting Entomologist of the Royal Agricultural Society, to endeavour to gain trustworthy information on these points. My applications were most courteously and widely responded to by leading cattle owners, farmers, and also by heads of hide and tanning firms, and cattle and butchers' associations, and for special points of investigation I was greatly helped by co-operation of some of our leading veterinary surgeons. Specimens were forwarded, and arrangements made, enabling me to examine the infested hides in fresh state, and, when necessary, the newly flayed carcase,—in fact, nothing was left undone to forward the research. I invariably met with the most cordial co-operation, and the results of the year's investigations were published yearly, each item of information being carefully acknowledged to its sender, and a copy of the report sent to each contributor, so as to give opportunity of correction of any error in statement.

So the work, our joint national work, has continued, and its published results have spread over a large part of the world. It has long been well known in various of our colonies, and in the United States of America; it has been translated for Continental use; and at home about 150,000 leaflets—some on Warble attack, some on Licked Beef, one of the results of Warble attack,—have been circulated,

besides translations of the Warble Fly leaflet into North and South Welsh dialects.

All this has been done by ourselves; no "Board" has helped us; we have had no grant for expenses, and now it appears desirable to bring forward in a condensed form,—amongst other reasons that those interested may be able to recognize and point to the results of *their* own labours,—a history of the results of *our* ten years' labours.

To begin with a description of the attack. *Warble attack is commonly known as consisting of swollen lumps*—few or many—to be found from February to September, chiefly during the months of April and May, though sometimes badly later in the summer, on the back or loins of the attacked animals, each swelling or warble containing a maggot or "bot," which lies with its black-tipped tail (often taken for its head) at a small opening in the swelling, and the other end (which contains the orifice which serves for a mouth) in a sore on which it is feeding in the under tissues of the hide.

The great injury, however, which is caused year after year by this attack is not only from the perforations of the maggots lessening the value of the hides, but the loss in flesh and milk and health in summer, when the animals are started by their terror of the fly to gallop as fast as they can go, and later on the suffering and drag on the system of supporting may be six, ten, twenty, or a hundred, sometimes even more than four hundred, of these strong maggots growing up to an inch in length and feeding on the sore, which they keep up from before the warble-swelling is observable in January or February until they are full-grown.

First observation of young Warble beneath the flesh side of the Hide.

On November 12th, 1884, a cutting from a yearling skin brought in that day was forwarded to me by Messrs. C. and H. Hatton, Barton Tannery, Hereford, with the note that they considered it showed first symptoms of warble-maggot. This piece of hide was about 12 in. by 4 in., and on the *flesh side* there were upwards of seven slight swellings about a quarter of an inch across, of a livid or bluish colour. each forming a raised centre to greatly-inflamed patches. Within the blue centre I found a small warble-maggot, just large enough to be distinguished by the naked eye when removed, but not plainly so whilst in the swelling, as the inside of this was of blood-red tissue, and *the small maggot was blood-red also.* Under the microscope it was easily distinguishable by its patches of minute prickles. From the red mass or maggot-cell I found that a fine channel, no wider than a hair, passed up through the hide to the surface. The course of this channel was easily traced by the blood which in handling the specimen was pressed from below along this gallery till it came out in a little drop on the

outside of the hide. These channels (of course examined microscopically) had no lining membrane as is the case further on; they were merely a passage (see fig. 2) apparently gnawed or torn by the mouth-forks of the young maggot, and they varied in direction, being sometimes slanting, or taking a straight course, or so completely curved at the upper part, that it was quite impossible that this channel could have been caused by the perforation of the ovipositor (the egg-laying apparatus of the female fly), and in one instance in which the maggot-tunnel had only gone about half the way through the hide I found a small soft body lying at the bottom, which, though crushed in taking the section, appeared without doubt to be the maggot.

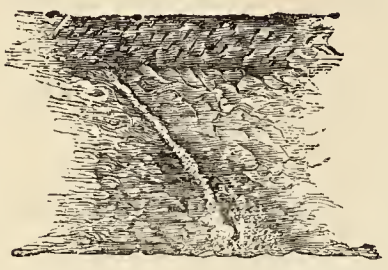


Fig. 2.—Section, magnified.

The egg is of the shape figured at p. 1, and is thus described by Prof. Riley, late Entomologist of the U. S. A. Department of Agriculture, from his own personal observations of warbled cattle in Illinois from 1860–1863, when interested directly in stock-raising, and having the charge of some three hundred head of cattle*:—"... The eggs of this Ox Bot are elliptic ovoid, slightly compressed, and have at the base a five-ribbed cap on a stout stalk with which to strongly attach them to the skin of the animal." Prof. Riley remarks that the grooved and slightly pedicelled enlargement of the end which is attached is admirably adapted for being strongly fastened to the skin, and to the base of the hairs, and all observations that have been recorded point to the fact that the young larva works its way directly from the egg under the skin. "... The structure of the ovipositor clearly excludes the possibility of puncture, for though horny, it has a blunt trifid tip, and is beset at the end with certain minute hairs."

The point of where the egg is deposited is very important relatively to effect of dressings, and there has been a great deal of what cannot but be considered vague speculation on the subject, as few of authority, excepting Prof. Riley, speak from observation. But we know that the ovipositor is not suited for purposes of boring; also I can speak personally to the borings through the hide not being such as could be formed by the passage of an ovipositor, and in the absence of any evidence from observation of the eggs being passed down through the hide, I believe that all the different points which we know from observation prove that the deposit takes place on the outside.

* See 'Insect Life.' Periodical Bulletin of U. S. A. Department of Agriculture, Vol. ii., No. 6, pp. 173, 174; Washington, U. S. A., 1889.

First observations of open Warble-swelling.

Careful watch was kept both on living cattle and newly-flayed hides in various localities throughout the winter of 1885–1886, in order to secure the date of the first appearance of the warble in its open condition, which took place (generally) from about the 14th to the 25th of February. The first advance on the condition of a mere hair-like streak through the hide was found in specimens cut from the hide of a young bull, and sent me by Mr. John Dalton, of Wigton, on Jan. 27th.

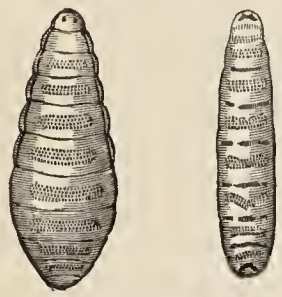


Fig. 3.

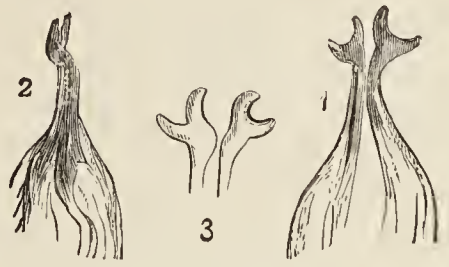


Fig. 4.

Fig. 3.—Maggots, club-shaped and worm-like, magnified. Fig. 4.—Mouth-forks of young maggot, much magnified.

Following this I had observations from various places in England and Ireland during February of the progressive enlargement of the warble-lumps,—as of lumps increasing in number and size; some "appearing like a gathering coming to a head." On February 18th Messrs. Hatton, of Hereford, mentioned that they had received an ox-hide with many warbles in it, specimens of the maggots from which were forwarded; * and on the previous day they had informed me that notice had already been given that hides on Birmingham Market would be sorted for warbles, and those having more than three would be out-classed; and from various quarters, especially from Mr. Hy. Thompson, M.R.C.V.S., Aspatria, Cumberland, to whom I have been greatly indebted for assistance in our researches, I received specimens of infested hide, or of young warble-maggots.

In the earliest of these there was the first appearance of the warble as a *perforated swelling*, with the maggot of a clearly distinguishable size within. The channel through the hide was still very small, the opening on the outside being about as large as the prick of a common darning-needle, and below, though larger, scarcely the sixteenth of an inch across. The smallest of the maggots from these warbles were about a quarter of an inch long by a third of that measure in width, *not* as yet oval, but straightish, and somewhat worm-like in shape; when older they become rather enlarged towards the mouth-end, so as

* The cost of this hide was 29s., whereas the value of the same weight of hide free from warbles would have been 35s. 5d.

to be of a pear- or club-shape, white, and partially transparent, and marked across what may be called the back with sixteen short bands of very minute black or dark grey prickles, placed, for the most part, in alternate very narrow and broader stripes (see fig. 3, p. 5). The young maggot possesses (apparently as an instrument for tearing out food) a pair of crescent-shaped forks or diggers (see fig. 4, p. 5). These are of such excessive minuteness that they are only to be found with difficulty, and I have not as yet found them in any but very young maggots. The apparatus may be described as consisting of a pair of crescent-shaped forks, placed nearly side by side at the extremity of processes somewhat bent apart at the ends by which they are attached to the crescents, and attached by the other ends to the membranes or tissues forming the gullet or internal sac of the maggot. The material is chitinous or horny, and the possession by the embryo (still worm-like) maggot of this apparatus for cutting or tearing is of considerable interest in connection with the first minute track (which shows as being cut or torn) down through the hide to the embryo maggot lying below.

The power of pressure possessed by the maggots at this period of their life is enormous, from their capacity of inflating themselves with fluid until they are so hard that it is scarcely possible to compress them with the fingers, and likewise from their having (apparently) no power of discharging any of their contents. Thus they form living and growing plugs, quite capable of pressing back the tissues from around them, or from before the small hard tip; but *not* subject (so long as they continue inflated) to being themselves compressed. I had opportunities of watching this process of inflation both in the worm-shaped maggots and when they were slightly more advanced in growth to a club or lengthened pear-shape. On placing them in fluid suitable for absorption (as in glycerine and water, in which they would live for as long as eighty hours, or until the *spiracles* sank completely beneath the surface) they became hard and shiny, and with little trace of the segments which are so clearly marked when the maggots are fully developed; in fact, they were almost of a glassy smoothness, save for the short bands of minute prickles placed along a portion of the back.

This power of inflation of the maggot appears to be an important agent in forming what is presently the open passage or warble-hole down to the cell beneath. The various stages of maggot life consist of the passage of the worm-like larva to the under side of the hide, where, at this stage, in the small inflamed patches or swellings (see p. 3) it lies free, that is to say, not enclosed in a cell or thickened tissue, merely in a small bloody sore, in which by the colour of its contents it may be seen to be feeding on the bloody matter. This

changes, as above mentioned, to a more pear-shaped form, placed with the smallest end (containing the minute horny spiracles at its tip) uppermost, and thus with the compact hard-tipped apparatus above, and the growing body behind, is well calculated to force open and enlarge the passage down which it came.

The size and shape of the perforation through the hide altered progressively with the growth of the maggot. At first this passage was very little larger at the lower than at the upper opening; and, though the walls of the perforation had now become smooth and shiny, I could not distinguish the presence of any distinct lining membrane. With the enlargement of the passage its shape became more cone-like (corresponding with the altering form of its tenant); and, on March 5th, I found for the first time a distinct pellicle or skin-like membrane covering the walls of the perforation, or passage, and continuous with the lining of the maggot-cell below.

The great change, both in the appearance and the internal structure of the maggot, took place when it was grown to about a third of its full size, when it assumed its well-known shape. Previously to this, whilst the work of forming its passage was still in progress, its chief characteristics externally were the absence of everything that could obstruct its power of pressing onwards; and internally it was little more than a bag of fluid, with a large proportion of the space *occupied by breathing-tubes*,—a very important consideration relatively to available methods of destroying the creature. At the period, however, of its moult to its final stage a change takes place respectively in the nature, or in the amount, of development of nearly the whole of both the internal and external structure of the maggot. The hard tips necessary, or at least serviceable, for forcing a passage up the hide, are no longer needed, and they are exchanged for a broad form of spiracle (fig. 8, p. 8), and the internal organs become suited to provide material for the development of the fly, which will presently form in the dry husk of the maggot which serves as the chrysalis-case.

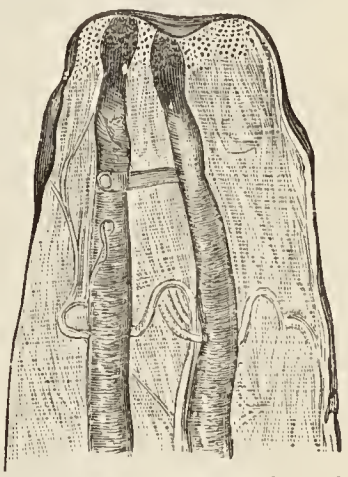


Fig. 5.—Breathing-tubes of maggot, magnified.

In methods of destruction of warble-maggot a large proportion turn on choking up their breathing-apparatus. This consists mainly of two large breathing-tubes, or *tracheæ*, which draw in air at the tip of the tail by two perforated bodies known as spiracles (see fig. 5).

From the earliest stages which I had opportunity of observing up to date of change mentioned in preceding paragraph the general form

continued (see fig. 5, p. 7) to be that of a pair of short horny, somewhat bent cylindrical, or partially cylindrical, tubes, covered at the end (fig. 6) with round or oval discs, which appear to have a definite narrow border, and across the centre of the disc to be of a sieve-like or spotted appearance. Fig. 7 precisely represents the appearance when

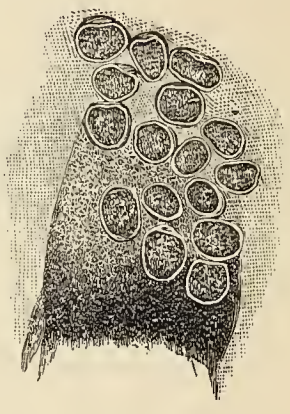


Fig. 6. Fig. 7.

Fig. 6.—Spiracle-tube (one of the pair), much magnified. Fig. 7.—Discs at extremity of spiracle, as seen with quarter-inch object-glass.

much magnified. These discs may amount to as many as about six-and-twenty on each spiracle, and appear to me to be placed each at the extremity of short cylinders. Whether the spotted or sieve-like appearance is caused by minute hairs placed so to preserve the delicate tubes from the entrance of foreign bodies, I had not sufficiently high microscopic powers to ascertain. Up to the time when the moult takes place to the final form, these spiracles were in all the specimens I examined buried up to their disc-covered tips in the tail-end of the

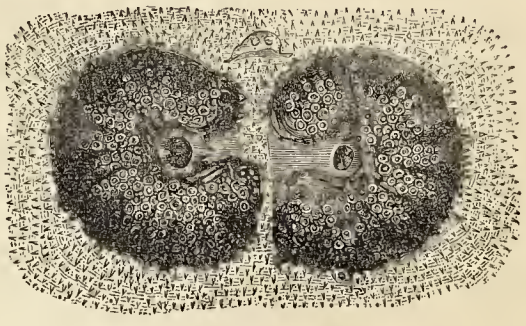


Fig. 8.—Spiracles fully developed, magnified.

maggot; then they are cast entirely with the moulted skin, and in the newly exposed surfaces beneath we find the first appearance of the well-known kidney-shaped spiracles (see fig. 8), but (in the specimens I examined) with the surface somewhat more radiated, and the colour of a paler chestnut than in their later condition.

The changes of condition appeared to be rapidly gone through, and it was when the maggot has gained about a quarter or third of

its growth that the spiracles were developed to their angularly kidney-shaped form, and the maggot assumed the compressed oval shape in which it is best known. It was still white, but opaque, and with the segments well-marked; and the early part of its work being done, and the warble-passage open, *it has no occasion now to bore its way, and ceases to be furnished with a form fitted for perforation.*

Other alterations of a very practical bearing also take place at this time, or follow on this most important of the moults. The skin of

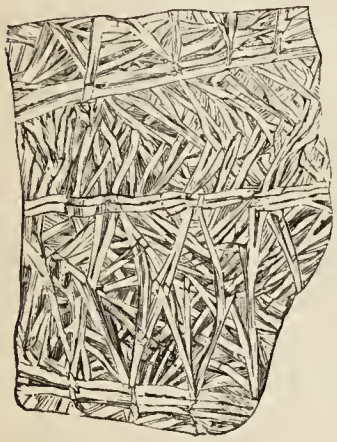


Fig. 9.

