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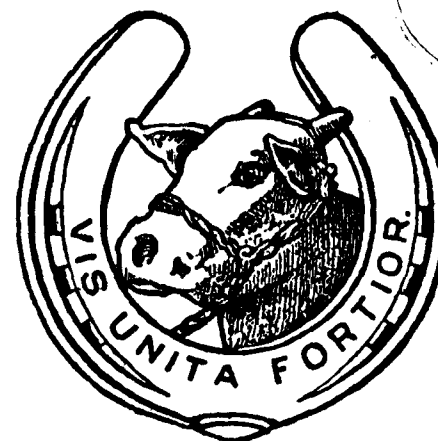
MAY, 1955

THE INDIAN VETERINARY JOURNAL ^{AES}

(The Journal of the All-India Veterinary Association)

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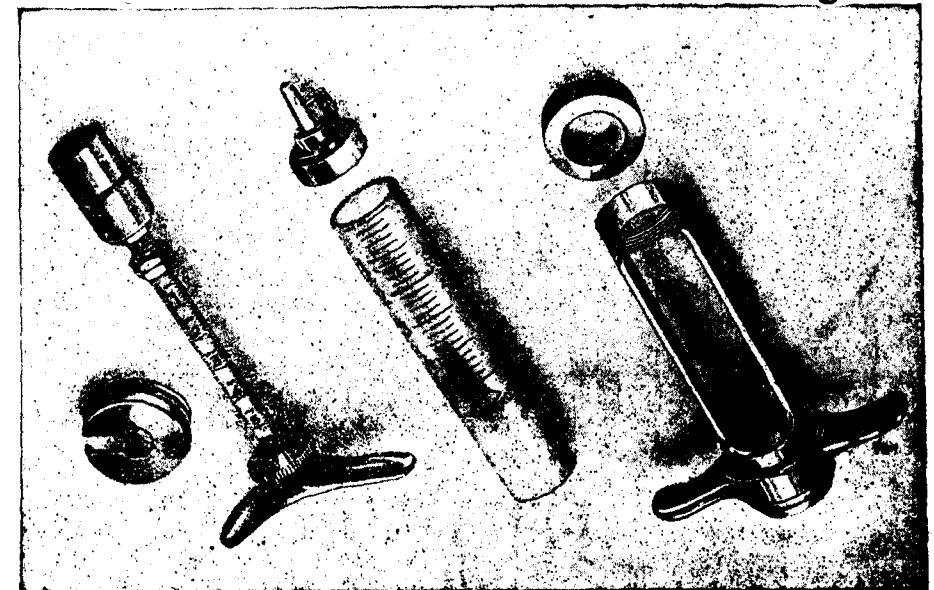
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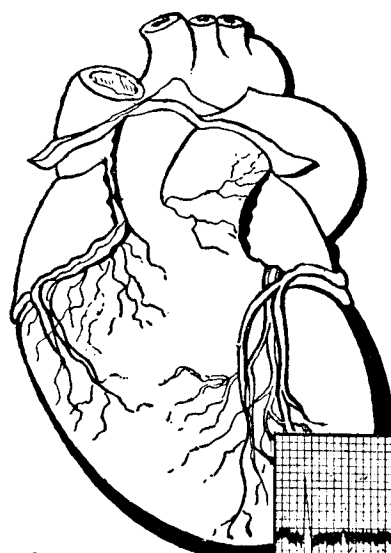
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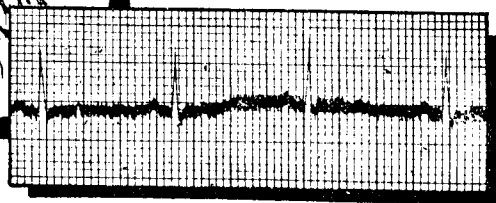
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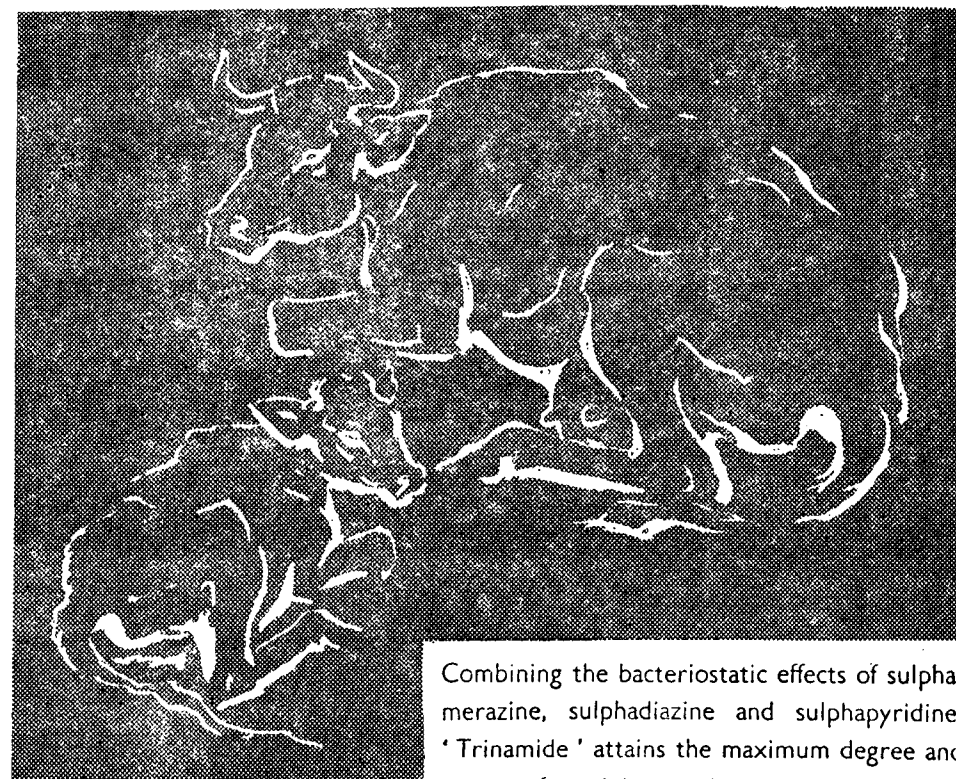
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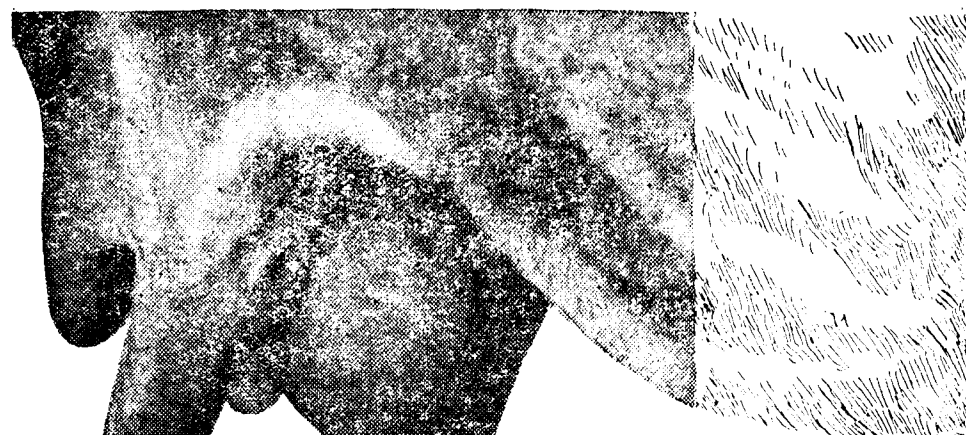
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THE Indian Veterinary Journal

