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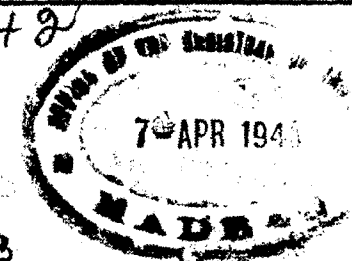
No. 5

THE INDIAN VETERINARY JOURNAL

Published Bi-monthly

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Observations:—Right Eye—A slight watery discharge was observed the next morning. The ulcer started healing from the 4th day and completely healed on the 9th leaving behind a very small speck. The eye looked normal by the end of a month, when the animal was discontinued.

Discussion

In spite of the fact that the disease under reference could not be transmitted to the healthy goats by all the possible means at the disposal of the author, readers would wonder why it has been called 'Contagious (?) keratitis' with a mark of interrogation after the word 'Contagious'. The only plea for using this word is that similar outbreaks in cattle and sheep have in the past been observed, by various workers in different countries and in none of them the disease could be transmitted experimentally and yet these were grouped and described under Contagious keratitis, Infectious keratitis, Epizootic keratitis etc, on the ground that not only a large number of animals were involved in each case but the infection spread from one locality to another.

One might ask for explanation for the peculiar behaviour of goat No. 233 in the above experiments, which developed opacity and ulceration in the control eye. Could it be that the swab was applied to the left eye instead of the right eye thus proving that the ocular secretion was infective? But in that case goat No. 231 ought to have developed some lesions too. As the experimental healthy goat had not come from the affected locality it cannot be argued either that the goat under reference was already in the incubation period. The cause of these lesions is an unanswered question but the rest of the experiments at least go to show that the condition was either not of a contagious nature or the mode of infection was different to those tried in these experiments.

That the disease under reference is similar to the one described in cattle and sheep abroad in lesions, contagion and amenability to local treatment, is evident from the following records.

Brown (1934) records outbreaks of contagious ophthalmia amongst cattle in various Farms where almost all the cattle were later or sooner involved. Constitutional disturbance was absent. In some cases ulceration of cornea was also reported. In most cases the eyes cleared up gradually whereas in some permanent opacity causing blindness was left. Sheep and horses running with affected cattle remained free. All laboratory attempts to reproduce the disease experimentally both by swabs from the field cases and by actual contact failed. Soetisno (1934) reported infectious keratitis of cattle in Sumatra but could not demonstrate by laboratory methods any particular organisms as the cause. Rose (1942) too while describing true infectious keratitis states that the mode of transmission is definitely unknown and that transmission experiments have failed.

Farley in the same article failed to transmit the disease through common flies. Bambaer (1938) also failed to transmit Contagious keratitis in cattle and considered it primarily a Vitamin 'A' deficiency with superadded infection of the cornea responding to treatment with disinfectant eye lotions and vitamin rich foods. Graig and Ratter (1940) have observed several outbreaks of keratitis with similar lesions in sheep and in which cattle grazing on the same fields remained free from eye trouble. This observation together with that of Brown's and of the present author would seem to suggest that there may be different factors responsible for outbreak in cattle and other farm animals. These authors mention too their failure to transmit the affection by swabs of discharge from affected cases. Tasi (1934) reports infectious keratitis in sheep which was amenable to ordinary local treatment. No transmission experiments were carried out by him. Edgar (1931) also deals with an infectious type of ophthalmia widespread in sheep in N. S. Wales appearing in summer months and resulting in keratitis. The cultures from the affected eyes were incapable of setting up the disease in healthy sheep. He succeeded in transmitting the disease by contact, but that only occurred when sheep were grazed on long grass and not when they were kept on short pastures. He considered the condition specific for sheep, in particular for the Merino. Jones and Little (1922) investigated an outbreak in Ohio and recovered an organism—a short plump bacillus with rounded ends, with which they reproduced the disease. The condition in their case was accompanied by a thick yellow discharge and corneal opacity and ulceration was noticed only in a few instances unlike in the outbreak under discussion. It is evident from the above that as far as contagion, it is far from being proved. It may be mentioned in conclusion that Linter attributes epizootic keratitis in cattle to a caterpillar, (*Cnethocampa processionea*) which lives in great numbers on the oak and other trees and he thinks that the beasts rubbing against the trees cause them to fall. He supports this theory by stating that the disease does not affect animals in sheds nor in years when caterpillars are not plentiful. But against this theory there are well established facts that although the larvae of the caterpillar have produced experimental conjunctivitis and corneal opacity in Man (Pagenstecher, 1883) and in rabbits (Krüger and Backer), the lesions in each case represented pseudo-tubercular nodular inflammation (ophthalmia nodosa) and in no way resembled the bovine keratitis.

Acknowledgments.

The author is greatly indebted to Mr. M. I. Malik, Director, Veterinary Services, Bihar for his keen interest in these experiments and for providing all facilities to conduct them in the Bihar College

and to late Dr. M. Huspain, Eye Specialist, Prince of Wales Medical College Hospital, Patna for examination of the eye lesions and his valuable guidance.

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"PRELIMINARY REPORT ON CANINE COCCIDIOSIS AND ITS TREATMENT"

By

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and

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The Genera Isospora and Eimeria are collectively spoken as the Coccidia. Isospora are coccidia which have oocysts containing two sporocysts with four sporozoites in each sporocyst. Eimeria are coccidia which have oocysts containing four sporocysts with two sporozoites in each sporocyst. Eimeria, as well as, Isospora, occur in Cats and Dogs. There are very few records of the occurrence of Eimeria in carnivores, which appear to be much more commonly infected with species of Isospora. The oocyst of Eimeria canis, Wenyon, 1923, is ellipsoidal or ovoid in shape and varies in length from 18 to 45 microns and in breadth from 11 to 28 microns. The oocyst of Isospora bigemina (Stiles, 1891), measuring 10 to 14 microns by 7.5 to 9 microns are found in the sub-epithelial tissue of the intestinal villi.

"Clinical Coccidiosis is a common and highly fatal disease of dogs between the ages of six and twelve weeks. The majority die in convulsions. Symptoms are variable, determined probably, by the species of secondary pathogenic invaders and the tissues involved. Only seldom is there fresh blood in the stool. This is due to the fact that the inflammation and ulceration is usually confined to the small intestine. Champing of the teeth and frothing at the mouth are common. There may be a *locomotor inco-ordination. A few develop chorea. There may be pustular eruption on the skin and a purulent or muco-purulent conjunctivitis at the same time." (Emmerson and Dashoff, 1943).



Fig. 1

Tan and White Terrier dog infected with *Isospora bigemina*.

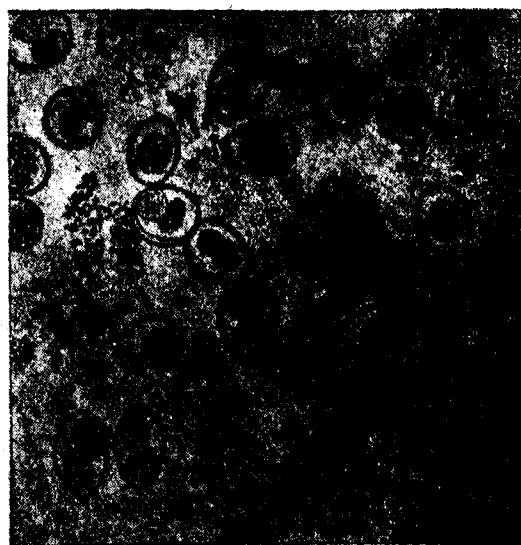


FIG. 2

Oocysts of *Isospora bigemina* as passed in fresh faeces (X 230)

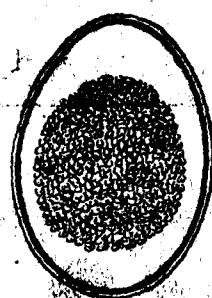


FIG. III (a)

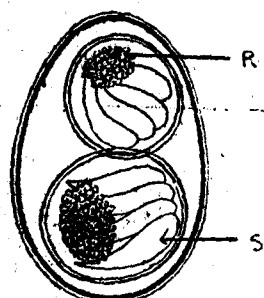


FIG. III (b)

FIG. III(a)—Oocyst containing an immature ovum as passed in fresh faeces (X 1000).

FIG. III(b)—Oocyst containing two sporocysts each with four sporozoites (X 1000)

R—Residual body.

S—Sporozoite.

"PRELIMINARY REPORT ON CANINE COCCIDIOSIS & ITS TREATMENT" 317

It is difficult to form an idea about the incidence of Canine Coccidiosis in India as the literature on the subject is either wanting or very meagre. At any rate, no such case appears to have been met with in the Bengal Veterinary College Hospital during the last several years. The senior author of this paper found, during the course of the routine examination for ova of worms in the faeces of dogs treated at the Dog Ward of Bengal Veterinary College, oocysts of coccidia, morphologically identical to *Isospora bigemina*, in five dogs-

Case No. 1:—A black Cocker Spaniel dog with the history of diarrhoea and emaciation was brought for treatment on 18-4-43. Faecal examination revealed numerous immature oocysts of *Isospora bigemina*. No treatment was given as the owner did not bring the dog to the hospital after the diagnosis.

Case No. 2:—A black Terrier dog (Puppy) was admitted in the Dog Ward on 3-6-44 with the clinical symptoms of Distemper in which chorea had already developed. Faecal examination revealed numerous immature oocysts of *Isospora bigemina*. The dog, however, died during the course of the day and no treatment was possible. The carcass, owing to unforeseen circumstances, was not available for P. M. examination and no histopathological examination of the infected tissue was possible.

Case No. 3:—A tan and white Fox Terrier bitch was admitted in the Dog Ward on 1-7-44 with epileptic fits. The case was clinically diagnosed as Distemper. Stool was loose and coated with mucus. Faecal examination revealed numerous immature oocysts of *Isospora bigemina*. Treatment for coccidia was not done. The bitch died on 7-7-44, but the carcass was taken away from the hospital by the owner for burial. Hence, post-mortem examination was not possible.

Case No. 4:—A tan and white Fox Terrier dog was admitted in the Dog Ward on 18-6-44 with the history of depraved appetite, irritable temper, champing of the teeth and occasional howling. It was straightaway put in the Rabies Ward and kept under observation for ten days. The symptoms more or less persisted throughout the period of observation and on the eleventh day the dog was transferred from the Rabies Ward to the General Ward for treatment. Faeces was examined and found to be positive to oocysts of *Isospora bigemina*. But the owner was leaving Calcutta and removed the dog from the Dog Ward without waiting for the treatment.

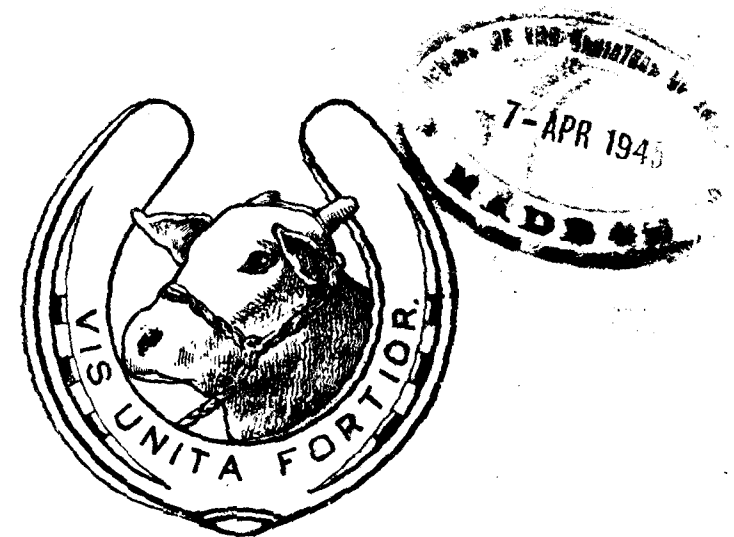
Case No. 5:—A tan and white Terrier dog (Fig. No. 1) was admitted in the Dog Ward on 29-8-44 for treatment of skin disease. The dog, as reported by the owner, was rapidly running down in condition. The stool was found to be loose, dark coloured and coated with mucus. Faecal examination revealed numerous immature oocysts of *Isospora bigemina* measuring 10 to 14 by 7.5 to 9 microns, (figs II and III a).

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Faeces was kept in a petre dish moistened with 2½% of Potassium bichromate solution and in 2 to 7 days' time, segmentation of the immature oöcysts commenced and each sporocyst contained four sporozoites and a residual body. This is the infective stage. (Fig. IIIb).

Treatment, suggested by Mc Peek and Armstrong, 1941, was adopted. Sulfanilamide was given in powder form in the dosage of one gram per 20 lbs of body weight per day. It was divided into two doses, administered morning and evening in gelatine capsules. The faeces was negative to oöcysts of coccidia by the morning of the fifth consecutive day of treatment and Sulfanilamide was not continued longer than this. The condition of faeces improved and the dog gradually regained health in the hospital inspite of the limited environmental conditions. Faeces was continued to be examined daily upto about a month from the date of administration of the medicine and found to be negative.

Summary

Oöcysts of *Isospora bigemina* have been detected in the faeces of five dogs admitted in the Dog Ward of Bengal Veterinary College. Sulfanilamide was tried in one case with encouraging result. As the number of cases observed and treated is inconsiderable, no conclusion in respect of the pathogenicity of the disease and the therapy of the drug employed could be arrived at.

Acknowledgments

The authors are grateful to Mr. A. Latiff, B. H. V. S., Principal, and Mr. K. C. Mukerjee, M. Sc., M. R. C. V. S., Vice-principal, Bengal Veterinary College, for the keen interest they have taken in this subject and also for encouraging me to write out this paper. Thanks are also due to Mr. L. Chandra, Artist, for the photograph and the drawings.

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SOME OBSERVATIONS ON *STRONGYLOIDES PAPILLOSUS* FROM INDIAN RUMINANTS

BY

M. M. SARWAR,

Military Dehydrated Meat Factory, Agra.

This species is known from a variety of animals, including sheep, goat, ox, pig, rabbit and rat and has a wide geographical range. Chandler (1925) regards the forms recorded from monkeys as varieties or at the most subspecies of *S. papillosus* and records one such form from *Macacus rhesus* and *Hoolock gibbon* in Calcutta. Vaidyanathan (1942) records the species from cattle at Madras.

In the present paper the parasite is recorded from sheep, goat and cattle from Izatnagar and Mukteswar and some factors giving rise to free living forms are discussed.

The examination of cattle at Izatnagar comprised faecal as well as cultural examination while diagnosis in goats and sheep consisted in examination for eggs alone. Thirty dairy animals were examined ranging in age from 1½ months to 3 years. Fifteen animals were found positive, their ages varying from 1½ months to 1 year and 2 months. A batch of eighteen lambs and kids ranging in age from 2 months to 6 months was also found positive at Izatnagar but animals above 1½ years housed with the infected kids were free from the infection.

In routine examination for worms eggs of the species were discovered in faeces of a two years old goat. Free living forms were collected from a 2½ year old heifer slaughtered soon after its arrival from Baheri (Bareilly District).

Out of the 15 positive dairy calves and 5 others, free living forms were collected from 4 animals only, three being dairy calves and one being a heifer of 2½ years of age. The calves were free from any other kind of infection but the heifer harboured 4 individuals of the species *Mecistocirrus digitatus* and about a dozen of those of *Cooperia punctate*. All the four animals were in excellent condition. The free living strains from the 3 dairy calves were kept in the laboratory under unfavourable conditions of moisture and temperature for 6 months, the culture being soaked with water without the addition of charcoal and temperature ranging from 35–38°C but the cultures survived and during all this time did not undergo development to filariform larvae. The material from the heifer was examined by scraping off the mucous from the small intestine and examining it under the microscope. A meshwork of different stages and eggs could be discerned.

Beach (1935–36) working in Faust's laboratory showed conclusively that the course of development can be influenced by nutritional conditions and as these become favourable more and more of the rhabditiform larvae undergo direct development to filariform larvae instead of becoming males and females. The same author working on *Strongyloides simia* in 1935 has shown for the first time that under optimum conditions indirect development consistently takes place and may be continued through several generations, and theoretically over an indefinite period. However, if unfavourable conditions supervene, as for example reduction in the amount of necessary nutrient ingredients or reduction in the viscosity of the medium and possibly reduction in its tonicity, the tendency is towards directness.

NOTICE

The Indian Veterinary Journal

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Thus the direct type of life cycle is found to be an adaptation to unfavourable conditions in the environment and not predetermined by genetic factors. Under optimum conditions *Strongyloides* may be propagated exclusively as a free living organism.

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VETERINARY MEDICINE IN MOURYAN TIMES

(4th Century B. C.) *

(Based on Kautilya's Arthashastra)

BY

DR. D. V. S. REDDY,

Andhra Medical College, Vizagapatam.

The existence of the Science and Art of Veterinary Medicine in India, from the earliest historic times, is no more in doubt, on account of the discovery of the many valuable treatises in Sanskrit, which deal with the care of cattle and cure of their diseases, in a very systematic and scientific manner. There are also many allusions in non-professional, religio-historical works, like Puranas, epics etc., to cattle diseases, as well as to the eminent experts and writers on Veterinary Medicine, from Sages to Princes. Kautilya's Arthashastra or Political Economy, composed in 4th century B.C. as a code for the guidance as well as a record of the Mouryan administration, gives a general but interesting peep into the work of the Veterinary doctors under state control. The numerous references scattered throughout the book may be classified under certain headings.

- (1) Care and treatment of elephants and horses for the use of Royalty and for the Army.
- (2) Care and treatment of cattle for the benefit of Agriculture and for the sake of milk products.

* Paper read in the Medical and Veterinary section of the 32nd Indian Science Congress held at Nagpur in January 1945. This article is one of the series from the studies of the author in the Medicine of the Mouryan Empire based on Kautilya's Arthashastra. Kautilya's Arthashastra is a treatise on Political economy said to have been written by Chanakya the preceptor and prime minister of Chandragupta, the founder of the Mouryan Empire about which fragmentary writings are found in the early Greek writers. The book is a sort of administrative Code as well as a record of the Mouryan Administration.

Elephants

Why were elephants cared for? "The victory of kings in battles depends mainly upon elephants, for elephants, being of large bodily frame, are capable of not only destroying the arrayed army of an enemy, his fortifications and encampments but also to undertake works that are dangerous to life," (page 56). Special elephant forests were preserved; and so important were elephants that a rule was passed stating "whoever kills the elephants shall be put to death".

There was a superintendent of elephants, with many duties relating to the housing, feeding and training and care of the animals, including supervision of the work of elephant doctors (p. 169). Elephant doctors received rations (one prastha of rice, a handful of oil, 2 palas of sugar and salt) and they had to apply necessary medicines to elephants which, while making a journey, happened to suffer from disease, over-work, rut or old age. Elephant doctors gave instructions to experts in catching elephants, to catch certain types of elephants, with auspicious characters (p. 56). Diseased elephants should not be captured, (p. 170). Waving of lights at certain times and sacrifices to *Bhutas* were done for the safety of the animals, (p. 173-174).

The following extracts relating to the daily life and rations of the elephants are interesting:—

Daily Life:—"The first and the seventh of the eight divisions of the day are the two bathing times of elephants; the time subsequent to those periods is for their food; forenoon is the time for their exercise; afternoon is the time for drink; two (out of eight) parts of the night are the time for sleep; one-third of the night is spent in taking wakeful rest."

Rations according to size and class:—"That which is) seven aratnis in height, nine aratnis in length, ten aratnis in circumference and is (as can be inferred from such measurement), 40 years old is the best.

That which is 30 years old is of middle class; and that which is 25 years is of the lowest class.

The diet (for the last two classes) shall be lessened by one-quarter according to the class.

The rations for an elephant (of seven aratnis in height) shall be 1 droma of rice, $\frac{1}{2}$ adhaka of oil, 3 prasthas of ghee, 10 palas of salt, 50 palas of flesh, 1 adhaka of broth (rasa) or twice the quantity (i.e., 2 adhakas) of curd, in order to render the dish tasteful, 10 palas of sugar (kshara) 1 adhaka of liquor, or twice the quantity of milk (payah) 1 prastha of oil smearing over the body, $\frac{1}{8}$ prastha (of the same) for the head and for keeping a light in the stables; 2 bharas of meadow grass, $2\frac{1}{2}$ bharas of ordinary grass (sashpa) and $2\frac{1}{2}$ bharas of dry grass and any quantity of stalks of various pulses (kadankara).

An elephant in rut (atyarala) and of 8 aratnis in height shall have equal rations with that of 7 aratnis in height.

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General Articles ⁴⁴²

AN ANALYSIS OF RECORDS OF CASES AND CASE-MATERIAL
 SUBMITTED FOR LABORATORY EXAMINATION
 FROM JANUARY, 1914, TO DECEMBER, 1939

BY

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We study the dead subject in order to aid the living patient; such may be the motto as it should be the motive of the pathologist. Contemplation of a disease will not reveal much concerning it; but reflection upon observations of it will do so; it may stimulate our intuition to reveal a new fact. The late Professor Dick¹ writing in 1845 said, "It is of more importance to the veterinary student to see what is really useful and the ordinary occurrences of practice than the more rare and extraordinary cases." That is true. The student needs to see as many cases as possible of the diseases he is likely to encounter in practice, since even similar diseases vary in their manifestations in different subjects, and every case will add to his experience. The experienced practitioner on the other hand may be justly interested in the unusual case; and may be inspired to record it; and if the circumstances permit to send suitable material from it for exhibition in a museum, and in order that he may obtain due credit for his effort his name may be recorded in the museum archives along with the specimen.

There are four questions which confront the veterinary practitioner when taking up a new practice or the veterinary inspector when appointed to a new district:—

- (1) What are the prevailing diseases?
- (2) Why are they prevalent?
- (3) What can be done to reduce their prevalence?
- (4) What can be done to prevent their occurrence?

The rest of 6 or 5 aratnis in height shall be provided with rations proportional to their size.

A young elephant (bikka) captured for the mere purpose of sporting with it shall be fed with milk and meadow grass."

Horses

The regular training of a horse was its preparation for war, and training in different movements, forms of jumping and galloping.

There was also a superintendent of horses who kept a register of all classes of horses, according to their breed etc., made a report on the crippled and diseased horses, housing of the horses, fixed or supplied rations for colts and for horses of various sizes and qualities etc. (p. 164).

On new moon days, sacrifices were made to *Bhutas* and on full moon days, chanting of auspicious hymns was performed. At the time of the commencement and close of journey and in times of disease, a priest waved lights invoking blessings on the horses, (p. 169). There were some special people who applied remedies against poison. If they failed to discharge their duties, they forfeited their daily wages.

"Veterinary surgeons shall apply requisite remedies against the undue growth or diminution in the body of horses and also change the diet of horses according to changes in season. When owing to defects in medicine or carelessness in the treatment, diseases (of the horse) become intense, a fine of twice the cost of the treatment shall be imposed. When, owing to the defects in medicine or not administering it, the result becomes quite the reverse, a fine equal to the value of the animal shall be imposed," (p. 169). Horses undergoing treatment were kept in comfortable stables and were not to be taken out for riding.

Care of the old horses:—Stallions which are incapacitated owing to old age, disease or hardships of war, and, being therefore rendered unfit for use in war, live only to consume food, shall, in the interests of citizens and country people be allowed to cross steeds.

Rations for horses:—"For the best horse (the diet shall be) 2 dronas of any one of the grains, rice (sali, vrihi), barley, panic seeds (priyangu) soaked or cooked, cooked mudga (phraseolous) Munga or masha (Phraseolous radiatus); one prastha of oil, 5 palas of salt, 50 palas of flesh; 1 adhak of broth (rasa) or 2 adhakas of curd, 5 palas of sugar (kshara) to make their diet relishing, 1 prastha of sura, liquor, or 2 prasthas of milk.