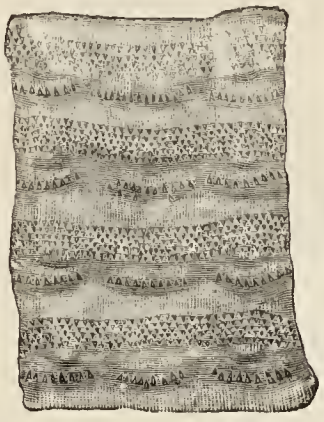


Fig. 10.

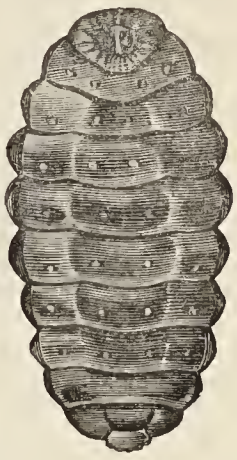


Fig. 11.

Fig. 9.—Muscles within skin of maggot, much magnified. Fig. 10.—Prickles of maggots, much magnified. Fig. 11.—Full-grown maggot, magnified.

the maggot becomes furnished within with a powerful coat of muscles, extending over it like basket-work, which give it a power of contraction and expansion. Externally in this stage the skin of the maggot is furnished with a much larger amount of prickles arranged in more numerous bands, than are noticeable in the previous stages. The prickles are now strong enough to cause an unpleasant sensation when the maggot crosses the hand, and to play an important part in its locomotive powers in its cell, and in the effect on the tissues caused thereby. The visceral contents are now thick, and obviously formed of the filthy matter which is caused by the perpetual irritation of the suction of the mouth-end of the maggot at the bottom of the sac. It is also now furnished with a small curved caudal aperture, placed nearly between the spiracles (see fig. 8, p. 8) from which some slight amount of discharge of contents can take place.

Fig. 11 shows the maggot about four times the natural size, in its fully developed state, with the tips of the pair of spiracles indicated in the centre of the tail-end. It is, as is well-known, when full-fed, and for much of its previous life, of a bluntly oval somewhat compressed shape, of various shades of colour, from whitish to deep grey or brownish, and marked with cross-bands, which, under the magnifier, are seen to be formed (as figured above) of minute prickles.

The above are the main differences connected with the moult to the final form of the maggot, and, following on these alterations in its structure, and especially on the power of keeping up a constant irritation by means of the muscular expansion and contraction of its prickly skin, we find the lining membrane of the cell increasing in thickness, until it becomes well defined as a tough wall round the perforation, continuous with the upper part of the cell. Fig. 12 shows a cell drawn in section, and slightly magnified after maceration in water. The lowest end of the maggot-chamber appears full of foul matter, caused by the irritation of the friction and suction of the

Fig. 12.

Fig. 13.

Fig. 12.—Warble-cell, slightly larger than life. Fig. 13.—Chrysalis of Ox Warble Fly, side view, and showing contained fly.

maggot; and, after the creature has crawled from its hole, a pressure on the empty warble is followed by a discharge of some amount of purulent matter.

When the warble-maggot is full-fed it presses itself gradually out of the opening at the top of the warble, which at first sight looks much too small for the exit, but the opening can be squeezed somewhat larger, the soft maggot is compressible, and is further helped in dragging itself out by the ringed shape and roughened skin, which prevent its slipping back again into its former hole. When it has fallen to the ground it creeps to some shelter, under a stone, a clod, or where may be convenient, and there the skin hardens into a chrysalis coat much like the grub, excepting in being dark brown or blackish in colour, and somewhat flattened on one side (see fig. 13). From these chrysalids the Warble Flies come out, in favourable weather, in about four weeks from the dropping of the maggot from the back of the cattle; in cold weather the time required for the change is longer.*

When the maggot has gained the condition mentioned above it undergoes no further great change until it turns to the chrysalis-state. The spiracles become less radiated and darker, the maggot also becomes darker as it increases in size; but the main points of its life now are to form, at the expense of the animal in which it lives, the material from which the fly will presently be developed.

* For details see 'Essay on Bots,' by Bracy Clark; 'Monographie der Œstriden,' by Friedrich Brauer and other writers.

In some observations taken by Mr. A. C. C. Martyn, Agricultural College, Aspatria, Cumberland, in 1885, of which he sent me notes, he found that the full-grown maggot squeezed itself out of the warble in the morning, or at some time between six o'clock in the evening and 8 a.m. the following day. This point he ascertained in the course of his experiments in rearing the chrysalis; in these he found the maggots leaving the warble stuck fast, or trapped, as the case might be, on bird-lime, or in the little bags fixed for them to drop into, in the morning, but never in the middle of the day.

In the case of eighteen specimens watched by Mr. Martyn, the chrysalis stage lasted about twenty-five days; but, to ascertain the effect of cold on rate of development, four chrysalids were put by themselves at a much lower temperature. These developed into flies (scientifically speaking, the pupæ developed into the imago-state) in an average of thirty-six days (that is, took ten days longer in development than the others), and the flies were not such fine specimens, not so large or well marked as the others.

The Ox Warble Fly, or Bot Fly (scientifically, the *Hypoderma bovis*), 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 usually 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. There are, however, some slight differences in colouring, and amongst those reared by Mr. Martyn, in the case of five out of the twenty-five, the portion of the abdomen beyond the transverse black band was grey instead of yellow or orange.

Fig. 14.—Ox Warble Fly.

The female fly has an ovipositor, or egg-laying tube, formed of telescope-like joints, and ending not in a point for piercing with, but a trifid extremity beset with small hairs (see p. 4). The egg-laying season is mostly in the warm part of the year, but as the time of presence of the maggots extends (as shown by trade reports of condition of hides) from February to September, so also must the existence of Warble Flies, to which these warble-maggots turn, extend to some degree over many months, and the date of egg-laying vary conformably.

Process of formation of the Warble.

The early part of this operation, including the minute maggot no thicker than a hair going down to the under part of the hide, and there lying feeding in the little bloody sore which it has caused, has been described, so also has its growth, until (tail uppermost) it lies in the

central hole of the swelling, with its feeding end, which cannot be called a head, in the foul matter of the cell, and the black spots, which are the ends of its breathing-pores, in the tip of the tail above. At this full-grown, or nearly full-grown, condition, removal of a maggot from the cell, and careful watching of it for a little while in the hand will show the powers with which it is furnished for its own safety, and great disservice to ourselves.

A maggot at this stage, besides the power given by its strong coat of muscles (see fig. 9) of contraction and expansion, which may be observed in protruding and withdrawing the mouth-end with the regularity of pulsation, has a power of movement so definite that it can drag itself along at the rate of three times its own length in two minutes, and with a definite method of progression. The mouth-end I observed to be somewhat raised, and the creature appeared to move with as settled a purpose as other grubs and caterpillars. Whilst still inside the warble, of course this power is unimportant, so far as "travelling" far is concerned; but it is very important as to giving it power to move up and down at pleasure in the warble-hole, causing constantly recurring discomfort. Externally at this stage the skin of the maggot is furnished with a much larger amount of prickles, arranged in more numerous bands than are noticeable in the previous stages. These prickles are now, I found, strong enough to cause an unpleasant sensation when the maggot crosses the hand, and, as well as the muscles, play an important part in its power of movement in its cell, and in its powers of irritation.

With regard to what the sensation might be caused by just one or a few *Œstrus* (that is, Bot or Warble) maggots working below the skin, taking the subject quite independently of the graver considerations involved, as the animals could not explain this, and I was aware that a somewhat similar attack occurs not unfrequently to the human subject in the more central parts of America, I wrote on the subject to Mr. Everard im Thurn, then resident in British Guiana, and well known for his scientific attainments, and also as the scaler of the (previously supposed inaccessible) mountain of Roraima, in those regions. Mr. im Thurn replied that he had himself suffered from the attack of warble-maggot a little below the knee, and he described the pain as not being constant, but from time to time quite sharp, as if the maggot was screwing itself round in its hole. This gives an idea of one kind of pain connected with attack of *Œstrus* larva. Further, in communication with Mr. J. S. Macadam, Army Surgeon, British Guiana, he mentioned one case of a black soldier of the 1st West Indian Regiment, who presented himself, complaining of a sort of large boil with hard edges on the front of the throat, which had broken and would not heal up, and that the *itching round it at times* was intense.

Mr. Macadam gave me details of appearance of the maggots reminding "him of cattle-bots"; these he destroyed in boil or warble-like swellings, simply as we often do here, by excluding air, and drew up the description of the pain as being that of "an ordinary sore plus the intense itching."

Independently of effects on the constitution of inflammation, and ulceration (when cattle-attack is on a large scale), it certainly cannot be desirable, if their sensations are like those described, that even on a small scale they should be troubled by the pain of sores plus the intense itching, and also *plus* (what our warble-maggots have quite structural appliances to cause) pain, *at times* "quite sharp, as if the maggot was screwing itself round in its hole."

Formation of membrane or false-skin over surface of warble-hole or cell.

Coincidently with the alteration in size, position, and condition of the maggot, and especially on the power of keeping up a constant irritation by means of the muscular contraction and expansion of its prickly skin, there are changes in the state of the surface of the cell in the lower part of the hide, and also of the surface of the passage up the warble swelling, which are of the greatest importance to tanners, and all connected with sale of hides. At a certain stage, instead of the surfaces being torn and raw, or presently, in part, of a glass-like smoothness, a distinct pellicle or skin-like membrane begins to form, covering the walls of the perforation or warble-hole, and also, and continuously with it, the greater part of the surface of the maggot-cell. The beginning of March is the earliest date at which I have myself found the lining pellicle observably forming, but the date must obviously vary with circumstances.

On the 3rd of March, 1884, Messrs. Hatton, of Hereford, favoured me with a piece of heifer hide, less than six inches square, containing twelve or more warbles, which had now advanced in growth, so as to show on the flesh side of the hide as well-defined lumps, ranging from three- to five-eighths of an inch across, and up to as much as three-eighths of an inch in height of the swelling.

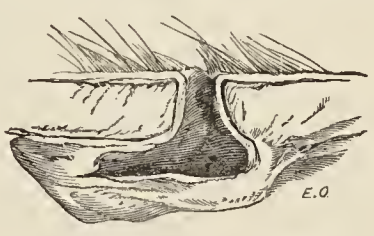


Fig. 15.—Section of warble-cell, after soaking in water.*

All that I examined had openings on the upper side of the hide, and internally were now coated with a distinct formation of some kind of lining membrane, like thickened yellowish skin, continuous with the coat of the cell below.

At first the channel down through the hide, and the spot where the maggot lies below are merely sores or openings caused by the sharp mouth cutters of this then almost microscopic grub. *These* injuries

* Figure is repeated from p. 10 to save trouble in reference.

then heal up readily, and early in the year also they will heal fairly well; but where the maggot has been allowed to remain for several months, working itself about in the hole, which, by its growth, it keeps pressing larger, then the kind of false skin or film mentioned above forms over the surface of the cell (see fig.); and as this is not got rid of when the maggot is killed or removed, it is very apt to make a kind of plug in the hole, which prevents it drawing completely together for a long time, and thus causes much depreciation of the value of the hide, though not always noticeable by the buyer.

On July 9th, 1884, Mr. John Dalton wrote me from his tannery at Wigton:—"In two or three weeks after the escape of the worm the hole quite closes up, and the only trace remaining is the cicatrix where the wound has been. In some of the pieces of leather sent you might notice both holes and *marks;* the later were the healed wounds of the previous year. A warble-hole, like any ordinary injury to the skin, though healed, can always be traced, and no matter how long the animal may live, the scar remains." And Messrs. Thomas and Sons, of Llandillo, in the course of communication on warble injuries, mentioned that in one old cow-hide they found 500 scabs, these showing the traces of warble-attack in previous seasons.

I was also obliged, in 1889, by the following note on this subject from Mr. W. H. Hill, Vice-President of the Sheffield Butchers' Association:— "In one of my letters you may possibly remember my reference to the loss to the tanner on finding the *tanned hide* to be spoiled for the purpose intended, by the ravages of warbles, and to my explaining that traces of the warble-holes are left on the hide when tanned, even after the holes are closed up by suppuration. I have no doubt it will interest you to know that a few weeks ago a local tanner brought for my inspection a tanned hide of as good quality as can be found, and for which, being off a polled Scotch beast, and weighing 98 lbs. in the raw state, he had paid us an extra price over ordinary hides of a similar weight. When purchased in the raw state no distinct traces of warbles could be seen, but on being tanned the grain-side in the best part of the hide was speckled, ragged, and blistered, where formerly warbles had been. The tanner, who is reliable, stated the difference in value and loss on this one hide would be at least 25s., and probably 30s."

The following observations, of which the four first were sent me in 1885, *give examples of the severity to which warble-attack runs.*

Such specimens as were sent accompanying were in a shocking condition, and, if not the cause of the death of the animals, must have severely aggravated the effects of illness.

"I to-day received the skin of a young bullock, about one year and

a half old, which was very much warbled, and which showed signs of a considerable amount of inflammation. I have cut a piece out and forward it for your inspection. . . . . You will notice that the membrane covering the warble is much thinner than at a later period. I cannot help thinking that the death of this animal has been brought about solely by warbles: the irritation caused by the presence of so large a number must have been very great, and it may be supposed the draw upon the system to supply such a large colony with food must have been more than could be borne." — JOHN DALTON, Wigton, March 28th, 1885.

[The thinness alluded to was very noticeable, the segments of the maggot being clearly discernible through the membrane. The piece of hide contained eight or nine warbles in a space of not more than two and a half inches square, and was in a state of inflammation. The maggots were upwards of a sixth of their full growth, and the warbles containing them in some cases so close together as not to be clearly distinguishable from each other.—ED.]

"Almost immediately after receipt of your letter to-day we had the skin of a yearling sent in; it was covered with warbles down the centre of the back. The man who brought it said they considered it died of 'blackleg.' We think the warbles killed it. This makes the fifth within the last four or five days, all supposed to die of 'blackleg, or quarter-evil,' but all equally affected by warbles. By this post we send you a box of the maggots, all of which the writer cut out within the space of this sheet of paper."—Messrs. C. and H. HATTON, Barton Tannery, Hereford.

"We received a hide to-day taken off a beast supposed to have died of 'blackleg.' Looking at it spread open, it was most distressing to think that a poor beast should be allowed to get in such a state. However, we have cut the centre out, and send it you by this post."—Messrs. C. and H. HATTON, Barton Tannery, Hereford.

[The piece of hide was 28 in. long by $8\frac{1}{2}$ in. at the widest part, and contained upwards of seventy-two warbles.—ED.]

From Mr. W. Williams (tanner), of Haverfordwest, I 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."

In the course of our investigations, 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.

The following observations, forwarded in 1888, are just a few examples of the communications sent me regarding serious injury to the condition of the infested 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 caused by 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."

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

"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 into 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."

