

Dhananjayrao Gadgil Library  
1 00000 00000 00000 00000 00000  
GIPE-PUNE-015862

# HOW TUBERCULOSIS IS SPREAD IN INDIA.

---

It is now definitely accepted that Tuberculosis in cattle may and does cause Tuberculosis in man, and this is especially important with reference to the disease in children in India. The interest taken in the cause and control of this disease in England, France, Germany, America, Australia and other countries of the world has tended to reduce the incidence of the disease considerably, and the investigation undertaken by those countries has awakened the people to a knowledge of the importance of the measures suggested to prevent it. But in India little has been done to ascertain whether the conditions which obtain in other countries exist here or how they may vary.

It is generally assumed that Bovine Tuberculosis is rare in India and with a view of ascertaining whether this statement was correct, I undertook some investigations.

Thinking that the Principal of the Veterinary College, Bombay, would be in a position to give me some information as to the prevalence of Tuberculosis in cattle in India I addressed him as follows:—

“Can you give me any information with regard to the prevalence of Tuberculosis in Milch Cattle in India, especially Bombay? Cows or Buffaloes? If you have no experience on this subject, would you kindly inform me who would be an authority, and whether any work has been done in this direction?”

His reply was not encouraging; it was:—

“I have no information with regard to the prevalence of Tuberculosis among cows or buffaloes in the City of Bombay. Let me remind you that you yourself are the authority in charge of Dairies and cowsheds within the City, and in consequence should have full information on the subject.”

Tuberculosis in his opinion was rare amongst Indian cattle, and he suggested I should consult the Inspector of Bandora Slaughter Houses.

The only work done that I could trace was in 1897 when the Health Officer of Bombay tested some cows and buffaloes with Tuberculin. No record was kept, and the opinion given was that Bombay cattle did not suffer from Tuberculosis.

“Tuberculosis” means the changes taking place in the animal body when it is invaded by the organism called the “tubercle bacillus.”

The tubercle bacillus discovered by Prof. Koch in 1882 is an organism capable of living, not only within, but also outside the animal body; it may be cultivated on various artificial media. Like other organisms it exhibits certain morphological characters which may be observed by means of the microscope; it grows and multiplies in certain ways; and it possesses certain physiological properties, through which it acts upon, and acted upon, by its environment, whether that environment be a living animal body or a lifeless artificial medium.

Tubercle bacilli, when stained with carbol fuchsin, are seen to be delicate cylindrical pink rods, slightly curved or straight, with a granular appearance; they are “acid fast,” that is, when stained and treated with acid, they retain the original stain. The difference in the microscopical and morphological appearance of human and bovine tubercle bacilli is very slight. What difference there is, is cultural and one of degree only.

Tuberculosis occurs in many if not all of our domestic mammals, in the ox, pig, horse, sheep, cat, dog and others.

It has also been observed in many wild mammals, the monkey, for instance, when kept in captivity. A disease called avian tuberculosis, is known to occur in certain birds; and reptiles have been described as suffering from tuberculosis. Hence the phrase tuberculosis in “animals other than man” opens up a very wide field of inquiry.

The Royal Commission on Tuberculosis, 1907, state that the cases of tuberculosis and the tubercle bacilli, found in the intestinal glands of children, are similar to that of bovine tuberculosis, and the disease was due to infection by food and milk. There can be no doubt but that in a certain number of cases the tuberculosis occurring in the human subject, especially in children, is the direct result of the introduction into the human body of the bacillus of bovine tuberculosis ; and there also can be no doubt that in the majority at least of these cases the bacillus is introduced through cow's milk. Cow's milk containing bovine tubercle bacilli is clearly a cause of tuberculosis and of fatal tuberculosis in man.

A very considerable amount of disease and loss of life, especially among the young, must be attributed to the consumption of cow's milk containing tubercle bacilli. The presence of tubercle bacilli in cow's milk can be detected, though with some difficulty, if the proper means be adopted, and such milk ought never to be used as food. There is far less difficulty in recognising clinically that a cow is distinctly suffering from tuberculosis, in which case she may be yielding tuberculous milk.

The milk coming from such a cow ought not to form part of human food, and indeed ought not to be used as food at all.

These results clearly point to the necessity of measures more stringent than those at present enforced, being taken to prevent the sale or the consumption of such milk.

The tubercle bacilli may be present in the milk of cows which are otherwise apparently healthy ; they are found in large numbers in the fæces of infected cows.

Shroeder, in an interesting paper, states that 40 per cent. of the dairy cows that retain the appearance of health and are not known to be affected till they are tested with tuberculin, actively expel tubercle bacilli from their bodies in a way dangerous to the health of other animals and persons, and that tuberculous cows do not expel tubercle bacilli till some time after they contract the affection. The practical importance of this is that herds of tuberculous cattle can be cleaned by the periodic application of the tuberculin test.

Shroeder draws attention to the fact that a considerable proportion of the dairy products are infected with tubercle bacilli, owing to the frequency with which cow fæces are found in milk, for it has been proved that the commonest way for tubercle bacilli to pass from the bodies of tuberculous cows is with their fæces, and once milk is contaminated with tubercle bacilli, the latter enter the various articles of diet prepared from it, and are specially numerous in butter, in which they may remain alive seven weeks or longer without diminishing in virulence. He points out the usefulness of the tuberculin test, and the desirability of separating all reacting animals.

Some interesting experiments were conducted by Oberwarth and Rabinowitsch to disapprove the assertion that the appearance of tubercle bacilli in the lungs and bronchial lymphatic glands after the introduction into the alimentary canal was due to aspiration.

### Phthisis.

The principal form in which Tuberculosis affects man is "Pulmonary Tuberculosis," "Phthisis" or "Consumption," but all parts of the body may be affected as in *Tabes mesenterica*, Tubercular meningitis and Tuberculosis of the joints and organs.

Tuberculosis may be spread from man to man, by the inhalation of dust containing tubercle bacilli, or by direct infection from the sputum, also by infected milk and meat and flies.

The role that flies play in the transmission of tuberculosis has been worked out by Andre of Lyons.

He observed that flies which have had access to tuberculous sputum retain the tubercle bacilli in their digestive tubes for several days, and that the tubercle bacilli multiply there more rapidly than in cultures. Furthermore, he observed that the tubercle bacilli were present in abundance in the droppings of the flies, and

therefore it is obvious that the fly can act as a vehicle for tubercle by depositing its infected droppings on articles of food. Although the fly is only a simple vehicle and does not itself become tuberculous, its digestive fluids appear to be a favourable medium for the cultivation of the tubercle bacilli, and, if so, why not for other pathogenic organisms?

These experiments lend added importance to the necessity for disinfection and destruction of tuberculous sputa.

In connection with tuberculous sputa, mention may be made of a paper by Ziesche, whose observations on the disinfection of droplets by coughing consumptives are of interest. He found that the droplets originating in the oral mucosa were free from tubercle bacilli, while in the drops originating from the bronchial mucosa bacilli were usually found, often in great quantities. The droplets were collected on a glass screen, 18 c. c. square, and 40 c. c. to 80 c. c. distant from the patient.

In 80 per cent. of the cases no bacilli, or less than 400 bacilli were present; in the remaining 20 per cent. between 400 and 20,000 tubercle bacilli were found. He concludes by saying that drop infection would not occur if one remained in the presence of a consumptive person only for a short time, but a constant and close intercourse, as between mother and child, often leads to infection.

In July 1901 at the British Congress on Tuberculosis, Prof. Koch made the statement that Bovine Tuberculosis and Human Tuberculosis were different. That Bovine Tuberculosis could not be transmitted to man except under very exceptional conditions and that precautions against Bovine Tuberculosis were not necessary. This came as a thunder-clap to the Medical World, and the result was, a Royal Commission was appointed in 1901, and from the report published it has been shown that there is very little difference in the Tuberculosis of cattle and man and that they can be transmitted from one to the other.

Koch said:—Considering all these facts I feel justified in maintaining that Human Tuberculosis differs from Bovine and cannot be transmitted to cattle. It seems to be very desirable however that these experiments should be repeated elsewhere in order that all doubts as to the correctness of my assertion should be removed.

“But, now, how is it with the susceptibility of man to bovine tuberculosis? This question is far more important to us than that of the susceptibility of cattle to human tuberculosis, highly important as that is too. It is impossible to give this question a direct answer, because of course, the experimental investigation of it with human beings is out of the question. Indirectly, however, we can try to approach it. It is well known that the milk and butter consumed in great cities very often contain large quantities of the bacilli of bovine tuberculosis in a living condition, as the numerous infection-experiments with such dairy products on animals have proved. Most of the inhabitants of such cities daily consume such living and perfectly virulent bacilli of bovine tuberculosis, and unintentionally carry out the experiment which we are not at liberty to make.

“If the bacilli of bovine tuberculosis were able to infect human beings, many cases of tuberculosis caused by the consumption of aliment containing tubercle-bacilli could not but occur among the inhabitants of great cities, especially the children. And most medical men believe that this is actually the case.

“In reality, however, it is not so. That a case of tuberculosis has been caused by alimenta can be assumed with certainty only when the intestine suffers first, *i.e.*, when a so-called primary tuberculosis of the intestine is found.

“Though the important question whether man is susceptible to bovine tuberculosis at all is not yet absolutely decided, and will not admit of absolute decision to-day or to-morrow, one is nevertheless already at liberty to say that, if such a susceptibility really exists, the infection of human beings is but a very rare occurrence. I should estimate the extent of infection by the milk and flesh of tubercular cattle and the butter made of their milk, as hardly greater than that of hereditary transmission, and I therefore do not deem it advisable to take any measures against it.

So the only main source of the Infection of tuberculosis is the sputum of consumptive patients, and the measures for the combating of tuberculosis must aim at the prevention of the dangers arising from its diffusion.”

Koch's opinion in 1901.

## Report of the English Royal Commission, 1907.

### *Extract—*

“Now, the spread of tuberculosis from man to man is generally held to take place mainly through the respiratory passages. The bacillus is thrown off from the body of man mainly with the sputum, and through the sputum gains access to the human body chiefly in the inspired air, by the channel of the respiratory passages. Some of these air-borne bacilli may, it is true, be absorbed from the fæces before they can reach the respiratory passages proper; and bacilli of human source may in various ways contaminate human food, and be absorbed from the intestine; but it is generally considered that the amount of infection which takes place by these means is not great.

“Very different are the conditions determining the entrance into the human body of bacilli coming from a bovine source. The opportunities for the transmission to the body of man by the respiratory passages of the air-borne bacilli coming from the lungs of a tuberculous cow are insignificant compared with the abundant opportunities for the transmission to man, by the fæces, or by the intestines, of tubercle bacilli present in cow's milk. We are, therefore led to a conclusion from which there seems to be no escape, not only that the tuberculosis which was present in each of the cases of Group I. was identical in all its features with bovine tuberculosis but also that the bacilli actually came from a bovine animal; the tuberculosis was bovine tuberculosis implanted in a human body.”

*The following is a quotation from the Report of the Royal Commission on Tuberculosis. (Third Interim Report, 1909.)*

“The experiments which we have carried out with regard to infectivity of the fæces of Tuberculous cows were dictated by the knowledge of the fact that dirt of various kinds from cows and the cow-shed is almost constantly present in the milk as it reaches the consumer. Cows suffering from extensive tuberculosis of the lungs must discharge considerable numbers of bacilli from the air passages in the act of coughing, and some of the bacilli thus expelled may find their way into the milk.

“But our experiments indicate that the excrement of cows obviously suffering from tuberculosis of the lungs or alimentary canal must be regarded as much more dangerous than the matter discharged from the mouth or nostrils. We have found that even in the case of cows with slight tuberculous lesions tubercle bacilli in small numbers are discharged in the fæces, while as regards cows clinically tuberculous our experiments show that the fæces contain large numbers of living and virulent tubercle bacilli.

“The presence of tuberculous cows in company with healthy cows, in a cow-shed, is therefore distinctly dangerous, as some of the tubercle bacilli, which escape from their bodies in the excrement, are almost certain to find their way into the milk.”

I do not propose to attempt to repeat in detail, the experiments that have been carried out by the Royal Commission on tuberculosis and the other numerous investigators quoted here.

The work done since Koch made his statement in 1901 at the Congress on Tuberculosis in London, by the Royal Commission, and English and German, French and American workers was very thorough and complete.

The different schools represented by Behring, Baumgarten, Bang, Bullock Cobbett, Griffith, Calmette and Guerin and others are all in accord that tuberculosis is spread from animal to man, and that tuberculosis of children is chiefly spread through infected milk.

There is however a difference of opinion as to which is the chief portal of infection in Phthisis or Pulmonary tuberculosis.

