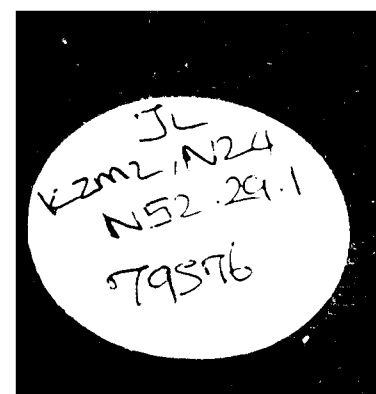




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Vol. XXIX

JULY, 1952

No. 1

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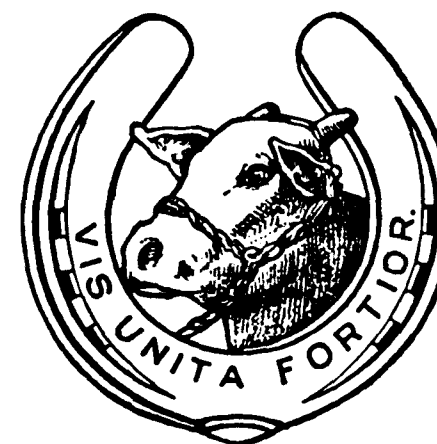
No. 1

THE INDIAN VETERINARY JOURNAL

[THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION]

PUBLISHED ON ALTERNATE MONTHS

MONTHLY
RECORD OF
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DEVOTED TO THE
CAUSE OF THE
VETERINARY
PROFESSION

(ESTD. 1924)

EDITOR

P. SRINIVASA RAO, G.M.V.C., Madras.

Office:—26, Wallajah Road, Madras-2 (S. India)



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THE
Indian Veterinary Journal

(The Journal of The All-India Veterinary Association)

Vol. XXIX JULY, 1952 No. 1

General Articles

THE COST OF FOOT-AND-MOUTH DISEASE*

By

F. C. MINETT

On a few occasions in the past speculations have been made on the financial loss suffered by the agricultural industry from foot-and-mouth disease. These, however, have been little more than bare statements without supporting evidence or concerned with one aspect only, such as the average reduction in value of animals which have suffered an attack, or the value of animals which have died as a result of the disease. The present inquiry is a more comprehensive attempt to reach conclusions, Indo-Pakistan could no doubt have been taken as an example, but it seemed far preferable to restrict the inquiry to Pakistan, largely because the necessary data were readily available, also because the areas and cattle populations involved in Pakistan, though large, are a good deal smaller than those of the subcontinent as a whole, and consequently there are less variables to contend with. Even so, the problem is sufficiently complicated because western and eastern Pakistan, though politically single, are agriculturally quite distinct. For this reason separate estimates have to be made for these two parts of the country. Finally, it must be made clear that there is no implication that Pakistan is more heavily infected than any other country similarly situated.

In this investigation there is, of course, no pretence to accuracy, and difference of opinion is to be expected on the reasoning upon which some of the calculations are based. In anticipation of criticism it may be said now that every effort has been made to keep the estimates conservative, that the attempt concerns only the measurable losses, and that the estimates are thought to provide some reasonably solid basis for crystallizing one's ideas.

*Empire Journ. of Exper. Agric., Vol. 20, No. 77, 1952.

Cattle population.—The population of cattle, including buffaloes, in Pakistan may be set down as follows:

	Oxen	Buffaloes
W. Pakistan	9,555,500	4,854,900
E. Pakistan	16,039,007	583,665
	<u>25,594,507</u>	<u>5,438,565</u>

The figures are taken from the following censuses: NW. Frontier Province and Sind 1945, W. Punjab and E. Bengal 1940, Khairpur 1939, Bahawalpur and Sylhet 1935, Baluchistan (estimate only).

Goats, though susceptible to foot-and-mouth disease, are not considered.

Attack-rate.—Here it is especially important that estimates should be conservative, since the attack-rate forms the basis of most of the calculations that follow. Unfortunately there is no proper knowledge of the extent of the disease in the country and at the outset assumptions are necessary. In the first place, the effect of the nutritional state of the animal on its reaction to infection is now a well-established fact; for this reason and owing to the greater weight of the cattle, lesions may be expected to be more severe in the more robust oxen of W. Pakistan than in the smaller and less well-nourished animals of E. Pakistan. Thus, in the Fourth Progress Report of the Foot-and-Mouth Disease Research Committee of Great Britain [1], it is recorded that cattle with well-developed mouth lesions are much more infective for other cattle than animals with poor mouth lesions or animals undergoing otherwise abortive reactions. This is one reason why in Bengal (E. Pakistan) the disease may be expected to be less widespread. Another reason, pointed out by Mr. S. M. Ali, is that in Bengal many of the cattle live in very small units, so reducing the chances of their being infected; also more foot-and-mouth disease may be expected on the borders of the country than in the interior.

For the purpose of the inquiry, it is taken that in W. Pakistan foot-and-mouth disease is so prevalent that one-half of the oxen are attacked once in their lifetime. This is quite a conservative statement, when it is remembered that many get it twice or even thrice. With buffaloes, the incidence is taken as half that in oxen, apart from, or owing to, the disease being milder. In E. Pakistan we take it that, instead of one-half of the oxen as in the west, one-eighth will be affected once during their lifetime and that the incidence in buffaloes is again half that in oxen.

If we assume that 30 per cent. of the ox population are breeding cows with a fertility-rate¹ of 66 per cent. and that the population is remaining fairly steady, the average duration of life would work out at

¹This term is used to include both conception-rate and calf mortality.

about 8 years. It is sufficient to make the same assumption with buffaloes, for although breeding she-buffaloes in Indo-Pakistan form 46 per cent. of the buffalo population the mortality in the young is higher. This would mean that 12.5 per cent., say 12 per cent., of the ox population would suffer every year if every animal were attacked once in its lifetime and 6 per cent. would so suffer if, as in W. Pakistan, every other one were attacked once. With buffaloes the figures would be 3 per cent. instead of 6 per cent. In E. Pakistan the corresponding figures would be 1.5 and 0.75 per cent. More commonly animals of the lower age-groups will be attacked.

In estimating the overall attack-rate, the question was considered whether in the first place a reduction ought to be made in respect of the lowest age-group, viz., birth to 6 months, since that is a period when mortality is heavy, and when death would remove from the population many animals which might otherwise have caught foot-and-mouth disease. It was decided, however, to make no such allowance because most of the deaths during early life occur within the first two months, so that the census figures for the youngest stock will be made up in part of animals which have escaped this early mortality.

Thus taking as the annual attack-rate in W. Pakistan 6 per cent. with oxen and 3 per cent. with buffaloes, in E. Pakistan 1.5 per cent. with oxen and 0.75 per cent. with buffaloes, the number of animals affected every year becomes:

	Oxen	Buffaloes
W. Pakistan	573,330	145,647
E. Pakistan	240,585	4,377
	<u>813,915</u>	<u>150,024</u>

These figures, however, have to be further subdivided because the composition of the population in respect of young stock, adult females, and adult males differs as between oxen and buffaloes and also in different parts, also because we must assume that the disease has its greatest incidence among young stock, say from 3 months to 3 years old. In conformity with this, if we say that of the oxen affected each year 50 per cent. are young stock, 25 per cent. adult females, and 25 per cent. adult males, then we can assume that with buffaloes in W. Pakistan the respective proportions are roughly 55, 35, and 10, and in E. Pakistan 20, 25, and 55. These proportions are arrived at by considering the distribution of the various categories of stock, as given for different regions in the Report on the Marketing of Cattle in India [2]. For this purpose the distribution shown for Bengal is taken as representing E. Pakistan, and the overall distribution for the Frontier Province, Punjab, and Sind as representing W. Pakistan.

The total attack-rate figures are therefore to be redistributed as follows:

		Oxen	Buffaloes
W. Pakistan:			
young stock	...	286,665	80,106
adult females	...	143,332	50,976
adult males	...	143,332	14,565
		573,330	145,647
E. Pakistan:			
young stock	...	120,293	876
adult females	...	60,146	1,094
adult males	...	60,146	2,407
		240,585	4,377

The categories of loss due to foot-and-mouth disease, for the purpose of this paper, may be set out as follows:

A. Mortality due to the disease. B. Loss in bodily condition. C. Loss of milk. D. Loss of working capacity.

These are sources of loss which together affect practically all classes of the cattle population and which one can attempt to measure, but there are other important factors for which no estimates can be made. These may be given as follows.

(a) There is evidence of a definite seasonal incidence of foot-and-mouth disease in India. Edwards [3] noted that most of the outbreaks reported during a single year in the Central Provinces occurred during the winter season when the cattle are better nourished. Figures for 66,312 outbreaks occurring during periods of 6 to 8 years between 1936 and 1943 in thirteen provinces are available to me. The distribution and highest monthly incidence of these were as given on p. 5.

Briefly, the maximum incidence in W. Pakistan is roughly from April to June, in U.P. and Bihar it is roughly the same with secondary peaks in September (very pronounced in U.P.), in Assam during the summer, and in the remaining provinces during the cool season. In W. Pakistan and N. India the greater incidence in the spring is presumably due to greater movement of cattle during these months, as well as to the more numerous fairs held at that time. At this spring season also the cattle are engaged in threshing and carting operations, as well as in cultivation of the land for the *kharif* (summer) crops.

Province	Outbreaks	Max. incidence	Years
Punjab	... 9,217	May-June	... 7
NW. Frontier Province	... 1,061	April to July	... 6
Sind	... 778	March to May, January	... 6
Baluchistan	... 274	April-May	... 7
United Provinces	... 15,177	April-May, August-September	... 8
Bihar	... 6,443	March to May, September	... 8
Assam	... 4,133	June to September	... 6
Bengal	... 6,302	November	... 7
Bombay	... 9,091	January to March	... 7
Madras	... 6,481	" "	... 7
Orissa	... 5,837	" "	... 8
Central Provinces	... 1,385	" "	... 7
Ajmer-Merwara	... 133	" "	... 7

(b) It is pointed out in the Cattle Report [2] that owing to a number of causes there are seasonal variations in price which relatively increase or diminish the losses. Thus in W. Pakistan bullocks are in greater demand and fetch higher prices in the autumn and spring when they are required for agricultural operations. Outbreaks at such times will cause far heavier financial loss than at more quiescent periods, and the cost of replacements will be higher. And, as pointed out under (a), outbreaks are more frequent in the spring months in W. Pakistan. Also, in the spring, dairy cows cost more because that is the main calving season. Cows which lose their calves early in lactation will show a relatively higher reduction in milk yield, quite apart from the fact that cows with calf at foot are worth more in the market.

(c) It is recognized that the disease causes extensive dislocation to routine animal management and breeding. For instance, on the military farms severe foot lesions in heavy and valuable bulls can prevent service for weeks and completely upset the breeding and milk-production programmes. Outbreaks of the disease may interfere with plans for vaccination against rinderpest. The fact that in certain years and in certain areas famines or floods or other diseases like rinderpest may remove cattle, which might otherwise fall victims to foot-and-mouth disease, is cold comfort. A final point for which no allowance can be made is the human service and the medicines required for treating sick animals.

(d) Quite apart from the very important fact that outbreaks leave behind them the seeds of further outbreaks, foot-and-mouth disease is well known to have troublesome *sequelae*. Myiasis of the feet is a common and serious complication in a warm country, also pedal deformities leading to chronic lameness. Other recognized results are abortion, and the awakening of latent cases of mastitis. What may be called 'panting disease' [4] is another sequel to be mentioned, though it is of little concern for the present purpose, because it mainly affects cattle with European blood and these form an insignificant proportion of the cattle population. When foot-and-mouth disease occurs in animals already suffering from other infections, such as *piroplasmosis*, or if the outbreak occurs at times of heavy rains or floods, effects are likely to be more severe and mortality is said to be increased.

It would be quite impossible to make allowances for sources of loss such as those mentioned, so any calculations that can be made necessarily oversimplify the problem.

A. Mortality due to the Disease

Many of the Indian provincial reports give figures relating to numbers of cattle dying from the disease and its complications. A few of the reports give at the same time the number of cattle said to be affected. These, for what they are worth, together with some statistics from the military farms, may be summarized as follows:

Province or organisation	Period	Numbers attacked	Numbers of deaths	Mean mortality-rate (per cent.)	Remarks
Punjab ...	1904-12	600,000	8,44	1.39	oxen
Sind ...	1936-42	28,940	675	2.33	"
Bombay ...	1937-41	165,286	701	0.42	"
Bihar ...	1935-41	150,192	544	0.36	mainly oxen a few buffaloes
Army Veterinary Service Report	1934-7	3,859	43	1.11	oxen
Military farms ...	1945-6	2,475	24	0.97	"
"	"	4,940	84	1.7	buffaloes
Sind ...	1937-42	5,861	55	0.94	"
Bombay ...	1937-41	31,069	165	0.5	"

Thus there is great variability, even in the mean percentage figures for mortality-rates, perhaps due in part to varying proportions of young animals. For present purposes it is proposed to take 1.0 per cent. as the mortality-rate for oxen. This is justified by the fact that this rate is close to the most frequent mean figure in populations totalling over 950,000 attacked, and is intermediate between that noted for the better-class animals of the Punjab and the poorer types of Bihar. Since foot-and-mouth disease in India is usually mild, and in order to be still more conservative, we may restrict the rate to young stock attacked. Since in buffaloes the disease is still milder, the death-rate should be distinctly lower than that decided for oxen. It would therefore be wiser to ignore the figures given and assume a rate, say, one-quarter that of oxen, or 0.25 per cent. An average valuation of Rs. 200 will not be excessive.

The loss therefore is 4,069 young oxen at Rs. 200	...	813,800
" " 203 " buffaloes at Rs. 200	...	40,600
		Rs. 854,400

B. Loss in Bodily Condition

This may be put under two subcategories:

(a) Animals which are slaughtered shortly after the attack, because owing to extreme loss of condition it is no longer considered economical to maintain them.

(b) Animals which lose condition as a result of the attack and to which the owner decides to give extra food for, say, three months.

Subcategory (b) concerns W. Pakistan only, where fodder is rather more plentiful. The great majority of animals which survive an attack will fall under neither of these heads. They are either left to recover without any extra attention or some of them may be sold out at subnormal prices during the period of temporary incapacity. Let us assume that for every animal that dies naturally of the disease one more will fall under subcategory (a), and that 10 per cent. of the remaining young stock will fall under subcategory (b). Since in both cases the losses will fall most heavily on the younger age-group (3 months to 3 years), for purposes of calculation we may assume that losses are restricted to this group and take as an average live-weight 200 lb. The calculations are as follows:

With (a), a loss of 50 lb. in body weight is assumed. Of the 150 lb. live-weight at time of slaughter, 55 per cent. or 82.5 lb. is flesh, for which in 1943 the butcher might have been expected to pay 4 annas per lb., or say, Rs. 20 [2]. The total payment to the owner may be put at Rs. 30 to include skin and offal, and is to be deducted from the cost of the replacement.

The loss therefore is 4,069 young oxen at Rs. 170	...	691,730
" " 203 " buffaloes at Rs. 170	...	34,510
		Rs. 726,240

With (b), 50 lb. live-weight per head are to be recovered in the case of 10 per cent. of young cattle in W. Pakistan which have survived natural death or necessary slaughter following the attack. The cost of the extra food per lb. live-weight gain is put at 6 annas.

	Oxen	Buffaloes
Attack-rate	286,666	80,106
Death and slaughter	5,732	400
Survivors	280,934	79,706
10 per cent	28,093	7,970
Live-weight to be gained (at 50 lb. each)	1,404,650	398,500
Total lb. 1803,150 at 6 annas = Rs. 676,181.		
Total of (a) and (b) Rs. 1,402,421		

C. Loss of Milk

It is practically impossible to make a close estimation of this source of loss, owing among other things to the varying uses to which milk is put, the differing prices of liquid milk and milk products, as well as of town and country milk, and seasonal effects on prices. According to the Report on the Marketing of Milk in India and Burma [5], the total Indian milk production on a percentage basis is distributed as follows:

Province or State	Cow	Buffalo
NW. Frontier Province (with agencies and tribal areas)	1.56	1.44
Punjab	13.53	24.45
Bahawalpur State (estimate)	1.03	1.05
Sind	3.90	3.30
Khairpur State	0.36	0.21
Baluchistan and States	0.65	0.02
Bengal	13.17	0.73
	34.20	32.20

Making the necessary allowances for the partition of the Punjab and Bengal the percentages may be in the neighbourhood of 23.92 and 21.75 for cow and buffalo milk respectively.¹ These figures are of interest in showing the high production of the areas now included in Pakistan in relation to their much smaller extent in the Indo-Pakistan subcontinent. The area of Pakistan is about 15 per cent. of that of the whole subcontinent.

In estimating the loss of milk, cows and buffaloes have to be considered separately for reasons of which some have already been mentioned. In the two species the disease has different characters, the milk yield is different, the relative proportions of the cows in ox and buffalo populations differ, and for buffaloes the proportions are also different as between E. and W. Pakistan, finally in E. Pakistan a larger proportion of females is used for work. The category of adult females will thus include milch animals as well as females which are used for work, the latter forming 10 per cent. of the adult females in W. Pakistan and 30 per cent. in E. Pakistan. Hence deductions for working females have to be made from the number of animals affected, but as it is assumed that the death-rate in adults is negligible no deductions are made on this account. Of milch cows 60 per cent. are taken as wet, and of milch buffaloes 50 per cent. The average milk production per lactation, on the basis of estimation of yields given by Wright [6] and in the Cattle Report [2], is taken as follows: W. Pakistan cows 1,300 lb., W. Pakistan buffaloes 2,000 lb., E. Pakistan cows 420 lb., and E. Pakistan buffaloes 960 lb. Deductions of 10 per cent. in yield due to foot-and-mouth disease are assumed in all cases, such a reduction in yield being equivalent to a cow being dry for one month of her lactation period. This estimate of loss is perhaps too far on the conservative side for the higher-yielding cows of W. Pakistan, especially as they may be expected to be in fairly good condition, and to be attacked in March-April when many of them are at the flush period. With buffaloes, however, which are at the flush period in September-November, and the lower-yielding cows of E. Pakistan, the average reduction in yield may probably be safely put at 10 per cent.

1. Roughly 60 per cent. of the Punjab falls in W. Pakistan. The portions of Bengal and Sylhet lying in E. Pakistan amount to about 63 per cent. of undivided Bengal.

We may now proceed to estimate the loss of milk, as follows:

	W. Pakistan	Oxen	E. Pakistan
Adult females attacked	143,332		50,146
Working	14,333		18,043
Milch	128,999		42,103
Wet	77,399		25,261
Yield (at 1,300 lb.)	100,618,700	(at 420 lb.)	10,609,620
For calves (reduction of 1/5)	80,494,960		8,487,696
10 per cent	8,049,496		848,769
Sold liquid	2,495,344		263,118
Sold as milk products	5,554,152		585,651
Prices	Rs. 520,326		Rs. 54,866
		Buffaloes	
Adult females attacked	50,976		1,094
Working	5,097		328
Milch	45,879		766
Wet	22,939		383
Yield (at 2,000 lb.)	45,878,000	(at 960 lb.)	367,680
For calves (reduction of 1/10)	41,290,200		330,912
10 per cent	4,129,020		33,091
Sold liquid	1,279,996		10,258
Sold as milk products	2,849,024		22,833
Prices	Rs. 266,904		Rs. 2,135
		Total Rs.	844,231

1. According to Wright (6), utilization of milk produced in India and Burma is about 31 per cent. as liquid milk and 69 per cent. as products, mainly ghee.

2. General price figures are mentioned by Wright as Rs. 5 per maund (80 lb.) for liquid milk and Rs. 2/12 for ghee produced from one maund of milk. These prices were considered to be ruling prior to 1937. For the present purpose a 50 per cent. increase has been allowed, but even this undoubtedly underestimates more recent advances in price.

No account is taken of the diminished supplies of *lassi*, since this product of ghee-manufacture is ordinarily kept for home use. Nor is account taken of the loss of milk due to the fact that the calf, whose dam has suddenly gone dry or practically so, has to be fed on the milk of other cows.

D. Loss of Working Capacity

Three factors have to be considered under this heading:

- Cost of feeding the affected animal during the time it is actually immobilized.
- Cost of feeding the affected animal to bring it back into condition.
- Loss on cultivations.

Under (a), similar calculations are required to those just set out in Section C. From the percentage attack-rate of adult males, we deduct

2 per cent. to allow for breeding bulls and the few adult males that are not used for work. To this we add the small proportion of working cows and she-buffaloes. We assume that the overall working period in each year is 8 months and that it is only during this period that the loss under this head has to be considered. We assume further that the average period of immobilization, including 6 days in which the lesions are in the eruptive stage when the animal eats little, is 28 days, and that the daily cost for 22 days of feeding the idle animal is 6 annas in W. Pakistan and 3 annas in E. Pakistan, where the available feed is minimal.