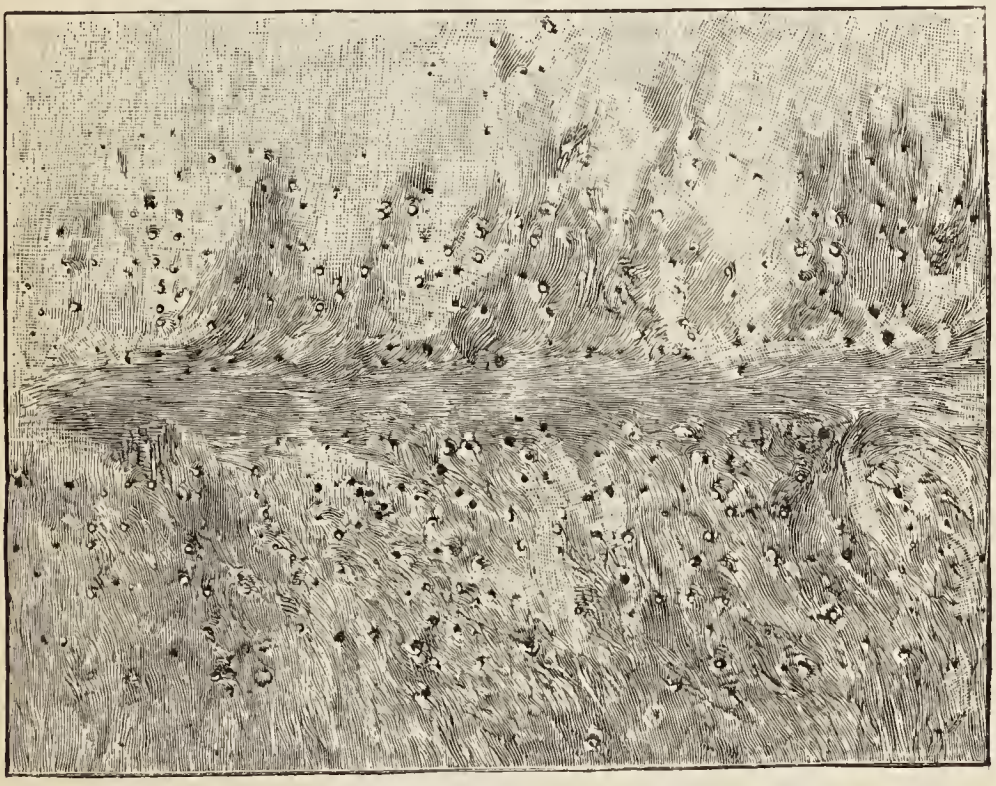


Fig. 14.—Piece of yearling skin with 402 warble-holes.

From specimens then sent to myself, I was able to speak personally to the serious extent to which the attack would run on. In one of the

hides, that of a two-year-old heifer, there were 300 warble-holes; and in another taken from an animal which died on consequent mortification of the back, there the warble-holes were more than 400 in number. The accompanying figure (see previous page), giving some idea of this damaged hide, though necessarily in miniature, is from a photograph presented to me by Messrs. R. Parsons and Son, tanners, East Street, Taunton, of a piece of a yearling skin, 24 by 14 inches, containing 402 warble-holes.

Loss on the hides is a very serious matter, and special estimates and calculations are given on this head by themselves further on; but in the above observations the condition of the hide has chiefly been alluded to in connection with the illness or death of the attacked animal, of which the infested hide showed the cause, sometimes little suspected until attention chanced almost accidentally to be directed to

Fig. 15.—Piece of under side of warbled hide; warbles about half-size. From a photo by Messrs. Byrne, Richmond, Surrey.

it, as in the observation of the late Mr. Magniac, of Colworth. But bad as this loss on hides is,—and to be counted by hundreds and even thousands of pounds per annum to individual firms,—this is only a

part of the loss caused by warble-attack: in the words of Mr. R. Stratton, of the Duffryn, Newport, Monmouthshire, to whom I have from the beginning of our work been greatly indebted for co-operation, "it is as pennies to sovereigns" compared to the loss on the animals.

Licked Beef.

Warble-attack, when severe to an extent often found to be the case, causes inflammation, and consequently very evident alteration in the state of the tissues immediately beneath the warbled part of the hide.

This condition, known as "licked beef" or "jelly," has long been only too well known to all connected with dressing cattle after slaughter, but the nature and precise cause of the condition was, as far as I am aware, *not* known. And *in the year 1889* we were enabled, through *post mortem* examinations, to obtain clear proof of connection between presence of inflammation seriously injurious to condition of the animal and presence of warble in the overlying part of the hide.*

In the investigation I was greatly indebted for assistance to Prof. John Penberthy, of the Royal Veterinary College, Camden Town, N.W.; to Mr. Henry Thompson, M.R.C.V.S., of Aspatria, Cumberland, who has long devoted much attention to warble-treatment; and also to Mr. John Child, Managing Secretary of the Leeds and District Hide, Skin, &c., Company.

The reasons for the name of "licked beef" being applied to the altered condition, and a description of this altered state, is given in the following observations, with which I was favoured in reply to my enquiries by Mr. Henry Thompson, M.R.C.V.S., Aspatria, Cumberland:—

"With reference to what you call 'licked beef,' I suppose you mean that portion of the back (sirloin) where the warbles are generally most numerous, and, when ready to leave their quarters, cause so much irritation that the cow licks them with her rough tongue, and assists in their removal, and is thus thought by many to damage the flesh underneath; hence the name, 'licked beef.' But I cannot see

* The reader will please observe that in these notes I am entirely limiting myself to observation of the nature of the mischief caused by warble-presence. Inflammation may be caused by injury to the animal, or local disease, or it is considered sometimes to arise from too-high keep given to push on the condition of the animal rapidly; but *the* great cause of the alteration under consideration is warble-presence, therefore I have only given the results of examination of specimens where we had the warble-presence in connection. The mischief itself and its origin from warbles we have ample evidence of for many years back; but the point especially asked for was to learn what this changed state was, anatomically considered.—E. A. O.

this; the heavy, thick skin will protect the beef from being damaged with the cow's tongue; therefore, in my opinion, the term 'licked beef' is a misnomer.

"Now, what causes the damaged meat, or beef, is the chronic inflammation set up by the warbles in the skin, which extends to the connective tissues, thence to the flesh, producing the straw-coloured, jelly-like appearance of a new-slaughtered carcase of beef, which in twelve to twenty-four hours, when exposed to the air, turns a dirty greenish yellow colour; and this spoils the beef, having a frothy discharge oozing from the surface, with a soapy-like look; hence the name, 'licked beef.'"—H. T.

With regard to this altered material, which has to be scraped away, Mr. John Child, Manager of the Leeds and District Hide, Skin, and Fat Co., wrote me on the 3rd of July:—"In the worst part of the warble season I could get you bucketfuls of inflamed tissue (commonly called by the butchers, 'jelly'), cut and scraped from the carcase after the hide is taken off. The formation of this matter must be a great drain on the health, condition, and quality of the animal, and must be a great loss to somebody."

The height of the warble-season was then quite past, but on July 16th Mr. Child forwarded me a sample of this so-called "jelly," with the remark that it was "difficult to get at this time of year. When the grub leaves the hide, the inflamed tissue soon diminishes, and in a very few weeks disappears altogether; but during the most active part of the warble-season the condition of the carcase of the animal is such as to considerably reduce the value to the butcher."—J. C.

This disgusting-looking sample of scrapings from the inflamed surface appeared to the unpractised eye as a mass of variously discoloured, soft, wet, or jelly-like-looking material, in which there were here and there orange- or ochre-coloured patches or streaks, and dark red lumps or patches like coagulated blood; and in this material, or jelly, the warble-maggots were still to be found.

This sample I forwarded, by his kind permission, to Prof. Penberthy, who wrote me regarding it as follows:—"I have made an examination of the *post mortem* specimen sent. The so-called 'jelly' is the product of inflammation, and there is every reason for believing that this inflammation is due to the warble. In the small portion of material received there were three apparently healthy warbles, evidence of two others in a decomposing state, and three cavities where other warbles had been lodged. The material is not fit for human consumption. I think it very deleterious to the health and comfort of the affected animal."

In reply to my enquiry as to how I should rightly describe the

altered tissues, Professor Penberthy wrote me :—"I should call the material inflammatory product in the subcutaneous tissues. . . . . Inflammatory product is made up of constituents of blood exuded through vessel-walls which have been damaged. It is allowed, too, by some pathologists that inflammation, too, may excite growth of the cells previously existing in the part. The dark red colouring is most probably due to escape of blood from small vessels which have ruptured; the orange-coloured material which I have found in some cases is inflammatory product undergoing degenerative changes, in others decomposing warbles."—J. P.

A few days later Mr. Child further wrote that the sample which he sent me of inflamed tissue was obtained from the animal while in the process of dressing, so that the inflamed matter was taken both from the hide and the carcase at the same time.

"In watching the slaughterman take off the hide, we were surprised to find the warble-grub present, a somewhat rare case so late in July; however, it enabled me to send you a perfect sample on a small scale. But during the worst part of the warble-season they sometimes cover one-third and in some few cases one-half of the entire carcase; the warble always develops on the top of the animal from the shoulder to the tail-head, which spoils the choicest parts of the carcase, ruins the best parts of the hide, and makes it worthless when tanned for many purposes, namely, for harness, engine-straps, boot-soles, &c. The effect on the carcase of the animal afflicted with warbles in regard to colour is, when quite dry after dressing, in some cases a pale yellow, in others a light brown, and in some scarce examples dark as mahogany."—J. C.

On the 17th of May a very good specimen was sent me, by favour of Mr. Henry Thompson, from Workington, in Cumberland. This was a large piece, containing the back-bone, flesh, and hide, all cut right out of the centre of the animal after slaughtering. This was an excellent specimen for our purpose, because it was so moderately warbled that it showed how mischief may arise, even from an average or less than average amount of warble-presence.

Regarding this specimen, Prof. Penberthy (who kindly examined it for me) wrote me from the Royal Veterinary College on May 20th :—"The parcel arrived quite safely, and the contents in good preservation." . . . "In a superficies of 450 inches I found eighteen well-developed and eight very small warbles. There was, however, ample evidence of inflammatory products.

"The change had not apparently affected the red flesh (muscles). It so happens that in the parts more seriously invaded the muscles are covered with dense fibrous tissue.

"This morning, in those parts in which the warbles were most

numerous, putrefactive change was much more advanced than in those in which there were no warbles."—J. P.

The following communication from Mr. C. E. Pearson (wholesale butcher), Sheffield, is valuable both from the practical information conveyed, and pointing out extent to which warble-presence unavoidably tells against the health and thriving of the infested animal:—

"In answer to yours of March 9th, I may say that the effects of warbles on the carcase is more serious than can possibly be imagined by an outside appearance of the beast. The beef, as I stated in my letter to the 'Meat Trade's Journal,' is most unsightly, but the taste of the beef is very bitter where the warble has been, and very objectionable to the consumer. The carcase of beef assumes a nasty yellow colour, and also a soft flabby appearance on the outside rind of the beast (where the warble has been in operation); so much so, that the carcase has to be pared in some cases down to the flesh to make the appearance of the animal at all presentable for the market, thereby causing a grievous amount of loss to the butcher, and an unsightly article to the consumer. I am, of course, speaking from experience, killing on an average twenty beasts or more a week, and the loss to me alone in hides last year amounted to something like £3 per week during the season that warbles had developed on the hide, and no one a gainer."

Amongst various more general observations in Mr. Pearson's letter, sent to me at his request by the Editor of the 'Meat Trade's Journal,' he added the following very just remarks as to loss caused to owners by the wearing pain and discomfort in which the animals are kept by presence of warbles:—

"They are a pest not only to the butcher as a matter of loss, but, from a humane point of view, to the poor beasts that suffer from them, ... causing a great amount of pain that might be avoided if only the farmer would be at the trouble *to try at least* to rid them of the pest. Of course, while the animals are suffering physical pain the owners themselves are suffering in pockat, and more than they imagine; the loss results from the lowering of the condition of the cattle, and the dairy-farmer loses from the yield of milk, not only reduced in quality, but also in quantity, and it is an impossible thing for the general health of the cattle to be so good when suffering the pain caused by the warbles."

I have myself also had the opportunity of seeing the altered state and colour of parts of the surface of a carcase from which the hide, when removed, had been found to be so infested with warbles that I was asked to come and look at it. This was at Spring Grove, near Isleworth, and the butcher cut thin slices off the discoloured yellow

part to show me how much the condition was altered from that of the healthy portions.—Ed.

The hide in this case, and in the others in which pieces were sent to show the condition when badly infested, was a truly loathsome sight. The figure at p. 18 shows just a small piece with the warble-cells as they appear on the lower surface when the hide has been removed, but in this case only half the full size. Those whose business connects them with observation of this state of things know well what a sight a much-infested, newly-flayed hide is. Those who do not may imagine the inner side scattered over along the region of the loins or upper part of the back with a quantity of loose baggy-looking lumps, which, if watched, will show the shape of the thick fleshy maggots, up to about an inch in length, wriggling about within, and in some cases breaking out through the thin tissues of the lower part of the hide. With this comes the flow of the filthy matter they have been feeding on, and the sight, accompanied by all the various discolorations from inflammation, ulceration, and other wretched circumstances, is, in the words of the heads of one of our tanning firms, "truly sickening."

In answer to an enquiry of mine whether the alteration in the carcase, called "licked beef," takes place only where the beast can lick the place, Mr. Pearson replied:—"It will take place whether the beast can lick it or not, as there is the irritation continually going on; of course licking aggravates the case, and makes the carcase worse."

Much communication on this subject passed through my hands during the investigation; but without entering on all these, the above observations and just the two following short notes, with which I was favoured, are quite enough to show the nature of this diseased condition consequent on warble-attack.

The first is from Mr. Joseph Wing, hide broker, of Pen Street, Boston, who noted from his own observations as to condition of warbled beasts:—"The effects are something as you state. There is a jelly or watery substance on the back of the carcase when dressed, on and between the rind or thick skin and the bone of the beast."

The following note was given me at the beginning of April by Mr. John Risdon, of Golsoncott Farm, Washford, Taunton (auctioneer to the Devon Cattle Breeders' Society):—"I received your communication on my way to Taunton Market on Saturday; one butcher, well known to me, and a man of great experience, told me he killed a bullock a few days before so discoloured by licking the warble-grubs that he had to scrape off nearly the whole of the spine (fat) to render the carcase presentable for sale."

To these may be added the following detailed note turning partly

on presence of the condition known as "licked beef," with the accompanying "butcher's jelly"; and also noting the loss on hide, loss on meat, and loss from the warbled animal not answering properly to her extra good keep .

On April 10th, 1889, Mr. James Sparkes, of Wearhead, Darlington, forwarded me the following information regarding loss consequent on bad warble-presence in the case of a heifer he had lately sold:—

"I recently sold to a butcher here a very good heifer, which turned out a much lighter weight than I anticipated from the extra good feed, &c., and much surprised to find the poor animal had been one of the martyrs, hide considerably reduced in value, and understand some parts of the meat had to be scraped to be made presentable. I will now take good care this shall not occur again, having procured McDougall's Smear and careful inspection."

A few days later, in reply to my request for further details, Mr. J. Sparkes wrote me that the butcher had found the badly-warbled animal above mentioned:—"Down the spine was frothy, loose, and mattery, or suppose in a sort of jelly-state, and (as I said in my last) some of the beef to scrape before sending it out. The loss on hide, 1d. per lb.; suppose that would mean on hide, 5s.

"Now, loss in beef fell upon myself, the animal being sold to the butcher so much per stone. But (as I said before) the heifer did not make near the weight I anticipated from the extra good feed and length of the time she had. It should have been at least six stones more, so may venture to say, loss in beef and hide from fifty to sixty shillings. I never suspected warble-trouble until told by the butcher."

How far the altered condition of the surface may affect the taste of the meat does not seem certain; I have only had a few reports on this subject, but from these most of the evidence appears to lean to the taste *being* altered.

In the following notes, kindly procured for me by Mr. McGillivray, secretary of the Hide Inspection Society, Newcastle-on-Tyne, from butchers of that town, it will be seen two of the writers consider the taste to be altered, but the other writer does not:—

Mr. M. H. Penman, Gateshead, writes:—"Your letter to hand. There is nothing nastier than licked beef, and the worst of it is that it is always licked on the most expensive parts, *viz.*, the back, which comprises the sirloin and forechain; and it is quite true that it not only gives the beef an unpleasant appearance, but a nasty bitter taste. If I knew, I would not buy a licked beast, supposing I could get it at a shilling a stone less."