For the purposes of this paper, this is not of much importance. All authorities agree that the lungs can be directly infected by inhalation, while they differ as to the primary portal of infection.

My object is to reduce to practice the enormous amount of valuable work done by the different celebrated workers on this subject.

The latest article in English is by Cobbett, who was working for the English Royal Commission.

He, discussing and explaining his own work and the opinions of the other scientists as to how Phthisis or Pulmonary tuberculosis is primarily acquired, deals exhaustively with the experiments carried out by himself and other European workers.

In a valuable contribution to the Journal of Pathology and Bacteriology, April 1910, he gives it as his opinion that the chief cause of Phthisis is by inhalation of infected material and not by ingestion of infected food, but he concludes thus:—

“Finally I should like to make it quite clear that while I believe that Phthisis is commonly caused by the inhalation of tubercle bacilli, I do not deny that many cases of tuberculosis, especially in children, are caused by bacilli which gain entrance through the mucous membrane of the intestine. In such cases, I believe, there are usually lesions in the mesenteric glands, and not rarely in the gut itself. On the question whether tubercle bacilli ever get through these glands, without producing disease in them, and settle down and cause lesions elsewhere, I maintain an open mind. I think it not unlikely that some cases of tuberculosis, possibly of primary bone or joint tuberculosis, have this kind of origin. I am quite prepared to believe that the glands are not a perfectly efficient barrier to the passage of microbes, but I think that the bacilli which get through them are not often numerous enough to set up disease, except perhaps in a *locus minoris resistentiæ* in a constitutionally susceptible person.

In some experiments done for the Tuberculosis Commission, I injected calves subcutaneously with 50 mgrms. of tubercle bacilli of the human type, and I found some of these bacilli a day or two afterwards in nearly all the glands and organs of the body. Similar results were subsequently obtained by the Griffiths (1907) working with bovine tubercle bacilli, not in the calf only, but in a number of other animals. They show, of course, that bacilli taken up by the lymphatics of the subcutaneous tissue may pass quickly through the glands, unless indeed they be taken up by the veins.

Statement showing the percentage of detection of Tubercle Bacilli in Milk and Road-side Sputum Samples examined from 14th February 1910 to 28th October 1910 (both days inclusive) the percentage being based on the results obtained thereof.

Ward from which samples received	MILK.		ROAD SIDE SPUTUM.		PERCENTAGE OF DETECTION.	
	Total number of samples received.	No. of samples in which Tubercle Bacilli detected.	Total number of samples received.	No. of samples in which Tubercle Bacilli detected.	Milk. Acid fast Bacilli.	Sputum.
A	22	2	48	5	9.0%	10.4%
B	16	Nil	27	4	Nil.	14.8%
C	(32) 36	(10) 11	84	12	(31.2%) 30.5%	14.2%
D	(25) 28	(4) 5	60	3	(16%) 17.8%	5%
E	36	3	83	7	8.3%	8.4%
F	(43) 44	(7) 8	57	10	(16.2%) 18.1%	17.5%
G	(26) 27	4	54	5	(15.3%) 14.8%	9.2%
H.O.	8	Nil	.....	.....	.. ...	.....
	(208) 217	(30) 33	413	46	(14.4%) 15.2%	11.1%

Figures in black type indicate without repetition.

Statistics of the Mortality from Tuberculosis and Phthisis in Bombay, Calcutta, Manchester, Birmingham and Glasgow for 1909.

Year.	Name of City	Population	Death-rate from All Causes.	Death-rate from Phthisis.	Death-rate from Tubercular Diseases other than Phthisis.	Death-rate from all Tubercular Diseases.	Percentage of Tubercular. 1	
							Milk. Not verified by inoculation or post-mortem acid fast Bacilli.	Sputum, Road-side.
1909	Bombay ...	977,822	35.66 (including plague)	2.46	.45	2.92	14.4	11.1
"	Glasgow ...	800,410	17.95 (corrected)	1.35	.82	2.17	4.5	.....
"	Birmingham ...	563,629	15.5 (corrected)	1.33	.30	1.63	7	7%
"	Manchester ...	654,584	17.70 (corrected)	1.70	.57	2.27	5.79	.....
1908	Calcutta ...	847,796	32.5	2.4	.1	2.5	.....	.....

## Investigation in Bombay.

We are now in this position, that tuberculosis is spread by inhalation and ingestion of material infected with tubercle bacilli.

That children chiefly do rapidly become infected with Tuberculous milk, and that they contract intestinal tuberculosis, which may become pulmonary and general.

That the most common cause of Phthisis (pulmonary tuberculosis) in young people and adults, is by inhalation of material containing tuberculosis bacilli.

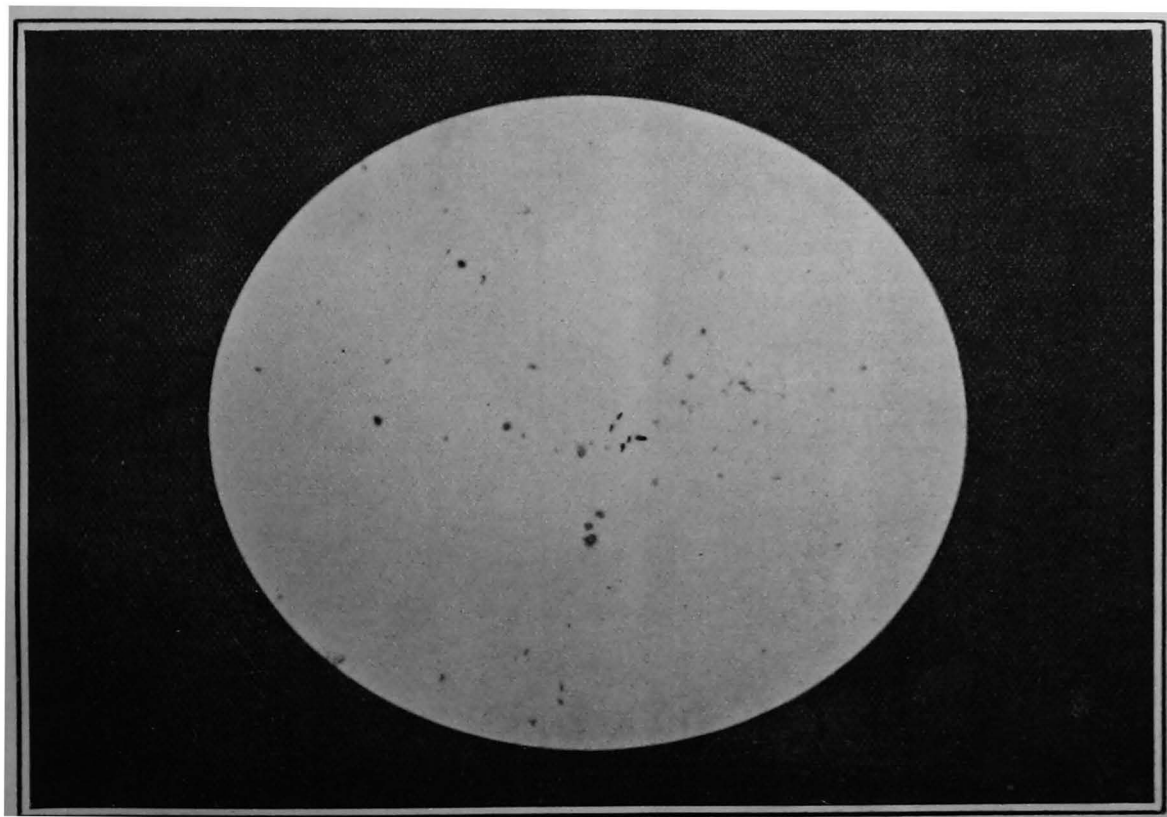
This brings me to my point, namely, the possibility of children in India contracting tuberculosis both general and pulmonary from tuberculous cattle, either by milk or infected fæces and also by milk, infected by human agencies.

1. Whether cows or buffaloes in India suffer from Tuberculosis.
2. Whether milk could be infected from human or bovine agencies after it had been drawn from a healthy animal by the habits and customs of the attendants and the infected fæces.
3. Whether the human being especially children could not contract Tuberculosis, because of the intimate relation of the working classes with cows, bullocks and buffaloes and the enormous use made of cowdung, some of which must be infected.

With a view of verifying this some nine months ago, I undertook the examination of samples of milk and human sputa from milkshops and milch cattle stables in Bombay, assisted by the late Dr. Ghadially, Municipal Analyst and Bacteriologist, and since by Dr. Joshi, acting Municipal Analyst and Bacteriologist.

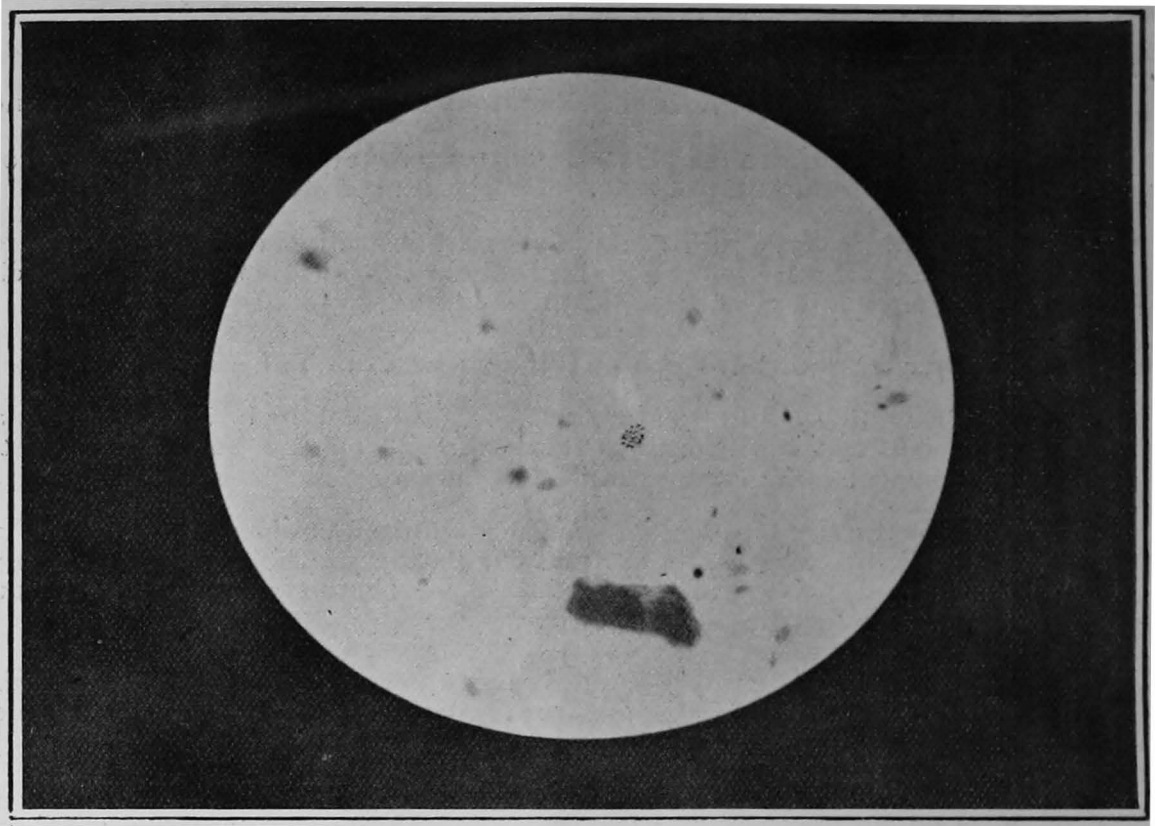
Along with these examinations samples of human sputa from milch cattle stables, bathing places, washing places for cows and buffaloes, and milkshops and in the streets, were collected and examined for tubercle bacilli.

Out of 208 samples of milk examined, 30 contained an acid fast bacilli resembling tubercle bacilli, or 14.4 per cent.; out of 271 roadside sputa examined 33 contained tubercle bacilli or 12 per cent.