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Vol. XXXI

MAY, 1955

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Editorial

THE IMPROVEMENT OF INDIA'S CATTLE WEALTH

2. NUTRITIONAL RESEARCH

In our November 1954 issue, we referred to the Gosam-wardhan Week that is celebrated in our land annually in order to draw pointed attention to the importance of improving the cattle wealth of this vast agricultural country. We said therein that such celebrations, "are not by themselves going to bring about cattle improvement. What is needed therefore is a *well planned scientific approach to the problem*." We are glad, this view was forcibly expressed by the Prime Minister of India, Pandit Jawaharlal Nehru when he inaugurated the Golden Jubilee Celebrations of the Madras Veterinary College. He said "Therefore, I think that those people who want to adopt, instead of a rational and scientific attitude to this important problem (Improvement of cattle wealth) a soppy and sentimental attitude, do more harm than good."

The one single factor that has been the greatest impediment in the improvement of the cattle wealth of the land, is the lack of food both in quantity and quality for the millions of livestock that help man to build up the Agricultural industry of this country and feed the teeming millions of its human population. This has been repeatedly brought to the notice of the Government and the public by all scientific men working on this problem and by the field workers. And yet the problem remains where it was decades ago. Let us face facts squarely. We ask

in all seriousness what definite steps have been taken to remove this shortage of cattle feed both in quantity and quality? Here is what Dr. Wright has said in his report on the Development of the Cattle and Dairy Industries in this country. "The majority of Indian dairy cattle are seriously under-fed. This is apparent from a superficial inspection of village stock which lacks the sleekness and bloom of well-fed cattle and not infrequently have an emaciated and malnourished appearance. It is equally apparent from the slow rate of growth, the late maturity and the long dry periods of Indian cattle which are kept under village conditions". Have they statistically assessed what this loss means to the country in monetary value? At least on considerations of humanity, if for nothing else, this starvation of Indian cattle (for it is nothing less) should be tackled immediately on a planned basis. True it is, feeble attempts are made here and there to solve this problem but they do not touch the fringe of this gigantic problem. Great problems require great efforts for their solution and yet decades on end no body seems to get down to brass tacks where this fundamental aspect of cattle development is concerned. How can any development take place on under-feeding, malnutrition, etc. Here is what Dr. K. C. Sen says in his book on 'Animal Nutrition Research in India'.—After furnishing all the available food supply for the animal population of undivided India (based on 1941 data) the learned Doctor says.—"Omitting sheep, goats and horses from the calculations and considering the 215 millions of cattle only, the dry matter supply per head per day comes to about 4.4 pounds, of which only 0.2 pound is concentrate. If the average body weight of the Indian cattle is assumed to be only 400 pounds, then the average dry matter requirement per head per day is about eight pounds. It is apparent, therefore, that even for maintenance, the available food supply is 45 per cent short of the actual requirements." That is with regard to maintenance ration and what then is the position if Production Ration also is taken into consideration. Have any steps been taken to stop export of what little cattle-feed is available in the land? Have steps been taken to import cattle-feed to meet the shortage and exercise a control over its distribution? If that is going to make the

cattle-feed costly, it is a fit case for the Government to subsidise it. The return from such a course, in way of improved milk supply and improved livestock will be enormous. Have legislative measures been taken to enforce greater production of cattle food and fodder? Are such measures beyond the capacity of a Government which with a stroke of its pen has abolished the Zamindari system or effected the Temple-entry for Harijans, over-night? Why then such apathy where the cattle wealth of the land is concerned? This is the position with regard to the quantity of cattle food required and now let us pass on to their quality.

India has often been described as a land of contrasts. This is true of several phases of her existence—from her people with varying customs, manners and habits to her meteorological variations and soil complex. And yet can it be said a systematic research is being carried on to determine on a regional basis "the yield and chemical composition of fodder crops and dry roughages as influenced by various factors, the nutritive quality of the feeding stuffs available in the country, the requirements for maintenance and production, the conservation of feeding stuffs, the question of deficiency and malnutrition and other related problems". How then, to advise the ryots on proper feeding on a balanced diet and all the rest of it.

Mr. T. J. Hurley who was the Director of Veterinary Services, Madras, for a number of years and reputed for his sobriety of views on all Animal Husbandry matters drew the attention of the Government so long ago as 1944. Presiding over the Provincial Veterinary Conference, Madras, he said, "A substantial proportion of the mortality and morbidity of our animals is the result of nutritional deficiencies. This may operate as in gross malnutrition as observed during the dry season or in periods of famine or in a less obvious manner when there may be sufficient food but it is deficient in some essential, a mineral, a vitamin, or a trace element predisposing the animal to microbic or helminthic infestation." Nutritional causes I am afraid are responsible to a very large extent for the under-development of

our stock and if any headway is to be made on their improvement, I consider it very essential to have systematic surveys of the various districts and even taluks undertaken which would give a true picture of the chemical characters of the soils and the deficiencies in essential elements prevailing. With the information thus obtained it would be an easy matter to make good the deficiency in the diets of animals”.

This fundamental research, this first step in cattle development, is yet to be seriously tackled by the authorities concerned. And when we hear of the proposed importation of Jersey bulls for seed material, we begin to wonder if we are not making a beginning at the wrong end. We will be the last to discourage any attempt in the direction of cattle development of our land; but we feel that first things must come first. Unless and until this first step is taken, cattle development in this land will be a myth.

TRIBUTE FROM HIGH QUARTERS

It is not always that a Minister of a State or of the Central Government thinks aloud and indulges in plain speaking. It is a common convention amongst these high personages to be delightfully vague and unnecessarily reserved in all their utterances giving one the impression that they speak with a lot of mental reservation. There may be sufficient reason for this or may not be. We do not pretend to know the exact cause or causes. But when a Minister of the status of Dr. Panjabrao Deshmukh of the Government of India thinks it fit to compliment the All-India Veterinary Association and the Veterinary Profession in public, from an All-India platform, we may be excused for drawing pointed attention to those compliments.

