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FLIES INJURIOUS TO STOCK

Sep 29<sup>th</sup> 1900.

BEING

LIFE-HISTORIES AND MEANS OF PREVENTION

OF A FEW KINDS COMMONLY INJURIOUS

WITH SPECIAL OBSERVATIONS ON

OX WARBLE OR BOT FLY

BY

ELEANOR A. ORMEROD, LL.D.

F.R.MET.SOC., F.E.S., ETC.

LONDON:

SIMPKIN, MARSHALL, HAMILTON, KENT, & CO.

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OF A FEW KINDS COMMONLY INJURIOUS

WITH SPECIAL OBSERVATIONS ON

## OX WARBLE OR BOT FLY

Department of Agriculture  
National Agricultural Library  
Division of Lending  
Beltsville, Maryland 20705

BY

ELEANOR A. ORMEROD, LL.D.

F. R. MET. SOC., F. E. S., ETC.

LONDON:

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1900.

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## TO THE READER.

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THE following observations are offered chiefly as an endeavour to bring such information as is generally needed for farm service, regarding the life-histories and habits of the kinds of flies which are most commonly injurious to our Farm Stock, up-to-date, in an accessible form for reference.

As the infestations referred to are for the most part very noticeable, both from their size and from the effects of their attacks, specimens have not unfrequently been sent me for many years back, together with enquiries and observations sometimes embodying notes of such serviceable interest that it has seemed desirable to collect the observations (which are not very accessible as scattered notes in the original reports), and to use them to complete the histories of the pests for practical service, together with additions of some observations from published works of various leading Continental writers on Cattle Fly Infestations, which give points that have not hitherto been studied in this country.

The paper on Warble Fly (*Hypoderma bovis*) is condensed from information published in my Annual Reports from 1884 (the year in which we began our investigations) up to date, and consists as far as possible of British observation, duly acknowledged to the contributors, and arranged in sections, which I trust may render reference easy for practical service.

In some few instances, where it was necessary to enter on details of condition, or remedial treatment, which it was obviously impossible for me to be personally acquainted with, I acknowledge with many thanks the assistance kindly given

OCT 10 1900

me by Dr. GEO. FLEMING, C.B., LL.D., Veterinary Adviser to the Army; Prof. JOHN PENBERTHY, F.R.C.V.S., Professor of Pathology at the Royal Veterinary College, Camden Town, N.W.; and Mr. HY. THOMPSON, M.R.C.V.S., Aspatria, Cumberland.

The illustrations are, I believe, acknowledged throughout, excepting those of development of the maggot of the Warble Fly from its early condition onwards, which are almost entirely from specimens prepared by myself. With regard to the contents of this little pamphlet generally, perhaps I ought specially to mention, for fear of misunderstanding, that I am quite aware that much of the information entered on has long been known to those who, from access to libraries or their scientific researches, have opportunity of supplying themselves with all the information that they need.

But, still, the description of the injurious insects *in intelligible wording*, and their life-histories, are plainly (from the enquiries sent me) so far from available to many to whom they would be desirable for practical use, that I trust I shall not be considered as trespassing beyond my proper department in endeavouring to arrange this little book to be of some service on these points, and (so far as lies in my power) also as to the methods of prevention and remedy commonly requisite.

ELEANOR A. ORMEROD, LL.D., F.E.S., &c.

TORRINGTON HOUSE, ST. ALBANS:

*September, 1900.*

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# LIFE-HISTORIES AND HABITS

OF A FEW KINDS OF

## FLIES COMMONLY INJURIOUS TO STOCK.

---

### INTRODUCTORY OBSERVATIONS.

DURING the summer season, and especially in hot and dry weather, all who may be passing through pasture lands where farm-stock—such as Sheep, Cattle, or Horses—are grazing can scarcely fail to notice how much they are troubled from time to time by some kind of attack, which their movements show that they are doing all they can to escape from.

The Sheep stand with their noses close to the ground, stamping at the same time with their fore feet; or shake their heads and run, obviously to get away from some great annoyance; or, again, they will crowd together in the heat of the day, with their heads down, and the noses even pressed into dry earth, being thus protected, as well as they can manage, from the much feared enemy getting at them.

Cattle may be seen going along at a good swinging trot, or galloping as fast as they can go, very possibly over hedge and ditch, with their tails erect, or floating in the air behind them. Horses do not show annoyance by galloping as much as cattle, but they may be noticed as giving a slight kind of shiver or vibration over their hides from time to time.

All these various signs of discomfort are owing to the attacks of different kinds of two-winged flies, and the attempts of the animals to protect themselves from infestation, or direct injury.

The flies which cause the above-mentioned troubles belong to two families—that of the *Æstridæ*, or “Bot Flies” (of which some that live in maggot state in swellings, known as Warbles, are thence called Warble Flies), and the family of the *Tabanidæ*, or “Gad Flies.”

These two families are quite different from each other in their habits, life-history, method of injury to stock, and also in some important points of their structure.

The *Æstridæ* (Bot, and Warble Flies) are flies of a medium or rather large size, that is, for the most part, ranging from about three-eighths to five-eighths of an inch in length, and often from their shape, their hairy or woolly coats, and bright colouring, much resembling Humble Bees, and especially distinguishable by the mouth parts being small and rudimentary; consequently they do not cause pain or injury by biting, or blood-sucking. The harm that they do is by means of their larvæ, or maggots, passing their lives and feeding up to maturity in some part of the infested animal. This is usually just beneath the hide, in the subcuticular tissues (as in the case of the Ox Warble Fly), or in the stomach (as in the case of the Horse Bot Fly), or in the nose or nasal cavities (as in the case of the Sheep Nostril Fly); it may occur elsewhere, but in this country, and to *domesticated* animals, the above mentioned are the most common localities of infestation.

Put shortly: in Bot Fly attack, so far as biting is concerned, the flies do *not* hurt the animals; but the maggots *do* harm by passing their lives in feeding somewhere within them, their “hosts.”

With the *Tabanidæ*, or “Gad Flies,” the case is quite different. These, which are known as “Breeze Flies,” or “Horse Flies,” as well as “Gad Flies,” vary in size in this country from about a quarter of an inch to an inch or more in length, and from three-quarters of an inch to one or two inches in spread of the wings. The distinguishing point about these flies is that the females are blood-suckers. The males live on sweet matter of flowers. They are furnished with a proboscis, enclosing, in the case of the male four, in the female six, somewhat lancet-shaped instruments, which in the latter can be driven so effectively into the skin that (as is constantly seen) blood flows immediately.



The *larvæ* or maggots do *not* live on or in animals, but in the ground, or sometimes in water, and are stated by recent writers to be carnivorous, living on small animals, snails, grubs, or the like; our "Great Gad Fly," of which the history is given, fully illustrated (see Index), may be taken as a good example of Gad Fly life.

The distinguishing points, put shortly, of the *Tabanidæ*, are that the flies cause pain and injury by blood-sucking, and the maggots live in the ground.

It is very much to be wished that all who write or teach, regarding the nature and habits of the above two families of flies, would do what they can to cause the above very plain differences to be kept in mind, and the *right names* used, for the confusion arising from the *demonstrably* wrong popular name being often made use of, even in technical cattle reports or scientific papers, adds very much to difficulties as to requisite remedial measures; and the applications to myself, even from high official quarters (almost up to date), to give some plain definitions by which the different kinds of flies might be certainly distinguished, will, I hope, be my excuse for the re-iteration above, of description, in order to condense the points into what can be borne in mind.

Besides the two above-mentioned families of flies, which give rise to trouble to stock in the open fields, there is yet another family, of which the attacks can scarcely be classed with them, as (in our two chief infestations) one of them is *not* drawn attention to by noticeable signs of discomfort; and the other (although accompanied by the circumstance of horses, on their *first introduction* to it, sometimes going nearly wild with terror) is only local. These are respectively the small wingless "Sheep Spider Fly," often, though erroneously, known as the "Sheep Tick" (*Melophagus ovinus*), and the Horse Forest Fly (*Hippobosca equina*), which was formerly supposed to be confined to the New Forest in Hampshire, and its neighbourhood, but is now known to occur in at least two other localities, one in North, and one in South Wales.

These flies have the very marked characteristic of, so far as external appearances go, having *no* maggots at all. They belong

to the family of the Hippoboscidae, of which the females, instead of laying eggs, or producing maggots just hatched, nourish the maggot within themselves until it is just at the stage of turning to chrysalis (or, more scientifically phrased, to *pupa*), consequently they and all the other genera of the family are called *Pupipara*, or pupa-bearers.

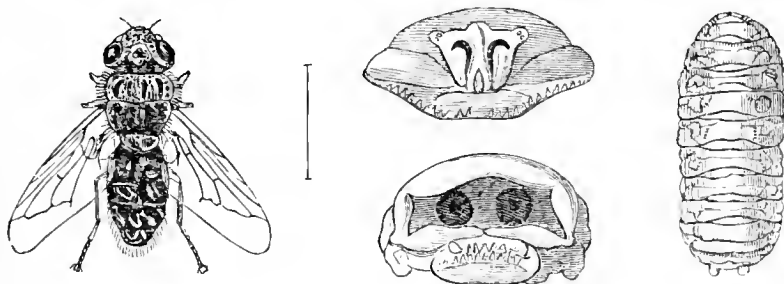
The Forest Flies are to some extent blood-suckers, but the chief annoyance which they cause appears to be from their power of running very actively backwards, forwards, or sidelong among the hairs of the horses which they infest, and so causing great irritation to the skin, and (to animals unaccustomed to it) great alarm. The attack of the Sheep Spider Fly is not so troublesome in several respects as that of the Forest Fly, as, being wingless, they have not a similar power of dispersing themselves, nor can they frighten animals by their sudden descents; also they have not the power of rapid movement amongst the hair possessed by the Forest Fly.

In regard to almost all the above attacks, as well as some of very similar infestations entered on in the following pages, much advance in information has been gained in the past few years, and in my own special investigations and the observations sent me, published in my Annual Reports, I have been able also to make some additions to previous records; and, as some plain and accessible account of these common infestations appeared needed for general use, I have formed the material in my hands to the best of my power into papers, which I hope may be of service relatively to the histories and habits of the pests mentioned, and also of preventive and remedial measures, based on their habits.

For more elaborate details, involving anatomical research, and points of veterinary treatment, which do not lie in my province, I have given reference to the publications of various leading Continental as well as American and British writers, where presumably readers will find all that they require.

---

## SHEEP.

Sheep's Nostril Fly. *Æstrus ovis*, Linn.

ÆSTRUS ovis.—Fly, magnified, line showing natural length; maggot; mouth hooks of maggot; and tail segment, showing spiracles, and lobes, acting as organs of progression; all magnified. After Brauer.

The *Sheep's Nostril Fly* is from about two-fifths to half an inch in length, and slightly hairy. The upper part of the head and body between the wings of some shade of grey or dull yellow, spotted or mottled with dark markings. The abdomen yellowish, or white, mottled with dark brown or black; the under side similarly coloured, but “with a dark spot in the middle of each ring.” Legs brown or yellowish brown; wings transparent, and when at rest extend beyond the body. Mouth wanting. There is a good deal of difference in the exact shades of colour described by various writers; from such as I have myself examined I should say that the fly might be described as spotted, or mottled with ash-grey, and black between the wings, and the abdomen also spotted with black and yellowish white, with a silvery lustre when alive.

The presence of the *Nostril Fly* amongst the flock may be known by the sheep holding their noses close to the ground, shaking their heads, and striking the ground violently with their fore feet. Sometimes gathering together with their heads in the centre and their noses down to the ground, or buried in dust or sand if there is any, and occasionally one sheep going off at a gallop as if to escape from an enemy.

The fly lays the eggs, or maggots lately hatched, at the opening of the sheep's nostrils. Formerly it was supposed that the egg was laid, and hatched after being deposited, but many observations, ranging back to at least the middle of the last century, and given both by European and U.S.A. writers, record, beyond doubt, the fact of deposit taking place in the form of living maggots. Amongst special entomological observers, the late Prof. Riley (Entomologist to the Department of Agriculture, U.S.A.) has recorded obtaining

living maggots from a Fly,\* and Dr. Brauer pointed out that the genus is one which deposits its young alive.†

In their first stage the little larvæ or maggots are hardly as much as the twelfth of an inch in length, white, semi-transparent, and long in shape. As they grow they alter both in shape and colour. This gradually changes to a yellowish tint, and marked across with a dark transverse streak on the segments, excepting on the first and last; beneath, each segment, from the third, has the front border furnished with spine-like tubercles. At maturity they are about an inch (rather more or less, as the case may be) in length, and rather less than a third of an inch in width; the under surface flat; the back very convex or arched, and the general shape of a very long oval, or rather the sides parallel, with the head end prolonged, the tail end obtuse. One very important point in the structure is the presence of two dark brown hooks at the head end (see fig.). Between these is a little depression showing all that the maggot possesses by way of a mouth. The last segment at the tail extremity of the maggot is truncated upwards, with a circular margin projecting over the breathing pores, and a lip below bearing small spines.

By the help respectively of the head hooks, and of the spines at the end of the abdomen, the maggot is enabled to pull itself forward, and keep itself in place, and likewise to push itself onwards wherever there is space for it to pass along.

The young maggots on being deposited fasten themselves by means of their head hooks, and then travel up the nostrils, and proceed at will into any of the attainable cavities, in some of which they thrive, come to maturity, and from thence make their escape in due time; from others, on the contrary, which they have reached when small themselves, through small orifices, they are unable when full grown to make their way out, and perish, but they in *no case make their way into the brain.* They "*never do, and never can, penetrate into the brain.*"‡

In the paper on this attack, referred to below,§ it is mentioned that where "the larvæ are very numerous . . . they may be encountered in the larynx and trachea, where they had probably wandered after the death of their host." Of this straying about I

\* 'Insects of Missouri,' First Annual Report, 1868, p. 165.

† Brauer, 'Monographie der Œstriden,' p. 154.

‡ See 'Animal Parasites of Sheep,' by Cooper Curtice, D.V.S., M.D., U.S.A. Department of Agriculture, Bureau of Animal Industry, p. 29. Washington.

§ See 'Parasites and Parasitic Diseases of Domesticated Animals,' by Prof. L. G. Neumann; translated by Dr. Fleming, p. 571.

have had two instances sent me, one in which the maggots sent were taken from what in a general way was called the lungs; another, last year, when the maggots were sent me as an attack apparently affecting the windpipe.

*The exact method and rate of speed of progression* of the maggot is of a good deal of practical interest, and may easily be seen by giving a little attention to the subject.

In my own observations I found that, whilst I held the maggot, the strong black curved mouth-hooks were frequently protruded and withdrawn, and were well fitted to act as flat nippers, or pincers, to pinch up any soft matter that lay between them, as well as to enable the maggot to drag itself onwards, or (at will) to fix itself firmly or to loosen hold. The tail segment was (as figured, much magnified, p. 5) somewhat rounded, with a slightly swollen border, and in the centre of the upper part are the brown plates of the spiracles, or breathing-pores, of a shape which might be called five-cornered, or three-cornered, with the corners much rounded. Beneath these spiracles the caudal or tail extremity of the larva was so much enlarged that it projected greatly, forming a central lobe bearing a little patch of prickles on its surface; also it was furnished on each side with a fleshy process or projection, apparently very useful in progression.

The power of rapid movement was remarkable. On placing one of the nostril maggots (that is, one of the larvæ of *Æstrus ovis*) on a cloth, it moved onwards at the rate of three and a half inches in the first minute, and four and a half inches in the second, and when the maggot was placed on the hand the movement could be seen to be helped both by head and tail. The black head-hooks were *almost* fixed in the skin of the hand, so firmly that the pressure could be felt, and thus served as a power by which the maggot kept itself in place whilst the lobe of the tail and the pair of fleshy tubercles, or processes, on each side, presumably also the small prickles beneath the segments, served as a means to push the soft body onwards from the tail end, the maggot thus advancing at a very fair pace by alternately pushing and fixing. When placed on glass the maggot had a power of movement simply by adhesion of its own lower surface.

*The number of maggots* found in individual cases of infestation varies much. Commonly it does not appear to exceed from two or three to six or seven (*vide* 'Youatt on the Sheep,' p. 366, for the smaller number, and 'Animal Parasites of Sheep,' by Dr. Cooper Curtice, p. 31, for the larger number), but very many more are

recorded as having been occasionally found, even up to as many as sixty to eighty.

*From the middle of April to the end of July* is the time noticed in this country as the most special time for the maggots to leave the nostrils; but they may be found at other seasons, and maggots of all ages, it is stated, may be found in the winter time. Amongst inquiries sent me about this attack last year, one was accompanied by six maggots of different sizes up to five-eighths of an inch long taken from one sheep. This was on the 12th of May.

They are stated by various writers to remain for about ten months in the nose cavities, but this is not absolutely proved. When fully matured they loosen the hold of their hooks on the mucous membrane, and, having freed themselves, they drop to the ground, or are expelled with much sneezing and snorting. Sometimes there is a good deal of trouble, amounting in severe cases to difficulty of breathing from stoppages occasioned by presence of the maggots, or inflammation of the mucous membrane; but, excepting where there are many maggots, the attack does not appear to be often fatal, and when the cause of the trouble has been got rid of in natural course the sheep recovers.

*When the maggot has fallen to the earth* it bores down into it for an inch or two, and there very soon changes in appearance by contracting and by the hardening of its outer skin into a smooth black chrysalis case, within which the fly develops, and from which it emerges, according to various observers, at very different lengths of time—some giving three or four weeks, some more than twice that time, as the period of development according to state of weather.