The calculations are as follows, variations in seasonal incidence being neglected:

	W. Pakistan	Oxen	E. Pakistan
Adult males attacked	143,332	60,146	
Deduct 2 per cent. non-working males	2,867	1,203	
Add working females	14,333	18,044	
Total working animals attacked	154,798	76,987	
Working for 8 months	103,198	51,325	
Feed (at Rs. 8/4)	Rs. 851,383	(at Rs. 4/2) Rs. 211,716	
		Buffaloes	
Adult males attacked	14,565	2,407	
Deduct 2 per cent. non-working males	291	48	
Add working females	5,097	328	
Total working animals attacked	19,371	2,687	
Working for 8 months	12,914	1,791	
Feed (at Rs. 8/4)	Rs. 106,540	(at Rs. 4/2) Rs. 7,388	
		Total Rs. 1,177,027	

Under (b), it was finally decided to make no allowance. The animal husbandry conditions in the country are such that in the dry season most animals normally become thin, that is they lose fat or food reserve, but they are still capable of working and in practice they continue to do so. The reserve lost is replaced during the rains by natural grazing, which can be said to cost nothing.

Under (c), loss on cultivations caused by foot-and-mouth disease, there are two basic facts to be considered: the proportion of the market value of the produce received by the grower, and the bullock-power used for cultivation.

As to the first, the grower's share, taken in this instance as 50 per cent., is considered, since in this inquiry questions of loss are examined mainly from the agricultural standpoint.

As to the second point, the following statement may first be made. We have estimated that of the oxen annually attacked one-quarter are adult males and the rest adult females and young stock. Since the annual overall attack-rate for oxen is 6 per cent., this means that the annual rate for adult males is $1\frac{1}{4}$ per cent. Since, however, they work not for 12

months in the year but for 8 months only, the attack-rate over the 12 months becomes 1 per cent. One per cent. would be the fall in crop-yield if every affected adult male suffered throughout the 8 months, but since the loss of power by affected animals may be said to endure for 3 months only during and after the attack, the crop-yield is lowered not by 1 per cent. but by $\frac{3}{8}$ of 1 per cent. If again we assume that in nine-tenths of the instances some arrangement is made by the owner for supplementing the animal draught-power as by utilizing bullocks or other draught animals borrowed from neighbours, the crop yield may be said to be lowered by $\frac{3}{80}$ of 1 per cent.

The matter, however, is not quite as straightforward as this, for reasons explained above. Thus (1) not quite all the adult males are working animals and some adult females have also to be included; (2) the attack-rate in buffaloes is taken as half that in oxen, and for all cattle the attack-rate in E. Pakistan is taken as one-quarter that in W. Pakistan; (3) the distribution among animals attacked in respect of young stock, adult females, and adult males is different as between oxen and buffaloes, and as between buffaloes in W. and in E. Pakistan.

It is necessary therefore to work out, from (a) above, the ratios between the attack-rate in adult males, expressed as a percentage of the total attack-rate, and the similar figure for working animals. These ratios are as follows:

W. Pakistan oxen. Adult males 25 per cent., working animals 27 per cent.

W. Pakistan buffaloes. Adult males 10 per cent., working animals 13.3 per cent.

E. Pakistan oxen. Adult males 25 per cent., working animals 32 per cent.

E. Pakistan buffaloes. Adult males 55 per cent., working animals 61.3 per cent.

Then, with

W. Pakistan oxen,
27 per cent. of the 6 per cent. annual attack-rate is 1.6 per cent. and for 8 months 1.07 per cent.

W. Pakistan buffaloes,
13.3 per cent. of the 3 per cent. annual attack-rate is 0.4 per cent. and for 8 months 0.27 per cent.

E. Pakistan oxen,
32 per cent. of the 1.5 per cent. annual attack-rate is 0.48 per cent. and for 8 months 0.32 per cent.

E. Pakistan buffaloes,
61.3 per cent. of the 0.75 per cent. annual attack-rate is 0.46 per cent. and for 8 months 0.31 per cent.

For W. Pakistan we may take the reduction in crop yield as $\frac{3}{80}$ of 1 per cent., since only about 10 per cent. of the working animals are buffaloes; for E. Pakistan we take $\frac{3}{80}$ of 0.3 per cent. The final calculation is shown in Table 1, which gives the production and market value of the major crops in Pakistan. The total value of these crops to the grower is Rs. 4,732,673,000, so the total loss under this heading comes to Rs. 923,839.

STUDIES ON PLASMODIUM GALLINACEUM

By

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Rao, Das and Ramnani (1950) first recorded fowl malaria in India. Plasmodium of fowls has been intensively studied in India, but these studies have been confined to exotic strains. In one of the large poultry farms in U.P., sporadic cases of fowl malaria were met with, during July and August 1949 and July, 1950, in two cockerels and one pullet aged from 6 to 12 months. During the period from July, 1949 to November, 1950, 1,700 individual fowl's blood smears were examined. The strain from the first case was maintained in chickens of various ages and breeds for sixteen months in 35 serial passages by inoculating healthy birds either subcutaneously or intramuscularly with infective blood (Table I).

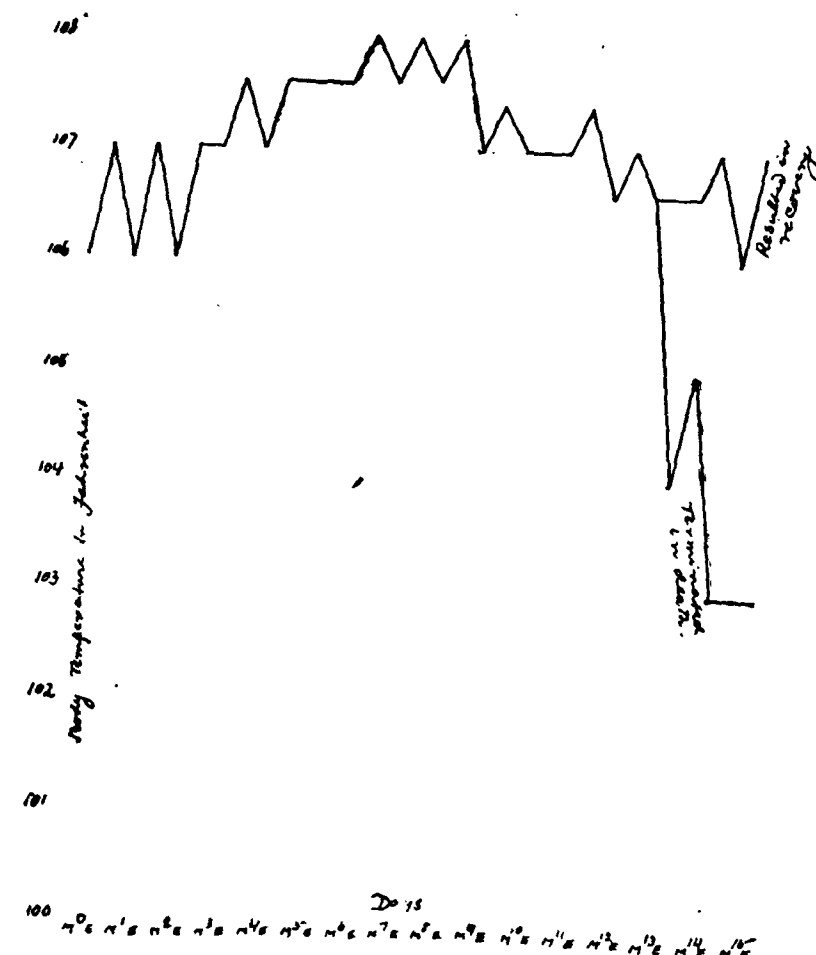
Experimental.—During the serial passage, a total of 140 birds were given virulent oxalated blood, with 121 takes, and 8 negatives. 11 were autopsied periodically during incubation in search of the parasites. An average of the several series of observations showed that the parasites appear in peripheral blood after an incubation period of seven days, the earliest being three and the latest ten days.

The mortality among the untreated ones was 59.3 per cent. Out of a lot of 108 ailing birds, 64 died within a period of 20 days of infection, 33 dying within seven days and 31 after the seventh day of infection. Of the remaining 44 chickens, 10 developed clinical symptoms of avitaminosis-A at variable periods during the after-phase of the disease, 21 chickens were autopsied while ailing or soon after recovery to locate the exo-erythrocytic form of the parasite in the tissues and the 13 survivors were tested for immunity at different periods after recovery. In addition, 13 infected chickens were used for chemotherapy of the disease.

Symptoms.—The early symptoms noticed were slight rise of temperature, the fever lasting for 9 days when the parasites began to appear in the peripheral blood. After this period of mild pyrexia, the temperature came down to normal in favourable cases and became subnormal when the prognosis was usually bad. (Graph I). The birds as a rule became unthrifty as the disease advanced (Graph II). During the incubation period and in the early stage of infection, the birds fed well, looked bright, but, as the disease progressed, they went off feed, huddled together and were reluctant to move. At this stage they either died or got over the infection and began to feed well after 3 or 4 days of visible sickness. Clinical anaemia was marked at the peak of infection as evidenced by pallor of comb, and this condition was roughly

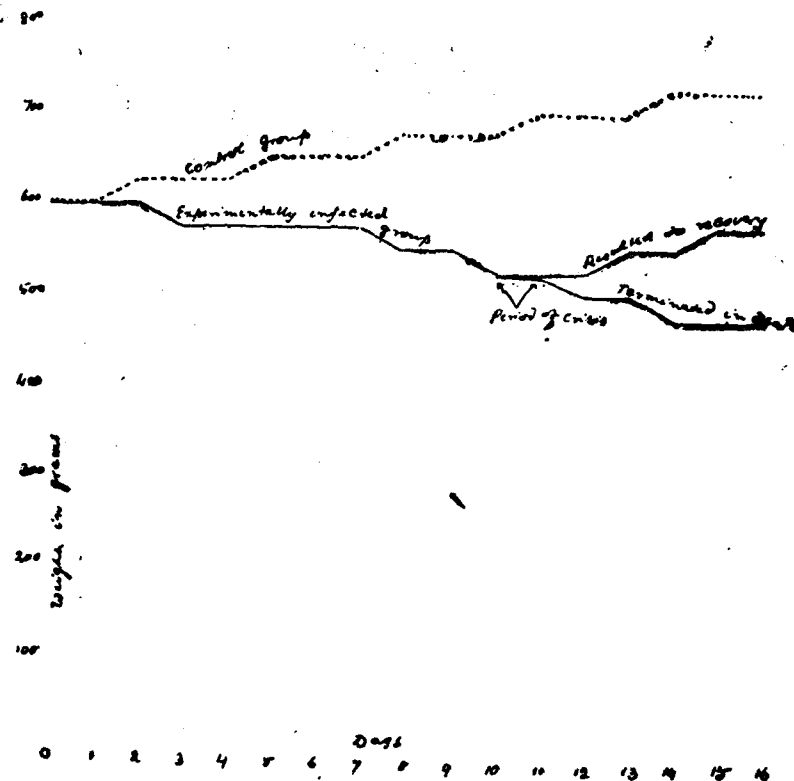
GRAPH I

Graph Showing Daily Body Temperature of Chickens Experimentally Infected with Plasmodium gallinaceum.



GRAPH II

Graph Showing Daily Average Weight of Birds Infected with *Plasmodium gallinaceum* and the Control.



Note:—Eight weeks old white Leghorn Cockerels were used for experimental purpose as well as for control in three serial passages. Average weight has been so adjusted as to classify them in one of the weight groups given in the graph, e.g. birds weighing from 587 gms.—612 gms. have been taken in 600 gms. group where as birds weighing from 613 gms.—637 gms. have been taken in 625 gms. group.



Fig. 1
White Leghorn Pullet No. 9132 Passage 22 showing pericarditis.



Fig. 2
Section of Liver X 500
Mark the mass of pigment in the intra-hepatic vessels.

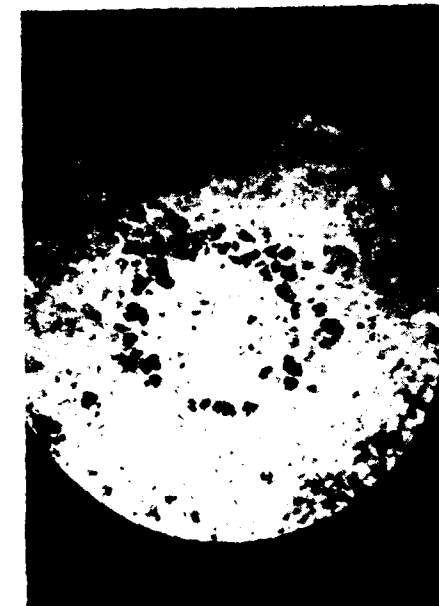


Fig. 3
Section of Spleen X 600
Note the blood vessel packed with leucocytes and the latter discharging the blood pigments, the product of haemolysis outside the vessel wall.

Freehand drawing representing various stages of development of *Plasmodium gallinaceum* in the vertebrate host.

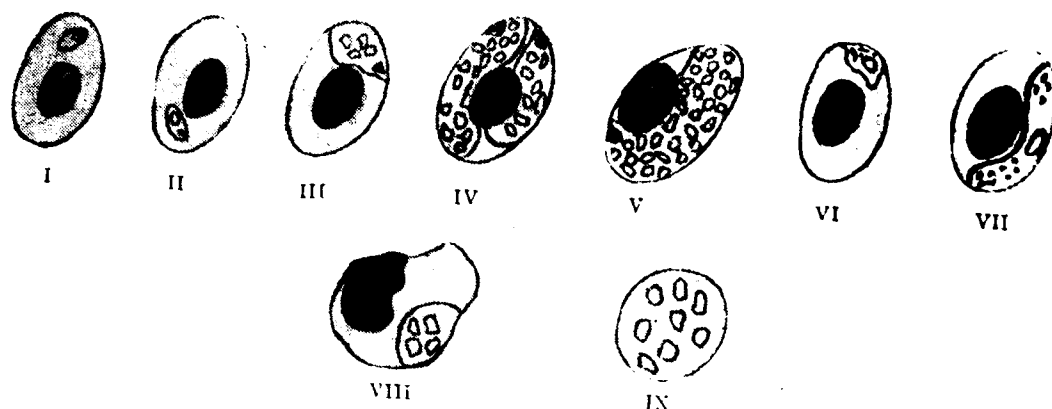


Fig. I to VII. Development inside the erythrocyte.

- I. Non-pigmented trophozoite with blue cytoplasm and red chromatin mass.
- II. Pigmented trophozoite with a mass of chromatin and a mass of pigment.
- III. Developing trophozoite—chromatin divides, pigment granules remaining undivided. This will lead to schizont.
- IV. Developing schizont—The erythrocyte is invaded with two parasites.
- V. Fully grown schizont. Mark the eccentric position of the nucleus of the invaded erythrocyte.
- VI. Developing trophozoite—chromatin mass remains undivided and the pigment divides. This will lead to the development of gametocyte.
- VII. Fully grown gametocyte. Mark the elongated form of the parasite with a single, centrally placed chromatin mass, the nucleus and the coarse pigment granules distributed in the cytoplasm of the parasite.

Fig. VIII & IX. Exo-erythrocytic schizonts of the parasite.

- VIII. Inside the cytoplasm of a monocyte.
- IX. An unattached schizont in spleen impression smear. Mark the absence of pigment in both.

Note:—The nuclei of the erythrocytes and the monocyte are represented by pencil shade, cell wall by pencil line and unstained portion—the cytoplasm. The parasites are represented by pencil line of the cell, unstained portion—the cytoplasm, vacuolated portions. The chromatin mass inside the parasite and pencil dots are its pigment granules.

proportionate to the parasitic count. A daily blood count of a dozen of infected birds revealed in the positive phase a progressive decrease in total erythrocyte level, though the proportion between the erythrocytes and leucocytes remained within the normal range. In the differential count a gradual increase in monocytes with a proportionate decrease in lymphocytes was noticed during the incubation period as well as in the positive phase of the disease (Table II). A slight rise in Basophiles with a proportionate fall in Neutrophils was also seen during the positive phase. At the beginning of infection, rare erythrocytes were infected but within three to four days of infection 40 to 60 per cent of the erythrocytes became infected. During this period the appearance of large numbers of erythroblasts in the peripheral blood of infected chickens proved usually to be a premonition of natural recovery.

Post-mortem lesions and exo-erythrocytic forms of the parasite :—

The carcasses were invariably emaciated. A constant feature was the enlargement of the spleen often about six times the normal, the colour of the organ being characteristic slatey-grey. The liver also was invariably dark-grey in colour. Other common findings were effusion of the pericardial sac (Pl. 1. Fig. 1) with a yellow jelly like fluid in most cases and a pallor of other organs. Exoerythrocytic forms of the parasite were detected only after the eighth day of infection, i. e. 7 days after the parasite was first seen in the peripheral blood, in spleen, brain and liver impression smears in about 50 per cent of the cases. When stained by Wright's stain they appeared as well defined, blue bodies with chromatin granules varying from 4 to 64 or more, in number and without pigment deposit. Exo-erythrocytic forms were also seen during the after-phase of the disease even up to 72 days after recovery in one out of 13 cases.

Histo-pathology :—Paraffin sections of liver, spleen, heart and brain were studied for histo-pathological changes. Brain and heart tissues revealed little abnormality excepting capillary congestion. The changes noticed in the liver and spleen were as follows.

Liver.—A marked change in the liver was the presence of an appreciable amount of blood pigment in the form of coarse granules in the intralobular capillaries (Pl. 1. Fig. 2) which appeared to be distinctly dilated, isolating columns of liver cells. Focal cellular infiltrations around some blood vessels and some portal veins were evident. These cells appeared to be mostly of mononuclear type, perhaps endothelial in origin. No fatty or albuminous degeneration was noticed.

Spleen.—Abnormal masses of blood pigment were observed spread out in the tissue. There was a distinct enlargement of organ as evidenced by the rare presence of stroma appearing as small islets in the pulp. A few of the vessels in the pulp showed marked sclerotic changes. Some of the capillaries were greatly dilated, the lumen being filled with leucocytes and surrounded by a compact zone of blood-pigment (Pl. 1. Fig. 3). Pigment laden leucocytes were

arranged near the periphery of vessels, possibly trying to discharge the product of haemolysis outside the vessel. The pulp, though containing more leucocytes, did not seem to contain any strange cells. Giant cells, which should be normally present in this organ in a certain proportion, seemed to be conspicuously absent in the pulp. The cells arranged around some of the capillaries seemed to be of mononuclear type. The flattened endothelial cells in the capillaries seemed to have been definitely changed to cubical type in some cases. Proliferation of vascular epithelium was evidenced by amitotic division of the epithelial cells.

Chemotherapy.—Thirteen infected birds were used for trials in curative treatment. A daily dose of 0.075 gms. of paludrine per kilogram body weight was given orally to each bird for three days in succession. The parasites invariably disappeared from the peripheral blood after this treatment, except in one case which died on the second day of treatment and in another the treatment was prolonged to five days before the blood was microscopically free from the parasites.

Table below gives the details of the experiment :—

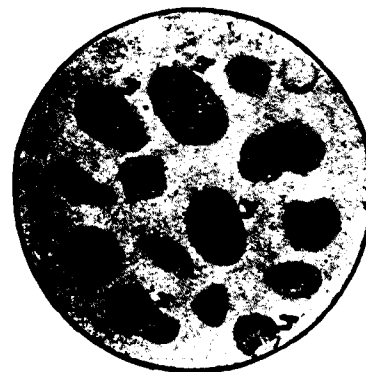
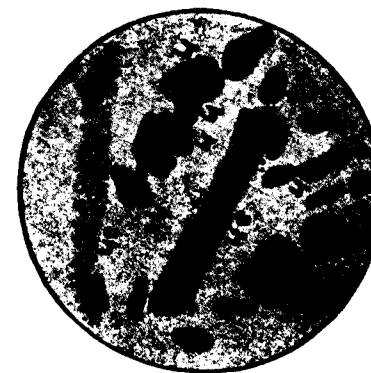
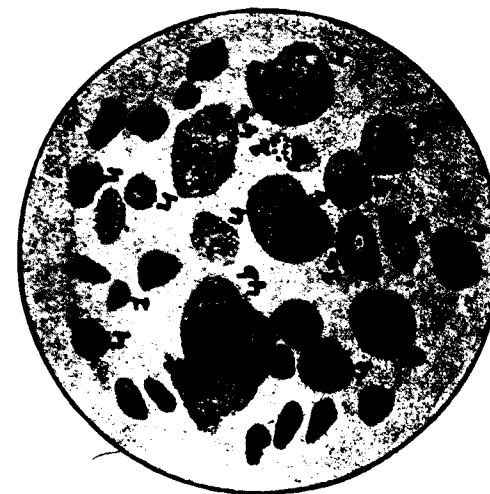
Day of infection when treatment was started with paludrine.	Numbers of birds treated.	Number of days treated.	Results.
2nd day	1	5 days	recovered.
3rd day	2	3 "	"
4th day	1	3 "	"
5th day	3*	3 "	" { 2 "
6th day	2	3 "	" { 1 died
7th day	2	3 "	recovered.
9th day	2	3 "	"

*One died on the 2nd day of treatment. Blood smear revealed the presence of the parasites. Impression smears from spleen revealed the exo-erythrocytic forms and the spleen and liver were as described under P. M. findings.