It is indeed a remarkable piece of address which he delivered when he inaugurated the combined Session of the XII All-India Veterinary Conference and the Madras State Veterinary Conference on the 18th January 1955. There is

enough advice in that to all concerned. “Associations like the All-India Veterinary Association are a *vital need for the healthy growth of every profession.*” (Italics are ours). Now let us pause and think what this means. Many seem to entertain the idea that there may not be need for the All-India Veterinary Association any more, now that the Indian Veterinary Council has come into existence. This is a bit of confused thinking and mixing up of issues. One is an official body brought into existence to register and regulate the conduct of the profession and perhaps to serve as a consultant body for laying the policy and programme of work to be turned out in this country. But the All-India Veterinary Association is purely a professional body caring for the “healthy growth” of the profession as the Minister puts it, by providing the necessary “press and platform” for discussion of professional and other cognate matters. Its record of work for the last 31 years is there for any one to scan and study. Of this, we shall take another opportunity to discuss in greater detail. Suffice it to say, that the Hon’ble Minister thinks that it is a “vital need” to have Associations of the type of the All-India Veterinary Association. What more, he says, “Like the string of a rosary, these Associations serve to link together their members wherever they are placed and the periodical Conferences provide a common platform for mutual exchange of views”. He further adds “These Associations maintain the profession alert and trim so as to be of the best possible service to themselves as well as to the nation. This can happen only if the members keep a due sense of realism and sobriety.” What words of wisdom to the profession to follow!

Next he compliments founders and workers of the All-India Veterinary Association. “Likewise, we must also admire the fortitude of that small band of workers who working against many odds, succeeded some 30 years ago in organising an All-India Veterinary Association. These pioneers and all those others who have laboured hard not only in keeping this Association alive but also in making it a representative body of the profession deserve a reference and a tribute for what they

left behind." These are heartening words indeed which we miss, more often than not, from the mouths of the members of our own profession. Hence they sound sweeter when they come from such an unbiased person of the eminence of Dr. Panjabrao Deshmukh.

Now let us see what he says regarding the actual achievements of the profession. "Veterinary Science and Animal Husbandry in India have made considerable strides in the past few decades and some at least of the achievements have been remarkable indeed." That he did not indulge in mere words of courtesy is evident from the fact he had sounded a note of warning as well to the profession. He says "But no progressive organisation can rest content on past glories. We still have such a tremendous ground to cover that the task before our Veterinarians is of a gigantic magnitude. The real burden of this gigantic task, however, rests on our workers, who have to discharge efficiently the duties entrusted to them". Thus there is enough advice in that address and we are thankful to Dr. Panjabrao Deshmukh for such straight talk to the profession.

SIR ALEXANDER FLEMING

World mourns the loss of one of its greatest benefactors, in the passing away of Sir Alexander Fleming, the discoverer of Penicillin. We had the good fortune of meeting him when he visited Madras in 1953. He impressed us as 'great' in every sense of that term. His humility was touching. His example of service to humanity will endure till the world lasts. We offer our condolences to the members of the bereaved family.

General Articles

STUDIES ON HAEMORRHAGIC SEPTICAEMIA VACCINES

The effect of adjuvants upon the immunizing value of Formalin-killed *Pasteurella bovisseptica* organisms.

By

S. VANCHESWARA IYER, G.M.V.C., M.S. (Michigan),

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

and

K. RAMANI, G.M.V.C.

Institute of Veterinary Preventive Medicine, Ranipet, Madras.

Received for Publication on 1-2-1955.

Haemorrhagic Septicaemia caused by *Pasteurella bovisseptica* is an important disease of cattle and buffaloes in the Madras State and causes heavy economic loss. It is next in importance only to Rinderpest in the economic loss it causes to the ryots year after year. The disease has a distinctive seasonal incidence occurring mostly soon after the onset of the monsoon rains; and in certain low-lying marshy and deltaic areas and in places having intensive rice cultivation, it is almost endemic. Due to the sudden onset, brief duration and fatal nature of the disease, treatment in most cases is not possible, and the only satisfactory and practical method of control and prevention is by carrying out timely vaccinations of all healthy and incontact animals with suitable vaccines and adopting necessary sanitary measures.

During the past 2 or 3 decades, a Haemorrhagic Septicaemia bacterin or vaccine prepared by growing highly antigenic strains of *Pasteurella bovisseptica* in nutrient broth for a period of 24 to 48 hours and inactivating it later by heat or chemicals like formalin, phenol, lysol, etc., has been used with considerable success in controlling outbreaks of this disease. But the period of immunity conferred by this bacterin is so short and the quality not entirely satisfactory that in many places vaccinations have had to be repeated two or three times a year. Instances are also not wanting in which some of the vaccinated animals were reported to have succumbed to a subsequent infection with the organisms within a short period after vaccination, which may be due either to the insufficient immunity produced by the bacterin or to infection by strains antigenically different from those used in the preparation of the vaccines. This has necessitated further study and research in the manufacture of more efficient and potent vaccines. Rajagopalan (1944) has remarked that, while preparing *Pasteurella bovisseptica* bacterin, care should be taken to see that the essential parts

of the organisms, particularly their surface layers should not suffer by the treatment adopted to kill them. Govinda Rao and Govil (1950) reported that *Pasteurella bovisseptica* organisms grown on the surface of buffered agar in Roux flasks, washed and killed either by heat or by formalin and the concentration of organisms in saline suspension adjusted to opacity tube 20 of Brown's opacity tube, in doses of 5 c.c. conferred adequate immunity in inoculated bovines for a period up to 4 months after vaccination, when two injections were given with an interval of one month. The use of this type of vaccine was confined primarily to the animals in Government Farms in Uttar Pradesh.

Bain of Australia in his studies (1953) on *Pasteurella multocida* for producing improved vaccines for the control of Haemorrhagic Septicaemia in bovines has remarked that *Pasteurella bovisseptica* organism in its first phase, in freshly isolated cultures, shows small capsules which can be easily demonstrated by the Indian Ink method and these capsules have high antigenic value as an immunizing agent against Haemorrhagic Septicaemia. He felt that this capsule was lost after 2 or 3 transfers in solid or liquid media and as such the strains for vaccine production should be used soon after isolation from a natural case of Haemorrhagic Septicaemia. He has also stated that a vaccine prepared with this first phase organisms by suspending the washed growths from surface of agar in formal saline adjusting the concentration of cells to Burrough's Wellcome opacity tube No. 6 or 7 and adding liquid paraffin and lanolin as adjuvants to it in the proportion of 15 parts to 10 parts to 1 part respectively, confers a good and strong immunity against a challenge dose of 5,000 to 50,000 m.l.ds of *Pasteurella bovisseptica* virulent culture. The immunity after the use of this vaccine in doses of 2 c.c. injected intramuscularly was found to be solid after 2 months, but Bain expected that the immunity might last for a period of 6-12 months. The only difficulty with this vaccine was that the resulting emulsion of the adjuvant vaccine was creamy and thick in consistency with the result that it was found difficult to draw it into a syringe with hypodermic needle and inject into animals. To overcome this difficulty he has suggested the use of thinner mineral oils in the place of liquid paraffin. Live, (in his studies (1949) on *Brucella abortus* Vaccines in the U.S.A.) found that Ether-killed *Brucella abortus* adsorbed on alum or combined with talc and mineral oil as adjuvants distinctly enhanced its ability to prolong the state of resistance in guinea pigs more than the same vaccine did without an adjuvant.