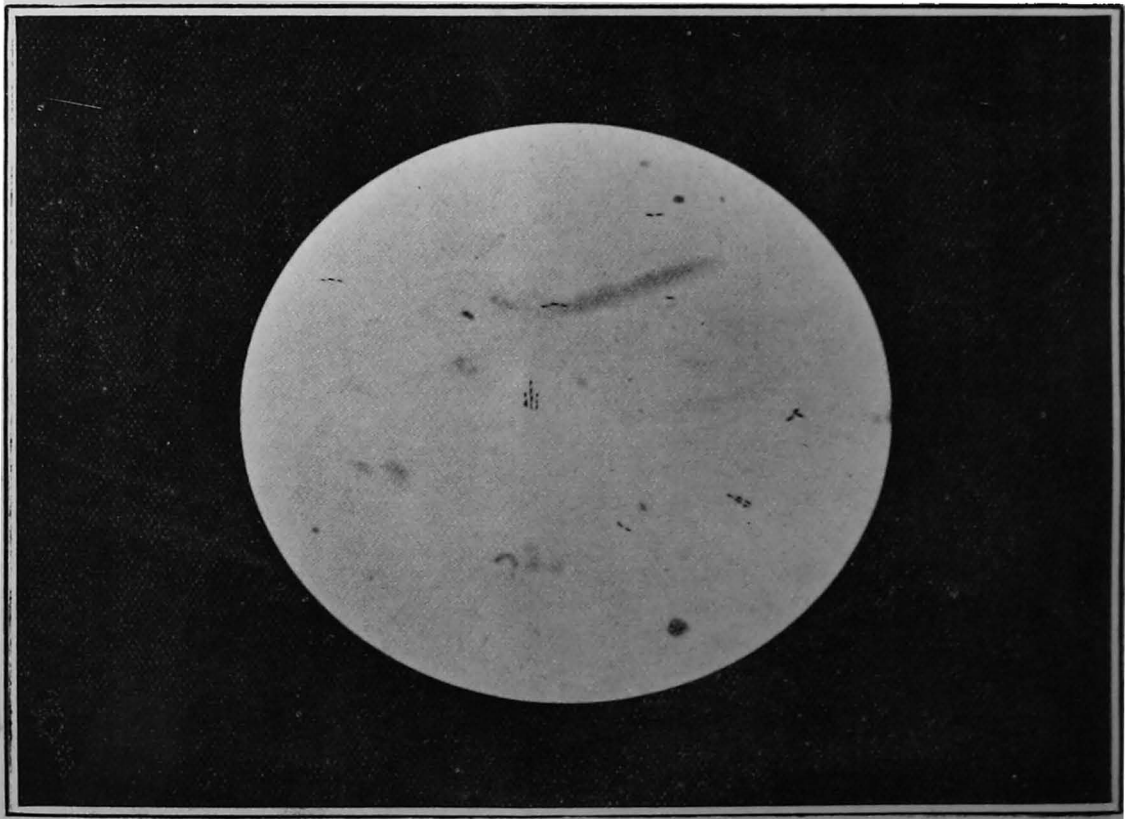


*Acid fast Bacilli in Milk.*





*Acid fast Bacilli in Milk.*



*Tubercle Bacilli in sputum collected at a milch cattle stable.*

The method of examination of milk was as follows :—

The milk was collected from milkshops by the Deputy Health Officers of the Wards in sterile glass bottles and sent to the Laboratory, 20 c. c. of each sample were centrifuged and the sediment examined and if "acid fast" bacilli resembling tubercle bacilli were found, the Health Officer of the Ward was asked to try and trace the source of the milk.

This was not easy, as the milk sold at the retail shop is mixed, but in six cases the infected milk was traced to cows.

Milk of these cows was then drawn into sterile glass bottles and again examined and a positive result obtained in all the six cows.

The other samples in which acid fast bacilli were found could not be traced.

All the six cows were treated with tuberculin, four of them reacted 2·5 and two only '7.

Milk of these four cows was injected, subcutaneously into guinea pigs, with no result.

My idea in examining the sputa collected in stables and shops was to ascertain, if possible, whether the milk could be infected in that way.

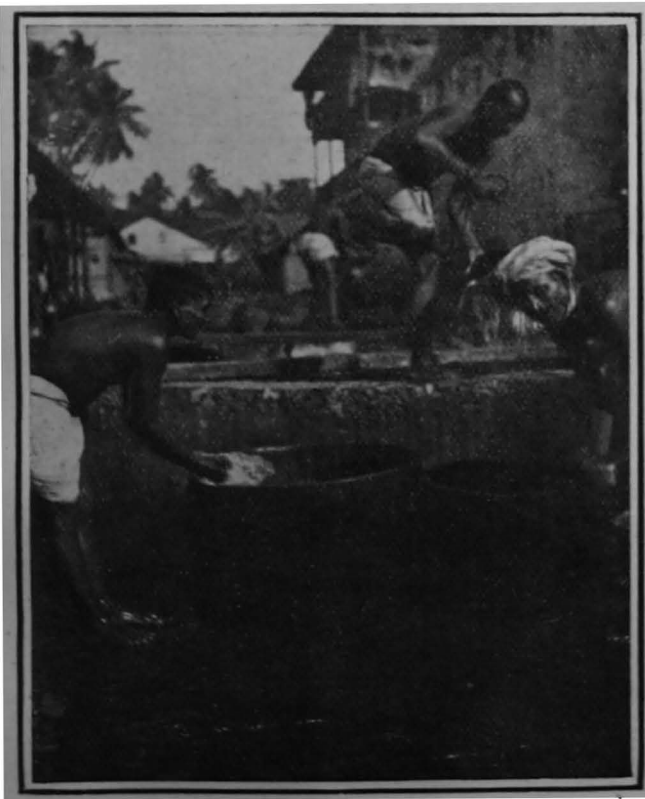
Anyone who has had any experience of milch cattle stables, dairies and milkshops in India, and the habits and customs of the gowlis, their methods of milking and washing themselves and their milk vessels, can easily appreciate that milk could be infected in this way and that possibly the samples examined may have become infected by human agency and not bovine.

The results of the tuberculin test and *post-mortem* examination on the cows tested, however, showed that this could not be the only source of infection.

The results of the Royal Commission proves clearly that the fæces of the tuberculous cow are loaded with tubercle bacilli, and a visit to a milch cattle stable in Bombay will readily show how this may be a possible means of infecting milk.

The milk vessels are cleaned with cowdung and dirt, the buffaloes and cows wallow in their excrement and the buffaloes are washed at the same place and from the same well that the milk vessels are cleaned at.

It is a common thing to see the gowlis and stable attendants preparing their morning toilet at the well, and at the same place and with the same water they use for washing the buffaloes and milk vessels.



*Washing at the well in a stable.*

This, then, I suggest is a common way of infecting milk and peculiar to India, because in England and Europe the value of the cleanliness of the cow and the utensil are much more appreciated and the regulations concerning the milk supply are much more strict, and although the buffalo is washed regularly in some stables in India, its surroundings and the habits of its attendants are much more insanitary.

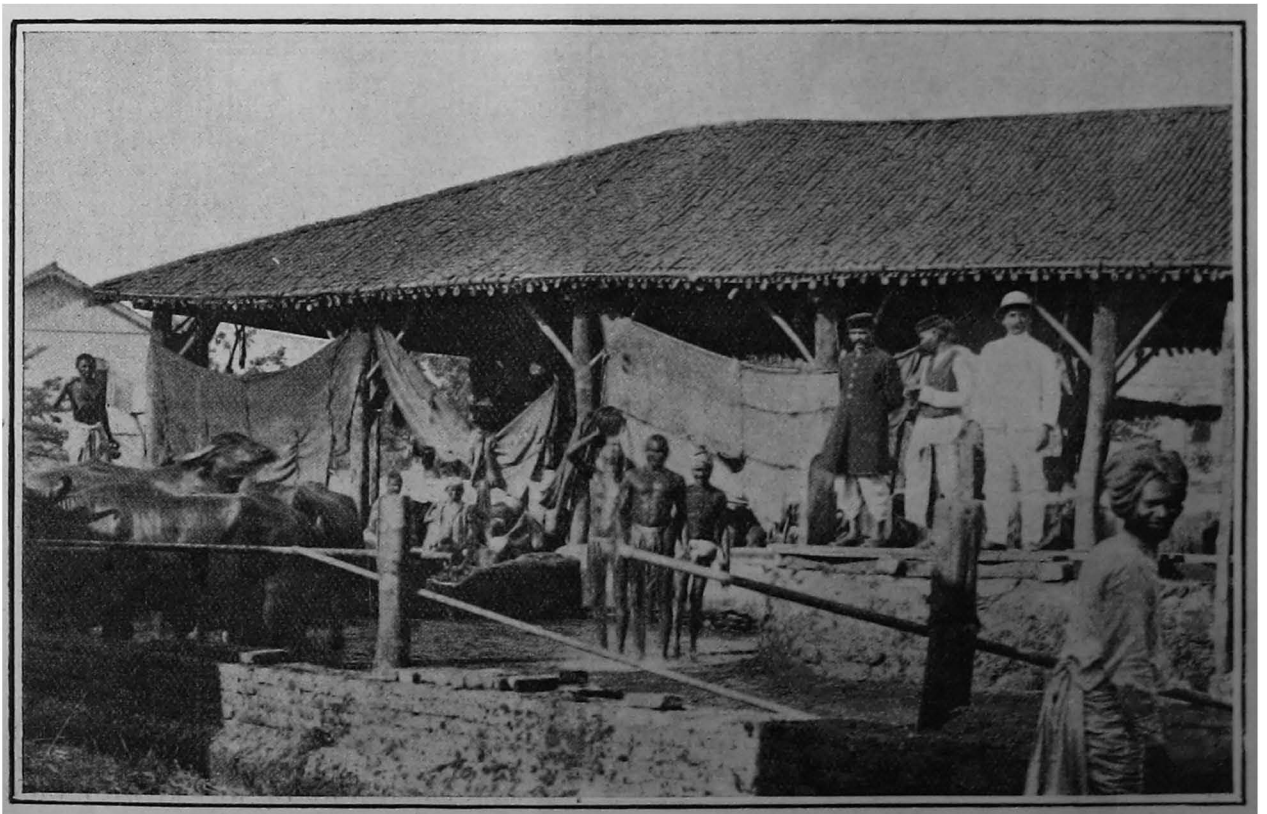
The facilities then for the transmission of the Tubercle Bacilli from animal to man are greater in India, because of the intimate connection between these.

There are 1,985 cows, 17,328 she-buffaloes and 22,817 bullocks in Bombay City.

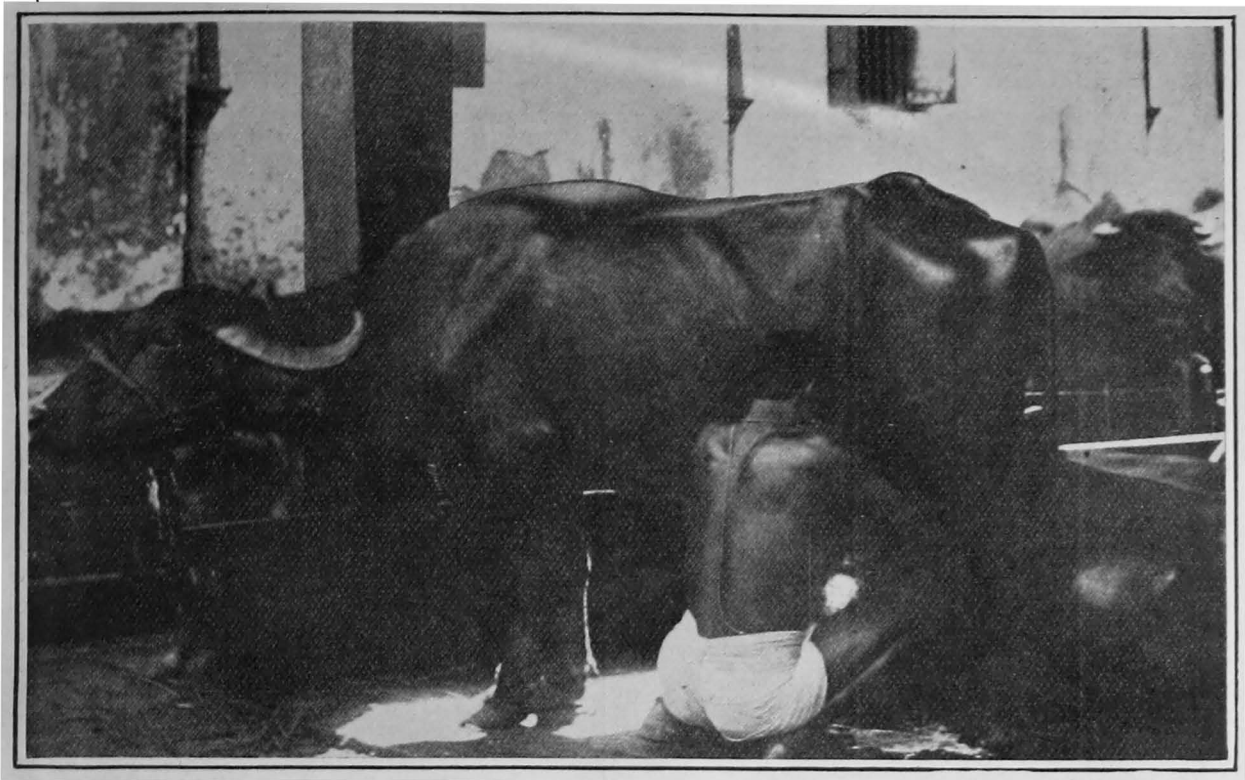
The majority of the public milk supply is from buffaloes, but there is also a large amount of cows' milk sold separately or mixed with buffalo milk.