Eleven of the twelve recovered birds were reinfected 15 days after recovery. All of them took up experimental re-infection and responded to paludrine given for 3 days. Again 30 days after recovery from the re-infection, seven were given infective blood intramuscularly. They took up the infection and responded to the above treatment. 100 days later all of them were autopsied. In no case was there any macroscopical or microscopical evidence of the parasites. The one case in which re-infection was not tried got a spontaneous relapse 21 days after the first recovery. This case will be described later.

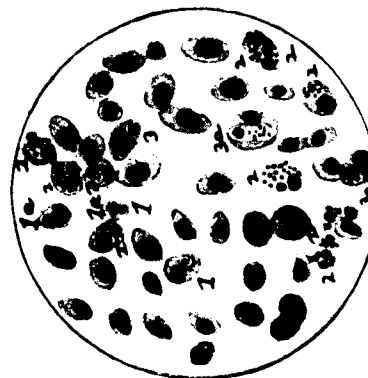
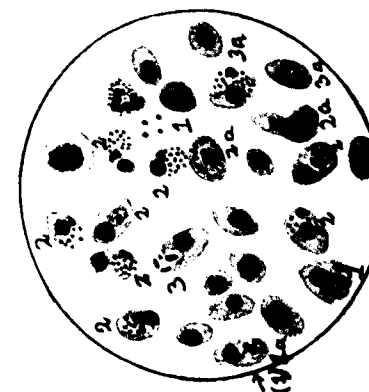
Negative results were obtained in four chickens which were administered for two days a daily oral dose of one leaf of *Calatropis gigantea* which is said to have anti-malarial properties and is largely used in South India as an

Plate No. 3

Fig. IV
Liver impression smearFig. V
Brain impression smearCamera lucida drawing
Magnification 1:720Fig. III
Spleen impression smear

Explanation of the Plate:

1. Nonpigmented trophozoite.
- 1a. Pigmented trophozoite.
2. Developing schizont.
- 2a. Segmented matured schizont.
3. Male or Micro-gametocyte.
- 3a. Female or Macro-gametocyte.
4. Exo-erythrocytic schizont.
- 4a. Exo-erythrocytic schizonts arranged in a group.
- 4b. Exo-erythrocytic schizont liberating merozoites.
- 4c. Exo-erythrocytic schizont dragged in the smear.

Fig. I
Blood smearFig. II
Blood smear

indigenous cure for human malaria. However, its active principles have to be studied and the dose standardised before definite conclusion as to its efficacy can be drawn.

Immunity.—The untreated chickens which survived were checked up for immunity, four to 252 days after the disappearance of the parasites from their peripheral blood. Thirteen birds were repeatedly inoculated with heavy doses of infective blood. Two of them got reinfection as proved by the presence of the parasites in their blood and tissue impression smears, the first being reinoculated four days and second ten days after the disappearance of the parasites from the peripheral blood in the first infection. The rest eleven birds could not be reinfected even after four repeated inoculations at different intervals. Nine of these immune birds were autopsied and their internal viscera examined for the presence of any evidence of infection. In all the cases splenic enlargement was noticed and in six of them splenic impression smears revealed rare exo-erythrocytic form of the parasite.

One of these immune birds which got a spontaneous relapse 97 days after recovery was autopsied. Another was transferred to Salmonella infection experiment and died of fowl typhoid but showed erythrocytic form of *P. gallinaceum* as well.

Relapses.—Among the experimental birds, relapses were noticed in three cases. The history of these cases were as follows :—

(1) *W. L. chicken No. 1146.*

30-3-50—inoculated with infective blood.

6-4-50 to 14-4-50—Parasites present in the peripheral blood.

12-4-50 to 14-4-50—0.075 gms. of paludrine was given daily orally.

15-4-50 to 29-4-50—Peripheral blood negative.

30-4-50 to 4-5-50—Blood was not examined.

5-5-50—Found dead i. e. 21 days after recovery with treatment.

The post-mortem examination of the dead bird revealed the presence of the usual and exo-erythrocytic form of the parasite in impression preparations of liver, spleen and brain.

(2) *W. L. cockerel No. 1668.*

12-7-50—Infective blood was given.

19-7-50 to 25-7-50—Parasites present in peripheral blood.

8-8-50—Infective blood was given for immunity test.

9-8-50 to 23-8-50—Peripheral blood was negative.

24-8-50 to 30-10-50—Blood not examined.

31-10-50 (97 days after natural recovery) Blood examined and found to be positive.

The bird showed anaemic comb. Its blood was examined and on finding the parasites in the peripheral blood it was killed and post-mortemed. Liver and spleen impression smears showed the exo-erythrocytic as well as the usual forms of the parasites.

(3) *Deshi chicken No. 989.*

11-6-50—Inoculated with infective blood.

19-6-50 to 24-6-50—Parasites present in peripheral blood.

8-8-50—Infective blood was given for immunity test.

9-8-50 to 23-8-50—Peripheral blood did not show any parasites.

24-8-50—Transferred to Salmonella experiment for production of anti-serum.

24-8-50 to 4-9-50—Blood not examined.

5-9-50—Found dead. Culture proved positive for *S. gallinarum*.

The chicken was given 0.1 c.c. of a thick suspension of killed culture of *S. gallinarum* intramuscularly on 24-8-50 and 0.1 c.c. of living *S. gallinarum* suspension intramuscularly on 2-9-50. It was found dead on 5-9-50 and revealed rare erythrocytic forms of *P. gallinaceum* apart from *S. gallinarum* organism. No exo-erythrocytic forms could be detected in the impression smears from spleen, liver, brain and bone-marrow.

Vitamin A deficiency.—In ten cases of the untreated experimentally infected birds, clinical Vitamin A deficiency symptoms were marked features in the after-phase of the disease. One out of ten was affected on the 15th day of infection and the rest developed symptoms 12 to 72 days after natural recovery. Bio-chemical analysis of livers of these chickens revealed no trace of vitamin 'A'. A series of controlled experiments were conducted to compare the Vitamin level in birds kept under same conditions of management as the experimental birds. The livers of the former always showed the presence of vitamin A at varying strengths (65 to 104 L. B. U. per gm. of liver).

Embryo inoculation.—A few unsuccessful attempts were made to infect 16-day old chick embryo by intramuscular inoculation of infective blood but the chicks could not survive the period of incubation.

Discussion

Exo-erythrocytic forms.—Our report on the presence of exo-erythrocytic forms of *P. gallinaceum* in liver, spleen and brain confirms the observations of other workers. Huff and Bloom (1935) demonstrated these forms in the bone marrow of canaries in *P. elongatum* infection and considered that the condition represented a precocious invasion of erythroblasts. Raffaele (1936) was the first to recognise that there was a definite schizogonic cycle in the development of *P. elongatum* and *P. relictum* in the cells of reticulo-endothelial system. James and Tate (1937) were the first to demonstrate exo-erythrocytic forms in *P. gallinaceum* infection in chickens. Kikuth (1937) and Brumpt (1937)

confirmed the above finding but the latter doubted if the schizogony of *P. gallinaceum* in endothelial cell, being so irregular, was an essential stage in the life cycle of the parasite. James and Tate (1938) demonstrated these forms in the haemoglobin free cells, viz. circulating leucocytes, especially monocytes and the reticulo-endothelial cells of brain, lungs, spleen and liver. James (1939) recorded the incidence of these forms at a late stage of the disease in 54 per cent of chickens infected with *P. gallinaceum* but direct inoculation of infective blood and was of the opinion that exo-erythrocytic schizogony in *P. gallinaceum* infection might possibly be regarded as an alternating method of multiplication which came into operation pre-eminently towards the end of the process of repeated schizogony in red blood corpuscles. Our findings are in agreement with those of James (1939). We had no occasion to confirm his findings by inducing infection with infective mosquitoes or those of Shortt, Menon and Iyer (1948) and Shortt and Garnham (1948). Ray (1948) recorded an exclusive exo-erythrocytic schizogony of a malarial parasite in Himalayan flying squirrel. He has analysed the findings of previous workers on exo-erythrocytic forms of different species of malarial parasites and has re-defined the parasites of genus *Plasmodium* and the family *Plasmodiidae*.

Mortality.—Mortality in our experimental chickens was fairly high. This might have been due to a high infective dose of the parasite. Basu (1944) working with *P. gallinaceum* states that it is a highly fatal disease, few surviving the experimental infection. Srinivasan and co-workers (1950) have pointed out that the rate of mortality varies directly with the dose of the parasite.

Chemotherapy.—Our work shows that Paludrine is highly efficacious in curing *P. gallinaceum* infection. We had no occasion to test the action of this drug on any other species of avian malaria. Basu (1944) states that usual anti-malarial drugs are quite effective cures of *P. gallinaceum* infection. According to Russel (1934) Atebrin is not a true causal prophylactic against avian malaria. Manwell (1930) reported that both quinine and plasmochin were effective against *P. elongatum*, *P. cathemerium* and *P. praecox*, the different strains of *P. praecox* reacting to the treatment in essentially the same way as to quinine or plasmochin. The three species, however, showed marked differences in their response to treatment. Similarly the negative results obtained in the present experiments with the leaf of *Calatropis gigantea*, used in South India for treatment of human malaria, show that action of an anti-malarial drug may vary with different species of Plasmodia.

Immunity.—As has been observed by previous workers in these series of experiments too, definite immunity has been observed in a good number of naturally recorded cases. This offers a practical means or method of controlling the disease. The demonstration of the parasite in two out of 13 chickens was perhaps possible due to a reappearance of the latent parasites as

TABLE I

Statement of chickens used for experimental transmission of

Age groups in weeks	No. of chickens injected with infective blood					No. of chickens infected					No. of chickens died or killed before the parasite could be seen in the peripheral blood					No. of chickens found to be refractory				
	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL
4-8	40	17	8	1	66	33	12	8	1	54	5	4	—	—	9	2	1	—	—	3
9-12	27	16	5	—	48	24	15	4	—	43	2	—	—	—	2	1	1	1	—	3
13-16	5	10	—	1	16	4	9	—	1	14	—	—	—	—	—	1	1	—	—	2
17-20	4	—	—	—	4	4	—	—	—	4	—	—	—	—	—	—	—	—	—	—
24 and above	5	1	—	—	6	5	1	—	—	6	—	—	—	—	—	—	—	—	—	—
Grand Total	81	44	13	2	140	70	37	12	2	121	7	4	—	—	11	4	3	1	—	8

*One died.

Note:—Treated chickens which were reinfected and successfully treated again and statement.

TABLE I

Plasmodium Gallinaceum with results

No. of chickens treated with paludrin orally dose 0.75 grns. per day for 3 successive days.	No. of chickens recovered after treatment					No. of untreated infected chickens					No. of chickens died in the untreated group with mortality percentage				
	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL	W. L.	R. I. R.	DESHI	B. P. R.	TOTAL
4	1	—	—	—	5	3	1	—	—	4	29	11	8	1	49
											20	7	7	—	34
											68.9%	63.6%	87.5%	—	69.4%
6	—	—	—	—	6	6	—	—	—	6	18	15	4	—	37
											11	10	—	—	21
											61.1%	66.7%	—	—	56.8%
—	—	—	—	—	—	—	—	—	—	—	4	9	—	1	14
											3	3	—	—	6
											75.0%	33.3%	—	—	42.9%
—	—	—	—	—	—	—	—	—	—	—	4	—	—	—	4
											1	—	—	—	1
											25.0%	—	—	—	25.0%
1	1	—	—	—	2	1	1	—	—	2	4	—	—	—	4
											2	—	—	—	2
											50.0%	—	—	—	50.0%
11	2	—	—	—	13	10	2	—	—	12	59	35	12	2	108
											37	20	7	—	64
											62.7%	57.7%	58.5%	—	59.3%

naturally recovered chickens which were used for immunity test are not shown in this

TABLE II
Statement of total blood count, differential count and percentage of infected erythrocytes in experimental chickens infected with *Plasmodium Gallinaceum*.

Date of infection.	Range of total erythrocytic count in million per cubic millimeter.	Range of total leucocytic count in thousand per cubic millimeter.	Percentage of different leucocytes on an average.				Percentage of infected erythrocytes.	Remarks.
			Neutrophils.	Eosinophiles.	Basophiles.	Lymphocytes.		
0	2.5-3.0	20-30	37.0	0.5	0.5	56.0	-	At the beginning only trophozoites are seen, but as the disease advances all forms from trophozoites to gametocytes are detected in the same blood. Most of them are schizonts at various stages of development.
1	2.5-3.0	20-30	37.0	0.5	0.5	55.0	-	
2	2.5-3.0	20-30	35.0	0.5	0.5	55.0	-	
3	2.5-2.8	20-30	35.0	0.5	0.5	55.0	-	
4	2.5-2.8	20-30	33.0	0.5	1.0	53.0	Rare in some	Period of crisis.
5	2.5-2.8	18-28	33.0	0.5	1.0	52.5	Rare in some, one to five in some and more in the rest.	
6	2.5-2.8	18-28	33.0	0.5	1.0	52.5	5%	
7	2.5-2.8	18-28	30.0	0.5	3.0	50.5	20%	
8	2.0-2.5	16-28	30.0	0.5	3.0	50.5	25%-30%	
9	2.0-2.5	16-28	29.0	0.5	3.0	50.5	30%-40%	
10	1.5-2.0	15-25	29.0	0.5	2.5	50.0	40%-60%	
11	1.0-2.0	15-25	29.0	0.5	2.5	48.0	40%-60%	
12	1.0-1.8	15-25	29.0	0.5	2.5	48.0	40%-60%	
13	1.5-1.8	15-20	29.0	0.5	2.5	50.0	40%-60%	
14	1.5-1.8	15-20	29.0	0.5	2.0	50.5	30%-30%	
15	1.5-2.0	15-20	30.0	0.5	2.0	52.5	10%-25%	

a result of a stimulus. Demonstration of exo-erythrocytic form of the parasites in six out of nine immune birds autopsied suggests a type of carrying immunity. Taliaferro and Taliaferro (1929 & 1940) Cannon and Taliaferro (1931) and Manwell and Goldstein (1940) have done outstanding work in this line. Taliaferro and Taliaferro (1929) showed that the highly parasiticidal mechanism in birds with a latent infection is not associated with a humoral anti-body and is not the type of immunity ordinarily interpreted in the usual immunological sense. Cannon and Taliaferro (1931) proved that immunity to superinfection results from two factors, viz. (a) an acute increase in the numbers of phagocytosis cells, and (b) a greatly increased rate of phagocytosis by individual phagocytes. They are the product of cellular reaction in the tissues of latent carriers.

Relapses.—The three cases of relapse as reported here are of rare occurrence. One of the three was a treated case and probably of a natural reinfection. Out of two immune birds one showed spontaneous relapse which cannot be explained while in the other an induced infection of *S. gallinarum* caused the flare up of a latent infection of *P. gallinaceum*.

Embryo inoculation.—The unsuccessful attempt to infect chick embryos by intramuscular route could only be due to the fact that the chicks died before the usual average incubation period recorded by us. Gavrilovatel *et al* (1938) made an unsuccessful attempt to cultivate *P. gallinaceum* (Brumpt) by inoculating infected heparinised blood into developing hens egg, whereas Hass and Ewing (1945) successfully transmitted *P. gallinaceum* by including infected mosquitoes to feed on the allantoic vein of 10-13 day old living chick embryo.

Avitaminosis A.—Our infected chicken were prone to avitaminosis-A, particularly in the after phase of the disease. It was probably due to an interference in the normal function of the liver brought about by deposits of blood pigment as revealed by the histopathological examination of the organ.

Summary

1. On examination of 1,700 birds in a large farm, 3 showed natural infection of *P. gallinaceum* during the period from July 1949 to November, 1950.

2. Birds were infected by direct blood inoculation, the incubation period being seven days. Parasites were found in the peripheral blood for 12 days on an average. Generally it is an afebrile disease. Marked anaemia, enlargement of spleen, a fall of total erythrocytes, and monocytosis were the main features. Masses of blood pigments in the capillaries of the spleen and liver were present. Vitamin 'A' deficiency was a marked feature in the infected birds during the after phase of the disease.

3. Exo-erythrocytic forms of the parasites in the spleen, liver and brain were found mostly during the later stage and after-phase of experimental infection.

4. A daily oral dose of 0.075 gm. of paludrine per kilo gram body weight for three successive days was found to be curative. Birds so recovered could be reinfected.

5. Once an infected bird recovers naturally it is generally found to be immune against further infection. But in the treated cases this phenomenon was not shown. Relapse has been observed in 3 out of 24 cases studied, in one treated and two immune birds.

Acknowledgment

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A STUDY OF THE ORGANISMS RESPONSIBLE FOR OUTBREAKS OF BLACK-QUARTER IN THE MADRAS STATE

By

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Introduction:—It is now well known that Black-quarter among cattle is a fairly widespread disease among livestock in nearly all the States of India. For many years *Cl. chauvoei* was considered to be the only organism responsible for this disease, but, of late, workers in other parts of the world—Leclanche and Valle (1924), Gaiger (1924), Scott (1926), F. Breed (1937) and others—have reported that Black-quarter, clinically indistinguishable from pure *Cl. chauvoei* infection, can also be caused by other anaerobes. They have incriminated *Cl. septicum*, *Cl. oedematiens* and *Cl. welchii* as the other causative agents. Viswanathan G. R. (1934) reported the presence of *Cl. chauvoei* and *Cl. septicum* by serological findings in outbreaks of Black-quarter in this State. As late as 1937-38, Narayanaswami Naidu (Mysore) reported that, in Mysore State, he came across cases of Black-quarter caused by organisms other than *Cl. chauvoei*, (viz.) *Cl. septicum* and *Cl. welchii*. He had further suggested that immunisation against Black-quarter using products of *Cl. chauvoei* alone did not protect all the inoculated cattle when the disease was caused by other organisms of the *clostridia* group. Viswanathan (1936) advocated the use of a bivalent product of *Cl. chauvoei* and *Cl. septicum* for controlling the disease in the Madras State. Narayanaswamy Naidu, (1937-38,) reported that attempts were being made in Mysore to produce a polyvalent vaccine against Black-quarter incorporating the various *clostridia*.

In the Animal Husbandry Research Workers' Conference held at New Delhi during 1936, the chairman remarked that a great deal of investigation was necessary to elucidate the etiology and the role of various organisms in the production of Black-quarter in India. Accordingly some research work was undertaken in this direction at the Serum Institute, Madras, during the year 1941-42.

This paper describes an attempt to determine the organisms that are met with in outbreaks of Black-quarter in the different districts of Madras State with a view to produce, if possible, a satisfactory polyvalent vaccine against the disease. As no systematic work to elucidate the organisms responsible for the disease in this State was undertaken so far, it was considered desirable to carry out a certain amount of preliminary investigation before incorporating new organisms in the Black-quarter vaccine which at present is prepared from a few strains of *Cl. chauvoei* only.

Accordingly the staff of the Civil Veterinary Department, Madras, were requested to supply the Superintendent, Serum Institute, Madras, with dried strips of affected muscles from authentic cases of Black-quarter, while attending to Black-quarter outbreaks in their jurisdiction. Along with each muscle specimen they were requested to fill in a form giving particulars regarding the nature of outbreak, kind of animals affected, severity of the outbreak, mortality encountered, age of animals affected, seasonal variations and other epizootological factors.

Technique—Soon after receipt of the muscle piece in the laboratory a small piece of it was emulsified with distilled water, a smear prepared, stained and examined under the microscope for the presence of Black-quarter organisms. When satisfied with this preliminary identification, the muscle pieces were placed, separately in stoppered wide-mouth bottles over calcium chloride, properly labelled and stored in the refrigerator until required for further use. 80 muscle pieces were received from various parts of the State of which 30 muscle strips were used in the experiments as detailed in the statement No. I. The experiments were commenced in April, 1941 and completed during September of the same year. The isolation of the organisms in pure cultures and their subsequent identification was carried out on the following lines.