Mr. W. C. Brown, Newcastle, writes:—"In reply to your note of to-day respecting 'licked beef,' my experience teaches me that the

quality is not at all deteriorated; it interferes very much with the outward appearance, and more if the beef hangs for a week or more; the colour becomes somewhat darker, but certainly it *has not a bitter taste*, for only on Sunday last we cooked a piece (of beef of that character) from an animal slaughtered ten days before, which was very much licked, and beef of better quality no one could eat."

Mr. Wm. Thompson, Newcastle, writes:—"When beef is badly licked, it is very bitter; I have seen it quite unsaleable, all the outside fat taken off, and you could not get the bottom of it. Sometimes it is so bad that it is right through the chain and down to the rib-bone, when it is as bad as that it is quite useless."

It is perhaps worse than useless to venture a conjecture where those who thoroughly understand the subject differ amongst themselves in opinion, but it does occur whether the difference in bitterness of taste may not be according to the completeness with which the diseased tissues above the meat may have been removed.—Ed.

With regard to age of cattle at which infestation has been found most prevalent, it will be seen by casting the eye along the columns of the *folding table* of particulars of sound and warbled hides sold at one of the Birmingham markets, that the three heaviest classes named, ranging from 75 lbs. to 95 lbs. and upwards, do not suffer as much as the three lighter classes, of which details are given on the same table.

The three lighter classes (that is, the classes weighing 65 to 74 lbs., 56 to 64 lbs., and 55 lbs. and under) are principally heifer hides, and are shown by the table to be the greatest sufferers. We also find that in these three lighter classes infestation was found continuing from about seven to sixteen weeks later in the season than with the three heavier classes, warble being still present in the lighter classes to some degree up to Sept. 19th. Dates from Feb. 14th to Sept. 19th, 1885.

The following notes give some individual observations on the subject of the warble-maggots being found in young things, down to the size of animal of which the back can be reached by a little lad of ten years old. These are perhaps no information to all versed in warble matters, but are inserted partly in reply to an enquiry, or erroneous view, recently sent me:—

"Cattle at the age of one or two years are most subject to attack."—John Dalton, Wigton, Cumberland.

"Young (yearling and two-year-old) beasts are most subject to attack [of warbles], and shorthorns more so than the thicker-skinned Welsh or Scotch breeds; the hide of a Welsh 'runt' is quite twice as thick as that of a shorthorn bullock."—E. A. Fitch, Brick House, Maldon, Essex.

"They are worst upon young cattle, if they strike, as they often

do, when they are stirks six or eight months old. The infliction takes greater effect upon a young growing animal than upon one that is older and fuller in condition." —W. H. Liddell, Leather Market, Bermondsey, London.

"I notice that nearly all kips (that is, hides off yearling cattle) that have died a *natural* death are covered with warbles. Are deaths of these almost calves to be attributed to the fact that the irritation they cause exhausts nature?"—H. C. Haines, Newport, Mon.

On Feb. 24th (see my Warble Report for 1884), Mr. H. Thompson, M.R.C.V.S., Aspatria, Cumberland, reported that on that day some of the pupils at the College of Agriculture had found several enlargements on the backs of *young cattle* at the farm; and in the course of our work, carried on by the boys of the Aldersey Grammar School (referred to in detail further on), one little lad, only ten years old, not to be behind his fellows in the extent of his powers, as he could not reach up to the full-grown cattle, brought in his contribution of maggots, which he had squeezed out of the calves.

The almost world-wide distribution of this cattle-pest is important relatively to possibility, or rather certainty, of its importation from some countries, and also of its general transmission colonially. I have myself been consulted in the case of transmission to a Cheshire farm from the U.S.A.

The following note gives the wide distribution of the species on the first-rate authority of Dr. Friedrich Brauer.* This species is distributed from Scandinavia to the most southern parts of Europe, and is also to be found occurring in Asia, Africa, and North America." . . . "A beautiful variety was shown me by Prof, Löw, from Asia Minor. This differed from the ordinary species in all of what are usually yellow hairs, being in the variety of a pure white.†

The following notes of amount of injury to imported hides, for which I was indebted to the courtesy of the Colonial Company in favouring me with a reply to my enquiry, add a very solid practical confirmation to Dr. Brauer's entomological statement:—

On the 8th of August, 1884, Mr. B. Brown, Secretary, wrote me as follows:—"I enclose copy of reply I have just received from an experienced firm of hide and skin brokers to an enquiry we made of them as to the injury done to hides, &c., by the Warble Fly."

"Reply to the inquiry of the Colonial Company respecting the damage done to hides and skins by the Warble Fly:—

"'Parcels of Ox- and Cow-hides and Goat and Sheep skins coming

* See 'Monographie der Œstriden,' von Fr. Brauer, Wien. 1863, p. 127.

† This to some degree resembles the variety of which a few specimens were found by Mr. C. C. Martyn amongst the Warble Flies which he reared from chrysalids captured by himself at Aspatria, Cumberland (see p. 11).

from all parts of the world, all contain a varying proportion of warbled hides and skins, the damage, as a rule, being greatest on those from the hottest climates, and generally affecting goat skins to the greatest extent.

"'Those hides and skins coming from Mogador and other northern parts of Africa suffer most in this respect, an average perhaps of about one-fourth of them being damaged to the extent of 60 or 70 per cent. Those from Kurrachee also suffer damage to almost the same extent, while those from Calcutta, Madras, and Bombay are depreciated perhaps to the extent of 50 per cent. on 10 per cent. of the skins.

"'From Cape Colonies the damage is comparatively slight, and still less in those hides and skins from Australia and South America.'"—Communicated by sec. of Colonial Co., Leadenhall Street, London.

The great injury, however, which is caused year after year by this attack is not only from the perforations of the maggots lessening the value of the hides, but the loss in flesh and milk and health in summer, when the animals are started by their terror of the fly to gallop as fast as they can go, and later on the suffering and drag on the system of supporting may be six, ten, or twenty, sometimes even a hundred, or two, three or four hundred, of these strong maggots growing up to an inch in length and feeding in the sore, which they keep up from January or February until they are full-grown.

What the losses from effect of warble-attack may amount to yearly is difficult to calculate with certainty. Mr. W. H. Liddell, of Bermondsey, put it at two million pounds sterling annually to Great Britain and Ireland; and on March 3rd, 1885, Mr. Richard Stratton, of The Duffryn, Newport, Mon., remarked:—"You have made one trifling mistake, and that is in the amount of my estimate of the annual loss sustained by the fly, you make me put it at *a million*, but I do not think I have ever put it at less than a pound per head on every animal unsheltered from the ravages of the fly, which would probably be seven or eight millions for the United Kingdom, and this, I fully believe, is not above the mark."

This looks a large estimate just on the face of the thing, but a great deal of the amount may be fairly approximated, calculated out by returns of loss per stone, or per carcase, on damaged animals, and losses on hide, of which some notes are given below.

To these have to be added, for one thing, losses on fatting beasts; in the words of Mr. R. Stratton, on August 8th, 1884:—"Cattle are suffering very much at this time from the fly. Fancy a fat beast having to run perhaps ten miles a day in this heat! Many lose £1 worth of beef in a week from this cause."—R. Stratton, The Duffryn, Newport, Mon.

Also as mentioned below:—

. . . . . "In the hot summer days our cows are tormented by the fly, and we frequently see them galloping with tails up to get out of the way of their tormentor; this lessens the quantity of milk, and prevents feeding cattle growing."—D. BYRD, Spurstow Hall, Tarporley.

All who are at all connected with management of cattle know so well about the mischief caused by these wild gallops that it is not necessary to give observations of these in detail, more particularly as they have to be mentioned further on in the notes from contributors regarding successful methods of prevention and remedy; but all stock keepers and dairy farmers know to their cost the mischief thus caused, not only in delaying fattening, but danger both in the gallop itself, and risk of accidents to incalf cows, and also loss in quantity and deterioration both in quality and condition of the milk.

Loss on milk.—The only precise calculation I know of on the subject is thus referred to by Prof. Riley, late Entomologist of the U. S. A. Department of Agriculture:—"'The Effect of the Warbles in the Dairy' is the title of an interesting article by T. D. Curtis, in which the loss in the quantity of the flow of milk as well as its deterioration in quality, resulting from the annoyance of the animals by the flies while the latter are depositing eggs, and later by the grubs, is conclusively shown, and he estimates the shrinkage at 10 per cent., and the loss in quality at the same rate, making a total of 20 per cent."—See 'Insect Life.' Periodical Bulletin of U. S. A. Department of Agriculture. Vol. ii., No. 5, p. 158. Washington, U. S. A., 1889.

The following note, from personal observations by Mr. D. Byrd, gives *approximate estimates of loss of value on growth of feeding cattle* from disturbance, and on *weight of cheese and percentage of milk* calculably lessened by the same cause:—

"We all know to our cost how greatly these tormenting flies irritate and madden the cattle, causing them to gallop or run, as if for their lives, to get away from the buzz and presence of their tormentors. Feeding cattle cannot grow in flesh without quiet and rest, and milking cows must suffer to a greater extent than we are aware of. To use a common remark, they soon 'bate'—give less milk. To drive a cow fast, or cause her to be excited, reduces the quantity and quality of the milk. Without perfect quiet and rest they cannot do their best for us.

"This leads me to the one important point. What is our loss in the cheese-tub caused by the Warble and Gad Fly? I have tried to estimate the loss during the four or five summer months, or even the eight months that a cow is supposed to be in profit. There are certain times of unrest when the cow will give about one-half of her usual flow of milk. These tormenting flies, and the continued presence of

the prickly-coated warble-maggot, must keep up a perpetual uneasiness, and retard the growth of our feeding cattle to our loss, it may be, of £2 per head. In the dairy cows the loss will be greater. The daily loss of milk may make a difference of 1 cwt. or ¾ cwt. of cheese per cow per annum. Half a hundredweight, or 12½ per cent., of milk less in a dairy making 4 cwt. at 70s., comes to 35s.; but 12½ per cent. is too low an estimate: it may in some cases be put at £3 per head, and in a dairy of 100 cows would show a loss of £300." *—D. Byrd, Spurstow Hall, Tarporley, Cheshire.

With regard to direct loss in value of the carcase of the animal by beef being what is called "licked."—In some serviceable observations with which I was favoured in 1889 by Mr. John Child, managing secretary of the Leeds and District Hide, &c., Company, as to details requisite for forming estimate of our British loss in the aggregate from warble-attack, he mentions:—"The greatest loss on the worst carcases of beef I ever saw, taking a number together, would not be less than £1 per carcase, or 6*d.* per stone; of course there are some exceptional cases worse than these, but they are rare—in fact so rare that they should not come within your calculations.

"I think I am right in saying that the depreciation in the value of licked carcases of beef are from 6*d.* per stone down to 1*d.* per stone, and as the highest figure named comes in fewest number, the average figure for reduction in value should not be taken at more than 2*d.* per stone. Take the average weight of cattle affected by 'lick' and 'Warble' at forty stone, we have thus a loss on the carcase of 6*s.* 8*d.*"—J. C.

This estimate of our scale of loss or lessened value on this one item appears to run lower than that in America. The above estimate at 1*d.* to 6*d.* per stone equalling 3*s.* 4*d.* to 20*s.* per carcase at average weight given, runs a good deal lower than the Chicago estimate of 2 dollars to 5 dollars per carcase, that is, 8*s.* to 20*s.* of our money. Our highest estimate is considered to occur so rarely comparatively,

* The above note also formed part of a paper communicated by Mr. Byrd to the 'Chester Chronicle' of Feb. 7th, 1884. Mr. Byrd's mention of "the Warble *and* Gad Fly" is very important, as these two very different attacks are often confused. The Gad Fly, *Tabanus bovinus*, is much larger than the Warble Fly; it does not injure the animals by means of its grubs, as these feed in the ground, but it causes mischief by driving its sucking apparatus into the cattle very painfully and drawing away the blood, and also, like the Warble Fly, by terrifying them into the wild gallops we know so well. From some of the various subsequent observations given it appears that the applications noted as useful to keep off one sort of fly are equally useful to keep off the other; and this point of the cattle so dressed being able to feed in peace whilst the others were being hurried in all directions is well worth consideration.

that our average loss as calculated above is 6*s*. 8*d*., not quite up to the lowest sum noted from Chicago.*

"The amount of this loss can be better appreciated, perhaps, by reproducing in condensed form the approximate estimate of the loss on the hides of cattle received at the Union Stock-yards of Chicago during the grubby season, which includes the months from January to June. Using the reports by States above given as a basis, it is estimated that fifty per cent. of the cattle received are grubby. The average value of a hide is put at 3·90 dollars; and while, from the report referred to, one-third value is the usual deduction for grubby hides in this estimate, but 1 dollar is deducted, or less than one-third. The number of cattle received in 1889 for the six months indicated was 1,335,026, giving a loss on the fifty per cent. of grubby animals, 667,513 dollars. When to this is added the loss from depreciated value and lessened quantity of the beef, the amount for each infested animal is put at 5 dollars, indicating a total loss on these animals from the attack of the fly of 3,337,565 dollars."—See 'Insect Life.' Periodical Bulletin of U. S. A. Department of Agriculture. Vol. ii., No. 5, pp. 156, 157. Washington, U. S. A.: Government Printing Office.

As it is of a good deal of interest to be able in some degree to compare the proportion of warble-presence in infested cattle, and also estimates of rate of money-loss thereby in countries which (as in the present case) suffer connectedly by reason of cattle-traffic from this cause, I give the preceding observation, with some amount of estimate as to amount of warble-presence, and injury from it, in the U. S. A.; reference to the original reports is subjoined in the foot-note.

The great points of our national loss from warble-infestation turn on loss of health and sometimes death of the beasts, loss of milk, injury to produce in the herd, and loss of flesh in the fatting beasts. All this falls on the cattle owner, but also there is enormous loss *running through all classes* concerned on the warbled hides.

* During the year 1889, very widely extended investigations regarding warble-attack were set on foot, under the superintendence of Mr. A. S. Alexander, Member of the Highland and Agricultural Society of Scotland, and whilst still in this country one of the contributors to my own Annual Reports, then Editor to the 'Farmer's Review' of Chicago, U. S. A. Circulars were sent out by the proprietors of the paper over an enormous area of stock-producing country, and much information sent in, of which some was valuable, some not so, but when sifted and arranged, the reports are well worth attention.

These will be found at length in the 'Farmer's Review' (Offices 134, Van Bureu Street, Chicago, Illinois, U. S. A.), in Nos. for July 17th, 24th, 31st, and for August 7th and 14th, 1889; and an abstract of these reports was published in the U. S. A. Department of Agriculture Bulletin entitled 'Insect Life' for Nov. 1889.

None but those very intimately concerned could be expected to wade through the mases of reports sent in, which I have, however, still at hand, but the above short abstract is of considerable interest.

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.

Loss on Warbled Hides.

In the following pages I submit returns of information with which I was favoured in reply to my enquiries regarding amount of money-loss on hides from warble injury (during one year, or during the warble season) from several of our chief hide markets, companies or associations connected with business in hides, namely, from Aberdeen, Birmingham, Boston, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham and Sheffield.

Most of these were placed in my hands in the year 1888; but particulars on the annexed table, with which I was favoured by the courtesy of Messrs. Fry and Company, Leather and Hide Factors, Moor Street, Birmingham, was placed in my hands in 1884.