Though the attack is considered not to be serious, excepting in occasional instances, as where there may be an unusual number of maggots, yet even the symptoms recorded as accompanying common amount of maggot presence show a degree of annoyance to the sheep that is much better avoided. The discharge from the nose, the throwing the head upwards and shaking it, and the sneezing and snorting all show great uneasiness; and, as noted by Dr. Cooper Curtice (*op. cit.*, p. 28), the fact that the mouth-hooks sink so deeply into the mucous membrane as to cause minute points of hæmorrhage, indicated afterwards by minute black dots scattered over the surface of the inside of the nose, speaks for itself as to the annoyance that must be caused when the maggots are travelling upwards, inserting their hooks as they go.

The troubles arising from presence of Nostril Maggot are some-

times, though very erroneously, ascribed to an affection popularly known as *Gid*, *Sturdy*, &c., of which "one of the most striking symptoms is the rotatory movement of the affected beast." Though several of the disordered movements are similar in the case of this attack and that of the presence of *Nostril Maggot*, it is to be observed that "turning in a circle does not take place in this [*Nostril Maggot*] disease. The latter is nearly always accompanied by nasal discharge and snortings, which do not occur in true *Gid*,"\* caused by *Cœnurus cerebralis*.

**PREVENTION AND REMEDIES.**—The most simple method appears to be that noted by Dr. Cooper Curtice in his work previously quoted:—

"A practical means of prevention consists in smearing the noses with a mixture of equal parts of tar and grease, or of tar and fish oil, or of tar and whale oil. The better way is to apply the preparation directly by a brush. Some recommend smearing the salt and grain troughs with the mixture, expecting the sheep while feeding to get more or less on the nose. This method is not thorough enough. Fish or whale oil alone is also recommended."

The following ointment is advised:—

"Beeswax, one pound; linseed oil, one pint; carbolic acid, four ounces. Melt the wax and oil together, adding two ounces of rosin to give body, then, as it is cooling, stir in the carbolic acid. This should be rubbed over the face and nose once in two or three days during July and August.

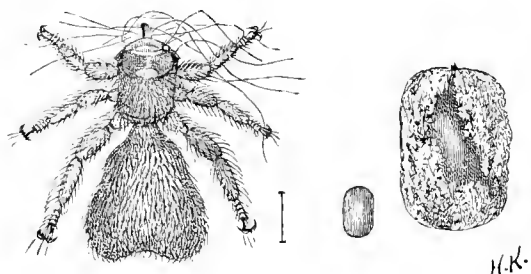
"All grubs seen on the ground should be crushed. Heads of slaughtered sheep should be cared for so that mature grubs cannot escape to the ground. Sheep-yards should be periodically cleaned and sprinkled with lime."

In regard to remedial measures, especially by operation, these do not come in the scope of the present observation, and more particularly as for such cases veterinary advice and assistance would be requisite. Probably, also, though the concluding words of the sentence are not pleasant, Neumann's advice, as suggested by Dr. Cooper Curtice, is "the soundest to follow, except in the cases of breeders of valuable sheep":—"At all times, if the number of animals affected is con-

\* See, for full accounts of brain disease and its effects, caused by the *Cœnurus cerebralis*, or *Hydatid* (the early condition of the *Tapeworm* of the dog), 'Parasites and Parasitic Disease,' by Prof. Neumann, translated by Dr. Fleming, previously referred to; likewise 'Internal Parasites of our Domesticated Animals,' by Dr. Cobbold.

siderable, the malady should be left to take its course, and those which present the gravest symptoms should be sent to the shambles."

**Sheep Spider Fly; "Sheep Tick."** *Melophagus ovinus*, Linn.



*MELOPHAGUS OVINUS*.—Fly, magnified, with line showing natural length; puparium, magnified (showing incrustation), also natural size.

The Sheep Spider Fly and the Horse Forest Fly (mentioned further on) differ from all the other kinds of flies mentioned in these pages in their methods of propagation and habits. They only live actively in fly state, and they multiply, *not* by egg-laying or by deposit of ordinary maggots, but by deposit (or laying) of maggots in the very act of altering into puparia, or pupa-cases, commonly known as chrysalids, from which, in due time, the fly comes out.

*With regard to the name of Sheep Tick*, which is so commonly bestowed on this sheep pest that it may be said to be now the established appellation, it should be observed that it is in reality *not a Tick* at all. The difference may be easily told by noticing that the true Tick possesses *eight* legs, excepting in its earliest (that is, its larval) state, when it has only six; and also Ticks have no division between the fore body and abdomen.

The so-called "Sheep Ticks" (*Melophagus ovinus*) are wingless, about a quarter of an inch long, flattish in shape, leathery in texture and bristly, especially on the abdomen and legs. The colour brownish, varying in tint on different parts of the body and legs, and more or less tinged with grey on the abdomen. The head is squarish, rather wider than the thorax, in which it is partially sunk, and is furnished with a tubular proboscis, protected externally by two flat elongated bristly pieces. The eyes very small; ocelli or simple eyes none; the horns (*antennæ*) very short, sunk in pits, and wart-shaped at the ends.

The thorax (or fore body), as seen from above, is square, and is *without wings*. The abdomen is much contracted at the base, and



then enlarged into a flattish bag-like shape, more or less concave at the tail extremity. (See figure of fly, magnified.)

A very noticeable part of the structure is that of the feet, which much resemble those of the Forest Fly (for figure, see index), and are each terminated by a pair of strong black curved claws, each furnished with a much shorter and lumpy or somewhat thumb-like side claw, and a bearded bristle or feather-like appendage of the same nature as the "bearded hair" of the Forest Fly's foot, but much shorter and broader in proportion. By means of these claws the flies are enabled to cling tenaciously to the wool, and it is supposed that the "bearded hair" may, by being curled round portions of wool in the sheep's fleece, help the "Sheep Ticks" in moving about; but this point appears rather conjectural.

*The method of propagation* is for the maggot of these pupa-bearing flies (belonging to the division *Pupipara*) to be hatched *within* the female fly from an egg, which is recorded by Dr. Leuckart to be long and slender in shape, rather more than the twenty-fourth part of an inch in length, and about half that measure in breadth. Within the parent fly the maggot feeds until it is full-grown, when it is deposited on the point of turning to a puparium, or chrysalis.

These puparia are of the shape figured, from life, at p. 10; that is, bluntly ovoid, with the two ends truncated so as to be almost of a long square, with the four corners rounded off. The colour, where it can be seen, is of a clear bright chestnut, but this is often hidden by an incrustation (see figure), which is stated to be sticky when the puparium is laid, and to glue it to the wool.

In the course of 1895 such a good supply was sent me in wool of live "Sheep Ticks" from fleeces of sheep that had *not* been dipped, that I was able to study the flies and the chrysalis-cases carefully, and, amongst other points, noticed the incrustation as figured. But in the past season when a small consignment of flies was sent just at the time of pupa-laying, I did not notice the coating, and therefore conjectured that it was not always present. The *puparia* are laid one at a time in the wool; but with regard to the numbers laid successively by one fly there is a difference in opinion, some stating that each female only produces one or two, others that eight or nine may be successively laid by one fly during her life-time. Dr. Taschenberg, the well-known German entomologist, considers that one Spider Fly may produce in the course of her life as many as eight puparia.

From these "cases" the fly comes out in due course; but I have not been able myself to record length of time required for

development, and the only note I have met with of time taken is that of within four weeks at ordinary temperatures, given by Dr. Curtice from his own observations.

*The food* is recorded by some of our best authorities of most recent date as consisting wholly of blood. At p. 41 of Dr. Curtice's work, previously referred to, he describes the operation of blood-sucking, as he observed it himself (through a lens) to be carried on, on the back of his own hand. Thus he was able to watch the flies, or "Ticks," boring into the skin, and also to see the abdomen enlarge as they slowly drew in the blood. Where the skin was too hard to be easily pierced, they "usually succeeded by slipping their tube into a hair follicle." No itching or irritation, or scarcely any, was felt at first, "but little swellings came on a day or two later which itched for over a week."

In all Dr. Curtice's observations the "Ticks" died in the course of a few days when removed from the sheep, excepting those mentioned above, which lived "for nearly two weeks, or until their daily feeding was neglected." In the case of the numbers sent to myself in wool in 1895, and also with those sent me in the past season, they all soon died. There appears to be no doubt that, excepting in accidental circumstances—such as the fly being carried away on fleeces, or by persons coming in contact with the sheep, or the pupa-cases falling from the fleeces to the ground—the parasite spends its whole life on the sheep; but in each of the above-mentioned ways the infestation may be very readily spread to other sheep and lambs, and to the latter they are noted as a cause of great irritation, "veritable pests" at shearing time if they take refuge in their longer wool when the shorn coats of the old and infested sheep no longer afford the requisite shelter.

PREVENTION AND REMEDIES.—The most important remedial treatment appears to be dipping; whether here or in the United States all that appears to be considered necessary by way of application is the use of "dips." On this point Prof. Robert Wallace notes, in his 'Farm Live Stock,'\* speaking of these "Sheep Ticks" (known in Scotland under the name of Kades or Keds), "they may be kept very much under by timely dipping, if not got rid of altogether."

With regard to the kind of dips to be preferred: as it is quite certain that all sheep-owners have their own views on this point,

\* 'Farm Live Stock of Great Britain,' by Robert Wallace, F.L.S., &c., Professor of Agriculture in the University of Edinburgh, p. 273.

it is wholly unnecessary to enter on it here, more especially as I am quite unqualified to offer an opinion on this part of the treatment. But, looking at the matter from an entomological point of view, as to the known power of kerosine emulsion as a most serviceable insecticide, I may perhaps be allowed to give the formula for kerosine emulsion quoted by Dr. Curtice, in his work mentioned above, from the 'American Agriculturist,' October, 1889, p. 490, as one amongst various desirable applications:—"Churn fresh-skimmed milk and kerosine together in the proportion of one gallon of milk to two gallons of kerosine, either in a churn, or by using a force-pump, until an emulsion is made. The method of using the force-pump is to set it in the vessel containing the mixture, and turn the stream back into the same vessel. The emulsion will form quicker if boiling hot milk is used. For dipping, use one gallon for each ten gallons of water required."

The reader will please observe that I do not recommend the above on my own responsibility, only as being given on good authority, and, in case it is not injurious to sheep or wool, I should think it was very likely to do good as an insecticide. Probably paraffin oil would do just as well as kerosine.

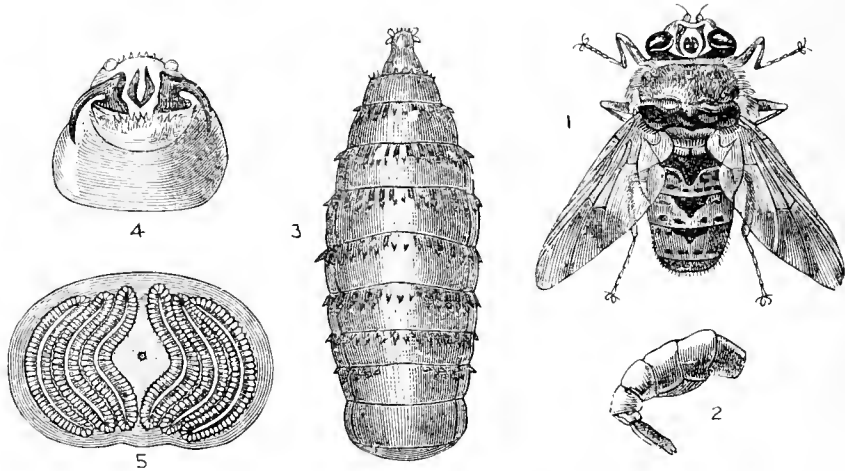
The methods of prevention are obviously based on the habits of the pest, as, for instance, keeping animals known to be infested, or newly purchased sheep not certainly known to be clear, away from the flock until they have been dipped; care not to let sheep after being dipped be turned again into the former pastures or pens until a week has elapsed, by which time it may be considered that all flies harbouring on the ground will have died; also not allowing shorn wool to be stored where Ticks, or young Ticks hatching out of the pupa-cases, can crawl out to sheep in the neighbourhood.

This attack is not as disturbing to the sheep as that of the very nearly allied Forest Fly attack is to horses, because the "Sheep Ticks," being wingless, the animals have not the terror to bear which is caused by the sudden descent of the Horse Forest Fly. Also the "Ticks" have not the power of very rapid movement in every direction possessed by the allied pest.

Still, from irritation and to some degree of loss of blood, it is, where prevalent, bad—sometimes very bad—for the sheep, and, as it can easily be transferred from one sheep to another, it is very desirable to get rid of the infestation as soon as possible.

## HORSE.

Horse Bot Fly; Horse Bee. *Gastrophilus equi*, Fab.



GASTROPHILUS EQUI.—1, male; 2, curved extremity of abdomen of female; 3, maggot; 4, mouth hooks; 5, spiracles at extremity of tail of maggot—all greatly magnified, after Brauer; nat. size given in descriptions.

In the case of the “Horse Bot Fly,” sometimes also called the “Horse Bee,” the method of infestation may be shortly described as follows. The female fly lays her eggs for the most part on the hairs of the mane, shoulders, or on the fore legs, where they can be reached by the tongue of the horse. By this means the eggs, or the maggots hatching from them, can be readily licked into the mouth, and thence the maggots pass down into the stomach. There they fix themselves by their mouth hooks, and feed by suction, till after three-quarters of a year or more, when they are full grown, they loose hold, and pass out of the horse with the rejectamenta. In these, or in the ground, they bury themselves and turn to a hard dark-coloured chrysalis, in which the fly forms, and from which it comes out (in summer) in about six or eight weeks.

This is the method of life-history given shortly, but the following details describe the chief points of the infestation, of which the knowledge is commonly needed for practical use.

The flies are from half an inch to somewhat more in length, and clothed with wool or hair. The body between the wings with reddish or olive brown hair and some black or dark markings; abdomen yellowish brown, also with dark or black markings, but the mixture of black, whitish, yellowish, and brown hairs makes it very difficult to describe the colouring clearly, and the descriptions by different writers vary much. The two wings are transparent

(though sometimes opaque) and white, with a smoky or brownish cross-band, and also two spots or a single marking at the tip. The legs yellowish brown.

The male (fig. 1, at heading) fly is rounded at the end of the abdomen, commonly called the tail; the female is more prolonged to a bluntly pointed shape; but when at rest this part, which includes the ovipositor, or egg-laying apparatus, is curved down under the body (fig. 2).

When the fly is about to lay she hovers for a moment or so near the horse, then, darting down, leaves an egg fixed by a kind of gummy matter to the hair she has selected, and so she goes on until her stock of eggs is exhausted. The eggs are yellowish white, about the twelfth of an inch in length, spindle-shaped at one end, and truncate at the other. They are fixed to the hair by the narrow end, the truncate end being unattached and pendent, and several eggs may be placed on one hair, and it is stated several hundreds may be found on one horse.

The hair of the mane, or shoulders, also of the knees and shanks, are parts especially chosen for egg-laying, so that commonly the horse on which they are laid can reach them with its tongue; but, if not, the nibbling or licking of one horse by another, which may often be seen going on in the field, answers every purpose needed for maggot transportation.

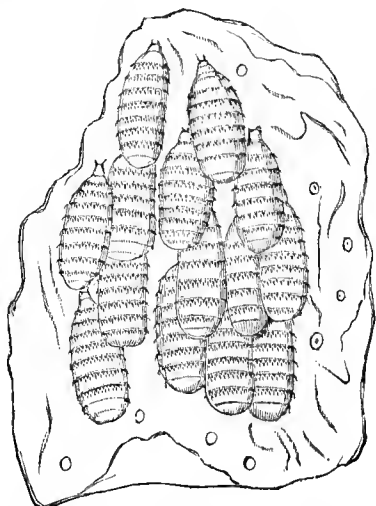
There appears to be some difference in opinion, as expressed by various writers, as to the condition in which the infestation is carried into the mouth. It may be that the egg itself is carried in on the tongue, but one of the more recent views is that the warm moisture of the horse's tongue hatches the eggs, or rather frees the maggots from the eggs if hatching time is near. Another view is that the maggot on hatching crawls on the skin, and thus causes a slight itching, which induces the horse to lick the skin, and thus in either case the maggots may be conveyed into the mouth. From thence (although it is possible some of them may stay by the way) most of them pass downwards, or are conveyed downwards, with the food into the stomach, where they fix themselves to the white membrane which lines (what may for common purposes be called) the "gullet end" of the stomach. In general, "they fix themselves on the gastric mucous membrane and almost exclusively in the



Eggs of *G. equi*,  
mag. and nat. size.  
After Bracy Clark.

left sac, . . . though some stop in the œsophagus, . . . in the part where the membrane offers the same characters as in the left sac of the stomach." By the same authority it is noted that the numbers found in one stomach have been counted from ten or more up to hundreds, as 600, 700, or even 1000, and are stated "to be collected in one or more groups, one of which is always larger than the other."\*

*The maggot when first hatched* is long, narrow, and somewhat worm-like, but in the stage in which it is best known (up to the



Maggots or Horse Bots attached to membrane of stomach. After Bracy Clark.

second moult) it is of the shape figured accompanying, and also magnified at heading, "3"; namely, for the greater part of its length barrel-shaped, banded round with rows of prickles or horny joints, blunt at the tail end, widest about the middle, and gradually lessening in size towards the foremost end, in which is a slit or opening that serves the purpose of sucking in food, with a brown hard hook on each side. When full-grown the maggots are about three-quarters of an inch in length, and yellow in colour; earlier in life they are red or flesh colour.

Where the process of fixing themselves has been observed, it is noted that they draw back the mouth hooks until the points are close together; then, keeping them side by side, use them as a boring instrument, until whatever they are working at is pierced well into. Next, spreading the hooks sideways and dragging them downwards, the maggots secure such firm hold that no more trouble is needed to keep them in place.