About 1 gramme of each muscle piece received was emulsified with 5 c.c. of N.S.S. and 1 c.c. of the emulsion was injected intramuscularly into the thigh of a healthy guinea-pig. The guinea-pig was carefully watched and observed for the development of lesions. These guinea-pigs developed typical Black-quarter lesions in 24 to 48 hours and usually succumbed to the disease. Soon after death, a post-mortem examination was conducted on these animals and the heart blood was cultured aseptically in Robertson's media. Smears were made from the affected muscles, heart blood and liver impression and examined for the presence of organisms. The type of oedema produced, the nature of gas formation, colour and smell of the affected muscles etc. were also carefully observed and recorded.

The smears were examined for filaments or chain formation in addition to the typical Black-quarter rods and spores. The heart blood was inoculated into both Robertson and liver media and incubated for 24 to 48 hours at 37°C. These cultures were later examined for growth and purity and suitable controls were made to check the presence of any aerobic contamination. When a particular culture so isolated was found contaminated or unsuitable, a piece of the original material used for the culture was injected again into a fresh guinea-pig and the process repeated until a pure culture of the organisms was obtained. The cultures so obtained were streaked on the surface of blood agar plates and incubated in an anaerobic jar for 72 hours to observe the nature of the growth and to

study the morphology of the colony. The cultures were also examined for motility and put to the following bio-chemical tests and the reactions studied. Sugar fermentation on Glucose, Lactose, Maltose, Sucrose, Inulin, Mannite, Salicin and reactions on Litmus milk, Loeffler's serum and Gelatin stab.

The sugar tubes and other media inoculated with the culture isolated were incubated anaerobically at 37°C in a McIntosh and Fildes jar for 72 hours. The tubes were then removed from the jar and the presence of growth and gas formation noted. Later a drop of Andrade's indicator was added to each sugar tube to note the formation of acid.

The litmus milk tubes were examined for formation of acid and clots and stormy fermentation, if any. Liquifaction was looked for in Loeffler's serum and gelatin tubes. A classified statement (No. II) is appended giving particulars of cultural and biochemical reaction observed.

STATEMENT NO. 1

No.	Place of origin.	Kind of animal.	Age.	History of specimen.
1	Chittoor	Heifer	2 years	Died with swelling of thigh.
2	Sirugappa (Bellary)	Bull calf	1 year	
3	" "	Cow	3 years	Died suddenly with "swelling of left hind leg.
4	Hospet "	Bull	2 years	Swelling of both hind quarters; died suddenly.
5	Hosur (Salem)	Bull	6 months	
6	Vayalpad (Chittoor)	Heifer	1½ years	From affected quarters; died in 24 hours.
7	Trichinopoly	Heifer	1½ years	Muscle from right thigh.
8	Dhone (Kurnool)	Bull calf	2 years	Died in 8 hours—muscle from right shoulder.
9	Dharmapuri (Salem)	Bullock	8 years	Muscle from region of croup.
10	Salem	Bull	2½ years	From swelling on right shoulder.
11	Vellore	Bull	2 years	Muscle from thigh region; died in 24 hours.
12	"	Bull	3 years	Muscle from neck, died in a day.
13	Dharmapuri (Salem)	Bull calf	4 months	Muscle from left thigh.
14	"	Buffalo		
15	Madagasira (Anantapur)	Heifer calf	8 months	Muscle from left shoulder.
16	Namakkal (Salem)	Bull calf	2 years	
17	Harpanahalli (Bellary)	Bull calf	4 years	From swelling in right quarter; died in a day.
18	Hadagalli (Bellary)	Heifer	1 year	Pectoral muscle.
19	" "	Bull calf	2½ years	Swelling of shoulder
20	" "	Bull	1 year	From right shoulder
21	" "	Bull	3 years	" "
22	" "	Heifer	1 year	" hind quarters
23	" "	Buffalo calf	1½ years	" shoulder
24	Harpanahalli "	Bullock	10 years	" leg
25	" "	Heifer	8 months	" left fore limb
26	Kollegal (Coimbatore)	Bull calf	1½ years	" left hind quarter
27	" "	" "	1 year	" right "
28	Kodaikanal (Madura)	" "	6 months	Swelling of right shoulder
29	" "	Heifer calf	1½ years	" "
30	Hosur Cattle Farm	Bullock	7 years	Swelling of left quarter
	Perambalur (Trichy)	Bullock	6 years	Swelling of left quarter; died in 24 hours.

STATEMENT No. II

Specimen No.	Source District.	Muscle smears.	Liver impression smears.	Colonies on blood agar.	Motility.	Sugars—Biochemical reaction.										Organism isolated
						Glucose	Lactose	Sucrose	Maltose	Inulin	Mannite	Salicin	Litmus milk.	Gelatin	Loeffler serum	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Chittoor		Rods & spores	Rods filaments & spores	Spreading hæmolytic	+	+	+	—	+	—	—	+	Acid	Liquified	—	<i>Cl. septique</i>
2. Bellary		"	Rods only	Discreet hæmolytic	+	+	+	+	+	—	—	—	"	"	—	<i>Cl. chauvoei</i>
3. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
4. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
5. Salem		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
6. Chittoor		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
7. Trichy		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
8. Karnool		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
9. Salem		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
10. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
11. North Arcot		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
12. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
13. Salem		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
14. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
15. Anantapur		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
16. Salem		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
17. Bellary		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
18. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
19. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
20. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
21. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
22. do.		"	Rods & filaments	Spreading hæmolytic	+	+	+	+	+	—	—	+	"	"	—	<i>Cl. chauvoei</i> and <i>septique</i>
23. do.		"	"	"	+	+	+	+	+	—	—	+	"	"	—	do.
24. do.		"	Rods & spores	Discreet hæmolytic	+	+	+	+	+	—	—	—	"	"	—	<i>Cl. chauvoei</i>
25. Kollegal (Coimbatore)		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
26. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
27. Madura		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
28. do.		"	"	"	+	+	+	+	+	—	—	—	"	"	—	do.
29. Salem		"	Rods & filaments	Spreading hæmolytic	+	+	+	+	+	—	—	+	"	"	—	<i>Cl. chauvoei</i> and <i>septique</i>
30. Trichy		"	Rods & spores	Discreet	+	+	+	+	+	—	—	—	"	"	—	<i>Cl. chauvoei</i>

10. The characteristics and biochemical reactions of *Cl. chauvoei* and *Cl. septique* are as follows:—

	Motility.	Colonies on blood agar.	Glucose	Lactose	Sucrose	Maltose	Inulin	Mannite	Salicin	Litmus milk	Loeffler serum	Remarks
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Cl. chauvoei</i>	Motile	Irregular discreet slight hæmolytic	+	+	+	+	—	—	—	Acid only	—	—
<i>Cl. septique</i>	Motile	Spreading, hæmolytic, filamentous	+	+	—	+	—	—	+	Acid only	—	—

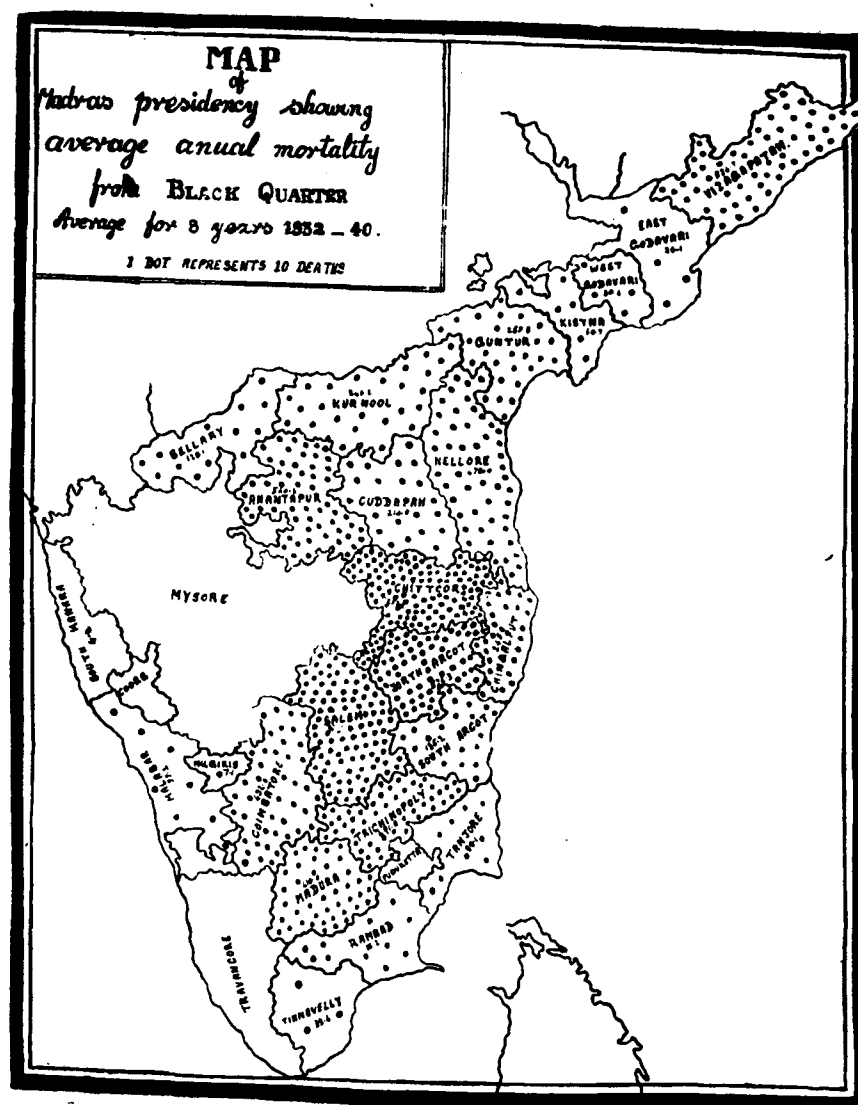
Note: + Acid and gas; — No reaction.

The organisms isolated were considered as *Cl. chauvoei* when the colonies on blood-agar surface were discreet, hæmolytic with no tendency to spread, sucrose fermented and salicin unaffected. Further there should be no long chain or filament formation in the liver impression and heart blood smears. When sucrose was found unaffected, when salicin fermented with the formation of acid and gas, and long filaments were observed on liver impression smears, and the colonies on the surface of blood agar showed a tendency to spread into a thin grey film showing finger-like periphery with hæmolytic also around the colonies, the organism was typed as *Cl. septique*.

When both sucrose and salicin were found fermented with acid and gas formation, long chains and filaments were observed on liver impression smears, and the blood agar plates showed both discreet and spreading colonies, it was considered as a mixed infection of both *Cl. chauvoei* and *septique*.

From a classification of the results arrived at, it will be seen that out of the 30 muscles typed 26 specimens showed pure *Cl. chauvoei* infection, while only one showed pure *Cl. septique* infection. 3 muscles showed a mixed infection of *Cl. chauvoei* and *Cl. septique*. No case of *Cl. welchii* infection was encountered.

Cattle of all ages ranging from 4 months to 10 years were found affected although the majority of the muscles received were from cattle aged between 1 to 3 years. The specimens included muscle strips from two buffalo calves also. No specimens were received from sheep though outbreaks among sheep are also reported now and then from some parts of the State.



Discussion

Discussion

The results of this experimental work indicate that outbreaks of Black-quarter in the Madars State are caused by either *Cl. chauvoei* or *Cl. septique* or a combination of both. But in the majority of the cases only *Cl. chauvoei* is met with while *Cl. septique* is encountered rather rarely. Under field conditions it is rather difficult to estimate as to whether a particular outbreak is caused by *Cl. chauvoei* or *Cl. septique*. Stray cases of deaths have also been reported among the animals vaccinated against Black-quarter with a vaccine prepared from *Cl. chauvoei* only.

It has been observed in some of our experiments and also reported by other workers that immunisation against *Cl. chauvoei* does not confer immunity against *Cl. septicæ* infection. Hence it is highly probable that the deaths reported as due to Black-quarter among cattle after vaccination with *Cl. chauvoei* bacterin are due to a subsequent infection with *Cl. septicæ*. The present vaccine prepared for controlling Black-quarter outbreaks at the Madras Serum Institute and at the Indian Veterinary Research Institute, Mukteswar is prepared from strains of *Cl. chauvoei* only. It is highly necessary and desirable that *Cl. septicæ* also is incorporated or mixed in the vaccine so that the vaccinations carried out against Black-quarter in the field will have its full value and may not become unpopular by an occasional death among vaccinated animals caused by *Cl. septicæ* subsequently. The above experiments justify the necessity for using a polyvalent or mixed bacterin prepared by using both *Cl. chauvoei* and *septicæ*.

The results also confirm the findings of Viswanathan 1934 that *Cl. septique* was also found in outbreaks of Black-quarter in this State. But *Cl. welchii* which was found to be one of the organisms causing Black-quarter outbreaks in Mysore by Naidu (1937) was not encountered in this State so far.

Though the majority of the animals that died of Black-quarter and from which the above muscle specimens were received are mostly from young cattle of 1 to 3 years of age, older animals upto 8 years also are found susceptible. Two of the specimens received were from buffalo calves. No materials were received from outbreaks of Black-quarter among sheep.

Summary

Out of 30 specimens of muscles from Black-quarter cases received from the staff of the Madras State, *Cl. chauvoei* was isolated from 26 specimens, *Cl. septicum* from 1 and a mixture of *Cl. chauvoei* and *Cl. septicum* from 3 specimens. This indicates that outbreaks of Black-quarter in this State are caused either by *Cl. chauvoei* or *Cl. septicum* alone or as a mixed infection. *Cl. welchii* was not met with in the above specimens.

A sketch map of the Madras State showing the areas where the disease is endemic and causing heavy mortality is enclosed for reference.

The work will be continued.

Addendum.—Based on the results of the above work, *Cl. septique* is incorporated with *Cl. chauvoei* in the Black-quarter Vaccine now manufactured and supplied from the Veterinary Biological and Research Institute, Ranipet. This polyvalent vaccine is reported to be yielding very good results in the field in controlling outbreaks of Black-quarter.

Acknowledgment

It is my pleasant duty to express my sincere thanks to Sri K. S. Nair, the then Superintendent, Serum Institute, Madras for his valuable advice and interest in the experiments and to Sri K. Ramasubramaniam for technical assistance.

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THE SENSITIVITY TO STREPTOMYCIN OF CERTAIN GRAM-NEGATIVE ORGANISMS OF PATHOGENIC IMPORTANCE

By

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Introduction

There is great inclination to evaluate streptomycin more and more in medical science as an agent of antibiotic-therapy. The intensive research efforts of the modern workers in this direction have resulted in a growing promise for combating many bacterial infections among men and animals. Accordingly this experiment was undertaken to determine the degree of sensitivity to streptomycin of some gram-negative organisms of pathogenic importance, viz., *Brucella abortus*, *Escherichia coli*, *Eberthella typhosa*, *Shigella gallinarum*, *Shigella dysenteriae*, *Salmonella typhimurium* and *Alcaligenes bronchisepticus*.

The dextrose-agar medium was used to simplify the complex procedure for the preparation of any special medium in ascertaining the extent of sensitivity of these organisms to streptomycin. This simple medium contained streptomycin in varying proportion.

Review of Literature

Discovery of penicillin (12) as an antibiotic has been generally accepted to be most conducive and stimulating to medical science. Pasteur,

however, reported in 1877 that the air-borne contaminants inhibited the growth of *Bacillus anthracis*. Bouchard observed in 1888 that *Pseudomonas aeruginosa* was antibiotic to *B. anthracis*. This remains true in respect of many other organisms. Emerich and Law (merchant, 1948—vide Ref. 12) extracted an enzymelike substance from the filtrate of *Ps. aeruginosa* culture called pyocyanase which was bacteriolytic to several species of bacteria including *B. anthracis*.

The antibiotic substances from many bacteria were similar to pyocyanase in respect of their action on the sensitive organisms. Waksman reported about thirty two different species (9, 16, 17) of such spore-forming and non-spore-forming micro-organisms.

The mould of the species of penicillium grown by Alexander Fleming in 1929 (11, 12) in nutrient broth at room temperature for a period of more than one week acquired growth inhibiting, bacteriocidal and bacteriolytic properties to certain species of bacteria. The agent with these properties produced from the mould is 'penicillin'. In 1943 the therapeutical manufacturers in United States of America produced a large quantity of penicillin and it was made available for curative purpose in the infection of streptococci, staphylococci, bacillus of gas-gangrene group, etc.; but penicillin failed to produce any appreciable result in the infections with gram-negative bacteria. This quality appeared to be either due to certain inherent characteristics owing to the prolonged contact with penicillin or due to the resistance against it owing to the secretion of an enzyme by them. The enzyme is known as penicillinase and it is able to destroy penicillin.

Actinomyces griseus produced an active chemotherapeutical agent 'streptomycin' which is similar to penicillin in its action on gram-negative bacteria. It was discovered by Schatz, Bugie and Waksman (13, 16, 17) in 1944. A considerable research effort followed which eventually resulted in the manufacture of a large quantity of streptomycin for curative purposes.

Streptomycin is manufactured by growing *Actinomyces griseus* in meat and glucose medium (12). It is soluble in dilute acid and in water but insoluble in chloroform and in ether. It is thermostable and has a therapeutic value of great importance. Its dosage has been assayed by units. Each unit of dry powdered streptomycin is equivalent to the quantity of the same which is capable of inhibiting the growth of *Escherichia coli* in a milliliter of nutrient broth culture.

The former investigation of Waksman and his co-workers established by experiments that streptomycin was active against many other bacteria including *Mycobacterium tuberculosis*. Fledman and Hinshaw (7) experimentally demonstrated in 1944 that it was quite effective in suppressing an

induced Tuberculosis in guinea pigs. It also prevented death in them (15) in experimental Brucellosis and was appreciably active against pasteurella infections. These facts were revealed by Heilman; and he maintained similar views with regard to the experimental Tularemia in mice.

A combined treatment of penicillin and streptomycin has been advocated (3) by some with quite beneficial results in cases of mixed infections. The combined use of streptomycin and sulfadiazine (6, 14) has been evaluated in the treatment of Brucellosis during recent years. The combination of streptomycin and aureomycin (8) has been worked out to be the most effective method of treatment for brucella infections.

Materials and methods of experiment

Basic medium.—The medium used for this experimental purpose consisted of bacto-beef extract, 30 grams; bacto-tryptose, 100 grams; bacto-dextrose, 100 grams; sodium chloride, 50 grams; bacto-agar, 150 grams and distilled water, 1,000 milliliters. The medium thus made was autoclaved under 15-20 pounds of pressure for 20 minutes. The ingredients were thoroughly mixed up by rotatory movement and pH was fixed between 7.2 and 7.4. It was distributed into seven 200 ml. flasks at 135 ml. in each flask. The remaining 55 ml. were utilized for the control tube slants.

Streptomycin dilution.—A stock solution containing 50,000 micrograms of streptomycin per milliliter of distilled water was prepared. This solution was supposed to remain potent for 30 days under refrigeration. The desired dilution of streptomycin per milliliter was made from this stock solution.

The solution of known strength of streptomycin was added to the molten but cooled dextrose-agar medium already made at the temperature ranging from 47° C to 50° C; eventually the desired strength of streptomycin was obtained in the medium which would be used for testing the sensitivity of the said organisms. This was accomplished by keeping the flasks containing the medium in hot water heater and thoroughly mixing the streptomycin solution added to it with rotatory movements. The procedure followed has been detailed in table 1.

Tubing of the medium.—4 milliliters of streptomycin-dextrose-agar was poured in each of 15x150 mm. test tubes by means of a pipette when it was in molten condition and the slants were made. The test tubes containing these slants were labelled in accordance with the dilution of streptomycin, e. g., 100, 50, 10 and 1.

The slants made with 55 milliliters of the remaining dextrose-agar without streptomycin were marked with the letter "C" and were utilized for making the controls.

Sterility test of the medium.—All the slants made were incubated at a temperature of 37°C for 24-48 hours. The chances for contamination of the medium ranged upto 0.5 percent provided due care was taken to follow the proper technique in its preparation.

TABLE I

Preparation of Streptomycin solution.

Desired concentration of streptomycin per ml. of medium in micrograms.	Stock solution of streptomycin to be added to dextrose-agar medium.	Quantity added per 135 ml. of basic medium (i.e., dextrose-agar).
100	0.54 ml. of stock solution containing 50,000 micrograms per ml. plus 1.46 ml. of sterile distilled water yields 2 ml. of solution with 13,500 micrograms per ml. (Sol. No. 1)	1 ml.
50	1 ml. of solution No. 1 plus 1 ml. of sterile distilled water yields 2 ml. of solution containing 6,750 micrograms per ml. (Sol. No. 2).	1 ml.
10	1 ml. of solution No. 2 plus 4 ml. of sterile distilled water yields 5 ml. of solution containing 1,350 micrograms per ml. (Sol. No. 3)	1 ml.
1	1 ml. of solution No. 3 plus 9 ml. of sterile distilled water containing 135 micrograms per ml.	1 ml.