The same quantity of drink shall be specially given to those horses which are tired of long journey or of carrying loads.

One prastha of oil for giving enema (anuvasana), 1 kudumba of oil for rubbing over the nose, 1,000 palas of meadow grass, twice as much of grass (trinal) and hay stalk or grass shall be spread over an

The same quantity of rations less by one-quarter for horses of medium and lower size.

A draught horse or stallion of medium size shall be given the same quantity as the best horse; and similar horses of lower size shall receive the same quantity as a horse of medium size.

"Steeds and parasamas shall have one quarter less of rations.

Half of the rations given to steeds shall be given to colts.

Thus is the distribution of ration dealt with." (p. 165-166).

Rationing under special conditions and for different ages were also fixed.

"A steed that has just given birth to a colt, shall be provided for the first three days with a drink of 1 parastha of clarified butter; afterwards it shall be fed with a prastha of flour (saktu) and made to drink oil mixed with medicine for ten nights; after that time, it shall have cooked grains, meadow grass, and other things suited to the season of the day.

A colt, ten days old, shall be given a kudumba of flour mixed with $\frac{1}{4}$ th kudumba of clarified butter, and 1 prastha of milk, till it become six months old; then the above rations shall be increased half as much during each succeeding month, with the addition of 1 prastha of barley till it becomes three years old, then one drona of barley till it is four years old; at the age of four or five, it attains its full development and becomes serviceable." (p. 16-5).

Cattle

There was a superintendent of cows with multifarious duties including classification of cows, kept register of the classes of herds and supervised the work of cowherds etc. The superintendent saw that the cows were milked only according to rules, (once or twice according to the season) checked the utilisation of the milk as well as the quantity of butter yielded by the milk of cows, buffaloes, goats, sheep etc., according to the fodder given. Rations were fixed for different type of bulls and cows. All cattle were to be supplied with abundance of fodder and water. Draught oxen and cows yielding milk were given subsistence in proportion to the duration of time.

The owners of cattle had to protect cows from drowning, lightning, tigers, cobras etc. Cowherds had to see that their cattle did not enter deep rivers or lakes or get caught by mire or crocodiles. Whenever an animal was caught hold of, by a thief, a tiger, a snake, or a crocodile, or when it was too infirm owing to age or disease, the cowherds have to make a report to the Cowherds had to apply to remedies to calves or to aged cows of rations with that from disease, (page. 161).

A survey of records kept for an adequate period will afford an answer to the first question. Only the practitioner or inspector with his special knowledge of his district, and of the methods of animal management prevalent there, can answer the second question satisfactorily. An answer to the third and fourth questions may be afforded by his training as a student, supplemented by the reading of current literature, reinforced by his intuition and experience.

Apart from figures relating to the scheduled diseases, published by the Ministry of Agriculture and Fisheries, in Great Britain, and by other Government Departments abroad, the paucity in British veterinary literature of figures relating to diseases of animals has been a subject of comment from time to time. William Youatt² writing in 1837 said, when introducing an extract from the Proceedings of the Veterinary School of Alfort, "We again yield the place of honour to those interesting and valuable records of the progress of veterinary science in foreign schools. How happy should we be to place before the public the labours of other institutions nearer home!" More recently attention has been drawn to this matter by Worden³.

Articles dealing with the incidence of disease in fowls in Great Britain have been issued from the above Department (Matheson⁴) and (Matheson and Wilson⁵). William Dick⁶ in 1845 published a list of the cases of disease encountered in his practice of which Smith⁷ said, "A study of his tables gives a good notion not only of the variety of his practice, but of the class of case met with in a city eighty years ago."

The purpose of the following article is to present some results which have been obtained by an analysis of reports which have been issued from the above department from January, 1914, to December, 1939. This period of twenty-five years has been selected because when the writer assumed control of the department in October, 1913, he began to keep records of the work done, and these were continued until December, 1939, when, with the appointment of senior lecturers in Pathology and Bacteriology, other arrangements were made.

Dick's records are based upon his clinical practice, our records are those of material sent to a pathological laboratory for examination; any attempt at comparison must be made with this distinction in mind. Our records, like those of Dick, may come to have an interest for the historian in the future and are also of value at the present time. It should be emphasised here that the cases under consideration in the present article do not represent all the material coming into the laboratory for examination, since material is sent in by practitioners or obtained from the clinical department of the College, or from the Abattoir, Knackery, etc., for teaching and research purposes.

Nine thousand eight hundred and one reports have been scrutinized; these are based on material submitted by veterinary surgeons and others for the purpose of diagnosis, post-mortem examination, etc. Dick's practice included horses, oxen, sheep, pigs, dogs and cats; since his time the fowl has come into prominence and now occupies so large a place in our records as to require separate consideration. The results of the post-mortem examination of a large number of foreign animals and birds are also excluded from the present series. It is hoped that these, like the diseases of poultry, will form the basis of subsequent communications. Certain fur-bearing animals such as the silver fox, mink, etc., from commercial farms are included, however, in the present discussion. The receipt at the laboratory of the skinned body of a silver fox dead of anthrax, emphasizes the desirability of making a microscopical examination for anthrax in every case where the previous history does not exclude the possibility of that disease.

The present survey covers specimens of various sorts from skin scrapings to complete post-mortem examinations and includes, 468 horses, 6,575 oxen, 276 sheep, 116 pigs, 1,164 dogs, 228 cats, 22 goats, 103 foxes, 72 rabbits and 53 other animals, such as the beaver-rat, fitch, etc.

A good deal of material was lost to the records owing to its being received at the laboratory in an unfit condition for examination. Another source of loss was the receipt of specimens with an inadequate history; for example, a tumour is removed surgically or obtained from a post-mortem subject and sent to the laboratory with a request for examination, no details are submitted, the sender is aware of the facts and can relate the laboratory findings to the case, but the pathologist finds that his record is incomplete. The modern practitioner is aware of the necessity of a case history, details as to the source of the tumour; whether or not secondary growths were observed and their organ incidence; and, where material is limited, the desirability of sending a piece from the growing edge in relation to the normal tissue. Whenever possible tumours have been relegated to the body system to which they belonged; but, for the reason just given, 91 tumours are shown in the table as not classified. They will be discussed, however in due course, with the rest. Much of the material submitted for examination, for example for Brucellosis, Mange, Ringworm, etc., proved to be negative; the following table presents an epitome of the results obtained when all the negative cases are removed and shows the distribution of the positive cases, of the diseases indicated amongst the animals concerned. The table also indicates the method upon which the analysis has been based; and will permit later of a discussion of the diseases grouped under the various body systems, but the limits of the present article will not permit us to deal with more than the specific, general and parasitic diseases.

There were available Veterinary Surgeons and experts in cattle diseases to examine and advise. The passage quoted in the Section on horses, applied as much to the treatment of cows, buffaloes, goats and sheep as to the horses. One of the duties of the King was to protect cattle from cattle diseases. (p. 54),

There was a superintendent of Slaughter houses, (p. 152) with extensive powers. Among his many duties, the following relate to the protection of the cows etc... "Cattle such as calf, a bull or milch cow shall not be slaughtered. He who slaughters them shall be fined 50 Panas. The flesh of animals killed outside the slaughter house, headless, boneless, flesh or rotten flesh or flesh of animals which have suddenly died shall not be sold". Butchers should sell fresh flesh. Those using false balances were punished.

Cruelty to animals was punished. Whoever hurt or caused another to hurt a cow was to be slain. The state offered full facilities for cattle breeding by having bulls for crossing cows, as distinct from draught oxen, yoken oxen and bulls for supply of flesh:

Animal nutrition was well understood as can be seen from the following extract:—"Increase in the supply of milk and butter depends on the nature of the soil and the quality and quantity of water and fodder," (p. 162)

Rations for cattle were provided on a generous scale:—

"For bulls which are provided with nose-strings, and which equal horses in speed and in carrying loads, half a bhara of meadow grass (yavasa) twice the above quantity of ordinary grass (trina) one tula (100 palas) of oil cakes, 10 adhakas of bran, 5 palas of salt (mufihalavanam) one kundumb of oil for rubbing over the hns (hasya) 1 prastha of drink (pana) one tola of flesh, 1 adhaka of curds, 1 drona of barley or of cooked masha (phraseolous radiatus) 1 drona of milk or half an adhaka of sura (liquor) 1 prastha of oil or ghee (sneha) 10 palas of sugar or jaggery, 1 pala of the fruit of stringibera (giner) may be substituted for milk (pratipana).

The same commodities less by one quarter each will form the diet for mules, cows, and asses; twice the quantity of the above things for buffaloes and camels

The draught oxen and cows supplying milk (paya) shall be provided with subsistence in proportion to the duration of time the oxen are kept at work and the quantity of milk which the cows supply.

All cattle shall be supplied with abundance of fodder and water.

For bullocks, one drona of mash a (phraseolous radiatus) or one drona of barley cooked with other things as prescribed for horses, is the requisite quantity of food besides the special and additional provision of one tula of oilcakes (ghanapinyaka) or ten adhakas of bran (kanakundaka).

Twice the above quantity for buffaloes," (p. 163).

SPIROCHÆTOSIS OF FOWLS IN INDIA—I*

BY

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and

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Contribution to the Study of Fowl Spirochætosis

Since the discovery of *Spirochaeta anserina* by Sakharoff (1891) extensive work has been carried out on fowl spirochætosis in various countries, particularly in those of the southern hemisphere, where the disease seems to be more prevalent than elsewhere. In spite of its economic importance, the disease has up to the present escaped systematic investigation. Foster Reaney (1907) was the first to report the occurrence of spirochætosis in Central India. Montgomery (1908) met the disease in the North-western Punjab and in the United Provinces. He incriminated the tick, *Argas persicus*, as the transmitting vector. The next important paper reporting investigations upon this disease is that by Knowles, Das Gupta and Basu (1932). These authors give a very extensive review of the literature. Their report, however, is mainly of academic and entomological interest and the field veterinarian is left in the dark as to the treatment of individual cases and the carrying out of preventive measures on poultry farms.

The study of the disease, as may be seen from the literature, is far from being concluded. Although the reports correctly describe one or other outstanding feature of the disease, many of the statements contradict one another and some have not been confirmed by further work. The purpose of this paper, therefore, is to record the writers' observations on the natural and artificial disease, and certain experiments directed towards its control.

On the subject of nomenclature, Sakharoff (1891) who first discovered the parasite in geese in Caucasia, named it *Spirochaeta anserina*. Marchoux and Salimbeni (1903) found the disease among fowls in Rio de Janeiro and they are of opinion that the Brazilian parasite is different from the Caucasian variety. According to Sakharoff, *Sp. anserina* is incapable of infecting chickens, while *Sp. gallinarum* can infect not only chickens but geese, rabbits and sparrows. Nuttall (1913) says that *Sp. anserina* is synonymous with *Sp. gallinarum*. Stephens and Christophers (1904) were the first to use the name, *Sp. gallinarum*. Wenyon (1926) considers that the various spirochætes described from fowls, geese and ducks belong to one species and that the correct name for the spirochæte is *Treponema anserinum*, after Sakharoff. However, Wenyon admits that spirochætosis

*Reprinted from the *Veterinary Journal* August 1943.

The relatively large number of cases from oxen in Table I is explained by the fact that the record includes specimens of blood found, on examination, to give a positive reaction to the agglutination test for *Brucella abortus*, and samples of milk which were found on examination to contain *Mycobacterium tuberculosis*, etc.

Table I
Numbers of Positive Cases

DISEASES	Horse	Ox	Sheep	Pig	Dog	Cat	Goat	Fox	Rabbit	Others	Case Totals
Specific disease	47	724	20	11	28	16	1	7	2	1	857
General	4	6	14	2	10	7	...	1	...	...	44
Parasitic	52	16	24	1	21	5	4	20	31	9	183
Tegumentary System	45	16	8	4	193	22	2	...	2	3	295
Respiratory	19	30	45	34	66	11	...	15	1	4	225
Circulatory	16	5	3	2	23	7	2	...	1	2	61
Haemopoietic	7	4	2	4	21	3	2	...	...	1	44
Alimentary	33	59	79	34	190	70	6	34	18	9	532
Urinary	4	16	1	1	24	12	...	2	...	...	60
Generative	16	22	4	1	181	17	...	...	...	...	241
Locomotor	11	3	1	3	6	3	1	...	...	3	31
Nervous	1	...	2	1	11	...	1	...	...	...	16
Endocrine	2	...	...	...	1	...	...	...	...	...	3
Haemorrhage	3	1	2	1	21	9	...	3	1	2	43
Polypus	2	...	1	...	...	...	...	1	...	...	4
Cysts	2	...	1	...	30	...	1	...	...	...	34
Tumours, not classifiable...	7	6	4	...	68	3	...	...	...	3	91
Teratoma	6	...	...	1	...	...	...	...	...	...	7
Keratoma	1	...	...	...	...	...	...	...	...	...	1
Milk Tuberculous	...	272	...	...	...	...	...	...	...	...	272
Mastitis, other than T.B...	...	139	...	...	...	...	...	...	...	...	139
Milk, Blood Stained	...	4	...	...	...	...	...	...	...	...	4
Milk, B.abortus present...	...	2	...	...	...	...	...	...	...	...	2
TOTALS	278	1325	211	100	894	185	20	83	56	37	3189

Table II shows the distribution of the specific diseases amongst the animals indicated.

By a specific disease we may mean one whose etiology is known, whose symptoms and lesions are well recognised and the course and termination of which can be forecast with a reasonable degree of accuracy by an experienced practitioner. Accepting that definition, many of the parasitic diseases are also specific; the classification is arbitrary therefore, but it has the sanction of custom.

Of the diseases included in Table II, Glanders (and Farcy), Botryomycosis (Scirrhus cord), Cowpox, Distemper in Dogs, Strangles and Tetanus are included in Dick's lists, while some mentioned by Dick do not appear in our records, as since his day, Cattle Plague, Bovine Pleuro-Pneumonia, Rabies and Glanders, have been eradicated from Great Britain, Epizootic Lymphangitis and Sporotrichosis have been introduced and eliminated.

Such eradication has been made possible of course by the insular position of Great Britain, and by regulations governing the importation of livestock. The idea that certain diseases associated with obligatory parasites can be brought under control and ought to be eradicated is more generally acceptable to, and accepted by, stock-owners to-day than was formerly the case.

When considering the tables we must be careful not to draw far reaching conclusions from data which are inadequate to support such conclusions. The high incidence of Tuberculosis in the horse is noteworthy but it would be wrong to interpret the figures as indicating that tuberculosis is common among British horses; that is not the case; the figures show that out of 47 cases of specific disease in the horse examined in this laboratory during the period indicated, 20 were cases of tuberculosis; the explanation lies probably in the nature of the case. A horse is found to be ailing; is unable to do its work; and shows periods of partial recovery followed by relapses, each of which leave the animal rather worse than it was before. An increasing difficulty in feeding from the ground associated with a growing stiffness of the neck may be noticed; gradually the animal loses condition, until the development of respiratory symptoms indicates that the lungs are affected, and shortly after, death terminates the case. By this time the owner has become interested and readily agrees to the suggestion of his veterinary adviser that a post-mortem examination should be made with a view to confirming his provisional diagnosis of tuberculosis.

in fowls has now been found to occur in many parts of the world, though the disease in geese has been less commonly seen. Thomson and Robertson (1929), on the other hand, have described the parasites in geese, fowls and ducks as *Sp. anserinum*, *gallinarum* and *anatis*, respectively. Beyond naming them separately no differentiation has been mentioned. The strain concerned in the present review was originally isolated from a fowl, but it produced in ducks a disease with identical severity and symptoms. It is interesting to note, however, that when two clean fowls were subinoculated from these ducks at the height of infection, the former manifested practically no clinical symptoms, showing only a few parasites in the blood for two days and finally recovering. Since the disease is of more importance in fowls than in geese, it appears reasonable to use the name *Sp. gallinarum* for the parasite concerned.

Cantacuzene (1899) reports that adult fowls are almost immune, and that young chickens are most susceptible, with death occurring as a rule within twenty-four hours of the first appearance of spirochætes in the blood. He found that organisms in blood taken at the height of infection die out in half an hour, while spirochætes in blood taken at the end of lysis may survive *in vitro* for two or three days. From this, he infers that lysins are produced in the shed blood. It is now known, however, that adult birds are as susceptible as chickens and that death in almost all cases occurs only at the crisis. The writers have found living and viable spirochætes in samples kept for as long as ninety-seven days in the refrigerator, while in vaselined preparations made at the height of infection the parasites have been found living even after twenty-four hours at Mukteswar (7,500 feet). Hindle (1911) reports that in infected blood in sealed tubes the spirochætes live for three months. Neiva (1914) kept them at 0° for forty-nine days and found them virulent.

Balfour (1907, 1908) describes certain bodies in the red cells as stages in the after-phase of fowl spirochætosis. In a later report (1914) he mentions them as precursors. In 1913 he queries his previous theory and suggests that, if the granules are not some phase of the parasite, they are possibly chlamydozoal in character and transmitted by ticks. Gleitsmann (1913), however, believes the granules to be degeneration products formed by toxic action on erythrocytes and this is supported by Knowles *et al.* (1932), who produced them in the blood by injecting phenol products. Balfour (1914) experimented with the granules (inclusion bodies) by infecting chickens with tick eggs and finally concludes that the granules may be some new parasites closely associated with spirochætes and having a common vector in *A. persicus*. Curasson and Andrejesky (1929) made an extensive study of "Balfour's bodies" and spirochætes and proved conclusively that the two represent different parasites. Marchoux and Couvy (1912, 1913), continuing the experiments of Balfour, considered such

granules to be normal structures in a wide variety of acarines, having no connection with spirochætes. Balfour still claims to have produced the disease by means of the granules. Marchoux and Couvy, however, failed to do so and consider Balfour's results as due to thin spirochætes which were undetected. The writers have often observed thick and thin organisms, but in examinations of over 5,000 blood smears, including some from natural cases, have failed to see any granulated red cells.

Montgomery (1908) and Balfour (1911) are of opinion that the disease increases in severity in passage from bird to bird. Fulleborn (1909) has conserved the Brazil strain of spirochætes for seven years in canaries, the virulence having been maintained throughout. Marchoux (1907) and Anderson (1928), however, found that on passage of *Sp. gallinarum* from fowl to fowl the organism loses its pathogenicity but that its virulence may be maintained by passage through an intermediary host. Blaizot (1909, 1910) found that in chickens five to twenty-one days old, inoculated with infected blood, the course of the disease is longer in the earlier passages than in the later ones, in which also no tangle formation was observed before death. He concludes by saying that the Somaliland and Brazil strains become attenuated by passage through adult birds but that passage through chickens enhances their virulence.

Contradictory statements, such as those quoted, suggest that the parasite may behave differently in different environments. It is obviously necessary, therefore, to study the farms concerned in efforts at control.

The geographical occurrence of spirochætosis in India is not definitely known. Preliminary reports from the Punjab and Central Provinces confirmed the occurrence of the disease in those parts, and in recent years it has been reported from other parts of India as well. In Mukteswar, *A. persicus*, the transmitter of the disease, abounds in fowl-pens where healthy birds intended for experimentation are kept.

Maintenance of the Strain

At first, the strain of spirochætes was maintained in fowls by direct passage, but, later, blood containing spirochætes was stored in a refrigerator with sodium citrate and passaged through fowls once in three weeks.

Leadingham (1935-36) reports that one drop of 2 per cent. sodium citrate added to a cover-slip preparation from a lesion of Vincent's angina caused immediate cessation of movement and eventual dissolution of the spirochætes. He even treated ulcers in a patient successfully with this drug. However, even with four parts of blood and one part 4 per cent. sodium citrate, the writers have not noticed any spirochæticidal action, at least, against *Sp. gallinarum*. Altogether, up to the present time, the strain has been through twenty-four passages in forty six fowls during

Table II

Specific Diseases

DISEASES	Horse	Ox	Sheep	Pig	Dog	Cat	Goat	Fox	Rabbit	Others
Tuberculosis	20	42	...	8	23	16	1	...	2	1
Glanders	9	...	...	...	...	...	...	...	...	...
Botryomycosis	13	...	...	...	...	...	...	...	...	...
Strangles	3	...	...	...	...	...	...	...	...	...
Tetanus	1	...	...	...	...	...	...	...	...	...
<i>C. septique</i> infection	1	...	...	...	...	...	...	...	...	...
Anthrax	...	3	...	...	...	...	...	1	...	...
Actinomycosis	...	6	...	...	...	...	...	...	...	...
Johne's disease	...	29	...	...	...	...	...	...	...	...
Blackquarter	...	5	...	...	...	...	...	...	...	...
Bacillary necrosis	...	5	1	...	...	...	...	...	...	...
Cowpox	...	1	...	...	...	...	...	...	...	...
Actinobacillosis	...	5	...	...	...	...	...	...	...	...
Contagious Abortion	...	628	...	...	...	...	...	...	...	...
Lamb dysentery	...	...	12	...	...	...	...	...	...	...
Congagious pustular dermatitis	...	...	3	...	...	...	...	...	...	...
Braxy	...	...	3	...	...	...	...	...	...	...
Louping Ill	...	...	1	...	...	...	...	...	...	...
Swine erysipelas	...	...	...	2	...	...	...	...	...	...
Swine fever	...	...	...	1	...	...	...	...	...	...
Canine distemper	...	...	...	...	5	...	...	...	...	...
Leptospiral jaundice	...	...	...	...	...	...	...	6	...	...
No. of Cases	47	724	20	11	28	16	1	7	2	1

Tuberculosis is not uncommon in the ox and it is not surprising that 42 cases of the disease should have come under examination during the period under review.

Of 100 diseased pigs coming under examination 8 were found to be affected with tuberculosis; but that must not be interpreted to mean that 8% of pigs in general are so affected; the figures do not justify any such conclusion.

In a review, which appeared in "Veterinary Excerpts", of the second edition of Gaiger & Davies⁸ well known work, the following sentence appeared:—"It is stated (p. 311) that tuberculosis in dogs is rarely encountered in ordinary post-mortem examinations. Owing to the lack of statistics the incidence of this disease in dogs is probably not sufficiently appreciated. Among town dogs which die from or are destroyed on account of incurable

disease, a 5% incidence of tuberculosis is, in the opinion of the reviewer, a conservative estimate".

Our figures afford some definite information on the subject and show that over a period of twenty-five years 894 dogs were found to be diseased; of these 2.5% were found to be tuberculous. During the same period 185 cats were found to be diseased of these 8.6% were affected with tuberculosis. We must not conclude from this that tuberculosis is commoner in cats than it is in dogs; allowance must be made for the difference in the total number of dogs and cats respectively examined; also, the number is too small to be applied to dogs and cats generally; but the figures are a contribution towards wider observations and records, upon which statistics may be based.

Every case of pleurisy, or of ascites in the dog, or of enlarged mesenteric glands in the dog or cat, or of chronic ulceration of the skin of the cat should be suspected of a tubercular origin and an appropriate examination made to confirm or refute the suspicion; not every case will prove to be tubercular but experience shows the warning to be justified, so far as Great Britain is concerned.

The cat is usually affected by the bovine type of tubercle bacillus; the extent to which cow's milk entered into the dietary of the cat, before the present war, may be considered in relation to the incidence of tuberculosis in this animal.