In the study reported here, adjuvant vaccines were prepared on the lines suggested by Bain, using a first phase organism of *Pasteurella bovisseptica* with liquid paraffin and lanolin as adjuvants and also using thinner mineral oils like "Shell Ondina 17" and "white shell oil" in the

place of liquid paraffin. A study was also made on the effect of adding alum in 1% concentration as adjuvant to the routine broth bacterin, and to a concentration of bacterial cells similar to that used with liquid paraffin and lanolin and comparing their immunizing value with that of the routine formalin-killed broth bacterin.

Materials and Methods

1. *Preparation of adjuvant vaccine with liquid paraffin and lanolin as adjuvants.*—This work was commenced with the help of Mr. G. G. Alton an Expert assigned to this Institute under the Technical Assistance Programme of the FAO of the United Nations. The first few batches of the adjuvant vaccine were prepared with his assistance. The vaccine was prepared on the lines recommended by Dr. Bain.

From a buffalo-calf infected with a virulent culture of *Pasteurella bovisseptica* organisms (Mukteswar strain 52) the heart blood, pericardial and peritoneal fluids were collected under aseptic precautions, soon after its death. This material was seeded in blood-agar slants which gave a pure growth of the organism in its first phase. Twenty-four hours later, the growth on the surface of the blood-agar slant was washed with nutrient broth and transferred to four-litre flasks containing nutrient broth with a pH of 7.2 to 7.4. After incubation for a period of 18 to 24 hours, the growth in the flasks was examined for purity and freedom from contamination, and formalin (liquor formaldehydi) was added to a concentration of 0.5% to inactivate the organisms. Twenty-four hours later, the formalin-killed organisms in the broth were spun down in an International Centrifuge at 2,500 r.p.m. for 2 hours. The supernatant liquid was poured off and the bacterial cell deposit at the bottom was re-suspended in Normal Saline Solution to a density comparable to Burrough's Wellcome tube 6 to 7. To 15 parts of this suspension, 10 parts of liquid paraffin and one part of lanolin, previously sterilized in an autoclave, were added, and the mixture was worked in a Waring Blender for 3 to 5 minutes to form a stable emulsion. This formed the adjuvant vaccine with liquid paraffin and lanolin.

2. *Preparation of adjuvant vaccine with thinner mineral oils viz., Shell Ondina 17' and 'Shell white oil'.*—Since the emulsion prepared with liquid paraffin was somewhat thick and could not easily be drawn into a hypodermic syringe, thinner mineral oils, viz., 'Shell Ondina 17' and 'Shell white oil' supplied by Messrs Burmah Shell & Co., were used in the place of liquid paraffin. The vaccine was prepared as above using 15 parts of cell suspension, 10 parts of oil and 1.5 parts of lanolin and this mixture was beaten up in a Waring Blender for 3-5 minutes. This produced a stable emulsion, a little thinner than the previous one, which could be drawn into a hypodermic syringe with less difficulty.

3. *Preparation of alum-precipitated vaccine (concentrated).*—To a suspension of the formalin-killed bacterial cells in its first phase as described above, alum (Potassium aluminium sulphate) was added to a concentration of 1%. A sterile 10% solution of alum was prepared and added to the bacterial suspension in the ratio of 9 parts of cell suspension to one part of alum solution. This gave a vaccine containing formalin-killed bacterial cells adsorbed on 1% alum.

4. *Alum precipitated broth bacterin.*—To nutrient broth flasks seeded with virulent *Pasteurella bovis septica* organisms in its first phase and incubated for 18—24 hours, formalin was added to a concentration of 0.5% and 24 hours later alum was added as a 10% solution to give a final concentration of 1%. A flocculent precipitate was thrown down and this was thoroughly re-suspended by shaking before use.

5. *Preparation of Routine broth bacterin.*—The nutrient broth pH 7.2 to 7.4 was seeded with virulent *Pasteurella bovis septica* in its first phase and incubated for 18 to 24 hours. To this, formalin (40% liquor formaldehydi) was added to a concentration of 0.5% and incubated for a further 24 hours.

Bull calves, buffalo and zebu, aged 1 to 3 years and weighing 150 to 250 lbs. were used in these experiments.

The adjuvant vaccines prepared with the mineral oils and lanolin and the concentrated alum precipitated vaccines were injected intramuscularly into the calves in doses of 2 c.c. at the neck or rump. The alum precipitated broth bacterins were injected both intramuscularly and subcutaneously in the region of the neck in doses of 5 c.c. The routine broth vaccine was injected subcutaneously in the region of the neck in doses of 5 c.c. A small diffuse swelling appeared at the region, within 24 hours and disappeared in 48 to 72 hours. About two to three weeks after vaccination these calves were challenged with varying doses of virulent *Pasteurella bovis septica* culture (Mukteswar strain 52). A 24 hour growth of the organisms in nutrient broth in their first phase was used in this challenge and the minimum lethal dose of this culture was determined before each test. It was observed in the study made that 1 c.c. of a 10^{-5} dilution of the above broth culture invariably killed a buffalo-calf aged 1 to 3 years in a period of 18 to 72 hours producing typical symptoms of Haemorrhagic Septicaemia, and occasionally 1 c.c. of a 10^{-6} dilution also produced a fatal disease in them. Prior to each test, a healthy buffalo-calf was injected with 1 c.c. of 10^{-5} dilution and another calf with 1 c.c. of a 10^{-6} dilution of the culture to study the virulence of the culture used and to fix the correct minimum lethal dose for the test. The calves immunized with vaccines using mineral oil

and lanolin as adjuvant and the concentrated alum precipitated vaccine were challenged with 1 c.c. of a 10^{-2} or 10^{-3} dilution of the culture corresponding to 1,000 to 10,000 and 100 to 1,000 m.l.ds respectively, while those immunized with the routine broth bacterin and alum precipitated broth bacterin were challenged with 1 c.c. of 10^{-4} dilution and 1 c.c. of 10^{-3} dilution respectively which correspond to 10 to 100 and 100 to 1,000 m.l.ds respectively. In the actual tests also, control calves were used to assess the virulence of the culture employed and to estimate the correct number of m.l.ds in the tests.

EXPERIMENT I

Three batches of adjuvant vaccine were prepared using liquid paraffin and lanolin as adjuvants and they were injected intramuscularly into three batches of buffalo-calves, each batch consisting of three calves, in doses of 2 c.c. These calves were challenged at the end of 33 days, 21 days and 56 days respectively with 100 to 10,000 m.l.ds of virulent Haemorrhagic Septicaemia culture.

The results are tabulated in Table I.

TABLE I

S. No.	Batch of vaccine.	No. of calves vaccinated.	Dose.	Day of challenge.	Dose of culture.	No. of M.L.Ds.	Result.	Control.	
								Dose used.	Result.
1.	I	3	2 c.c.	33rd day	0.001 c.c.	100	3/3	0.001 c.c.	Died in 23 hours
2.	II	3	„	21st day	0.01 „	1000	2/3	0.00001 c.c.	Died in 100 hours
3.	III	3	„	56th day	0.01 „	10000	3/3	0.000001 c.c.	Died in 22 hours

Numerator: Number survived.