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:—

Six Classes of Hides. Weight from	Hides. No. of sound.	Hides. No. of warbled.	Sold at	Per hide less than the sound.	Loss on each Class. £	s.	d.
95 lbs. and upwards	286	67	¾d. per lb.	or 6s. 3d. per hide	20	18	0
85 lbs. to 94 lbs	446	222	⅞d. ,,	,, 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. 0d. ,,	110	5	0
55 lbs. and under ...	283	224	1d. ,,	,, 4s. 3d. ,,	47	12	0
Totals.....	3279	1906		Total.....	545	0	8

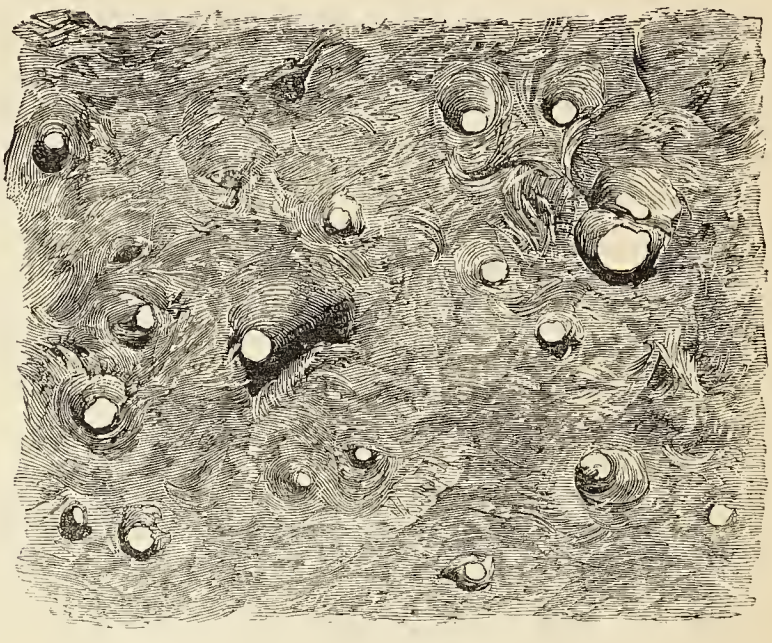
It will be observed that of the total number of hides (*viz.*, 5185) over one-third were warbled; and looking merely at one line of the figures, it shows that out of 1460 hides, ranging from 65 lbs. to 74 lbs. weight, 579 were lessened in value at the rate of 1d. per pound, or 5s. 10d. per hide, giving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

The above table of particulars does not include the three classes known as "heavy" and "light" cows' and bulls' hides, which also were warbled, but the numbers of which were not taken, on account of Messrs. Fry not being as much interested in these as in the other classes.

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



Portion of inside of tanned warbled hide.

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 30,000. 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 the 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.

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

* "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."

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 ...	58738	45813	104551

"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 & 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 Co-operative 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 ¾d. 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 prefix (p. 31) and append the 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 preceding 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 folding table the cows' hides are included, and the particulars are given week by week in detail from February 14th to September 19th.

This accompanying folding table, with which I was favoured by

Particulars of Sound and Warbled Hides, sold at one of the three Birmingham markets, from beginning of the warbled season, viz., February 14th; to the end,—September 19th,—1885.

		95 lbs. and upwards.	Price.	Total Sound.	Warbled.	Price.	85 to 94 lbs.	Price.	Total Sound.	Warbled.	Price.	75 to 84 lbs.	Price.	Total Sound.	Warbled.	Price.	65 to 74 lbs.	Price.	Total Sound.	Warbled.	Price.	56 to 64 lbs.	Price.	Total Sound.	Warbled.	Price.	55 lbs. and under.	Price.	Total Sound.	Warbled.	Price.	Heavy Cows.	Price.	Total Sound.	Warbled.	Price.	Light Cows.	Price.	Total Sound.	Warbled.	Price.
	O	11	5				29	4⅝				31	4½				44	4¼				38	4⅛				31	4⅛				44	4				54	4			
Feb. 14	X	33	5¼	44	1	4½	23	5	52	1	4⅜	25	4⅜	56	3	4¼	26	4⅓	70	3	4	11	4⅜	49	2	3⅞	5	4½	36	4	3⅞	17	4¼	61	2	3¾	9	4¼	63	0	
	O	15	5⅛				9	4¾				19	4⅜				46	4¼				37	4⅛				21	4⅛				38	3⅞				41	4			
,, 21	X	15	5½	30	1	4½	17	5⅛	26	2	4⅝	24	4¾	43	5	4¼	19	4⅜	65	18	4	10	4⅜	47	16	4	25	4¼	46	6	3⅞	25	4¼	63	2	3⅞	6	4⅜	47	3	3⅞
	O	20	5				22	4¾				29	4½				35	4¼				34	4¼				16	4				57	4				43	4			
,, 28	X	18	5⅜	38	2	4¾	10	5⅛	32	5	4½	19	4¾	48	7	4¼	14	4⅜	49	7	4	14	4⅜	48	11	4	3	4⅛	19	4	3⅞	11	4¼	68	9	3¾	9	4¼	52	3	3¾
	O	23	5¼				16	4⅞				22	4½				36	4¼				32	4¼				16	4⅛				47	3⅞				49	4			
March 7	X	9	5⅜	32	4	4⅞	11	5⅛	27	10	4½	19	5	41	7	4¼	16	4⅜	52	26	4	9	4⅜	41	9	4	5	4¼	21	6	4	9	4⅛	56	5	3¾	6	4⅜	55	7	3¾
	O	16	5¼				15	4⅞				25	4½				23	4⅜				29	4⅜				18	4⅛				32	3⅞				44	4			
,, 14	X	14	5½	30	6	4⅞	22	5½	37	10	4⅝	22	4⅝	47	14	4⅛	10	4⅓	33	19	4⅛	9	4⅝	38	20	4	2	4¼	20	14	4	8	4⅜	40	13	3⅞	10	4⅜	54	5	3¾
	O	9	5¼				21	4¾				15	4⅝				20	4⅝				15	4¾				16	4¼				26	4				40	4⅛			
,, 21	X	12	5⅝	21	3	4⅞	7	5⅛	28	11	4⅝	15	4¾	30	19	4⅜	20	4⅜	40	23	4⅛	15	4¾	30	23	4⅛	5	4⅜	21	12	4	10	4⅜	36	5	3¾	4	4⅜	44	6	3¾
	O	12	5⅝				6	4⅝				14	4⅝				33	4⅜				31	4½				24	4⅛				29	3⅞				43	4⅛			
,, 28	X	18	5¾	30	8	4⅞	17	5¼	23	11	4⅝	16	5	30	23	4¼	15	4¾	48	38	4⅛	9	4¾	40	21	4⅛	4	4¼	28	8	4	4	4¼	33	9	3¾	6	4¼	49	9	3¾
	O	14	5⅝				20	5⅛				26	4⅝				30	4¼				29	4¼				15	4				35	3⅞				28	4			
April 4	X	10	5⅝	24	6	4⅞	7	5¼	27	16	4⅝	16	4⅞	42	37	4⅛	10	4⅝	40	43	4⅛	8	4½	37	32	4	2	4¼	17	12	4	9	4½	44	15	3¾	5	4⅛	33	9	3¾
	O	10	5½				17	4⅞				41	4⅝				35	4¼				28	4⅝				18	4⅛				29	3⅞				27	4			
,, 11	X	19	5¾	23	9	4¾	12	5¼	29	9	4½	17	4⅞	58	24	4⅛	8	4⅝	43	32	4	7	4⅝	35	41	4	1	4¼	19	13	3⅞	4	4¼	33	7	3¾	4	4¼	31	5	3¾
	O	16	5½				18	5				33	4⅞				30	4⅝				23	4⅝				14	4⅛				32	4⅛				32	4			
,, 18	X	8	5⅞	24	11	4⅞	12	5⅜	30	13	4⅝	13	5⅛	46	24	4⅛	10	4⅝	40	35	4	5	4⅝	28	38	4	3	4¼	17	19	3¾	11	4¼	43	13	3¾	2	4¼	34	10	3⅝
	O	12	5⅝				16	5				26	4¾				29	4½				23	4½				6	4¼				20	4⅛				34	4⅛			
,, 25	X	11	5⅞	23	1	5	13	5¼	29	9	4¾	6	5	32	22	4¼	9	4⅓	38	42	4⅛	3	4¾	26	24	4	3	4⅜	9	25	4	8	4⅜	28	4	3⅞	0	4⅜	34	12	3¾
	O	9	5⅞				27	5¼				41	4¾				36	4⅝				28	4¾				21	4¼				28	4¼				33	4⅜			
May 2	X	6	6	15	2	5¼	10	5⅜	37	14	4⅞	17	5⅜	58	16	4⅜	7	4⅞	43	21	4⅛	3	4⅞	31	14	4⅛	2	4½	23	26	4⅛	7	4½	35	6	4	6	4⅝	39	5	3¾
	O	15	5¾				28	5¼				42	4¾				47	4½				31	4½				13	4⅝				33	4¼				39	4¼			
,, 9	X	6	5⅞	21	4	5⅛	6	5⅜	34	7	4¾	14	4⅞	56	14	4⅜	6	4¾	53	16	4⅛	4	4¾	35	13	4⅛	0	4⅜	13	13	3¾	9	4½	42	10	3¾	5	4⅜	44	5	3¾
	O	5	5⅝				13	5¼				39	4¾				48	4½				44	4½				11	4				28	4⅛				31	4			
,, 16	X	10	5⅞	15	5	5	7	5⅜	20	4	4¾	12	4⅞	51	13	4⅜	13	4¾	61	21	3⅞	8	4¾	52	25	3⅞	3	4⅜	14	10	3¾	12	4⅜	40	2	3¾	9	4⅜	40	9	3¾
	O	5	5¼				23	4¾				36	4⅜				39	4¼				40	4⅜				15	4⅛				31	3⅞				25	4⅛			
,, 23	X	9	5⅜	14	3	4¾	17	5⅛	40	2	4⅜	13	4¾	49	15	4⅛	14	4⅝	53	12	3⅞	5	4⅜	45	23	3⅞	2	4¾	17	16	3⅝	6	4⅜	37	8	3⅝	6	4⅜	31	3	3⅝
	O	15	5¼				15	4¾				28	4⅜				31	4¼				30	4¼				14	4¼				16	4⅛				21	4⅛			
,, 30	X	4	5⅜	19	2	4¾	4	5	19	4	4½	13	4⅝	41	17	4⅛	11	4½	42	19	3⅞	5	4½	35	14	3⅞	2	4¾	16	13	3¾	6	4⅜	22	5	3⅝	7	4⅜	28	5	3⅝
	O	6	5⅛				6	4¾				31	4⅜				37	4⅜				33	4⅜				23	4½				17	4				25	4			
June 6	X	6	5½	12	0		8	5⅛	14	2	4⅜	15	4¾	46	10	4	8	4½	45	20	3¾	4	4½	37	29	3¾	1	4⅜	24	22	3½	3	4⅜	20	1	3½	4	4⅜	29	6	3½
	O	3	5¼				13	4¾				33	4½				35	4⅛				32	4¼				21	4¼				34	3⅞				38	4			
,, 13	X	2	5⅜	5	0		7	5⅛	20	4	4⅜	16	4¾	49	10	4⅛	10	4⅝	45	20	3⅞	10	4½	42	23	3⅝	2	4⅜	23	9	3½	2	4⅜	36	4	3½	2	4⅝	40	7	3½
	O	2	5¼				8	4¾				30	4½				28	4¼				38	4¼				29	4⅛				27	3¾				27	4			
,, 20	X	2	5⅜	4	0		6	5⅛	14	1	4⅜	19	4¾	49	9	4⅛	10	4½	38	17	3⅞	9	4½	47	19	3¾	1	4¼	30	10	3½	3	4¼	30	5	3½	4	4⅜	31	5	3½
	O	2	5⅜				8	4¾				23	4⅝				54	4⅜				34	4⅜				27	4⅛				19	3⅞				29	4			
,, 27	X	1	5½	3	0		7	5¼	15	1	4½	16	4⅞	39	6	4	12	4⅝	66	34	3¾	2	4½	36	23	3⅝	3	4¼	30	9	3½	4	4¼	23	6	3½	4	4¼	33	9	3½
	O	8	5½				11	5				18	4⅞				53	4⅜				54	4⅜				34	4⅛				22	3⅞				42	4			
July 4	X	4	5¾	12	0		15	5⅜	26	0		15	5⅜	33	4	4	17	4⅝	70	26	3⅞	6	4⅝	60	15	3⅞	2	4⅜	36	9	3½	3	4⅜	25	2	3½	5	4⅜	47	3	3½
	O	6	5¾				8	5¼				25	4⅞				27	4½				51	4½				27	4⅛				23	3⅞				39	4			
,, 11	X	10	5¾	16	0		12	5⅜	20	1	4½	13	5⅛	38	5	4⅛	12	4⅝	39	15	4	9	4⅝	60	13	3⅞	1	4⅜	28	8	3⅝	5	4⅜	28	1	3⅝	5	4⅜	44	8	3½
	O	6	5⅝				9	5⅛				25	4¾				42	4⅝				37	4⅜				38	4				23	3⅞				36	3⅞			
,, 18	X	5	5⅝	11	0		12	5¼	21	0		26	5	51	1	4⅛	20	4¾	62	12	4	9	4½	46	12	3⅞	5	4¼	43	6	3½	9	4¼	32	2	3½	8	4¼	44	4	3½
	O	5	5½				8	5⅛				20	4⅞				29	4½				38	4⅜				30	3⅞				24	3⅞				40	4			
,, 25	X	6	5⅝	11	0		12	5⅜	20	0		20	5	40	0		16	4⅝	45	5	4	8	4½	46	10	3⅞	6	4¼	36	9	3½	6	4¼	30	2	3¾	4	4⅜	44	5	3½
	O	1	5¾				9	5⅛				23	4⅞				32	4½				64	4⅜				25	4⅛				16	3⅞				42	3¾			
Aug. 1	X	15	5⅝	16	0		16	5⅜	25	1	4⅝	18	5	41	1	4⅛	22	4⅝	54	0		22	4⅝	86	4	3⅞	3	4⅜	28	8	3⅝	5	4¼	21	0		3	4⅜	45	3	3½
	O	2	5¼				11	5				44	4⅞				51	4½				55	4⅜				23	4				23	3⅞				27	3¾			
,, 8	X	7	5½	9	0		21	5⅛	32	0		17	4⅞	61	0		22	4⅝	73	2	4	2	4¼	57	6	3⅞	2	4½	25	2	3⅝	8	4¼	31	1	3⅝	2	4¼	29	1	3½
	O	2	5¼				12	5				29	4¾				55	4⅜				60	4⅜				29	3⅞				28	3⅞				40	3¾			
,, 15	X	14	5⅜	16	0		22	5⅛	34	0		19	5	48	0		24	4⅝	79	1	4	19	4½	79	9	3⅞	7	4⅝	36	5	3½	8	4⅛	36	0		4	4⅛	44	2	3½
	O	4	5				17	4¾				27	4½				30	4¼				62	4⅛				33	3⅞				30	3¾				37	3¾			
,, 22	X	13	5¼	17	0		13	5	30	0		18	4¾	45	0		13	4⅜	43	2	3¾	18	4¼	80	2	3¾	5	4⅛	38	0		9	4⅛	39	1	3⅝	11	4⅛	48	2	3½
	O	6	5¼				17	4⅞				38	4⅝				65	4⅜				61	4⅛				33	3¾				44	3¾				52	3¾			
,, 29	X	15	5⅝	21	0		14	5⅛	31	0		21	4⅞	59	0		30	4½	95	2	3¾	17	4¼	78	2	3¾	5	4	38	3	3½	4	4¾	48	0		4	4¼	56	0	
	O	7	5⅜				21	4⅞				37	4⅝				59	4				90	3⅝				27	3¾				24	3⅝				55	3¾			
Sept. 5	X	13	5½	20	0		23	5⅛	44	0		19	4⅞	46	0		16	4⅜	75	6	3⅝	22	4¼	112	1	3½	8	4⅛	35	0		6	4⅛	30	0		9	4¼	64	0	
	O	3	5¼				17	4¾				35	4⅝				65	4⅛				80	4⅛				34	4				28	3⅝				40	3⅞			
,, 12	X	11	5½	14	0		15	5⅛	32	0		23	4¾	58	0		35	4½	100	3	3⅞	23	4⅜	103	1	3⅝	13	4¼	47	2	3½	9	4¾	37	0		6	4⅜	46	0	
	O	9	5½				22	4⅞				32	4¾				59	4¼				75	4⅓				32	4⅛				40	3¾				50	3⅞			
,, 19	X	16	5⅝	25	0		21	5	43	0		32	4¾	64	0		31	4½	90	1	4	31	4⅜	106	2	3¾	8	4¼	40	2	3⅝	6	4½	46	0		10	4⅜	60	0	
32 weeks.				621	68				911	138				1495	306				1789	541				1692	497				873	305				1193	140				1382	151	

O for ordinaries. X for extra flayed. The black lines show date of Cessation of Sale of warbled hides in these classes.—Ed.