The cases of Glanders occurred in connection with army horses during the last World War. The other tabulated diseases of the horse, with the exception of Botryomycosis, are recognised readily by the practitioner, hence the relatively large number of cases of "shoulder tumour" or "scirrhus cord" which are submitted for the confirmation of a clinical diagnosis by a microscopical examination.

The increased interest which has been taken in specific paratuberculous enteritis of cattle (Johne's disease) of recent years, accounts for its prominence in our list among the specific diseases of the ox. With regard to Contagious Abortion, the cases include, not only samples of blood positive to the agglutination test, but also post-mortem material such as membranes, foetuses, etc.

For an account of the outbreak of leptospiral jaundice in Silver Foxes see Macrae⁹.

sixteen months; of the forty-six fowls, thirty-four recovered without treatment and only six died. This suggested that the strain had undergone attenuation but it was uncertain whether such attenuation was due to refrigeration or to bird passage. After thirteen passages the strain was tested on a number of healthy birds and, although they were affected, they did not succumb. At this stage the strain was again passaged direct from fowl to fowl. After five direct passages the birds began to show acute symptoms and many of them died of the disease. It therefore appears that refrigeration was the attenuating factor and that subsequent direct passage again exalted it.

By refrigeration for about two weeks the parasites are sufficiently attenuated to be used as a vaccine under certain conditions, although recovery of all vaccinated birds cannot be guaranteed. Under refrigeration, the parasites remained alive for at least twenty days, often for fifty to seventy days, and in one instance up to ninety-seven days. In all cases, where moving organisms could be found, the sample proved to be infective. Blood samples, in which the parasites were motionless, were found to give some immunity, although the samples were not infective.

Course of the Disease

Infection.—It has already been established that the disease is transmitted from fowl to fowl by *A. persicus* in all its stages. The mechanism of transmission had been fully dealt with by Knowles *et al.* (1932). The writers, however, found that adult ticks do not transmit the disease as readily as larvae. Dodd (1910) failed to produce the disease with adult ticks but with nymphs and larvæ infection was always transmitted. Gilruth (1910) recorded a case where only the larval forms produced the disease. Bevan (1908) kept about thirty birds in a stand which had been left unoccupied for six months. On the second day all the birds were smothered with larval ticks and on the next day all showed symptoms of the disease. Williamson (1908) observed that in Cyprus the disease is common in summer and absent in winter, while it is more common in runs where the conditions are suitable for the hatching of tick eggs. Similar observations have been recorded at Mukteswar. Birds kept in a tick-infected run develop the disease during summer but seldom in winter; on examination only larval ticks are found on the birds. This suggests that it is the larvae of *A. persicus* which are the real vectors.

In the absence of the vector, infection can also take place by cohabitation of healthy birds with sick ones. Two healthy birds were kept with a sick one in a tick-free cage and both developed the disease.

Incubation period.—From the time of inoculation of virulent blood to the rise of temperature and the appearance of the spirochaetes in the circulation the incubation period varied from one to five days, averaging

TEMPERATURE CHARTS

NATURAL ATTACK BY TICK INFECTION

DAYS	109°	108°	107°	106°	105°	Symptoms & Treatment	Smear Examination
1							Negative
2							"
3						Dull & sitting in a corner	Eosinophilia
4						" " thirsty	Spirochaetes +
5						Characteristic posture	" ++
6						Sleepy	" +++ Monocytosis
7						Off feed	Tangle formation
8						Moribund stage	Negative
9						Died	

EXPERIMENTAL CASE - ROUTINE PASSAGE

DAYS	109°	108°	107°	106°	105°	Symptoms & Treatment	Smear Examination
1						Dull	Negative
2						"	" Eosinophilia
3						"	Spirochaetes +
4						"	" ++
5						"	Numerous
6						" Recovered	Negative

EXPERIMENTAL CASE SULFARSENOL TREATED

DAYS	109°	108°	107°	106°	105°	Symptoms & Treatment	Smear Examination
1							Negative
2						Dull	"
3						" Sulfarsenol 1 1/2 cc	Spirochaetes +
4						Recovered	Negative Lymphocytosis
5							

Table III

General Diseases

DISEASES	Horse	Ox	Sheep	Pig	Dog	Cat	Goat	Fox	Rabbit	Others
Pyæmia	1	1	...	...	2	1	...	1	...	...
Chloroform Poisoning	1	...	...	...	...	...	...	...	...	...
Inanition	1	...	3	1	2	...	...	...	...	...
Shock	1	...	2	...	...	...	...	...	...	...
Arsenic Poisoning	...	1	...	...	...	...	...	...	...	...
Toxaemia	...	1	...	1	...	...	...	...	...	...
Septicaemia	...	3	1	...	5	5	...	...	...	...
Pyobacillosis	...	...	4	...	...	...	...	...	...	...
Photosensitization	...	...	4	...	...	...	...	...	...	...
Heat Stroke	...	...	...	...	1	...	...	...	...	...
"Feline Distemper"	...	...	...	...	...	1	...	...	...	...
No. of Cases	4	6	14	2	10	7	...	1	...	...

Cases of pyogenic infection in sheep are common at the abattoir very few are sent to the laboratory for diagnosis.

Photosensitization is a new name for an old disease; the older names, "Yellowes" or "Yellowses" referred to the yellow colouration of the body tissues which is sometimes present; the new name gives a hint as to the etiology as now understood and refers to the effect of strong sunlight upon sheep which have been sensitized by the ingestion of fluorescent substances, the precise origin of which is not yet elucidated. (Russell Greig ¹⁰) (N.V.M.A. Report ¹¹).

The tormentil (*Potentilla tormentilla*) occurs in some pastures where "Yellows" is prevalent among the sheep; Armatage ¹² mentions the tormentil as deleterious to sheep, but he associates it with another disease, that known as Pining, Pine or Vinquish, now associated with a cobalt deficiency (except Solway Pine where a deficiency of Magnesium and Potassium may be responsible). (Russell Greig loc. cit. p. 12 et seq.) (N.V.M.A. Report p. 78 et. seq.)

The Bog Asphodel (*Narthecium ossifragum*) is also met with in pastures where "Yellows" occurs among the sheep; this plant has the reputation of rendering the bones of sheep feeding upon it very brittle and so liable to fracture as indeed its second botanical name "ossifragum" indicates.

Table IV

Parasitic Diseases

DISEASES	Horse	Ox	Sheep	Pig	Dog	Cat	Goat	Fox	Rabbit	Others
Mange	22	...	6	...	12	...	...	...	5	2
Worms	26	11	13	...	6	4	...	20	5	1
Ringworm	2	1	...	...	2	...	...	...	...	...
Favus	...	...	...	...	...	1	...	...	...	3
Sporotrichosis	1	...	...	...	...	...	...	...	...	...
Echinococcus	1	2	...	...	...	...	...	...	...	...
Linguatula infestation	...	1	...	...	...	...	...	...	...	...
Distomiasis	...	1	...	...	...	...	1	...	...	...
Coccidiosis	...	...	3	...	...	...	3	...	21	1
Sarcocytis infestation	...	...	2	1	...	...	...	...	...	...
Lice infestation	...	...	...	...	1	...	...	...	...	...
Trypanosome infestation	...	...	...	...	...	...	...	...	...	2
No. of Cases	52	16	24	1	21	5	4	20	31	9

With regard to the parasitic diseases, it is significant of the changes which have taken place since the first World War that, whereas at that time we had many horses to examine for mange, of which twenty-two gave positive results, during this war we have not had any. Five rabbits were received showing severe lesions due to *Sarcoptes* about the head and face. One cat and three mice were affected with *Favus* and showed the typical thick yellow scutula on the skin, especially about the lips, nose and face.

The case of sporotrichosis is of interest; it occurred in an army horse during the first World War. The animal was suspected of Epizootic lymphangitis but examination failed to reveal the *Cryptococcus farciminosus*, but did reveal certain oval refractile bodies which led the writer to suspect the rare condition of sporotrichosis and the suspicion was confirmed by cultural examination. The relatively large number of cases of worms in horses is due to the prevalence in these animals of the palisade or red worms, comprised in the general *Strongylus*, *Triodontophorus*, etc.

Infestation of the ox by *Linguatula serrata* is comparatively rare, but a wet film examination should be made for this parasite when examination of lesions in the lymph glands fails to reveal more common organisms such as *Mycobacterium tuberculosis*, *Actinobacillus lignieresii*, *Corynebacterium pyogenes*, etc. Dick related an interesting case of infestation of a dog by this parasite; one winter morning an apparently

healthy dog had been out, and returning home he became distressed and died suddenly. Post-mortem examination revealed nothing more than the presence of "three linguatules lodged—one in the larynx, another in the trachea and a third in the left bronchus". Death was attributed to asphyxia associated with the presence of the parasites. (Neumann 13).

As pointed out elsewhere (Matheson 14) an examination for coccidiosis should form part of a post-mortem examination, when the cause of death is not otherwise revealed.

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LIVESTOCK IMPROVEMENT AND THE GOVERNMENT OF INDIA PLAN

BY

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"On improvement in cattle depends to a degree that is little understood the prosperity of Agriculture and the task must be faced."

Royal Commission on Agriculture, in India, Page 191.

'Post-War Reconstruction' is the cry everywhere. Industrialisation of the country, reorientation of Agricultural Practices, "Grow More Food" and such other subjects are getting common in the every day Press. Gigantic plans involving hundreds of crores of Rupees, which were unheard of and

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unthinkable in the pre-war days, are being put forward, discussed and criticised by many prominent men, official and non-official. The Government of India through a special committee convened under the Indian Economical Agricultural Research is bestowing its earnest attention on one such plan what is come to be known as "the Rs. 1,000/- crore plan for agricultural development". And so, Agricolgy and allied subjects are to have a new lease of life. As a humble worker in the field I wish to record my impressions on these subjects, and to put forward a few suggestions.

The sentence quoted on top from the Royal Agricultural Commission's Report should be an incentive to us Veterinarians as livestock workers—to be alert and not to lag behind the rapidly changing times. Important and far reaching schemes are being evolved and are to be put into practice and these are certainly bound to change the whole outlook on, and approach to Rural Economic Problems. We must have our say on the things to be, in view of our intimate contact with Rural Practices—especially the question of "Animal Economics". I have deliberately coined a new word, "Animal Economics" (and this is peculiar to Rural India) and dare say that a mass of evidence can be adduced to show that the subject deserves, not only a separate name, but even a separate 'Chair' in every Veterinary College in our country. Recently some high placed people have been pleading for treating "Agricultural Economics" as an important part of all the University Curricula. "Animal Economics" is no less important a subject, and due attention must be paid to it, if any success is to be attained in solving the Ryot's problem i. e., the improvement of his condition. No scheme of Agricultural Development would be complete if it either ignores or minimises the importance of this subject. As quoted above "the task must be faced".

The Government of India Plan :—

The points of this plan relevent to this discussion.

- (1) Increased production of Crops (Cereals, oils, etc.,) and milk.
- (2) Bringing more land under cultivation.
- (3) Increased supply of Manure (Green, animal and artificial).
- (4) Improvement and extension of major or minor Irrigation works.
- (5) Better and a more profitable marketing of village produce.

It would be obvious to every student of rural life that the above propositions give rise automatically to the following (as corollaries).

1. Greater and more efficient bullock power is necessary to bring more land under cultivation.

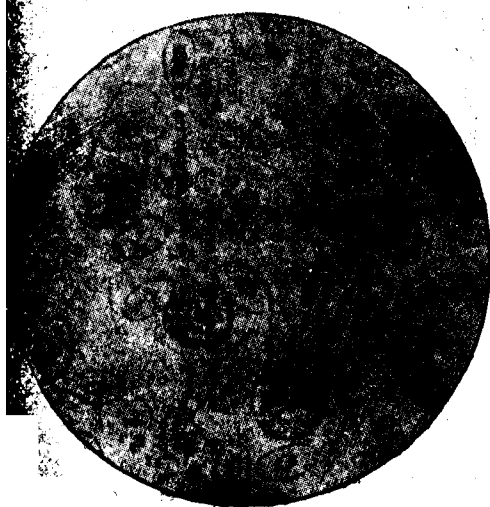


FIG. 1



FIG. 2

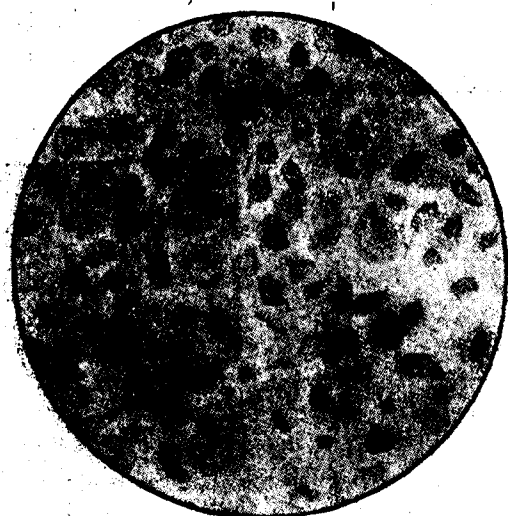


FIG. 3

FIG. 1—Stained blood smear from a bird suffering from spirochaetosis. Note the pseudoeosinophiles in different stages with granules and also the monocytes.

FIG. 2—Tangle formation at crisis.

FIG. 3—Section of spleen showing spirochaetes at the height of infection (Levaditis method).

one to two days. In the case of natural infection the period of incubation was three to eight days. Knowles *et al.* (1932) have pointed out that the incubation period depends upon the quantity of infective material used and the route of infection, the intramuscular route being the most rapid and certain method after the intravenous one. For purposes of comparison, the writers injected 0.2 c.c. passage blood diluted with an equal amount of citrate solution into four groups of five birds as follows: (a) intravenously, (b) subcutaneously, (c) intramuscularly and (d) by smearing on scarifications on the comb. Though the temperature reaction was observed to occur a little earlier in groups (a) and (b), the spirochaetes appeared in the circulating blood almost simultaneously in the first three and only a day or two later in the fourth batch. Altogether about 2,000 birds have been infected during the course of this work both by intramuscular and subcutaneous routes and no difference in the incubation period has been noted, always, of course, provided the material and quantity used is uniform.

Symptoms.—Although it is not possible to make a sure diagnosis without the aid of a microscope, certain symptoms may raise a suspicion of spirochaetosis.

In 500 healthy birds the normal temperature was found to vary from 106 deg. Fahr. to 107.5 deg. Fahr. The disease starts with a rise to 108 deg. Fahr. then to 110 deg. Fahr. or beyond; At the first rise of temperature blood smears may fail to show parasites, but they appear within the next twelve to twenty-four hours. When parasites are numerous the temperature may fall and finally become subnormal before death. Kapur (1940) stated that in fowls infected from ticks there was no appreciable rise of temperature synchronising with the appearance of spirochaetes in blood. Out of sixteen fowls observed, only five showed a rise of temperature. However, in the present observations on more than 2,000 birds, infected either artificially or naturally, very few positive cases failed to show an appreciable rise of temperature at the onset. The temperature charts representing both experimental and natural disease, are those of some typical cases. (Table I).

With the rise of temperature some birds show slight dullness, while others remain active. When parasites appear in the blood the birds become dull and assume a posture which, although somewhat characteristic, is not diagnostic, viz., with the head buried under the feathers of the back. (Plate VIII Fig. 1.) Rise of temperature as a rule is followed by intense thirst. As the disease progresses, profuse diarrhoea, ruffling of the feathers, loss of appetite, a crouching position, dullness, disinclination to move and rapid emaciation are noticed. In the last stage the head drops down and the eyes are closed. (Plate VIII Fig. 2.) In the terminal stage the symptoms are again identical with those of other acute diseases of poultry.

2. The importance of Animal Manure in Agriculture (dung, bone meal etc.) is not merely negligible but of greater importance.

3. The Bullock would continue to bear a good share of the power required for irrigation in areas depending on well irrigation.

4. The Bullock cart plays a very essential part in the transport of the Agricultural produce to the outside world.

Here, it is important to point out that all people, allot a secondary place to Animal Husbandry when Agricultural Questions are discussed and they would appear to believe that the former is only a handmaid of Agriculture. Be that as it may, Animal Husbandry has an importance equivalent to, if not more than that of, Agriculture. To quote just an example, "India's Milk and Milk products may be valued at about 300 crores of Rupees. This is roughly equivalent to the value of India's total output of rice and is three to four times the value of the output of wheat. India's output of Hides and Skins is valued at roughly 40 crores of Rupees or more than the value of the total Indian production of Sugar" (Report on the Development of the Cattle and Dairy Industries of India—N. C. Wright). So one may not be considered rash, when it is said that the possibilities of organizing the Livestock Industries (Milk and Milk products, Meat, Skin, Bone and other such) is almost unlimited—or in other words a proper understanding of "Animal Economics" and a planned and enthusiastic application of the same in practice is bound to increase our national income manyfold.

Bullock Versus Tractor :—There is much talk in the air about consolidation of fragmented holdings and running them on co-operative basis with tractors etc., and increasing the number of mechanised farms in the country. But one cannot but escape the conclusion, that India with its 70 lakhs of village with the average individual holding seldom more than 4 or 5 acres, the chances of the wholesale replacement of the bullock drawn plough by the tractor looks rather remote. Bullock-power has come to stay in our country and never can completely be ousted by the machine, atleast for many a year to come. And the "Animal Economist" (Call him Livestock Expert if you will) must have his say in every formulation of future policy for the development of Agriculture.

The Government of India plan envisages livestock improvement under three heads—Breeding, Feeding and Disease Control. I shall also examine them in the same order.

Breeding :—Before proceeding to discuss future plans let us have a cursory study of what has been done so far in this direction.

At the outset attempts were made to improve the milk-yield of the local cows through the use of Pedigree European Bulls. But this is not

in vogue now. As Dr. N. C. Wright says "the general adoption of a policy of cross-breeding to improve the milk yield of country stock would be fatal to the development of sound dairying in India" (Development of Cattle or Dairy Industries). Hence, this was given up as a general policy; but cross-breeding is being persisted in for purposes of Dairy-Farming in some urban areas.

These earlier attempts were followed by a policy of selective breeding and grading with the use of high class indigenous Bulls. For this purpose the breed tracts in the (Madras) Presidency, have been demarcated and stud-bulls of the breed best suited to the area are being used to improve the local cattle. The 3 chief breeding tracts in the Presidency are the Ongole, the Hallikar and the Kangayam. Intensive breeding operations are being carried out in these areas. To begin with bulls from the various Government stud farms were issued for service. Of late, in addition to these, bulls from certain established breeders in the respective tracts, which come up to the breed standards have also been included in the different Livestock Improvement Schemes, viz., 'Premium', Government of India Grant Scheme, Livestock Improvement Extension Scheme and others.

The aim in all these activities, is one of 'grading' the village cattle with a view to improving their work and milk capacities. It is too early to expect to find any marked improvement in the quantity of the indigenous cattle of the areas where these schemes have been working. But these schemes have certainly had the effect of creating enthusiasm in the minds of the ryots to rise up from their lethargic attitude towards Animal Husbandry.

The following are the chief difficulties met with in the field where the schemes are actually being worked.

1. **The apathy of the Ryot to Animal Husbandry** :—It is not easy always to secure a villager who wants enthusiastically to take up work under any of the schemes and thus help to bring about improvement of his cattle and those of others. The one important reason for this apathy is the ryot's love of "quick returns". "Like the poor in all countries he is lacking in foresight and prudence, and he prizes a rupee in the hand more than two or for that matter ten, at some future time" (R. C. A. R.—Page 192). It is impossible to expect every ryot to bring up his own pair of working bullocks from among his calves. He has neither the foresight nor the patience to do it. For him, bullocks are only available in shandies and the idea of himself producing them out of his cows is very fantastic. This is a slow and painful process and he is not for it. Give him the commercial crops (Groundnut, cotton, tobacco etc.) to get quick money,

Mortality.—In natural outbreaks this is high. In one outbreak among twenty-five chickens in a tick-infested cage twenty-one deaths occurred, from acute spirochætosis. Owing to the intensity of the infection, the onset was rapid and treatment could not be applied in time. Mortality varies with age, breed, condition and certain other causes. Birds of improved breeds such as the Rhode Island Reds and White Leghorns show acute symptoms and, even when in good condition and above one year old, seldom recover, even from experimental inoculation, unless treatment is commenced as soon as the parasites are noticed in the circulating blood.

Of the predisposing causes the most important one observed so far is visceral gout, a condition mostly seen in the Rhode Island Reds. It is said that visceral gout is caused by ill-balanced rations or the feeding of excessive proteins. Whatever may be the cause of death, more than 60 per cent. of the adult birds that died as a result of the present experiments showed extensive visceral gout with whitish deposits on the heart, liver, kidneys and spleen. The mortality is least in birds between six and twelve months of age, and such birds usually recover easily with chemotherapy.

After phase.—Of the 2,000 birds dealt with in the present enquiry, 98 per cent. were uncomplicated cases. Among the few complications met with, by far the most important was paralysis of the wings or legs, or both. The paralysis may have been caused through capillary embolism by clumped organisms, since with the disappearance of the clumps, symptoms passed off in most cases. The only treatment required was massage of the part with a stimulating liniment.

Blood picture.—In smears stained by Leishman or Giemsa methods the number of spirals in the parasites varies from five to eighteen. Single isolated organisms which are seen earlier are generally longer than those met with later. Together with the parasites there are seen under dark ground illumination small actively moving cocoid bodies which are absent in healthy blood preparations. Whether they are stages in the development of the spirochætetes or the so-called "Balfour's granules" is uncertain. As soon as one or two organisms per field are seen, treatment should be commenced. On the fifth or sixth day, the parasites have multiplied to such an extent that they are more numerous than the corpuscles. This is followed by tangle formation which marks the crisis of the disease. Two or three tangled masses may be seen in each field and each mass may be formed of hundreds or even thousands of parasites. (Plate IX Fig. 2) After the crisis the bird either recovers or dies. In the former case the parasites disappear from the blood.

Apart from the anaemia caused by the disease, the most important haematological change is leucocytosis. In the healthy fowl the mean white

cell count is 30,000 to 45,000 (Launoy and Levy Bruhl, 1914). Soon after infection there is a sudden wave of leucocytosis, chiefly of polynuclear type (pseudo-eosinophiles of Launoy and Levy Bruhl). The appearance of these cells indicates infection, though this is not entirely diagnostic.

The granules of the eosinophiles, seen at first as pink bodies, increase in size and finally appear as gram-negative, rod-shaped bodies before they are set free in the blood stream. (Plate IX Fig. 1.) This stage is followed by a decrease in the number of eosinophiles and an increase in the mononuclear cells. In certain monocytes, groups of pink, round granules are seen in the cytoplasm. These also disappear after a day or two leaving behind groups of vacuoles. Similar pink granules have also been observed sometimes in blood smears. These are extra-cellular and are embedded in an irregular cytoplasmic mass. In a recovering bird, in the place of monocytes, small lymphocytes appear in large numbers.

Morbid Anatomy

Lesions are almost entirely restricted to the liver and spleen. The spleen may be enlarged to about six times the normal. (Plate VIII Fig. 3.) The liver is pale, shows evenly spaced, yellowish, necrotic areas and in severe cases is more friable than usual. There is also biliary stasis. The heart muscle is congested and petechiated. If death takes place in the after-phase, splenic enlargement is not constant. The same is true of cases treated with an effective drug. In any case, whether treated or not, parasites disappear from the blood after death. Smears taken from the spleen, liver and heart blood about three hours after death failed to reveal spirochætetes, though sections prepared from the spleen, liver and brain from a bird destroyed at the height of the infection revealed these parasites. (Plate IX Fig. 3.)