Mode of inoculation.—Inoculation of the slants was accomplished by streak method. Two tubes of each dilution of streptomycin-dextrose-agar medium were inoculated with a species of organism to be tested for the sensitivity. A control tube was also made with the respective organism simultaneously for testing the potency of the seed culture. These freshly inoculated tubes were sealed with paraffin after an incubation of 48 hours at 37°C to prevent drying and obtain a uniform and steady growth of the organisms sown. These were further incubated for a period of six days.

The growth characteristics of the respective organisms in various dilutions of streptomycin-dextrose-agar medium were carefully studied and recorded separately. The nature of growth had been emphasized to throw light on the sensitivity of the organisms in relation to a particular concentration of streptomycin.

Observations and Results of Experiment

The sensitivity test of the organisms was made twice for some and only once for the others. This was due to the necessity of completing the work within the scheduled time. Moreover the organisms tested were not available all at once.

Sensitivity to streptomycin of these known species of organisms detailed below was estimated from the nature of their growth in streptomycin-dextrose-agar media of different given concentrations.

1. *Brucella abortus*.—The sensitivity test with this species of organism was performed once only. It grew very slowly with a few typical, circular, smooth, shiny and translucent colonies in one of the two tubes containing the lowest concentration of streptomycin. Therefore, the growth of this organism was uncertain even in dilution of 1 microg. of streptomycin per ml. of basic medium. There was no growth in the tubes containing higher concentration of streptomycin than 1 microg. per ml. of the medium. The colonies including those of the control tube were typical to this species.

2. *Escherichia coli*.—This species of organism was tested twice and both the tests yielded similar results. Its growth in dilution of 1 microg. of streptomycin per ml. of basic medium was rather scanty; and comparatively fewer colonies were observed in dilution of 10 microg. of streptomycin per ml. of the base. There was no growth in the tubes containing higher streptomycin concentration than the latter. The colonies developed including those in the control tube were opaque, moist, smooth, glistening, circular, slightly raised and inclined to become confluent. The growth including that of the control tube was characteristic to the species of organism.

3. *Eberthella typhosa* (Typhi R 2). This strain of organism was tested twice. In the former test lot the growth was observed upto the concentration of 50 microg. of streptomycin per ml. of the medium; but in the latter case it took place upto the concentration of 10 microg. per ml. of the base. The growth varied from abundant to scanty in the highest two respective dilutions of streptomycin-media used. The colonies formed by these organisms including those in the control tube were small, greyish, transparent and gradually became opaque. The growth characteristics were typical to the species.

4. *Eberthella typhosa* (Typhi M 1).—This strain of organism was tested twice. During the former test it grew most abundantly in the medium containing streptomycin in highest dilution. Its growth was gradually retarded with the increase of streptomycin concentration in the medium; and it was uncertain in the medium containing 100 microg. of streptomycin per ml. of base as the colonies did not show up in both tubes of similar dilution. In the latter test the organism did not grow in the medium containing lower dilution of streptomycin than 50 microg. per ml. of base. Other characteristics were like those of the foregoing strain of the species.

5. *Shigella gallinarum* (Typhi T 2).—This species of organism was tested once only. The growth was rather abundant in as low a dilution as 10 microg. of streptomycin per ml. of the base. It was uncertain in the

medium containing 50 microg. of streptomycin per ml. and no growth was observed in the tubes of higher concentration of streptomycin than these. The colonies developed including those in the control tube were small, circular, bluish-grey, smooth and moist. The growth characteristics were typical to the species.

6. *Shigella dysenteriae* (Typhi 2V).—This organism was tested twice. It grew most abundantly in the tubes of lowest concentration of streptomycin. Its growth at the first instance became scanty in the dilution of 100 microg. of streptomycin per ml. of the medium; but in subsequent test it was rather uncertain. Its colonies in all the tubes inoculated were circular, moist, greyish and smooth; and these were typical in nature to the species.

7. *Shigella dysenteriae* (Typhi 65).—This strain of organism was tested once only. Scanty growth was observed in the tubes of highest dilution of streptomycin and no growth took place in the media containing proportionately more of streptomycin than 1 microg. per ml. of the base. The growth characteristics simulated the foregoing strain of the group.

8. *Salmonella typhimurium* (Gal 785).—This species was tested twice and both the tests were similar to each other in character. Most abundant growth was observed in the lowest concentration. Gradually the colonies diminished in number in the media containing more and more of streptomycin till those became quite scanty in 100 microg. dilution per ml. of the base. Greyish, smooth, glistening, and circular colonies with more or less entire edge were formed in the media tested. The growth including that of the control tube was characteristic of the species.

9. *Alcaligenes bronchisepticus*.—This species was tested once only. There were most abundant growths even in the highest concentration of streptomycin in the medium used for the test. Small dew-drop-like colonies made their appearance at the beginning of the incubation but those became flat, glistening and translucent with age. The colonies with similar characteristics were also observed in the control tube. The nature of the growth of these colonies were quite typical to this species of organism.

TABLE II

Reaction in various dilutions of Streptomycin.

Serial No.	Name of organism	Dilution of streptomycin per ml. of medium			
		1	10	50	100
1	<i>E. coli</i>	++	+	—	—
2	<i>E. typhosa</i> (Typhi R2)	+++	++	+	—
3	<i>E. typhosa</i> (Typhi M1)	++++	+++	++	+
4	<i>Shig dysenteriac</i> (Typhi 2V)	++++	++++	++	++
5	<i>Sal. typhimurium</i> (Gal 785)	++++	++++	+++	++

TABLE III

Reaction in various dilutions of Streptomycin.

Serial No.	No. of organism	Dilution of streptomycin per ml. of medium			
		1	10	50	100
1	<i>Br. abortus</i>	+	—	—	—
2	<i>E. coli</i>	++	+	—	—
3	<i>E. typhosa</i> (Typhi R2)	+++	++	—	—
4	<i>E. typhosa</i> (Typhi M1)	++++	+++	—	—
5	<i>Shig. gallinarum</i> (Typhi T2)	+++	+++	+	—
6	<i>Shig. dysenteriae</i> (Typhi 2V)	++++	++++	++	—
7	<i>Shig. dysenteriae</i> (Typhi 65)	++	—	—	+
8	<i>Sal. typhimurium</i> (Gal 785)	++++	++++	+++	++
9	<i>Alc. bronchisepticus</i>	++++	++++	++++	++++

— = no growth.

+ = most scanty growth in one tube and no growth in the other.

1+ = most scanty growth.

2+ = scanty growth.

3+ = abundant growth.

4+ = most abundant growth.

Discussion

Most of the gram-negative organisms of pathogenic importance which were subjected to this experiment were sensitive to streptomycin in varying degree. The rate of sensitivity of the individual organisms of a species did not appear to simulate one another. This was ascertained from the gradual but appreciable diminution in colony numbers and other growth characteristics i. e., the amount of their relative richness of growth in the dextrose-agar media of the control tubes and in those containing streptomycin in four different dilutions of known concentration employed in this experiment (see tables 1, 2, and 3).

The degree of streptomycin sensitivity of *Escherichia coli* was fixed as the standard for comparative study of the result obtained with regard to that of all other species of organisms subjected to this experiment. *E. coli* did not grow in 50 microg. dilution of streptomycin per ml. of the base. There was also absence of growth in the media containing streptomycin in higher concentration than this. In 1 and 10 microg. dilutions of streptomycin the growth was sparse and most scanty respectively.

Brucella abortus was more sensitive to the antibiotic from this stand point of views as it did not grow in 10 microg. dilution. Its growth in 1 microg. dilution was even uncertain; therefore, it was seemingly most sensitive species than all.

Both the strains of *Eberthella typhosa*, though markedly sensitive to streptomycin, did not respond as much as *E. coli* in this respect. These two strains also varied in the degree of sensitivity to streptomycin from each other. Similar was the result of experiment relating to *Shigella dysenteriae*; but there was a wider range of variation than *E. typhosa* between the two strains of the species tested so far. *Shig. dysenteriae* (Typhi 65) was more sensitive than *E. coli* but less so than *Br. abortus* to streptomycin. *Shigella gallinarum* was less sensitive to streptomycin than *E. coli*. But it was more sensitive than that of *E. typhosa*.

Salmonella typhimurium possessed least sensitivity than all with the exception of *Alcaligenes bronchisepticus*. The latter did not respond to streptomycin even in dilution of 100 microg. per ml of dextrose-agar base.

Such experiment still warrants the employment of intensive research efforts to be devoted in this direction. Could the efficacy of streptomycin be more extensively synthesized, it would be evaluated further to insure a wider scope for the employment of this antibiotic in a greater number of infections than the previously reported ones. It will eventually show a great promise for the evaluation of several therapeutic methods with the use of streptomycin alone or streptomycin and aureomycin, streptomycin and chloromycetin, streptomycin and terramycin, streptomycin and penicillin, streptomycin and sulfonamides (6,8,10,14).

Summary

The degree of streptomycin sensitivity of certain gram-negative pathogenic organisms, viz., *Brucella abortus*, *Escherichia coli*, *Shigella gallinarum*, *Shigella dysenteriae*, *Eberthella typhosa*, *Salmonella typhimurium* and *Alcaligenes bronchisepticus* was determined by studying their growth characteristics on dextrose-agar media containing given concentrations of the antibiotic.

The rate of sensitivity of *E. coli* was regarded as standard for the comparative study in respect of that of the other organisms which were individually subjected to this experiment.

B. abortus was more sensitive than *E. coli* and its growth was most affected even with the highest dilution of streptomycin than all of these organisms.

Shig. gallinarum, *Shig. dysenteriae*, *E. typhosa* and *Sal. typhimurium* showed their sensitivity to streptomycin to a lesser extent than *E. coli* and their degree of sensitivity was observed to be on the decline in the order named.

The highest concentration of streptomycin in the basic media did not tend to attribute any appreciable change from the usual growth characteristics of *Alc. bronchisepticus*.

More intensive researches in this direction have emphasized further scope for the application of streptomycin treatment in an increasingly greater number of infections than the previously reported ones—either alone or in combination with other antibiotics and sulfonamides.

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METHODS OF EVALUATION OF SEMEN QUALITY FOR ARTIFICIAL INSEMINATION AS ADOPTED IN THE ARTIFICIAL INSEMINATION CENTRE, MADRAS

By

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Examination of semen is one of the many important routines in a laboratory attached to an Artificial Insemination Unit as the success of the insemination is dependent on the supply of semen of good quality. Methods as to the evaluation of the quality of semen and their standards have been laid down by many. The writer, who has been connected with the Artificial Insemination work from October 1939 up to date, has adopted various techniques available in a laboratory without elaborate equipment. Samples of semen from various breeds like Ongole Scindhi, Ayrshire, Holstein-Friesian and also four Murrah Buffalo Bulls have been tested. Over 600 collections with the aid of artificial vagina from about 20 bulls of different breeds have been subjected to these tests and their characteristics noted. Semen studies were carried out once in a week regularly.

The collected semen samples were subjected to the following tests in the order given.

1. Appearance
2. Volume
3. Motility, Specific Gravity, Smell and Taste
4. pH, of fresh semen and diluted samples
5. Spermatozoal count
6. Percentage of abnormality
7. Resistance of sperms
8. Longevity of preserved samples.

1. **Appearance.**—The colour in a normal collection varies from a yellowish cream to light cream; yellowish colour being pronounced in the Ongoles; less so in Scindhi and least in the foreign breeds. In the Buffaloes the colour is milky white.

2. **Volume.**—The average volume of collection of a good sample varies from 4 to 5 c.c. in the adult bulls and 2 to 3 c.c. in those of the adult buffalo bulls. Volume less than that will usually be dilute or contain more shreds of epithelial cells and prove to be samples not worth preserving.

3. **Viscosity.**—It was determined with the aid of capillary attraction. The viscosity as compared with liquid paraffin and fresh cows milk was found to be double that of liquid paraffin and one and a half times as that of fresh milk of an Ongole cow.

Specific Gravity.—It ranges from 1020 to 1040

Smell.—The smell is like that of lime water (Liq. calcis)

Taste.—It has got a saline taste.

4. **Motility.**—When the collected sample attained the room temperature which takes about 10 minutes, a drop of the semen is placed on a clean slide and examined under low power. A swirling and wavy movement as observed at the margin of a big lake is seen. In a second, about 10 to 20 waves can be noticed to strike at the edge of the drop.

When a cover slip is placed over this drop, brisk movement of individual sperms is evident. The sperms appear as pin points. Waves, though formed, are less intense in bulk and volume. Under high power, individual spermatozoon of about 0.2 m.m. length looks like dashes, with the tails lashing about.

When diluted with normal saline to 1 in 1000, the sperms are seen, under high power, to be having a progressive motion by means of their tails. This progressive motility is lost in about 4 hours at room temperature. At this stage, only a non-progressive oscillatory movement of some of the sperms may appear. All sperms die in about 6 hours.

5. **Spermatozoal count and morphological study.**—The number of sperms is expressed in millions per c.c. A rough and ready method by means of comparisons of dilutions with the standard opacity tubes has been described by Burbank (1935) and Cornsleyek and Green (1939); care should, however, be taken to see that the sample examined is representative of the whole ejaculate. Methylene blue reduction time for all samples collected in the centre was found to be 3 to 5 minutes both in buffaloes and bulls. A more accurate method and the one adopted in this laboratory is counting with a Haemocytometer, the dilution being made with a graduated pipette instead of a leucocyte pipette where there are chances of the head and the tail being severed.

A special diluent, Sodii bicarb 5 grains, Formalin 1 c.c. and Aqua distillata to make up 100 c.c. is used. A dilution of the semen to 1 in 1000 is made with the above dilutor. A measured quantity i.e. 0.1 c.c. of this diluted semen is treated with 0.4 c.c. of one of the following stains viz. Methylene blue, Carbol fuchsin, Eosin or Iron Haemotoxylene and this mixture is incubated at 40° C. in a water bath for about 10 to 15 minutes by which time the sperms take the stain. This mixture is once again diluted with this special diluent to make a 1 in 10,000 dilution. A drop of this is allowed to run under a cover slip over the counting chamber of the Haemocytometer. This is allowed to settle and the mean count of sperms is taken in 4 corner squares; this is multiplied by 10,000 to find the number in 1 c.c. which subsequently is multiplied by 10,000 the rate of dilution. Whilst counting

unstained spermatozoa, sperms that lie sideways or under one another, are likely to be missed due to their translucency; but, in this method, these sperms being stained are easily located and not missed. This staining process may be carried out at any stage of dilution. The object of the special diluent is to kill the spermatozoa immediately and to fix them in their normal shape they had during life. Sodii bicarb in the fluid serves to dissolve the mucus in the ejaculate. (Vide annexed table for the average sperm counts).

A drop of the above stained sample is spread on a slide and dried and examined under oil immersion to count the abnormal sperms. 10 fields are counted and the mean struck and the percentage of unhealthy to healthy sperms is calculated. This is a combination of Williams III and Mechanze and Berbener (1937) methods. The percentage of abnormality like double tails or taillessness were not encountered. Coiled tails, tails twisted round themselves and crooked tails were counted and found to be more than 30% in bull No. S. 14 and the Buffalo bull No. 62 in later days. In the aforementioned two bulls and in the Holstein Freisian bull cytoplasmic droplets were observed in certain collections. The amount of nuclear material filling up the heads of the spermatozoa varied with the frequent number of collections in a day and with the age of the bull. From the above findings it can be safely concluded that the spermatozoa in the semen of immature bulls contain less of nuclear material as a rule. The percentage of sperms with sub-optimal sized nucleus varied between 20 to 25%. These are perhaps the immature spermatozoa.

6. **Hydrogen Ion concentration.**—The electrical pH meter, even though it affords accurate readings, requires a large quantity of semen. Webster (1939) has prepared a colorimetric method. The one that is used in this laboratory is by the B. D. H. Capillator Method, using Bromocresol purple or Bromo-thymol blue as indicators. In this, the quantity of semen required is 0.1 to 0.2 c.c. The readings were taken within 25 minutes of collection. The pH of the diluted sample freshly prepared and that after 12, 24, 36, 48 and 72 hours were taken. The pH of a good sample varied from 6 to 6.8. The diluted semen is buffered to a pH of 6.4. The observation reveals a regular rhythmic rise and fall of pH with the phases of the moon depending on the number of moonlight hours. (a separate paper on the rhythmic variation of the pH is under preparation). The diluted preserved sample was found to retain the pH 6.2 to 6.4 for 72 hours.

7. **Resistance:** Milavnov's method.—To a measured quantity of semen, 1% of Sodium chloride solution is added. The volume of semen, and volume of Sodium chloride solution needed for arresting the motility of the sperms are noted. Resistance of the given sample is calculated from

the formula $R = V/v$ where R = is the resistance, V = the volume of semen and v = the volume of sodium chloride. 0.1 c.c. of good quality semen requires 20 c.c. of 1% Sodium chloride solution to arrest motility of the sperms. However, in the semen samples obtained from the Holstein-Fresian, 10 c.c. of Sodium chloride solution brought about complete loss of motility.

8. *Longevity of preserved sample.*—This factor has been worked out in its two aspects viz. 1. Motility and 2. Fertility. Data collected on the fertility of the samples at varying periods have shown that preserved samples maintain both fertility and motility till the sixth day of preservation. Further work is in progress regarding fertility of preserved samples. (Regarding motility, results have been published in my article 'Preservation of Bovine Spermatozoa', in Indian Veterinary Journal Vol. XX No. 5.)

APPENDIX I

	No of collections made	Average quantity	sperm count in millions	% of abnormality
Ongole 2 a	30	4 to 5 c. c.	600 to 800	10
Ayrshire (Daniel)	12	5 to 6 c. c.	450 to 700	15
Scindhi 128	50	4 to 5 c. c.	500 to 700	5
Ongole 196	250	4 to 5 c. c.	600 to 800	5
Red Scindhi	25	4 to 5 c. c.	400 to 500	10
Crossbreed	20	5 to 6 c. c.	600 to 650	15
Ongole 289	30	3 to 4½ c. c.	600 to 800	12
Ongole 258	25	6 to 7 c. c.	600 to 800	10
Scindhi 448	50	5 to 6 c. c.	600 to 800	7
Scindhi 447	22	3 to 4 c. c.	400 to 500	12
Scindhi 430	10	5 to 6 c. c.	600 to 800	10
Scindhi 14	5	5 c. c.	500	35
Scindhi 553	1	5 c. c.	700	7
Holstein Fresian	5	6 c. c.	400	25
<i>Buffaloes.</i>				
Murrah No. 62	30 (till 1944)	3 to 4 c. c.	500 to 600	10
Do	12 (till 1951)	2 c. c.	400 to 600	30
Murrah 69	15	3 to 4 c. c.	500 to 600	10
Local Breed. 1	7	3 to 4 c. c.	600	5
Do 11	7	2 to 4 c. c.	500	7
Murrah 96	25	2 to 3 c. c.	600	5
Murrah	5	1 to 2½ c. c.	700	5

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TUBERCULOSIS IN CATTLE

BY

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The incidence of tuberculosis in cattle was supposed to be very infrequent in India but investigations made during the last few years have shown that the disease is far more prevalent than was formerly supposed.

The first of these investigations was made in our country by Dr. Soparkar in 1928, who found that 16-20 per cent of cows and buffaloes were affected with tuberculosis. Later on, in 1939-41 Abdus Salam and Shirlaw conducted Tuberculosis test in Government Livestock Farm herd, Hissar, which revealed that 25.5 percent cows, 28.3 percent bullocks, 12.7 percent young stock (9 months to 3 years old) and 1.2 percent bulls were positive.

The exact percentage of cows in our country affected with Tuberculosis is not known at present in-as-much as no extensive data have been obtained by veterinary examination of cattle in health and disease.

This paper records the results of a 'Double Intradermal Tuberculin Test' carried out in Gauskhala herd, Agroha (Hissar District) by the author on the 7th of August 1949.

Technique of the test.—A small area of skin was shaved on the left side of the neck and the fold of the skin in that area was measured with a pair of calipers and the measurements noted. The shaved area was then cleansed with methylated spirit. Then 0.1 c.c. of concentrated Tuberculin (obtained from the Indian Veterinary Research Institute, Mukteswar) was injected into the deep layers of the dermis by means of a sterilised dental syringe, so that a very distinct bead formed at the site of injection.

48 hours after this 'sensitizing' injection, the fold of skin over the site of injection was measured with a pair of calipers and the measurements noted. Then 0.1 c.c. of concentrated Tuberculin was injected in the same manner as before into the pea-like swelling.

After 24 hours from the second or 'diagnosing' injection, i.e. 72 hours from the first injection, observations were made by examination of the nature of the swelling.

Cattle showing hot, painful, diffuse oedematous swelling, with the thickness of the skin-fold double the original measurement, were declared as 'positive to tuberculin test'.

Animals showing only a hard, pea or bean-like swelling without oedema, heat and pain, were declared as negative.

