

Post-mortem Appearances.—Anaemia, emaciation; marked hyperaemia of all the parenchymatous organs; degeneration of the liver; impaction of the rumen and reticulum; haemorrhagic abomasitis and enteritis; and a haemorrhagic swelling of the bronchial, mediastinal and retropharyngeal lymph glands.

Microscopical Pathological Anatomical Diagnosis.—Fatty degeneration of the liver, kidneys and myocard.

Paper No. 29.

THE TENACITY OF THE VIRUS OF FOOT-AND-MOUTH DISEASE UNDER FIELD CONDITIONS.

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During recent years the tenacity of the virus of foot-and-mouth disease under widely different conditions has been tested in a number of European laboratories, and recent veterinary literature contains abundant information as to the viability of the virus under conditions which at times faithfully represent natural conditions or conditions met with in practice, whilst in others they merely approximate to natural conditions. The history of foot-and-mouth disease in Great Britain during the past 20 years presents a unique opportunity for examining the question of the tenacity of virus under field or natural conditions, inasmuch as the stamping out policy has been in force during that period as a general policy which has been departed from in a limited number of cases only. The observations are not therefore liable to be confounded by the presence of recovered animals in the herds and recurrence of disease is not to be associated with the presence of possible "carriers" of infection, nor generally speaking, is the risk of infection from other centres of disease comparable with that which would arise in countries where the disease is dealt with by isolation.

Before proceeding to the examination of the cases in which the survival of the virus was demonstrated by the reappearance of disease among animals after an interval, it will be necessary to describe briefly the measures taken on the diagnosis of disease.

On declaration of the disease the affected animals and those in contact are valued and within 12 to 24 hours are slaughtered and their carcasses incinerated. From the earliest moment buildings, yards, pig-sties, etc., are sprayed continuously with a disinfectant solution, and after the carcasses have been disposed of a thorough cleansing and disinfection of the infected buildings is carried out, a solution of a coal-tar preparation being used.

Heavily contaminated food materials, litter and sacks are burnt.

The clothing of attendants is fumigated, and vehicles, milk churns, threshing machines, etc., disinfected by suitable processes.

Manure is closely packed into a heap 4 to 6 feet high and fermentation is relied on to destroy the virus except on the surface, which is sprayed with disinfectant solution.

The outside of hay-ricks, straw-stacks, etc., is sprayed with formaldehyde solution. Fumigation with formaldehyde in a closed chamber is carried out where it is necessary to deal with cereals or quantities of artificial feeding-stuffs which have been exposed to lesser risk of infection. Formerly fumigation by sulphur was employed but for some years only formaldehyde has been used for this purpose. In the treatment of cake and grain formaldehyde gas has been found to be superior to spraying with a watery solution which is likely to be followed after the lapse of a few weeks by abundant growth of moulds.

Time and natural agencies alone are depended upon in the case of pastures since disinfection is not practicable and only the heavily contaminated parts, such as gateways and the vicinity of the incineration pit, are disinfected.

Then after an interval animals are re-admitted to the premises.

In certain cases this interval between the final cleansing and disinfecting of the premises and re-opening must be modified, for example, where disease has occurred in an abattoir or in one of the landing places at the ports at which animals are imported. On such premises disinfection is carried out comparatively rapidly and does not present the problems which one finds on farm premises. Generally, when the disinfection has been completed these premises are immediately re-opened to trade, though under control since general restrictions are in force in the infected area. Despite the fact that no interval of time is usually insisted upon between completion of disinfection and resumption of trade, in only one out of about 200 such cases has disease reappeared.

At present the normal practice is to allow animals to be brought on to infected farms six weeks after disinfection has been completed, or alternatively eight weeks after slaughter of the diseased animals, whichever period is the shorter. The number of animals permitted to be brought on to the infected premises at this stage is 50 per cent. of the original stock. These animals are kept under observation for three weeks and if, at the expiration of this period, they remain healthy, all the restrictions are removed. This procedure has been slightly modified from time to time in respect of the number of animals which owners are allowed to bring on, but the accompanying table gives details of the time which elapsed between the completion of slaughter, the completion of disinfection, and the recurrence of disease, and it also shows the length of time during which animals were on the premises before they became affected. Re-stocking took place at varying intervals from 62-176 days after slaughter of the original diseased stock; of 28-128 days after disinfection on the premises; and the newly arrived animals developed foot-and-mouth disease at intervals varying from 6-104 days after arrival on the premises.