Denominator: Number tested.

The results of the above tests show that animals protected with the adjuvant vaccine having liquid paraffin and lanolin are able to withstand a challenge dose up to 10,000 m.l.ds of virulent culture.

EXPERIMENT II

Two batches of adjuvant vaccine were prepared using 'Shell Ondina oil 17' in the place of liquid paraffin and another two batches with 'Shell white oil' and lanolin. Nine buffalo-calves in all were injected intramuscularly with 2 c.c. each of the Shell Ondina oil vaccine, in the neck of six and in the gluteal region of the other three. Another 12 calves were injected intramuscularly with the shell white oil adjuvant vaccine in the region of the neck. All the above calves were challenged

about three weeks later with 1,000 to 10,000 m.l.ds of virulent Haemorrhagic Septicaemia culture. The results are tabulated in Table II.

TABLE II

S. No.	Batch of vaccine.	No. of calves vaccinated.	Dose.	Day of challenge.	Dose of culture.	No. of M.L.Ds.	Result	Control.	
								Dose used.	Result.
'Shell Ondina 17'									
1.	I	3 neck	2 c.c.	20th day	0.01 c.c.	10,000	2/3	0.000001 c.c.	Died in 24 hours
2.		3 gluteal region	"	21st day	0.01 c.c.	"	3/3	"	"
	II	3 neck	"	22nd day	0.01 c.c.	1,000	3/3	0.00001 c.c.	Died in 34 hours
'Shell white oil'									
3.	I (a)	3	"	21st day	0.001 c.c.	"	3/3	0.000001 c.c. 10^{-6}	Died in 32 hours
	(b)	3	"	"	0.01 c.c.	10,000	3/3		
4.	II	6	"	25th day	0.01 c.c.	1 000	4/6	0.00001 c.c. 10^{-5}	Died in 44 hours
Numerator: Number survived. Denominator: Number challenged.									

The results of the above two experiments indicate that adjuvant vaccines prepared with liquid paraffin and other thinner mineral oils as adjuvants confer more or less the same degree of protection in vaccinated animals. The adjuvant vaccines set up an immunity which can resist a challenge of 1000 to 10,000 m.l.ds of virulent *Pasteurella bovisseptica* culture.

EXPERIMENT III

In this experiment a study was made to see if careful killing of the organism by exposure to heat for a minimum period instead of by formalin will retain its maximum antigenicity and have better immunizing value. A 24-hour broth culture of the *Pasteurella* organism was made to pass through copper coils which were immersed in a water-bath at 56°C. The rate of flow of the culture through the coils was so adjusted that a given quantity was exposed to the heat (56°C) only for a period of 5 minutes. The heat-treated culture after examination for sterility and freedom from extraneous contamination was spun down in a centrifuge. The bacterial cells were

resuspended in saline to a concentration corresponding to opacity tube 6 and an adjuvant vaccine using 'Shell Ondina 17' oil and lanolin was prepared as in the above experiments. Nine buffalo-calves were injected with 2 c.c. of this vaccine intramuscularly, and three weeks later they were challenged with 1,000 to 10,000 m.l.ds. of virulent *Pasteurella bovisseptica* culture. Five of the nine calves succumbed to the challenge, the other four surviving. The result is shown in Table III.

TABLE III

S. No.	Kind of animal and No.	Dose of vaccine.	Day of challenge.	Dose of culture.	No. of M.L.Ds.	Result.	Control.	
							Dose of culture.	Result.
1.	Buffalo-calves-3	2 c.c.	21st day	0.01 c.c.	10,000	2/3	0.000001 c.c.	Died in 40 hours
2.	Buffalo-calves 6	"	25th day	"	1,000	2/6	0.00001 c.c.	Died in 44 hours

Numerator: Number survived in the test.
Denominator: Number used in the test.

In this test, the heat-treatment not only failed to offer any advantage over the formalin inactivation but did not prove even as effective as the latter, as one of the three test calves challenged with 10,000 m.l.ds. and 4 of the 6 test calves challenged with 1000 m.l.ds. succumbed to the challenge, while in the case of formalin inactivated culture vaccine a higher percentage of the challenged calves withstood the challenge to a similar dose of virulent culture.

Experiments with the use of alum as adjuvant

1. *Concentrated alum-precipitated vaccine.*—Two batches of this vaccine were prepared and injected into nine buffalo-calves in doses of 2 c.c. intramuscularly in the region of the neck using three for the first and 6 for the second batch. These calves were challenged on the 24th and 28th day respectively with 1,000 to 10,000 m.l.ds of virulent *Pasteurella bovisseptica* culture and the results are tabulated in Table IV.

2. *Alum precipitated broth bacterin.*—In this experiment, six batches of buffalo-calves and one batch of Zebu bull-calves were immunized with 5 c.c. of the alum-precipitated broth bacterin both intra-muscularly and sub-cutaneously. Simultaneously, three batches of buffalo-calves were immunized with 5 c.c. dose of the same broth bacterin that was also used for the preparation of the alum-precipitated bacterin, sub-cutaneously to compare the immunizing value of the alum-precipitated vaccine with that of the routine bacterin in use at

TABLE IV

Kind of animal and No. used.	Dose of vaccine.	Day of challenge.	Dose of culture.	No. of M.L.Ds.	Result.	Control.	
						Dose of culture.	Result.
I. Buffalo-calves-3	2 c.c.	24th day	0.001 c.c.	1,000	3/3	0.000001 c.c.	Died in 33 hours
II. Buffalo-calves-3	"	28th day	0.001 c.c.	1,000	1/3	0.000001 c.c.	Died in 24 hours
" -3	"	28th day	0.01 c.c.	10,000	2/3	0.000001 c.c.	Died in 24 hours

Numerator: Number survived in the test.
Denominator: Number used in the test.

present. After a period of two to three weeks, the calves immunized with the alum-precipitated vaccine were challenged with 100 to 10,000 m.l.ds and those immunized with the routine bacterin with 10 to 100 m.l.ds of virulent *Pasteurella bovisseptica* culture. The results are tabulated in Table V.

The results in these experiments show that the alum added vaccine confers immunity in the vaccinated calves 10 to 100 times as strong as the one conferred by the broth bacterin which was very poor, and in one experiment failed to protect 4 out of 5 calves against a challenge dose of 10 m.l.ds of the culture. Out of 11 calves immunized with broth bacterin, only 5 survived the challenge dose of 10 to 100 m.l.ds of virulent culture, whereas out of 27 calves (buffalo and zebu) challenged with 100 to 1,000 m.l.ds of virulent culture, 23 calves have survived the challenge and only four calves succumbed to it. All the three calves protected with the alum-precipitated vaccine that received the ten thousand m.l.ds of virulent culture died in the test, which indicates that the immunity produced by this vaccine is not sufficient protection against such a heavy dose whereas three other calves challenged with 1000 m.l.ds of the culture in the same test have withstood the challenge. No appreciable difference in the type of immunity produced could be noted in the calves protected either by the subcutaneous or by the intramuscular route.