Summary

A strain of spirochætetes was maintained by three-weekly passage of blood, stored in the intervals in a refrigerator. Spirochætetes stored in refrigerated blood may remain alive up to seventy days or more. The organisms in refrigerated blood are attenuated but become exalted on subsequent direct passage through fowls.

In respect of transmission of the disease, the larval form of *A. persicus* is more infective than the adults. Infection is also possible by cohabitation.

The period of incubation is dependant upon the concentration of the infective material rather than upon the route of inoculation. There is invariably a rise of temperature before the parasites appear in the blood.

and he is on safe grounds. But not so animal husbandry which to be profitable, should be spread over a number of years and requires capital and expenditure in advance, with profit to come later.

2. The majority of ryots (cattle-owners) have a habit of either selling away or exchanging their cows and bullocks at least once a year. This habit is a major obstacle to a correct recording of the progeny born to a particular bull.

3. That it is impossible to push through the process of "Grading" to the desired end (viz., better livestock through the use of good bulls) in a sustained manner, is obvious from the above. A certain amount of pedigree blood is introduced at the first crossing, but it is difficult to continue the good work started due to frequent change of animals from one village to another.

The following quotations are relevant here—"No substantial results can be expected from the policy of distributing selected bulls to District Boards generally, which has been suggested in Madras. Such bulls should be used to raise the quality of stock in selected areas and improved cattle of those areas should be placed at the disposal of District Boards, Co-operative Societies and other suitable agencies" (R. C. A. R.—P. 253) "Comparatively slow progress is being made in the distribution of pedigree and approved bulls; the number of bulls at present at stud represents only one per cent of India's requirements. There is little doubt that material progress will only be achieved by increasing the number of approved and registered stock raised in villages and by private breeders" (Development of cattle and Dairy Industries in India N. C. Wright).

Suggestions for a comprehensive future plan for the Improvement of Livestock.

1. *Breeding*:—Up to the present, all livestock improvement work has been centred on improving the work and milk-yielding capacities of the indigenous cattle with special emphasis on the latter in urban areas. But a new vista opens up when one considers the actual state of affairs. "India is attempting to maintain an excessive number of cattle" (R. C. A. R.—P. 191). This view point is shared by almost all people who have devoted any attention to the matter, Livestock workers, Economists and others. "Owing to adverse climatic and economic conditions the productive value of the cattle industry is not commensurate.....with its size" (N. C. Wright "Development of cattle and Dairy Industries of India") "Half the cattle in India are more a drag on the country's resources than an aid to the exploitation thereof—(Nanavati and Anjaria—"The Indian Rural Problem"—Pages 39).

In this connection I cannot help pointing out that nobody appears to have given any thought whatever so far to the possibility of developing a Meat Industry in our country; and the question of Livestock Improvement has never been viewed at from the angle of "Meat Production" (beef and mutton). All attention has so far been paid to work and milk, and this aspect of the problem has not so far been tackled to the extent that it deserves to be. Now is the time to consider whether ways and means cannot be found to make use of the "excess" stock of India's cattle to build up a Meat Industry on proper lines. Of late a big hue and cry has been going around the country about the alarming rate at which India's cattle population is decreasing due to large slaughter. This obviously sounds illogical since it is conceded that we have a super abundance of 'Excess' cattle. It may be pointed out that the animals that are slaughtered are the valuable ones, i.e., animals that are being taken away from the ryot's ploughs, carts etc., and not the scrub ones. To counter such ill-effects, laws have been made by the Governments of various provinces and states prohibiting slaughter of useful cattle. To those who had been advocating the slaughter of "excess" cattle, the present is a good opportunity. Hence, with a little planning and co-ordination, two birds can be hit with one stone—the surplus scrub cattle can be decreased easing the fodder situation, and a good meat Industry set going with prospects of all success.

And as a result, and after a time the position will be, an optimum number of efficient cattle required for agricultural and food purposes and an adequate distribution of the available fodder.

Before fixing up the type (or types) of animals to be aimed at in any future plan, the following facts should be borne in mind:

Mortality in natural outbreaks was 60 per cent. or even more. Rhode Island Red fowls were found to be more susceptible, the death-rate among this breed being also very high. The most common predisposing causes of mortality among adult birds are visceral gout, high breeding and obesity.

In some recovered birds, paralysis of the wings and legs was observed.

Enlargement of the spleen is a common post-mortem feature.

SPIROCHÆTOSIS OF FOWLS IN INDIA—II*

By

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and

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Methods of Immunisation, Treatment and Immunity.

The prevention of spirochætosis consists in taking measures to eliminate ticks, a policy which can be adopted on organised poultry farms owned by educated and well-to-do keepers. In India such farms are few and almost the whole poultry industry, if it can be so termed, is in the hands of villagers. Attempts to give advice on poultry-keeping and hygiene to such persons are usually fruitless. Obviously, therefore, in India it is more suitable to adopt such measures as immunisation and treatment of birds. Investigators in different parts of the world have attacked these problems in different ways and a number of such methods have been reported, though some are supported by few experimental data. The only agreed fact is that after an attack birds are strongly immune. As regards the duration of such immunity, again there is difference of opinion. The only work on methods of immunisation and their possible application in the field and on duration of immunity so far carried out on an adequate scale is that of Kliger, Hermoni and Perek (1938) in Palestine.

Gabritschewsky (1938) was the first to make serological studies on the disease. He prepared a prophylactic serum from a horse by immunising it with massive doses of goose serum containing spirochætetes. He claims that in geese the period of passive immunity, following a dose of not less than 2 c.c. of this serum, ranged from twenty to thirty days.

Marchoux and Salimbeqi (1903) prepared a vaccine with fresh fowl serum and virulent blood. After forty-eight hours' exposure to the serum the spirochætetes were dead and the serum-blood, when injected into a fowl forty-eight hours before artificial infection, prevented the disease. They also found that serum from a recovered fowl prevents infection when given twenty-four hours before an injection of virulent blood.

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Levaditi (1904) found that 2 to 4 c.c. inactivated convalescent serum, injected into a fowl on the third, fourth or fifth day of the disease, causes severe symptoms and death, due to capillary embolism following agglutination of spirochætetes, and agglomeration of leucocytes. On a healthy bird, the serum had no such effect. The occurrence of this phenomenon has been corroborated by Neufeld and Prowazek (1907) who further report that the disease is prevented by injecting 0.0025 c.c. of immune serum into a fowl twenty-four to forty-eight hours before infection. Virulent blood containing spirochætetes killed by the addition of sodium taurocholate is said to be useful as a vaccine.

Dschunkowsky and Luhs (1909) obtained a curative and preventive vaccine from the serum of recovered geese and claim that injection of 0.01 gm. of this serum protected against the disease and 5 gm. proved curative.

Aragao (1911) prepared a vaccine by formalinising infected fowl's blood. The vaccine is said to retain its efficacy for thirteen months and 1 c.c. of it given subcutaneously confers immunity. He also prepared a serum from goats, which was said to protect a bird against the disease when injected half an hour before infection in dose of 0.5 c.c., in dose of 1 c.c. simultaneously or when 10 c.c. was given twenty-four hours after infection.

Aoki (1914) found that the antigenic properties of the spirochætetes were not injured by (a) drying at 50 deg. cent. for twenty-four hours, (b) through washing with saline, followed by refrigeration for a month, (c) treatment with chloroform.

Hoffmann (1921) found that the blood of birds recovered from the disease is protective against infection for three to four weeks and that there is hereditary transmission of immunity in fowls.

Verge (1923) successfully immunised fowls with infected blood which had been kept for sixty days or heated at 55 deg. cent. for from five to ten minutes.

Morcos (1935) prepared a vaccine by emulsifying the liver and spleen of infected birds in glycerine saline, preserved in formalin and kept for ten days.

Knowles *et al.* (1932) recommended 2 c.c. of immune serum injected twenty-four hours before infection as a prophylactic against the disease. Their results are, however, based on work with only a small number of birds. They report that the birds acquire a strong immunity but fail to mention the duration thereof.

and he is on safe grounds. But not so animal husbandry which to be profitable, should be spread over a number of years and requires capital and expenditure in advance, with profit to come later.

2. The majority of ryots (cattle-owners) have a habit of either selling away or exchanging their cows and bullocks at least once a year. This habit is a major obstacle to a correct recording of the progeny born to a particular bull.

3. That it is impossible to push through the process of "Grading" to the desired end (viz., better livestock through the use of good bulls) in a sustained manner, is obvious from the above. A certain amount of pedigree blood is introduced at the first crossing, but it is difficult to continue the good work started due to frequent change of animals from one village to another.

The following quotations are relevant here—"No substantial results can be expected from the policy of distributing selected bulls to District Boards generally, which has been suggested in Madras. Such bulls should be used to raise the quality of stock in selected areas and improved cattle of those areas should be placed at the disposal of District Boards, Co-operative Societies and other suitable agencies" (R. C. A. R.—P. 253) "Comparatively slow progress is being made in the distribution of pedigree and approved bulls; the number of bulls at present at stud represents only one per cent of India's requirements. There is little doubt that material progress will only be achieved by increasing the number of approved and registered stock raised in villages and by private breeders" (Development of cattle and Dairy Industries in India N. C. Wright).

Suggestions for a comprehensive future plan for the Improvement of Livestock.

1. *Breeding*:—Up to the present, all livestock improvement work has been centred on improving the work and milk-yielding capacities of the indigenous cattle with special emphasis on the latter in urban areas. But a new vista opens up when one considers the actual state of affairs. "India is attempting to maintain an excessive number of cattle" (R. C. A. R.—P. 191). This view point is shared by almost all people who have devoted any attention to the matter, Livestock workers, Economists and others. "Owing to adverse climatic and economic conditions the productive value of the cattle industry is not commensurate.....with its size" (N. C. Wright "Development of cattle and Dairy Industries of India") Half the cattle in India are more a drag on the country's resources than an aid to the exploitation thereof—(Nanavati and Anjaria—"The Indian Rural Problem"—Pages 39).

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And as a result, and after a time the position will be, an optimum number of efficient cattle required for agricultural and food purposes and an adequate distribution of the available fodder.

Before fixing up the type (or types) of animals to be aimed at in any future plan, the following facts should be borne in mind:

(1) Every village (villager) possesses an excess number of cattle and the majority of these are unproductive (in respect of work, milk etc.) "The density of cattle per 100 acres sown area is as high as 67 in India as against 25 in Egypt, 15 in China and 6 in Japan. (Nanavati-P-18).

(2) For agriculture to be more profitable, the work capacity of our bullocks should be increased i.e., lesser number of more efficient animals and not vice-versa as at present existing.

(3) The average Indian cow is decidedly uneconomic as a milk producer. She produces 600 lbs. per year as against, 5,400 lbs. of the British Cattle. The per capita milk consumption in India is only 7 ozs. whereas a minimum of 20 ozs. per head daily is required for good health.

(4) Exploitation of our animal wealth has been haphazard and unorganised so far. Industries dealing with Milk, Meat, Hides and Skins, Wool, Bone and other animal-products, require to be planned and worked on a broad comprehensive way.

Although some success has attended the use of serum and vaccines, such methods are less frequently employed than chemotherapy, e.g., with atoxyl and soamin.

Uhlenhuth, Gross and Bickel (1907) used atoxyl in 5 cgm. doses on fowls against spirochætosis and found it efficacious. Levaditi and McIntosh (1907) made a close study of the therapeutic effect of atoxyl and found the action to be indirect by stimulation of phagocytosis and the bringing about of a "precocious crisis." For years, atoxyl had been the agent chiefly used as a spirochæticide. Recently, other arsenical preparations have been introduced for the purpose but no tests of the comparative value of such compounds have been carried out.

Dschunkowsky and Luhs (1909) used 0.3 to 0.5 gm. of atoxyl two hours before infection and obtained prophylactic effects. Doses of 0.3 to 0.4 gm. when injected at twenty-four-hour intervals from the third to fifth day of the disease, proved curative.

Dodd (1910), in Queensland, found soamin to be very efficient in the treatment of spirochætosis.

Leese (1912) treated successfully spirochætosis in Jhelum and Sohawa with soamin. One-eighth gr. was given to adult Indian fowls and 1/10 gr. for pullets and chicks. In many cases, however, a second dose was required.

Macfie and Johnston (1914), in Southern Nigeria, treated three natural cases of spirochætosis in fowls by injecting 3/50 gr. atoxyl. Two of the birds recovered with the first injection but the third died in spite of repeated injections. Two others were treated with 0.002 gm. of salvarsan and, although both recovered, one continued to show spirochætetes for three days. Yakimoff, Schokhor and Koselkine (1916), in Russian Turkestan, found atoxyl in doses of 0.06 to 1 gm. to adult fowls and 0.03 to 0.05 gm. to chickens gave excellent results.

Wirth and Langer (1937) experienced mortality of 50 per cent. after treatment with atoxyl, 0.05 gm. per kilogram live weight. All the dead birds showed visceral gout. Atoxyl is contraindicated in such cases, owing to the severe intoxication which follows.

At the beginning of this investigation the most popular method of immunisation was followed, i.e., injecting 0.25 c.c. of virulent blood and twenty-four hours later injecting 0.03 gm. of atoxyl per kilogram body-weight intramuscularly. This was not found to be very satisfactory owing, presumably, to the drug having been given too early.

The present experiments were conducted in order to establish a safe method of immunising fowls against spirochætosis and also to collect information on the spirochæticial action and dosage of various arsenical

preparations available in the market. During this enquiry more than 2,000 fowls, mostly Rhode Island Reds and White Leghorns, were used. Most of these were over six months of age.

The work may be considered under the following headings:—

(1) Methods of immunisation.

- (a) Refrigerated blood as vaccine.
- (b) Serum-simultaneous.
- (d) Immunisation by drug treatment of infected birds.

(2) Duration of immunity.

(1) *Methods of immunisation.* The following methods have been used:—

(a) *Refrigerated blood as vaccin.*—In order to find out how far attenuated blood is safe and effective as an immunising agent against the disease, 186 birds, in eight batches, were tested at different periods with blood which had been refrigerated for varying lengths of time, with and without resort to chemotherapy. The results are shown in Table I.

TABLE I

Immunisation with refrigerated virulent blood

Batch	No. of birds used	Period of refrigeration (days)	Nature of reaction	Mortality	Remarks
1	40	9	All reacted	7	All birds treated with atoxyl
2	31	21	" "	7	No atoxyl
3	30	25	" "	5	No atoxyl. Deaths in heavy adult birds
4	17	29 to 30	" "	5	Out of 22 infected, 17 left untreated with sulfarsenol, and the treated ones recovered.
5	40	41	" "	9	No drug treatment. Deaths in heavy adult birds
6	22	45	" "	Nil	No drug treatment
7	2	50	Both showed temperature, but only one positive	Nil	" " "
8	4	66	All reacted	Nil	" " "
Total	186			27	

The results from the use of refrigerated blood, except in the case of young birds, are not encouraging. The mortality, however, was mainly among the heavy birds, especially among the Rhode Island Reds. With blood refrigerated for forty five to sixty-six days, all birds recovered. It may be inferred, therefore, that the longer the refrigeration, the safer the blood becomes. When atoxyl or soamin is used in immunisation, even stored blood cannot be used, since these two drugs are toxic and weaken the system so that even attenuated virus may prove dangerous.

The local conditions prevailing in the different districts are so varied that no hard and fast rule can be made regarding, the 'type' of animal. As a working proposition the 'Dual purpose' animal may be taken as the type generally to be adopted. And our motto is to be "Fewer and better animals". The situation to be tackled successfully calls for an immediate short term programme and an elaborate long term one.

The Short term Programme :—This has got necessarily to be more practical than scientific, as the situation calls for urgent measures. Hence in the absence of elaborate scientific researches into the question, action has got to be taken now.

The aim should be to improve the local cattle wherever a distinctive breed is found (e. g.) Ongole, Hallikar, Kangayam. Action may be taken on the lines suggested below :—

(1) A clear demarcation of the different breed areas with reference to geography, climate, soil fertility, availability of grass, fodder and other concentrates and the presence of experienced breeders. The question of administrative convenience should also be considered.

(2) A thorough statistical survey of the above areas in respect of :—

(a) Cows, Calves, Bulls, Sheep and Goats etc., (Opening of stock Registers.)

(b) Grazing area available and prospects of increasing the same.

(c) Other fodders and concentrates—Ways and means of augmenting the same—Chances of introducing crop rotation.

(d) A census of all the reliable breeders in the areas and the prospects of their taking up earnest work.

(e) The past history of breeding activities in these areas in detail.

(3) A detailed survey into the breeds of cattle which are almost extinct now (Punganur) and others which are not so well-known Umbacheri, Gumsur etc.

(4) Establishment of a number of Government stud farms in the various breed areas actual field conditions for purposes of research, guidance to other breeders, supply of bulls etc.,

(5) Giving impetus to approved breeders; breeding societies, companies and other agencies to produce more cattle of the better varieties in the above areas, by means of grants, bonuses, rewards etc.,

(6) Setting up of suitable and well-organized, presidency wide agencies for distribution of work-bullocks and cows to the villagers.

(7) Provision of ample Veterinary aid in these areas with special reference to contagious diseases and elimination of scrub bulls.

(8) Side by side with these, schemes for the improvement of the urban milch cattle, sheep and goats, as also poultry should be taken in hand.

The long term Programme :—This being a permanent course of action has to be grounded on a purely scientific basis, and the following suggestions are made :—

(1) Intensive and extensive research into the qualities, scope of improvement etc., of all the breeds of cattle in the province and opening of stock books.

(2) Detailed research into the suitability of different fodder crops in the different localities, with special reference to nutritional factors, milk production capacity etc. Also research as to the best and most profitable means of increasing the present fodder and concentrate supply in the districts.

(3) Research and investigation as to the feasibility of introducing "Lay-farming", "Rotation of Crops", grass land cultivation over wide areas etc.

(4) Similar research with reference to sheep, goats and poultry.

(5) Organising all the above research studies under one co-ordinated plan, and setting up the different branches under suitable expert.

(6) Exploring ways and means to give impetus to the starting of Dairy, Meat, Wool, Bone and other such animal products industries throughout the presidency in suitable localities.

(To be continued).

CONTAGIOUS (?) KERATITIS IN GOATS

BY

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Introduction

The object of this article is to place on record an outbreak of Keratitis amongst goats which appears to be in all probability the first of its kind and whose etiology and mode of transmission are obscure.

* The author was working as Disease Investigation Officer, Bihar when these experiments were carried out.

Stored blood containing dead organisms.—Blood treated by reagents to kill spirochaetes was used as a vaccine by Aragao (1911) and by Marchoux and Salimbeni (1903). The writers also used refrigerated blood samples containing dead spirochaetes (Table II). It was shown that dead spirochaetes

TABLE II

Refrigerated blood containing dead spirochaetes as a vaccine

Birds tested (fowl)	Period of refrigeration (days)	Date of inoculation	Nature of reaction	Date and nature of retest	Nature of reaction
1 89 178	21	7/7/41	Temperature only	12/7/41 Virulent blood	Nil
2 458 455 453 804 810	22-25	22/6/42	Nil	27/6/42 Exposed to natural infection	Three (458, 455 & 453) developed infection
3 477 480 484 448	23	19/8/41	Nil	28/8/41 Virulent blood	No. 477 alone developed infection
4 524 475	60	1/11/41	Nil	16/11/41 Virulent blood	Both developed infection
5 808	95	22/6/42	Nil	27/6/41 Exposed to natural infection	Developed infection
6 441 472 457	100	20/10/41	Nil	28/10/41 Virulent blood	All developed severe infection

Out of the seventeen birds vaccinated none reacted to the vaccine, but ten developed infection on retest.

are harmless but it is doubtful whether these give any immunity. Blood samples in which the spirochaetes had been killed by the addition of oxalate also failed to produce immunity.

(a) *Serum simultaneous method.*—Kliger, et al. (1938), carried out extensive researches to evolve a practical method of immunisation. They used a killed vaccine (formalised), as well as immune serum plus live spirochaetes. They report favourably upon the serum vaccine, the resulting immunity lasting for six months. They used as a routine 0.5 c.c. immune serum followed shortly afterwards by an injection of 0.25 c.c. virulent blood. Injection of immune serum alone is said to give protection for about three weeks. One important point, i.e., the optimum time to bleed a bird for immune serum, is not mentioned.

In the present enquiries, four brews of serum were prepared and tested in doses of 0.5, 1 and 2 c.c. in sixty-six birds (both chickens and adults). Control birds were left untreated. Serum was used (a) simultaneously with virulent blood, (b) 2½ hours before, and (c) twenty-four hours before the injection of virulent blood. The serum was from fowls which had just

recovered from experimental infection and from fowls which had recovered between 2½ to ten months previously and which shortly before bleeding had been proved immune by an injection of virulent blood. The results are shown in Table III. From these it will be seen that immune serum failed as a prophylactic.

TABLE III
Details of Serum Test

Group	No. of birds	Serum	Dose	Time Interval	Source of virulent blood	Reaction	Result
1	12	Brew No. 3	0.5 c.c.	Simultaneous	Fresh chicken strain	Severe and one died. Control reacted mildly	Others saved by sulfarsenol at the last stage
2	12	"	"	"	Fresh adult strain	Severe. One control died	Birds saved by sulfarsenol
3	10	Brew No. 2	1 c.c.	2½ hours before	"	First six days no reaction, re-infected—severe reaction	ditto
4	10	Brew No. 1	5 c.c.	"	"	Severe late reaction. one died	ditto
5	10 chickens (4 months old)	"	"	"	"	Reacted earlier	ditto
6	14	Brew No. 4	2 c.c.; 2 birds, 1 c.c.; 2 birds, nil	10 birds, 24 hours before	Fresh natural infection	Eight of the serum birds reacted and one of them died (in 2 c.c. lot). Two controls died.	Birds not re-treated; eleven covered

In the first five batches serum neither prevented nor modified the disease; indeed, in certain cases, it aggravated the symptoms. This result was also observed by Levaditi (1904). In batch I the controls reacted mildly but the birds which received the serum reacted severely and had to be saved by administration of sulfarsenol.

(c) *Immunisation by drug treatment of infected birds.*—Four arsenical preparations, namely salvarsan, atoxyl, soamin and sulfarsenol were used and of these the last three were studied in detail. The drugs were injected intramuscularly on a live-weight basis or in a flat predetermined dose. In every immunised batch all the birds, or at least ten where the groups were large, were closely observed as to temperature and presence of spirochaetes in the blood. It was found that the second day after infection, is the safest and best time for chemotherapy.

(1) *Salvarsan.*—The drug was used by Balfour (1911) in fowl spirochaetosis and though effective, was found to be toxic. Dschunkowsky (1911) injected geese with 0.075 gm. salvarsan simultaneously with virulent blood

An outbreak of Contagious keratitis was reported from the Village Garhia, Police station, Forbesganj, District Purnea, North Bihar in January, 1941. Almost all the goats numbering about 100 in that village had been affected. The disease appeared peculiar to goats only as no other species of animals in that locality involved.

Symptoms and Lesions

The disease was characterised by the development of acute Keratitis with a tendency to ulceration. There was an active congestion of the conjunctiva accompanied with a copious muco-purulent discharge. The corneal opacity starting centrally, extended to the periphery thus resulting in temporary blindness. No constitutional disturbances were noticed in any case. In 90% of cases both eyes were involved while in the rest only one was affected. The course of the disease lasted for about a month and most of the cases were cured by ordinary antiseptic treatment. Permanent blindness resulted only in 4 or 5 cases. No mortality occurred amongst the affected goats.