The records of outbreaks of foot-and-mouth disease in Great Britain during the past 20 years (1909-1928) show that there occurred 5,659 outbreaks, in 105 of which the animals were dealt with by isolation instead of by the usual procedure of slaughter. In other words, the slaughter policy was adopted in 5,554 cases. Of the 5,554 premises on which animals were slaughtered, disease reappeared on 57. Of these there is reason to think that in 13 instances disease was brought on the animals with which the farms were re-stocked during

times when disease was prevalent in the districts, despite the care taken to obviate this risk, or infection was re-introduced by other means from outside sources. Details are appended as regards 42 of the remaining cases:—

No. of Case.	Interval which Elapsed before Reappearance of Disease after :		
	(a) Re-stocking.	(b) Slaughter of the Affected Animals.	(c) Disinfection of the Premises, etc.
	Days.	Days.	Days.
1.....	22	89	66
2.....	25	108	107
3.....	43	96	—
4.....	26	90	66
5.....	14	93	71
6.....	44	140	128
7.....	35	92	68
8.....	10	96	76
9.....	37	99	69
10.....	7	80	62
11.....	6	63	50
12.....	—	96	70
13.....	35	99	—
14.....	7	70	65
15.....	60	97	58
16.....	21	55	28
17.....	32	87	52
18.....	18	82	67
19.....	11	69	57
20.....	15	100	91
21.....	21	98	84
22.....	45	100	87
23.....	41	106	87
24.....	81	135	126
25.....	18	90	89
26.....	33	88	77
27.....	34	103	84
28.....	14	87	71
29.....	8	77	64
30.....	8	94	75
31.....	18	80	67
32.....	34	91	77
33.....	10	84	73
34.....	27	89	74
35.....	12	62	58
36.....	104	176	141
37.....	29	99	81
38.....	7	63	52
39.....	9	75	73
40.....	—	62	57
41.....	20	73	66
42.....	6	64	53
Average No. of Days...	26	90	74

A further set of premises on which disease recurred was a pig market, and in this case the survival of virus was attributed to the difficulty of thorough disinfection on account of faulty woodwork of a section of the premises. After the recurrence of disease the woodwork was removed, and no further trouble occurred.

In another case, which does not appear in the table, the circumstances were unusual. An outbreak of disease occurred in a flock of sheep hurdled on a crop of turnips. Two months earlier disease had occurred on another part of the farm among cattle which had been slaughtered, and the usual methods of disinfection employed on the infected part of the premises. On declaration of disease among the sheep it was ascertained that the cattle which had been affected in the earlier outbreak had, on one occasion just before the outbreak was reported, broken into this turnip field and were there for some little while during which they ate some of the growing turnips, both roots and foliage. The sheep had been in the field about three weeks before they developed disease, but in accordance with the custom in this country they were penned on a fresh patch of turnips daily, and it was not until some days after their admission to the field that they reached the part to which the cattle had had access.

It is estimated that pastures are involved in about 75 per cent. of the outbreaks which occur in this country, but in no instance has disease recurred where pastures alone were involved in an outbreak. The minimum period for re-stocking pastures has never been less than six weeks.

All the recurrences appear to be associated with buildings or with foodstuffs and straw. In four cases it was reported that defective floors had probably been responsible for the upkeep of virus despite the fact that disinfectant solutions had been used on a very liberal scale on account of the unsatisfactory hygienic conditions. The foodstuffs in most cases consisted of a variety of provender including hay, meals, cake, roots, and there were usually more or less abundant supplies of straw. In some cases the hay was stored in a loft over the cowshed. Such supplies of hay were contaminated by the attendants during the early stages of an outbreak, and since the lofts were not airtight fumigation was impracticable. Destruction was equally impracticable in view of the large quantities frequently found in these lofts. The usual practice was to spray with a formalin solution the parts of the store to which the attendants had access in drawing supplies for the cattle. In only one case no foodstuffs remained after the cleaning of the premises after the first outbreak of disease.

In case No. 6 on the list where disease occurred 140 days after the slaughter of the original diseased animals, the recurrence was attributed to a stack of straw which had been thrashed shortly before the original case was reported but when disease existed among the animals. The straw was used for the bedding of animals subsequently brought on.

It happens occasionally that just prior to notification of an outbreak a stack of grain has been thrashed on the premises, all farm hands assisting. There is, in such cases, a grave risk that the straw which is restacked after thrashing has been contaminated by workers tending diseased animals. Obviously it is impossible to disinfect the straw thoroughly, and impracticable to destroy it. In such cases the outside of the stack is sprayed with a formalin solution, and the owner forbidden to use the straw for a minimum period of three months. In a number of cases where this practice has been adopted, no recurrence of disease has been experienced.