*When full-fed*, which is after about ten months, they loosen their hold, and (as above mentioned) pass along the intestines, and are discharged by the animal (chiefly in the summer season, from May to August). They then bury themselves in the horse-dung, and in a space of time of twenty-four to forty-eight hours turn to chrysalids, formed outside of the hardened skin of the maggot, and much resembling it in general appearance; in colour, after the first twenty-four or forty-eight hours, of a bright brown changing to dark brown, almost black, colour. From these chrysalids the fly comes out after about four or five to seven weeks in summer.

\* 'Parasites and Parasitic Diseases of Domesticated Animals,' by Prof. L. G. Neumann, translated by Dr. Geo. Fleming, p. 356.

PREVENTION AND REMEDIES.—The maggots of *Gastrophilus equi*, as well as those of other species of the *Gastrophili*, “are found in horses which frequent pastures, or live much in the open air, and which do not receive much grooming. The age, state of health, or disease, and mode of feeding have no influence on them.”—(W. F.)

Regular methods of treatment are, such combings, brushings, clipping away hair from infested parts, as would get rid of a deal of infestation, and the use of such soaps and washes as, whilst they would not be in any way injurious to the horse, would help to get rid of hatching maggots, and to some degree of eggs, though the firm hold of these to the hair makes it very difficult to dislodge them.

Washes, or smearings of any kind of insect deterrent, such, for instance, as paraffin oil, as used to keep off Horse Forest Fly, would almost certainly help to prevent egg-laying if applied from time to time to the parts preferred for oviposition by the flies.

As it is stated that the flies do not follow the horses into stables, it might be worth while to allow horses access to stables or field sheds in hot weather, or when horses showed from the egg-presence on the hair that much attack was going on.

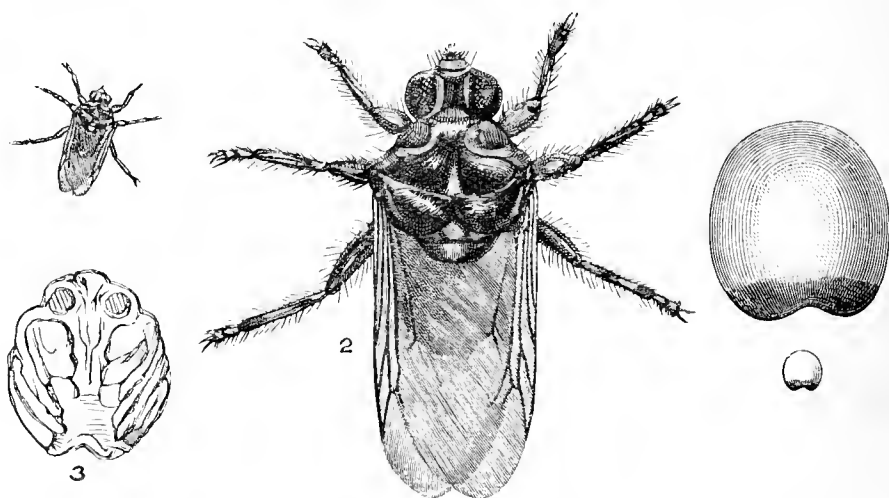
One very obvious and certain way of lessening recurrence of the infestation is to notice whether there is presence of the yellowish or yellowish pink maggots, or the brown or blackish chrysalids, in the horse droppings, and to take requisite measures to destroy them, probably by throwing on some strong dressing, but in some way treating the filth so as to render it harmless. If buried, it should be buried to a good depth, as otherwise (it being natural to the maggots to *bury themselves*) in all probability the flies on developing from the chrysalids will, according to their usual habits, simply come up to the surface and take wing, as if nothing had been done.

In regard to remedial measures, this lies in the province of the Veterinary Surgeon, but in a communication with which I was favoured by Mr. Hy. Thompson, M.R.C.V.S., of Aspatria, Cumberland, he mentioned: “I know of no medicine that will destroy them, or make them leave their winter quarters until fully developed;” . . . but if it was thought desirable to try some remedy in the way of medicine, he mentioned that he considered “two oz. turpentine and twenty oz. of raw linseed oil, mixed, and given as a draught once a fortnight,” to be the best.

In the work quoted below it is mentioned that “From all the serious attempts made before him and by him, and numerous

experiments . . . A. Numan arrived at the conclusion that agents endowed with great energy, and which arrive in the stomach without undergoing any modification, act upon that viscus, but scarcely produce any effect on the larvæ. No medication can therefore be recommended for their destruction or expulsion! It is fortunate that their sojourn is only temporary, and that they are eliminated spontaneously when the summer returns. Therefore, as a cure should occur spontaneously, without any medication, there is no necessity to intervene unless the health is seriously compromised.”\*

**Forest Fly; Spider Fly; Forester.** *Hippobosca equina*, Linn.



HIPPOBOSCA EQUINA: 1 and 2, natural size, and magnified from life; 3, pupa removed from egg-like puparium (after Réaumur). Puparium, natural size and magnified, before complete coloration.

The “Forest Fly,” or “New Forest” Fly as it is sometimes called, known also by the names of the “Spider Fly,” “Flat Fly,” and “Horse Louse” (scientifically the *Hippobosca equina*), has been a well-known pest to horses and cattle in the New Forest in Hampshire and its neighbourhood from at least as far back as the year 1781. As, however, it was generally considered only a local trouble, little attention was paid to it in this country beyond the area of the district in which it was mainly to be found, until the year 1895, when it was brought into more than ordinary notice by the New Forest (the especially known locality of the pest) having been selected as the scene of our autumn military manœuvres.

\* ‘Parasites and Parasitic Diseases of the Domesticated Animals,’ by L. G. Neumann; translated by Geo. Fleming, C.B., LL.D., &c., late Principal Veterinary Surgeon to the British Army, 1892.



In that year, consequently on official enquiries being sent to myself as to the effects of the infestation on horses unused to the attack, and methods of prevention, I endeavoured to obtain serviceable practical information from local residents accustomed to deal with the matter, and in the following pages give an abstract of the information placed in my hands, of which I gave a full account, collated with previously published observations, in my Annual Report for 1895.

The especially noticeable point in the life-history of this fly is that, like others of the genus *Hippobosca*, and also like the Sheep's Spider Fly previously mentioned, it only lives actively in fly state. *The flies do not lay eggs*, but the larvæ or maggots hatch, and are nourished up to their full growth separately within the abdomen of the females; at full growth they change to the pupal state, and are deposited in this condition (or ready quite immediately to turn to it) in the shape of white roundish bodies often mistaken for eggs, and very like them, excepting that they are notched at one end. These rapidly change from white to a dark brown colour, somewhat resembling a laburnum-seed, and within this *puparium* the fly forms, and in due time escapes by cracking off the notched end of its hard covering. (Figure at heading shows a puparium, nat. size and magnified, but as yet only partly coloured.)

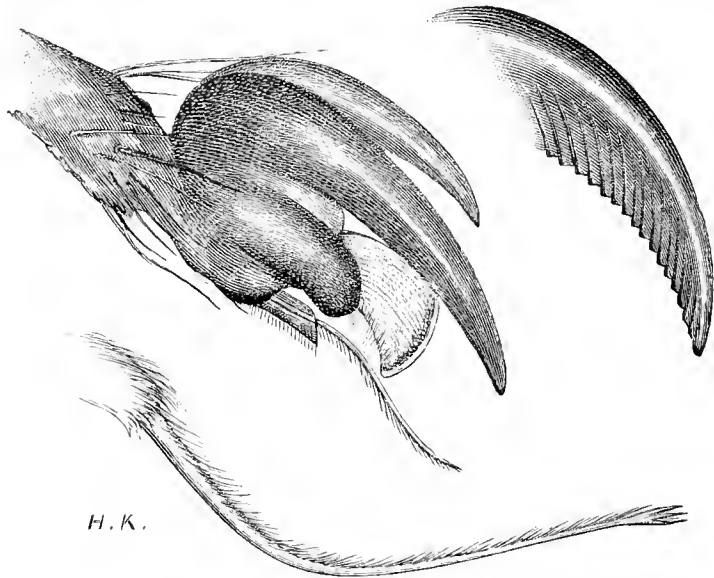
The Forest Fly, when at rest with the wings laid flat on the back (as figured, life-size and magnified, at heading), is three-eighths of an inch in length from head to the extremity of the wings; about a quarter of an inch in length from head to tip of tail. The shape is flattish, and the skin so hard and leathery that it is difficult to crush.

The head is tawny yellow, with a dark stripe down the middle of the face; the compound eyes dark and very large, occupying the whole sides of the head; ocelli, or simple eyes, *wanting*. The *thorax*, or body between the wings, has on each shoulder a large patch or irregular ring of tawny yellow, with more or less of the brown ground colour in the centre, some small pale markings along the middle of the hinder part of the thorax, and *a pale spot in the centre of the scutellum* (that is, of the small portion of the upper part of the thorax just preceding the abdomen). The abdomen is brown, grey below, and, like most of the fly, more or less beset with bristly hairs.

Wings two, strong and membranous, slightly opaque and brownish in colour, and furnished with several strong dark veins placed along the front portion, as exactly figured from life at p. 18.

Legs rather long (when extended flatly they appear very long), of great strength, and tawny yellow in colour, variously ringed, or clouded, or otherwise varied, with brown or black.

Each foot (or *tarsus*) is terminated by a pair of claws, each of the pair being formed of one large, very strong, much curved, black claw, at the outside of which is placed another much shorter and thicker, forming a kind of thumb-like appendage to the main claw. See figure below. On placing the curved claw in a good



Foot of *Hippobosca equina*, showing double claws, central process, and long prickly bristle; also portion of side of claw of *H. maculata* (also magnified), showing parallel grooves and saw-edge.

light, it can be seen (with the help of magnifying powers) that the lower parts of the sides are furrowed by minute grooves placed parallel to each other, and that the lowest part of the claw has, running beneath it, a regularly serrated, or scalloped, edge, each groove running down to a notch in the saw-like edge. This structure I have also observed in the Indian Forest Fly (*Hippobosca maculata*); see figure above of a *portion* of a curved claw very much magnified. Consequently on this peculiar structure, when the fly presses the sides of the curved claws together, they form a kind of flat-sided forceps, perfectly adapted for holding fine objects like hairs, amongst which the presence of the infestation causes exceeding discomfort, or with horses unaccustomed to it quite uncontrollable terror.

Beneath the foot, and between the cushions or pulvilli (see figures above, greatly magnified), is a long stout hair, or rather bristle, extending fully to the length of the curved claws, and bearded with side hairs, and at its base is a minute structure, only

observable with high magnifying powers, which may be described as a kind of flat transparent flap, with a bulb-like formation or appendage accompanying, covered with bristles.\* The use of the hairy bristle does not appear to be quite known, though it seems likely that, as in the case of the (conjectural) use of the very similar appendage to the foot of the "Sheep Tick" or "Spider Fly" of the Sheep, it may be of service to enable the Fly to gain a firmer hold, by curling the bristle around a few hairs or pieces of wool.

With regard to the "flap and bulb" structure, I believe not only its use but its existence were unknown up to the date of my observations in 1895. But from the very peculiar structure of the sides of the "flap," much resembling, to external observation, what are known as *pseudo-tracheæ* in the flexible lobes, known as *labellæ*, which form the terminal portion of the proboscis of the Bluebottle Fly †; also, from my own observations, that when the flies were confined in a card-board box with *upright* sides, no help was given by the claws to their ascent, but they simply progressed upwards by holding on with the *basal part* of the claws, the rest being thrown up apparently free from all attachment; from these circumstances I conjecture that the apparatus of the "flap" serves, by means of suction, as a kind of adhesive organ. This, however, I merely submit as a suggestion.

For ordinary work, by the help of their strong file-sided claws and the elaborate structure of the foot, the flies have an extraordinary power of holding on to the hairs, and besides can run to and fro, backwards, forwards, or sideways with a kind of crab-like movement, amongst the hair, or on the tender parts of the skin which they most frequent, so as by pulling, scratching, and tickling to perfectly terrify animals unacquainted with the infestation.

Horses unused to it become restive, and frequently unmanageable, plunge and kick and strike with their feet, in their endeavours to rid themselves of the plague; and the more high-bred and high-spirited the horse, and sensitive to foreign touch on the skin, the greater the annoyance and consequent risks.

The parts most infested are those which are the most tender, and also those from which the animal has itself the most difficulty in removing the plague. Beneath the tail is the locality that is

\* For description of these and other appendages of the foot of the *H. equina*, see my Nineteenth Annual Report, with two plates accompanying of greatly magnified figures.

† See figure, much magnified, given in 'Our Household Insects,' by Edw. A. Butler, B.A., B. Sc. Plate ii.

said to be especially attacked; also the inner parts of the thighs, and, speaking more generally, the abdomen, flanks, and also the upper part of the fore legs near the body.

The flies certainly feed to some extent by blood-sucking, as might be presumed from the nature of the proboscis enclosing the sucking tube; nevertheless, *locally*, and by those well used to observation, it has been told me so often that they feed on the moisture amongst the hair, or on "perspiration given off by cattle [horses, of course, included] during the period of their activity, *i. e.* the summer months," that it seems very likely that this also occurs. Also, in my own observations of the habits of the fly in captivity, it appeared to me that the great power of sweeping surfaces possessed by the very flexible end of the long sucking-tube, which the insect could lengthen or withdraw at pleasure, pointed to the possible drawing in of fluid for food from the surface of the skin of infested animals, as well as from beneath it.

In regard to the important matter of locality where this pest to horses, cattle, and to a lesser degree to some other animals, was known to exist, specimens from Dorsetshire, as well as from the New Forest, have for some years been in the entomological collections of the Mus. of Nat. Hist. at South Kensington, but to these we can now add localities in North and South Wales.

Consequently on the enquiries set on foot in 1895 by the editor of the 'Veterinary Record,' information was sent me, with specimens of the fly accompanying, of this *H. equina* being found in the valley running from Portmadoc on the seaside in Carnarvonshire, North Wales, to Beddgelert, at the foot of Snowdon, about eight miles distant. In this district, where ponies are kept on the mountains in the summer, and a herd of them on the lowlands both summer and winter, and where, likewise, there was much horse traffic along the road in the summer season, the flies were noticeable from the beginning of June to the middle of September. The flies sent me were captured on one of the coach-horses employed on the above route.

In August, 1898, I was favoured by Dr. D. Thomas, Medical Officer of Health of the Pontardawe Rural District Council in Glamorganshire, with specimens of *H. equina* found in the parish of Ystradgynlais, in Breconshire, with the comment that "a more terrible nuisance to some horses I have never known." About three weeks later Dr. Thomas forwarded me some more specimens caught on a hillside farm about four miles from Neath, Glamorganshire. Thus localities both in South and in North Wales are added to

those previously known of this very great horse pest, which it is of service to note, as it is far from unlikely that, if attention was given to the subject, sudden unaccountable unruliness of horses elsewhere might be traced to presence of the Forest Fly.

PREVENTION AND REMEDIES.—The attack having been up to 1895 mainly confined to one locality in this country, I have rarely had it brought under my personal observation, excepting in regard to such investigation of the habits and characteristics of the fly as could be studied in captivity; but in the researches relatively to the (then coming) autumn military manœuvres in the New Forest, much information was placed in my hands by observers in various ways qualified to give trustworthy notes of practical treatment, from which I give the following extracts.

The first, regarding method of attack, symptoms of its presence, and method of removal of the fly, are a portion of some notes placed in my hands by the courtesy of Mr. Thomas B. Goodall, F.R.C.V.S., Christchurch, Hants, omitting some points of technical detail:—

“A strange horse is alarmed and frightened because of his inability to dislodge the fly, its power of prehension being so great that the horse’s tail is powerless to remove it, and it crawls over the body of the horse, and does not remain quiescent until it finds a thin part of the skin, where in the Forest ponies it may sometimes be seen in clusters. . . . When a strange horse has a ‘Forester,’ as the fly is called locally, on him, he shows symptoms which at once tell us who have experience in the matter what ails him. He has a *frightened* look, lays his ears back, and makes short stamps and kicks with his feet; and if the fly is not taken from him he will sometimes sweat profusely, kick violently, and even roll. Most strange horses become accustomed to it in a few days, but some never do.

“I do not think the fly ever goes into a stable of its own accord, and if the horse is freed from them before going into the stable he is safe from attack until he is taken out again; and the custom here is to search the horse well over, particularly in the fly’s favourite haunts, before he is taken into the stable after being in the ‘fly’ district, *for we never find them away from the Forest*, unless they are taken by horses.

“There is some danger, to one not accustomed to the habits of the fly, and also of the horse, in attempting to dislodge the fly. It will when disturbed make short flights from one part of the body

to another, and then *run*, generally sideways. Strangers will sometimes endeavour to *knock it off*, which is useless, and increases the irritation of the horse. The only method is to clap the hand or fingers *flatly over the fly*, and then remove it, and it is killed by pressing the thumb-nail in the thorax lengthways."—(T. B. G.)

In my own small experience, I have found moistening the fingers helped very much in securing the fly, as thus the wings were a little clogged, so that they were not at once serviceable again. Sometimes the fly may be secured and pinched in the fold of a handkerchief, or the following plan might answer:—Have a box, such as a wooden pill-box, in the pocket, and on the bottom of this have a little cotton-wool fixed, and on the cotton-wool some drops of benzine, and the lid fitted firmly on. When the fly is noticed on any accessible part, take off the box-lid, and quickly as possibly put box and wool over the fly. If this is done dexterously the fly will very shortly be stupefied, and if the lid is replaced directly the box is lifted the fumes within will last for several captures.