The alum added vaccine prepared by the addition of alum as an adjuvant to the same concentration of cells as that used in the preparation of adjuvant vaccine with liquid paraffin and lanolin did not also confer any decided advantage over the alum-precipitated broth bacterin as only 4 out of 6 calves challenged with 1,000 m.l.ds. and two out of three calves challenged with 10,000 m.l.ds survived the tests (vide Table No. 4).

TABLE V

Kind of animal and No. used.	Kind of vaccine used.	Dose of vaccine.	Day of challenge	Dose of culture	No. of M.L.Ds	Result.	Control.	
							Dose of culture.	Result.
Batch I. Buffalo-calves 3	APB	5 c.c. i/m.	23rd day	0.0001	100	3/3	0.0001	Died in 34 hours (MLD 10-6)
II. Buffalo-calves 3	"	"	28th day	0.001	1000	3/3	0.000001	Died in 29 hours. Died in 30 hours.
" 3	"	"	"	0.01	10000	0/3		
II.(a) Buffalo-calves 3	BB	5 c.c. s/c	23rd day	0.0001	100	2/3	0.000001	
III. Buffalo-calves 6	APB	"	15th day	0.001	1000	6/6	0.00001	Died in 16 hours (MLD 10-6)
IV. Bull-calves 6 (Zebu-cattle).	"	"	17th day	0.001	100	4/6	0.001	Died in 60 hours (MLD 10-5)
V. Buffalo-calves 6	"	"	17th day	0.001	100	5/6	0.000001	Died in 38 hours (MLD 10-5)
V.(b) Buffalo-calves 5	BB	"	17th day	0.0001	10	1/5		
VI.(a) Buffalo-calves 3	APB	"	16th day	0.001	1000	2/3	0.000001	Both survived (MLD 10-6)
VI.(b) Buffalo-calves 3	BB	"	16th day	0.0001	100	2/3		

APB: Alum Precipitated Bacterin.

BB: Broth bacterin.

Numerator: Number survived.
Denominator: Number used.

Tests for period of immunity

Twelve buffalo-calves were vaccinated with 2 c.c. each of adjuvant vaccine manufactured with mineral oil and lanolin and challenged at varying intervals with 1000 to 10000 m.l.ds of virulent *Pasteurella bovisseptica* culture. One of the twelve calves died before challenge due to extraneous causes. The results are tabulated in Table VI.

TABLE VI

Kind of animal and No. used.	Kind of vaccine used.	Dose.	Day of challenge.	Dose of culture.	No. of M.I.s.	Result.	Control.	
							Dose of culture.	Result.
Buffalo-calves-9	Adjuvant vaccine with liq. paraffin and lanolin	2 c.c. i/m	3 after 56 days	0.01	10000	3/3	0.0001	Died in 87 Hrs.
			3 after 109 days	0.01	1000	"	0.000001	" " 37 "
			3 after 168 days	0.01	1000	2/3	0.000001	" " 22 "
							0.000001	" " 29 "
Buffalo-calves-3	Adjuvant vaccine with white oil and lanolin.	"	2 after 248 days	0.001	1000	2/2	0.00001	Survived
			1 died before challenged				0.000001	Died in 30 Hrs.

Numerator : Number survived.

Denominator : Number challenged.

The results of the above tests indicate that the immunity conferred by the adjuvant vaccines prepared with the addition of mineral oils and lanolin is solid and lasting as the vaccinated calves have resisted a challenge of 1000 m.l.ds of virulent culture on the 248th day.

Studies on the duration of immunity conferred by Alum-precipitated broth bacterin are in progress.

Keeping qualities of the adjuvant vaccine

Adjuvant vaccine prepared with the addition of mineral oils and lanolin on 18-6-1953 and stored in the refrigerator at 40° F for a period of 165 days was injected into three buffalo-calves in doses of 2 c. c. intra-muscularly, and these calves challenged on the 20th day after vaccination with 1000 m.l.ds of virulent *Pasteurella bovisseptica* culture. Two out of three calves challenged, survived the test showing that there was no deterioration in the potency of the vaccine when stored at 40° F for a period of 5½ months. Further work on this aspect and on the keeping qualities of the Alum-precipitated broth bacterin is contemplated.

Field trials with adjuvant vaccine

Since it was reported that routine broth bacterin used for immunizing animals against Haemorrhagic Septicaemia was producing anaphylactic shock in some of the animals at the Livestock Research Station, Lam (Guntur District), all the livestock at the farm numbering about 250 were protected with adjuvant vaccine using mineral oils and lanolin. No anaphylactic shock or other untoward result was observed after the use of the adjuvant vaccine.

Discussion

The above study indicates that the addition of mineral oils and lanolin or alum as an adjuvant to a bacterial suspension of *Pasteurella bovisseptica* in its first phase, enhances the degree of immunity conferred by it 100 to 1000 times to that produced by the broth bacterin in use in the country now. The adjuvant vaccines for *Pasteurella bovisseptica* offers us a very potent and reliable medium for the effective control of Pasteurellosis in the country which has been a complex problem due to the low and unsatisfactory nature of immunity produced by the broth bacterin in use. The mineral oil and lanolin added adjuvant vaccine has a better and stronger immunizing value than the alum precipitated concentrated or alum-precipitated broth bacterins, owing to its retention in the tissues for longer periods, thus providing a prolonged antigenic stimulus for continued antibody formation. But there seem to be practical difficulties in the large-scale manufacture and use of adjuvant vaccines with the addition of mineral oil and lanolin, as it requires large quantities of broth bacterins to be spun down to obtain sufficient bacterial cells, and this is possible only with the help of special equipments like the Sharple's Super Centrifuge. The cultivation of the organism on surface of agar and obtaining the bacterial cells in sufficient quantities is also laborious and cumbersome as the growth obtained on agar surface is often poor and scanty. Further, the emulsification of large quantities of the cell-suspension with the mineral oil and lanolin is another process requiring special apparatus and equipments.

These difficulties are easily overcome in the alum-precipitated broth bacterin which requires only the addition of a sterile solution of alum to a strength of 1% to the present routine broth bacterin. Though the degree of immunity conferred by the alum-precipitated broth bacterin is not as strong as that produced by the one with mineral oil and lanolin yet for practical purposes an immunity conferred against 100 to 1000 m.l.ds of virulent culture is all that is needed for conferring adequate protection under field conditions. Another difficulty encountered with the mineral oil adjuvant vaccine is the thickness of the resultant emulsion which makes it difficult to be drawn into an ordinary hypodermic syringe and needle and injected into an animal. In addition, due to localization and slow absorption of the antigen, it is expected that at least two to three weeks would be necessary for adequate immunity to develop in inoculated animals. Hence it does not appear to be a very useful product for use in actual outbreaks of the disease where the product used must be able to confer adequate immunity in the shortest possible time. No doubt, the utility of this adjuvant vaccine in immunizing animals in free as well as endemic areas well in advance of the

expected season cannot be overlooked or ignored. But for use in already infected premises, in the absence of availability of anti Haemorrhagic Septicaemia Serum, it may be expedient to use the routine broth bacterin in the first instance, as the bacterin is absorbed quickly and stimulates antibody production earlier, and to reinforce it two to three weeks later with a dose of the adjuvant vaccine. In the case of the alum-precipitated broth bacterin the precise time taken by the vaccine to confer adequate immunity has not been determined; it is however expected to fall within the range of times required by the routine broth bacterin and by the mineral oil adjuvant vaccine. This aspect is under study.