*Pouring milk into vessels for retail.*



*Washing place for Buffaloes. Gowlis washing themselves and their milk vessels.*

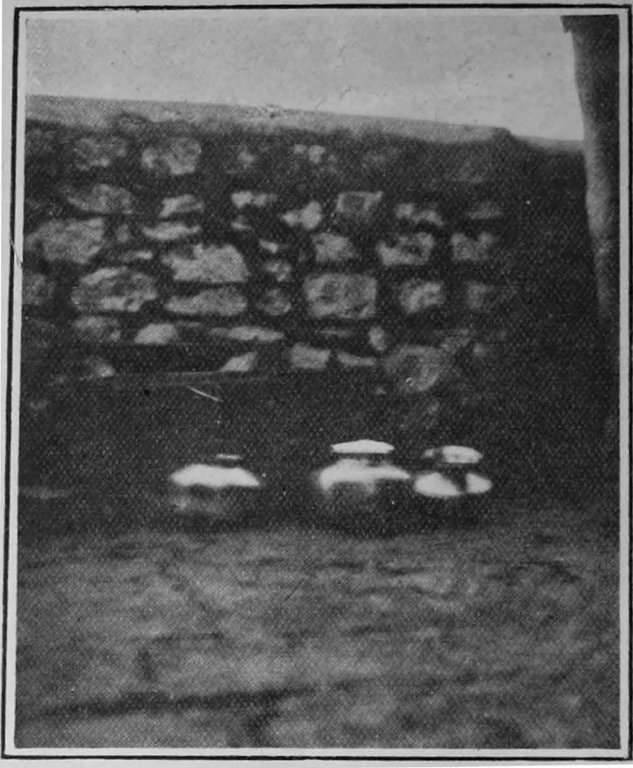


*Milking.*



*Govtis washing Buffaloes at a well in the stable.*

Cows are generally kept by themselves, but it is usual to find one or two cows among a large herd of buffaloes in the same dairy.



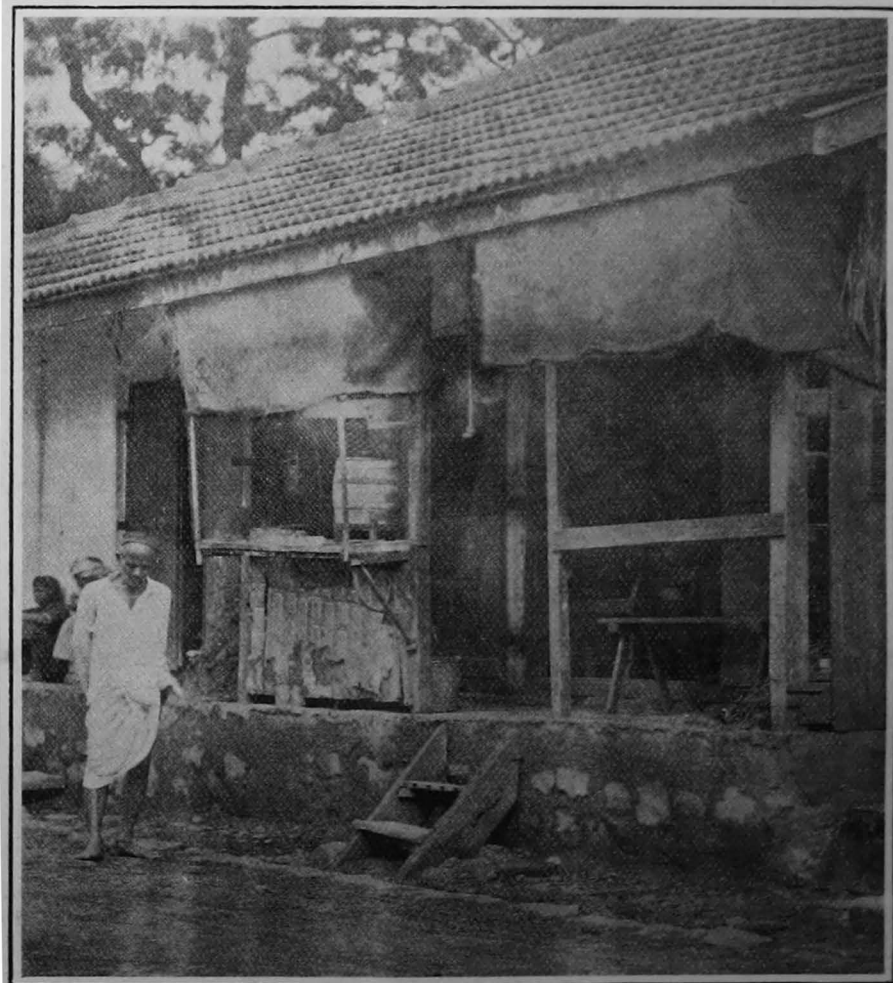
*Vessels containing milk set aside in the stable.  
A crow was drinking the milk.*

Apart from the conditions referred to in the stable and methods of washing and cleansing milk vessels, &c., the traffic in cowdung is enormous. Cowdung, mixed with urine and mud, is used for plastering walls and floors and roofs of houses; it is stored in the house.

Even, in large cities the cow and bullock is an inmate of the dwelling house, and all the cooking pots and vessels used scoured with cowdung and dirt from the street.

Fortunately the climate has some influence on the life of the Bacilli and the exposure to the heat of the sun checks the growth; but the dust of streets, where there is so much bullock traffic, must contain a large number of Tubercle Bacilli, while flies and dust must convey the infection to the food and milk.

It is a very common sight to see crows eating sputum in the streets or in the stables, and it is also common to see crows after picking up sputum fly to a milk or water vessel and dip



*A milk shop from which milk was obtained which contained an acid fast Bacillus.*

in their beak or pick the meat and fish in the market, or from the open basket on the head of a cooly, or drink milk out of milk vessels in the stables or open cans in the street or shops.

The following are a few examples of places where milk was taken from :—

Samples of milk were received from a shop in Naigaum Road. The Milkseller was reluctant to state where the milk came from, but it was ultimately traced to two cows kept in a bamboo and matting shed in the village; a photograph shows the shed and cows. Milk from these animals was then drawn off in sterile bottles and again examined with the positive result, an acid fast bacillus being present in both samples; the milk was injected into guinea pigs with no result. After much persuasion the owner allowed these cows to be tested with tuberculin, the result being a positive reaction in both cases. The cows were sent away, as they were in calf and have since calved; on a second testing, 3 months later, no reaction occurred, and the milk did not contain any acid fast bacilli.

2. Samples of milk were received from a shop in Kamathipura and found to contain suspicious bacilli.

After some trouble, the milk was traced to two cows kept in a dilapidated matting shed in Kamathipura. Samples of milk were again drawn off in sterile bottles and again tested and an acid fast bacilli found. Both of these cows were tested with tuberculin and both reacted. The milk was injected into guinea pig with no result. The owner was warned not to sell the milk. The cows were sent to the Panjrapole.

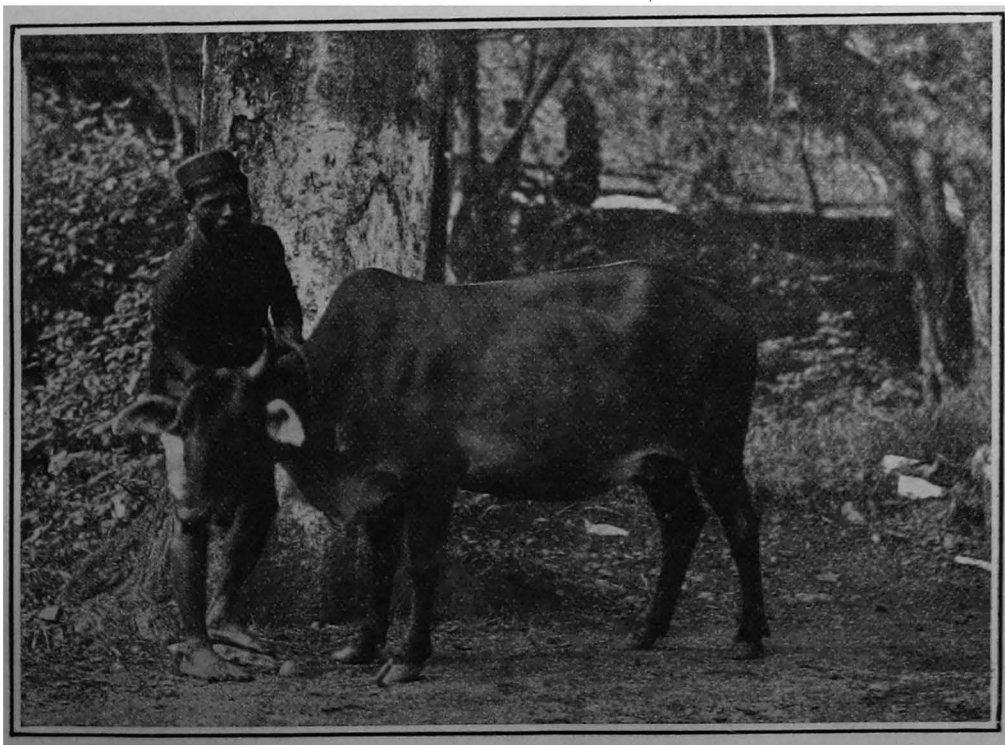
3. Samples of milk from a shop in Falkland Road.

An acid fast bacilli present on microscopical examination. The milk was traced to two cows in Falkland Road.

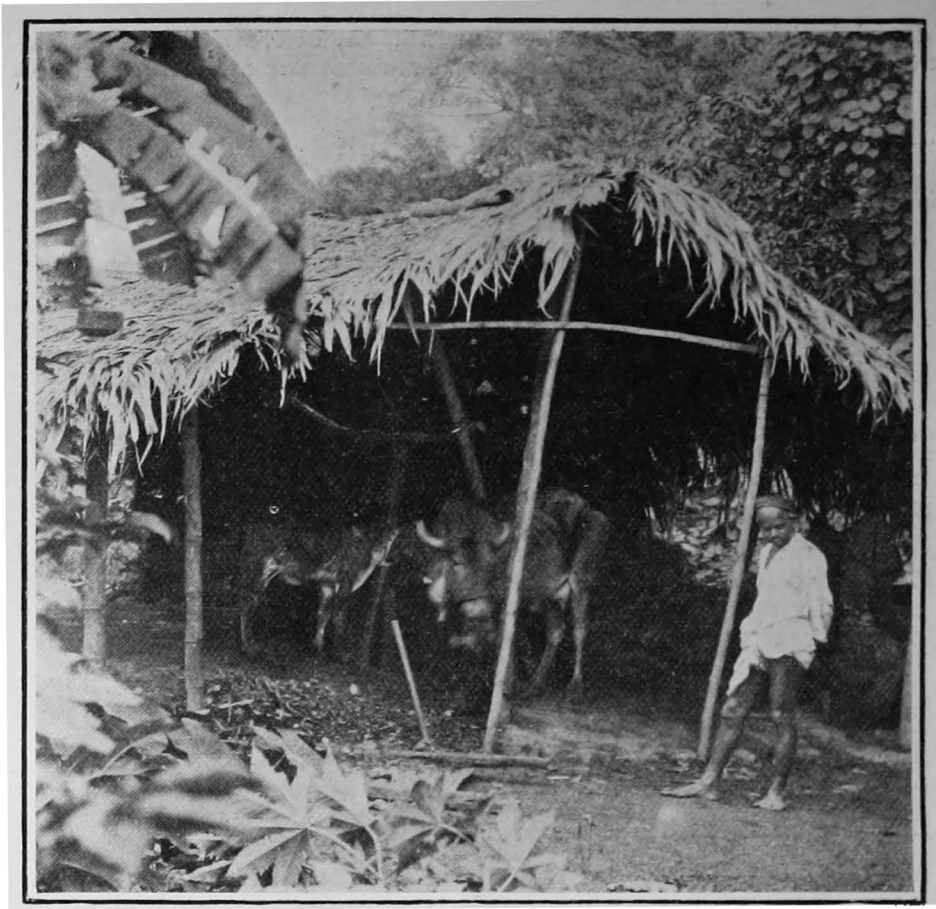
On testing the cows with Tuberculin no reaction.