*With regard to methods of prevention*, Mr. Goodall wrote me:—“I really know of no specific for preventing attack, though wiping the horse over with a paraffin-rag renders him less inviting to the fly; but when we know that it may settle on any part of the body it will be readily seen how inconvenient it would be to do this often or daily, and, as I have already said, we here simply catch and kill the fly.”

The paraffin application is the only one mentioned by most of my correspondents, but still other dressings (where circumstances allow of their application) sometimes are effective. The following note was given me by Mr. D. Dalziel Gibb, Ossemsley Manor Farm, Lymington, one of my constant contributors:—

“The common remedy adopted by those driving in the Forest with an unseasoned horse is to damp a cloth with paraffin and rub lightly over the animal, particularly the parts beneath, and under the tail, which are most subject to attack. For some years I have used with excellent results a carbolic sanitary fluid prepared by Mr. Johns (chemist), High Street, Southampton, which is clean and far from offensive in use, and effectual in keeping off Forest Flies. When added to hot water it mixes very readily, giving the water a milky appearance. For dressing or rubbing over with a wet cloth, two table-spoonfuls to a gallon of water would be sufficient. To wash animals over (if desired) one pint to twelve gallons of water would be the quantities. Doubtless McDougall's or Jeyes's preparations would serve the same purpose.”

In continental publications extreme cleanliness and soap-washes applied to the affected parts are particularly dwelt upon.

### Gad Flies, Horse Flies, or Breeze Flies.

*Hæmatopota pluvialis*, Linn. Horse or Rain Breeze Fly.

*Theriopectes tropicus*, Meig. (No known English name.)

„ *solstitialis*, Meig. Midsummer Gad Fly.

*Atylotus fulvus*, Meig. Tawny Gad Fly.

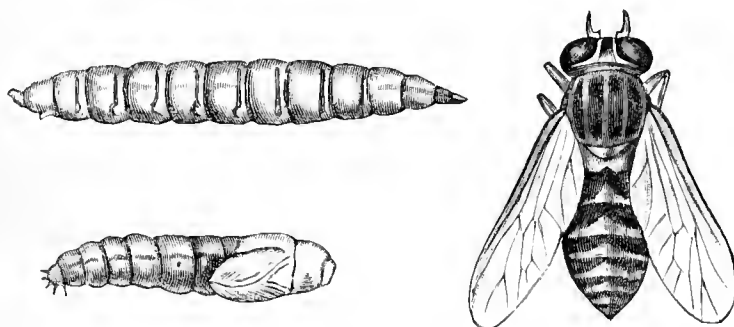
*Tabanus bovinus*, Linn. Great Ox Gad Fly.

„ *autumnalis*, Linn. Breeze Fly.

„ *bromius*, Linn. “Noisy” Breeze Fly.

„ *cognatus*, Löw. “Allied” Breeze Fly.

*Chrysops cæcutiens*, Linn. Blinding Breeze Fly.



TABANUS BOVINUS, Linn., and larva and pupa. After De Geer.

The family of the *Tabanidæ*, commonly known as Gad Flies, Horse Flies, or Breeze Flies, are strong and mostly broad-made flies, varying in size in this country from about a quarter of an inch to an inch or more in length, and from three-quarters of an inch to one or two inches in the spread of the wings. Of these we have about eighteen kinds, and in 1895, when much attention was given to injurious horse and cattle flies, twelve or more kinds were sent me, either still alive or sufficiently fresh to enable me to identify the species.

Some of the kinds are easily distinguishable for all practical purposes, as, for instance, the Great Ox Gad Fly, a painful attacker of horses, as well as cattle; the little straight-sided grey Horse Fly; and the pretty little *Chrysops*, with its banded wings; but though there is difficulty in distinguishing a good many of the kinds one from another scientifically, the flies of this family of the *Tabanidæ* may be known as mentioned shortly at p. 2, *ante*, by being furnished with a proboscis, used by the female for *blood* sucking. Or (apart from any scientific investigations) if a fly is found to draw blood this may be taken as a sure and certain sign that it is *not* a Bot or Warble Fly.

*The formation of the mouth* in Gad Flies is as follows. The proboscis is short, and projects horizontally, and in the female encloses *six*, in the male *four*, somewhat lancet-like instruments. It is terminated by two fleshy lip-like lobes, and is guarded at

the sides by the maxillary palpi, which are large and two-jointed. *The females only are blood-suckers*; in the males the mouth-parts are less adapted for piercing, and they live on the sweet matter in flowers or on "sweet sap."

The compound eyes are very large, and often, especially in the males, nearly cover the head, and are frequently gaily patterned (*whilst living*) with spots or stripes of bright colours. The third joint of the antennæ is large, and often with such a decided notch as to give a tooth-like projection (see figure of fly, p. 25). The *ocelli*, or simple eyes (mere little spots on the top of the head), are said to be usually absent, or almost obsolete, though sometimes, as in *Chrysops*, three are recorded to be present. The *thorax* (body between the wings and to which the legs are appended) is compact and thick, with the scutellum (*i. e.* the small upper hinder portion) much developed. *The wings* rather deflexed, or laid flat, and with many veins; when at rest usually *not* laid over each other, but about a quarter or half open, or extended horizontally. *The alulets*, or winglets (an enlargement of the membrane at the lower part of the hinder edge of the wing), large. The abdomen seven-ringed. The legs stout.

The figures of the Great Ox Gad Fly, given at pp. 25 and 27, convey a fair idea of the above details so far as they can be shown without being very much magnified.

With regard to the eggs of the *Tabanidæ*, the only information which I am aware of as being definitely given is that quoted (as follows) from Dr. Willeston, in Bulletin No. 5, new series, U. S. Dept. of Agriculture, referred to below, in which he says:—"The spindle-shaped brown or black eggs are in spherical or flat groups, stuck together and attached to the leaves or stems of grasses and other plants; those of the aquatic larvæ are fastened to rushes. . . . The young larvæ are known to penetrate beetles or other larvæ, and remain within them till they have completely consumed them, and their enlarged bodies have filled out the skins." (Stand. Nat. Hist. vol. ii. p. 417.)\*

*The larvæ, or maggots*, of the family of the *Tabanidæ* do not live in or on the hides of horses or other animals; many live in damp earth or sand, or under decaying leaves and stems in damp places. The *T. bovinus* (Great Ox Gad Fly) has been reared from maggots taken from the earth of a meadow; and the maggot of *Tabanus tropicus* (= *Theriopectes tropicus*) has been found to feed underground in damp woods, from whence the flies greatly tormented the horses

\* "Insects Affecting Domestic Animals," by Herbert Osborn. 'Bulletin' No. 5, new series. U.S.A. Dept. of Agriculture, Washington, 1896.



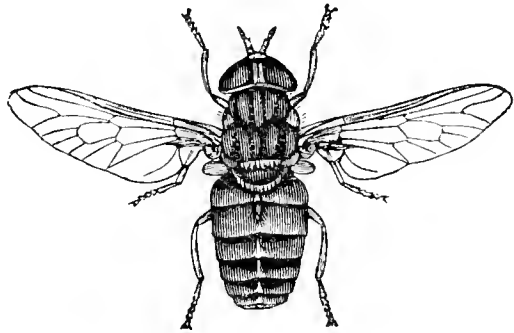
in neighbouring meadows. The maggots of *Chrysops* are stated also to live in earth.

With regard to rather more detailed observation, especially regarding the nature of their food, it is stated by Prof. Comstock\* that "the larvæ are carnivorous; many live in the earth; others live in water. They feed on various small animals; some upon snails, others upon the larvæ of insects. In most cases they have a single pair of spiracles, which is situated at the hind end of the body; some have a pair of spiracles at each end of the body." As I have never had an opportunity of studying the conditions of the life in maggot state myself, I give the above quotations from known authorities.

The pupa-case is not formed of the hardened skin of the maggot, as is the case with many kinds of dipterous flies; but where known, appears somewhat to resemble that of the *Tipula*, or Daddy Long-legs. The figures at p. 25 are from specimens of larvæ and pupæ of *Tabanus bovinus*, from which the fly was developed, as noted.

In the year 1895 thirteen species of Gad Flies were sent me for identification, of which I give at p. 25 the names of nine of the kinds most easily distinguishable without very minute technical description.

Of these the great size and colouring of the kind popularly known as the Great Ox Gad Fly distinguish them perfectly from all the other species, excepting that separated from them by recent writers under the scientific name of *Tabanus sudeticus* of Zeller. But though the two kinds are distinguishable by experts, they are not at all so without types and full descriptions, inappropriate here; therefore, as the early name of *Tabanus bovinus* (of Linnæus) includes both kinds scientifically, and the name of Great Ox Gad Fly does so for practical use, and also because even up to the present day the observations of De Geer of the life-history of this species continue to be one chief source of information we possess of method of



Great Ox Gad Fly, with wings expanded; also viewed sideways.

\* 'Manual for the Study of Insects,' by John H. Comstock, Professor of Entomology in Cornell University, U.S.A., p. 454.

transformation of the *Tabanidæ*, I give (following) the history and description of *T. bovinus*, Linn., but with a few remarks added as to the chief points by which *T. sudeticus* (of Zeller) may be distinguished from it.

This fine species, commonly known as the Great Ox Gad Fly, is four-fifths of an inch or rather more in the length of the body, and from about an inch and a half to two inches in expanse of the wings.

*The male* has greenish eyes of one colour (that is, not striped or spotted). The fore body black-brown, upper side shining, with five indistinct greyish yellow stripes, and short thick mixed brownish black and yellowish grey hair. The hinder body (abdomen) reddish yellow-brown, having above a central stripe, and tip of a darker or blackish tint, with *always* a triangular yellowish or a triangular pale milk-white spot in the middle of the hinder borders of the first to the fifth segment. The second to the fourth segment with fine and short light yellow-brown and whitish hair at the hinder edge. Abdomen beneath orange colour, the three last segments and a central stripe along all the segments black-brown or shining black or entirely covered with yellowish grey powder. The wings hyaline, yellowish grey, and especially yellow towards the fore edge; the veins there of a bright to yellow-brown. Legs black-brown; *tibia* (shanks) more or less yellow-brown; *tarsi* (feet) pitch-brown.

*The female* differs in the one-coloured eyes being of a *bright* green with a coppery glow. The fore body and its appendages like those of the male, only brighter and more clearly striped with grey along the back. The abdomen flatter and more rounded at the end than that of the male, but similarly coloured and marked, the white triangles in the dorsal line variable in size, and reach the front edge in the second, third, and fourth segments. The under side of the abdomen as in the male; but mostly orange only as far as the fourth segment, or, by the side of the central stripe, brown-grey or ash-grey; behind this entirely black-grey.\*

*Tabanus sudeticus*, Zell., referred to above, is to some degree distinguishable from the above by its larger size, the females being *usually* from just under to just over an inch in length. The eyes (without cross-bands) are *not* bright green, or greenish, as in *T. bovinus*, but blackish, or blackish-brown, with a coppery glow; and the abdomen, or hinder body, is only orange-coloured for a

\* For full descriptions see "Die Zweifügler, des Kaiserlichen Museums zu Wien," von Prof. Dr. Friedrich Brauer, pp. 105-216 of 'Denkschriften der Kaiserlicher Akademie der Wissenschaften,' Zweiundvierzigster Band, Wien, 1880 (*i. e.* 'Transactions of the Imperial Academy of Sciences in Vienna,' forty-second volume.

short distance along the sides, the almost velvet-black colour predominating above.

As in *bovinus*, there is a central row of spots, but when type specimens of the two kinds are examined side by side the black ground colour of *sudeticus* catches the eye at once. Also it is considered to fly earlier in the year—*sudeticus* in May and middle of June, *bovinus* end of June, July, and August.

The following short notes of method of transformation of *T. bovinus* of Linnæus and De Geer, of which no author had previously written, are abridged from the accounts of M. De Geer of his own observations.\*

During the month of May, whilst searching in the earth of a meadow, M. De Geer found many maggots (larvæ), and having shut up seven or eight of these in a box filled with fresh earth, he observed, on June 12th (1760), that one of these larvæ had taken the form of a chrysalis (or pupa), and had come half out of the earth, whilst the rest of the body was buried in it. Only three others of the larvæ were to be found living in the box, which afterwards similarly changed to chrysalis state—coming similarly half out of the earth; and, as besides these there was only one small dead larva to be found, this was considered to point to the others having been devoured by those which had arrived at transformation.

Since then, the fact of maggots of the *Tabanidæ* living on grubs, or similar ground-living creatures, has been entomologically recorded.—(E. A. O.)

The largest larva measured by M. De Geer was an inch and a half in length when fully extended, and nearly a fifth in breadth at the middle of the body, and was noted as much resembling those of the large *Tipulæ* (Daddy Longlegs or Crane Flies), which live in the earth. The shape was cylindrical, of nearly equal thickness throughout, though lesser towards the head, so that the foremost part was somewhat conical; the tail extremity was also somewhat pointed, but not as much prolonged as the head end, and it bears a small tubercle at the termination.

The colour of the larva was dirty yellowish white, with roughish or somewhat raised bands of a blackish colour on the fore part of the fourth, fifth, and following segments to the tenth inclusive, these encircling the body like hoops. These segments have towards

\* See 'Mémoires pour servir à l'histoire des Insectes,' par M. le Baron Charles De Geer, p. 214. Tome sixième. Stockholm, 1776. Also, for extracts at greater length than the above, my 'Nineteenth Annual Report on Injurious Insects,' p. 125.

the sides and at the lower part some fleshy tubercle-like projections, which the larva can withdraw or push out again at pleasure.

The little head was brown and shining, with two small short horns (antennæ), and two large hard hooks of the length of the head placed above, but curved downwards. When at rest it draws the head into the first segment, and this into the second. By the help of the contractile tubercles on the segments and the head-hooks, the larva is enabled to make its way through the ground.

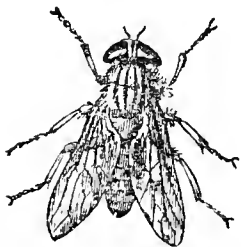
The pupa, or chrysalis (see figure, p. 25), is nearly an inch long, and much resembles those of the larger *Tipula*, *i. e.* the flies commonly called Daddy Longlegs. The colour is of a greyish brown, darker on the abdomen. This is divided into eight rings, each one having along the hinder edge a fringe of long grey hairs. The last ring is armed at the end with six hard and scaly points, which serve to push the chrysalis half out of the earth (as noted, p. 29).

At the end of a month or rather more the fly emerged from the pupal envelope or chrysalis-case, and the identical specimen, which proved to be *Tabanus bovinus*, Linn. and De Geer, together with its larva and chrysalis, are figured in plate xii. of the 'Mémoires' of De Geer, referred to at p. 29, *ante*, from which my figure at p. 25 is precisely copied.

So far as I am aware, no such excellent observation of transformation of this species has been taken since that of M. De Geer, and it is from his information (acknowledged or *not*, as the case may be, to its distinguished source) that details of the life-history are usually given.

*The females* are noted by Dr. Brauer (see reference, p. 28) as swarming about horses, cattle, and deer; *the males* soaring in woodlands and on somewhat elevated meadow-ground near water, not at the summit of mountains, especially in close sultry weather, in sunshine after rainstorms, or in early morning.

*Short descriptions of some of the species named in list given at p. 25:—*



Autumnal Breeze Fly  
(after Railliet).

Of the other Gad Flies which are troublesome in this country (mentioned at p. 25), the *Tabanus autumnalis* (the Autumnal Gad Fly, or Breeze Fly) is one of the most noticeable.

This is a rather smaller and much greyer fly than the *bovinus*, being not quite four-fifths of an inch in length. The eyes are very dark, black, or partly grey, *without* cross-bands. *The thorax black-brown or grey above*, with five grey stripes (see figure accompanying). The

abdomen above of a greyish red-brown in the male, black in the female; in both male and female with three rows of white or white-grey spots. The central row triangular; the rows (one on each side of the central stripe) of oval usually white spots placed slantingly from the inner and foremost to the outer and hindmost edge of each spot.

*Tabanus bromius*, sometimes known as the "Noisy Breeze Fly," much resembles *autumnalis* in its general colouring. Like it, *bromius* is of a greyish tint, and has five grey stripes along the thorax, but rather more noticeable; also it has three stripes along the abdomen, similarly of a central row of triangular spots, and two slanting side rows. In regular course the central row is whitish, the side rows yellowish; and this, together with the side of some of the foremost segments in the male being more or less of an orange colour, and occasionally something of the same tint in the female, gives the fly more of a greyish yellow colour than *autumnalis*; also it is somewhat hairy. The main difference, however, is in size; *bromius* being only about half an inch long, and *autumnalis* about four-fifths of an inch.

*Tabanus cognatus*, Löw (= *T. glaucopsis*, Meig.), has eyes with two or three purple bands, the ground colour partly grey and green in the male, green in the female.

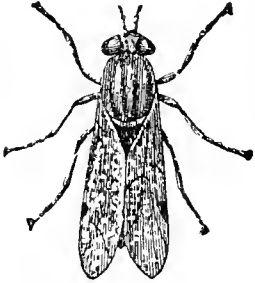
The length of the fly is three-fifths of an inch or rather more. The thorax grey, but bright black on the back, with five pale stripes. Abdomen may be generally described as black, with the hinder edges of the segments yellow and with a middle stripe, on each side of which is a stripe of pale yellow (in the female the middle stripe is formed of grey) triangular spots.

The *cognatus* mentioned above is considered by Dr. Brauer to be only a variety of the *glaucopsis* species; in this *cognatus* (noted by Brauer) the thorax is of a darker grey, and the ground colour of the abdomen dark-red brown, or chestnut brown to the fifth segment; in the female the red-brown ground colour sometimes extends to the sides of the second segment observably, otherwise the segments black, with smaller and greyer stripe along the centre, and pale yellow or orange isolated round side spots.