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 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 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, 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	$4\frac{1}{2}$d. to $5\frac{1}{4}$d.
85 lbs. to 94 lbs. ...	911	$4\frac{3}{4}$d. ,, $5\frac{3}{8}$d.	138	$4\frac{3}{8}$d. ,, $4\frac{7}{8}$d.
75 ,, 84 ,, ...	1495	$4\frac{1}{2}$d. ,, $5\frac{3}{8}$d.	306	4d. ,, $4\frac{3}{8}$d.
65 ,, 74 ,, ...	1789	4d. ,, $4\frac{7}{8}$d.	541	$3\frac{3}{8}$d. ,, $4\frac{1}{8}$d.
56 ,, 64 ,, ...	1692	$3\frac{7}{8}$d. ,, $4\frac{7}{8}$d.	497	$3\frac{1}{2}$d. ,, $4\frac{1}{8}$d.
55 lbs. and under ...	873	$3\frac{3}{4}$d. ,, $4\frac{3}{4}$d.	305	$3\frac{1}{2}$d. ,, $4\frac{1}{8}$d.
Heavy cow-hides ...	1193	$3\frac{7}{8}$d. ,, $4\frac{3}{4}$d.	140	$3\frac{1}{2}$d. ,, 4d.
Light cow-hides ...	1382	$3\frac{7}{8}$d. ,, $4\frac{5}{8}$d.	151	$3\frac{1}{2}$d. ,. $3\frac{7}{8}$d.
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 warble 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 and 38 sound, and 25 warbled to 9 sound."

I was also favoured by the following valuable information from Messrs. Richard Markendale & Co., Manchester, which may stand as a very special example of the serious amount of the loss which is 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.

A glance at the sum totals of warbled hides, and 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, President 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."

Various other communications were sent me from tanners as to amount of warble-presence in hides sent in, but these have been enough entered on under warble-effects in the preceding pages.

It may not, however, be out of place here to point out what great good could be done towards warble-prevention by exhibition of warbled hides. 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. The farmer naturally is not likely to be forward to draw attention to his beast being warbled; the cattle salesman or auctioneer will (or too often will) declare anything to get a beast, whose back is well-nigh eaten up with so-called "rottenness" from maggots, off his hands; and for the butcher it would be no gaining speculation to show the fearfully disgusting state of hides, beneath which the backs were, in the words of Mr. Williams (tanner), of Haverfordwest, "a mass of jelly from warbles." So the matter gets hushed up, but if the real state of the case could be shown it would be thoroughly desirable.

* "Classed as perfect on the market." During the time when it was necessary I should examine the condition of hide personally, to ascertain what might be going on for myself, I was one day examining a newly-flayed warbled hide, shown me by a neighbouring butcher on a large scale, who worked a good deal for me on the matter of warble investigation; and, with the under side of the warbled hide before us, he showed me how to *pass a "grubby" hide* on the inspectors as perfect. The process was simple. Just with a penknife to make a little slit across the thin tissue covering the maggot; then a gentle pressure frees it, or allows it to come out; the puffed-up apparent swelling caused by the maggot-presence sinks down flat; and though I did not experiment myself enough to be sure of possibilities of deceiving the inspector, I should say that the plan was one which, if not known of, it might be well to draw attention to as practicable. It may be well to add that my informant was then a butcher doing a large business, and in communication with hide firms, but has now retired.—Ed.

METHODS OF PREVENTION AND REMEDY.

The notes directly following refer to prevention of attack, or of the fly "striking," as it is called, by application of washes or dressings such as may make the coat of the animal obnoxious to the fly, or may destroy the vitality of the egg, or may kill the newly-hatched maggot; also the feeding-ground being where there is shelter—natural or artificial—when the fly is about, or where there is access to water.

The following notes confirm the opinion (brought forward, I believe, first by Bracy Clark, and held by many writers) *that the Warble Fly does not follow the cattle over water, consequently that allowing access to shallow pools is a great preservation from attack*:—

The first observation on these points was sent me by Mr. Henry Thompson, M.R.C.V.S., Aspatria, Cumberland:—"The amount of warbles on an animal and amount of warbled animals in a herd will be rather difficult to arrive at, but I would say from fifteen to twenty warbles on the back of each animal,—that is, grazing on lands well sheltered with trees; but where there are *good large ponds, and the animals go into the water and stand during the hottest part of the day, they are not so rife.* From what I can gather, as well as from observation, I find the Warble Fly will not cross any extent of water."

June 28th, 1884. "During the recent hot weather I have frequently seen my feeding bullocks suddenly gallop off, with their tails erect, and rush into the nearest water, where they seem to be less tormented by the flies."—J. B. Scott, Sutterton Grange, near Spalding.

"Our cattle do not suffer much, but then we have plenty of marshy ground close at hand, and a good deal of timber which affords shade."—Prof. W. Fream, College of Agriculture, Downton (1884).

In a communication on warble prevention sent me by Mr. B. St. John Ackers, of Prinknash, Painswick, he mentioned regarding the cattle, "Those that are in sheds escape entirely with me."

The following note, sent me by Mr. W. E. Cattley, Edderton, Ross-shire, N.B., refers very specially to benefit (with one exception) from housing cattle as a preventive to attack:—"A lot of three-year-old heifers (black polls), which had not been housed last summer except in bad weather, were all affected. They have now calves at foot. The short-horn crosses used for the dairy, which had been kept in at night all the summer, were clear of warbles, except a three-year-old, which was always in the house at night."

Whilst I was still resident at Sedbury Park, Gloucestershire, I have seen our cows going at the swinging trot that shows fly attack in the exposed pastures, or in the park, but I never saw this in

one field where there was a thick open grove of oaks with a shed beneath it, within and around which the herd sheltered themselves and picked the hay which might be strewn about.—Ed.

The following note refers to the above point, and likewise to *housing at night*, which may prove important relatively to some of the *Œstridæ* being exceedingly lively in the bright moonlight:—"I seldom get any warbles in my own young cattle, and I think from this cause, —that *they have sheds to run under during the summer, and are housed at night*, and have a good feed of cake," &c.—E. R. Berry Torr, Westleigh House, Bideford.

It would be useful if we could have more notes on the above heads, for if water and tree protection are to be depended on as preventive of attack something might often be done to give this to the cattle simply by leaving gates open. It is not a question of making ponds, or building sheds, or going into expenses, but in many cases of letting the cattle have the benefit of what exists.

The following communication gives an example of an animal who, by special circumstances was feeding on tether where most of the herd were house-fed in hot weather, broke his tether and came straight home for protection on attack. The Warble Fly itself is seldom captured, but I was fortunate enough in the summer of 1887 to have two specimens sent to me by Mr. W. S. Richards, of Rathturret, Warrenpoint, Co. Down, Ireland. The first was forwarded on the 30th of June, with the observation:—"It seems that when the cattle hear it in the air they are off. It does not seem to do more than rest on the cattle for less than a second. My cows are docile; I can stand near them and watch. Bees of different kinds they took no notice of, but knew the hum of this insect." On the 17th of August Mr. Richards sent me the second very beautiful specimen, which was quite soft and uninjured when I received it. From the downy appearance the insect looked exceedingly like a good-sized bee (only with one instead of two pairs of wings), and the black band across the body between the wings, with a yellowish band before it, also the blackish band across the abdomen, and orange colour at the tip showed well (see figure, p. 1). Mr. Richards wrote accompanying, after alluding to my previous letter on Ox Warble Fly. "We have been since trying to catch some more, and, though we had several chases, only were able to get one this morning. . . . . This one flew at the legs and flanks of a young Guernsey bull; he broke tether and came home, the fly still at him; we got them both. . . . . All my cattle are on tethers, and house-fed by day in hot weather, excepting six before mentioned" (referred

Ox Warble Fly.—Fig. 5, p. 1 (repeated to save trouble in reference).

to in Mr. Richards' letter), "which I had no room for and could not then sell."

It is worth remark, that where the cattle were from necessary circumstances, as above mentioned, more exposed to attack, the fly was so much more noticeable as to allow having several chases and two captures, and it was also mentioned that the few cattle that were free were so maddened by the fly as to leap a parapet wall for the purpose of getting into water, and *continued swimming about* in a reservoir nine feet deep, with their own good will, to avoid attack.

Summer Attack.

About four weeks after the maggots have been noticed leaving the backs of the cattle the summer attack from Warble Fly may be expected to begin, and to be great or small in amount according to the number of maggots which were allowed to live.

In the following notes of applications or treatment of the animals, which have been found to *prevent* attack, it will be seen that there are a few special points acted on. These are—*1st, applying mixtures of such a strong smell as may be obnoxious to the fly and overpower the attraction of the smell of the animal; 2nd, applications which would stick the fly fast or kill the egg; 3rd, washes which would clear off the eggs or destroy them if laid on the skin, or kill the grub whilst near the surface; 4th, protection afforded to cattle by being housed at egg-laying time.*

"Respecting the application of anything to prevent the Warble Fly depositing the eggs, there are a number of matters of a tarry nature that might be applied, and nothing better than Stockholm or green tar itself rubbed along the cows' backs before turning them out, which would last all the summer season, or applied in May or June between the top of the shoulder-blade and loins. This is the only part the cow cannot lick, rub, or lash with the tail; hence the only *peaceable* place where the fly can leave its egg. Or sheep-salve (bad butter and tar mixed with sulphur). About two applications would last a full season. Or the application of brine and the mixture I have already given you. Paraffin, kerosine, carbolic acid, phenyle, &c., are all too transient to be of much service, and would have to be applied frequently."—H. Thompson, M.R.C.V.S., Aspatria (1884).

Mr. Thompson further noted that he had been told it was a common practice to wash the cows' backs with pickling brine, the application being used two or three times during the season. In this part large farmers keep what is called the pickling-tub, wherein they put beef and mutton; the brine is made with salt and water, salt being added till an egg will float. This is an old remedy, and I think a good one, as I think the ova would be destroyed immediately it was placed in the skin.

"I have used and also recommend the following mixtures as a preventive:—Flour of sulphur, 4 oz.; spirits of tar, 1 gill; train (whale) oil, 1 quart. Mix well together, and apply along the spine of the cow once a week with a small brush. The smell drives off the flies, and prevents them depositing their eggs, and the cattle are left *at peace* to graze, and warbles thus prevented."—Henry Thompson, Aspatria.

"I venture to give my experience of many years. If cattle that are turned out into the fields (those that are in sheds escape entirely with me) are rubbed all down the spine with train oil, and a little also on the loins and ribs, they will be free from this pest, have their hides uninjured, will do much better, and will graze quietly at the time that others not so treated are tearing about with their tails in the air.

"Two or three dressings I generally find enough, but much depends on the season and the thickness of the 'coat.'"—B. St. John Ackers, Prinknash Park, Painswick.

"I should have written you before as to the effect of dressing for fly, but thought I would wait and make quite sure as to the results. I prepared mixture as you recommended, *id est*, 4 oz. flower of sulphur, 1 gill spirits of tar, and 1 quart of train oil, and applied the same to sixteen beasts. The effect was very marked; previously they had been galloping about all the day, continually getting out of the field and giving much trouble thereby; since not one of them has got out, and the men who were making hay in adjoining fields, and had full opportunity of watching them, tell me that *since being dressed they have scarcely run about at all.* I have since applied the same mixture to the whole of the beasts on my farm, and am so well satisfied with this application that I have not tried either of the other receipts."—H. J. Hillard, Helland, North Curry, Taunton.

"I am glad to say my cattle have to my knowledge only once been disturbed through this very hot weather. I have dressed this year with sulphur and train oil, which I see you recommended."—W. Davidson, Lower Green, Acton, Northwich.

"I had each cow dusted along the back with sulphur. The result is that only two cows had one solitary deposit each; the others were perfectly free, whilst there are several on the backs of their calves. To those deposits I have used carbolic acid mixed with hog's lard, in the proportion of one to twenty, with excellent effect."—T. Duckham, Baysham Court, Ross.

"I promised to write you again regarding dressing cattle against the Warble Fly. My experience at present is that they lie much quieter in the fields, and appear far more contented, after being dressed than without. I dressed them with McDougall's Smear, and then

powdered them over with flour of sulphur."—T. Rogers, The Homme, Dilwyn, Leominster.

"As a preventative from attack we rubbed a quantity of dry sulphur upon the back of our dairy cattle, from the shoulder to hip on each side of the spine, and a little on the brisket. We believe the sulphur had the desired effect, as our cattle were quiet in their pastures, while I could see some herds near were much tormented. The dressing was repeated frequently; the brisket was dressed to keep the Gad Fly away. We used sulphur as being free from smell, and not liable to taint the milk."—David Byrd, Tarporley, Cheshire.

"For many years I have used a weak solution of McDougall's sheep-dip, and have found it keep my grazing cattle perfectly quiet in the hottest day. We drive the cattle to a corner and keep them jammed close together by the dog, whilst the man sprinkles them with a common garden watering-pot with a rose on the spout. This is done every week if the weather is wet, otherwise about every ten days."—H. Lindsay Carnegie, Kinblethmont, Arbroath, Nov. 13.

On looking over the preventatives for attack, the sulphur, or sulphur, tar, and train oil, mixtures appear to be most approved; but the frequent mention that where the warble-maggots had been destroyed the herds rested at peace is a matter that calls for careful consideration. I give only a few words on this here, as the subject occurs further on under heading of remedial measures. But in a communication from Mr. Stratton, of The Duffryn, Newport, in 1884, he mentioned:—" . . . Here, where I had all the warbles destroyed, I have observed only one animal running from fly so far, though in other years they have suffered badly enough. This looks like the effect of treatment, and, if so, indicates that the fly does not go far from its birthplace "

The following observation bears on the same subject:—

"Regarding the Ox Bot Fly, I may say that I have had none on my farm for at least ten years. My cattle are now never seen, with tails erected, running as fast as their feet can carry them. Purchased animals generally have these warbles in their backs; these we take good care to take out by making a small opening with a penknife and pressing out the worms. Thus we do not have the Bot Fly, neither does it seem to come from other farms."—John Milne, Mains of Laithers, Turriff, Aberdeenshire.

A few remarks should perhaps here be given on the Ox Gad Fly, Tabanus bovinus, as, although this insect differs in every point as of size, appearance, and habits, in all its stages from the Warble Fly, its attacks cause severe pain, and in neighbourhoods frequented by the

fly, the galloping of the cattle is as bad from this cause as from Warble Fly presence.

The Ox Gad Fly, figured below, life size, is very much larger than the Warble Fly, and is mostly brown or bees-wax colour; the abdomen handsomely banded across with alternate brown and tawny yellow. This fly does mischief by piercing into the hide with the sharp knife- or lancet-like apparatus, enclosed in its proboscis, possessed by the female, and sucking away the blood. This is a great distinction

Tabanus bovinus, "Ox Gad Fly"; side view, showing proboscis.

between the Gad Fly and the Warble Fly, which has nothing that can be called a feeding-mouth.