4. Samples of milk were sent from a milkshop in G Ward on 4 different occasions and found to contain an acid fast bacilli; after some trouble the source of the milk was traced to 12 cows in G Ward. The milk of these cows was drawn off in sterile flasks. Re-examined with the result that 3 contained acid fast bacilli.

In all 217 samples of milk were examined, 9 were repetitions, so that out of 208 examined, an acid fast bacilli was found in 30; of these 9 were traced to cows and tested

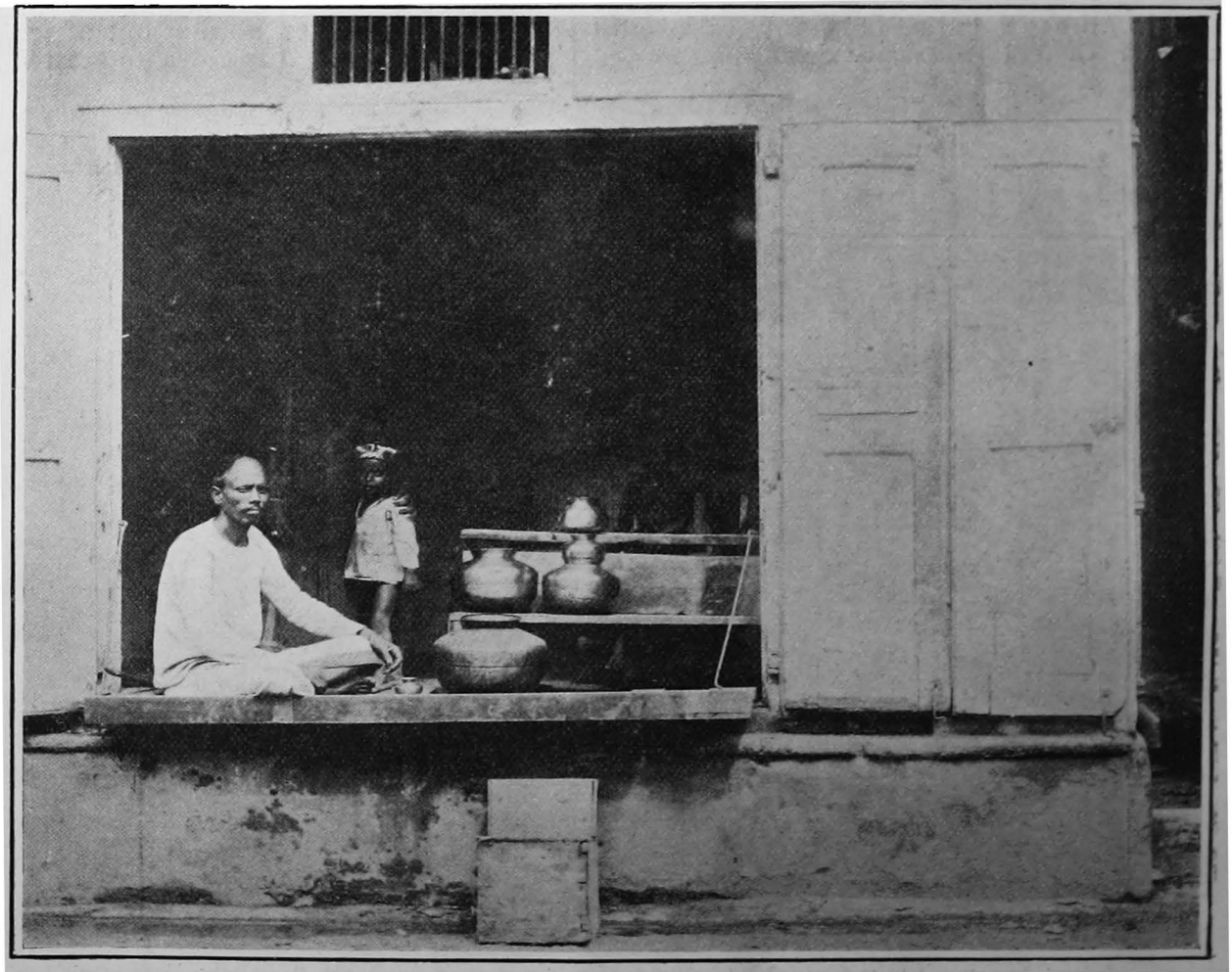


No. 1. A cow whose milk contained an acid fast Bacillus and who reacted to Tuberculin.



*Cowshed of Cow.*

*No. 1.*



*A milk shop in Kamathipura from which milk was collected containing an acid fast Bacillus.*

with tuberculin and 6 reacted. A *post-mortem* examination could not be made. Much difficulty is experienced in getting permission for testing with Tuberculin.

In all 105 cows were tested with tuberculin—

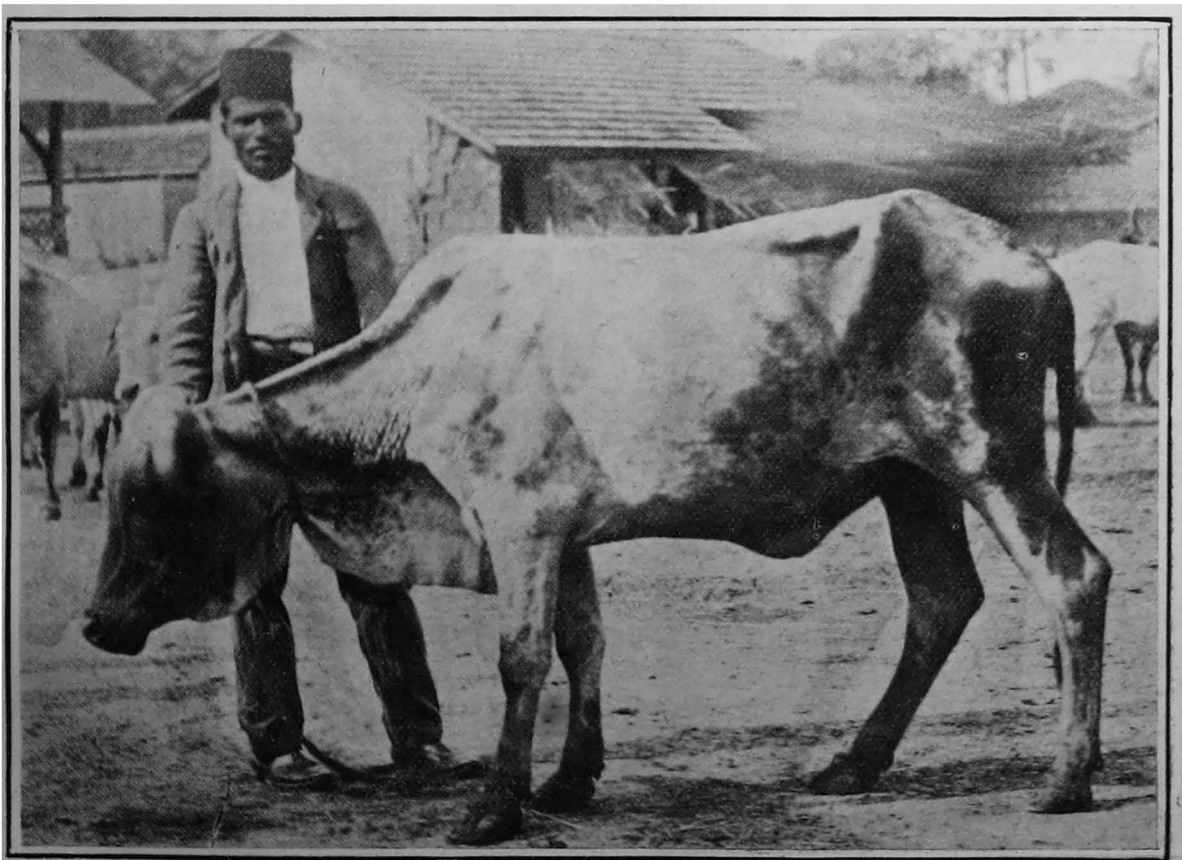
34 at Bandra Slaughter House	...	None reacted.
5 buffaloes, 31 cows at Panjrapole	...	Two cows reacted.
26 cows privately	... ..	3 reacted. No <i>post-mortem</i> .
9 Buffaloes privately	... ..	No reaction.



*A cow brought for slaughter at Bandora Slaughter House.  
Tested with Tuberculin and did not react.*

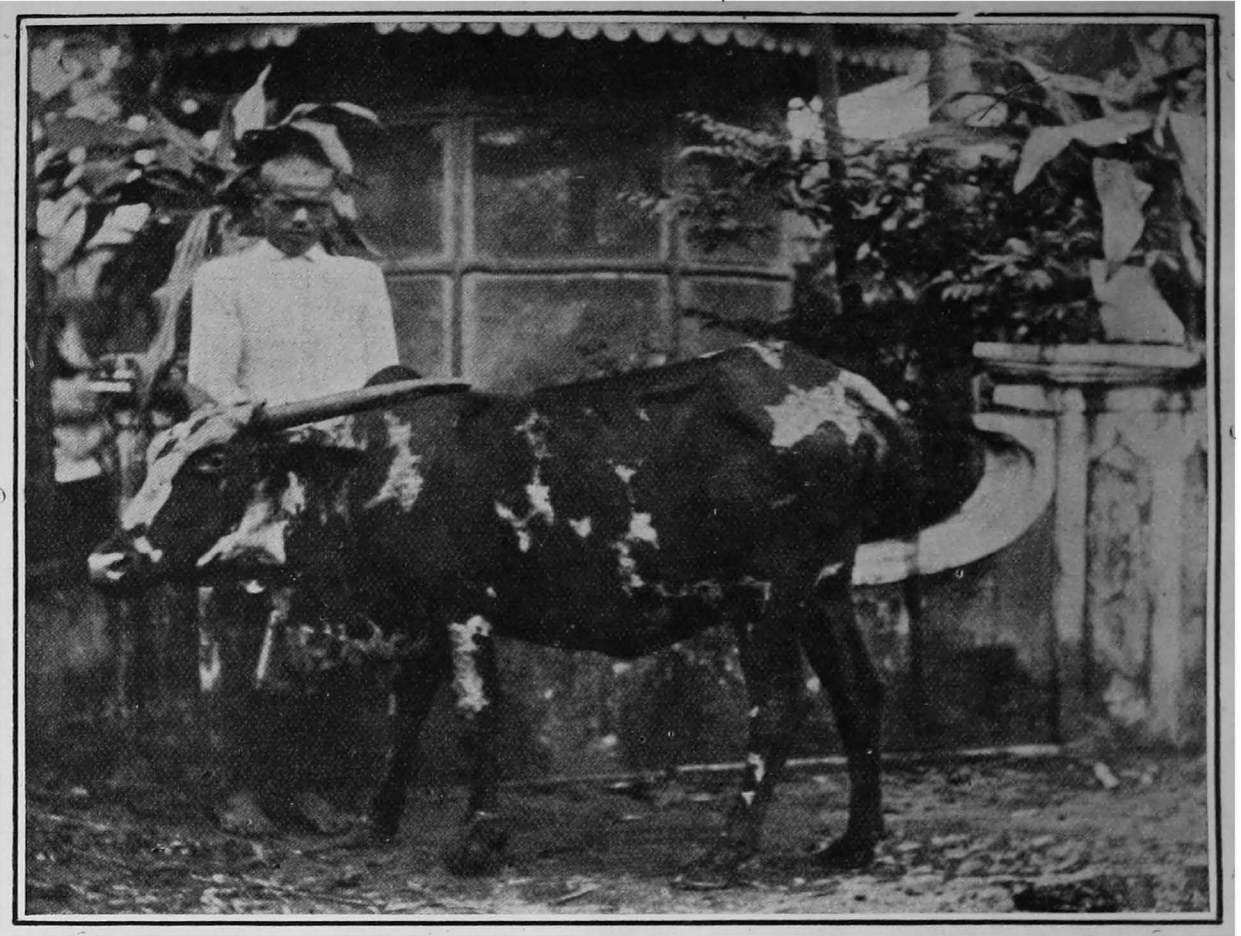
The faces of the two cows reacting to tuberculin were examined and found to contain an acid fast bacilli of the same type as in milk.

On a *post-mortem* from the examination of these cows no tubercle bacilli could be found in any of the organs, but cystic degeneration and cysts were plentiful.