Subgenus *Atylotus*. *A. fulvus*, Meigen. The "Tawny Breeze Fly"; "Golden Yellow-felted and Orange-powdered kind." This kind is remarkable for its hairy or felted appearance. The length is little more than half an inch; the thorax is strikingly clothed with golden yellow hairs; the abdomen has a dark stripe, but is of a general reddish-yellow colour, and the hair entirely of a golden colour.

The eyes of the male with thick and long yellow grey hair, commonly without stripes; of the female pale olive green, with many black, round, bright points, and a fine sloping darker line.

Of the two other very troublesome Breeze Flies of distinct genera to the above, one is the very common *Hæmatopota pluvialis* (the Small Rain Breeze Fly, or Horse Breeze Fly), which especially harasses animals in stormy weather in summer. This is a little, somewhat straight-sided fly, not quite half an inch in length; the males blackish grey, the females whitish grey, and both sexes much covered with whitish hair.

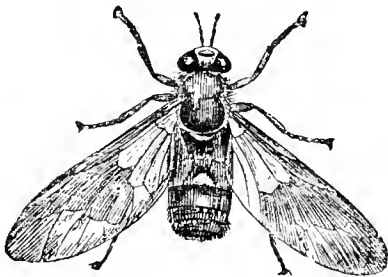


Small Rain Breeze Fly; magnified. After Railliet.

The eyes (when living) green above, purple below, with bluish stripes, or one coloured with stripes. The wings grey, and covered with little pale markings of short narrow stripes forming straight or curved lines, or even parts of broken circles, in all directions. When at rest the wings are placed like a roof over the abdomen.

This species is noted by Dr. Taschenberg as "an extraordinarily troublesome Breeze Fly." Dr. Rudolph Schiner notes the flies as numerous by roads and paths, and on hot days attacking the draught animals, especially horses. Also as being always at hand near water in the height of summer, and annoying bathers, and being so persevering in their attacks that they can be seized by the fingers without their flying away. The early stages appear to be still unknown.

Genus *Chrysops*. *Chrysops cæcutiens*, Linn. "Small Blinding Breeze Fly." Eyes golden green with purple spots, and hind border, or stripe; has distinct ocelli (that is, little speck-like eyes on the top of the head), three in number; and the antennæ (horns) are longer than the breadth of the head, but without a crescent-shaped notch at the base. Wings when at rest expanded, as shown in accompanying figure, to being about half open. Length from a third to two-fifths of an inch.



Small Blinding Breeze Fly; magnified. After Railliet.

General colour black in the male, but browner in the female, with a yellow band across the upper side of the base of the abdomen, bearing in the middle a dark marking

somewhat in the shape of a capital X, the centre of the upper part (that is, the part nearest the fore body) entirely dark; *sometimes* the male also has a similar mark on a yellow band. *Wings* in the male almost entirely black or blackish brown; in the female somewhat lighter or occasionally lighter, with two large pale spaces, dividing the dark part into three patches; one at the tip, a much larger one across the wing beyond the centre, and a smaller one at the base of the wing.

Of this kind Dr. Schiner notes: Metamorphosis unknown; according to Fabricius they live in larval condition in the earth. The flies are often found near water in great numbers, and cause much annoyance to men and animals by their persevering attacks. (Schiner, 'Fauna Austriaca: Die Fliegen Diptera,' vol. i., p. 40.)

To those who have not occasion or any reason for desiring to identify the special kinds of Gad or Breeze Flies, by which themselves or their horses and cattle are tormented, the foregoing description may appear quite unnecessarily minute; but from the enquiries which are sent me yearly as to the name and nature of specimens of these obnoxious pests forwarded, I believe that a sufficient note of their characteristics to enable their "victims" (so to say) to make out (with the help of a hand magnifier) what is doing the mischief, would be of use as well as interest.

*The following short note of a few of the most important points may help observers in identification.*

1 & 2.—The two first named, *Tabanus bovinus* and *T. suleticus*, both popularly known as Great Gad Flies, may be known by their great size, being as much as from four-fifths to over an inch in length of body, and have much red brown, yellow brown, and black in their colouring. The eyes (the large bodies on each side of the front of the head) *are without stripes or spots.*

3.—*Tabanus autumnalis*, "Autumn Gad Fly," is next in size to the above, being not quite four-fifths of an inch in length, and is a greyer fly. The eyes dark, without cross bands.

4.—*Tabanus bromius*, the Noisy Breeze or Gad Fly, is also greyish, but smaller than the above, being only about half an inch long, and the eyes have a purple cross stripe.

5.—*Tabanus cognatus*, Löw. = *T. glaucopsis*, Meigen, is about three-fifths of an inch or more in length, with often a good deal of yellow marking on the abdomen. Eyes with *two or three* purple bands.

6.—*Atylotus fulvus*, "Tawny Breeze Fly," or "Golden Yellow-

felted," and "Orange-powdered" kind, noticeable by its hairy or even felted appearance. Eyes of the male with thick and *long yellow-grey hair*, commonly without stripes; of the female pale olive green, with black round bright spots.

7.—*Hamatopota pluvialis* (Panz.), Small Rain Breeze or Horse Fly. A little greyish fly, hardly half an inch long. Eyes, *when living, green above, purple below, with bluish stripe*, or one-coloured with stripes. Wings with numerous little pale variously shaped marks.

8.—*Chrysops cæcutiens*, "Small Blinding Breeze Fly." Length about a third to two-fifths of an inch. Eyes golden green with *purple spots*, and hind border or stripe; also has three *distinct ocelli*, that is, little *speck-like* eyes on the top of the head (a very distinguishing mark); wings when at rest expanded to being about half open (see figure, p. 32).

It is of some practical service to be able to distinguish the above mentioned kinds of flies, as there is some difference in the localities which they chiefly frequent; also between the appearance of the harmless males and the blood-sucking females, and, when alive, or at least quite fresh, the colouring or marking of the great eyes which occupy much of the head, will be found to be a great help in identification. By looking at the above list, it will be seen that in some kinds the eyes are *entirely of one colour*, in some they are *striped*, and in a few they are *spotted*.

PREVENTION AND REMEDIES.—In the first-rate Bulletin (No. 5, New Series, p. 63) of the U.S.A. Department of Agriculture, it is mentioned with regard to these kinds of flies that, "as we have unfortunately no certain means of repelling them from cattle [horses, of course, to be understood also, E. A. O.] so as to prevent the bites, which is the only thing we need fear from them, a description of remedies is unnecessary."

But still, observation of localities chosen for, or avoided by, the flies as places of annoyance might save some trouble.

The small Horse Fly is especially noted as "at hand near water in the height of summer," also as being numerous by roads and paths, and attacking animals on hot days.

The yellow-marked little Blinding Breeze Flies are also often to be found near water in great numbers, and it was an interesting remark sent from a contributor near Lymington, Hants, apparently referring to the above kind, but possibly including all the Gad Flies of the New Forest, *certainly* upwards of twelve species, that,



“It is curious how our forest ponies go on to the top of the rising ground where there is a breath of wind,” to protect “themselves out in the full sun, for the flies don’t like the wind, and are always most troublesome in sheltered places.”

Somewhat similarly to the above observation, Dr. Brauer notes some of the flies being frequenters of raised meadow ground, though not the summits of mountains.

Of the Great Ox Gad Fly (*Tabanus bovinus*), we well know that the flies torment cattle, and the grubs are to be found feeding beneath the surface in pasture land. The localities of other larvæ are recorded as being very various; they may be in wholly dry ground, as a corn field for instance, in pasture land as before noticed, in damp earth, or under decaying vegetable matter in damp places, or as swimming about in numbers in water, and also to be found in accumulations of various kinds of fly grubs in leaves, &c., over mud.

Of *available methods of prevention*, some which are recommended keep the flies off, either by giving a slight protection, or by their continual movement. One of these arrangements is a net thrown over the animal, the edge being bordered by a fringe of twine, which by its perpetual movement keeps away attack. Sometimes the fringe alone is used, this being fastened to the reins on each side, and sometimes a bit of cloth tied over the head with a fringe hanging down over the eyes is employed.

A sample of this kind of headgear, which I was favoured with by Messrs. Hart, of Calcutta (Vet. Surgeons to the Viceroy and Governor General of India), as being of great service to keep off the virulent attacks of House Flies (*Musca domestica*), otherwise coming in legions to infest the eyes of the horses, would in all probability answer equally in the present case, so far as the head was concerned. The head-dress was simply a fringe about thirteen inches long by nine and a half deep, and was formed of about seventy-six hanging strands of white cord, each strand about an eighth of an inch across. These were secured to a heading about an inch in width, which, though very firm, and thick and durable, was quite flexible, so as not to hurt the horse, and even when placed experimentally on the human skin, was no annoyance when placed on the forehead for the fringe to hang over the eyes.

A loop was left at one end of the fringe, and two ends at the other, to secure the apparatus in its place, and each strand of the fringe was *not cut* at the end (which would have allowed it to become “fuzzy”), but the twine was doubled up on itself so as to

make each strand of it a double firm-ended piece. Of this Dr. Spooner mentioned, regarding *fly prevention*, the close eye fringe is all that is required if the owner will look after it, and *keep it clean*, and in proper order.

Twigs and branches of leaves, which are so very often placed at horses heads to keep off flies in hot weather, might be much more used, and also fastened to other parts of the harness with advantage. The constant movement disturbs flies, and the scent of some leaves (as Walnut leaves for instance), if occasionally rubbed a little to give out the perfume, might act as a deterrent.

There is often a difficulty as to applying chemical dressings to riding or carriage horses, on account of the unpleasantness of the scent, likewise the soiling of the coats or the harness of the animals. But looking at the beneficial effects of weak phenyle, lightly rubbed on whatever part of the animal it is wished to protect; also, that of the following application in allowing cattle to rest in peace in the meadows from all kinds of fly attack (as well as that of Warble Fly):—"4 oz. flowers of sulphur, 1 gill spirits of tar, 1 quart train-oil; to be mixed well together, and applied once a week along each side of the spine of the animal"; also, thirdly, the apparently serviceable (though not directly reported) use of McDougall's dip or smear, something might be done by way of protection, during the season when many working animals would be much the better for it.

**Horse Warble Fly.** ? *Hypoderma Loiseti*, Loiset = ? *Ædemagena equi*; ? *Hypoderma equi*.\*

In the paper following at p. 39, "Notes on the Ox Warble Fly," the *Hypoderma bovis* will be found given in careful detail, but besides the injury that is caused to cattle by this infestation, horses also are occasionally so much troubled by an attack of a very similar nature, that, as the *entomological history* does not appear as yet (so far as I am aware) to be fully known, it seems desirable to mention it as a "horse attack," under a separate heading.

The names noted above with notes of interrogation prefixed give scientific appellations which have been *provisionally* bestowed

\* Publications on Horse Warble attack are:—Loiset; Note sur l'æstre cuticule du cheval, Mem. Soc. Veter. d. l. Manche et du Calvados, 9, 197, 1844 (*Ædemagena equi*); Joly, Recherche s. l. æstre, H. Loiset, p. 241, 1846; and Joly, Comptes rendus d. l. Academie, p. 86 (*Hypoderma equi*, die larve, 88), Paris, 1849.

on the infestation, and, since the date of their publication, I have once (in 1894) had an observation sent me, of an attack differing so much in the *numerous presence* of warbles from the very small amount which is considered characteristic of Horse Warble infestation, that it suggests the *H. bovis* (our Ox Warble Fly) may be also a cause of mischief.

The attack is certainly of a *Hypoderma*, that is, of a Warble Fly of the genus to which our *H. bovis* belongs, but as yet no fly appears to have been developed under circumstances available for identification, nor (so far as I know) have any *technical* descriptions of the maggot, excepting that of Dr. Brauer,\* been published, which I do not give here, as to it the author adds the following remark: "From the description it will be seen that the larva may be judged to be in the second stage, in which it does not appear to show any especial difference from others of the genus. To distinguish whether it is the larva of the *Hypoderma bovis* or of another kind, we must know the third stage."—(F. B.)

*For all practical purposes, however, it seems enough to know that the maggot strongly resembles that of the Ox Warble Fly, which is very generally known, and will be found by those who wish for minute observations described and figured, and also in external and internal detail in the following article, with means of prevention and remedy.*

The specimens which I have received myself do not afford further advance, and the only flies which were hatched were merely reported to be rather longer than the Ox Warble Fly, but as they shrivelled so that unfortunately the observer did not consider them worth sending, we should be very much the better for some more well-observed information.

*In regard to the very few warbles noticed on one animal.* In the year 1886 (the only year in which any special amount of enquiries have been sent to me regarding this attack), of nine communications forwarded, including one from Dr. W. Fream, and another from Mr. Hy. Thompson (Aspatria, Cumberland), there were six that mentioned presence of only one maggot, only two mentioned three maggots, and one "three or four" being present.

Of these Mr. Thompson mentioned with regard to one larva sent: "This is the third from the same animal, which is very peculiar, as you seldom see them." Dr. W. Fream, who entomologically as well as agriculturally would be acquainted with attacks

\* 'Monographie der *Æstriden*,' von Friedrich Brauer, Wien, pp. 137, 138. Also quoted *in extenso* (trans.) in my Annual Report for 1886, p. 90, E. A. O.

of this nature, wrote me: "Regarding your query about warbles in the horse, I have only known one case." Mr. R. Stratton, of the Duffryn, Newport, Mon., amongst other information with which he kindly favoured me about this attack, mentioned: "You seldom find more than one on a horse." Messrs. H. & C. Hatton, of the Barton Tannery, Hereford, noted that they had known a few instances of horses being attacked by Warble Fly, but had never received a hide showing the effects. Mr. John Dalton, also of the Tannery, Wigton, Cumberland, mentioned: "Of the horse-hides I get, I should say not one in fifty is warbled, and the appearance of the hides when tanned shows that warbles in the horse are of rare occurrence; *there is no cicatrix, as in cattle*, and when a warble does exist, it is a single one, and never, so far as I have seen, in numbers . . . I never remember seeing more than one warble hole in a horse-hide; I mean in any single hide."

*The locality of attack* was noted as being not only along the back, as commonly occurs in the case of warbles on cattle, but also on neck, flank, and quarter. Also, though the numbers of warbles were very few, both by reason of the very small proportion of horses attacked, and also the very small presence on the attacked animals, yet the mischief caused was (or had a power of being) much more serious than is caused by any one warble in cattle. As an example, Mr. Thompson, before referred to, wrote me that in the case of a warble under his treatment on the neck of a horse, that the swelling caused was diffused and extensive (nearly all the length of the shoulder-blade). Points also as to duration of the maggot attack, date of opening of the warble, and size of orifice, appeared not as well known as in the case of Ox Warble attack.

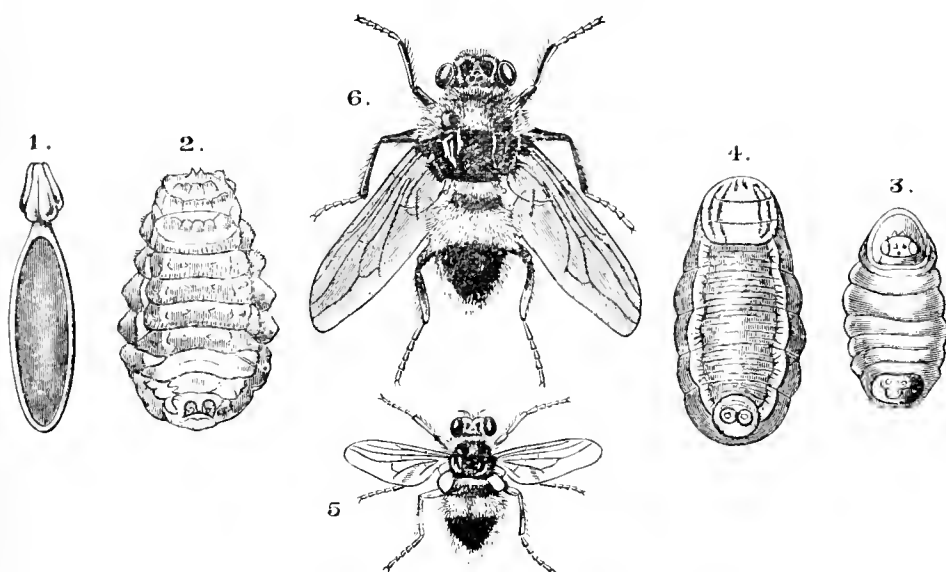
The above notes refer to communications sent in 1886, and since that date no observations worth record have been sent me, excepting that in 1894 I had information from a contributor at Cardiff, that in the case of a mare which he had bought in the previous January, without there being any signs of warbles on her, by the middle or end of February there were "at least forty" distributed on the shoulders, back, and quarters. Of these, such as were not squeezed out, were, my informant wrote, treated with a mercurial application, which destroyed them all in a week or ten days.

In the above remarks I give the information sent me in the course of inquiries, to which I attended to the best of my power (although not in the scope of my regular work), and, leaving the

veterinary points and practical treatment in the hands of those better qualified to deal with it; but irrespective of the immediately *practical view* of the attack, it would be of great entomological interest to have observations by which the fly might be identified and we might find whether one or more species are present.

## CATTLE.

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



*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, magnified.

Warble attack is well-known by farmers and cattle owners in the form of swellings or “bumps” on the backs of cattle, which, when at maturity, or “ripe,” as it is termed, open in the middle, and show within what looks like a black head, but which is really formed of two breathing spots placed in the tail end of the maggot, which lies, head end downwards, within the boil-like swelling. There it feeds by drawing in the filthy putrid fluid which the irritation caused by its presence gives rise to, and, when full grown, it forces itself out at the “warble-hole” and falls to the ground, where it buries itself, and in due time goes through its changes to a Warble Fly, to continue the infestation.