The two kinds of flies differ also in their early stages. The maggot of the Gad Fly *never lives in the hides of cattle.* It lives in the ground, something in the manner of the Daddy Longlegs grub, and, somewhat similarly, is long and cylindrical, and it has a shining brown elongated head. The chrysalis is long and somewhat cylindrical, and both in development and pupation these Gad Flies resemble the Daddy Long-legs. The buzz of this great fly is described as a kind of heavy, droning, intense noise, easily known when it has once been heard.

I believe this fly not to be very common in England, and I have only rarely received specimens; but it is sometimes greatly confused with the Warble Fly, without the slightest regard to its very name showing the difference of possession of the "mouth-gads," or prickers, which are such a clear distinction, and therefore it seems desirable to mention it.

As far as we are aware, the same deterrent dressings which are useful against the Warble Fly serve equally well against this Gad Fly. It will be observed that in the remarks by Mr. David Byrd, at p. 44, he mentions, "The brisket was dressed to keep the Gad Fly away."

Methods of destroying the Warble-maggot in the Hide.

When the warble-swelling has "ripened," as it is called (that is, has opened so that the two black specks at the end of the tail of the maggot are visible), then it can be destroyed easily and cheaply by so many kinds of applications, or kinds of treatment, that it is difficult to arrange them in some sort of order for reference.

Where the maggot can be squeezed out, this is probably the very best plan of all. The grub is thus cleared out bodily,—quite got rid of,—the filthy fluid in the hole oozes out, the cavity draws together in somewhere about three weeks (where we have the date of healing given), and, excepting that the false skin (see p. 13) remains for a while in the opening, and that there will always be more or less of a scar or injured condition of the spot, the work is complete. But it is not always possible to manage this squeezing out; the maggot may not be advanced enough to come away, and later on, where attack is bad, the back may be too sore to bear handling.

For such conditions, dressings or applications to the entrance-hole of the warble are needed, and all that is wanted is something that will stifle the maggot by choking up the breathing-pores at the end of its tail, or that will poison it by running down into the warble-cell where the maggot is lying mouth-end downward, and, mixing with the fluid which it sucks in, thus poison it.

Amongst the many applications of which we have notes of success on sound authority, I think the only really poisonous one advised is mercurial ointment, and observations have been sent in, of which several are given below, of the safe and successful use of mercurial ointment for killing the maggot in the warble from various cattle-owners and others who have used it up to the amount of application to 250 head in a herd of 800 cattle.

In these cases the ointment has been used in the manner I have always most carefully advised, namely, *only as a small touch on the opening of the warble.* By *no means* as a large dab, *nor* as a smear, *nor* (where warbles were gradually appearing or were numerous) as an application to be made repeatedly over a large surface of warbled hide.*

The first communication on this subject was sent me from Mr. R. Stratton, of The Duffryn, Newport, Mon., on April 11th, 1884, with a few remarks on some other remedies :—

"I have treated some warbles with acetic acid, some with tar, and

* Only one instance has ever been reported to me of ill effects, and in this case the ointment was *not* applied according to directions, but the animal, which was suffering to a quite unusual extent from warbles, was smeared along from head to tail. Details, comments, and opinions thereon will be found in the 'Agricultural Gazette,' Nos. 598, 599, and 601 (1885).

some with *mercurial ointment;* I have not the slightest doubt but that all will be effectual. I am satisfied there will be no difficulty in killing the grub with any one of fifty simple remedies."

About a week later Mr. Stratton added:—"I treated others with *mercurial ointment* (such as is used for scab in sheep); the effect of this is very remarkable, for in a couple of days after the application the grub appears to be quite decomposed; and I am persuaded that no remedy can be more safe, simple, and effectual than this. It would not cost twopence a head to treat all the cattle in the country in this way.

"It is quite easy to destroy the grub by a stab, but the cattle object to it; it appears to hurt them almost as much as a puncture through the skin. The objection to the scalpel, &c., is that when you treat an animal for this attack all the grubs are not in the same stage, and some have no orifice developed, or only a small one, through which it would be difficult to make an insertion; whereas, whether visible or not, a little of the ointment rubbed in would destroy the grub effectually.

"Tar had the desired effect in every case but one, and in that I think the hair kept it from the opening. Acetic acid was perfectly effective."—R. Stratton, The Duffryn, Newport, Mon.

Other notes of approval of the application were sent in, from which I have chosen the following, as being from large cattle-owners, or, in the first instance, from Professor Riley, who has given special study, practical as well as scientific, to warble-treatment:—

"In America it has been found that a little *mercurial ointment* applied to the swellings in autumn acts very well in killing the young *Hypoderma* larva, but the simpler and equally effectual way is to rub the back and sides, and especially the back, with pure kerosine oil."—Prof. C. V. Riley, Consulting Entomologist, Department of Agriculture, Washington, U.S.A.

"The smallest quantity of *mercurial ointment* (as much as a small pea) placed on the hole in the skin carries death within twenty-four hours. After applying the ointment to about forty-five cows, I cannot tell exactly the numbers that were in the cows' backs, but my impression is that there were seldom more than six in one beast."—E. E. McBride, Glendonagh, Middleton, Co. Cork.

"June 10th, 1885. Resulting from your advice, I have within two months dressed about 250 head of cattle out of 800 with mercurial ointment for warble-maggots with speedy and complete success, and without any bad effect whatever. My herdsmen all now swear by your remedy; but I think at a very early period in spring, dressing down the backbone with sulphur might be a great prevention also."—J. A. Farrell, Esq., D.L., Moynalty, Kells, Co. Meath, Ireland.

"We put the mercurial ointment on to the swellings this year, and I was much pleased with the effect, as the cattle were certainly much smoother than last year."—Colonel G. Coussmaker, Westwood, Guildford.

"I have used the mercurial ointment on several beasts, and in most instances the grub has been killed. I am going to dress again the lumps where there seems to be a grub alive."—Hon. Cecil Parker, Eaton Estate Office, Eccleston, Chester.

"After reading Miss Ormerod's pamphlet on the subject, I sent for some mercurial ointment, both blue and yellow, and got the bailiff to apply it at once, as most of our cattle were infested with warbles. This he did by putting a small quantity sufficient to cover each hole, and slightly rubbing it in, and I believe in every case it had the desired effect. It either choked or poisoned the maggots, for on pressing the warbles a few days afterwards it was evident they were killed and decomposed, as nothing but a yellowish matter came from the sores. Both ointments appeared equally efficacious, and no harm resulted to the cattle from its use. I intend to renew the treatment next year."—T. A. Sutton, Yew Tree Farm, Tarporley, Cheshire.

To the above I venture to add some parts of a letter by Dr. G. Fleming, which he was good enough to write me on my laying the details of the case above alluded to before him, and also permitted me to give in the 'Agricultural Gazette' (see reference in note, p. 46).

"With regard to the cases of supposed poisoning of cattle in Cornwall, I cannot understand how such an accident could happen, unless your instructions were ignored, and the animals were smeared and rubbed with a large quantity of the ointment." . . . "You recommend destroying the maggot of the Warble Fly *by just touching it with a little mercurial ointment, such as is used for scab in sheep*. . . ."

Dr. Fleming went into all the points *seriatim* of the illness and death of the animal, which was ascribed to treatment with mercurial ointment, giving details as to amount and effects of action of mercurial ointment, all which will be found in 'Agricultural Gazette,' as referred to; and ended the long consideration he was so good as to place in my hands with this sentence:—"I am confident that no ill-effects can arise if your directions are followed with anything like ordinary care."—G. Fleming, LL.D., F.R.C.V.S.

If used under proper superintendence, and according to direction, mercurial ointment is a safe and serviceable remedy; but, seeing the liability there is to carelessness and misunderstanding in the matter, in my later leaflets on Warble Fly I have only slightly alluded to the application, thus:—"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."

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. Henry Thompson, M.R.C.V.S., of Aspatria, Cumberland, gives the following recipe used for a bad case:—

"Last year about this time I was called in to a little three-year-old heifer whose back was almost covered with warbles, and the effect on the constitution was very marked; the poor thing was very thin, and would not eat. I was satisfied that the irritation set up by the warbles was the cause, and applied the following:—Turpentine, 1½ oz.; sulphuric acid, 1 drachm (here a chemical action takes place, and it 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." — Henry Thompson, M.R.C.V.S., Aspatria, Cumberland, April 11th, 1887.

Where neither proper advice nor more elaborate applications are at hand, lard or rancid butter, mixed with a little sulphur, or cart-grease (if not of too strong a kind), also mixed with a little sulphur, have been found to succeed well; and, as shown in the following observation, the butter or lard will answer well in very bad cases, by being soothing in effect, as well as destructive to the maggot, and this, as will be seen, safely and satisfactorily in about the most ignorant and untrustworthy hands that could be found.

In 1885 a communication was sent me by Mr. P. M'Hale Greer, Ballycastle, Co. Mayo, Ireland, to the effect that when the cattle were severely affected by warbles, it was a common practice to take them to the charmers, who in some way or other killed the maggots:—

"In the barren and bleak districts of West Connaught, exposed to the searching rays of the sun, and without stream or pond, tree or bush, to afford coolness or shade, the hardy mountain cattle suffer to an alarming extent from the ravages of the Warble Fly when laying its eggs. The tract of country through which some of these poor animals career is often surprising. It extends to miles, and eventually causes their owners no little trouble and expense to bring them back again. The injury done to the animals themselves from exhaustion during the summer, and from irritation in the winter, is so great that many a strong and healthy animal becomes languid, unable to eat, and unable consequently to thrive. These cattle have not been properly housed, and oftener than not half-fed, and the warble-maggot develops with extraordinary rapidity and to a large size. The larger the maggot grows the more pus it requires for its support, so that, what with insufficient food and the great annoyance caused, the cow becomes a fit subject for the 'charmer' and her spells. She is generally an

old woman, and the methods of procedure are very simple. When she enters the stable of the sick cow she calls for some butter or lard. After it has been placed before her she prays for a time to some spirit (that I wot not of, nor could I find out). After the spirit of destruction is exorcised she takes the butter, and gently covers the breathing aperture of the maggot and crosses it. The result of all this is that the maggots die, and fall, or are easily picked out, without causing the least pain. I know not what good the incantations of the 'charmer' may have exercised, but a little butter or lard, and I should say a small quantity of sulphur (I believe the 'charmers' use sulphur), laid on as we have seen, will leave a warble-less hide."—P. M'Hale Greer.

As the "charmers" require a good sum for their services, I felt sure that the remedy must be one that acted, as well as something very simple, and therefore obtained a quiet investigation, with the above results.

Lard and butter answer well as being soothing, in addition to their direct effect in killing the maggot, and so does "cart-grease," if there are no irritating ingredients in it; but some of the mixtures sold under this or similar names, as "axle-grease" or "railway grease," are too irritating in their action to be safely applied excepting with care, and (till the action is known) watching as to effects.

The above applications are especially useful in their different ways where the back is too tender to be touched; but lard or rancid butter is not always at hand, and for regular work the smears and dips, of which so many kinds are furnished by many well-known firms, are the most commonly used.

Destruction of warble-maggots by application of smears or dressings or washes.—It should be carefully kept before the minds of herdsmen, with regard both to dressings to keep fly off and to destroy maggots, that—though the effect of some kinds lasts a long time—it is often almost waste money just to run the animal over with some wash of which the effect soon goes off.

The number of kinds of dressings that will answer the purpose are endless. All that is needed is that the grease or mixture should be thick enough, and tenacious enough, for a little "dab" of it, when placed on the opening of the warble, to adhere firmly, and thus choke the maggot by preventing it drawing in air through the breathing-apparatus in the two black spots at the end of the tail, which may usually be seen in the opening of the warble-swelling.* If, besides the above, anything can be added to the application having a scent likely to deter attack, it is all the better.

* This of course does not apply to washes of brine, which are sometimes very useful.

In the following notes observations have been chosen from great numbers, just to show the variety of applications that answer, and that various firms furnish them; but readers will please observe that this is without prejudice of others, whose manufactures, so long as the above-mentioned conditions of the dressing were held to, and due care exercised in applying them, could not fail to have good effects.

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" (1888, as also the three following notes).

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 November. I think for them carbolic acid and water ought to suffice."

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 following reports are a few of the observations sent me of successful use of Messrs. McDougall's preparations :—

"My cattle have been very much troubled with warbles. The summer before last, in the end of May, I dressed them with McDougall's sheep-dip, repeating the dressing occasionally till the end of August. The result was most satisfactory, *as the next year they were almost free from them.* I shall in consequence always continue to dress them so." —John M. Moubray, Broom Court, Alcester (1886).

"I always notice that bought cattle, and especially those from Wales and the West Country, are more affected with warbles than our own. I am strongly of opinion that the best way of killing the grub is to rub some unguent on the surface of the lump-hole in spring. An old friend of mine always used McDougall's sheep-dip preparation for this purpose with good effect. This method, of course, leaves the hide injured by holes. If there is any chance, however, of exterminating the fly, it is a feasible and right method."—Prof. H. J. Little.

In 1885, Mr. David Byrd, writing from Spurstow Hall, Tarporley, Cheshire, mentioned :—"I am glad to say that we found McDougall's smear effectually killed the warble-grubs. The mode of dressing we adopted was to shape a piece of wood or stick like a knife-blade with a point. We searched carefully for the warble-hole, leaving a good portion of the smear on the warble ; this appeared to completely choke up and kill the maggot. The mode of dressing to kill the warble was not painful to the cattle ; those that were quiet appeared to like the friction."

On June 27th, 1888, 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 results. 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."

On June 21st, 1889, Mr. G. F. Street, writing from Maulden, Ampthill, observed:—"Warbles are getting quite stamped out now on our two farms, as for the past three years we have not had on an average one dozen warbles on from sixty to seventy head of cattle, mostly young stock. We always use the McDougall's smear, and find it a safe remedy."—G. F. S.

In a letter from Messrs. J. R. and R. R. Kirkham, of Biscathorpe, Lincoln, the Warble Fly paste, manufactured by Messrs. Tomlinson and Hayward, of Lincoln, is mentioned as very efficacious, not only by preventing the fly striking (if put on in time), but, if this has not been the case, by killing the maggot. This paste is mentioned as better than a liquid cure, for it is easier to use, adheres much longer on the cattle's back, and is not so easily washed off by the rain (1894).

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, 1888:—

"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.

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

Relatively to the effect of salt in destroying the maggots, Mr. Edw. Argyle, writing from Tamworth, with the mention that he was an

* 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.

amateur breeder and keeper of stock, noted as a report of the success of his treatment in 1889 :—"I am glad to say that I believe the fly has not been anything like so troublesome about here this season as it has usually been. I have never seen my cattle at all distressed by it. I may mention that I have employed common salt for the destruction of the grub this season with good results. I bought some young cattle of very nice quality in the early summer; they were terribly infested with grubs. I had their backs damped, and salt well rubbed in, and this was repeated about a week later. The result was that every grub was destroyed."

Very many other dressings have been duly recorded as found to answer; but in looking over the United States returns I do not find that there is any dressing or treatment better than ours, unless it may be a greater use of salt and water, or brine, for washing the coats of the animals. This is an old-fashioned but apparently very good preventive measure, which is noted by Mr. Henry Thompson as used in the North of England, and the application of it by *rubbing it well on with a wisp of straw* (as mentioned by one of the U.S.A. reporters) would probably be very serviceable in removing eggs; and getting the wash thoroughly in amongst the hair, and well down into the minute hair-like channels through the hide, at the bottom of which we find the maggot in the very earliest stage at which the infestation is easily observable.

In the foregoing pages observations are given of various easy methods of destroying the Warble Fly maggot by stifling it in its cell, poisoning it, &c.; but there is yet another method which, when circumstances allow (such as condition of the hide, and open state of warble), is probably the best of all, namely, squeezing out the maggot, and thus getting entirely rid of it at once.

This requires no outlay in mixtures, no trouble in looking them up, and careful application of them when needed, but is what may be done by any man or boy on the farm, and which commonly (especially in the case of the boys) they enjoy doing. Where care is bestowed on the subject, squeezing out may usefully follow on killing by smears, &c., in the hide, and healing up happen sooner, and also there will be proof that the work was thoroughly done.