At the suggestion of the Director, Veterinary Services, Bihar, four affected goats were purchased from that locality and brought to Patna for experimental purposes. They were examined in collaboration with Dr. Husnain, Eye Specialist attached to the Patna Medical College Hospital. The lesions were as described below :—

Goat No. 1, Right Eye :—There was a band-like opacity in the centre of the cornea slightly more dense at places (pannus-like appearance). Two or three blood vessels from the top and more from below extended to this area. No breach of corneal surface was seen. The everted lids looked granular (Trach?). There was no muco purulent discharge and hardly any inflammatory reaction. This appeared to be the last or second stage.

Left Eye :—Here the opacity was more localised and denser. A few blood vessels were seen passing to it. There was no muco-purulent discharge and hardly any inflammatory reaction. This appeared to be the 2nd or 3rd stage.

Goat No. 2, Right Eye :—Whitish ulcerated area on the cornea with slight infiltration in the cornea around. A red uniform area was seen immediately around the ulcer. Two blood vessels came from above. There was no ciliary injury, no conjunctivitis or muco-purulent discharge. The ulcer did not stain with fluorescein. There was not much inflammatory reaction. The duration of ulcer was not known. This was probably the 3rd or 4th stage of ulcer which presented 3 zones :—(1) Central with a slough (2) Vascular zone and (3) beyond it a zone of slight infiltration of cornea.

Left Eye :—Normal.

Goat No. 3, Right Eye :—The larger opacity was again a central dense area. There was a zone of slight infiltration and two or three blood vessels going to the area. No staining. Adjoining it, was a typical 'Betol's spot'. Cornea presented a foamy appearance, with no discharge or inflammatory reaction.

Left Eye :—Lesions as in the right eye but there was slightly more vascularisation.

Goat No. 4, Right Eye :—Diffuse, somewhat patchy opacity of the cornea. The Iris looked atrophied. There were white slightly raised patches. The eyeball was soft, almost like phthisis bulbi (advanced stage).

Left Eye :—There was a central moderately dense area surrounded by a zone of cloudiness of the cornea. A few blood vessels were going from the top and a very large number from below. The Iris was healthy. There was no staining in either eye. There was muco-purulent discharge in the inner canthus.

With the object of finding out the etiological factors and contagion of the disease, as well as its behaviour towards local treatment the following experiments were undertaken.

(a) Cultural

Scrapings from the corneal ulcer in goat No. 2 as well as swabs from the conjunctiva were cultured in different media and the following organisms were isolated by the Bihar Veterinary College Laboratory.

1. Dipolococcus.
2. Bacillus cereus.
3. Lactobacillus.

These were all of nonpathogenic type.

(b) Transmission

All goats for experimental work were young and healthy and were procured from the Goat Tissue Virus Section attached to the Bihar Veterinary College. Experiments were out on the lines of 1. Direct contact 2. Application of swab directly from the affected to the healthy eye, 3. Implanting of the scrapings from the corneal ulcer, 4. Application of a mixed culture on a healthy cornea and 5. Blood inoculation. Both morning and evening temperature were taken in all the affected and experimental goats and their eyes examined daily.

and thus prevented infection. He also found the drug to be curative. As only a small amount of the drug was available to the writers, it was only possible to experiment with thirty birds. Doses of 0.015 and 0.02 gm. were injected with promising results, all the birds recovering.

(2) *Atoxyl*.—For toxicity tests with this drug, eighteen healthy birds were divided into three equal lots. The first lot was given 0.03; the second, 0.04; and the third, 0.05 gm. per kg. live-weight for each bird. The birds did not show any rise of temperature but all evinced extreme inanition, went off their feed and remained gathered together in one corner in a stupefied condition. This was followed by greenish diarrhoea, exhaustion, a subnormal temperature and in some cases by death. The severity of the symptoms was not proportional to the size of the dose. Eight out of the eighteen died.

Altogether, sixteen batches containing 537 birds were immunised, using atoxyl in doses of 0.03, 0.04 and 0.05 gm. per kg. body-weight, the drug being given thirty-six to forty-eight hours after an infective dose of blood. Out of the sixteen batches of birds treated, only one batch (twenty birds) of about six months recovered without incident. The average mortality was 10 per cent. Mortality was highest in the group which received 0.05 gm. atoxyl and in this dose, in spite of being more toxic, was used in order to avoid having to give a second dose. Of the birds that died, more than 60 per cent were Rhode Island Reds and most of these also showed extensive visceral gout at autopsy. Mortality also occurred in Leghorns, Minorcas and cross-breeds, even among those receiving the 0.03 gm. dose.

Apart from the toxicity of atoxyl it also proved somewhat unreliable. In many cases the dosage, irrespective of the amount given, had to be repeated several times owing to persistence of the organisms.

Six healthy birds were used in a prophylactic test. All were given atoxyl at 0.05 gm. dose, three of them twenty-four hours before and three two hours before infection with the routine attenuated strain. Five birds developed the disease. Those of the first lot (twenty-four hours before) reacted severely and one died. In the second lot the reaction was much the same, two of the three showing symptoms. The experiment indicates that atoxyl in the dosage used depresses the body defences and exalts even an attenuated strain of spirochaetes.

(3) *Soamin*.—In toxicity tests with this drug, ten healthy fowls were divided into two lots, the birds in each lot being given $\frac{1}{2}$ gr. and $\frac{1}{4}$ gr. respectively. All ten became dull and declined food, while one of those which had received $\frac{1}{2}$ gr. died. This one showed gouty lesions at autopsy.

In all, 106 birds in four batches were immunised by similar method as used in the case of atoxyl. Dosing often had to be repeated before the

spirochaetes disappeared from the blood. The mortality was also very high, reaching about 11 per cent. Though the blood was negative twenty-four hours after treatment, some birds died, probably owing to toxic effect of the drug. In these cases the spleen was found to be enlarged.

Mortality was highest in the White Leghorns. There appears to be an individual idiosyncrasy or some special susceptibility associated with breed, age, condition, etc. Neither atoxyl nor soamin are, therefore, satisfactory for treatment or immunisation.

(4) *Sulfarsenol*.—Of the three arsenical compounds sulfarsenol is the least toxic. The drug was subjected to a toxicity test by injecting 0.03, 0.04 and 0.05 gm. into three batches of two birds each. The only effect noted was slight dullness lasting for five or ten minutes.

As yet, there is no information as to the action and safety of sulfarsenol in fowl spirochaetosis. The present experiments provide ample evidence of the importance of this arsenical in the control of the disease. The clinical condition quickly improves and no toxic effect is produced. The results suggest that a dose of 0.015 gm. per bird, irrespective of breed, weight or age, acts satisfactorily. A dose of 0.01 gm. sometimes proved insufficient. In all, 1,072 birds were immunised with sulfarsenol (Table IV). The procedure adopted was similar to that with the previous three drugs.

TABLE IV

Immunisation using sulfarsenol					
Batches	Number of birds in each batch	Infective material	Dose rate	Mortality	Remarks
1	71	Fresh blood, routine strain	0.01 gm.	0	
2	23	Blood, 18 days refrigerated	ditto	0	
3	108	Fresh virulent blood	ditto	5	Mortality in 5 birds may be due to insufficient dosage
4	21 (chickens)	ditto	ditto	0	
5	185	Fresh blood, routine strain	0.015 gm.	0	
6	117	Virulent blood, natural case	ditto	0	
7	40	Fresh blood, routine strain	ditto	0	
8	184 (fowls)	ditto	ditto	1	Condition of chicken which died was poor
9	10 (chickens)	ditto	ditto	0	
	91 (fowls)	ditto	ditto	0	
	7 (chickens)	ditto	ditto	0	
10	20	Virulent blood, natural case	ditto	0	
11	40	Virulent blood, routine strain	ditto	0	
12	55	ditto	0.02 gm.	0	
13	100	Virulent blood, natural case	ditto	4	The four dead birds were fat
Total	1,072			10	

Note.—223 received at the rate of 0.01 gm. each, 694 at 0.015 gm. and 155 at the rate of 0.02 gm. each. Percentage of mortality is less than 1 per cent. on the whole.

Experiments and observations

1. *Direct contact* :—Two healthy goats Nos. 228 & 229 were left in company with the four affected ones in one room for a period of one month. None of them showed any lesions and were taken away after a month.

2. *Swab application* :—Swabs from the right eye of goat No. 2 were applied to the right eye of two goats No. 231 & 233. No. 231 showed congested conjunctiva with a slight watery discharge on the 2nd day. Congestion disappeared on the 8th day. No further change was noticed and after keeping the animal under observation for sixteen days it was discontinued. Goat No. 233 showed slight ocular watery discharge on the following day and congestion of the conjunctiva on the 2nd day which subsided on the 5th day. On the 4th day the left eye which had never been touched developed corneal opacity foamy in appearance. The opacity increased on the 5th day and on the 6th day three spots of dense opacity situated on the inner, outer and the inferior aspect of the cornea were observed. On the 8th morning formation of a corneal ulcer was noticed and it was complete on the 10th day when treatment with Ung. hydrarg. oxide flavi 1% with Dionine 2% twice a day was started. No improvement was noticed for eight days and it was then decided to treat the eye with atropine and liquid paraffin. In twelve days time the ulcer completely healed and the opacity lessened to a great extent. By the end of the month the eye was quite normal and treatment of the animal was discontinued.

3. *Corneal scrapings* :—The scrapings from the corneal ulcer were obtained after cocainising and washing with normal saline the eye of goat No. 1 and planted on the right eye of two goats No. 226 & 230. No. 226 showed no change in the eye for 12 days and was discontinued. No. 230 showed congestion of conjunctiva and a slight discharge on the following day. On the 2nd day the eye looked normal and the animal was discharged on the 12th day.

4. *Culture application* :—Mixed culture of organisms cultivated from the eye of goat No. 2 in blood agar was painted on the surface of the left eye of two goats No. 230a and 226a. A slight watery discharge was observed in No. 230a on the following morning and it disappeared on the 3rd day. As the animal did not develop any other symptom for 11 days it was discontinued. 226a showed no change whatsoever for 12 days when it was discontinued.

5. *Blood inoculation* :—3 c. c. of whole blood from goat No. 4 was given subcutaneously to goat No. 231. The latter was kept under observation for 12 days without showing any symptoms and it was then discontinued.

(c) Deficiency Experiments

It has been observed that various affections of the eyes in animal are caused by Vitamin 'A' deficiency, the damage varying from inability to see in dim light to Keratitis, ulceration of the cornea and almost complete destruction of the eye ball. As the presence of 'Betol's' spot in the right eye of goat No. 3 was typical of avitaminosis 'A' it was decided to put goats No. 3 and 4 (affected lot) on Haliverol, each receiving four capsules a day, while goat No. 1 was kept as control.

Observations

Goat No. 3, Right Eye :—Ulcer formation was observed on the 3rd morning. On the 9th morning the Betol's spot disappeared while the opacity lessened. A complete ulcer was seen on the 13th with a thick discharge on the inner canthus. On the 16th day the ulcer was healing and was completely healed on the 21st day when a small central opacity with a leash of blood vessels from below was left. There was a thick purulent discharge. By the end of one month the eye looked quite normal.

Left Eye :—The opacity started decreasing on the 7th day and on 13th a faint opacity was left. After 7 weeks the eye recovered completely.

Goat No. 4, Left Eye :—Dried discharge on the inner canthus was seen on the 2nd day and on the 7th day the zone of cloudiness disappeared. On the 9th day the central opacity started getting faint and on the 21st day the eye cleared away completely.

Right Eye :—With the exception of a little lessening of the opacity no change was noticed for about seven weeks when the animal was discontinued.

Goat No. 1 (Control) Right Eye :—A little discharge with a slight congestion of conjunctiva was noticed on the 2nd day. The discharge was thick from the 4th to the 7th day. On the 10th day the opacity lessened to some degree and on the 16th morning a very faint opacity was left. On the 21st day the eye looked quite normal.

Left Eye :—A slight congestion of conjunctiva was noticed on the 2nd day and on the 7th the opacity was clearing away. On the 13th morning the eye looked quite normal. It will be seen from the above that the eyes of control cleared much quicker than those receiving doses of Haliverol.

(d) Treatment

Goat No. 2, (affected lot) :—Was given local treatment consisting of Atropine sulphate lotion 1 per cent followed by sterile liquid paraffin and finishing up with a pad and bandage twice a day.

To make a fair comparison between atoxyl and sulfarsenol, the following experiment was undertaken. Thirty birds were divided into two well-balanced lots, one lot receiving atoxyl at 0.04 gm. per kg. and the other sulfarsenol at a flat dose of 0.01 gm. Both drugs were given forty-eight hours after infection, when all thirty birds were showing parasites in the circulating blood. In the atoxyl group four died and all showed visceral gout at autopsy, while in the sulfarsenol group all recovered. It is certain that, in the latter group also, some birds were affected with gout, but even in these sulfarsenol failed to cause death.

The only instance of failure met with in using sulfarsenol was in a batch of twenty-five young chicken in a severe natural outbreak of spirochætosis, in which twenty-one of the twenty-five died. The failure may perhaps be attributed to the drug having been given too late and to the very poor condition of the chicks. On the other hand, thirty-eight chickens were experimentally infected and then treated with sulfarsenol with only one death.

The superiority of sulfarsenol over atoxyl and soamin was again clearly demonstrated in a comparative experiment on ten birds each. All the birds in the sulfarsenol group improved rapidly after treatment and even gained in weight. In each of the two latter groups two birds died.

The three arsenical compounds are easily soluble in water. Of the three, sulfarsenol seems to be more stable in solution and is undoubtedly the most active chemotherapeutic agent so far tested on fowl spirochætosis. Experience indicates that unlike as with atoxyl and soamin different batches of birds do not vary in their tolerance of this drug.

Every effort should be made in natural outbreaks to give treatment, however advanced the disease may be. In deed, sulfarsenol may perhaps be advised in all febrile conditions in valuable laying hens, even when spirochætosis have not been demonstrated. Old and fat birds are, however, unsuitable for immunisation even with this drug. An experiment, summarised in Table V, shows that sulfarsenol is not only curative but also prophylactic.

TABLE V

Prophylactic tests with sulfarsenol

Number of birds used	Dose	Time between drug and infection	Reaction	Interval before test	Results
3	0.03 gm.	Simultaneous	Nil	9 days	Immune
3	ditto	2 hours	Nil	ditto	ditto
3	ditto	24 hours	Nil	ditto	ditto
2	ditto	48 hours	Nil	5 days	ditto
2	ditto	72 hours	Nil	Not tested	

Control birds inoculated with spirochætosis at time of immunisation and test reacted severely.

As will be seen from Table V, 0.03 gm. sulfarsenol protects birds against an infective dose of spirochætosis given up to seventy-two hours previously. It is not clear, however, whether the non-reaction to the second test was due to the presence of the drug in the system or to active immunity produced as a result of the virus injection. If the latter, it may be possible to produce an immunity without the least tissue reaction, as achieved in the case of the blocked-out reaction in the serum-simultaneous immunisation against rinderpest. These points will be taken up later for investigation.

Finally, it must not be forgotten that in India no treatment which is too costly could possibly be undertaken. The cost of the three drugs, as obtained from a commercial house in Bombay, worked out per dose as follows: atoxyl, six pies; soamin, three pies; and sulfarsenol nine pies to 1½ annas per bird. This takes no account of the expense of the inoculation service. The sulfarsenol used in this work had been prepared for human use. Possibly a cheaper preparation for veterinary use could be provided if a sufficient demand for this most useful arsenical could be created.

SPIROCHÆTOSIS OF FOWLS IN INDIA—III.*

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Methods of Immunisation, Treatment and Immunity.

(2) *Duration of Immunity.* Few workers have reached any definite conclusion regarding the period and nature of immunity in birds recovered from spirochætosis. Kliger *et al.* (1938) state that immunity lasts for six months after serum-simultaneous inoculation. Catanei (1926) found that inoculation with the Algerian virus produced a strong immunity in fowls for thirteen to twenty-one months, while the Brazil virus gives solid immunity in canaries for 7½ months. Reinoculation some months later does not, however, increase or prolong this immunity.

* Reprinted from *The Veterinary Journal* October 1943.

TABLE VI
Immunity Test

No. of birds tested	Date and method of immunisation	Date and method of retest	Interval between immunisation and retest	Result of retest	Remarks
10	26/11/40. Virulent blood and atoxyl	4/3/41. Virulent blood	97 days	All immune	Controls reacted
5	22/3/41. Virulent blood and atoxyl or soamin*	5/4/41. Left in tick-infected run	43 days	None developed disease	*3 birds immunised with soamin and 2 atoxyl. 5 unimmunised birds left with these in the run died of spirochaetosis. Controls reacted
6	10/8/41. Virulent blood and sulfarsenol	28/9/41. 3 with chicken - and 3 with adult blood	48 days	All immune	Controls reacted
4	23/7/41. ditto	28/9/41. Virulent blood	66 days	ditto	ditto
3	27/6/41. ditto	28/9/41. ditto	91 days	ditto	ditto
2	26/11/40. Virulent blood and atoxyl	16/4/41. Left in tick-infected cage	141 days	ditto	ditto
5	29/4/41. Refrigerated blood 28 to 45 days	27/11/41. Virulent blood	7 months	ditto	ditto
5	22/3/41. Virulent blood and soamin	26/11/41. ditto	8 mths. 4 days	One reacted and died	ditto
4	26/7/41. Virulent blood and sulfarsenol	26/3/42. Virulent chicken blood	8 months	All immune	ditto
3	26/11/40. Virulent blood and atoxyl	24/9/41. ditto	10 months	All reacted and one died	ditto
8	10/8/41. Virulent blood and sulfarsenol	30/6/42. Virulent blood	10 mths. 20 days	All reacted	Treated with sulfarsenol and re-covered
7	10/8/41. ditto	6/7/42. ditto	Abt. 11 mths.	ditto	ditto
2	27/6/41. ditto	6/7/42. ditto	12 mths. 9 days	Both reacted	ditto
4	24/5/41. ditto	30/6/42. ditto	13 mths. 6 days	All reacted	ditto

Note.—The immunity is found to be solid definitely up to seven months; at eight months or a little over, out of nine birds tested one reacted and died. All the birds at ten months and over had no immunity.

To test the duration of immunity, birds were selected at random from batches immunised at different periods by different methods. They were exposed to infection, both natural, by keeping them in tick-infected cages and runs, and experimental, by injecting them with virulent strains of spirochaetes. Their blood was examined daily for a period of seven days after artificial infection and for ten days after exposure to natural infection.

A series of tests is shown in Table VI. Clearly, immunity does not last for more than eight months, whatever the breed, age, method of immunisation or degree of reaction to immunisation.

Kroo, and Orbaneja (1935) consider that a strong inherited immunity can be built up in chickens hatched from eggs laid by fowls experimentally inoculated with spirochaetes. The blood serum of chickens from such eggs was found to inactivate the spirochaetes, as also were the white and the yolk of eggs laid by experimentally infected fowls. In the course of the present work six chicks were hatched from eggs laid by hens which had been experimentally immunised a short time previously. When three to five weeks old, the six chickens were inoculated with virulent blood. Four of them developed the disease and two died.

Before arriving at a conclusion about the degree of immunity acquired by vaccination with a particular strain of spirochaete, it would be necessary to test this with strains from other parts of India. In this connection, Galli-Valerio (1908) reports that the Tunis virus is probably identical with the Sudan variety, but that the African and Brazil viruses are different.

Comte and Bouquet (1908) tested the Tunis and Brazil strains and found that fowls immune to Brazil virus were not immune to the Tunis virus.

Brumpt (1909) experimented with a virus strain from Senegal. Fowls recovered from the Senegal strain were immune to that virus but not to a Tunisian strain. Nor did a Somaliland virus confer immunity against the one from Senegal. Blaizot (1909, 1910) reports that young and old birds may react differently to the same strain.

Hindle (1911) believes that Balfour's granules result from nuclear degeneration and that they are characteristic of infection with the Sudan and South African viruses.

Gonder (1914) also found some difference between Brazil and Sudan strains. Fowls recovered from the Brazil strain were not immune to the Sudan strain, but those recovered from the Sudan strain were immune to the Brazil strain. Gonder found that the passage of a particular strain of spirochaete through a Javanese sparrow could break down the immunity of fowls to this strain. Similarly a sparrow that had recovered from an attack

of spirochætosis was only immune against the same strain so long as this was maintained in sparrows, but were still susceptible once the spirochæte strain has been passed through a fowl.

Four ducks were inoculated with the stock strain of spirochætetes and all suffered from a severe form of the disease. When, however, the spirochætetes from ducks were passed through two healthy fowls, the behaviour of the strain was changed in that the fowls showed only a few spirochætetes in the blood and recovered spontaneously. At its third sub-passage in fowls, this altered strain completely failed to cause infection in fowls, though they retained their susceptibility. Such variations in strains and the different behaviour of the same strain in young chickens and in adult birds, as referred to above, makes large-scale attempts at immunisation against spirochætosis an exceedingly difficult problem. It is not known whether there are any differences among the viruses from different parts of India. In the absence of definite knowledge it may be wise to use local strains where possible for immunisation and to be cautious in introducing strange birds into an immunised flock.

Summary

(1) Various methods for immunising fowls against spirochætosis have been described. Infection associated with chemotherapy has been found to be the best and safest method. For this purpose, atoxyl, soamin, sulfarsenol, and, to a less extent, salvarsan, have been used. Atoxyl and soamin were found to be toxic and not suitable either for immunisation or treatment, especially when birds are old and fat and affected with gout. Sulfarsenol has been used for the immunisation of more than 1,000 birds and the mortality has been less than 1 per cent. The dose fixed for immunisation, irrespective of breed, age and bodily condition, is 0.015-0.02 gm, though the drug is non-toxic even at a dose of 0.05 gm. Birds under immunisation with sulfarsenol do not lose weight, as is the case with the other two drugs. Sulfarsenol can also be used as a prophylactic.

(2) Immunity was found to be strong for about eight months after artificial infection. Whether serviceable immunity can be prolonged is a point to be determined.

(3) A suggestion that chickens hatched from eggs laid by immune hens possess some immunity has not so far been confirmed.

Acknowledgment

We are indebted to Dr. F. C. Minett for his interest and help in compiling this paper; to Mr. J. R. Haddow for valuable advice; and to Dr. B. C. Basu for undertaking many of the microscopical examinations of fowls' blood.

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Editorial

BOVINE STERILITY

With the increased attention now being bestowed to the livestock of the country and their improvement, certain diseases of great economic importance have come up to the forefront. They are not quite so spectacular in their manifestations nor quite so virulent in their course like Rinderpest, Hæmorrhagic Septicæmia and Anthrax. Consequently they do not draw the attention of the public to the same extent as the contagious diseases. All the same, the economic loss to the owners of the animals from these diseases is very great and that is a factor to be taken seriously into consideration in Dairy Economics. Bovine Mastitis is one such disease about which we have already written in these pages. Another such disease is Sterility or Infertility which may be defined simply as the inability of the animal to procreate its species. The cause of this inability may be very varied from a simple easily rectifiable malnutrition to a serious incurable congenital deformity. And therefore Sterility may be considered only as a symptom of a latent or patent defect in the animal. Both the sexes are subject to it but, as is well known, the females are prone to it more often. Not that there is a sex predisposition but the female generative organs are more elaborate and more subjected to the risks and dangers of pregnancy and parturition. As such it is the cow that is brought often for treatment of Sterility. In the case of the bull, if he is found unsatisfactory, he is promptly castrated and put to yoke.