The above is the portion of the attack most commonly noticed, but the enormous yearly losses from injury by the maggot to condition of cattle, and by depreciation of hides, make it desirable that all the details of the life-history of the pest should be fully known, and in the following pages I have tried to give the account clearly.

It is about two hundred years ago since the first *noticeably recorded* observations were made on what we now know as the Warble Fly; and in 1797 a paper by Bracy Clark (published in the *Trans. of the Linnæan Soc. of London*, vol. iii.) was the foundation which long served as the centre of practical knowledge for farm use.

Since then many valuable observations were given by eminent writers, British and Continental, but these were not always easily accessible, and in many cases were simply entomological. Therefore, as it was greatly needed that some plain information, in a form accessible for reference regarding the life-history of this Ox Warble Fly, with practical means for prevention of the attack, should be placed at the disposal of those interested in the subject, I undertook in 1884, whilst Consulting Entomologist of the Royal Agricultural Society, to endeavour to gain trustworthy information.

My applications were widely responded to by leading cattle owners, farmers, also by heads of hide and tanning firms, and of cattle and butchers associations, and, with regard to special points of investigation, I was greatly helped by co-operation of some of our leading veterinary surgeons. Specimens were sent me, and detailed information forwarded, until the history of every point of the infestation, and its effects on the animal, and cheap and practicable means of prevention, and also returns of losses, calculated or estimated as circumstances allowed, were furnished, and the results of the investigation being published yearly, afforded from our *own* qualified contributors a reliable mass of information on the infestation of this one kind—namely, the *Hypoderma bovis*, as it is found and treated in this country.

In the following pages I have arranged the main points of the observations sent me since 1884 under the headings of history of the fly attack; the injury consequent on the infestation to health of animals, and also condition of hides; the means found always serviceable for prevention and remedy when properly applied; statement of amount of damage, from depreciation of hide at per pound, up to yearly estimates; and various points of general interest.

*Description of the Ox Warble Fly.*—The Ox Warble Fly, or Bot Fly, the *Hypoderma bovis* scientifically, is a two-winged fly, of about half an inch to three-fifths of an inch in length, and so banded and marked with long thick differently coloured hair as to be not unlike a Humble Bee.

The head is large and somewhat hemispherical, and has a very small mouth-opening, with rudimentary proboscis, and, their mouths being thus atrophied, appear to be unable to take food; face clothed with whitish or yellowish hairs, the hinder part of the head with blackish hairs. The body between the wings brownish or yellowish before the transverse suture, dull blackish behind it, with four broad, naked, and shining long stripes of a deeper black colour. Scutellum (small portion of the hinder edge of the thorax just before the abdomen) with shining black edge, otherwise with yellow hair. Tufts of whitish yellow hairs under the roots of the wings.

Abdomen usually whitish or yellowish at the base, banded with black across the middle, and yellow or some shade of orange at the tip.\*

Wings large, pale smoky brown, clearer at the tip; alulets (enlargement at the base of the wings) very large, white, with yellow-brown border. Legs black-brown, with feet and some other parts yellow in the female.

*The ovipositor or egg-laying tube* is formed of a kind of telescope-like apparatus of four articles appended to the abdomen of the female, of joints which can be passed within each other. “When it is extended it projects backwards and slightly upwards, and at the end of the last article are three horny appendages, a little curved inwards toward each other, like pincers, between which the eggs pass out.” †

*The eggs* (fig. 1, p. 39) are white, elongated, spindle-shaped, and a little flattened, with a brownish appendage, which appears to be

\* In the case of twenty-five Ox Warble Flies, reared from maggots captured as they left the Warbles, by Mr. A. C. C. Martyn, Agricultural College, Aspatria, of which he sent me observations; with five out of the twenty-five, the terminal portion of the abdomen beyond the transverse black band was *grey*, instead of yellow or orange. A somewhat similar variety is mentioned in the ‘*Monographie der Œstriden*,’ von Friedrich Brauer, p. 127. Here Dr. Brauer mentions that he was indebted to Prof. Löw for the sight of a beautiful variety of this species from Asia Minor. This differed from the ordinary individuals in all the hairs, which are yellow in these, being here of a clear white.

† See ‘*Parasites and Parasitic Diseases*,’ by Prof. L. G. Neumann, translated by Geo. Fleming, C.B., LL.D., &c., p. 47, and figs. p. 49.

used to make the eggs adhere to the hair or to the skin ; they are one millimetre and a quarter long (that is to say, rather more than half a line in length).

*With regard to the method of egg-laying*, it is stated (see work quoted below, p. 50) that when the fly is about to deposit its eggs it flutters over the back of the ox for a minute or two, then suddenly drops, deposits an egg on the skin, rises in the air, again flutters, descends with the like rapidity as before, and drops another egg,—and that this performance is repeated ten or twelve times in half an hour. In the same work an instance is given where, on alarm having been caused by a Warble Fly, the insect was captured in the very act of laying, with the egg still in the pincers of its ovipositor, and was identified by Dr. Brauer as the female of the *Hypoderma bovis*.

The point of where the egg is deposited is very important for practical considerations, and there has been a great deal of very vague speculation on the matter, but we *know* as matter of proof that the ovipositor is not suited for purposes of boring, also that in the different directions of the microscopic channel communicating between the embryo larva beneath the hide with the minute orifice on the surface, the channel is to be found so curved that it could not possibly have been formed by the ovipositor having been inserted.

In the course of my own examinations, by making sections of hide in the early stage of infestation, I was able to trace the course of the maggot channels (*then* no wider than a hair passing from the minute then bloody maggot cell beneath the surface) by giving a light pressure. Thus the blood pressed along the gallery marked its course until it appeared as a very little speck on the outside of the hide, showing the course of the channel clearly. The channels (of course, as examined microscopically) were not a smooth boring, but merely a passage, apparently gnawed or torn by the mouth forks of the young maggot, and varied in direction. They were sometimes slanting, or taking a straight course ; or again, so completely curved at the upper part (going a little way along just under the cuticle, and then turning and going right down to the embryo maggot-cell just below the hide), that it appeared impossible in any case, and demonstrably so with regard to the curved channel, that the passage could have been formed by the perforation of the telescope-jointed ovipositor,\* set with a row of hairs or bristles standing forward on the edge of each of the

\* See much magnified figure, 'Parasites and Parasitic Disease,' p. 49, referred to, *ante*, p. 41.



three upper joints, preceding the fourth with its kind of pincer-like termination for depositing the egg.

In one instance in which the maggot tunnel had only gone about half way through the hide, I found at the bottom of the passage a small body, which, though crushed in taking the section, was still obviously the larva.

*The first observation of young warble infestation beneath the hide* was sent me on November 12th, 1884, by Messrs. C. & H. Hatton, Barton Tannery, Hereford, with the note that they considered it showed first symptoms of warble attack. The piece of hide sent was a cutting from a yearling skin about twelve inches by four inches, 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 passed up through the hide to the surface. The course of this channel was easily traced (as above mentioned) 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. This passage of blood or matter appeared to have been going on previously in the natural course of things, for I found some specks of dried matter outside on the hide.

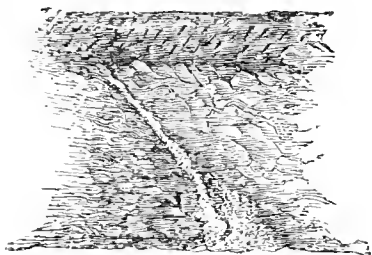
*First observations of open warble swellings.* Careful watch was kept for me both on living cattle and on newly flayed hides in various localities throughout the winter of 1885-1886, in order to secure the date of first observation of appearance of the warble in its open condition, and the first notice of advance on condition of a mere hair-like channel through the hide was sent me on Jan. 27th, 1886, in specimens sent me by Mr. John Dalton, Wigton, Cumberland. The first *general observation* of the appearance of the warble, as a swelling or in open condition, began about the middle of February.

Amongst these, on February 14th, Mr. E. E. McBride wrote from Glendonagh, Midleton, Co. Cork, that "the lumps were increasing in number and size on his cattle"; and on the same day Mr. Byrd, Spurstow Hall, Tarporley, Cheshire, after examination of the swellings on the cattle, mentioned that "some

appeared to be soft lumps resembling a soft 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.* †

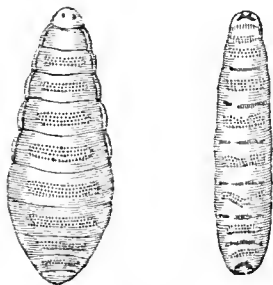
*In the earliest of the above mentioned specimens of infested hide forwarded to me, I found the first appearance of the warble as a perforated swelling, with the maggot of a clearly distinguishable size within.*



Maggot channel, much magnified.

*The channel or passage 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 one twelfth of an inch (that is, one line) in width, not as yet oval, but straightish, and somewhat worm-like in shape (see figs. from life). When older they became rather enlarged towards the mouth-end, so as 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 prickles, placed for the most part in alternate, very narrow, and broader stripes.*



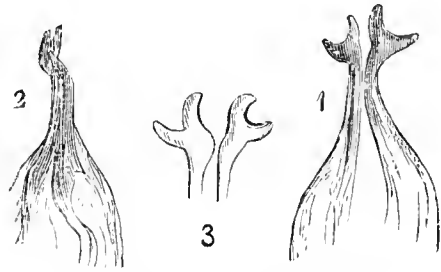
Maggots, club-shaped and worm-shaped, magnified.

*The young worm-like maggot possesses (apparently as instruments for tearing out food) 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, these processes being attached by the other ends to the membranes or tissues forming the gullet or internal sac of the maggot. These forks are of excessive minuteness,*

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

† For detailed returns of amount of attack to "classes" of hides of specified weight and description, and also of consequent reduction of value, see returns further on.

and I have never found them in any but very young maggots. The material is chitinous, or horny, and the possession by the *young worm-like maggot* of this apparatus for cutting or tearing is of considerable interest in connection with the first minute track down the hide, to the embryo maggot below, having been to all appearance cut or torn.



Mouth-forks of young maggot, much magnified.

*The various successive forms and conditions of maggot-life* as observed in this country, in the case of what is most especially the “British Ox Warble Fly,” the *Hypoderma bovis* of De Geer, are as follows.

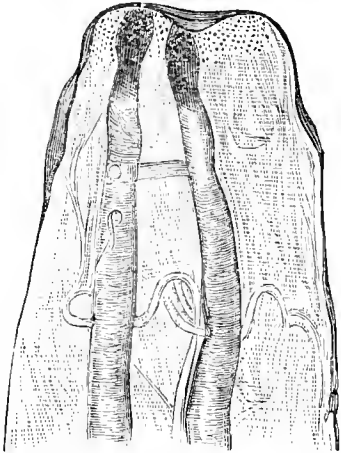
The first consists of the passage of the worm-like larva to the under side of the hide, where, at this stage, in the small inflamed patches or swellings it lies free, that is to say, not inclosed in a cell or thickened tissue, merely in a small bloody sore, in which by the colour of its contents it may 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 (see preceding figs.).\*

*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);

\* At the above stages the power of inflation of the maggots by absorption of fluid is very remarkable. In my own experiments I found that by placing them in glycerine and water (in which they would live for as much as eighty hours) they became inflated until they were shiny almost without trace of the segments, and so hard that it was almost impossible to compress them with the fingers. I had not the opportunity of seeing whether this inflation takes place in the *living* hide, but, if such is the case, as the maggots would thus form what may be called “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; this power, whether used instinctively or automatically, might be a great help in forcing the little maggot *tail uppermost* (as we find it) to the surface of the hide, *from* which it had previously torn its way *head foremost* downwards.—E. A. O.

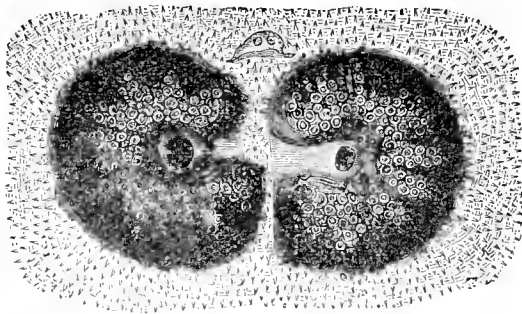
and, on March 5th, I found for the first time a distinct pellicle or skin-like membrane covering the walls of the perforation, or passage, and continuous with the lining of the maggot-cell below.

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.



Breathing-tubes of maggot, magnified.

From the earliest stages which I had opportunity of observing up to date of change mentioned in preceding paragraph, the general form of the tracheæ and the spiracles at their extremities (that is, of the breathing-tubes and the breathing apparatus at their tips, see above figure) continued to be that of a pair of long tubes, each ending in a short, horny, somewhat bent cylindrical, or partially cylindrical, tube, covered at the end with round or oval discs, through which the air is drawn in. \*



Spiracles fully developed, end view, magnified.

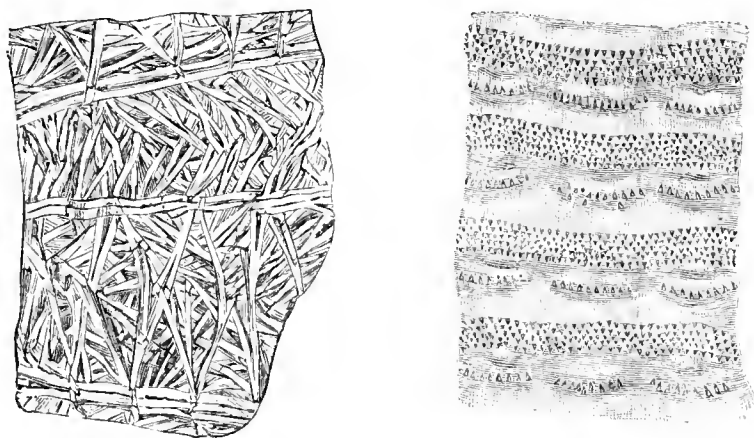
*At the period, however, of its moult to its final condition a change takes place respectively in the nature, or in the amount of development, of nearly the whole of both the internal and external structure*

\* Figures of the apparatus, taken from my own dissections, greatly magnified, are given in various of my Annual Reports, notably in my Eighteenth, p. viii. of Appendix, but these minute microscopic details are not needed here.

of the maggot. The hard "tips," serviceable for forcing a passage up the hide, are no longer needed, and they are exchanged for a broader form; 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 (figured at p. 46, magnified), which are what are to be seen as two little black dots at the tail-end of the maggot in the open warble.\*

The changes of condition appeared to be rapidly gone through, and it was when the maggot had 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



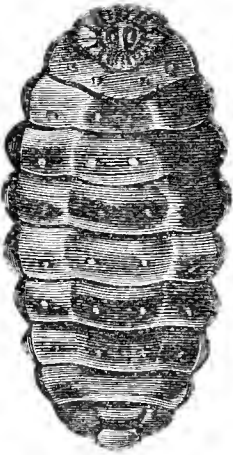
Muscles within skin of maggot, and prickles outside skin of maggot. much magnified.

skin of the maggot becomes furnished within with a powerful coat of muscles (see figure), 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

\* In my own observations I was fortunate enough to see a maggot in the very act of moulting off its first form of spiracles, and to be able to secure the specimen, which I still preserve for microscopic use, and also had carefully figured, showing the early as well as the adult form not quite completely separated.

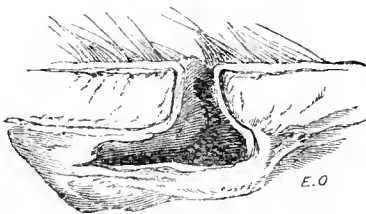
the hand, and to play an important part by its locomotive powers in its cell, and in the effect on the tissues caused thereby. The visceral contents are now thick, and obviously formed of the filthy matter which is caused by the perpetual irritation of the suction of the mouth-end of the maggot at the bottom of the sac. It is also now furnished with a small curved caudal aperture, placed nearly between the spiracles, from which some slight amount of discharge of contents can take place.

The accompanying figure, in which the maggot is represented as in its natural position (tail end uppermost), shows it 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 at p. 47) of minute prickles.



Maggot, much magnified.

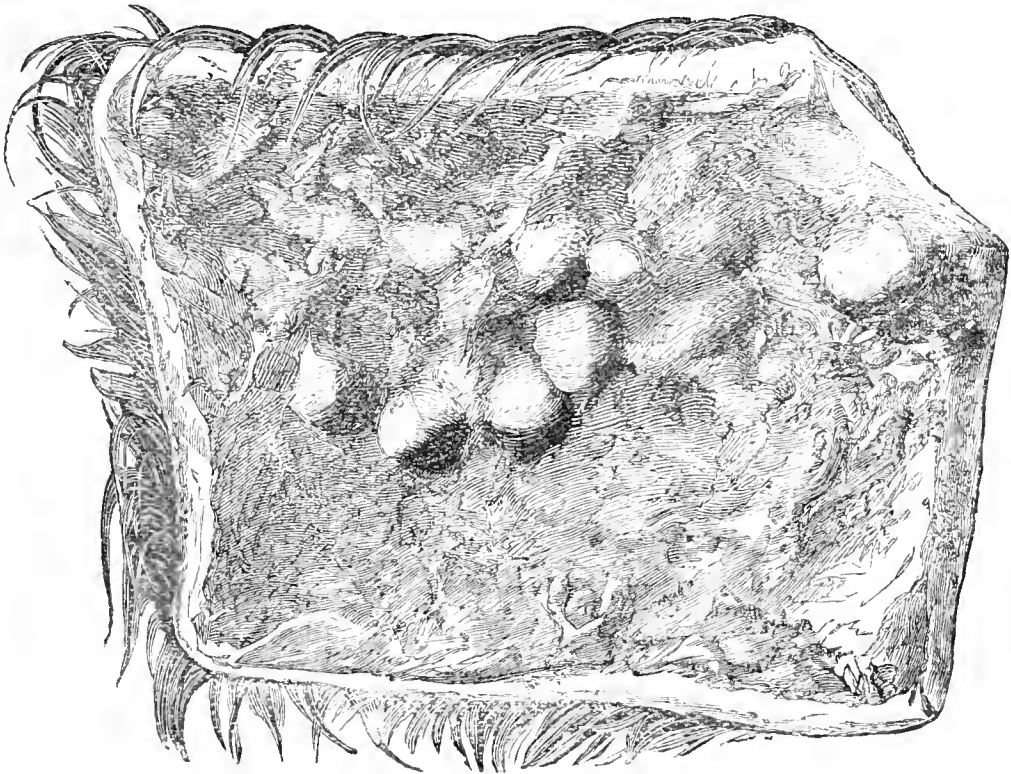
*The above are the main differences connected with successive moults up to the fully-developed form of the maggot, or larva; and following on these alterations in its structure, and especially on the power of keeping up a constant irritation by means of the muscular expansion and contraction of its prickly skin, we find the lining membrane of the cell increasing in thickness until it becomes well defined as a tough wall round the perforation, or warble-hole, continuous with the upper part of the cell.*



Section of warble-cell, after soaking in water.