In all 103 animals were subjected to the test and the following table summarises the details and the results.

Summary of the D. I. D. Test

Table No.	Type of the animals.	Total No. of animals.	Positive to D.I.D. test.	Doubtful to D.I.D. test.	Percentage positive to D.I.D. test.
1.	Calves, female	20	4	—	20%
2.	Calves, male	13	—	—	Nil
3.	Cow heifers.	9	1	—	11.1%
4.	Cows.	51	16	—	31.4%
5.	Bullocks.	9	5	2	55.5%
6.	Bull.	1	1	—	100%
Total. Strength of the herd. 103			27	2	26.2%

The following are the details of the animals that gave a positive reaction.—

No.	Kind of animal.	Age.	Measurements of the skin.		
			Before the 1st injection on 7—8—49.	Before the 2nd injection on 9—8—49.	24 hours after the 2nd inj. on 10—8—49.
1	Cow-calf.	5 months	7.2 mm.	26.2 mm.	44.7 mm.
2	"	2 "	4.0 mm.	10.3 mm.	15.0 mm.
3	"	2 "	4.0 mm.	9.7 mm.	27.3 mm.
4	"	5½ "	7.4 mm.	10.5 mm.	24.5 mm.
5	Heifer.	5 "	5.0 mm.	13.5 mm.	19.5 mm.
6	Cow.	9 "	6.3 mm.	19.9 mm.	42.5 mm.
7	"	5 "	6.0 mm.	13.0 mm.	20.6 mm.
8	"	13 "	6.0 mm.	15.7 mm.	18.6 mm.
9	"	20 "	6.6 mm.	11.2 mm.	18.2 mm.
10	"	8 "	6.3 mm.	9.8 mm.	17.8 mm.
11	"	7 "	5.4 mm.	7.3 mm.	14.7 mm.
12	"	9 "	4.8 mm.	7.9 mm.	13.6 mm.
13	"	5 "	5.2 mm.	13.8 mm.	21.2 mm.
14	"	5½ "	4.8 mm.	9.2 mm.	21.0 mm.
15	"	7 "	8.0 mm.	17.1 mm.	25.7 mm.
16	"	10 "	4.7 mm.	9.5 mm.	16.7 mm.
17	Bullock	10 "	8.7 mm.	22.2 mm.	26.8 mm.
18	"	12 "	8.2 mm.	20.6 mm.	35.5 mm.
19	Bull	4 "	15.1 mm.	24.0 mm.	35.0 mm.

Conclusion

1. It has been observed that cattle of the Gaushalla in apparent sound health, with attractive eyes and impressive looks, were positive to D. I. D. test.
2. All the male calves were found negative to the test, while 20 per cent of the female calves were positive to it.
3. The existence of the disease in a high percentage among cows and bullocks is significant and suggestive of an age-factor in its incidence.

Acknowledgment

The author wishes to express his gratefulness to Major A. C. Aggarwala, B.Sc. (Hons.), M.R.C.V.S., A.I.R.O., Director, Veterinary Services, Punjab, for affording facilities for the studies and to Shri S. Mohan Singh Malhi, Principal, Punjab Veterinary College, Hissar, for his keen interest and valuable instructions in the work.

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DEHORNING OF ADULT CATTLE - NEW TECHNIQUE.

By

F. D. WILSON, G.M.V.C., B.V.Sc.,

Department of Surgery,
Madras Veterinary College.

Amputation of horns in domestic animals is necessitated not only when they are fractured, deformed and dangerously long, but also in disease, especially in sinusitis of the frontal sinus for effective drainage.

The usual technique for the operation as described by Dollar is to have the animal under proper control and after administering anaesthesia, either general or local, the horn to be amputated is sawn through by means of a thin fine-toothed sharp saw. The after-treatment consists in arresting the haemorrhage and bandaging the operated part after application of an antiseptic.

Dehorning has also been done by ligaturing the horn base and it is reported by Cockburn (1948) that the horn drops away after 3 to 8 weeks depending on the age of the animal and the thickness of the horn but it is questionable whether this method is humane.

The new technique adopted by the author successfully in more than a dozen cases is as follows:— The skin around the base of the horn is shaved for a depth of an inch. With ordinary control of the head of the animal, the horn is anaesthetised by blocking the cornual nerve with 10 c.c. of 4% solution of novocaine. After cleaning the part and rendering it sterile, an

elliptical transverse incision is made at the junction between skin and horn but inclined more towards the skin, enclosing completely the base of the horn. The skin is then freed from the underlying fascia and bone, throughout the base of the horn, by blunt dissection and the dissected skin is completely deflected. With a fine saw the bone is sawn through as close to the deflected skin as possible. A point of importance in this process is that the saw goes through the upper part of the frontal bone very near its junction with the horn core, and not through the horn core itself. As such the haemorrhage is very negligible and gets arrested spontaneously. After removing clots, if any, in the superior aspect of the frontal sinus, the deflected skin is brought into apposition by interrupted sutures. Should the skin, however, not come into apposition, plastic surgery, akin to Cherry's operation for blemished knee, may be done. The operation is finished off by covering the sutured area with layers of leukoplast.



No after treatment is required and the skin sutures are removed on the 8th day, by which time the skin would heal by first intention.

This method of operation is thus an improvement over the existing method and gives a good finish. No unsightly stamp is left behind and, if the operation is done on both sides, it will give a neat appearance to the head of the animal.

Summary

1. A new method for dehorning adult cattle is described.
2. In this technique the haemorrhage is limited, the after treatment is very little, infection especially of the sinuses is minimised and the stamp is covered up by the skin.

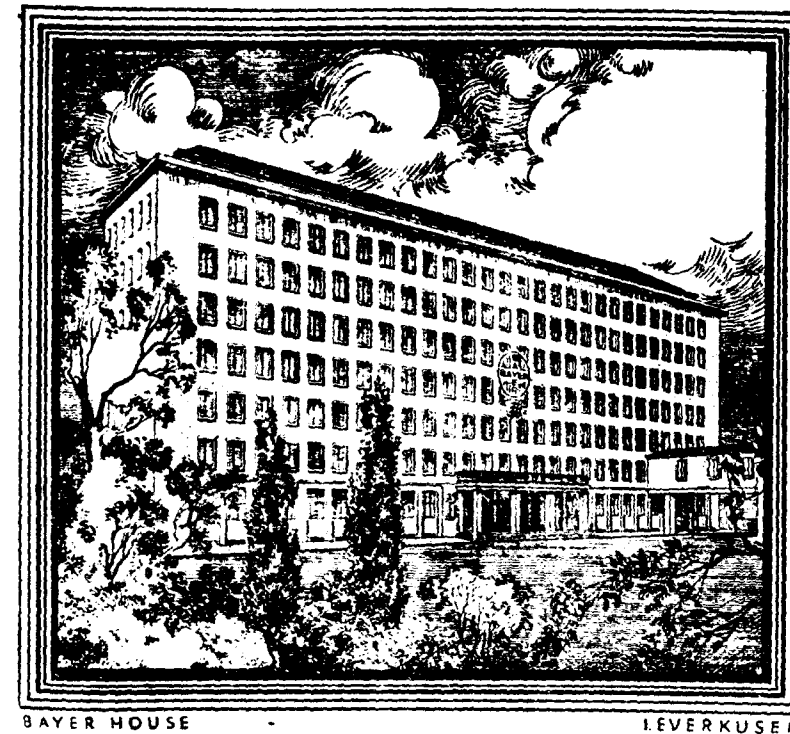
Acknowledgments

I wish to thank the Principal Dr. I. M. Azizuddin, B.A., G.M.V.C. B.V.Sc., Ph.D. (Edin.) for his useful suggestions.

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Summary

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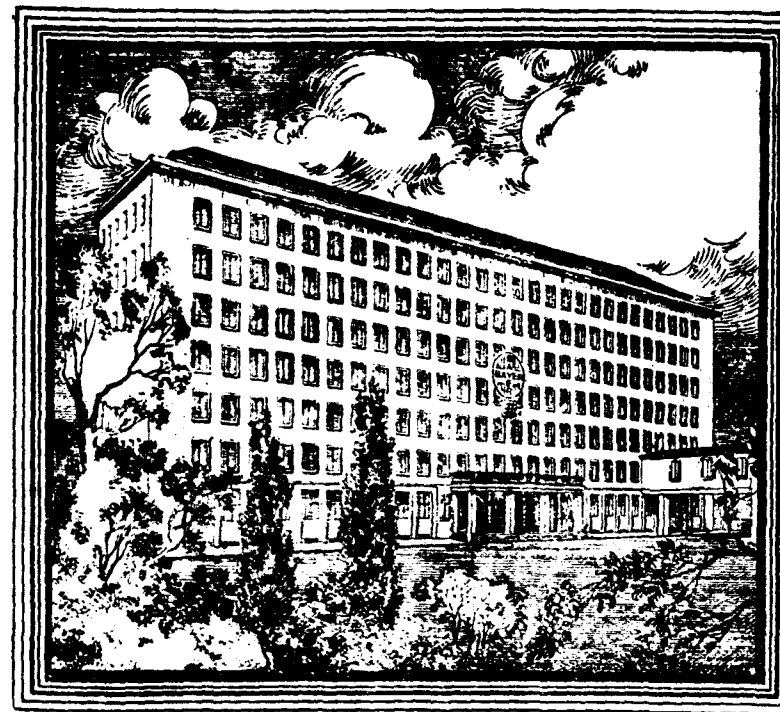
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THE
Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

Vol. XXIX

JULY, 1952

Editorial

VETERINARY EDUCATION

We publish elsewhere in this issue a notification of the Government of India, in its Ministry of Food and Agriculture, setting up an Indian Council of Agricultural Education under the aegis of the Indian Council of Agricultural Research. The object of creating this body is 'to co-ordinate agricultural education programmes so that a uniform standard of agricultural education in tune with the present day requirements of the country might be achieved'. Agricultural education is defined to include education in Animal Husbandry and Dairying—and, by a curious interpretation, the latter has been made to connote veterinary education. The notification also says that the Council will concern itself with only the broad principle of agricultural education and will advise provincial Governments in such problems as will be referred to it and that it will prepare model syllabuses for adoption in the various teaching institutions concerning agriculture, animal husbandry and dairying. It is, therefore, essential that the creation of this Council is widely known, especially to the Veterinarians, so that they may know exactly the nature and functions of the proposed authority for controlling Veterinary education in this country. It is also necessary now to examine the *raison d'être* for the creation of this Council and whether it is the correct thing to do for achieving objects in view.

This subject of Veterinary Education has been of perennial interest to all Veterinarians in the country for a long time past.

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It has attracted the attention of doctrinaires and politicians to try their pet theories on and to experiment with their favourite themes. It has also been engaging the attention of the Indian Council of Agricultural Research for a number of years; as a result it appointed a sub-committee in the year 1942 to go into the question of Veterinary Education in all its aspects. The recommendations of this Committee were not unanimous and, as commented upon in these pages then, the report did not commend itself to many a Veterinary educationist in this country. Since then great changes have taken place. It is being realised more and more that animal health and human health are greatly interlinked and that animal health is an essential pre-requisite for increasing agricultural production and in improving the general living standard of the people. Consequently, the general trend in Veterinary education has been to lay emphasis equally on Animal Husbandry and on Disease control and not on the latter alone as was being done in former days. Feeding, breeding and general management of livestock began to claim the attention of Veterinarians and suitable alterations and additions were made in the curricula of veterinary colleges. Unfortunately, however, for want of a central authoritative controlling body, each of the Veterinary Colleges in India pursued its own policy and shaped its own syllabuses and course of studies. As a result, there is now a distressing lack of uniformity and efficiency in our veterinary graduates. We have drawn pointed attention to these defects in these pages very often and there is no need to go over them again now. The profession, anticipating all these drawbacks from the lack of a centrally working directive body, has been crying with one voice for nearly three decades now for the creation of a Statutory body in the form of an Indian Veterinary Council which will look after the organisation and development of Veterinary education and allied interests in much the same way as the Indian Medical Council does over medical education and allied medical interests. In its last two Conferences held by the All-India Veterinary Association at Bombay in 1950 and 1951, this subject came up for discussion and resolutions for the creation of such a body were passed and sent up to Government along with, in the year 1951, a draft copy of the constitution of the

proposed Council based on democratic principles. In the face of all these representations, it is a matter for surprise and regret that the Government should have adopted a novel procedure of creating an *ad hoc* committee of about 50 members to advise on Veterinary Education. How this Committee consisting of diverse interests can advise the Government on such a technical and scientific subject as Veterinary education passes our comprehension. It is equally incomprehensible how a study of Animal Husbandry and Dairying can be construed as Veterinary Education. We fear the background of all this new novel approach to the subject is this lack of understanding of what Veterinary Science really means. The authoritative definition of Veterinary Science as given in British Encyclopaedia is as follows: Veterinary Science is the branch of knowledge that deals with the anatomy of the domesticated animals, their physiology and racial characteristics, their breeding, feeding and hygienic management, the pathology and treatment of their diseases and injuries, their relation to man with regard to inter-communicable maladies and to his use of their flesh and products. This definition clearly shows how vast and expansive Veterinary Science really is and what amount of knowledge is required of a Veterinary Surgeon. To reduce that Veterinary Science to the knowledge of a few elementary things about Animal Husbandry and Dairying is doing the grossest injustice to that Science and to the Veterinary profession. Veterinary Education is allied more to medical education than to agricultural education in that it involves the study of the health and disease of animals and, therefore, the authority that should concern itself with and be responsible for the development of Veterinary education and unifying it on an All-India basis must be a representative body of only Veterinarians created by the profession. No other organisation can meet the requirements of the case and satisfy the profession. This new Council of Agricultural Education is therefore a superfluous creation with doubtful utility. Even as a co-ordinating body, it is a redundancy of the old well-established Indian Council of Agricultural Research which, with its various sub-committees on soil, crop, animal husbandry etc., has been doing this kind of work for a long number of years. Taking all

things into consideration, the Government would be well advised to scrap this new creation and sanction instead the early formation of an Indian Veterinary Council which, as has been repeatedly put forth by the Veterinary profession, will look after not only the organisation of Veterinary Education but also other Veterinary interests. That is the only correct approach to the subject.

DISAPPOINTING

In our last issue we drew pointed attention to the resolution passed by the All-India Veterinary Association in its conferences held in Bombay during the years 1950 and 1951 and appealed to the Government to consider this resolution favourably and nominate representative Veterinarians to the Council of the States in the Centre and in the States. The All-India Veterinary Association, we understand, had also sent out special appeals on similar lines to the President of the Republic, Governors of States, Prime Minister, Chief Ministers of States and others connected with the administration and urged the granting of a representation to this scientific profession in the Legislatures. Still, in spite of all these endeavours, in spite of its best efforts, the profession has not been able to secure even one single nomination in any of the Legislative Chambers either at the Centre or in any of the States. This is a matter for profound disappointment to the profession. The Government, by this omission, have ignored the just claims of the Veterinary profession which, in the matter of general utility and intrinsic usefulness to the body-politic, can claim a very high priority. The welfare and development of livestock of the land have been admitted in our Constitution as a matter of vital concern to the general prosperity of the country: and it has been specifically laid down that the State shall endeavour to organise Agriculture and Animal Husbandry on modern and scientific lines and shall, in particular, take steps for preserving and improving the breeds of cattle. Yet, the Government has denied itself the advantage of independent expert advice and guidance on the subject. It has chosen to depend entirely on

the advice of its own official experts. Knowing fully well that that advice is not always infallible, and that independent views and opinions are needed even as a corrective, the Government should have nominated to the Legislatures non-official advisers from amongst the Veterinarians in the country. It is a great pity it has not done this. Not only has the Government lost by this action but the livestock of the country also. The Veterinary profession as the custodian of the health, welfare and development of the livestock of the land had a right and a claim for representation in the Legislatures in the letter and spirit of the Constitution and still, very unfortunately, its representations have not appealed to the Governments. The Veterinary profession need not on this account lose heart but should redouble its efforts to convince the Government about the soundness of its claims in the general interests of the country.

THE INDIAN SCIENCE CONGRESS

It is a matter for great pleasure that the President of the Medical and Veterinary Section of the Indian Science Congress for the year 1953 has been elected from amongst the members of the veterinary profession and that Dr. Datta, the Director of the Indian Veterinary Research Institute, Mukteswar, has been chosen for the honour. We congratulate Dr. Datta on this high honour conferred on him and we do hope and wish that this honour will bring still greater honours to him.

It is quite a long time since the Veterinary Profession had this distinction conferred on it. When the section of Medical and Veterinary Sciences was first created, there was an understanding that the Presidentship of the section would go to either of these sections alternately. This understanding was necessary owing to the paucity of veterinary members in the Congress and was acted upon for some time. Subsequently, for some unknown reason, the practice was given up and the veterinarians did not get a chance for a number of years. This matter was taken note of by the All-India Veterinary Association last year and a representation was sent up to the President of the Indian Science Congress to get this rectified at the earliest opportunity. It is heartening that this representation had its effect and that, at the very next election, a veterinarian of the eminence of Dr. Datta was chosen as the President of the section. We extend our thanks to the Indian Science Congress for so readily responding to the representation of this profession.

It is now up to the profession to strengthen the hands of the President and give him all the support he needs. It is necessary that as many members of the profession as possible should register themselves as permanent—other than sessional—members of the Indian Science Congress and contribute a good number of scientific papers for the next session to be held in Lucknow between the 2nd and 4th of January 1953. This will give adequate strength and support to our President in both men and material. Ordinary members can be enrolled only if the subscription of Rs. 12/- is paid before the 15th July each year, after which date, the members will be eligible to become only 'sessional' members with no voting rights. Therefore, there is not much time to lose. Veterinarians in the country must hurry up to become members and take their proper place in this large body of scientists not only in their own interests but also for enhancing the prestige and status of the profession and its capacity for service to the country. The subscription should be sent to the Treasurer, Indian Science Congress Association, 1, Park Street, Calcutta-16.

NOTIFICATION

GOVERNMENT OF INDIA
MINISTRY OF FOOD AND AGRICULTURE
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)

No. F. 32 (7)/51-Ext.

New Delhi, dated the 27th February, 1952.

With a view to co-ordinating agricultural education programmes (including education in Animal Husbandry and dairying) in the country so that a uniform standard of agricultural education, in tune with the present day requirements of the country, might be achieved, an Indian Council of Agricultural Education has been set up under the aegis of the Indian Council of Agricultural Research on the recommendations of a Conference of State Ministers of Agriculture, Vice-Chancellors of Universities, Deans of Faculty of Agriculture and Principals of Agricultural Colleges in India held on the 3rd and 4th November 1951. The composition of the Council is as under :—

Personnel

1. The Hon'ble Minister for Food and Agriculture—President.
2. The Vice-Chancellors of the Universities having under them colleges imparting education in agriculture, animal husbandry or veterinary science with the deans of faculty of agriculture as alternate members of the Council.
3. Nine Principals of Agricultural Colleges.
4. Four Principals of Veterinary Colleges.

5. Vice-President, Indian Council of Agricultural Research.
6. Joint Vice-President, Indian Council of Agricultural Research.
7. Director, Indian Agricultural Research Institute.
8. Director, Indian Veterinary Research Institute.
9. Director, Indian Dairy Research Institute.
10. The President, Forest Research Institute.
11. A representative of the Inter-University Board of India.
12. A representative of the Ministry of Education of the Government of India.
13. A representative of the Ministry of Food and Agriculture, Government of India.
14. The Agricultural Commissioner with the Government of India.
15. The Animal Husbandry Commissioner with the Government of India.
16. The Agricultural Extension Commissioner with the Government of India.
17. The Inspector General of Forests.
18. Three members nominated by the Government of India.
19. The Secretary, Indian Council of Agricultural Research (Ex-Officio-Secretary).

Functions

- (a) The Council will be purely an advisory body.
- (b) It will co-ordinate agricultural education (which term includes education in Animal Husbandry and dairying) programmes so that a uniform standard of agricultural education might be achieved throughout the country ;
- (c) It will concern itself with only the broad principles of agricultural education and will advise provincial Governments on such problems as will be referred to it ; and
- (d) It may prepare model syllabuses for adoption in the various teaching institutions concerning agriculture, animal husbandry and dairying.

Executive

The Council will function through two Executive Committees one for agricultural and the other for animal husbandry (dairying being included in the latter) subjects. These two Executive Committees will be concerned with the disposal of matters solely pertaining to their own individual subjects and the Education Council as a whole will be concerned with the general matters of policy affecting both the sides.

Terms of Office

The ex-officio members and the Vice-Chancellors will hold office so long as they hold official positions by virtue of which they hold membership of the Council. The three members to be nominated by the Government of India and the member to be nominated by the Inter-University Board will hold office for a period of 3 years. The Principals appointed will hold office for a period of 3 years or till such time as they hold their office of Principal, whichever is less. If, for any reason, a member vacates office before the expiry of the full term, the vacancy will be filled by nomination of another member for the balance of the period.