The immunity conferred by the mineral oil added adjuvant vaccine has been found to last over eight months, and the duration of immunity conferred by the alum-precipitated vaccine is being investigated. Immunity tests carried out recently on animals protected with Alum Precipitated broth bacterin at this Institute show that the immunity in these animals lasts for a period of over five months.

The alum-precipitated broth bacterin was found to confer a much stronger immunity than the routine broth bacterin and in some of the tests it compared favourably with the type of immunity conferred by adjuvant vaccine prepared by the addition of mineral oils and lanolin. It is easy of preparation, does not require any special equipment, could easily be drawn into the hypodermic syringe, and also be administered either intramuscularly or sub-cutaneously. The duration of immunity conferred by this vaccine is also expected to compare favourably with the mineral oil adjuvant vaccine which has been found to last over eight months. With the availability of these two types of adjuvant vaccines for Haemorrhagic Septicaemia, it should not be difficult in the coming years to control this disease effectively. Due to the practical difficulties in preparing large quantities of mineral oil adjuvant vaccine without special equipment for spinning down the bacterial cells to make the emulsion etc., the alum-precipitated broth bacterin which is easy to manufacture will be an ideal product for use in large scale vaccinations under field conditions, in place of the present broth bacterin; and the mineral oil adjuvant vaccine may be used for protecting livestock in Government farms and other valuable livestock in select endemic areas well in advance of the anticipated season. Due to the high quality and long duration of the immunity conferred by the adjuvant vaccines, annual vaccination of animals may be sufficient to give adequate protection against the disease in endemic areas. These adjuvant vaccines have not produced any pronounced local swelling or other unpleasant reactions in any of the vaccinated animals used in the above experiments.

It is significant to note that in all the animals that succumbed to the challenging dose the heart blood, when cultured, proved positive for *Pasteurella*.

Summary

This study deals with the question whether formalin-killed *Pasteurella bovisseptica* organisms in their first phase when mixed with alum or mineral oil and lanolin as adjuvant, form a better immunizing agent against Haemorrhagic Septicaemia than does the routine broth bacterin now in use.

The results obtained in bovines indicates that either of the two adjuvants combined with *Pasteurella bovisseptica* organisms, distinctly enhances protection against a higher challenge-dose of virulent *Pasteurella* organisms, although the mineral oil adjuvant vaccines proved to be more efficacious than the alum-precipitated broth bacterin.

With the availability of the above two types of adjuvant vaccines, it may not be difficult to control Pasteurellosis among livestock effectively, in the future. These adjuvant vaccines give us a much-needed immunizing agent for the effective control of Haemorrhagic Septicaemia in livestock.

Acknowledgment

The authors are greatly indebted to Dr. V. R. Rajagopalan, Director of Animal Husbandry, Madras, for his continued interest in this work and valuable suggestions offered from time to time. Their thanks are also due to Mr. G. G. Alton, FAO Expert, for his assistance in this work, to Sri T. Subramaniam and other members of the staff of the Institute of Veterinary Preventive Medicine, Ranipet, for technical assistance, and to Messrs. Burmah Shell Oil Storage and Distributing Company of India Limited, for the free supply of 'Shell Ondina 17 and BOC white oil' for the preparation of the vaccines.

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"FEEDING MASH FOR STARTING CHICKS"

By

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Rapidly growing young chicks require a well balanced and palatable mash, besides good clean water and sound sanitary surroundings. The most extensive nutritional studies on poultry requirements carried out in the United States and other countries have been responsible for our present knowledge regarding the exact quantities of 11 vitamins, 9 minerals and 13 amino acids needed by starting chicks. The National Research Council in the States has recommended in 1950 the following nutrient allowances given in Table I, for growing chicks 0 to 8 weeks old.

TABLE I
*Recommended Nutrient Allowances for Starting Chicks,
 0 to 8 Weeks Old.*

Nutrient,			Percent of diet.	Amount per pound of feed.
Total Protein.	...	...	20.0	—
Arginine.	...	...	1.2	—
Methionine.	...	...	0.9	—
or				
{ Methionine. (1).	...	...	0.5	—
{ Cystine.	...	...	0.4	—
Lysine.	...	...	0.9	—
Tryptophane.	...	...	0.25	—
Histidine.	...	...	0.30	—
Glycine. (2).	...	...	1.0—1.5	—
Leucine.	...	...	1.4	—
Phenyl alanine.	...	...	1.6	—
or				
{ Phenyl alanine. (3).	...	...	0.9	—
{ Tyrosine.	...	...	0.7	—
Threonine.	...	...	0.6	—
Valine.	...	...	0.8	—
Isoleucine.	...	...	0.6	—
Vitamins.	...	...		
Vitamin A activity I.U. (4).	...	...	—	2,000.0
Vitamin D ₃ I.C.U. (5).	...	...	—	135.0
Thiamine.	milligrams	...	—	0.9
Riboflavin.	do	...	—	1.6
Pantothenic acid.	do	...	—	5.0
Nicotinic acid.	do	...	—	8.0
Pyridoxine.	do	...	—	1.6
Biotin.	do	...	—	0.045
Choline.	do	...	—	700.0
Folic acid.	do	...	—	0.35
Vitamin K.	do	...	—	0.18
Vitamin B ₁₂	microgram	...	—	7.0
Antibiotic supplement.	milligrams	...	—	5.0
Minerals.	...	...		
Calcium.	...	...	1.0	—
Phosphorus. (6).	...	...	0.6	—
Salt.	...	...	0.5	—
Potassium.	...	...	0.2	—

Feeding Mash for Starting Chicks

By

Prof. V. Mahadevan



CHICKS 7 Weeks old on second ration.



1st Row :—Dr. V. N. Murty (A.R.O.-Bio), Dr. A. K. Pal (O.C.-Class), Dr. S. S. Prabhu (R.O., A.G.), Dr. Srivastava (H.D., Parasit),
Dr. N. D. Khar (H.D., A.N.), Sri L. Sahai (Director), Sri M. R. Dhanda (H.D., P.B.), Sri P. Doval (U.P.),
Sri C. Seetharaman (H.D., B.P.), Sri S. G. Iyer, H.D., P.R.), Dr. S. Bose (R.O., P.F.)
2nd Row :—Sary Sri—M. V. N. Rao (R.A.), T. D. Mahadevan (R.A.), C. M. Sen Gupta (R.A.), Lecchiramani (R.A.),
V. P. Kesavan (Madras), T. R. Sethi, (U.P.), D. N. Datta (U.P.), N. R. Ghosh (Tripura), A. L. Kamaswamy (Andhra),
N. P. Bhalla (R.A.), S. Gupta (W. Bengal), T. S. Johnson (T.C.), A. C. Chaudhuri (W. Bengal),
3rd Row :—Sary Sri—L. M. Naik (Bombay), T. G. Ramchandran (T.C.), S. E. Basu (W. Bengal), B. N. Soni (R. O. Hides).