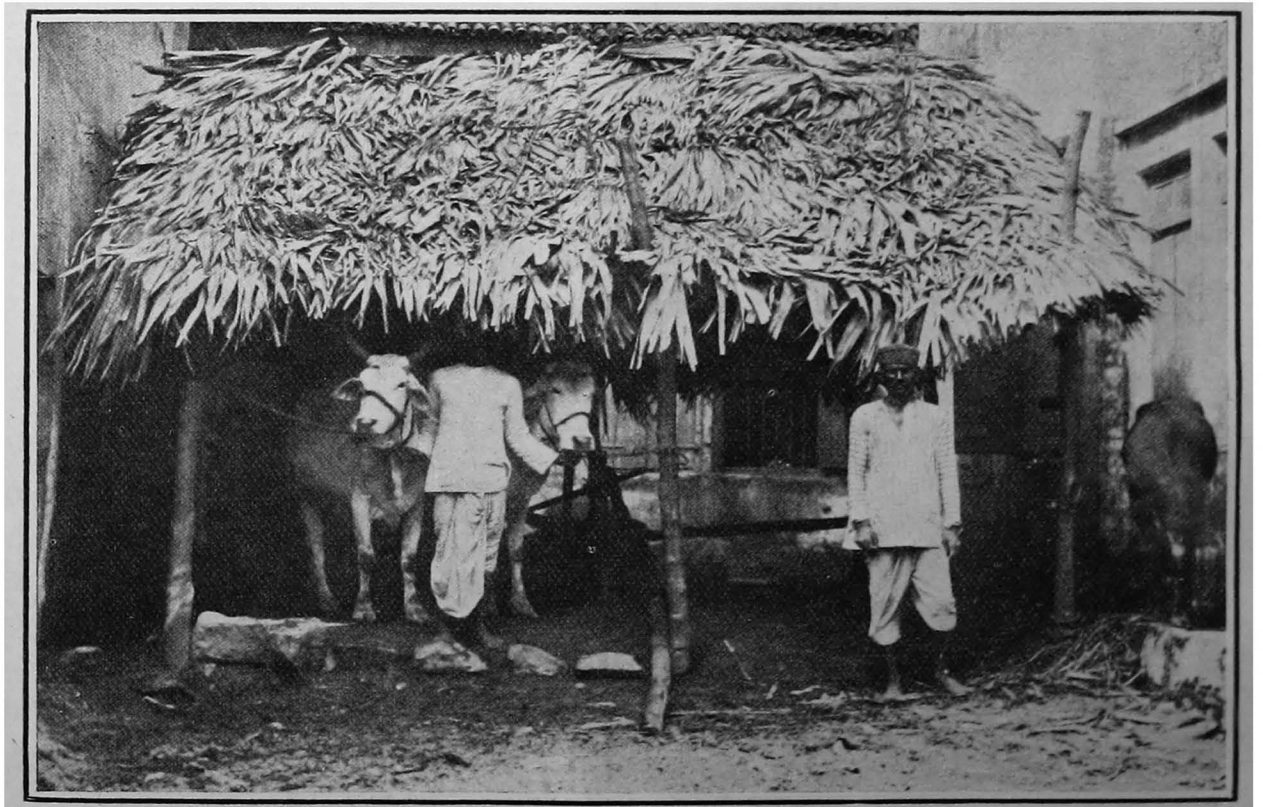


*A cow brought for slaughter at Bandara Slaughter House.*





*A cow whose milk contained an acid fast Bacillus and reacted to Tuberculin.*



*Cowshed in Kamathipura. Milk contained acid fast Bacilli and the cows reacted to Tuberculin.*

To find Tubercular Bacilli in milk, unless the animal is suffering from acute Tuberculosis of the udder is difficult and requires care ; other acid fast bacilli may be present, and to differentiate the infected milk must be inoculated with a guinea pig. This, however, is not always decisive, as milk may contain very few bacilli and no reaction takes place.

This process was followed on nine (9) occasions with no result. The Tuberculin Test when followed by a high and maintained rise of temperature is considered sufficient evidence of Tubercle in cattle, which can be verified by a *post-mortem* examination. Unfortunately this could only be carried out on two occasions with a negative result.

The other three cows reacting to tuberculin are alive and have calved since—on re-inoculating them 3 months later no reaction occurred.

I have, therefore, come to the conclusion that, so far as these experiments have shown, Tuberculosis in cattle is rare in Bombay.

In 30 cows selected at Bandra as looking suspicious of Tuberculosis, I only found tubercle bacilli in the organs of one—an animal brought for slaughter at Bandra Slaughter House. The acid fast bacillus found in the milk was not tubercle.

The subject, however, is worth considering further, but with the pressure of work this is impossible in the Health Department of the Municipality; but I would suggest that it be taken up by the Parel Laboratory to whom I will give all assistance possible.

The results of my investigation are :—

- (1) That cattle in Bombay and presumably other parts of India do suffer from Tuberculosis to a slight extent.
- (2) That it is possible to infect milk by human agency owing to the habits and customs of the attendants and the method of distributing milk.
- (3) That a possible source of infection is the fæces of infected cattle due to the intimate connection there is between the labouring class and the cattle and the enormous use made of cowdung in the houses and surroundings.

I do not mean to suggest that Tuberculosis in India is caused only by infected milk or food ; on the contrary, but that it is one cause which has hitherto not been investigated, nor do I maintain that the experiments detailed here anything like cover the whole ground or are in any way complete, or that there is not a probability of error as in all such experiments but with the pressure of other work in a very large and busy Department complete research cannot be undertaken ; they are sufficient evidence to warrant further inquiry and more stringent regulations regarding the milk and food supplies in India.

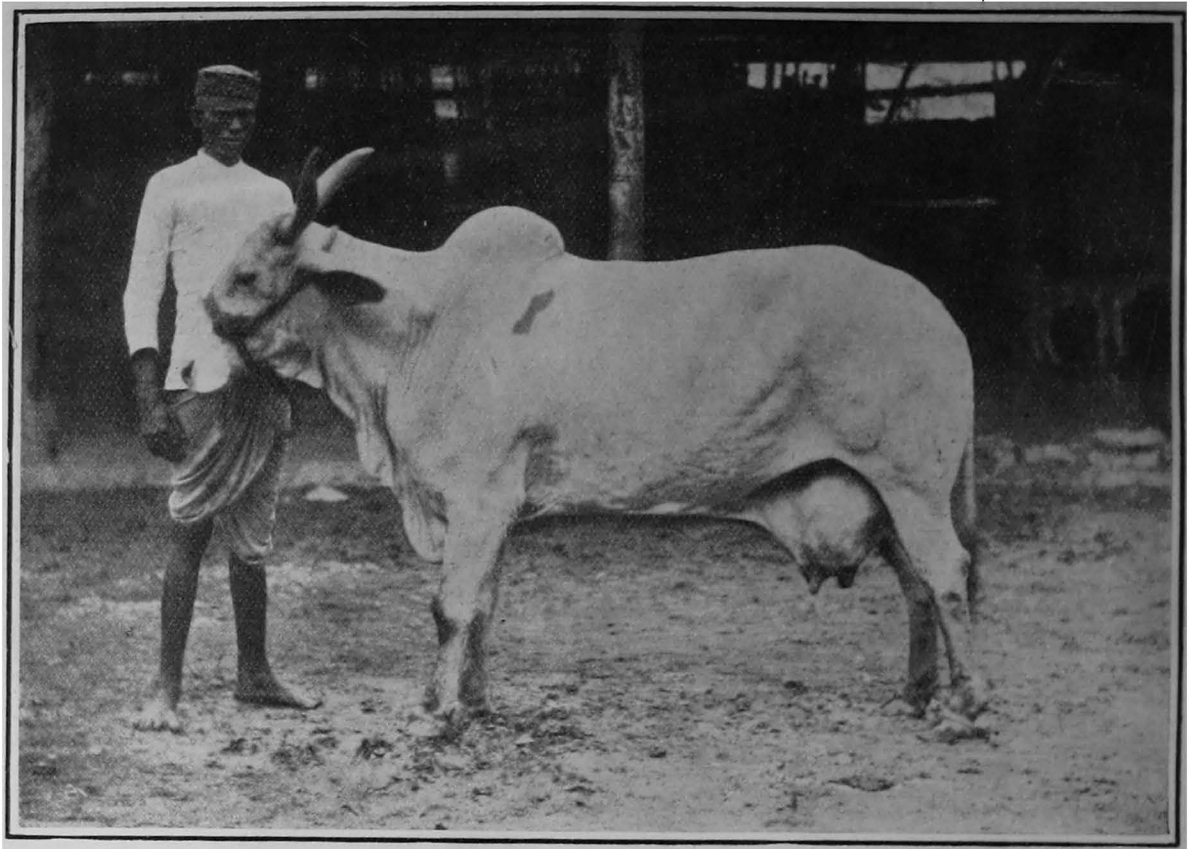
The figures I have given show that the mortality from Tuberculosis is higher in India than in England ; that the milk and sputa examined show that there is risk of disseminating the Tubercle Bacillus, while the presence of the Tubercle Bacillus in the fæces of infected animals is a greater danger in India than in other countries.

The argument that all milk is boiled before being used is applicable to any milk-borne disease. The majority of people would prefer to know that the milk comes from healthy animals and is pure.

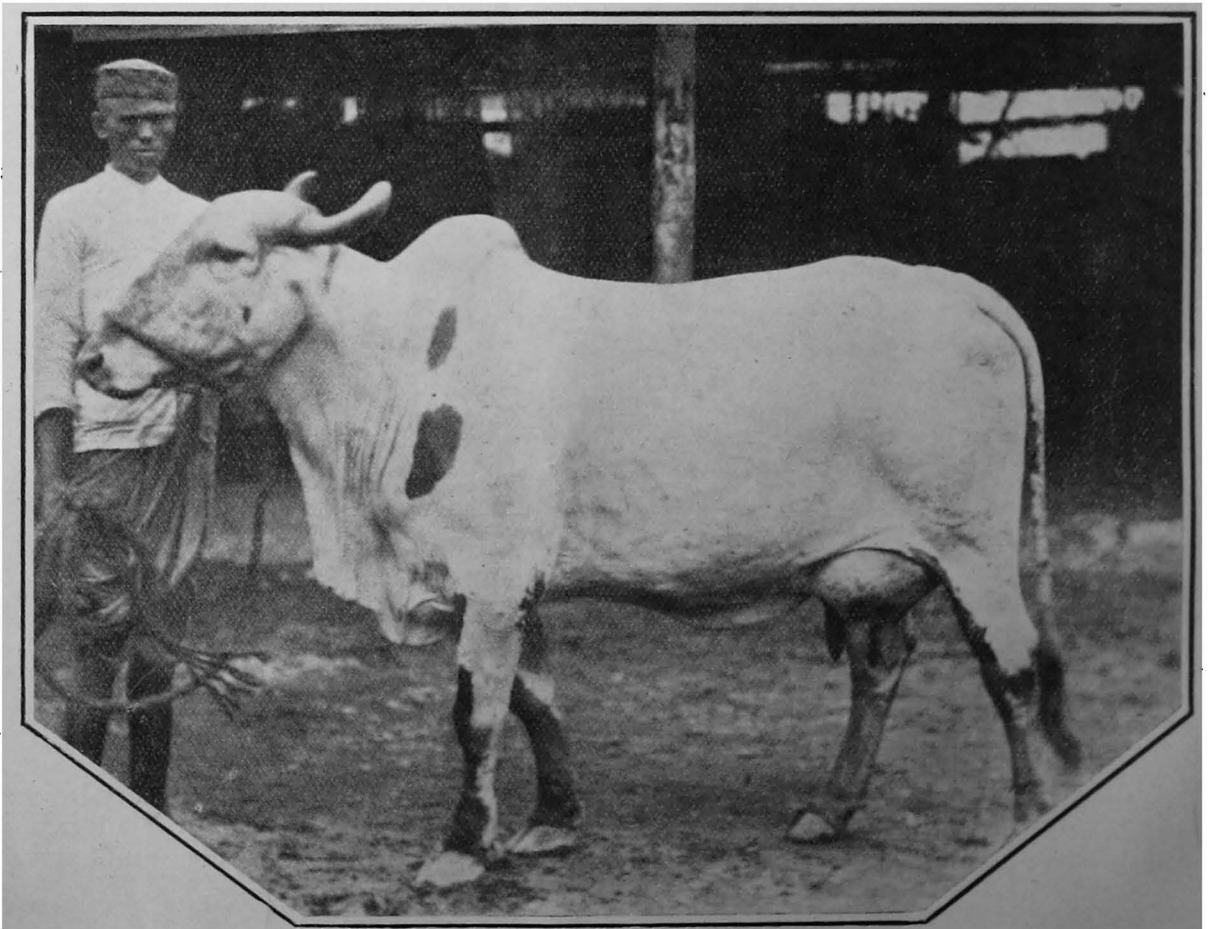
The same argument applies to malaria. There are those who advise taking quinine, as it is hopeless to exterminate the mosquito ; but will people take quinine regularly and in sufficient quantity to render themselves immune from malaria bearing mosquitoes any more than they will regularly and systematically sterilise all-food?