During the whole course of our ten years' work we have been kept constantly aware of the success of the plan acted on (that is, destroying in the maggot form) preventing recurrence of attack. It is obvious indeed that if it had not answered, the plan would not have been gone on with, and in the preceding pages reports of the success of this have been given; but I just add a few below, received in 1889 (taken from many others), regarding benefit obtained.

The following note, with which I was favoured on September 21st

by the Hon. Cecil Parker, from the Eaton Estate Office, Eccleston, Chester, also mentions the attack having been nearly got rid of:—"I am quite sure that more notice has been taken of the means of destroying the warble. As far as our own cattle are concerned, we have nearly exterminated them by killing the maggot in the beast, and also by smearing the backs of the stock twice in the season. If the farmers could be persuaded that they lose money,—in cows by the milk getting less, and by the beasts losing flesh,—they would take more interest" (1889, as also three following notes).

Sir J. Stewart Richardson, Bart., of Pitfour Castle, Perth, N.B., writing on September 24th, similarly mentioned benefit following the care taken:—"For the last three years I have been waging war against the warble-pest, and think I have done a good deal to alleviate the sufferings of my cattle, and the result is that I have nothing to complain of as to the way they have fed."

In September last, Mr. J. Risdon, Auctioneer of the Devon Cattle Breeders' Society, writing from Golsoncott Farm, near Taunton, mentioned that last spring he had all the animals in his own herd dressed with sulphur and lard, which, he believed, killed every maggot in their skins. He further added:—"There are many farmers who at first regarded the Warble Fly as a mere 'fad,' who are now anxious to use means to relieve their cattle of the pest."—J. R.

Mr. Henry Thorp Hincks (Auctioneer), Silver Street, Leicester, wrote on April 9th, with regard to success of preventive measures:—"Out of a herd of over seventy head dressed last year for warbles, this season one cow only has one warble upon it."—H. T. H.

These show success in the special localities reported from; but the manner in which, by steady quiet attention, the warble-presence in the cattle-farming district round Bunbury and Tarporley was reduced from its enormous prevalence a few years ago down to the result of most careful search only bringing in twenty maggots, is a very important record.

This has been the work of the boys of the Aldersey Grammar School at Bunbury, Tarporley, Cheshire, 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.

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 land-owners, or to the one or two cows of a small holder, to whom the health of his animals is even more important.

We (I can say *we*, as I had the pleasure of co-operating with Mr.

Bailey in his work) did not go into scientific points, nor was the work in any way compulsory. In 1885 the boys were shown the warbles, told their history, and begged to bring what they could find; amongst them, one pupil alone brought in 250, and in the *following year*, when he examined his father's and his brother's stock (numbering 114 head of cattle), *he found no warbles*, excepting on young cattle which had not been dressed because they were out in the fields.

So year by year the work continued. The boys examined the cattle at the time when the maggots were beginning to be in a state to remove, and brought them in to Mr. Bailey, who noted numbers and details, and gave me the results yearly in tabulated form until the pest was nearly stamped out. These gave in separate columns the names of the finders, the number of stock examined,—ranging in the table before me from a single cow up to eighty-six,—and also the amount of warbles on cow, calf, or heifers. From these tables and notes the steady and immediate drop in amount of warble-presence where care was taken was clearly shown, and also the immediate running-up of numbers where uncared-for cattle had been brought in, or from some cause there had been difficulty in giving the necessary attention.

Relatively to this point, on April 13th, 1887, Mr. Bailey informed me:—"Another lot of boys have examined and reported to me on 250 head of stock. The results agree with those I sent you.

"Where the cattle were properly attended to last year by the warble-maggots being squeezed out, or dressed with McDougall's smear or cart-grease, there are scacely any maggots to be seen now; where, however, this precaution has not been taken, the enemy is to be found in full force."

As examples of the former, Mr. Bailey mentioned two of the boys, who had paid great attention to the matter in the previous year, and had (at time of report) examined, respectively, one 58, the other 53 cows and heifers; in the first case finding only *one* warble, in the other only *six*.

"On the other side, where remedies had not been applied, two brothers removed 40 maggots this week from one stock, and their task is not half done; another boy applied McDougall's smear to 70 warble-maggots.

"It is not only on our large farms where so much energy is being shown in an effort to stamp out this pest, but the sons of our cottagers are equally active in the cause. These boys in a few years will be our agricultural labourers, and I encourage them to examine and report to me on their one cow and heifer.

"Where the stock is free from the pest the boys tell me the cows are milking unusually well this year." . . . . "*I have no hesitation in*

saying that in this parish alone what has been done at your suggestion has put many pounds into our farmers' pockets, for their stocks are giving more milk, and are feeding better. The hides also are worth more money."—W. B.

I have given the above at length as the work being done under the eyes of Mr. Bailey, and likewise of Mr. D. Byrd, of Bunbury Heath, and many of the other farmers of the neighbourhood: it is no mere fancy or half-proved experiment, but what could be judged of by all connected with the stock in the district, and it shows not only the benefit of getting rid of warble-grubs, and the thoroughness with which they can be cleared out of a district, but the benefit of plain common-sense instruction on the subject of farm-insect pests.

The work was carried on with the full approbation of the Haberdashers' Company, to which the Aldersey Grammar Schools belong; also it was considered so satisfactory that an account of it, written by Mr. Bailey to His Grace the Duke of Westminster, was read by the Hon. Cecil Parker before one of the Committees of the Royal Agricultural Society of England in 1887, and recommended for publication; and the work since has been equally satisfactory.

The treatment, so far as I am aware, was wholly either squeezing out the maggots, or killing them by cart-grease, or application of the ointments prepared by Messrs. McDougall Brothers, the Dee Oil Company, Chester, and Jeyes' Sanitary Compounds Company (Limited), the effect in the case of all the dressings being very satisfactory.

Last year (1893) the result of the spring search produced scarcely any maggots, and in this year Mr. Bailey, writing to me on the 6th of November (that is, the 6th inst.), reported, in reply to my enquiries, as follows:—

"The specimens brought to me this season, notwithstanding a most diligent search, have been so few that I think we may now claim that, in this parish, the pest is practically stamped out. The total number of warble-maggots found by the boys did not exceed a score, although special marks were given for every maggot brought, and the contest between some of the boys for the prizes which you so kindly give was very keen.

"If you will refer to my report to you in 1889—*only five years ago*—you will notice that 577 head of cattle were then examined by the boys, and that no fewer than *1077* maggots had been squeezed out and destroyed by them, or killed by the application of smears." . . . "The farmers in this district are fully alive to the importance of this duty. Stocks are regularly and carefully overlooked, and cattle bought at fairs or elsewhere are specially examined."—W. B.

During the present year the application to myself for information regarding special cases of infestation, papers for publication, and for leaflets has in no way lessened: for, on reference to my letter-book, I find it began on the 2nd of January, and continued at intervals to the 20th of April. From that date, until the 8th of June, hardly a day occurred without applications regarding warble, sometimes amounting to as many as five, eight, or ten per diem; and since then, though not as frequently, the applications have continued until within a few days of the date of writing, Nov. 9th.

As many of the applications have been for leaflets for distribution, it may be hoped that information is gaining ground; and one marked advance in the past season has been the number of applications from Ireland, from localities in nearly all the Irish counties. The simple methods of treatment continue to be approved wherever they are carried out with any sort of care.

SUMMARY.

The information in the preceding abstract is almost entirely taken from reports sent me from British and Irish observers, and colleagues in the work, and published in my Annual Reports on Injurious Insects from the year 1884 to 1890 inclusive. Of these the first—that for 1884—deals with as much of the history of the infestation and means of prevention as could then be collected. The second (of 1885), besides what may be called the notes of practical treatment given in all the Reports, contains hide returns from Birmingham, and figures and notes of the anatomical structure of the maggot by myself. In 1886 some observations on horse-warble were also given. Losses on hides are especially entered on in returns from hide and cattle firms in 1888; and in 1889 the damage known as "licked beef" is more especially entered on. In the Report for 1890 various good notes were given of loss from "licked beef," diminished amount of Warble Fly-presence where the cattle had access to water, and other points confirming previous observations; and in 1891, as it appeared unnecessary to go over the information yearly, I only gave a short abstract of the work.*

Through all these years, up to the present date of writing, the work of reply to enquiries had been carried on and (since their issue) the leaflets, giving in short serviceable form the main points of history of attack and well-proved means for its prevention and remedy, distri-

* See Annual Reports on Injurious Insects for years named, price 1s. 6d. each, published by Messrs. Simpkin, Marshall & Co., Stationers' Hall Court, London, E.C. Also (same publishers), 'Warble Fly': Special Reports (from 'Reports on Injurious Insects' for 1884, 1888, and 1889). Royal 8vo, price 3d.; 2s. 6d. per dozen; 16s. per 100. References to U. S. A. Board of Agriculture publications are given, with passages quoted.

buted to all applicants. This has been mostly gratuitously, at my own wish and request, though not entirely so. As 133,000 of the four-page warble leaflet have been distributed, and about 25,000 of the longer leaflet entitled 'Licked Beef,' and as those who were good enough to help our important cause by undertaking distribution of large numbers had all the trouble and postal expenses, I declined wherever I could to receive payment.

In this present abstract, which I have now the honour of laying before my readers, I have endeavoured so to arrange the main points of the information collected in our many years' work as to form a connected account, beginning with egg and egg-laying of the Warble Fly, and working on through its life-history and habits, and structural details of the maggot (by which it lies in our power to destroy it), up to its complete development; then to continue with the sometimes ruinous and constantly injurious effects of the attack to health and produce and return to grower and purchaser of the infested animals, giving under these heads the result of special investigations as to "licked beef," and also special returns regarding losses on hides. To this is added, at considerable length, details of measures of prevention and remedy, and also result of the same in getting rid of the pest, not only locally, but, as in the case of our carefully watched work at Bunbury and Tarporley, Cheshire, over a whole district.

In this I have endeavoured with the greatest care to do justice to the importance of the subject, and it will be seen that I have carefully avoided giving general views and considerations that may or may not be right, but have as far as possible given each observation in the contributor's own words, with the name appended. Very much more could be given from my Reports—because for several years we went over the same ground—especially of means of prevention and remedy, that by the *evidence of so many witnesses*, giving their separate testimony in their own words, the fact which we were working up to of the possibility of certainly and cheaply stamping out warble-attack might be made sure. Those who wish to go over the many repeated details will find them in the Reports referred to at p. 58; but in this pamphlet I have taken those standing on the highest authority, and I think those who will look at the high standing of the names of those leading men and leading firms who have given their help in the different branches of this national investigation, will think we need not fear to go far astray.

One thing I do greatly fear, and that is mischief from erroneous advice of those who, whilst they have neither practical nor scientific knowledge of the attack or its cure, yet unfortunately may, by their attempts to institute unfounded methods of treatment, put back our good work. *I would most earnestly beg all interested to be on their guard.*

What can be done to induce farmers to pay greater attention to warble extirpation is a problem very difficult to solve, but personally I put great confidence in the simple measure of dissemination of *plain* and *true* information. It has only been in the last few years that sound practical knowledge has been attainable for general agricultural use on warble matters, and now it is equally as certain that the information is doing good in many places as it is that the subject is by no means receiving the general attention it deserves.

Whilst these observations were going to press I was favoured, in the course of communication with Mr. W. H. Hill, President of the Sheffield Butchers' Association (and from whom I have received at various times valuable information), with the following remark, which unfortunately describes the state of things only too truly:—

"I have often discussed the matter with farmers, but as a class, whilst admitting the evil, and further admitting it is inexpensive to cure and simple of treatment, yet it is 'too much trouble,' or 'cattle always were so affected,' or 'they are too busy with other things'; with the result that, whilst agriculture is, in their opinion, going to the dogs, and the bulk of them, they say, on the verge of bankruptcy, yet they, taking farmers as a whole, are rich enough to throw away several million pounds yearly in the reduced value of their cattle due to this pest."—W. H. H.

The matter seems to stand something in this way. On the farms this attack, unless in its fully-developed state, and to an unusual extent, is often what may be called a "hidden evil." From ignorance and idleness and utter carelessness, even when the beasts are sickened with it, the cause is often overlooked. But how this can be met by any outside influence is the difficulty. "Inspection" is sometimes spoken of, but it is not clear how this could be brought to bear on an attack of this sort, where the presence of the warbles may very likely indeed not be observable all at one time, even on one beast, much less on all through a district, but may show gradually, according to date of egg-laying and circumstances of treatment, as in- or out-of-doors feeding of the animal, &c.

The point where it appeals to me (under correction of those who understand the bearings of the case far better than myself) is, with regard to badly-warbled beasts sold for slaughter, whether, so far as direct losses to butchers go from "licked beef," *i. e.*, state of carcase and coincident bad state of hide, something might not be done by *inspection*. It need not be "governmental." In this sense most of us, I believe, would quite endorse Mr. Hill's remark now before me, "I am afraid 'inspectors' would be a nuisance, for we have too much red tape as it is"; but if the butchers could be spirited up to inspect the animals *thoroughly* themselves before purchase, or to employ a man to

examine them, this would meet *part* of the trouble. If he did not know his work *they* would discharge him; and if he did, his wages would, divided as an outgoing payment from the body of his employers, be a great saving to them.

This would not meet the loss on hide from former injury; it would not meet the losses from coming-on injury; again quoting Mr. Hill's letter to me of the 13th inst. on these points:—"A warbled hide THIS *year* will bear signs, and is damaged by the result of LAST *year*, even when externally nothing could be detected. So, when the maggots are small, or have left their cells, the damage is still there, but by casual inspection not so easily discernible" (W. H. H.). But it would do something.

The great loss from "licked beef" and "jelly" ranges, of course, with the height of the warble-season. After that is over there is not the same need for care (see remarks by Mr. John Child, Manager of the Leeds and District Hide, &c., Co., at pp. 20, 21). Therefore, the expense of examination for this part of the trouble would be only for a portion of the year. Some butchers are well aware of the bearing of the matter, some obviously not; and if all could be got to be on the alert, even about this one part when the attack is obvious to moderate examination, it would do something towards saving loss.

At present we seem to be just in the condition described by Prof. Riley, the late Entomologist of the Department of Agriculture of the U. S. A., when, after the widespread American investigation in 1889, he was requested to take up the question officially. After some observations on the bearing of the subject, in which he greatly noticed our British observations and recommendations, he said he considered there was little to be done, excepting continuing the enquiry on statistical lines similar to those which had been already followed by the investigators; also, that even admitting that some more careful observations might be made on one or two points, that "these are points of biologic interest rather than of economic importance." Therefore, as the case stood, Prof. Riley, speaking officially, stated that, as regarded investigation with a view to fuller statistical information, "we should hardly feel justified in spending time and means therefor"; . . . and he closed his paper with this sentence:—"Being thoroughly familiar with the stock-interests of the country, we know how difficult it is to get farmers to care for their stock, so far as this warble is concerned; and we are satisfied that where self-interest does not dictate better attention we can do little more than point out the means of avoiding injury and the desirability of so doing."*—C. V. R.

* Insect Life. Periodical Bulletin of U. S. Dept. of Agriculture. Vol. ii. No. 6, pp. 176, 177.

This comes very strongly from a man of Prof. Riley's standing, who, besides being unsurpassed for sound knowledge of insect-life, can speak with practical weight as having been a farmer, and for some years manager of 300 head of stock ; but still it seems at least open to hope that with the perfect knowledge of the needs and of the state of the case possessed by our great associations connected with hide and cattle trade in this country, their thoroughly informed considerations, and perhaps united action, might lay a basis which would bring about a much more regulated condition of this great trouble.

ELEANOR A. ORMEROD,
Late Consulting Entomologist of the Royal Agricultural Society.

Torrington House, St. Albans,
Nov. 20th, 1894.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