In countries like America and England, where Dairy Industry has been developed on a vast business scale, there has been extensive research into the incidence and causal factors of Sterility in animals. The remedial measures also have been worked out and it can be fairly well said now that Sterility there is kept well under control. The research on this subject got a real fillip during this War, especially in England, where the economic loss consequent on low output of milk-yield was brought to the front prominently owing to War conditions. What was called the Survey Committee drew pointed attention to the seriousness of this complaint; and the Veterinary Profession there started an intensive work on it and practically every cow in the Dairy underwent a vigorous 'check up' about its breeding capacity.

In this country, however, owing to the absence of any big scale Dairy Industry, the question of Sterility in animals does not come up to us with the same force and urgency as it would be otherwise. Still, it is there and is brought to our notice spasmodically and rather leisurely. Some months or even years elapse before some cases are brought to the notice of professional men for opinion and advice and even then with a history which is provokingly vague. The frequent change of ownership of such cases is a contributing cause to this vague history. It, therefore, becomes a bounden duty of the attending Veterinary Surgeon to go into these cases carefully and deeply and prescribe suitable remedial measures. It is worthwhile remembering here that 'urban' cattle suffer from Sterility more often than 'rural' cattle owing to the unnatural conditions under which they are kept; and as these animals are economically of greater value owing to their high milk yield, a condition of Sterility in them becomes all the more serious.

How far this Sterility in cows has contributed to the present day 'Milk problem' it is difficult to say with precision but judging from the number of dry cows that come up for Veterinary Examination now-a-days it may be unhesitatingly

stated that it has contributed not a little to accentuating the present scarcity of milk. Dietetic disorders and dietetic deficiencies, qualitatively and quantitatively have been, as far as we could see, the main factors; and diseases of the generative organs arising from other causes have also been responsible. It is time therefore that the Veterinary profession organised an enquiry into the incidence of Sterility in cows and bulls at least in select areas, so that there may be some accurate data on the subject.

THE ALL-INDIA VETERINARY ASSOCIATION

Madras Branch

We are glad to announce that the Madras Branch of the All-India Veterinary Association is holding a Provincial Veterinary Conference at the Madras Veterinary College on the 6th, 7th and 8th April 1945 with Sri K. S. Nair, G.B.V.C., M.R.C.V.S., D.T.V.M., Principal of the Madras Veterinary College as President. Sri T. Vinayaka Mudaliar, G.M.V.C., Livestock Development Officer, Madras, has been elected as Chairman of the Reception Committee. Arrangements have been made for the lodging and boarding of the Delegates at the Hostel attached to the Veterinary College.

We are also given to understand that there would be an Exhibition put up at the College during the Conference wherein the different sections of the College will have something highly interesting and educative to exhibit.

Judging from the interest and enthusiasm shown at the preliminary meetings, we are confident of a successful session with illuminating discussions on the current Veterinary or rather Animal Husbandry problems.

We wish the Conference every success.

Clinical Articles

A CASE OF BILIARY LITHIASIS IN A HORSE

By

M. R. SUBRAMANIA SASTRY, G.M.V.C.,

Lecturer, Madras Veterinary College.

Introduction :—(1) Wooldridge says that "gall-stones are met with most frequently in animals possessing a gall-bladder and more rarely in the horse". The presence of a gall-bladder is invariably considered as predisposing to the formation of biliary calculi, since it is likely to act as a reservoir in which stagnation and decomposition of biliary secretions may readily take place. But according to (2) Hutyrá and Marek, "They are most often found in horses and cattle" than in other animals. However there is no divided opinion regarding the view that the lesions are more often discovered post-mortem. The absence of diagnostic symptoms is evidently responsible for the condition not being recognised during life and this is proved by the facts of the case under report.

Subject :—The subject was a grey, Arab, entire, aged seven years, height being 14 hands 3 inches.

Previous History :—The horse was under immunisation during the last ten months against tetanus. He had six injections of formal toxoid with tapioca commencing with 25 c.c. and gradually increased to 75 c.c. During this period, he was showing every now and then vague symptoms of digestive disorder associated sometimes with colicky pains of a dull and continuous nature. He had eleven such attacks at varying intervals. On almost all the occasions the animal was off feed and showed a rise of temperature which varied from 101°F to 104°F. Only once or twice the symptoms shown were of an acute nature. With salines and febrifuges the animal became normal invariably within a day or two. Formal saline, occasionally sedatives like chloral, vegetable bitters and a course of hypertonic salines were also tried. Being a bolter steps were taken to prevent the animal from bolting the food. The molars were sharp and they were rasped. In spite of all these attentions, colicky pains continued to recur. The visible mucous membranes never showed any appreciable icterus nor was his dung or urine indicative of any hepatic disorders. The recurrent colicky pains and rise of temperature were thought to be due probably to a moving intestinal calculus. His weight before the first sign of illness was 801 lbs. and there was never any marked variation in his weight either as a result of tetanus toxoid injections or as a result of the illness he was subjected to periodically.

Present History and Clinical Signs :—At 5 p.m. on 17—4—44 he began to show acute signs of colic and great distress. The animal had taken his noon feed normally and the attack was quite sudden. The clinical signs shown on this occasion were :—

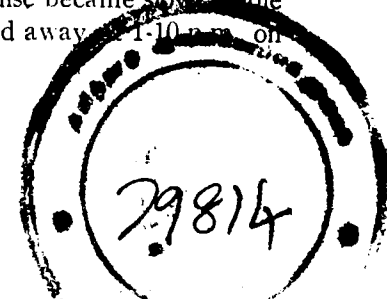
The animal was rolling on his bed with patchy sweating and anxious expression. The pain was of a continuous nature; conjunctiva was injected; dung was hard, pelletty, mucous-coated and slightly clay coloured, the odour being not very offensive. Urine was retained. He had no inclination to take his evening food or hay; temperature was 104°F; pulse 60; and respiration 48. Rectal exploration and examination of faeces revealed no abnormality.

He was given copious warm soap-water enemata and stimulant treatment with ammonium carb, nux vomica and gentian followed two hours later by a dose of chloral, belladonna, turpentine, soda salicylas and linseed oil. The patient was put in loose box, warm clothing and bandages to all four legs were put on and plenty of dry straw bedding was given.

The present attack lasted till 29—4—44 when it terminated fatally. The following interesting clinical signs were manifested in the course of this attack :—

The animal continued to be dull and restless throughout, though occasionally signs of great distress were seen. The conjunctiva showed icterus, then petechial hæmorrhages and later on a deeply congested condition besides the icterus and petechiæ. The urine which was at first yellow, gradually became dark yellow and then turned to dark green and during the last stages of the disease to dark brown in colour. The reaction became acid. It contained bile salts and bile pigments and as the disease advanced, albumin in varying quantities was also present besides calcium oxalate crystals. The quantity became gradually reduced and became scantier and scantier until at last only a few ounces were passed. Blood showed no protozoal organisms. The icteric index of the blood was very high. Later on toxæmia and venous hyperæmia developed as indicated by dull, sleepy, half-closed eyes and inability to lift up the head with a tendency to rest it on the ground or on the door of the colic box, a prominent jugular pulse and passive congestion of the lungs with breathlessness and exaggerated vesicular sounds. On the day previous to its death, the skin broke into general sweat which dripped freely to the ground. The sweating became more and more profuse. The breathing became hurried and laboured. Facial expression became haggard and showed great distress. Subsequently the animal showed extreme restlessness fell to the ground and lay stretched out. Coma supervened, extremities became cold, breathing stertorous, temperature went down to 97 degrees, pulse became slow, feeble and gradually imperceptible, and the animal passed away at 11—10 p.m. on 29—4—44 after an illness of about 11 days.

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Diagnosis and Treatment:—The case was provisionally diagnosed as one of "Acute Hepatitis with catarrh of the bile ducts". The treatment adopted was mostly symptomatic. Sedatives as chloral and belladonna to allay the pain, salicylates and urotropine as antiseptics and antipyretics, stimulants as camphor in oil to maintain the heart's action, salines, enemata and hepatic stimulants to regulate the bowels and rouse the torpid liver, cardiac tonics as digitalis and nuxvomica to increase the force and strength of the heart, Glucose saline intravenously to support the heart and to maintain the consistency of the blood and atropine during the last stages as a cardiac stimulant and anhydrotic.

The diet given was in the nature of bran-mash, quaker oats kanji, milk, barley water and hay-tea. The animal never showed any great inclination to eat by himself. He had to be handfed especially during the later stages of the disease.

Postmortem Findings:—Postmortem examination was made immediately after death and the following important findings were recorded.—

- (i) Icteric condition of the visible mucous membranes, more particularly of the conjunctiva.
- (ii) Distended condition of the heart with hæmorrhages under the endocardium of the papillary muscles in the left ventricle.
- (iii) Enlarged condition of the liver, its consistency being tough, surface dull and finely granular, and colour greenish slaty. Short shreds of fibrous tissue projecting from the liver capsule were seen scattered on the diaphragmatic surface. A fibrosed or cirrhotic condition of the parenchyma was apparent on incising the liver. The cut surface presented a general greenish-brown discolouration. The main bile duct was distended and when slit open, it revealed the presence of a large gall-stone of the size of a lemon and numerous others of smaller sizes varying from that of a pea to a marble all of which were more or less fragile. (Vide Plate X Fig. 1 showing all the gall-stones collected).

Histopathology:—Histopathological study of the liver was also made. A section of the liver stained with hæmatoxylin and eosin revealed the following under the microscope:—

- (i) The capsule was thickened and it was associated with a monolobular cirrhosis.
- (ii) The proliferated tissue of the portal tract was found young and, moderately vascular in which attempts at formation of new bile ducts were very obvious (Plate X, Fig. 2).
- (iii) Many of the smaller pre-existing bile ducts contained plugs of bile; others were either empty or contained some mucous secretions.

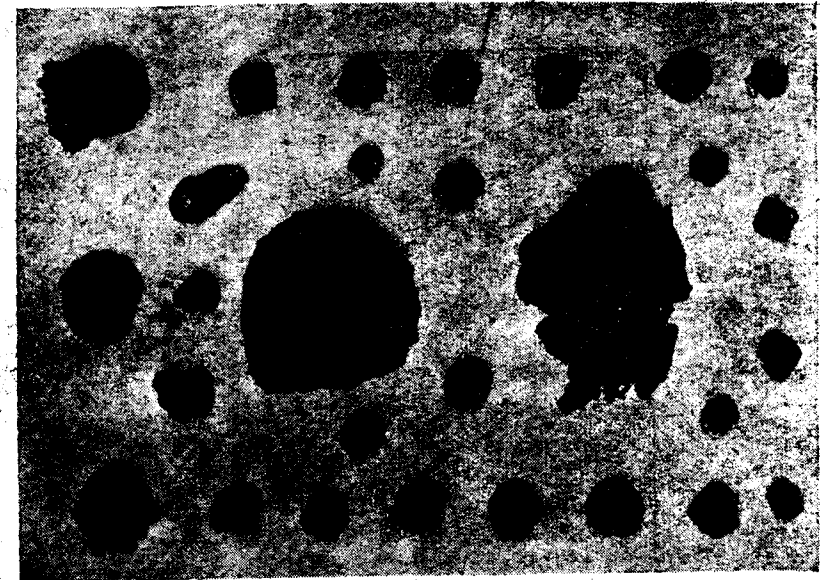


FIG. 1.—Showing the gall-stones collected. They are of different sizes and their fragile nature can also be seen in some of them.

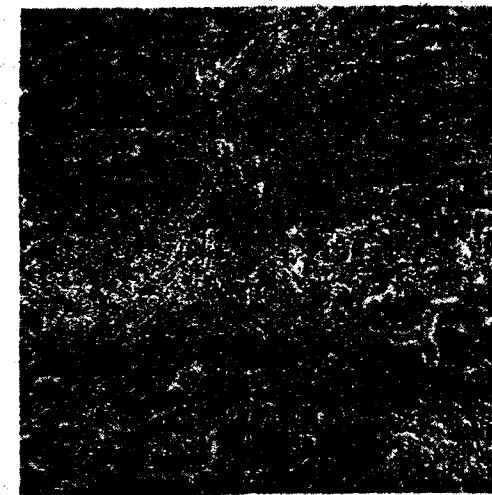


FIG. 2.—Showing the formation of several rudimentary new bile ducts in the young cirrhotic tissue of the portal tract. (X 80)

Plate XI

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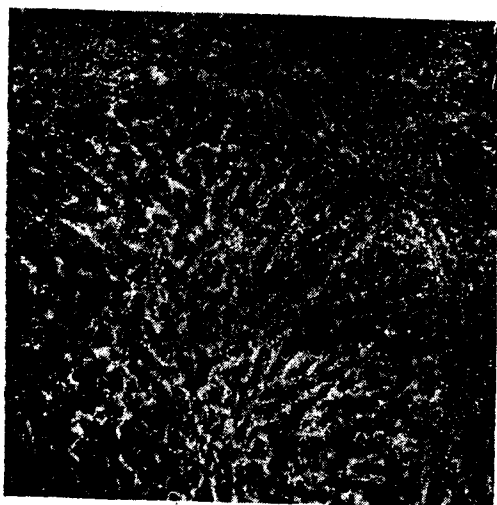


FIG. 1.—Showing the presence of pigment-masses in the lobule. (X 80)



FIG. 2.—Showing a magnified portion of liver-lobule with much retained pigment. (X 400)

- (iv) The blood vessels in some tract appeared distended with blood.
- (v) The liver lobules were clearly defined by a surrounding peri-lobular cirrhotic or fibrous tissue.
- (vi) The liver cells did not stain well with eosin; they appeared finely vacuolated, the cytoplasm presenting a finely reticulated and a somewhat basophil picture.
- (vii) The bile canaliculi contained more or less homogeneous and irregular masses of bile. (Plate XI Fig. 1 and 2).
- (viii) Granules of bile were also seen in the hepatic cells as well as in the cells of Kupffer.
- (ix) No hæmosiderin could be demonstrated in section.

Discussion :—The icterus seen in this case is distinctly 'hepatogenous' associated with obstructive changes in the bile passages. The course of the disease, the symptoms presented and the postmortem findings indicate that the gall-stones seen should be regarded more as precipitations and incrustations in the bile ducts than as true gall-stones. They should have originated from a gastroduodenal cattarrh leading to tumefaction of the lining membranes of the bile ducts and of its branches as a result of microbial infection probably bacillus coli, from the intestine by way of the bile ducts. Inflammatory changes have evidently occurred in the bile vessels with cellular infiltration of the connective tissue and development of new billary canaliculi resulting in billiary cirrhosis and hypertrophy of the liver. So long as the bile duct was not completely obstructed, the 'stones' gave rise to transient attacks of dull colicky pains with remissions and disappearance. When, however, complete obstruction of the duct had occurred, the colicky pains became very acute, the jaundice persisted and increased in intensity and death resulted. The symptoms presented during life were never diagnostic of the condition and the condition was not therefore suspected during life. This confirms the view "that the lesions are more often discovered postmortem."

Acknowledgments .—My thanks are due to Messrs. F. D. Wilson and E.R. Nagarajan for the valuable help they rendered in treating the animal, and to Messrs. M. Y. Mangrulkar and K. P. C. Nair for the postmortem examination and histopathological study, and to the two artists Messrs. P. Doraiswamy Mudaliar and A. Someswara Rao for the photos.

References :

- (1) Encyclopædia of Veterinary Medicine, Surgery and Obstetrics Vol. I, page 498—2nd Edition.
- (2) Special Pathology and Therapeutics by Hutyra, Marek and Manninger, Vol. II, Page 367—IV edition.

A SHORT NOTE ON DUCK REARING IN KAIKALUR TALUQ OF KRISHNA DISTRICT

BY

S. SREENIVASA RAO, G.M.V.C.,
Veterinary Assistant Surgeon, Kaikalur, Madras.

Kaikalur Taluk, in the Kistna District affords good facilities for the rearing of ducks. This taluk is bounded on the North by the Kolleru lake which is one of the biggest in these parts. Many a stream such as the Budameru and Tammileru fall into the lake. In rainy seasons the whole of the taluk especially the villages bordering the lake is subjected to submersion. As there is plenty of water available in the villages bordering the lake, duck-rearing is practised on a very large scale in the taluk. The climatic conditions etc., also seem to favour this industry.

Breed of ducks.—All of them are indigenous country-bred ones. They are mostly black and white or black in colour and weigh, on an average from five to six pounds. Compared with ducks in other provinces, they appear to be larger in size and in weight. It is reported that there are about two to three lakhs of ducks in the taluk.

Feeding and management.—They are kept by illiterates in flocks of two to three hundred. They are housed for the night on the borders of the lake. Early in the morning, after the eggs are laid, they are left outside. They seek the water margins in quest of their food where plenty of snails are available. They live on the fresh water snails, worms, moss etc., which are available in plenty. No hand-feeding is given to them at all. From December to March, the hens lay almost every day. In summer April to June the laying capacity is not good. From July to November, as the land is mostly submerged, they do not get enough of feed such as snails etc., to thrive on.

Laying Capacity.—From December to February the owners keep about a dozen eggs or so under brood pen for hatching. Each owner hatches a sufficient number of birds to replenish his stock. It is also reported that these hens lay about two hundred eggs in the year and begin to lay at the age of five months. In the second year a fall in the number of eggs laid is noticed and in the third year the bird is said to be not profitable except for table purposes.

Trade in eggs and birds.—The eggs are two to three ounces in weight, white in colour and thin shelled. They are mostly exported to Bombay, Hyderabad, Madura and other markets. In the season, this is from

December to March, about seventy to eighty baskets each containing about two hundred and fifty eggs are exported, from these parts.

Cockerels and old birds are also exported from these parts and it is estimated that two to three thousand birds, are also sold every year and about eight to ten thousand eggs are daily exported during the season. These eggs though not preferred to hen's eggs, find a ready market in many places. The present price of these eggs is Rs. 9 per hundred as against Rs. 3 pre-war.

Diseases affecting the birds.—These ducks do not appear to suffer from many diseases unlike poultry. It is probably the general environment, freedom of movement and natural diet that wards off some of these diseases. The percentage of mortality is very low and almost negligible when compared with poultry.

General remarks.—Many a ryot prefers ducks-rearing as being a good and profitable business as compared with poultry as the maintenance charges are low and they get a very good profit now a days.

IS IT A CASE OF LATENT HÆMORRHAGIC SEPTICÆMIA?

BY

B. MOHAN RAO, G.M.V.C.,
Touring Veterinary Assistant Surgeon,
Korvur, West Godavari Dt.

While conducting Hæmorrhagic Septicæmia vaccinations in an actual outbreak of the disease, an aged Ongole Cross Bred bull weighing over 800 lbs. was given 10 c.c. of H. S. Vaccine at about 6 p.m. The animal was perfectly healthy at the time of inoculation. At about 6.45 p.m. the owner came running and informed me that the animal was shivering and the abdomen was bloated. I gave him 5 grs. of Pot. Permanganate embedded in a plaintain fruit and instructed him to dash cold water on the head after administering the medicine. By about 8 p.m. the animal was brought to me from the nearby fields. To my great surprise, I saw the animal with typical symptoms of Hæmorrhagic Septicæmia viz., staring coat, profuse salivation, swollen head and dewlap and stertorous breathing with tongue protruded. On enquiry the owner told me that the animal was perfectly healthy before the injection and was actually ploughing till an hour before the inoculation. There was a big gathering of the big wigs of the town. I could hear every one say, 'The Doctor has injected and animal got ill'. My explanation that the vaccine can do nothing within 6 to 7 days and that the disease must have been in the incubation period was of no use. To save the situation I told them that

I would remove the effect of the vaccine and gave the animal 20 c.c. of Liq. Iodine intravenously. Early next morning I enquired about the animal only to hear that he was no more. But surprisingly I was told that the animal got alright and had gone back for ploughing. The points for discussion are (1) Is it a case of H. S. in the incubation period? If so, is it possible for the vaccine to bring about the disease in such a short period of less than an hour? (2) Has liq. iodine really got the effect of killing the potency of the H. S. Vaccine?

I should very much like to see my professional brethren comment on this case.

CÆSARIAN SECTION IN A BITCH

By

K. S. SHETTY, G.M.V.C.,

Assistant Veterinary Surgeon, Narayanaguda, Hyderabad Dn.

On 19-7-44, a bull terrier bitch was brought to me with the history that she was straining for the previous 24 hours and was very listless. On examination it was found to be a case of Dystokia with one dead pup in breach presentation obstructing the passage. Efforts to remove that one proved futile. Hysterotomy was then decided upon.

The site of the operation on the median line behind the umbilicus was properly prepared and the bitch was anaesthetised by chloroform. With the usual aseptic precautions for laparotomy, the abdomen was opened. The exposed uterus was then drawn to the edge of the wound and incised on a longitudinal direction avoiding blood vessels as far as possible. Five puppies, two dead and three living were found inside. They were all removed one by one with their membranes. The whole inner surface of the uterus was at first swabbed with sterile gauze and then freely sprinkled with Cibazol powder. The uterus and the abdominal openings were closed in the normal way (details avoided). The bitch made uneventful recovery. On the second and third day there was a slight rise of temperature (103°F) which was combated with a few tablets of Cibazol internally.

It is interesting to record that the mother in spite of such a major operation nursed 3 puppies exclusively by the breast milk for three weeks until they started lapping cows milk. Cibazol antiseptic powder and tablets were perhaps as effective as to eliminate any sort of sepsis which might have occurred in an operation like this.

The photo of the patient and the puppies taken one month after the operation is enclosed and may be found interesting. (Plate No. XII)

My thanks are due to Mr. V. Seetharama Rao, G. M. V. C., Assistant Veterinary Surgeon, for his valuable help in conducting this operation.

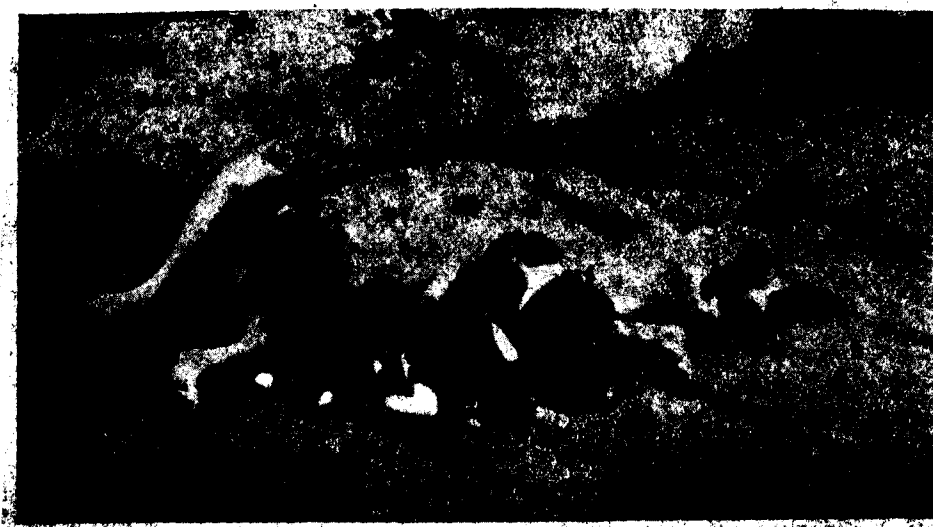


Photo of the bitch with three pups taken one month after the operation of Caesarian Section.

DIAGNOSIS AND TREATMENT OF CO-EXISTENT INFECTIONS IN EQUINES

BY

D. B. KHOLE G.B.V.C.,

Lecturer, Bombay Veterinary College,
Parel, Bombay.

The task of Veterinary Surgeon in treating the animals is always attended with enormous difficulties and complications due to incorrect diagnosis, unavailability of the most desirable medicines coupled with the superstition and ignorance on the part of the public.