The figure shows a warble-cell, drawn in section, after soaking in water, so that it is slightly magnified, and the lining membrane, or kind of false skin, which has formed round the warble-hole, and which runs partly down into the cell below, is clearly observable. At this stage, as long as the *host animal is alive*, the warble is noticeable amongst the hair of the hide as a good-sized lump, with an opening in the middle, in which the tail of the maggot, with its two large dark breathing-pores, is visible. When the hide is removed, as the pressure *from beneath ceases*, the maggot is instead much more to be

found in the cell beneath the hide, and the *then covering under-tissue* is often of such a mere film, that the shape and segments of the maggot may be clearly seen.



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

It is just below the under surface of the hide that the maggot carries on its operations,\* at first (as previously noticed, pp. 43, 45) in the little bloody sore which it has torn in its earliest life, and afterwards in the chamber (as figured at p. 48, extended *when removed from the hide*), where it rests with its feeding-end, which cannot be called a head, drawing in the foul matter caused by its own irritating presence.

When the maggot has gained the condition mentioned above, it is of the shape figured at p. 39, and magnified about four times at p. 48, and is from rather more than one line less, to rather more than one line more, than an inch in length, and it undergoes no

\* The following is the technical description, as given in 'Parasites and Parasitic Disease' (previously referred to), p. 54:—"Larval existence is passed beneath the skin of the host, in the subcutaneous connective tissue, in the panniculus-carnosus muscle, or underneath aponeuroses. In the earlier period no irritation is remarked around the parasites; but when spring arrives, the presence of the larva is made manifest externally by tumours."—(L. G. N. and G. F.)

further larval change. When 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 operation; but the orifice can be squeezed somewhat larger, and the maggot is compressible, and is further helped by its roughened skin and by its ringed shape, which prevent it slipping back into its former hole.

The larval exit from the warble has long been recorded as taking place early in the morning between six and seven o'clock. But speaking more generally, in the case of some observations made by Mr. A. C. C. Martyn (previously referred to, p. 41), 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 eleven days longer in development than the others), and the flies were not such fine specimens, nor so large or well marked as the others.

*The ordinary duration of the pupal condition* is given in German observations by Dr. E. L. Taschenberg as being twenty-six to thirty days.

*When the maggot has fallen to the ground* it creeps to some shelter, as under a stone or a clod, or (it is stated) goes down two or three inches into the ground, or otherwise shelters itself for the chrysalis change. In my own observations I have found that the maggot (though legless) could drag itself along at a rate on a smooth surface of three times its own length in two minutes.

For appearance in chrysalis state, see figure at p. 39. The external observable change consists in the coat of the maggot hardening and turning to a dark brown or blackish colour, otherwise the maggot and chrysalis much resemble each other.

Within this hardened skin the fly forms, as shown at figure 6, p. 39, and it takes flight, to commence a new series of trouble and mischief; but, so far as we know, regularly preferring to select for



its operations the cattle in its quite immediate neighbourhood. For description of fly, see p. 41 preceding.

OBSERVATIONS OF INJURY TO HEALTH AND CONDITION OF CATTLE, AND ALSO OF DAMAGE TO HIDES CAUSED BY OX WARBLE FLY INFESTATION.

*The preceding observations* are an attempt to give as shortly as possible, consistently with sufficient detail to be of use, a continuous account of the life-history of the Ox Warble Fly (*Hypoderma bovis*), from the egg onward to full development, with especial observations of the method of life of the maggot, and effects of its presence in the hide.

*In the following pages* I give, from information placed in my hands by cattle owners, chairmen and managers of cattle and hide associations, and others scientifically, as well as practically, interested in the subject, some notes of the extent of the losses which we are suffering yearly from warble attack, classed under headings of "Injury to Health and Condition of Cattle," "Licked Beef and Jelly caused by Warble," and "Losses by Damage to Hides," preceded by the following *general estimate*.

*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 from 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 deal of the amount may be fairly approximated, in considerations of dairy losses, and to a great degree calculated out by returns of loss per stone, or per carcase, on damaged animals, and losses on hide.

INJURY TO HEALTH AND CONDITION OF CATTLE.

The great yearly loss 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.

Amongst these may be specially mentioned losses to fattening beasts; in the words of Mr. R. Stratton, a most careful observer, written during hot weather in August, 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.

The following note, from personal observations by Mr. D. Byrd, Spurstow Hall, Tarporley, Cheshire, 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,' *i. e.* 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 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  $\frac{3}{4}$  cwt. of cheese per cow per annum. Half a hundred-weight, or  $12\frac{1}{2}$  per cent., of milk less in a dairy making 4 cwt. at 70s., comes to 35s.; but  $12\frac{1}{2}$  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."

*Loss on milk.*—The only precise calculation I know of on the subject is thus referred to by the late Prof. Riley, 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 to 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.”\*

The following observations, forwarded to me in 1888, are just a few examples of the communications sent me regarding serious injury, in some cases ending in death, occurring from warble attack; and as happily attack does not commonly run on to this extreme condition, I quote them verbatim, with my contributors names.

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:—

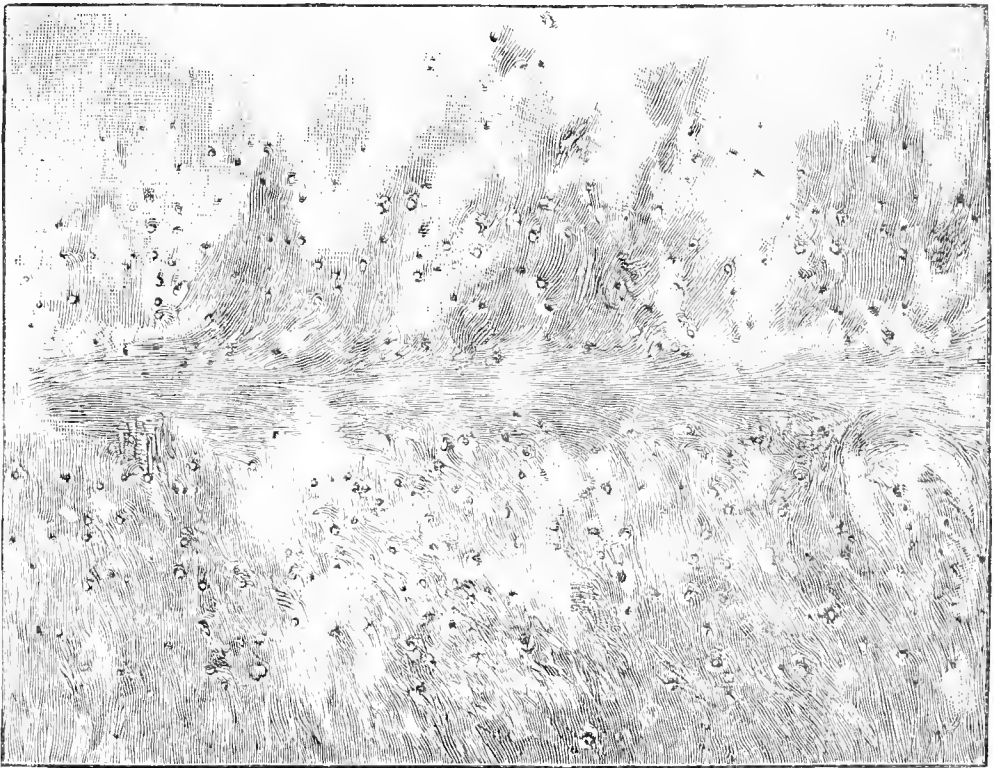
“I live where it is all grazing farms, and the good work has not begun yet. Several of the cattle which were grazed on our highest land did very badly through the winter, and I could only keep them up with very good feeding. These turned out to be totally covered with warbles. Some of the lumps when 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.”

\* See ‘Insect Life,’ Periodical Bulletin of U.S.A. Dept. of Agriculture, vol. ii. No. 5, p. 158. Washington, U.S.A. 1889.

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

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

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



Piece of yearling skin with 402 warble-holes.

“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.”

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 of consequent mortification of the back, the warble-holes were more than 400 in number. The figure, p. 54, giving some idea of this damaged hide (though necessarily in miniature), is from a photograph presented to me by Messrs. R. Parsons & Son, Tanners, East Street, Taunton, of a piece of a yearling skin, 24 inches by 14 inches, containing 402 warble-holes.

#### LICKED BEEF AND JELLY CAUSED BY WARBLE.

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 I was requested to procure information from some *known* authority as to the cause and precise condition of this altered layer, and to give the results in leaflet form for distribution to those interested.

By means of *post mortem* examinations, and specimens and skilled reports forwarded, we were able 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. And in the following notes, which are condensed into as few words as possible (reprinted from my own leaflet) I

give some of the main points of the investigation with the names of the contributors who were good enough to help me appended.

Mr. C. E. Pearson, Wholesale Butcher, Sheffield, stated:—

“I may say that the effect of warbles on the carcase is more serious than can possibly be imagined by the outside appearance of the beast. . . . 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 in some cases to be pared down to the flesh to make the appearance of the animal at all presentable for the market, causing thereby a grievous amount of loss to the butcher. I am speaking from practical experience, killing on an average twenty beasts or more a week.”

Mr. Wing, Hide and Skin Broker, Boston, writes me:—

“There is a jelly or watery substance on the back of the carcase when dressed, on and between the rind or thin skin and the bone of the beast.”

Notes given me from butchers, per favour of Mr. J. McGillivray, Sec. of the Hide Inspection Society, Newcastle-on-Tyne, also mention the loss from having to pare the injured part away,—and also show the special part of the animal, which is known to all cattle owners to be that most affected by warbles, as that beneath which there is most damage,—*viz.*:—“The worst part of it is that it is always ‘licked’ on the most expensive parts, *viz.* the back, which comprises the sirloin and fore-chain. . . . If I knew, I would not buy a ‘licked’ beast, even suppose I could get it at a shilling a stone less,” &c.

On applying to Mr. Hy. Thompson, M.R.C.V.S., of Aspatria, Cumberland, who has long devoted much attention to warble attack, for an exact description of the damage, he replied:—

“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 newly slaughtered carcase of beef, which in twelve or twenty-four hours, when exposed to the air, turns a dirty greenish yellow colour, and thus spoils the beef, having a frothy discharge oozing from the surface, with a soapy-like look.”

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 bucketsful 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."

About the middle of July, Mr. Child forwarded me a mass of this inflamed tissue, or "jelly," obtained from the animal whilst in the process of dressing, so that the material was taken both from the hide and the carcase at the same time, and as warble maggots were present in it the specimen was a very perfect example, because the cause of the evil (namely, the maggots) were there plainly to be seen, as well as the damage they had caused. This mass I forwarded, by his kind permission, to Mr. John Penberthy, Professor of Pathology at the Royal Veterinary College, Camden Town, N.W., requesting him to tell me the nature of the so-called "jelly," and the cause of the diseased condition, to which Prof. Penberthy replied:—"I have made an examination of the 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 warbles. The material is not fit for human consumption. I think it very deleterious to the health and comfort of the affected animal."

On the 19th of July, in reply to my request that he would tell me by what name the diseased tissue should be described, Prof. Penberthy wrote as follows:—"I should call the material inflammatory product in the subcutaneous tissue. Inflammatory product is made up of constituents of blood exuded through vessel-walls which have been damaged. It is allowed by some pathologists that inflammation, too, may excite growth of the cells previously existing in the part. The dark red colouring is most likely 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."

Another very fine specimen for our purpose was sent me by favour of Mr. H. Thompson (before mentioned). This consisted of the whole length of spine,—that is the backbone, flesh, skin and all, cut right out along the centre of the animal after slaughtering. On examination it proved to be only moderately warbled, the number of warbles (twenty-six, including the very small ones) not being more than are often met with; so that whilst the above-mentioned specimen gave example of the completed mischief, this one showed the earlier stage of injury from moderate and not fully-

developed attack. Of this sample, Prof. Penberthy wrote me:—  
 “In a superficies of 450 inches, I found eighteen well-developed and eight very small warbles. There was, however, ample evidence of inflammatory action, and, in a few spots, of inflammatory products. . . . 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.”

To the above notes I add a single one, of many which I have, showing the loss to the cattle owner by waste of food not formed into meat by the warbled beast, as well as deficiency of receipt per stone on the carcase and per pound on the hide. Mr. J. Sparkes, Wearhead, Darlington, wrote me, on the 10th of April, that he had lately sold to a butcher a heifer, which turned out a much lighter weight than was expected from the extra good food. The animal turned out to be badly warbled, and “down the spine frothy, loose, and mattery, or in a sort of jelly,” and some of the beef had to be scraped before sending it out. The loss on hide at 1*d.* per pound would be about 5*s.* on the hide; the loss on beef, the animal being sold by the stone, fell on the owner. This was estimated as at least six stones less than it should have been, and deficiency in receipt on hide and beef was put at 50*s.* to 60*s.*, to which has to be added cost of food spent to no purpose. Mr. Sparkes added, he would take care that this should not occur again, with the help of McDougall’s smear and careful inspection.

*With regard to direct loss in value of the carcase of the animal by beef being what is called “licked.”*—In some able observations with which I was favoured 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 carcasses 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.”

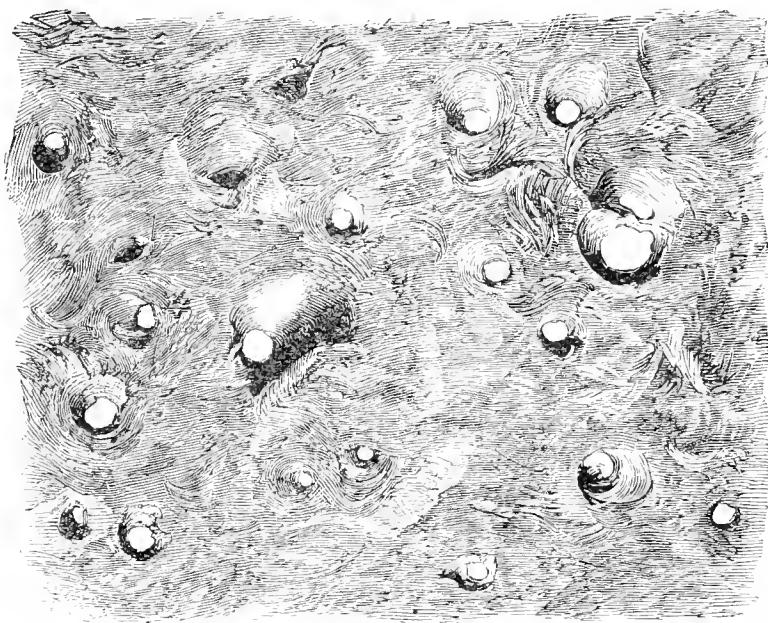
“I think I am right in saying that the depreciation in the value of licked carcasses of beef is from 6*d.* per stone down to 1*d.* per stone, and as the highest figure named comes in fewest number, the average figure for reduction in value should not be taken at more than 2*d.* per stone. Take the average 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.



## LOSSES BY DAMAGE TO WARBLER HIDES.

In the following pages I submit some extracts from the 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 engaged in 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, when I was especially collecting information on Warble Fly attack and its effects.



Portion of inside of tanned warbled hide.

Quoting generally from these,—before giving some tables of more exact details,—the number of hides passing through these markets respectively were from about 30,000 and upwards to three or four times that number in the year—in some instances the numbers exceeded 100,000 in the year, and in two instances amounted respectively to about 130,000 per year, and to near on 150,000.

The estimates of loss per hide at the markets vary from about 2s 6d. to 5s., or sometimes over that sum per warbled hide, and the

average weight of hide from which the calculations, or estimates, are made is (where mentioned) about 65 lb.

The exact proportion of warbled hides is difficult to ascertain, excepting at markets where hides so injured are classed by themselves, but these are given in some cases, and by calculation or estimate the loss at various of the above markets on warbled hides runs in the year reported (or during the four or five months specially known as the Warble months) to sums of respectively £1400; £1500 to £2000; £1800; £2800; and at one of the chief hide centres, where there is careful attention paid to inspection, the loss in the year reported was £15,000. In the return from one town where the amount of cattle slaughtered per week is 700, the proportion of warbled hides during summer and autumn is fully one-third, and the average loss on these is calculated at not less than 5s. per hide.

In 1885 I was favoured by Messrs. Fry & Co., of Birmingham, with tables giving 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 Warble season, *viz.*, February 14th, to the end, September 19th, in 1885. But\* as these tables are too long and elaborate for convenient insertion here, I give the following tabulated abstract, on opposite page.