Sanitation and education in sanitation and the application of sanitary laws and regulations, sanitary surroundings and the removal of the *cause* of the disease applies in Tuberculosis and malaria and plague as in all other communicable diseases.

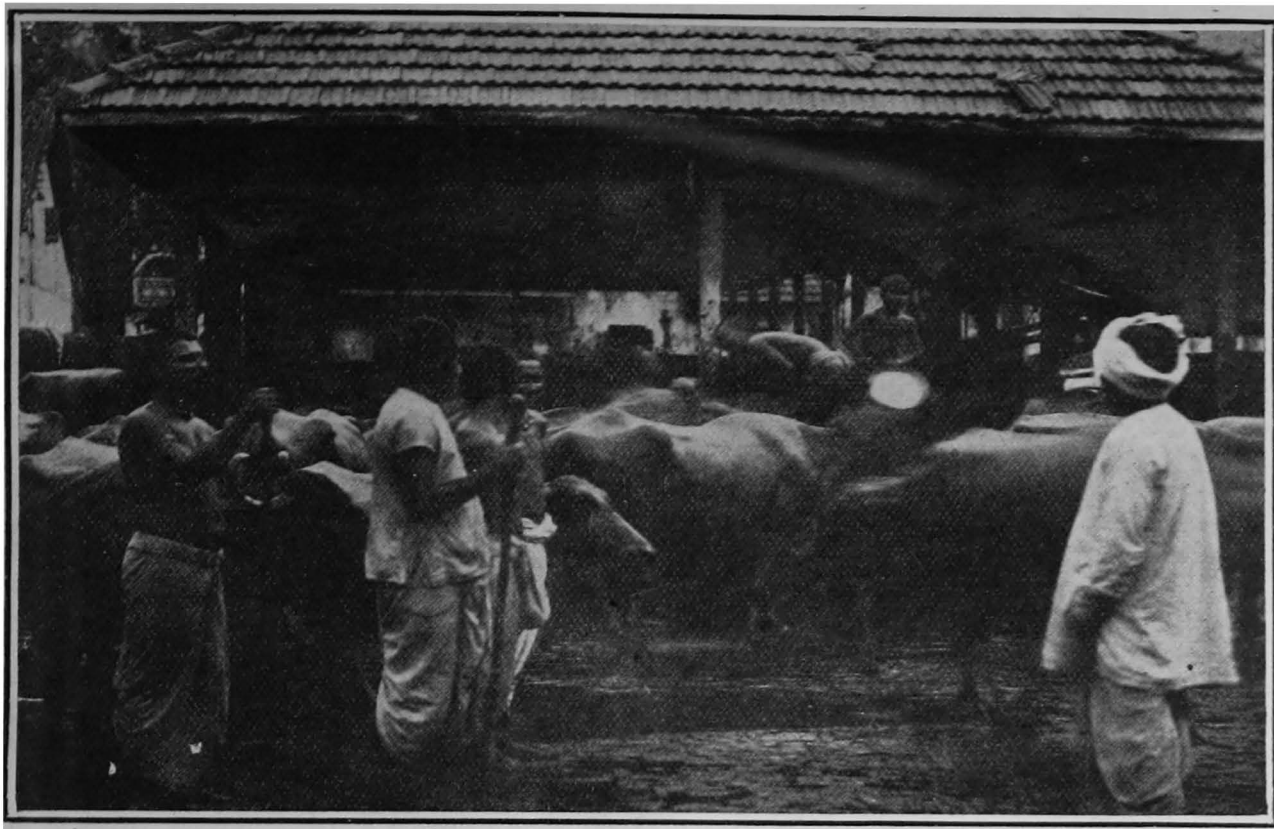
Every preventive measure should be availed of and all milk should be boiled.



*A cow whose milk contained an acid fast Bacillus but did not react to Tuberculin.*



*A cow whose milk contained an acid fast Bacillus but did not react to Tuberculin.*



*A Milch Cattle Stable.*

The Tuberculin tests were carefully carried out by Inspector Ranina, G.B.V.C., and Mr. Mahomedkhan Bawakhan, Chief Veterinary Inspector, assisted by Mr. Rodrigues, G.B.V.C., Inspector of Meat, Municipal Markets.

*January 1911.*

J. A. TURNER,  
*Executive Health Officer.*

### **Practical Precautions.**

The sections of the Act relating to the control of milk in Bombay are so defective that little control can be exercised over the sale of milk.

It has been suggested more than once that amendments are necessary.

The Bye-laws relating to milch cattle and bullock stables have been amended but await confirmation of the Corporation and Government. Then a more rigorous enforcement by the Magistrate will be expected.

There is power to prevent the sale of milk from a diseased animal.

The remedy is to test with Tuberculin all milch cattle and give a certificate that they are free from Tuberculosis.

To cast and destroy all infected animals.

To improve the condition and surroundings of the milch cattle and bullock stable and the habits and customs of the attendants.

Tuberculosis then is spread by the inhalation or ingestion of the tubercle bacilli. In the former case by bacilli from dried infected sputum, dust, etc., and in the latter by infected food, meat or milk.

The methods of control then may be divided into Personal and Public.

*Personal* :—Compulsory Notification of all cases of Phthisis and the examination of the sputum at a recognised Laboratory by the Sanitary Authority.

Oral and Printed instructions should be freely circulated in all public places, workshops, factories, common lodging houses, vehicles, railway, tramcars.

Notice as to spitting should be widely circulated ; it is controlled in Europe and America and should be controlled in Bombay.

In Bombay cases of Phthisis are notified to the Health Officer and the houses are disinfected and lime-washed.

The number of cases notified last year is 2,085 and the number of houses disinfected on account of the disease is 2,365.

Leaflets in the Vernacular have been freely circulated and lectures given and notices regarding spitting issued to all schools and public places.

---

## PUBLIC PRECAUTIONS.

### Municipal and State.

To thoroughly undertake the work of controlling and exterminating Tuberculosis in a community, much time, trouble and energy is required with a perfect organization and thorough control and suitable bye-laws and regulations. A perfect routine system will have to be followed beginning with compulsory notification of every case by the Medical man in charge or by direct inquiry by a special Qualified Medical Staff, male and female, also by Health Visitors and Nurses.

Circular notices and printed precautions will have to be freely distributed and thorough disinfection of rooms, clothing, &c., in which a case has occurred.

On receipt of a Notification or information of a case, a certificate of death from Phthisis, or as the result of examination of sputum sent to the Laboratory, the Sanitary Officer visits the house, making inquiries into the duration of the cases and its surroundings. Instructions are given printed and oral, and the case, if possible, removed to the Hospital for Consumption.

He then proceeds to disinfect the room and bedding. Esmarch process of rubbing the walls with dough to collect the infected dust may be adopted in suitable houses, but would not be practicable in all Indian dwellings.

Two per cent. Solution of Chloride of Lime or Izal 1-30 may be used for washing the floor, walls and ceilings.

The furniture having been washed with a damp cloth soaked in Izal and the linen soaked in Carbolic Acid.

The walls, ceiling and floors should be rubbed over with dough to collect the dust, and the dough afterwards burnt ; on no account should the room be swept with a brush or duster as the infected material may be dispersed in the air and may be inhaled by the operatives.

The floors, walls and ceilings should be treated with Formalin Spray or with Chloride of Lime  $1\frac{1}{2}$  oz. to a gal. of water or Izal 1-50.

The linen and bedding passed through a steam sterilizer.

A room occupied by a Phthisical Patient should be thus treated every 6 months.

Regular forms should be kept and a register made of all cases visited and the action taken.

---

### Municipal.

Improvements in dwellings, Town Planning and ventilation of houses and areas.

Hospital accommodation, Sanatorium and Consumption Dispensaries should be provided.

In all countries these Institutions are provided by the Municipalities, State or Charitable persons and privately.

Inspection of meat and milk, dairies, cow-sheds, slaughter-houses and the overcrowding of workshops and factories should be systematically carried out.

Under the Heading of Inspection of food and milk these matters are dealt with.

All milch cattle should be tested with Tuberculin and Legislation adopted for compensation and slaughter of infected animals.

- (1) Compulsory notification of births within 24 hours.
- (2) Complete control of the milk supply by the State, ensuring the removal of dairies from the centres of large towns and cities ; cleanliness in the collection of milk and the transmission of it from the dairy to the consumer ; the application of the tuberculin test to dairy cattle and the removal of such as react to the test.
- (3) Medical inspection of school children and school premises, factories, workshops and infected houses by medical men and Health Visitor to ensure sufficient hygienic measures and sanitary arrangements.
- (4) Housing reform, thus raising the social and domestic conditions of the poor.
- (5) Segregation in Hospital of advanced cases and public and private Sanatoria.
- (6) Compulsory notification of the disease.

---

### Hints for the Prevention of Tuberculosis.

---

*Public Health Department, Bombay Municipality.*

Phthisis, Tuberculosis or Consumption is an infectious disease, chiefly conveyed from person to person by the habit of spitting.

The germs causing the disease are to be found in the sputum of infected persons and escape into the surrounding air from the dried sputum.

Persons sleeping in a room with one suffering from phthisis may contract the disease.

The disease may be contracted by eating infected milk or meat.

Overcrowding of living rooms and workshops predispose to diseases.

The habit of spitting causes the disease to spread.

Room in which a case of phthisis has occurred should be disinfected and limewashed.

All sputum from infected persons should be received into a receptacle containing a strong solution of carbolic acid.

Spitting on the floors or walls should be avoided.

Cases of phthisis should be reported to the Health Officer.

J. A. TURNER, M.B.,  
*Executive Health Officer.*

### Instructions to Persons Suffering from Consumption.

---

The material which you cough up and spit (the sputum) contains the infection of consumption. If this is allowed to become dry and to get broken into dust, such dust when inhaled will produce the disease in your own lungs.

Great care must, therefore, be used, so that the sputum is not discharged on any spot or into any substance on which it can be dried and subsequently broken into dust.

It must, therefore, not be discharged on the floor or walls of any living room, workshop, meeting room, theatre, or other confined place in which people assemble. It must not be discharged into a pocket handkerchief carried in the usual manner,

since it readily dries in such a situation, so that not only are the clothes infected, but, when the pocket handkerchief is again used, a cloud of infective dust is scattered around you.

There are various ways in which this danger may be avoided.

At home you should spit into a piece of paper or clean rag, carefully clean your mouth with it, and then throw the soiled rag or paper on the back of the fire.

If there is no fire you should spit into a cup containing water, which must be emptied once a day into the drains outside the house and then thoroughly cleansed with boiling water before being again used.

Outside the home you should carry a number of pieces of soft tissue paper, perfectly oiled, and when you must spit use one of these, folding it after use, so that the sputum is right in the centre of it, when it will not dirty the pocket. Use one pocket for the unused papers and another for those which have been used.

Or you may carry a pocket spittoon charged with moistened blotting paper. This may be readily obtained at any chemists or made. It is essential that the lid should fit tight, and that the spittoon should be kept clean.

All persons who have a chronic cough and spit should carry out the above precautions.

Consumptives should not kiss on the lips.

The eating utensils which they have used should be at once thoroughly cleansed before further use.

If these precautions are strictly observed, a consumptive person runs no risk whatever of infecting others, and adds considerably to his own chances of recovery.

The sleeping room of a consumptive should be kept rigorously clean. If, by any chance, the pillows or bed clothes have been soiled with sputum, they should be at once disinfected by steam or washed with boiling water.

Dust should not be allowed to accumulate anywhere in the bedroom. The room should be kept well aired and the bedroom window should, whenever possible, be kept slightly open.

Persons who have contracted consumption, or who have a family history of the disease, should not live or sleep in a room which is damp, crowded, badly lighted, or badly ventilated.

It will often happen when a consumptive person's attention is first called to these rules that a considerable amount of infective dust will have collected in the rooms which he has occupied. These must be carefully disinfected.

Articles, including wearing apparel, carpets, hangings, bed cloths and mattresses, which admit of such treatment will be disinfected at the Municipal Health Department Station free of charge. Articles which admit of washing with boiling water may be so washed. Other articles, as well as the floor, walls and ceiling, should be thoroughly cleaned down with a disinfectant, and the Health Department will do this work if requested. Where the work is done by the householder, directions will be given in each instance of the precise degree and kind of disinfection necessary.