Microscopical examination of blood, pus, faecal matter, urine etc., and biological test may throw some light on diagnosis, but the high cost of medicines in general, and, inability to obtain the desirable drugs in these days in particular add to the difficulty of treatment.

The following case reports may be found interesting :—

Case No. 1.—A combined infection with *T. Evansi* and *Babesia equi*.

Subject :—A bay Indian bred, entire, 6 years old, belonging to Mr. X was brought to Bombay from Matheran (a summer resort close to Bombay) for treatment. The blood examination was positive for trypanosomes. The animal was immediately seized under Glanders and Farcy Act and admitted in Lazaretto (a place for animals affected with scheduled diseases). It was treated with Antrypol, the dose being $2\frac{1}{2}$ grs dissolved in distilled water sufficiently diluted, and injected intravenously. The dose was repeated after eight days. During the interval, daily blood examinations were conducted but they were negative. Invariably the Antrypol treatment produced a swelling all over the body, especially over the limbs, sheath, and abdomen. This persisted for a few days without disturbing the general health.

A few days after the second injection, examination of the blood showed the presence of *Babesia equi*; immediately therefore, an injection of Quinine Hydrobromide was resorted to, dose being 15 grs., dissolved in half an ounce of distilled water. The presence of organisms in the blood after injection necessitated another injection of the same quantity of the drug. Simultaneously Liq. Strychnine was given subcutaneously to counteract the depressing effects of Quinine. After the second injection, microscopical examination of the blood revealed no organisms; however to be on the safe side a third dose of the drug in the same quantity was injected. As the blood examinations continued to be negative, the horse was discharged eight days after the third injection.

Case No. 11.—A combined affection with *T. evansi* and Streptococci.

A Chestnut, Indian bred, entire, eight years old, belonging to Mr. B was admitted into the Hospital with a history that it was not keeping well. Blood examination revealed trypanosomes. The animal was treated with Antrypol, and detained in the Lazaretto for further observation and treatment. After the first injection 'Antrypol swelling' occurred all over the body. The dose was repeated after eight days. The swelling gradually subsided on all parts of the body, except on the hind legs where some 'buds' were noticed. Pus examination from the 'buds' showed the presence of Streptococci. 20 c.c. of 2% solution of Mercurio Chrome was injected intravenously and, it was repeated after a couple of days. The swelling and the 'buds' disappeared. The horse was tested with Mallein and as the reaction was negative the horse was discharged cured.

I am very thankful to Mr. P. V. Akula, Veterinary Inspector in charge of Government Lazaretto for his help, and, I am very grateful to Mr. M. Mohey Deen, the Principal Bombay Veterinary College, for his guidance and advice.

A CASE OF GLANDERS

By

D. B. KHOLE, G.B.V.C.,

Lecturer, Bombay Veterinary College, Parel, Bombay.

An Iron Grey, entire, 8 years old admitted in the Sakarbai D. Petit Hospital, Parel, for treatment of Bursatti.

The horse was subjected to a subcutaneous Mallein test and strangely enough the reaction was positive. It was isolated and removed to the Lazaretto for further observation and confirmation of the diagnosis of the disease. It was re-tested after 15 days. This time the test was intradermo-Palpebral and the reaction was again positive. There was serous discharge from the eye and oedema of palpebral membrane, swelling of the eyelids and conjunctiva with a slight rise of body temperature; the discharge was slowly turning into muco-purulent. The temperature was high throughout. The animal was watched for three to four days and then destroyed. The autopsy showed nasal septi highly congested and presence of "nodules" in the lungs.

I am very thankful to Mr. P. V. Akula, Veterinary Inspector in charge of Government Lazaretto for his help, and, I am very grateful to Mr. M. Mohey Deen, the Principal Bombay Veterinary College, for his guidance and advice.

A CASE OF ATYPICAL ANTHRAX IN A MARE

By

G. S. RATHORE, G.V.Sc., D.V.M.,

Chief Veterinary Officer, Alwar State

Subject:—A Grey mare, country bred, about 7 years of age, in very good condition used for polo playing.

History and Symptoms:—The mare was reported on the evening of 27th January 1945 to be suffering from colic and constipation. A dose of Turpentine, Asafoetida, Chloral Hydras in oil was given. On the 28th morning, the mare was reported to be relieved of colic but still was dull and off feed. A bolus containing Ammon Carb and Nuxvomica was prescribed. The mare seemed relieved, but did not start eating. Bowels had acted.

On the morning of 29th the mare was reported again to be suffering from colic. So it was admitted in the hospital as an in-patient, for further treatment and observation. On admission in the hospital, the temperature was found to be 101°F. The m.m. was slightly congested and there were signs of spasmodic colic. The rectum was empty and a warm water enema did not produce much result. Four doses of Chloral Hydras, and Turpentine in sweet oil was administered and the mare was ordered to be led and walked about as it was restless, with colicky pains. In the evening the mare did not show any symptoms of improvement, and therefore the morning drench was repeated with the addition of Acid Carbolio oz.ii. Thereafter the animal was a bit drowsy but again at about 8 p.m. it became restless, fell down and died.

Post-mortem:—Next morning, the carcass was observed to have become extremely bloated with dark blood oozing out of nostrils and vagina. Suspecting Anthrax, blood smears were taken and examined after staining with Methylene Blue. They were positive for Anthrax. The carcass was carefully removed to the burial ground for disposal.

Remarks:—The interesting features about this case were that during life the animal did not show any swelling or temperature or any other symptoms to suspect it to be suffering from Anthrax. There was also no outbreak of Anthrax in cattle at this time in Alwar State.

Other horses and animals which were living with the animal in the same bungalow were examined and all seemed normal with no rise of temperature. Still, as a preventive measure, all the animals were inoculated with a dose of anti-Anthrax serum.

FOREIGN BODY IN THE MAMMARY GLAND OF A COW

BY

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

Assistant Lecturer in Surgery, Madras Veterinary College.

Subject and History.—On 7—8—44 a cow, aged about 7 years, in the 4th month of lactation, was brought to the College hospital with the history that it was not milking from the left hind teat since that morning. Palpation of the udder revealed nothing abnormal, but as no milk could be drawn through that teat, syphon was introduced when the milk flowed out freely.

On 11—8—44, the same cow was brought back with the history that as the milk-flow stopped again in the same teat, the stalk of a Neem-leaf was passed through the orifice of the teat, the previous evening, by the owner to make the passage patent and that the stalk got stuck up inside and could not be removed.

Diagnosis.—Palpation of the teat and quarter revealed the presence of the foreign body close to the base of the teat. It was however possible to strip out the milk from that quarter.

Treatment.—Trials to bring out the foreign body by manipulation of the teat were in vain. Sterile olive oil was then injected into the teat with the hope that it would facilitate the outward passage of the foreign body. This too had no desired effect.

On 14—8—44 signs of mastitis (of the quarter) were noticed and the owner's consent was obtained for the surgical removal of the foreign body.

Operation.—The cow was cast and secured, 15 c.c. of Novocaine 3% solution, was injected into the quarter at different places above the base of the teat. The teat syphon was introduced through the teat and with the usual aseptic precautions a vertical incision 2" long was made immediately above the base of the teat on the posterior aspect of the left hind quarter. The incision was extended into the galactiferous sinus. By introducing the little finger the foreign body was felt, dislodged and removed by a pair of forceps. The incision was closed by a few interrupted sutures. The teat syphon was removed, the wound dressed and protected with a suspension bandage.

After-treatment.—The next day there was only a slight swelling at the seat of operation. On milking the affected quarter a little blood tinged milk was drawn. A drught containing Formalin oz. 1, Sodii chlor oz. 6, and Aqa Oi was administered and the owner advised to foment the part thrice daily.

On 16—8—44, the swelling remained the same but the milk drawn was found to be very watery without any blood.—200 c.c. of Euflavine (1 in 10,000) was infused into the quarter and stripped out 5 minutes later. The treatment was continued once daily till 18—8—44. From 19—8—44 Formalin and Saline were again administered per os. On 21—8—44 the swelling had considerably decreased and the sutures were removed. The milk had resumed its normal colour and consistency. Iodine ointment was rubbed over the thickening and Potassium Iodide in grs. xv doses was given internally. This treatment was continued till 26—8—44 after which the animal was discharged cured.

The result of the examination of the milk from the quarter on 16—8—44 revealed only contaminants.

The foreign body which was the stalk of a leaf, measured 4" in length and was of the thickness of a medium sized probe.

My grateful thanks are due to the officers in charge of the Hospital Dr. R. Swaminathan and Dr. M. R. Subramania Sastry for their invaluable suggestions and to Dr. M. S. Ganapathi, House Surgeon and student Unni Krishna Menon of the 5th year, for their assistance during the operation.

Association News

THE ALL-INDIA VETERINARY ASSOCIATION

(Madras Branch).

A special meeting of the General Body of the All-India Veterinary Association, Madras Branch, was held at the Dobbin Hall, Madras Veterinary College, on the 11th February 1945 at 3 p.m., with Rao Sahib K. Kylasamier, President, in the chair. Twenty one members including the President attended.

On the motion of the President, the following resolution was passed all standing.

"That this meeting of the All-India Veterinary Association, Madras Branch, places on record its sense of sorrow at the death of Sri P. Kadambavanasundaram, a life member of this Association and conveys its condolences to the members of the bereaved family".

The revised rules and bye-laws of the Association as approved by the Managing Committee were taken up for consideration clause by clause and passed.

Madras, }
5—3—45. }

R. SWAMINATHAN,
Secretary.

**THE ALL-INDIA VETERINARY ASSOCIATION
(Madras Branch).**

PANIKKAR MEMORIAL FUND.

List of subscription from 5-1-45 to 5-3-45.

(Continued from page 258, January 1945).

	Rs.	A.	P.
Brought forward	...	1,028	2 0
Mr. K. S. Shetty, Narayanaguda, Hyderabad-Dn.	...	5	0 0
Total Rs.	...	1,033	2 0

Madras, }
5-3-1945. }

V. GURUMURTI,
Jt. Secretary and Treasurer.

**PUNJAB SUBORDINATE VETERINARY SERVICE ASSOCIATION
Proceedings of the 10th Annual General Meeting**

The 10th annual general meeting of the Punjab Subordinate Veterinary Service Association was held on the 26th December, 1944 in the lecture room of the Punjab Veterinary College, Lahore.

The first sitting was presided over by J. S. Garewal Esq., I. V. S., Principal, Punjab Veterinary College, Lahore, and the following programme, was gone through :—

Minutes of the last meeting :—by the General Secretary,

Annual report on the working of the association for the year 1944 was also read out by the General Secretary in which he briefly mentioned the steps taken by the Managing Committee to get the grievances redressed by the authorities during the year under report. Then he placed the financial position of the association before the house and remarked that the total income during the year was Rs. 291-4-4 while the total expenditure was Rs. 115-13-3. It was further stated that out of the total strength of Veterinary assistants and Veterinary assistant Surgeons, which is about 450 only 132 enrolled themselves as members. He exhorted the members to influence others to join the association in large numbers.

The following papers were read by the various members :—

- (a) Treatment of scabies with Sea water (written by a Capt.) by Dr. Mohinder Singh L. V. P. Veterinary Lecturer, Punjab Agricultural College, Lyallpur.
- (b) An outbreak of Surra in Kalra Stud—by Dr. Ram Lal Ghulati L. V. P., Veterinary Assistant Surgeon, Amritsar.
- (c) Experiments on snake poisoning—by Dr. Jagan Noth Bansil L. V. P., Veterinary Assistant Surgeon, Patti, District Lahore.
- (d) Necessity of teaching Veterinary Hygiene in the schools—by Dr. D. D. Khurana L. V. P., Veterinary Assistant Surgeon, Kahna Nau, District Lahore.

Then the following resolutions were unanimously passed by the house :—

Condolence Resolution .—“Resolved that the members of the association deeply mourn the sad, sudden and untimely death of the wife of Dr. Ghulam Nabi G. P. V. C., and fully sympathise with Dr. Ghulam Nabi in his bereavement.”

1. In view of the fact that the education of masses in matters relating to animal Hygiene, management and feeding of livestock, prevention of contagious diseases etc., is extremely useful both for the public and the Veterinary department itself, it was resolved that the Director, Veterinary Services, Punjab, be requested to move the Punjab Government and the local bodies to introduce “Animal Hygiene” as a compulsory subject in the curriculum of all the schools under their control.

2. Resolved that the Director, Veterinary Services, Punjab, be requested to move the Punjab Government to sanction suitable war allowance for the Veterinary Assistants working on a consolidated pay since the Government employees who get annual increments according to the scale system of pay have already been given such allowance in the form of 2 increments from April, 1944, as the general rise in prices, which are soaring high these days, affect these people as much as increment-scale employees.

3. With reference to resolution No. 2 of 1941 and resolution No. 1 of 1943 and the orders received in this connection, it was resolved to offer thanks to the Director, Veterinary services, Punjab, for rightly and sympathetically pleading the cause of L. V. P's working as 3rd grade veterinary assistants and getting 120 posts (in the grade of 80-7-225) sanctioned for them. It was further resolved that the Director, Veterinary Services, Punjab be requested to move the Punjab Government to grant the grade of Rs. 80-7-225 to all the L. V. P's en-mass, working on consolidated pay of Rs. 60/- p.m. on the analogy of the Agricultural Department.

4. In view of the fact that the post of the Assistant Marketing Officer (livestock) and certain such other posts, have been given to the persons with the Agricultural qualifications, it was resolved that the Director, Veterinary Services may be requested to see that the posts originally meant for the persons holding veterinary qualifications, be not, in any way, given over to the persons in the other Departments.

5. It was resolved to offer thanks to the Director, Veterinary Services, Punjab, for getting the sanction of the Punjab Government for closing the Veterinary Hospitals in the Province for half of the day on Sundays. It was further resolved that the Director, Veterinary Services, be requested to move the Punjab Government to graciously extend this privilege for the full day, since it is the morning time, when rest from the routine work is badly needed. This will be subject to the conditions already contained in his circular letter No: 156-605-55 III-G., dated 5-1-44.

6. Resolved that the Director, Veterinary Services, Punjab be requested to move the Punjab Government to ask the Governing bodies of big Gaushalas to get the services of qualified veterinary staff attached to those places, in matters of breeding, feeding and treatment of their animals. This will greatly enhance the milk production in Gaushalas and also increase the efficiency of treatment. These bodies be further asked to pay suitable compensation to the staff performing the additional duties, in the form of Gaushalas allowance.

7. Resolved that the Director, Veterinary Services, Punjab be requested to move the District Boards in the Province to appoint one relieving compounder in each district in the interest of public service. At present, many Veterinary Hospitals are allowed to be left without the services of a compounder when the permanent compounders are obliged to go on long leave. This greatly affects the work of the hospitals adversely, especially the tour work, which cannot be undertaken in the absence of the compounder.

8. Resolved that the Director, Veterinary Services, Punjab, be requested to fix the minimum pay at Rs. 60 p.m., instead of Rs. 51 p.m., for the retired Veterinary Assistants, when they are re-employed to serve the benign Government.

9. This Association re-affirms all the resolutions passed at the previous meetings, the replies to which have not so far been received, and requests the Director, Veterinary Services, Punjab, to consider those resolutions favourably.

5. The president's remarks :—The president in his presidential remarks sympathised with the genuine grievances of the members and exhorted the members to work more energetically for the advancement of

the Veterinary science. He wished that the association should flourish like the other veterinary associations in foreign countries. Then the meeting was adjourned for a short recess.

The second sitting was held at 3 p.m., with Dr. Ghulam Nabi in the chair.

The President requested the members to elect the office-bearers for the year 1945, but S. Gurbakhsh Singh from Government Cattle Farm Hissar, requested to postpone the new election up to the time by which some definite decision was taken on his correspondence with the Secretary in which he had demanded a no confidence motion against the office-bearers. After some heated discussion, exchanged between him and Secretary the correspondence was placed before the house, and the house approved the action taken by the President, and by an over-whelming majority voted for holding the new election. Then the following office bearers were unanimously elected for the year 1945 :—

1. *President* :—Dr. Ram Lal Ghulati L. V. P., Veterinary Assistant Surgeon, Amritsar.
2. *General Secretary* :—Dr. Ikramullah Khan L. V. P., Veterinary Assistant Surgeon, Sialkot City.
3. *Joint Secretary* :—Dr. Mohammad Yaqub G. P. V. C. Veterinary Assistant, Chunian, Dist. Lahore.

4. *Members of the Managing Committee* :—

Dr. D.D. Khorana L. V. P., Veterinary Assistant Surgeon, Kahnana. Dist. Lahore.
 Dr. Amar Singh L. V. P., Veterinary Assistant Surgeon, Nankana Sahib.
 Dr. Ghulam Nabi G.P.V.C., Punjab Veterinary College, Lahore.
 Dr. Hari Mohan Bhatia L. V. P., Veterinary Surgeon, Lahore.

Aditors :—

Dr. Nisar Mohammad Khan L.V.P., Veterinary Assistant Surgeon, Gurdaspur.
 Dr. Narinjan Singh L. V. P., Veterinary Assistant Surgeon, Kasur.

Then the meeting was adjourned *sine die*

Sialkot }
 8-2-45.

IKRAMULLAH KHAN,
Hony: General Secretary,
Punjab Subordinate Veterinary Services Association,
Civil Veterinary Hospital, Sialkot City.

Fourth Annual General Meeting and Conference

Treasurer.—Mr. L. A. P. Britto-Babupulle. G.B.V.C.,
M.R.C.V.S., D.T.V.M.

Committee.—

J. C. A. Prins
Walter Witharne
S. Saravanamuttu
S. Alagasundaram
L. P. P. Goonetilleke
A. V. de Croos
J. S. Navaratnam
Lt. M. Lawrence
D. W. Amarsinghe
R. R. De Silva

Mr. J. S. Navaratnām, who initiated a discussion on this subject moved the following resolution: "This Association invites the attention

of the Minister of Agriculture and Lands and enquires whether the report appearing in 'The Times of Ceylon' is accurate wherein it was stated that the Minister of Agriculture had said that Mr. Crawford, the then Government Veterinary Surgeon, had preferred an unqualified officer to a Veterinary Surgeon because the latter could not handle an animal and if the answer is in the affirmative, what action does this Association propose taking to safeguard the interests of the professionals?"

Mr. Navaratnam referred to the question raised by Mr. W. Dahanayake in the State Council, and the replies given by the Minister of Agriculture. He thought that the replies were intended to white-wash the whole affair.

Mr. J. Habaragoda said that according to the information the whole matter was sub-judice and they should not take any steps at this stage.

Mr. L. A. P. Babapulle, Veterinary Surgeon, said that the explanation, as it appeared in the press was a slur on the whole profession. He had written to the National Medical Veterinary Association in regard to this matter and he had not received a reply yet.

After some discussion the resolution was passed and the Secretary was asked to communicate with the Minister in regard to this matter.

The Association also adopted the following resolutions.—

This Association condemns the action of the Government in recalling to service officers who had retired on account of old age, thereby depriving the officers in service of their legitimate promotions and not availing themselves of the services of highly qualified veterinary surgeons who were available at the time if filling of such vacancies were actually found necessary.

This Association is of opinion that veterinary surgeons employed by Government and by local bodies should be empowered by law to examine all carcasses of animals exposed for sale at public markets within the areas under their jurisdiction and take such steps as they may think proper to prevent diseased or putrified flesh from reaching the public.

This Association condemns the salary scale offered by the Registrar of Co-operative Societies to veterinary surgeons. The salary scale of Rs. 100 to a veterinary surgeon is in the opinion of the Association iniquitous, insulting and unjust to the profession.

With Dismay

The Director of Agriculture, Mr. L. J. de S. Seneviratne, who opened the conference of Veterinary Surgeons at the G.O.H., referred to the memorial submitted to the Minister by that Association and said that

certain views placed by him before the Minister had been stressed by that Association.

"I shall with your permission", he said, "mention one issue which which might prove to be of general interest. I am impelled to do this especially because I read with a great deal of dismay in one of your periodicals that the veterinary profession in Ceylon does not command the respect of the public. I half believe that this has been said to rouse the indignation and thereby the enthusiasm of members for your cause. I myself do not feel that this statement is substantially true; and if for no other purpose but to prove that, there are many who think as I do.

"I give you now the greetings of the Minister and his assurance (given to me long before I read the passage in question) that he fully recognises the importance of the profession, to the well-being of this island to which you belong and is completely in sympathy with your efforts to preserve your professional interests and to spread throughout the island the benefits of your science.

"Speaking for myself, I would say that if the public holds such a belief the worse for the public and I regret, to say for the island. I would like to place before you my personal reasons for this assertion. They are:—

"In the absence of a class of professional stock-owners, it is necessary to teach those who wish to take up this industry, *ab initio*. This duty must necessarily devolve on those who have made a scientific study of animals, namely, the veterinary surgeons in this island.

"As a result of the poverty of livestock owners in general and the poor quality of the livestock themselves it is uneconomical for them to seek the services of trained veterinarians. Veterinary surgeons must, therefore, look to the Central Government for employment generally speaking.

"The lands available for development in Ceylon lie mainly " the dry zone. Roughly about 5,000,000 acres will ultimately have to be developed under a system of arable cultivation. Research carried out so far points to a system of alternate husbandry as the best means of getting results, while preserving our capital asset, the soil. This implies that no less than 2,500,000 acres will of necessity have to carry livestock every year in order that the remaining 2,500,000 acres may carry annual crops. This does not take into account the 1,000,000 acres under coconut which also can be utilized for livestock grazing; nor the ample quantities of straw from say 2,00,000 acres of paddy lands for aftermath grazing. It therefore follows that the scope of employment for those interested in livestock is extremely wide and will progressively increase from year to year. "The emphasis on

milk and eggs as protective foods in all schemes of nutrition only helps to widen the scope. Even for our population of 6,000,000, our present outturn of milk is woefully inadequate.

'In view of the above facts, it is necessary to view the island's problem of agriculture and stock raising as one and it is very unlikely that the Government to whom both interests are vital, will be content to take a purely sectional view.

Closest contact

"Success cannot be achieved", he explained, "without the closest contact between the agricultural, livestock and veterinary services. How that co-operation can be achieved must be worked out with the greatest care in the future? For on it, success or failure will hinge.

"It must be recognised", he concluded, "that this business of contacts is two-edged weapon, for it either makes or mars. But with a spirit of friendliness and goodwill, disaster can be averted and success can be achieved."

Several subjects relating to the veterinary service were discussed at the conference.

At the lunch which followed, Mr. George E. de Silva, Minister of Health, the chief guest, pointed out that the grievances of the veterinary surgeons were not peculiar to that Association alone. Those complaints were common. He would ask the members of the Association to fight for their rights. They must agitate and without agitation nothing could be achieved. He agreed that the veterinary surgeons could not have performed wonders in regard to the recent outbreak of rinderpest. In spite of all criticism he realised that they had done what they could.

He was sure his colleagues would realise the importance of the veterinary service and redress their grievances. If state aid and recognition had been niggardly in the past, he explained, it was not due so much to a lack of appreciation of the utility of that work, but to administrative difficulties. He hoped that the association would grow in strength and maintain their dignity.

Mr. D. Seneviratne M. V. S. Kandy proposed a vote of thanks to the Director.

Visitor's Address

Major Datta, a visiting veterinarian from India, also urged that it was high time that the Government realized that a veterinarian was not merely a donkey-doctor, a cowboy or a farrier. Despite the fact that in Ceylon the entire profession was confined to a meagre membership of 44 (who incidentally had to deal with the ills of two million livestock, not to speak of a

larger number of goats, cats, poultry and game) their contribution to the development of livestock and the welfare of human nutrition could not be despised.