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. Bull's 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 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 extra-flayed.

\* For these tables printed *in extenso*, as I received them, but which require far too much space to be inserted here at length, the reader is referred to my Annual Report for 1885, and also to the Appendix to Eighteenth Report, facing p. xxxvi.

*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	4½d. to 5¼d.
85 lbs. to 94 lbs. ...	911	4¾d. ,, 5¾d.	138	4¾d. ,, 4¾d.
75 ,, 84 ,, ...	1495	4½d. ,, 5¾d.	306	4d. ,, 4¾d.
65 ,, 74 ,, ...	1789	4d. ,, 4¾d.	541	3½d. ,, 4¾d.
56 ,, 64 ,, ...	1692	3¾d. ,, 4¾d.	497	3½d. ,, 4¾d.
55 lbs. and under...	873	3¾d. ,, 4¾d.	305	3½d. ,, 4¾d.
Heavy cow-hides...	1193	3¾d. ,, 4¾d.	140	3½d. ,, 4d.
Light cow-hides ...	1382	3¾d. ,, 4¾d.	151	3½d. ,, 3¾d.
Totals ...	9956		2146	

The details of the tables, *giving returns in full*, afford a deal of information to those practically interested. Amongst other points they show the different periods in which attack is found 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 is also shown, that *sometimes* at what may be called the height of the Warble season, the number of the warbled hides exceeds that of the sound in some of the classes. On April 25th (of the year of return) entries occur amongst the "65 to 74 lbs.," and "55 lbs. and under" hides, respectively of sales of *42 warbled and 38 sound, and 25 warbled to 9 sound*.

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.

I was also favoured by the following valuable information from Messrs. Richard Markendale & Co., Manchester, and, without overloading my present observations with more of the communications with which I was favoured, this is much too important to be omitted, and was as follows:—

“March 16th, 1889.—Further to yours of January 14th, 1889,

re numbers warbled, and loss of hides passing through this market in one year. We have now 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.”

The above notes from three *great centres* give some idea of the amount of loss that is caused by depreciation of market value from warble attack to hides. But it should also be considered, as was pointed out to me in the course of communication by Messrs. Robert Ramsey & Co., Glasgow, and Mr. Hill, President of the Sheffield Butchers Co., 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.

Where the warbles have been left unattended to until the maggot drops out, the kind of false skin which has formed on the surface of the *warble hole* will remain (more or less) for a long time as a kind of “plug,” preventing perfect healing, and very injurious to soundness of the leather, and, later on (even when only scars remain), to its serviceableness, where large perfectly smooth surfaces are required. A warbled hide bears marks of the injury of the *present year*, and also more or less of the last and preceding years also. Messrs. Ramsey’s approximate estimate of damage from the above cause gives about *double the original loss* on the injured hides, as the amount thus wasted to the community.

Further (looking at the point under consideration of amount of warbled hides and loss thereby throughout the country), it is to be remembered that, 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. H. & C. 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.” —(H. & C. H.)

In the foregoing pages I have given the history of our Ox Warble Fly (*Hypoderma bovis*) in its various stages, and its effects in Warble formation, in great part from my own observations, of which I preserved the specimens in microscopic slides, with some additions of useful observations from British contributors, and information from British and European Continental publications (all duly acknowledged), these *together*, I believe, bringing this portion of the account up to date.

The reports (pp. 51–63) of effects of the warble maggot in injury to cattle, and loss in health, yield of milk, state of meat, and loss by depreciation of value of hides, have been carefully collected in the course of much communication from known Cattle-owners, Farmers, Chairmen and Secretaries of some of our chief Hide and Cattle Associations, and others well qualified to know the various details referred to, and the names of whom are appended. It is but a very small portion of the information sent to my hands which I am able to offer here, but still it is enough to show that the lowest estimate of the quite unnecessary loss we suffer from the pest, amounting to *upwards* of £2,000,000 per annum, is no imaginary statement.

The loss can be, *and is, enormously lessened* where means of prevention are properly applied, and in the following pages I give the main points requiring attention.

\* “*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 this very undesirable plan was one which 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.—E. A. O.

MEANS OF PREVENTION AND REMEDY OF WARBLE ATTACK.

*The two methods of treatment by which Warble Fly attack, and consequent maggot infestation of the hide, may be very much lessened, even down to being of no practical importance, are—dressings to prevent the fly egg-laying on the cattle, and destruction of the maggots before they leave the warble swellings.*

In the following notes of various kinds of applications or treatment for the above purposes, those only are named which have been advised on good *practical* authority, and are known to answer.

PREVENTION OF SUMMER ATTACK OF WARBLE FLY.—*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.*

The following observations were sent me, amongst other communications, by Mr. Hy. Thompson, of Aspatria, who has given especial attention to warble and its prevention:—

“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. [Noted below, E. A. O.] Paraffin, kerosine, carbolic acid, phenyle, &c., are all too transient to be of much service, and would have to be applied frequently.”

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 egg would be destroyed immediately it was placed in the skin.”

He also favoured me with the following recipe, which I have quoted in my leaflet on Warble Fly (of which a hundred and seventy thousand have been issued), and which is reported as answering excellently, and that the cattle so dressed were allowed to graze in peace without being started off at the tearing gallop injurious to flesh and milk, and likewise to health of cows in calf:—

“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.”—(H. T.)

The following note is *one* of the reports of satisfactory effect of Mr. Thompson's recipe sent me (in this case by Mr. H. J. Hillard, of Helland, North Currey, Taunton):—

“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 recipes.”

*Train oil*, applied as mentioned by Mr. St. John Ackers in the following note, has also been reported as answering excellently as a preventive of attack:—

“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.

*Sulphur*, dusted or rubbed on the back of the cattle, was found to be a good preservative from Warble Fly by Mr. Duckham, writing from Baysham Court, Ross, and by Mr. Byrd, Spurstow Hall, Tarporley, Cheshire.

Mr. Duckham noted :—

“I had each cow dusted along the back with sulphur. The result is that only two cows had one solitary deposit each. The others are perfectly free; whilst there are several on the back of their calves.”

Mr. Byrd mentioned as follows :—

“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 away the Gad Fly.”

*Sulphur powdered on the cattle* after they had been dressed with McDougall's smear was found to answer by Mr. T. Rogers, The Homme, Dilwyn, Leominster :—

“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.”

*McDougall's sheep-dip* is noticed as serviceable in the following report from Mr. H. Lindsay Carnegie, Kinblethmont, Arbroath, N.B. :—

“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 from a common gardening watering-pot, with a rose on the spout. This is done every week if the weather is wet, otherwise about every ten days.”

*That the Warble Fly does not follow cattle over water, consequently that allowing access to shallow pools is a great preservation from attack, is an opinion brought forward many years ago by the excellent authority Bracy Clark, and held since by many sound observers. Of this Mr. Thompson wrote me regarding presence of Warbles:—*

*“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.”*

Mr. J. B. Scott, Sutterton Grange, near Spalding, wrote:—

*“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.”*

Dr. W. Fream, who is well qualified to judge of the matter both entomologically and agriculturally, mentioned:—

*“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.”*

*The benefit of access to shade or shelter from trees or sheds, as shown by absence of warble attack, is mentioned in the notes sent me by various cattle-owners in various parts of the country—from Ross-shire, N.B., to Bideford, Devon; and I noticed this myself whilst still resident at Sedbury Park, Gloucestershire. I have seen the home herd of cows going at the swinging trot which shows fly attack in the exposed pastures, or in the park, but I never saw this happening in one field where there was a thick open grove of oaks, with a shed amongst the trees, within and around which the herd sheltered themselves, and picked the hay which might be thrown about.—E. A. O.*

#### 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, and, excepting that the*

false skin 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.

*Mercurial ointment* is, I believe, the only really poisonous application amongst the very many of which we have notes of success on sound authority, and as it has been found to answer excellently *when properly applied*, I give some of the reports sent me (with names appended) 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 warble 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 some with *mercurial ointment*; I have not the slightest doubt but that all will be effectual. I am satisfied that 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*

\* Special applications where cattle are suffering badly from warbles are noted at p. 71 under this heading.

to it; it appears to hurt them almost as much as a puncture through the skin. The objection to the scapel, &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.

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.

“*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.

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 in the matter, I have alluded to it, as the case may be, slightly (or not at all) in the later editions of my leaflet on Warble Fly, where there was not space to enter on

amount of detail, requisite to guard against every imaginable point of inattention to advice. In the *above* extracts the italics are *in part* additions of my own, to draw attention to the *objectionable character* of some kinds of treatment (as stabbing the grub, or stabbing *at it*) in the warble, and various other points which may serviceably be noticed. 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).

To the above I venture to add some parts of a letter from Dr. Geo. Fleming, Veterinary Adviser to the Army, which he was good enough to write me on my laying the details of the case, alluded to in the accompanying note, before him, and which he also permitted me to give in the 'Agricultural Gazette,' in reply to observations on the case:—

“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 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 good enough to place in my hands with this sentence:—“I am confident than no ill effects can arise if your directions are followed with anything like ordinary care.”—G. FLEMING, LL.D., F.R.C.V.S.

*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, of Aspatria, frequently quoted before, 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.”

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 too strong a kind*), also mixed with a little sulphur, have been found to succeed well; 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, safely and satisfactorily in about the most ignorant and untrustworthy hands that could be found,—namely, by old women called in as “Charmers” in the West of Ireland to cure warbles by incantations, but whose real operations, I found (with the help of an ally), consisted in covering the breathing aperture of the maggot with the butter or lard above mentioned, and (as far as we made out) a little sulphur.

As the charmers required a good sum for their services, which I felt sure would not be given unless the treatment was successful, I thought it was worth while to procure a quiet investigation, which gave the above results. It is not without noteworthiness that, rather than take a very little trouble, and prevent their cattle being nearly or quite killed by sore backs in the treeless and pondless districts of West Connaught, there are people who prefer calling in *lying old women, pretending to deal with unknown powers*, who, for a good round sum, effect a cure, with the *costless* application that ought to have been applied weeks before by the owners.

*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

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

the above, anything can be added to the application having a scent likely to deter attack, it is all the better.

For this purpose reports have been sent me during the past sixteen years of successful application of smears, dips, ointments, &c., far too numerous to enter on in detail, but I just mention names of a few, with the request to my readers that they will please to observe that this is without prejudice to 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.

Messrs. F. & C. Calvert's carbolic sheep-wash, in a *somewhat* stronger solution than as applied to sheep—which was in proportion of 80 to 100 of water to 1 of the carbolic-wash—was found to answer applied to parts affected with warbles.

Ointment prepared by the Dee Oil Co., Chester.

*Carbolic acid diluted with water* (where greasy mixtures are objected to), but experiment should be made or veterinary advice asked as to precise strength.

*Warble Fly paste*, manufactured by Messrs. Tomlinson & Hayward, Lincoln.

*Train-oil and sulphur*, applied to the warbles of the *consistency of thick cream*, is particularly well spoken of.

*McDougall's preparations*—that is, the smear, and in some cases the sheep-dip—are especially noticed as serviceable for destroying the maggots, by being placed on the opening of the warble. Mr. David Byrd, writing from Spurstow Hall, Tarporley, Chester, regarding method of application, mentioned:—

“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.”—(D. B.)

*Relatively to the effect of salt* in destroying the maggot, this appears to be serviceable whether rubbed well in as brine or strong salt and water with a wisp of straw into the coat, so that it may reach the opening of the warble even at the earliest stage, or applied by the backs of the cattle being damped and salt well rubbed in. No mention is made in one case specially reported, where the cattle “were terribly infested with grubs,” of any pain being caused by the application of the salt. The operation was repeated a week later, “and every grub was destroyed.”

Very many other dressings have been recorded as found to answer, and 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 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 method of treatment (that is, of destroying the maggots by squeezing them out of the warbles) deserves especial attention, as it can be brought to bear practically on warble-prevention at little or no cost, with absolute proof of the amount of work done, by amount of maggots produced, and so successfully that we can show by yearly reports the much lessened number of the pests to be found in one year, where in the preceding year the maggots had been cleared, and also, on the broad-scale view, the satisfaction of the cattle-owners concerned at the improved state of things, including quietness of cattle and more milk in summer, and less loss on hides.

The treatment in the district under observation 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 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.

It was begun 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.

These lists are of use for reference as not only showing precisely the small numbers of warbles to be found where warble maggots were exterminated in the previous year, but also the *very plentiful supply found on bought-in cattle*. In one of the tables before me, containing reports of condition of nineteen herds (or numbers of cattle) examined, of as many as fifty-seven, forty-two, forty, &c., down to two cows, the numbers of warbles found were in almost every instance very few, as from one to four in each herd (or collective number), *excepting where cattle had been brought in*. The following is an extract of just a few entries from one of the tables, to show the manner in which the record was kept:—

<i>Name.</i>	<i>Stock examined.</i>	<i>Number of warbles found.</i>
Percy Willis	20 cows and 20 yearling calves	3 warbles in cow lately bought.
Edgar Willis	40 cows and 3 heifers.....	Only 2 warbles. [in others.
John Whittle	42 cows .....	7 warbles in cow bought, none
Thomas Jones	20 cows .....	50 do. ( <i>bought cattle, E. A. O.</i> )
John Kirkham	3 cows and 1 heifer .....	None.

The work has been so much entered on previously that further details are not needed here, beyond that the observations are to be found in various of my Annual Reports, in the case above quoted the Eleventh, that for 1887, p. 113. It should be observed, however, that the work being done by boys employed about the cattle has great advantages. They can keep watch and remove the maggots successively as they become noticeable, and thus make a *very complete clearance*, and for a very trifling reward are willing to do so. At the Aldersey Grammar School a certain number of marks were given which, I believe, meant some small prize, or something of the sort, to be given presently to the collectors of the greatest numbers of maggots. But the boys worked with a will, one against the other, and the farmers were so well satisfied with the results that they allowed the lads free access for the search.

*Much is said from time to time* as to it being made compulsory on all cattle-owners to dress their cattle in some satisfactory manner, or otherwise so treat them as to remove the warble maggots, and that the police shall see the order carried out,

and I have repeatedly been desired to come forward and advocate the plan.

But, so far from thinking it desirable, I believe it would do little good, and be so highly objectionable for various reasons, that I feel no doubt that our *Board of Agriculture have acted very wisely* in refusing, when applied to, to issue any such order.

It is possible, and easy, for a cattle-owner who has his herd constantly under supervision, and likewise whose men or boys are so well known to the cattle as not to alarm the animals by investigating the state of the hides, to have the maggots squeezed out, or requisite dressings applied *every few days*, and thus by *repeated* work the maggots will be cleared. *But it is utterly useless* to suppose the maggots can be got rid of by one attempt at clearance; others will presently show in warbles *not then "ripe,"* and the effect of the police perpetually hunting in the hair for warbles (which would be necessary if the inspection is to do good) would be very injurious to the animals, and a most annoying intrusion to the owner.

Under ordinary circumstances I should not think myself justified in offering my opinion on the above point, but I have been so urgently pressed to advocate compulsory action that I have no hesitation in saying that I think all cattle-owners should be on the alert, and, if there was danger of such a thing occurring, that by earnest petition or by any other means lawfully in their power, they should protest against any such oppressive, compulsory interference with their property.

Also (and from circumstances brought under my own notice), I would advise farmers and cattle-owners to be very much on their guard against influence being brought to bear locally to the above end, by people whose *own end* is not the alleged benefit to the cattle or the country, but simply to put money in their own pockets by sale of mixtures which are not in the slightest degree more useful than many applications or methods of treatment which are almost costless, and are at hand, or can be carried out without delay.

At present we seem to be just in the condition described by the late Prof. Riley, 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 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.

But we have made the advance that we now *know* the life-history and the means of prevention of this wasteful scourge, so thoroughly that it is now only from the most utterly ignorant that we hear of the filthy ulcerated swellings with a rough maggot, as much as an inch in length, fidgeting about within them, being a sign of a thriving condition. Also, the widespread issue of my four-page leaflet, now amounting to about a hundred and seventy thousand (and which I should be only happy to continue to distribute gratuitously to any amount desired), shows the interest taken in the subject.

What could be done in the more advanced conditions of attack is open to consideration. If warbled beasts, and warbled hides, were subjected to a more rigid scrutiny, and purchase-money lessened accordingly, it would bring home the desirableness of previous attention, in order to prevent these losses to the sellers, in a way that nothing else could.

Whilst the beast can stand, and eat fairly well, it is very easy to say in the field, or afterwards in the auction-yard, that it is all right ; but a hide with the under surface disfigured by the great warble blisters, or a carcase covered beneath the places where the warbles were, with a licked beef or jellied surface, tells its tale beyond refuting, and here it seems to me is *the* point where local regulations, or coalition amongst butchers, might bring a most useful and justifiable pressure to bear.

ELEANOR A. ORMEROD, LL.D., F.E.S.

TORRINGTON HOUSE, ST. ALBANS :

*September, 1900.*

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

## ADDENDA.

Page 3, *3rd line from top*, for “living on,” read “feeding on.”

The reader will please to observe, that though, as stated at line 1st, top of page 3, the Gad Fly maggots do *not* live—that is, do *not pass this stage of life*—on or in animals, yet some kinds are considered to *feed* on living prey, such as snails, slugs, or other small creatures, which are to be found in the ground or water where the Gad Fly maggots pass their lives.

Page 12, *9th line from foot of page*, after the word “dipping,” add “with one or other of the numerous arsenic and sulphur or carbolic dips in the market.”

Page 12, *7th line from foot of page*, after the word “dips,” add “The operation should be repeated at the end of two to three weeks, with the object of destroying the young ‘Ticks’ which may have developed from chrysalis cases during the period.”—E. A. O.

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