PUBLIC HEALTH DEPARTMENT,  
BOMBAY, 1910.

Statement of animals tested with Tuberculin at the Bandra Slaughter House. All these animals were cows.

Date of Injection.	Register Number.	Age Condition.	Temperature before inoculation.	Temperature 12 hours after inoculation.	Temperature 15 hours after inoculation.	Temperature 18 hours after inoculation.	Result.	REMARKS.
21st Sept. 1910	353	6 good.	102°	102°	101°	102°2'	+	P. M. Ex. was held ; no lesions.
"	398	8 "	102°4'	103°	102°2'	104°6'		
"	253	6 "	102°2'	101°	101°4'	102°	+	P. M. Ex. was held ; no lesions.
"	23	8 "	101°	100°6'	102°4'	102°4'		
"	360	5 "	101°6'	101°2'	101°2'	102°4'		
"	522	Old ; weak.	100°	101°	100°6'	102°		
"	229	3 good.	103°	101°	101°	103°		
"	301	8 "	102°	100°6'	100°6'	102°6'		
"	369	8 "	102°4'	102°2'	101°	101°4'		
29th Sept. 1910	209	4 "	102°	100°6'	101°2'	102°		
22nd Sept. 1910	398	8 "	102°4'	100°6'	101°	102°		
"	348	Old ; weak.	101°4'	101°	101°	101°4'		
"	271	5 good.	101°6'	100°4'	100°4'	101°2'	+	P. M. Ex. Small black nodules in lungs.
"	240	8 "	103°	101°8'	101°8'	102°4'		
"	180	4 "	102°4'	101°4'	101°6'	102°4'		
"	490	5 "	101°6'	101°	101°	101°4'		
"	330	8 "	101°4'	101°4'	102°	102°4'		
"	226	6 fair.	101°4'	101°6'	102°	102°6'		
"	321	8 good.	101°	101°	101°6'	102°4'		
"	313	8 weak.	100°6'	100°2'	101°	101°6'		
"	304	8 good.	102°8'	101°4'	102°8'	104°2'		
"	381	Old ; fair.	101°	100°2'	100°6'	102°		
"	101	8 good	102°2'	101°	101°4'	102°2'		
"	371	8 "	102°2'	101°	101°2'	102°4'		



Statement of buffaloes tested with Tuberculin at the Milch Cattle Stable at No. 1-2, Forjett Street Cross Lane, on 28th September 1910.

Date of Inoculation.	Register Number.	Condition of Animal.	Temperature before inoculation.	Temperature 12 hours after	Temperature 15 hours after.	Temperature 18 hours after.	Result.	REMARKS.
28th Sept. 1910.	301	Good.	102'4°	102'4°	101'4°	102'2°	...	
"	304	"	102'2°	102°	101'4°	102'6°	...	
"	101	Fair.	102'4°	102'2°	102°	} Did not allow as it was milking time.	...	
"	226	"	102°	102°	102'2°		...	
"	209	Good.	103°	101'8°	102°		103'6°	...
"	398	"	103°	101'6°	101'8°	102°	...	
"	23	Weak.	102'2°	101'2°	101'6°	102°	...	
"	321	Good.	101'4°	101'4°	101'4°	101'6°	...	
"	360	Weak.	102'4°	101'8°	103°	102'8°	...	

Statement of animals tested with Tuberculin at the Bombay Pinjrapole. All were buffaloes. The Tuberculin was obtained from Parel Laboratory.

Date of Inoculation	Register Number.	Condition of the animal.	Temperature before inoculation	Temperature 13 hours after.	Temperature 15 hours after.	Temperature 17 hours after.	Results	Temperature 24 hours after.	REMARKS.
8th Oct. 1910 (6 p.m.)	62	Weak.	103'4°	101'2°	102°	102°	...	103°	
"	270	Good.	102°	101'4°	101'6°	101'8°	...	102'2°	
"	233	...	103'4°	102'2°	102'6°	102'4°	...	104'2°	Two animals were condemned, their temperatures being 104° and 106'2° respectively.
"	317	...	102°	101'6°	102°	102'2°	...	102°	
"	203	...	102°	102'4°	101'6°	102'2°	...	103'2°	The last temperature 24 hours after (and after the reaction period was over) was taken with a view to compare the same with the one taken before inoculation.

*Statement of Cows tested with Tuberculin at the Bandra Slaughter House on 5th October 1910 and at the Veterinary Hospital on 13th July 1910, 26th July 1910 and 31st August 1910, by Mr. Mahomed Khan.*

Date of Inoculation.	Register No.	Temperature 24 hours before inoculation.	Temperature an hour before inoculation.	Temperature 13 hours after.	Temperature 15 hours after.	Temperature 19 hours after.	Result.	REMARKS.
5th Oct. 1910.	381	102°6'	100°6'	100°	100°	100°	—	
"	42	102°8'	101°2'	100°	100°	101°6'	—	
"	136	101°4'	101°2'	100°6'	101°	101°8'	—	
"	67	103°	102°2'	101°	101°2'	102°	—	
"	348	101°6'	100°8'	100°	100°	100°4'	—	
"	77	101°4'	101°6'	100°2'	100°2'	101°4'	—	
"	128	103°	101°	100°	100°	100°6'	—	
"	300	103°	102°	100°4'	100°4'	101°8'	—	
"	321	102°	100°2'	100°6'	100°6'	100°8'	—	
"	271	102°6'	101°	100°	100°2'	101°	—	
13th July 1910.	Black & White.	} Nangam. {	101°2'	8 hours after. 103°6'	12 hours after. 104°	...	+	Re-inoculated at Borivli on 30th October 1910. No re-action.
"	White.		102°	104°2'	103°6'	...	+	Do. do.
26th July 1910.	Red with White Spots.	"	101°2'	10 hours after. 102°4'	14 hours after. 105°6'	...	+	Do. do.
"	Red & White.	"	100°6'	102°	101°4'	...	+	
31st Aug. 1910.	White with 2 blind teats.	"	101°	7 hours after. 102°5'	11 hours after. 102°	14 hours after. 102°1'	+	
"	White with red legs.	"	101°6'	102°1'	101°2'	101°2'	—	

Statement of Cows tested with Tuberculin at the Bombay Pinjrapole on 17th October 1910 and 20th October 1910.

Date of Inoculation.	Register No.	Condition of Animal.	Temperature before inoculation.	Temperature 13 hours after.	Temperature 15 hours after.	Temperature 17 hours after.	Result.	REMARKS.	
17th Oct. 1910.	73	Weak.	102°	101'2°	102°	102'2°	—	Two animals were condemned owing to high temperature, <i>vis.</i> , 104'2° and 104'6° respectively.	
"	76	...	102'8°	102°	102'4°	103'2°	—		
"	69	...	103'4°	100'8°	101'9°	102'4°	—		
"	68	Good.	102'2°	101'6°	101'4°	102'4°	—		
"	79	Weak.	103°	100'8°	101'4°	101'6°	—		
"	304	...	103°	101'2°	101'2°	102'4°	—		
"	226	...	103°	101'6°	102°	102'8°	—		
"	209	Good.	102'4°	101'4°	102°	102'2°	—		
"	398	Weak.	103'4°	100'7°	102°	102'4°	—		
"	101	...	103'2°	100'4°	100'6°	101'4°	—		
20th Oct. 1910.	68	Fair.	103'2°	103°	103°	102'8°	—		Three animals were condemned as all had 104° (high) temperature—one of them was in heat.
"	73	...	103'6°	101'4°	102'6°	101'2°	—		
"	76	Weak.	103°	101'2°	101'4°	101'8°	—		
"	398	Good.	102'4°	103°	103'2°	103°	—		
"	209	Fair.	102'4°	100'8°	101'2°	101°	—		
"	304	Good.	102'2°	101'4°	101'2°	101°	—		
"	226	...	102'2°	101'6°	101'8°	101'4°	—		
"	101	...	103'2°	102°	102'2°	102°	—		
"	69	Fair.	103°	105'4°	105'7°	105'6°	+ (1)	These two animals showed re-action indicating that they suffered from Tuberculosis.	
"	79	Good.	103°	104'2°	105'4°	106°	+ (2)		
								(1) White cow; small stature; a patch of red hairs on the near flank; down in the near hip joint which is fixed; both hocks bent; stands with both hind limbs under the belly. This animal is marked with figure 1 in red ink on the off quarters.	
								(2) Iron-grey cow; small wide horns; down in the near hip; abduction of the near hind leg; she is pregnant. This animal is marked with figure 2 in red ink on the off quarters.	
								The dung of both these cases was bacteriologically examined when both these specimens contained bacilli tuberculosi.	

Statement of cows tested with Tuberculin at the Bombay Pinjrapole on 26th October 1910.

Date of Inoculation.	Register Number.	Condition of animals.	Temperature before inoculation.	Temperature 13 hours after.	Temperature 15 hours after.	Temperature 18 hours after.	Result.	REMARKS.
26th Oct. 1910.	68	Good.	102°	100·4°	101·6°	102°	Nil.	Three animals were condemned owing to high temperature before the operation, <i>viz.</i> , 103·8° in two cases and 104·8° in the third case.
"	101	Weak.	102·2°	102·2°	102·2°	102·4°		
"	69	"	103·2°	100·6°	102°	101·8°		
"	304	Fair.	102·6°	102°	102·2°	102·4°		
"	73	Weak.	103·4°	100·6°	102°	102°		
"	79	Fair.	103°	101·6°	101·4°	102·4°		
"	398	"	103·2°	100·2°	101·8°	102·4°		
"	209	Good.	103°	101·6°	102°	102°		
"	76	Fair.	103°	100·6°	102°	102°		
"	226	"	103°	100·6°	100·8°	101°		
"	360	Good.	101·8°	101°	101·8°	102·4°		

Statement of cows injected with Tuberculin at the Mangaldas' stable, Fergusson Road, and belonging to Mr. T. R. Lawrence of the British Express Dairy, 1, Elphinstone Circle, Bombay.

Date of inoculation.	Register Number.	Condition of animals.	Temperature before inoculation.	Temperature 13 hours after	Temperature 15 hours after.	Temperature 17 hours after.	Result.	REMARKS.
10th Nov. 1910.	73	Good.	102·6°	101·4°	101·4°	Not taken.	Nil.	
"	304	"	103·6°	102·4°	102°			
"	226	"	102·2°	102°	102·4°			
"	79	"	102·8°	102·4°	103°			
"	301	"	102·4°	100·4°	101·8°			
"	101	"	102·1°	101·8°	102°			
"	398	"	102°	101·2°	101·4°			
"	209	"	102·4°	101·8°	102·8°			
"	360	"	101·8°	101°	100·8°			
"	69	"	102·2°	101·4°	101·8°			
"	68	"	101·8°	101·6°	102·8°			
"	23	"	102·4°	102·6°	101·6°			
"	317	"	102°	101°	101·4°			
"	330	"	102 1°	101·4°	101·8°			
"	201	"	102·4°	101 4°	101·2°			
"	229	"	102·4°	101·4°	101·4°			
"	85	"	103·4°	101·6°	101·4°			

Statement of cows inoculated with Tuberculin for the second time as compared with the first inoculation results.

	Description of the animal.	Date of inoculation and re-inoculation.	Temperature before inoculation.	Temperature after 13 hours.	Temperature after 15 hours.	Temperature after 17 hours.	Result.	REMARKS.
First ...	White ...	13th July 1910.	102°	$\frac{8}{104.2^\circ}$	$\frac{14}{103.6^\circ}$	...	+	Out of five cases only one case had re-action for the second time, which was not so strong as at the first time. All the remaining four cases had no re-action for the second time.
Second ...	...	30th Oct. 1910.	103.8°	102°	102°	102.2°	—	
First ...	Black ...	13th July 1910.	101.2°	$\frac{10}{103.6^\circ}$	$\frac{14}{104^\circ}$	...	+	
Second ...	...	30th ,, 1910.	102.8°	102.2°	101.6°	102°	—	
First ...	Red ...	26th ,, 1910.	101°	$\frac{10}{102.4^\circ}$	$\frac{14}{105.6^\circ}$	...	+	
Second ..	...	30th Oct. 1910.	102.8°	101.2°	101.2°	101.4°	—	
First ...	White ...	20th ,, 1910.	103°	105.4°	105.7°	105.6°	+	
Second ...	...	5th Nov. 1910.	103°	103.2°	103°	103.4°	—	
First ...	Iron-grey ...	20th Oct. 1910.	103°	104.2°	105.4°	105°	+	
Second ...	...	5th Nov. 1910.	102.8°	102.8°	104°	104.6°	+	