He claimed that a proper care of animal-health vitally affected the progress of human health. The elimination of human rabies for instance, could never be achieved unless the minutest care was exercised to eliminate the disease from dogs. He deplored the sparing recognition afforded to the veterinarian and hoped that the profession would decide to call itself by a better name which he thought would be conducive to its obtaining its rightful place in the sphere of science.

Best local strains as good as any from outside

Indian Veterinarian's Impressions

Summing up the difficulties that confront the veterinary profession in Ceylon and the most effective means of overcoming them Major Datta, a visiting veterinarian from India said at yesterday's conference of the Ceylon Veterinary Association that the surest way to improve their position economically was not to beg for better remuneration but to seek to improve the quality of the livestock and also to establish means of industrializing every part of the animal as was done in most progressive countries. In their endeavour to make the livestock industry more paying they should be complete husbandmen and make the rural districts their experimental stations.

As regards breeding, he contended that the best of local strains were as good as any imported variety. If this was not conceded local strains would never have the opportunity to improve.

He also emphasized the importance of research and the personnel that should undertake it. He advocated the recruitment of experts from abroad if necessary in order to obtain the best results. Such experts could be gradually replaced by Ceylon Veterinarians who could not do better than avail themselves of the facilities available for study and research in Indian institutes and in South Africa. In this connection he also advised veterinarians to send men to Australia to study breeding methods.

The conference also discussed several papers read by members of the Association. A paper on "Local Foods for our Livestock," read by Mr. Hector C. Perera, the Hony. Secretary of the Association provoked much discussion and was described by Major Datta as "the best of the series."

Mr. L.A.P. Brito-Babapulle proposed a vote of thanks.

"Ceylon Observer"

Veterinary Services

"The fourth annual conference of the Ceylon Veterinary Association during the week-end is a fresh reminder of both the importance and the present backwardness of veterinary science in the country. No one is more acutely conscious of the deficiencies of the service than the Association, whose official Journal comments editorially "At the present rate of progress, Ceylon may have a veterinary service adequate for its needs in the year of grace 2944 A.D. It has been suggested to us that even this is too optimistic an estimate". The needs of the country have been emphasised by the war, which has revealed the alarming inadequacy of our livestock industry, and the science on which its health and prosperity depends, to meet even our present day needs. It is evident how much greater this inadequacy must be to meet the requirements of a properly planned scheme of national health and food supply in the future. Investigations into local problems of nutrition have revealed the need of a much greater consumption of milk and dairy produce; and the implementation of measures to provide the necessary food values should be foremost among the Government's efforts to raise the standard of public health.

The Minister of Health admitted at Sunday's conference that State aid and recognition of the work of veterinarians in the past had been "niggardly", and said it was due not to imperfect appreciation of their worth but to "administrative difficulties". The journal of the Association remarks that the veterinary service has gone on for some fifty years, and that "its total overall strength today stands at the staggeringly low figure of 44. Three of these men are in retirement, four are in the fighting services, and four are private practitioners. In other words, Ceylon has pressed into service less than one veterinary surgeon every year for the last fifty years." On the staff of Government and municipal bodies there are in all only 31 veterinarians to deal with an animal population of two million buffaloes, cattle, goats, horses and swine—excluding dogs, cats, poultry and game. Far from being specially immune from animal disease as compared with other lands (as an observer from another planet might be tempted to infer from these facts), Ceylon has been the scene of an outbreak of rinderpest unabated after two years, and foot and mouth disease is prevalent all the year round.

Partly because of the ravages of disease in recent years, and partly because of the greatly increased demand for meat, the war has witnessed an alarming reduction in our cattle population, even more marked here than in other countries where the war has brought about similar conditions; and the nation's health would have sustained greater damage than it has in fact sustained if it were not for the fact that we were able to fall back upon imported foodstuffs and to meet some of our requirements with preserved milk foods from abroad. Our future programme should be not merely to increase the quantity of our livestock and its products, but to improve the

quality. It will obviously be necessary to have available the experience and advice of men with technical qualifications. Our present quota of trained veterinary officers is grotesquely insufficient and might perhaps be improved if the Government appreciated, in the words of a visiting speaker at Sunday's meeting, that a veterinarian is "more than a donkey-doctor, a cow-boy or a farrier". The Director of Agriculture has recently pointed out that most people in Ceylon cannot afford the luxury of veterinary advice; and this is obviously a factor for which the Government should make provision in the future. The great possibilities for development will be apparent to those who digest the figures adduced at the Conference. But these possibilities will never materialise without active interest, determination, enterprise and vision on the part of the State."

Editorial, "Daily News".

Correspondence

The views expressed in letters addressed to the Editor represent the personal views of the writer and must not be taken as expressing the opinion or having received the approval of the A.I.V.A.

South Indian Slaughter Houses and their Present Condition

Dear Sir,

Judging from my observations and personal experiences of some of the slaughter houses, I am of opinion that the meat inspection work conducted in these places, is most imperfect, deplorably unsatisfactory and unscientific. In these days when we talk so much of the improvement of public health in towns and villages of India, it is un-pardonable on the part of our authorities to leave the problem of meat inspection in such a scandalous state. The two slaughter houses of Madura and Coimbatore—most important and densely populated towns of great importance—that I visited during my recent trip, appeared to me like 'Gutter Houses', so filthy, foul smelling and ill-equipped. It was here that I found that the meat animals were slaughtered, dressed and distributed to markets for human consumption. It is no exaggeration when I say that any eater visiting these places, will turn out to be a real vegetarian including the "Vet" who is interested to carry out this work.

From these observations one can easily judge that Public Health authorities—both officials and non-officials—are absolutely indifferent and ignorant of the importance of scientific meat inspection. They do not even seem to have recognised that, maintenance of a modern and well-equipped slaughter house and its efficient management and control, is as

important a problem as general sanitation and public health. Municipal authorities who are responsible in improving and maintaining decent and up-to-date slaughter houses, out of the income derived from these institutions are really guilty of this negligence. When more advanced countries are far ahead in meat inspection we cannot afford to lag behind in these days of scientific advancement. It is high time for the municipal authorities to look ahead and see that a typed plan of all slaughter houses may be prepared in consultation with the veterinary authorities and a qualified veterinary surgeon may be put in charge of all important towns. For the smooth and efficient running of these institutions there must be close co-operation between the Health Officer and the Veterinary Surgeon, who should have an independent opinion in all matters connected with this work. The scope for future prospects in the municipal veterinary service being limited and the posts being non-pensionable, the Veterinary Surgeons should be adequately paid according to their qualifications and experience, instead of a niggardly start of Rs. 60 or 70. The veterinary surgeons should be directly responsible to the commissioner of the municipality for his official and professional work and not under the control of the health officer. But there is no harm for these officers to co-operate with each other in carrying out the work efficiently without having any sort of ill-feeling or misunderstanding.

A few practical suggestions which I gained from my long experience in a most modern and well-equipped abattoir with regard to the management, control and the method of scientific meat inspection will not be out of place for the information of those who are engaged in municipal work.

Public Abattoir is one of the important limbs of the municipal body where a complete and scientific method of meat inspection is carried out under the control and supervision of one or more qualified veterinarians with a number of other staff attached to it. It should be located away from the congested part of the town preferably on the side of a canal or a river—to facilitate efficient drainage. There should be separate buildings for sheep and goat, cattle and pig if any situated at respectable distance in the same compound. All buildings should be made of bricks and concrete avoiding as far as possible wooden materials. Floors and walls must be made of concrete so that they may be kept perfectly clean after slaughter; ceiling smooth and painted to prevent collection of grease, filth, dung and blood. A separate place should be reserved for killing, dressing and washing and another place for inspection alone. These two should never be done in one place. After dressing and cleaning the carcase it should immediately be shifted to inspection room and hung on specially arranged sanitary hooks. Every time the bowel contents are emptied they should not be allowed to remain there to attract flies and bad smell. They should be immediately removed to a manure pit made of concrete away from

SOUTH INDIAN SLAUGHTER HOUSES AND THEIR PRESENT CONDITION 375

the slaughtering place. The following accessories should be attached to a slaughter house to make it of a modern type.

1. An offal room to collect bones, hides and horns.
2. Detention room to keep suspected carcases under observation.
3. Plenty of water at all times to keep the whole place absolutely clean during slaughter and after slaughter and to clean the guts.
4. Necessary inspection equipments such as metal hooks on the wall, watering tanks, sanitary hooks, knives, towels and municipal stamp of approved pattern, and a small table to keep all internal organs for inspection.
5. Closely attached to each slaughter place, a lairage is necessary where the animals are to be detained previously for rest. This will help anti-mortem examinations to be conducted at any time. Animals to be slaughtered in the morning are to be brought and kept in the lairage the previous evening. Arrangements should be made for feeding and watering animals until they are slaughtered. The lairage also should be a pucca building.
6. An office for veterinary surgeon and his staff for keeping records and a room for microscopical work.
7. A quarter for the meat inspector and lines for dressers and labourers are also provided in big slaughter houses so that the people may always be present for any emergency work.
8. In a modern abattoir as that of 'Penang' it is necessary to have a well maintained garden to add to the beauty of the slaughter house compound.

Inspection work consists of careful examination of each carcase by a general look as to its colour and appearance, cutting and exposing the various glands of the body, feeling and manipulating certain parts as lungs, spleen, liver, kidneys, tongue, squeezing out the contents of passages and cavities, bacteriological and chemical examinations if necessary, detention of examined carcases for some time before releasing for proper setting, destruction of condemned carcases and organs-part or whole—in the presence of the veterinary surgeon. From these one can easily understand that the responsibility of a 'Vet' to guard human health is not a light one when it is realised that meat which, may look good outside, may be capable of causing severe illness or even death to the consumer.

Method of slaughtering are many which it is difficult to describe in detail. Whatever method is adopted the chief object is to kill the animal as quickly as possible to avoid unnecessary pain and suffering and to bleed properly so as to increase the keeping quality of meat. If this is not done properly decomposition and putrefaction may set in on account of large

amount of blood contained in it. A bold cut on the throat with a sharp knife severing the connection of artery, vein and trachea, is the common method adopted in India and other countries. The sikhs cut the neck of a goat by one bold stroke causing instantaneous death. In countries more advanced in meat inspection particularly Europe, America and even in Malaya in the East animals intended for slaughter are stunned now by mechanical means by the application of electrolethalers invented by Professor Maxmuller and his engineer colleague Mr. Weinberger. In all big abattoirs of Malaya this method has been in use for the last 10 years and applied only to pigs.

The operation is a simple one and any one with a little bit of training can apply this with safety. The instrument should be applied behind the ear and the current switched on a few seconds and then the current may be switched off when the animal falls to the ground. Less than ten seconds are required to stun a pig and the symptoms generally observed are closing of eyes, tilting the head up-wards, forelegs become stiff and extended, hind legs contracted, tremblings of the muscles, and finally the animals will go into a sitting position. At this stage they are taken into a table and stabbed right into the heart with a sharp pointed knife by the Chinese who are experts in that art.

The advantages in this method are that it is humane, instantaneous in action, economic in use and safe and ensures complete bleeding.

Realising that meat and milk are carriers of disease to man, meat inspection service has far advanced and organised in other countries with the object of protecting the health of the meat eating population and preventing the purchase of un-wholesome and unsuitable meat. This work is therefore an application of sciences of comparative anatomy, pathology, bacteriology and animal diseases and to entrust it to people ignorant of such sciences is barbarous and dangerous. It is therefore my earnest appeal to those who are responsible for public welfare—officials and nonofficials—to make suitable laws for the proper control and management of these useful institutions, the construction of typed plan of modern abattoirs and insist on the appointment of full-time veterinary surgeons on an attractive salary.

The re-orientation of this work should be given a prominent place in the public health schemes recently prepared and submitted to the Government of Madras by the post war reconstruction committee.

Health is the Foundation Upon which Rests The Happiness of the People and the Power of the state.

Trivandrum, }
15-12-44. }

M. V. PILLAY.

Importance of Veterinarians in India

Sir,

I find a very hopeful and interesting discussion in the correspondence column of your Journal of September 1944. It reminds me of a professional friend who would not introduce himself as a Veterinarian for fear of being slighted and ignored. Although I am not able to appreciate his views fully, I feel that he is partly justified in taking up such an apparently unreasonable attitude, for, we can't really expect to get due considerations from others, when we meet them as a Vet, no matter how awfully clever we may be. There surely exist many intelligent persons in the Veterinary Profession, but, unfortunately there also exist, what I consider to be good reasons, to make them suffer from inferiority complex. In fact it is no longer a mere complex which one can afford to overlook. It has become a deadly disease that needs proper treatment, but, it is curious to note that those in power are only advising the patient to treat and cure himself. I am inclined to think that no amount of drum-beating is going to help us not until the causes of such complexes and inefficiencies are removed by competent persons. Trying to dominate the world, will, I am afraid only help to make us more ridiculous. All that we can do is to sweat hard and turn in dog-tired every day. That way is perhaps the only sure way of gaining recognition and popularity.

MUKTESWAR, } M. ISRAIL,
16-10-1944. } I. V. R. Institute,
Mukteswar—Kumaun, Dist. Nainital, U. P.

Development of Livestock

One day Cattle Show for Pure Bred Omblacherry Cattle.

Successful show at Tiruturaipundi.

Sir,

With a view to the development of pure-bred pedigree sires and heifers of the reputed Omblacherry Breed of Cattle, native to Tanjore District and to infuse keen and robust enthusiasm and optimism in the endeavours of cattle owning ryots in relation to augmentation of their cattle-wealth, a one day Cattle Show for the pure-bred Omblacherry livestock of the Taluq of Tiruturaipundi, was successfully organised and held in the spacious stalls of the local Veterinary Dispensary, on the noon of Friday the 8th December 1944 under the joint auspices of the Civil Veterinary Department of the district and the Omblacherry Co-operative Breeding Farm and Society, Tiruturaipundi. The grounds and stalls were beautifully decorated, classified and demarcated to display separately, stud-bulls, bull-calves, heifers, bullocks and cows. A total number of 150 pure bred

head of cattle were admitted to the Show and 15 prizes were awarded to the several varieties displayed by the owners.

The Show was preceded by a Tea-Party to the President of the function Mr. S. Avudayappa Pillai, B.A., Revenue Divisional Officer, Mannargudi, by a committee of hosts, and was attended by prominent officials, dignitaries and livestock breeders of the taluq.

The Show which commenced at 3 p.m., was presided over by Sri Avudayappa Pillai, R.D.O., Mannargudi. Prominent among those were Messrs. V. Janakirama Ayar, G.M.V.C., and T. A. Viswanath Ayar, G.M.V.C., District Veterinary Officers of Tanjore and Trichinopoly and a host of Veterinary and S.P.C.A., officials.

The President along with Messrs. Sayyed Ibrahim Saheb, the District Munsiff, Mr. R. Seshayya, the Secretary of the Association and the two District Veterinary Officers formed a committee of judges and adjudged the award of prizes after a keen and intensive inspection of the relative merits of the animals displayed. Strict rules of adjudication were rigorously observed and the inspection extended over three hours. After the award of prizes to respective successful animal owners, Mr. Seshayya, the Secretary of the Association and the joint organiser of the function in extending his vote of thanks to one and all made a fervent appeal for the development of livestock wealth and milk products and milk supply in the district, on which alone, the country's health, wealth and prosperity would be based and built.

B. SESHAYYA. M.A., B.L.,

Secretary,

Omlacherry Co-operative Breeding Farm and Society,
Tiruturaipundi.

Extract

THE LIVESTOCK CENSUS OF 1940*

By

S. K. SEN, M.R.C.V.S.,

Assistant Animal Husbandry Commissioner
I.C.A.R., New Delhi.

Despite the present shortage of paper leading to the holding up of important publications not connected with the war effort, the authorities responsible for the publication of the Fifth Quinquennial Livestock have done well in bringing out the document, when use can be made of it for shaping policies for the fuller exploitation of animal wealth in the postwar period and to calculate the extent of help this country with her surplus livestock will be able to offer to devastated continents.

* *Indian Farming* Vol. V, No. 3.

The report, which is the fifth of its kind, presents separately for the provinces and states the numerical strength of the different species of domestic animals, including poultry, and agricultural machinery, as it stood in 1940.

Although the enumeration commenced as early as January 1940, the report was released only at the beginning of 1943 owing to the participation of a large number of Indian States in the census, the introduction of amplified classifications which greatly complicated the tabular work, and the late receipt of many of the returns from some of the Indian States necessitating reconciliation of discrepancies by prolonged correspondence.

Previous Censuses. The first livestock census in British India was held in 1920, as the result of a decision reached by the Government of India in consultation with the Provincial Governments to hold such enumerations every fifth year, and the Indian States were invited to join. The 1935 census marked a distinct departure from the previous three censuses in its scope in as much as reliable information as to (a) the number of unused cattle which the country supported at the cost of others, and (b) implements and machinery introduced in India for agricultural purposes, was made available. The special feature of this census, however, is that it presents a more complete picture by providing the additional enumeration of pigs and poultry and recording urban and rural population separately, but unfortunately, these revised classifications were not uniformly adopted by some of the provinces and states, which presented their figures in the old form. In the census of 1935 two important provinces, Bengal and Bihar and Orissa, failed to participate owing to financial reasons, and on similar grounds the United Provinces and Orissa dropped out from the present census. The figures for Burma, which was separated in 1935, have been excluded. Although Baluchistan has, for special reasons, been permitted to hold the livestock census decennially along with the human population census, it has been possible to include in this report the figures for 1941. As regards Indian States, the enumeration in the present report covers about 79 per cent of their total areas as against 66 per cent of the previous census. Owing to the lack of uniformity, extensions of areas under enumeration and provinces not participating regularly, the figures set forth in the last two censuses do not represent those for the whole of India and therefore are not comparable for the purpose of reviewing the trend of animal population.

Census Figures Compared. For the purpose of comparison, the census figures for different classes of animals of the provinces which participated in both 1935 and 1940 censuses and the total population in Indian states are shown in Table 1. The total Bovine population in British India and the Indian States, as calculated from the 1935 and 1940 census reports, has declined from 208 millions to 207 millions. It will be observed in Table 1 that the Bovine population in British India (excluding Bengal, the United Provinces, Bihar and Orissa) has dropped by about three and a half millions, while that in the States has increased by six millions. The apparent increase in the latter does not indicate an actual multiplication, because larger numbers of animals were brought within the scope of enumeration due to the extension of area.

TABLE I
Comparative Statistics of Livestock for 1935 and 1940
British India (excluding Barma, Royal Bihar, Orison
and the United Province).

CATTLE	1935 (in millions)	1940 (in millions)	Percentage increase or decrease
Bulls and Bullocks ...	22.0	21.2	-3.63
Cows ...	17.2	16.5	-4.06
Young stock ...	16.3	14.7	-9.02
Total cattle ...	55.5	52.4	-5.59
Buffaloes:			
Male buffaloes ...	2.9	2.5	-13.8
Cow buffaloes ...	8.9	9.4	5.62
Young stock ...	7.3	6.7	-8.22
Total buffaloes ...	19.1	18.6	-2.6
Total bovine ...	74.6	71.0	-3.21
Sheep ...	19.9	23.5	18.09
Goats ...	17.8	19.2	7.86
Total ponies and horses ...	.8	.81	1.25
Pigs ...	—	1.2	—
Poultry ...	—	30.1	—
Ploughs ...	11.3	11.6	2.65
Carts ...	3.5	3.6	2.86
INDIAN STATES			
Total bovine ...	54.3	60.4	11.2
Sheep ...	18.0	19.9	10.6
Goats ...	15.6	19.5	25
Horses and Ponies ...	.73	.71	-2.74
Ploughs ...	6.4	8.3	29.7
Carts ...	2.0	2.4	20

TABLE II
Comparative Statement of Statistics of Total Bovines
In each Province in Millions.

PROVINCE	1925	1930	1935	1940
Ajmer-Merwara ...	.4	.44	.48	.19
Assam ...	5.7	5.6	5.9	6.4
Bengal ...	25.4	25.2	—	23.6
Bihar and Orissa ...	20.7	21.3	—	20.3
Bombay ...	10.8	11.7	9.9	9.7
C. P. and Berar ...	11.6	14.3	13.8	13.2
Coorg ...	.1	.1	.1	.14
Delhi ...	.15	.1	.1	.14
Madras ...	22.1	22.4	24.6	22.1
N. W. F. P. ...	1.0	1.0	1.0	1.0
Punjab ...	15.2	14.2	15.8	15.4
Sind ...	—	—	2.6	2.3
United Provinces ...	31.0	31.4	32.4	—

Fodder Scarcity Decreases Cattle Population. In the usual course, however, it is only natural that, with the rapid rise in the human population, resulting in further fragmentations of holdings and extension of cultivation for food crops along the marginal areas and fallows, cattle should also proportionately multiply for meeting the extra demand for bullock and more milk and manure, but on the contrary the number has decreased. No special reasons can be ascribed for this reduction, apart from the seasonal scarcities of fodder which occurred from time to time in certain areas, causing mortality and the regional exodus of cattle. It is rather strange that, in spite of continuous famine conditions prevailing in certain tracts of the Punjab, there has not been any marked decrease in the total bovine population in the Provinces as can be seen in Table II, which gives the total bovine population figures in each province in British India from 1925 to 1940.

Economic depression affects livestock production. From the statement of mortality, as found in the annual reports of Civil Veterinary Departments, due to contagious diseases in bovines which occurred during the quinquenniums ending 1935 and 1940, it will be seen that there is no significant difference, the figures being 1.24 millions in 1935 and 1.16 in 1940. There can be no hesitation in assuming that contagious diseases played no part in the decrease. The other interesting factor, the indirect effects of which had limited considerably the normal activities of the village breeder, was the acute economic depression, which swept over the remote countryside, affecting the rural economic structure and livestock industry. With the general fall in the price-levels of commodities, livestock production became comparatively uneconomic.

Economic value of sheep and goats. Sheep and Goat populations show a remarkable rise, both in provinces and states. This increase may be due to the greater appreciation of these small animals by the cultivator, because of their valuable contribution towards his income. Their maintenance does not cost him anything, while in return he derives wool, meat, manure, milk and skins. Both the numbers of ploughs and carts show a definite increase which, of course, is in proportion to the increase in human population.

Equines, on the other hand, have declined by 9.6 per cent in British India and by 1.03 per cent in the States. Obviously mechanisation has been the greatest enemy of the equine species in all spheres of their utility.

Unused animals. Another interesting feature of the census of bovines is the number of unsued animals over the age of three years, i.e., cattle which are not used for work, breeding or milk production. The total number of these animals for the whole of India is about 7.5 millions.

Obituary

P. KADAMBAVANASUNDARAM, G.M.V.C.

We regret very much to record the sad and untimely death of Sri P. Kadambavanasundaram, District Veterinary Officer, Tinnevely, (Madras), at Tinnevely, on the 7th February 1945, due to Typhoid which he contracted at Virudhunagar camp.

He graduated from the Madras Veterinary College in 1916 and was employed in various capacities in the Civil Veterinary Department, Madras. He was also on active field service during the Great War. He was due to retire very shortly but alas! he was snatched away prematurely. He leaves behind his widow, two daughters, four sons, a sister, three younger brothers (of whom Mr. P. S. Sundaram, G.B.V.C., Assistant Director of Veterinary services, Berar Division is one) and a large number of friends and relatives to bemoan his loss.

He was a Life Member of the All-Indian Veterinary Association, Madras Branch, and took an active part in its affairs.

We offer our sincere condolences to the members of the bereaved family.

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