Of the 42 cases which appear in the table, disease first appeared in one case in October; in one case in March; in three cases in February, and in the remaining cases in November and December, but it is not suggested that in relation to the subject under discussion any conclusion should be drawn from this since the winter months represent the period of greatest incidence of the disease in Great Britain, probably because the viability of the virus, whether on its introduction from abroad or whether originating from an outbreak in this country, is assisted by the lower temperature and the lack of sunshine. It is, however, during these months that farms are found to be most heavily stocked with hay, straw, cake, roots, etc., which makes it more difficult to carry out the precautionary measures of disinfection.

All disinfectants to be used in connection with operations carried out under the Diseases of Animals Acts must be approved by the Ministry of Agriculture and Fisheries, and this approval is subject to biological (Chick-Martin) test, and the approved dilution in each case is equivalent to the bactericidal effect of a 5 per cent. solution of phenol. Practically all proprietary disinfectants at present approved are of the tar acid type. It has been shown that a high degree of success has been attained in practice in disposing of the risk of infection of foot-and-mouth disease by the use of these coal tar preparations, employed admittedly liberally and in conjunction with a lapse of time before animals are again brought to the infected premises; but in quite a number of instances the time factor has not operated and it has been necessary to rely entirely on the disinfecting power of these agents to render such places as slaughter-houses and lairs safe after the disposal of diseased animals had been effected so that facilities for the reopening of the premises to trade at the earliest possible moment could be granted. It is recognized that these coal tar preparations do not give results in the laboratory comparable with other preparations in the destruction of the virus of foot-and-mouth disease, that their destructive quality is bactericidal rather than viricidal, but nevertheless the results of their use in practice must be regarded as highly satisfactory.

The legal requirements which stipulate the use of approved disinfectants extend beyond the disinfection of premises infected by various scheduled diseases. They include the preventive measures of disinfection which are compulsorily carried out in the case of markets, lairs, railway loading stations, railway trucks, ships, vehicles, etc., and in this connection the opinion of the committee is invited on the methods of disinfection most suitable for general use.

That preventive disinfection of railway trucks, for example, can play a most useful part when thoroughly carried out, in the prevention of spread of disease is undeniable. Whether authorities should base their preventive measures essentially against foot-and-mouth disease as constituting the greatest immediate danger to the flocks and herds of the country, or whether they should bear in mind the general risks involved in the transport of animals will determine the type of disinfectant to be used. One cannot ignore the more or less serious risks of infection involved in the transport of animals, and it is suggested that the type of disinfectant to be recommended is one which will be the most suitable to deal with such varied types

of parasites and organisms as those which are responsible for the acariases, fungus diseases like ringworm, and diseases such as tuberculosis, Johne's disease, contagious abortion, foot rot and mastitis, in addition to foot-and-mouth disease. In this country, at any rate, the low incidence of anthrax enables us to ignore this disease as one requiring special attention when considering the disinfection of means of transport.

The results which have been obtained in Great Britain in the disinfection of foot-and-mouth disease infected places over a long period seem to justify the recommendation that disinfectants of the coal tar type essentially bactericidal agents are eminently suitable for use against the virus of foot-and-mouth disease and therefore can be recommended for general use in the disinfection of vehicles, railway trucks, ships, lairs and railway stations.

They are easily obtainable in most countries and comparatively cheap. They have, however, one serious disadvantage in that they taint meat and other foodstuffs.

Paper No. 30.

MEMORANDUM ON HORSE-SICKNESS IMMUNIZATION.

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THE disease African horse-sickness has been extensively investigated by Sir Arnold Theiler in South Africa, and his researches on the disease have been published in the various reports of the Director of Veterinary Education and Research for the Union of South Africa.

As the result of Sir Arnold Theiler's investigations it has been proved possible to protect horses and mules against fatal horse-sickness infection in the majority of cases by (1) paying particular attention to the stabling and prevention of bites of blood-sucking insects, and (2) by means of artificial immunization.

It is suspected that horse-sickness is insect-borne but, as yet, the particular insect concerned has not been definitely determined. As the result of observations made at Onderstepoort over a number of years during the horse-sickness season, some species of culicinae is regarded with suspicion. Accordingly, if horses or mules be stabled in mosquito proof stables, they are efficiently protected against infection. If such accommodation be not possible, it has also been proved that satisfactory results can be obtained by smoking the stable out and maintaining the smoke during the night. Where horses are to be used at night, deterrent skin dressing, e.g. paraffin, may be applied with good results. Such treatment has obvious disadvantages. Experiments carried out to determine the value of short interval dipping in specially prepared insect repellent fluids indicated the method to have some value, although not entirely satisfactory.

The movement of horses from horse-sickness infected areas to higher altitudes where the disease is relatively rare or absent, can be resorted to with advantage, but is not always possible. Moreover,