FIRST MEETING OF THE INDIAN COUNCIL OF AGRICULTURAL EDUCATION

Hyderabad 22nd and 23rd April, 1952.

Resolution No. I

The Indian Council of Agricultural Education :

- (i) *Having considered* the report of the Agriculture Wing of the Council on Items 1 and 5 of the agenda and the Animal Husbandry Wing of the Council on Items 2 to 4 ;
- (ii) *Having noted* the fact that in Indian Universities there are two types of courses in agriculture, one extending for 3 years after Intermediate and the other for 4 years after Matriculation ;
- (iii) *Recognising* the need for narrowing down the difference as far as possible in order to maintain a uniform standard with a view to securing equivalence of examination in agriculture throughout the country ;
- (iv) *Realising* that the main problem, whatever the minimum standard of qualification for admission to agricultural colleges may be, is primarily to produce a well-equipped agricultural graduate by giving him a type of education related directly and effectively to the tiller of the soil and making him "soil-minded" so that he can apply the scientific knowledge and techniques acquired in the college for improving agricultural development in the villages ;
- (v) *Considering* the importance of the English language as a medium for acquiring and developing the power of precise expression of scientific knowledge till Hindi and the regional languages develop the content and power adequate to maintain the high standard which English provides ;

RESOLVES :

That the following recommendations with regard to each item of the agenda be adopted :—

1. *Agricultural Education : Agenda Item No. 1.*

* * * * *

2. *Veterinary Education (Item No. 2 of the Agenda.)* Having regard to the discussions at the main Council meeting, it was resolved to refer this subject to the Standing Committee for consideration in the light of the salient points made at the discussion in the Council and to submit a detailed report, with recommendations, in consultation, as far as possible, with the Universities and Colleges concerned.

The Standing Committee may be free to co-opt such other members as may be necessary.

3. *Associateship of the Indian Veterinary Research Institute, Revision of Rules :*

(*Item No. 3 of the Agenda.*) The Rules as appended were approved.

4. *Indian Dairy Diploma versus B.Sc. (Agr) with specialization of Animal Husbandry and Dairying :*

(*Item No. 4 of the Agenda.*) The Council was of the opinion that the subject was purely of administrative nature for the Government of India to consider.

Resolution No. II

1. *Standing Committee.*

The Indian Council of Agricultural Education.

Having considered the need for laying down a procedure for the future working of the Council and to ensure follow-up action and continuity in the working of the Council through suitable machinery which could function between Council meetings.

RESOLVES :

- (a) That a Standing Committee consisting of not more than 6 members of the Council should be elected on a regional basis.
- (b) That in the first instance the President of the Council be authorised to nominate the 6 members.
- (c) That the Director of Indian Agricultural Research Institute be ex-officio Chairman of the Standing Committee.

Standing Committee as nominated by the President and approved by the Council.

1. Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi, (ex-officio Chairman).
2. Dr. T. J. Mirchandani, Dean of Faculty of Agriculture, University of Delhi Delhi. (Convener)
3. Dr. B. L. Sethi, Principal, Agricultural College, Kanpur.
4. Dr. L. S. S. Kumar, Principal, College of Agriculture, Poona.
5. Dr. Amir Ali, Principal, University College of Agriculture, Osmania University, Hyderabad.
6. Dr. S. Datta, Director, Indian Veterinary Research Institute, Izatnagar.
7. Dr. S. R. Chadha, Principal, Bombay Veterinary College, Bombay.

APPENDIX

Revised rules for the grant of the Associateship of the Indian Veterinary Research Institute as revised by the Council of Agricultural Education at its meeting in Hyderabad on 23rd April, 1952.

1. A limited number of properly qualified candidates is admitted at the Indian Veterinary Research Institute, with the sanction of the Government of India for a two-year post-graduate training leading to the award of the Associateship of the Indian Veterinary Research Institute.

2. Candidates seeking admission for the award of the Associateship should possess a degree or diploma in Veterinary Science of a recognised Veterinary College in India or abroad. Preference will, however, be given to those possessing in addition a degree of Biological Sciences. University Graduates in Physics, Chemistry and/or Physiology, and Graduates in Agriculture and Dairying will also be eligible provided they have a good working knowledge of farm animals, their anatomy and physiology. Any member of the staff at the Institute who otherwise holds the prescribed qualifications for admission and has been working at the Institute for a period of not less than four years and who during that time has carried out research work of originality and merit and presents a thesis thereupon, shall become entitled to the Associateship of the Institute, provided that the thesis is approved by the Committee appointed under Rule. 6.

3. Prior to admission, each candidate who fulfils the above qualification requirements, will have to name and outline the subject on which he wishes to work. After the programme of studies is approved by the Director of the Institute, the student will be attached to the appropriate section of the Institute where he will work under the supervision of the Officer-in-charge of the Section or under some other Officer assigned for the purpose.

4. Selection of candidates will be made by a selection committee appointed by the Council of the Institute. Students selected will, according to the nature of the subject in which they wish to specialise, be attached to one of the following sections :—

- (i) Pathology and Bacteriology Section.
- (ii) Section of Parasitology.
- (iii) Animal Nutrition.
- (iv) Animal Genetic section.
- (v) Poultry Research Section.

5. During the period of two years each student will have to pay a tuition fee of Rs. 26/- p.m. This will include rent free accommodation.

6. Students who successfully complete the two-year post-graduate training and present a thesis upon research work of originality and merit within six months of completion of the period of study become entitled to the award of the Associateship of the Indian Veterinary Research Institute, provided the thesis is approved by a Committee consisting of the Director of the Institute, the Section Officer concerned, and another suitable External Referee appointed for the purpose by the Council of the Institute. The candidate will also be required to pass a written examination and *viva voce* test in the field of science covered by the thesis.

7. Candidates shall not be allowed to count any period spent under any other post-graduate course at the Institute for the purpose of rule No. 6.

Notes and News

Educational concessions to children of non-gazetted officers and others in the Madras State.—The Government of Madras have directed that with effect from the school year 1952-53, the following educational concessions, be granted to the children of all non-gazetted employees of the State Government, all employees of local bodies drawing pay not exceeding Rs. 300 per mensem and all teachers employed in aided elementary schools and aided secondary schools. The concessions will be restricted to the sons and daughters of the classes or employees mentioned above and will not be extended to their relatives or dependants. Pensioners, village officers or casual workers who are paid wages at current market rates and who are not employed regularly, will not be included in the scope of the concessions.

The concessions in the case of the children of these employees will be by way of the remission of full tuition fees in the case of those studying in elementary schools and in secondary schools up to and inclusive of Form

III and by way of the remission of one half of such fees in the case of those studying in the high school classes (Form IV to VI) of a secondary school.

The concessions will not apply to any of the special fees levied for specific purposes such as medical inspection, library, games, laboratory, etc.

Children already enjoying educational concessions upto the extent specified above, either as members of Backward communities or on grounds of poverty or for any other reasons, will not be given further concessions.

* * *

Improvement of cattle.—To improve the quality of the livestock in the country the Central Government is planning to start 600 cattle improvement centres in different parts of India. The superior breeding material produced in these will be used in the surrounding areas in ever-widening circles, which will eventually cover the entire country.

The existing efforts at improvement of cattle are haphazard and unco-ordinated and have no uniformity. Further, they are too small to deal with the 17,60,00,000 cattle of India, which works out to a quarter of the world's total bovine population.

The new scheme has been drawn up by the Indian Council of Agricultural Research after a study of the results of its activities during the past several years. It has the unanimous support of the States and the approval of the Planning Commission.

Each centre where the scheme will be worked out will be a compact area, consisting of a whole village or part of a village or a group of contiguous villages containing about 500 cows or she-buffaloes over three years of age.

To begin with, an intensive house-to-house survey will be conducted for finding out the exact strength of the cattle population and its distribution, the general agricultural conditions of the selected area, the prevailing animal husbandry practices, feeding resources and other relevant matters. All existing inferior bulls in the area will be removed or castrated.

Superior farm-bred bulls, selected on the basis of scientifically-planned breeding policy, will be stationed in the centre. Breeding will be strictly confined to these bulls, and records will be kept as to which bull served which cow, and when. There will be facilities for artificial insemination also.

All animals will be protected against contagious diseases. Equal attention will also be given for proper feeding.

These schemes will be carried out under the responsibility of State veterinary authorities. A substantial grant will be given by the Centre.

The Centre will also give technical advisers and experts, who will visit each place periodically. The scheme also contemplates the marketing of milk and milk products on a co-operative basis.—*Nafen. Indian Express.* 25-6-52.

* * *

A special three months course on Artificial Insemination and Physio-pathology of Reproduction was conducted at the Indian Veterinary Research Institute, Izatnagar, from January to April, 1952, for training officers of the Key Village Scheme. The following officers of the various States have successfully completed the course :—

1.	Shri I. N. Bhuyan	}	Assam.
2.	" B. N. Kakati		
3.	" C. K. Goswami		
4.	" M. Mahaboob Ali		
5.	" B. Tamuli	}	Bhopal.
6.	" R. S. Malik		
7.	" H. S. Pannu	}	Kutch.
8.	" H. A. Shivnani		
9.	" J. R. Sharma		
10.	" V. S. Hazari	}	Hyderabad-Dn.
11.	" B. N. Karalgikar		
12.	" M. M. H. Siddiqui		
13.	" K. C. Nayar	}	Himachal Pradesh.
14.	" J. C. Kohli		
15.	" R. P. Sen	}	Tripura.
16.	" G. P. Verma		

* * *

A new Veterinary Dispensary has been opened at Nidubrolu, Guntur, Madras State, mainly through the efforts of the local people. The Dispensary buildings, costing over Rs. 50,000 have been built out of the funds donated by the philanthropists in the village itself and handed over to the Government. This is a kind of public work which should be encouraged and fostered as that is one of the ways in which our people can be made to take more interest in our livestock.

* * *

F.A.O. Expert.—The services of an Expert with knowledge of the use of modern equipments in the manufacture of Biological Products have been secured for a period of one year under the Supplemental Agreement No. 4 entered into by the Government of India with the F.A.O. of the United Nations. Mr. Godfrey G. Alton, who has been assigned by the F.A.O. for this work has arrived in Ranipet and is working there. The Expert will advise and assist in the production of Biological Products for effective field work and train personnel in this field.

Under the basis of the agreement, the F.A.O. will provide certain necessary equipments not procurable locally but essential to the manufacture of Veterinary Biologicals. Such items of equipment will be decided by the Organisation and their cost shall not exceed the equivalent U.S. \$ 8000/-. The Expert has brought with him a spin-freeze drying apparatus. In tropical countries, Biological Products in liquid form rapidly degenerate and with this new apparatus, the potency of the sera and virus for a longer period can be better assured by concentrating and drying them.

* * *

Personal

Sri M. Narayana Menon, Lecturer at the Madras Veterinary College, who went abroad in 1950 for Post-Graduate studies in the United Kingdom has returned and resumed his duties after completion of his studies. He has also taken the Diploma of the Royal College of Veterinary Surgeons. Before returning to India Sri M. N. Menon has also visited a number of important Veterinary institutions and Research Stations in the United Kingdom and Ireland.

* * *

Shri A. K. Varma, who went to U. K. in February 1951 for higher studies in Parasitology as a Bihar Government scholar, has got himself registered in the University of London as a Post-Graduate internal student for the degree of Ph.D. Shri Varma has been working there on some of our own problems and had come back to India last February for some field investigations into certain parasitic diseases of man and animals and also to collect some materials and data for pursuing further research at London. After a short stay in India, he returned to London in the second week of June.

* * *

Dr. V. Mahadevan, M.A., D.Sc. (Paris.), F.R.I.C. (Lond.), Lecturer in Nutrition, Madras Veterinary College, has been elected as a 'Fellow of the Royal Institute of Chemistry', London, in recognition of his research studies published during 1948-51 in France and India. We understand that the Fellow of the Royal Institute of Chemistry is the highest Diploma granted in Great Britain by examination or on the proof of equivalent competency by the Royal Institute of Chemistry and that it has received the recognition of the principal Government Departments and other public bodies concerned with chemical appointments in Commonwealth countries. We are indeed gratified of this high distinction obtained by a member of the staff of the Madras Veterinary College. Among the papers published by him are the following:—

1. 'Some Recent Discoveries in the B-Complex Vitamins' *Ann. Biol.* 1951, 27, pp. 21-38.

2. 'Views Regarding the Problem of Wool'. *Ann. Nutr. Aliment.*, 1950, 4, pp. 361-386.
3. 'The Determination of Cystine in Foods and Proteins'. *J. Sci. Indust. Res., India*, 1950, 5, 9B, pp. 143-147.

* * *

Obituary

Dr. J. R. Mohler (1875-1952). The death of Dr. J. R. Mohler which took place in Washington on February 28, 1952, removes a very prominent figure in international veterinary circles. A famed scientist and livestock expert, an outstanding administrator and Pathologist—these are the tributes paid to him by those who have known him. He was the Editor of well-known Hutyra & Marek's Special Pathology and Therapeutics in its 1912 and 1928 edition. He was also the recipient of the Twelfth International Veterinary Congress Prize for his contributions to the profession.

Death has also occurred of Dr. D. W. Campbell, the Editor of the Veterinary Medicine, on March 27, 1952 in Chicago at the age of 72.

Both of them evinced a great and keen interest in this *Journal* and we will miss them very much.

Clinical Articles

SOME RECORD ON NORMAL WORM BURDEN OF FOWLS

BY

SHRI S. G. DIXIT, G.B.V.C., P.G.,

Assistant Disease Investigation Officer, (Poultry), Bombay State, Poona.

This short note is an outcome of the consolidation of the work done during 1948-49 and 1949-50 on the problem of normal worm burden of fowls. Hitherto, scattered efforts were made by periodical examinations of faecal samples of birds from well managed farms and to some extent from village birds. These examinations undoubtedly revealed the extent of parasitic infestation in a certain faecal sample, or a farm for that matter, but did not carry us anywhere near to the subject proper. It was then thought, that some knowledge on the subject could be gathered by actually counting the worms in the entire intestinal cannal of a fowl. The study was thus undertaken and in all 760 samples were examined during the course of 12 months.

Venue of work:—The intestines subjected to the examination were collected from Cantonment Market, Poona. Birds are brought here for sale

from round about Poona, and majority of these are village birds. A customer desiring to purchase a fowl for table purposes buys the same and gets it dressed from a butcher on the spot, who removes the intestinal canal intact and gives away the rest of the dressed fowl. This butcher was the source of supply of intestinal canals throughout the period of this work.

Type of fowls used:—It will be seen from above that most of these birds from which the intestinal canals were collected belonged to villages round about Poona. These were collected at weekly village markets and brought to Poona Cantonment Market for sale. Birds of all ages are killed here, but almost the majority were adult birds. Another important feature regarding these birds from the point of view of the present problem is that these birds never had any dosing with anthelmintics.

Period of work:—January 1949 to December 1949 was the period when this work was undertaken. In all 760 samples of intestines were examined during the course of 12 months. Efforts were made to spread over these samples evenly throughout the period but there was some deviation from this objective. In no month however, less than 30 samples were examined. The minimum number of samples examined in a month was 44 and the maximum was 99. The number depended much on the number of customers at the market and my stay at headquarters. The following is the exact number of samples examined every month.

1. January	99	7. July	83
2. February	59	8. August	67
3. March	74	9. September	44
4. April	49	10. October	54
5. May	52	11. November	63
6. June	71	12. December	45

Procedure of work:—The sample in each case consisted of the entire intestines of a fowl from the duodenum to rectum (both inclusive). The intestinal canal of a fowl was imagined to have been divided in four parts as duodenum, jejunum, ileum and rectum and was cut into four parts arbitrarily. Actual counting of worms would then begin and the number of cestodes and nematodes was entered in the register separately. If perchance a worm was cut into half while cutting the intestines into sections as mentioned above, it was always counted to the rear part of the intestine. It is true that some error might have been done while dealing with tape worms which were counted by intact heads alone.

Worm burden recorded:—For tabularising the data collected, the samples were spread over different groups on the number of worms recorded

in each sample. The groups were decided upon arbitrarily and were worked out as 1 to 10, 11 to 20, 21 to 30 and so on. The following table will show the worm burden recorded in groups as stated above.

TABLE NO. I

Nematodes		Cestodes	
No. of samples.	No. of worms recorded.	No. of samples.	No. of worms recorded.
450	0	468	0
246	1 to 10	228	1 to 10
43	11 to 20	45	11 to 20
14	21 to 30	11	21 to 30
2	31 to 40	5	31 to 40
1	41 to 50	3	41 to 50
2	51 to 60		
Nil	61 to 70		
1	71 to 80		
1	81 to 90		
760		760	

In order to have more exact knowledge of worm record, out of these 760 samples, 467 were further analysed using the frequency distribution as 1 to 5; 6 to 10; 11 to 15; 16 to 20 and so on. The following table will show the worm burden record under these groups.

TABLE NO. II

Nematodes		Cestodes	
No. of samples.	No. of worms.	No. of samples.	No. of worms.
329	0	314	0
83	1 to 5	87	1 to 5
28	6 to 10	32	6 to 10
16	11 to 15	17	11 to 15
5	16 to 20	8	16 to 20
3	21 to 25	4	21 to 25
2	26 to 30	1	31 to 35
1	71 to 75	1	36 to 40
		2	41 to 45
		1	46 to 50
467		467	

If the intestinal canal of the fowl is imagined to have been divided into four parts as Duodenum, Jejunum, Ileum and Rectum as stated above, worms were found to be located as follows.

TABLE NO. III

	Nematodes		Cestodes	
	No. of cases.	Percentage.	No. of cases.	Percentage.
Duodenum	153	38.4	50	12.5
Jejunum	183	45.75	116	29.0
Ileum	60	15.0	155	38.75
Rectum	8	2.0	9	2.25

It was also observed that 72% samples (alimentary canals) showed worm burden of some kind or other, while 18% showed both cestodes and nematodes.

Collection of worms was sent to Parasitologist, on more than half a dozen occasions and the different species of worms identified were as follows.

- | | |
|-------------------------------|-------------------------------------|
| 1. <i>Ascaridia galli</i> | 5. <i>Raillietina tetragona</i> |
| 2. <i>Capillaria species</i> | 6. <i>Raillietina echinobothrid</i> |
| 3. <i>Stronguloides avium</i> | 7. <i>Heterakis gallinae</i> . |
| 4. <i>Acuaria hamulosa</i> | |

Summary:—It will be seen from Table No. I that 40% birds harboured Nematodes and an equal number harboured cestodes. Further analysis of the data has revealed that 72% birds harboured some kind of worm burden either Nematodes or Cestodes and that 18% harboured both Cestodes and Nematodes.

Out of the infested samples about 80% in the case of Nematodes and 79% in the case of Cestodes harboured 1 to 10 worms only.

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CAESAREAN SECTION IN A LIONESS

BY

DONALD A. SCHMIDT, D.V.M.,

Chicago Zoological Park, Brookfield, Ill.

A six-year-old lioness (*Felis leo*) exhibited difficulty in parturition on two successive years. This cat, received by the Zoo in 1949, showed signs of parturition in her first pregnancy, on September 27, 1950. From September 27 to October 5, she refused all food. On September 30, one still-born cub was found in the cage. On October 1, another cub was partially exposed, the head and anterior part of the body being tightly enclosed by the vagina. The animal was transferred to a small cage with bars at both ends, and a rope was put around the exposed cub. Traction was then applied and, with some difficulty, the cub was removed.

Following removal of the cub, about 2 to 2½ quarts of bloody, foul-smelling fluid was discharged from the uterus. Since, on the first pregnancy, the lioness usually gives birth to one cub, rarely two, and due to the difficulty and danger involved in making an examination for other cubs, the patient was given 1.5 million units of procaine penicillin in oil in the gluteal region and released. The discharge from the uterus continued until October 5, when a third still-born cub was found on the floor of the cage. Following the birth of the third cub, the lioness began to eat and recovery was rapid and uneventful.

On October 25, 1951, she was again off her feed and some straining was observed. Pregnancy and imminent parturition were suspected, in view of the fact that the abdomen was slightly enlarged and mating had been observed by the keeper on July 6 (111 days before). The gestation period in the lioness is 105 to 112 days, according to Kenneth¹.

A 3-c.c. dose of posterior pituitary extract (USP) was administered subcutaneously in a forefoot on October 28. Marked contractions of the uterus were observed, but nothing was expelled. On October 29, posterior pituitary extract was again administered with the same results as on the 28th.

Anaesthesia

Since posterior pituitary extract did not effect expulsion of a fetus, it was decided that the animal be anesthetized and an examination made to determine, if possible, the reason for the apparent dystocia. Accordingly, on October 31, the lioness was transferred from the cage to a small barred box that could be closed quite completely with solid doors. By using a hand sprayer, 1½ pounds of ether was sprayed into the box over a period of

about half an hour. Anæsthesia was not complete, but the animal was depressed to the point where it was relatively safe to open one of the doors several inches and make an examination of the birth canal. The cervix was dilated and a presenting cub could be felt, but the birth canal was found to be quite small. Dimensions of the canal were about $1\frac{1}{2}$ inches by 3 inches.

It was then decided that cesarean section be done, and since the results with the ether had not been encouraging, sodium pentobarbital was used as the anesthetic. The weight of the patient was estimated to be between 225 and 250 pounds. Since the amount of fat present and the tolerance of the lioness to barbiturates were unknown, the drug was administered at the rate of 1 grain per 7 pounds of body weight, in order to give an added margin of safety. Accordingly, an injection of 33 grains of sodium pentobarbital was given intramuscularly, in the gluteal region. One hour later, another 5 grain dose was given intramuscularly in the shoulder. We waited another hour and then gave another 10 grains intramuscularly. When anæsthesia appeared to be complete, the door of the box was opened and the lioness was removed to the floor of the large cage. Ocular reflexes were still present and some pain reflexes were elicited when the carpal region was tightly squeezed. Respirations were deep and regular. The abdomen was prepared by clipping the hair and shaving an area posterior to the umbilicus. The skin was washed with water and germicidal detergent (Parke, Davis), alcohol 70 per cent, and finally painted with tincture of iodine.

Operation

An eight-inch midline incision was made through the skin and the area draped with sterile towels. While incising the skin, the animal moved her legs considerably and this was accompanied by groaning. We administered 7 grains of sodium pentobarbital intravenously by way of the tail vein, after which anæsthesia was complete. This made a total of 55 grains of sodium pentobarbital administered. The amount of anæsthetic administered was too much for the estimated weight of the animal, but necessary to achieve surgical anæsthesia.

The peritoneal cavity was entered after incising through a two-inch layer of fat. The uterus was entered through a five-inch incision and two partially decomposed cubs were removed. These cubs were much too large to pass through the small birth canal.

No. 1 medium chromic gut was used to close the incision in the uterus in two rows of inverting sutures. Before suturing the peritoneum, we injected 1.2 million units of sodium penicillin in 10 c.c. of physiological saline into the abdominal cavity. The peritoneum and fascia were each

brought together with a continuous suture of No. 1 medium chromic gut. The skin was closed with a continuous suture No. 4 braided silk.

The incision was painted with tincture of iodine and left unbandaged. We gave 3 million units of procaine penicillin in oil intramuscularly, and the lioness was placed beneath a heat lamp for warmth. She remained completely anæsthetized for three days. On the morning of the first post-operative day, an injection of 500 c.c. of 5 percent dextrose in physiological saline, to which had been added 800,000 units of potassium penicillin, was given by way of the radial vein followed by another 500 c.c. of 5 percent dextrose in saline in the late afternoon. An injection of 3 million units of procaine penicillin in oil was given intramuscularly.

Postoperative care

On November 2, we administered 1,000 c.c. of aminosol with 5 per cent dextrose (Abbott) by way of the saphenous vein (55 drops per minute) and 3 million units of procaine penicillin in oil intramuscularly.

On the third postoperative day, she was still anaesthetized, although retraction of the foot occurred when the carpal region was squeezed.

The following day, she was on her feet, but quite shaky. She ate a small amount of milk and some meat. From that day on, recovery was uneventful, but slow. The region around the incision was quite swollen for about a week. She frequently licked the incision and, in two weeks, she had removed the skin sutures. Five weeks following surgery, she was eating normally and appeared to be completely recovered.

REFERENCE

1. Kenneth, J. H.: Gestation Periods - A Table and Bibliography. Technical Communication No. 5, Imperial Bureau of Animal Breeding and Genetics Edinburgh, 1947.

CHLOROMYCETIN IN THE TREATMENT OF EAR CANKER IN DOGS

BY

N. H. LAMBERT, M.R.C.V.S., and M. E. PARKHILL, M.R.C.V.S.,
Dublin.

In order to assess the chemical value of chloromycetin in the treatment of ear canker in dogs a series of cases were treated solely with the drug which was made available as an ointment in tubes, originally intended for intramammary injection, containing 200 mg. of chloromycetin made up in 3.8 g of a base. The usual procedure was to instruct the owner to squeeze a little of the ointment into the affected ears once daily and continue until healing was complete. In two cases of very advanced pannus the application was made twice or three times daily.

*The Irish Veterinary Journal, Vol. 6, No. 5.

It may be said that the results of this treatment were highly encouraging as in several cases the chloromycetin applications cleared up the condition in a spectacular fashion and obviated the necessity for aural resection which would otherwise have been indicated.

The following is the history of sixteen of these cases:—

(1) Four-year-old Golden Cocker with ulcers on lips and ears. Chloromycetin was used only on the ears. Trinamide was given internally. A fortnight later the ears were completely cured. Five weeks later there was a slight recurrence in one ear, but on further treatment with Chloromycetin, the ear has now almost recovered.

(2) Five-year-old Golden Cocker—moist eczematous ears, with ulcers later. This dog had been treated over a period of five weeks with such agents as sulphonamide powder, penotran powder, penotran cream, ryotin ear lotion, lorexene and various ointments as well as getting internal treatment with trinamide, but no improvement whatsoever was seen in the ears. Chloromycetin was then used in both ears for one week after which one ear was completely cured, while the second ear was very much improved. A further week's treatment was sufficient to complete the cure of both ears.

(3) Twelve-year old English Setter, suffering from very chronic canker of both ears, with vegetations and deep ulcers. This dog had an aural resection performed on both ears about two years previously. This gave some relief for about eighteen months, but eventually the condition became more troublesome than ever. Chloromycetin was used and the dog was seen at weekly intervals for about a month, during which time the improvement was very marked, and eventually a complete cure resulted. However, the left ear showed a slight discharge two months later but is again improving on chloromycetin applications.

(4) Seven-year-old Dachshund which has been in its present ownership for a period of about four years, during which time it has had continuous ear trouble, discharging brown matter with deep-seated ulceration. One week's treatment with chloromycetin completely cured the condition, and there has been no recurrence to date.

(5) Eleven-year-old Collie, suffering from chronic canker with a scaly eczema around the outside of the ear. One week's treatment with chloromycetin was sufficient to clear up the inside of the ear and surrounding area, the skin becoming soft and healthy with renewed growth of hair. This dog had been treated with other remedies and while it always improved, the conditions had never really cleared up until chloromycetin was applied.

(6) Four-year-old mongrel terrier, with chronic ulcerative canker and a heavy discharge. After the first examination this dog was not seen again for three weeks, when treatment had been discontinued for about ten days. In spite of this, however, there was considerable improvement. Treatment was re-started, but after about a fortnight the condition appeared as bad as ever; however, chloromycetin applications were continued. A subsequent examination of this case showed that no improvement had taken place.

(7) Five and a half year-old Cocker. This dog suffered from puppyhood from orbital eczema, and pannus developed later in life. Chloromycetin was given for daily massage into the eye-lids. The treatment had a remarkably good effect for the first fortnight, by which time the lesions had almost cleared up. In spite of continued treatment, however, there was a slight tendency to relapse. The animal is still receiving treatment and, whilst not cured, is very much improved.

(8) Ten year-old Cairn with chronic ulcerative canker of many year's standing, which often improved on other treatment, but never completely dried up. Chloromycetin, applied into ears once daily, completely cured the condition in 14 days. An acute itch now occurs occasionally, but passes off after one or two dressings of chloromycetin.

(9) Ten-year-old Alsatian with ulcerative canker of the right ear for several years. Several remedies almost cured it but the ulcers never healed completely. Chloromycetin healed the ulcers and the ear became much drier but still appears to become violently itchy about twice daily and the head is often held on one side. In spite of great persistence with chloromycetin the itch remains and the ear has become slightly moist.

(10) Nine-year-old Blue Roan Cocker suffering from chronic canker with vegetations and pannus of both eyes. Three weeks after chloromycetin applications had been started, the ears were amazingly improved and the pannus much improved. After another three weeks treatment the left ear was cured, but the right ear still smelt slightly. The eyes had also much improved. The animal is still receiving chloromycetin treatment.

(11) Eight-year-old Sealyham which had chronic canker with vegetations in both ears of long standing. With various remedies the condition had improved but was never cured. Chloromycetin applications, however, completed the cure of the left ear, but the right ear remained moist and thickened, though some of the vegetations disappeared and there was far less discharge. In spite of several weeks' treatment the condition has not been completely cured though the dog has now far less discomfort from it.

(12) Four and a half year-old Lemon Roan Cocker with pannus of both eyes and practically blind. Chloromycetin was applied twice daily for

six weeks. The eyes have cleared considerably so that the dog can see really well, but blood vessels are still noticeable on the cornea.

(13) Two-year-old miniature Poodle with chronic canker of both ears. Many other treatments had been tried but to no avail. Chloromycetin improved both ears immensely. The animal is still under treatment.

(14) Six-year-old Golden Cocker with chronic canker of both ears. This animal had been put under treatment for two weeks but with no improvement. It was then put on to chloromycetin and was cured in a week. There has been no recurrence to date.

(15) Twelve-year-old Red Setter with moist canker of a few days standing. Chloromycetin applications produced a complete cure in three days.

(16) Seven-year-old Black Cocker suffering from extensive follicular mange over the whole of the body and chronic canker with a heavy evil-smelling discharge. The follicular mange reacted well to treatment, but in spite of various treatments the canker remained just as bad as ever. Chloromycetin was then used, and both ears made a remarkable recovery, being almost cured in a week.

In addition to the above a number of cases of mild canker, which did not respond to one or two dressings of a parasitic canker dressing, were rapidly cured by chloromycetin applications.

From these case reports it will be seen that chloromycetin appears to be a most useful agent in combating the troublesome condition of canker of the ear. As previously mentioned, the tubes used in these trials were intended for intramammary injection and, in some cases, difficulty was experienced in ensuring that the chloromycetin reached the affected part of the ear. A base more easily squeezed out of the tubes would, it is felt, be of advantage as it would ensure that the average dog owner could squeeze sufficient ointment into the ear of a restive dog. Also, for those cases requiring lengthy treatment, larger sized tubes would be helpful.

Summary

Sixteen cases of canker of the ear in dogs are reported. Treatment with chloromycetin, applied as an ointment once daily, gave most encouraging results. In addition, two cases of very advanced pannus have been remarkably improved following chloromycetin application three times daily.

Acknowledgment

Our best thanks are due to Messrs. Parke Davis and Co., Ltd., for placing a supply of chloromycetin at our disposal.

Our Mail Bag

Sri K. D. Narayan, Touring Veterinary Assistant Surgeon, Garhwa Bihar, reports of his experiences in the use of Acid Carbolic for treating some of the septicaemic diseases of cattle like H.S. and Anthrax. He says that owing to the extreme poverty of the people, they are very reluctant to pay for the cost of medicines like Penicillin and Sulpha preparations and that consequently he had tried the cheap drug Acid Carbolic in a number of cases of Anthrax and H.S. and has found it very successful. He recommends the use of Acid Carbolic in doses of 3 to 4 c.c. mixed with equal parts of water and injected intramuscularly every three hours and supplement it with oral administration of the drug in half to one dram doses every four hours. He says that not more than three injections are required for a cure.

Shri H. N. Roy, Veterinary Assistant Surgeon, Sakoli, Madhya Pradesh, records an unusual outbreak of Haemorrhagic Septicaemia in his jurisdiction—villages of Gawarra and Keshori—during the month of February 1951, although the usual season for the disease was in the monsoonic weather between July to October. Both the villages are in a low lying swampy area with no proper facility for drainage and there was a localised rainfall prior to the outbreak.

Six cases were seen and they were treated with 20 to 30 tablets of M & B 693 according to the age of the animal mixed with rice gruel. Five animals recovered after five days treatment and one animal which discontinued treatment on the second day died of the disease.

Correspondence

[The views and opinions expressed in correspondence are those of the writers themselves. Ed. I.V.J.]

Hidden Disease of Cattle in South Kanara District (Lumbar Paralysis)

Sir,

1. During the year 1948, you were kind enough to publish an article by me on the incidence of an undiagnosed disease among Cattle and Buffaloes, —in S. Kanara Dt., Vide I.V.J. Vol. XXIV No. 4 P. 296. The main symptoms of the disease are :—"Lumbar Paralysis". Since then, sustained enquiry and investigations were made on the causative factors of the malady.

2. The following causes were considered with the expert work and guidance of successive Directors and Veterinary Investigators :—

- (1) Botulism, (2) Osteomalacia, (3) Babesiosis, (4) Trypanosomiasis, (5) Paramphistomiasis, (6) Mycotic Diseases, and (7) poisoning.

3. During the year 1950, the Director of Animal Husbandry was kind enough to depute the Veterinary Investigation Officer, for an intensive study of the disease and the latter spent over 3 months in the District, and examined various specimens and also submitted blood and spinal fluid to Muktesar. The results of the findings did not provide any positive clue as to the cause of the malady. The Muktesar findings were that the sera gave positive result with agglutination test for trypanosomes, in about 60% of the samples of Blood Sera. But, in the field, we were not able to find trypanosomes in more than 2 animals affected out of over 100 actually seen. At the conclusion of our work, we were considering the question of thorough histopathological study of the brain and spinal cord.

4. The Assistant Mycologist from the Agricultural College worked with us for some time, and his report will be found in that of the V.I.O., submitted to the Director during 1951. The Veterinary Investigation Officer and myself toured over all parts, where the disease was endemic, and with the help of microscope were able to eliminate many bacterial and parasitic diseases from among the affected cases.

5. I discussed about this disease in the Conference of Departmental Officers at Madras in 1951, and requested for a small staff comprising an Officer, a Pathologist in a mobile van and a small Laboratory in the District.

6. The disease was prevailing for over 15 years in the District and during the regime of my predecessor (Sri V. Appu Rao) and myself from May, 1947 till July, 1951, we visited all areas, and eliminated several causes, as likely to produce the disease.

7. It is most heartening to note that simultaneously with our work here, a similar disease was occurring among goats in Ceylon, and other parts, and thorough research was conducted.

In the two issues of the *British Veterinary Journal*, (quoted below), two articles are published :—

1. Vol. 107—11, Novr. 1951.—Necrotising Encephalomyelitis of goats in Ceylon (Lumbar Paralysis of Goats).

Vol. 108—Mo. 3,—March, 1952.—Epizootic Cerebrospinal nematodiasis), or Setariasis. (Lumbar Paralysis) (Cerebrospinal nematodiasis).

8. The symptoms described in the two articles closely resemble those found in cattle in this District. The authors of the articles mention that cases were not reported or recorded in cattle. Therefore, it is likely that investigations here, on the disease in cattle, will complement those done in Ceylon, Japan, and America, and the picture will be complete.

9. A short note on the District and the animals affected is furnished hereunder :—

The disease occurs mostly in hillside villages, where there is abundance of forest growth, mosquitoes, and *Stomoxys calcitrans*. The incidence of intra-ocular and extra-ocular filariasis in bovines is too frequent in the District. The soil is poor in Calcium. The disease occurs among cattle and buffaloes of all ages and is both of acute as well as of chronic type.

In the acute cases, there is pyrexia for a day or two, followed by constipation and posterior paralysis commencing with the tail. In 20% of the cases, there is stiffness of fore limbs. In 10% of the cases, there is retention of urine. The majority of the cases are of a lingering type—Sudden onset, no fever, feeding as usual, obstinate constipation, inability to rise—and the animals go on feeding moderately and finally die in about 20 days.

Generally the disease assumes an epidemic form and one after another, the entire stock in a cow shed get affected or die. I have visited a house, where the owner lost one after the other of his entire stock of 20 cattle, within a period of 2 months. In another shed, I noticed 18 cattle affected out of 20. On enquiry, I learnt that about 800—1,000 head of cattle in South Kanara District, get the disease every year and nearly all of them die.

10. The disease occurs immediately after rains. During June—August, the cattle are housed in green manure surfaced sheds. Without any scope for moving out and have sufficient exercise, due to the heavy rain of the west coast, and cultivation at that time. When the rains abate and green grass is up, the cattle move out to graze and various ailments occur, e.g., Ephemeral fever, H. S., Anthrax, Botulism, etc. Among these cases, one or two suffer from lumbar paralysis, and die in the course of 10–20 days. From December to March, i.e., during the cold season, and when there is very little grazing, typical cases are seen.

Cases are met with in animals of 6 months and above, and in all states of health, i.e., animals in emaciated condition, as well as those in pick of health.

11. The following remedies were employed on symptomatic line :—

- (1) Calcium injections.
- (2) Penicillin.
- (3) Altan and Diaquone.
- (4) Intestinal Antiseptics with oil in cases of intestinal atony or enteritis, etc.
- (5) Antimosan, Anthiomalin.
- (6) Prostigmin.
- (7) Carbachol.
- (8) Nuxvomica or Strychnine.

So far no treatment has given any encouraging result.

12. I am of opinion that due to detailed investigation required for the diagnosis of this disease, the field workers have been inclined to record it as one of dietetic origin or of simple non-contagious ailments. In the interest of science and also to save the enormous loss to the stock owners, I feel that intensive investigation of this complaint should be vigorously pursued.

I am confident that the same findings arrived at elsewhere will be noticed here also. This will eventually lead to trying a remedy to save a large percentage of animals from certain death from the disease.

Mangalore, }
6th March 1952. }

S. A. SASTRY, G.M.V.C., P.G.,
Retired District Veterinary Officer.

Sir,

With regard to the article on Contagious Otorrhoea in cattle, published in the *Indian Veterinary Journal* November, 1951, I request you to kindly publish the following further particulars of interest.

1. I have had occasion to treat 350 cases of Stephanofilariasis among buffaloes only in the Veterinary Hospital, Tattamangalam, Travancore—Cochin State, during the period from September 1951 to January 1952.
2. Most of the animals affected were adults.
3. Ears and eyelids were seen affected.
4. Treated successfully with Euflavine Solution 1 in 1000, and Oleum Picis Rectificatus.
5. Most of the cases were discharged cured within the course of 10 days.
6. Some buffaloes with eye lesions had developed corneal opacity which disappeared with normal saline injections and dusting with Sulphanilamide powder.

Chittur—Cochin, }
9th June 1952. }

T. C. MENON, G.V.Sc., P.G.,
Veterinary Surgeon.

Review

Index of Treatment in Small Animal Practice.—BY HAMILTON KIRK, M.R.C.V.S. Second Edition 1951. Publishers:—Messrs. Bailliere, Tindall & Cox, Ltd., London. [Copies can be had through the Editor, *I.V.J.* Price 40s.]

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REVIEW—INDEX OF TREATMENT IN SMALL-ANIMAL PRACTICE 79

Actino-therapy, Electro-therapy, Chemo-therapy, etc. and contains also chapters on Antiseptics, Anæsthetics and Anti-Histamines. Every section has been dealt with in a clear and precise manner and we are glad that the chapter on Hormone Therapy is comprehensive as it should be in these days when that line of treatment is very much in vogue.

The second part contains the main index of treatment of the diseases in their alphabetical order. The chapter on repairing of fractures is up to date with details on intra-medullary pinning, metallic bone plating and Kirschner-Ehmer splints. The inclusion of proprietary preparations for the treatment of cases is a welcome feature in this part of the book. Many of these preparations have been found by practical experience to be extremely valuable and, as the author rightly points out, it would be sheer folly to confine our attention to the drugs in the B. P. alone. While on the subject of treatment, we do not find any mention of it for *Babesia gibsoni* which is quite common in some parts of this country: nor can we agree with the statement that dogs can be rendered immune to *B. canis* by the injection of serum from recovered dogs. The treatment recommended for the rabid dog's bite is far too severe. There is no need for it as, according to the latest information, it would be enough even if the part is vigorously washed with soap and water.

The third part deals with handling and restraint, administration of drugs, care and management of sick animals, etc. The chapter on foods and feeding is very clear and informative.

The book is a handy publication, well-illustrated, highly informative and instructive and should be a welcome guide to the practising veterinary surgeons.

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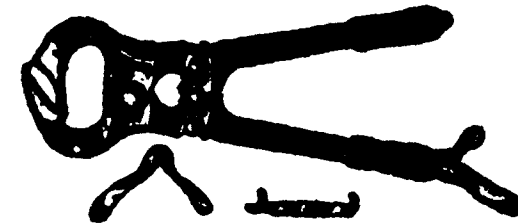
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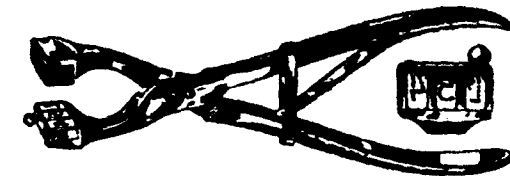
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