TABLE I—(contd.)

Manganese.	milligram	...	—	25.0
Iodine.	do	...	—	0.5
Magnesium.	do	...	—	180.0
Iron.	do	...	—	9.0
Copper.	do	...	—	0.9

- (1). Cystine will replace methionine as long as the ration contains not less than 0.5 per cent methionine.
- (2). The chick can synthesize glycine, but the synthesis does not proceed at a rate sufficient for maximum growth.
- (3). Tyrosine will replace phenyl alanine as long as the ration contains not less than 0.9 per cent phenyl alanine.
- (4). May be either fish oil vitamin A or provitamin A from vegetable sources, I.U., International Units.
- (5). I.C.U., One International Chick Unit = 1.33 A.O.A.C. Units.
- (6). Inorganic phosphorus should constitute 0.4 per cent of the total feed. Approximately 30 per cent of the phosphorus of vegetable products may be considered as inorganic.

If the required nutrients were present in exactly the proportions needed, the best possible use of the feed by the chicks would result, making their optimum growth economically and rapidly. A typical composition of two all-mash chick starting diets, which meet the recommended nutrient allowances, is given in Table II.

TABLE II
All-Mash Chick Starting Diets.

Ingredient	Diet 1. Per cent.	Diet 2. Per cent.
Ground yellow maize (corn).	25.0	} 49.4
Ground maize, wheat, barley, grain sorghum or milo.	11.8	
Wheat middlings or ground oats.	10.0	
Wheat bran.	10.0	
Alfalfa leaf meal (75000 I. U. vitamin A or more per lb.)	5.0	5.0
Soybean meal.	18.0	10.0
Cotton seed meal, ground nut cake or meal, corn gluten meal or soybean meal.	10.0	10.0
Fish meal.	1.0	4.0
Meat meal.	2.0	4.0
Riboflavin supplement (20 microgram riboflavin per gram).	4.0	5.0
Steamed bone meal, defluorinated superphosphate or other low fluorine calcium phosphate.	1.6	1.0
Ground lime stone or oyster shell.	1.0	1.0
Manganised salt (*1).	0.5	0.5
Vitamin A and D feeding oil (300 I.C.U. vitamin D and 1500 I.U. vitamin A per gram).	0.1	0.1
Total	100.0	100.0
Vitamin B ₁₂ supplement (micro gram per lb.) (*2)	7	7
Antibiotic supplement (milligram per lb.)	5	5

(*1). Manganised salt is prepared by mixing 100 pounds of table salt and 3 pounds of anhydrous manganous sulphate (or 4.6 pounds of manganous sulphate tetrahydrate).

(*2). If desired B₁₂ supplement can be omitted and level of fish meal and meat meal doubled in diet 1.

The importance of satisfactory composition in the chick's starting diet is generally recognised for assuring rapid growth, absence of nutritional deficiencies and freedom from other diseases by their resistance in their early life. The quality of ingredients used in preparing a feed is just as important as the composition of the mash, but this fact is not always appreciated. A mash with one ingredient of inferior quality is as undependable as a chain with one weak link.

The amounts of well balanced all-mash chick-starting diets required to obtain various average live weights with two common breeds of chicks are given in Table III.

TABLE III
Feed Required to Obtain Different Average Live Weights in Chicks.

Av. Live weight in pounds.	Breed and quantity of feed required per bird.			
	White Leghorns.		Rhode Island Reds.	
	Females.	Males.	Females.	Males.
	Pounds.	Pounds.	Pounds.	Pounds.
0.5	1.4	1.3	1.2	1.1
1.0	3.2	3.0	2.9	2.5
1.5	5.4	4.9	4.7	4.1
2.0	8.0	7.2	6.9	5.7
2.5	11.2	9.9	9.3	7.5
3.0	15.6	13.3	12.1	9.5
3.5	22.0	17.9	15.5	11.7

The above figures show that each half-pound addition to the live weight of the chicks requires more feed than the previous half-pound. As growing chicks become larger, the quantity of feed required for maintenance becomes larger and accounts for an increasing proportion of the total feed eaten. Thus the efficiency of feed utilization for growth decreases as chicks increase in weight. As it is a well known fact that "chicks grow only as they eat", it is false economy to try to save money by limiting the feed intake of growing birds.

The existence of extensive feed control service organisation consisting of feed analysis laboratories and regulating inspection service to standardize the quality of feeds in the western countries and the huge demand of balanced feed mixtures by the fast growing poultry industry have expanded considerably the trade in processed feed mixtures whose quality and composition are guaranteed by the feed control service who administer also the state feed acts. The feed formula is made according to the capacity of premixers employed in compounding chick starting mashers. But sufficient care is bestowed in calculating the formula for obtaining the balanced mash from the analysis of feed so as to meet the recommended nutrient allowances and to obtain the necessary guarantee feed control service labels for each lot of processed

feeds. Thus the feed control service is designed to protect the consumer or the purchaser of poultry feed by giving him the quality feeds for what he pays for. A model of making the feed formula to mix 2000 pounds or one short ton of balanced chick starting mash in a one ton mixer is given in Table IV.

The manufacturers of poultry feed work out a suitable formula as given in table IV, and register it with the state feed control service and obtain the licence to make and sell them with control analysis certificate issued by such an organisation. With such certified feed mash mixtures chick rearing becomes an easy and profitable business with anybody.

In the absence of such efficient national feed control services to assure the composition and quality of feeds used for poultry in this country, we have to find by trial and error method the most suitable feed formula for obtaining the best results with starting chicks. This method involves great risk, waste of time and loss at times, with poultry keepers in this state, so that the scientific and economic rearing of chicks is practically unknown to many of them. To illustrate learning by experience the proper feed formula under local conditions, the results of feeding trials conducted recently with chicks in the college poultry unit are presented below.

As a high mortality was experienced in January '55, among the young chicks at the college poultry unit inspite of good care and healthy environment, it was felt necessary to examine the adequacy of the feed given to them. The mash, which they received, had the following percentage composition:- wheat flour 45, wheat bran 10, fish meal 5, ground nut oil cake 15, skimmed milk powder 18, bone meal 5, salt 0.5 and fish liver oil 1.5, (total 100).

A second mash consisting of mostly the same ingredients has been made with the following percentage composition for comparing with the above one:- wheat flour 37, ragi flour 12, wheat bran 3, fish meal 2, ground nut oil cake 28, whole milk powder 10, lucern or alfalfa leaf meal 2, ground nut oil 1, churn meal 4, shell powder or calcium carbonate 0.5 and fish liver oil 0.5 (total 100).

A feeding trial was conducted with two groups of 16 ten-day old Rhode Island Red chicks during a test period of 10 days with the two mashers. The chicks receiving the second mash were given daily each one-fourth ounce of freshly prepared lucerne or alfalfa leaf juice being incorporated in the mash and making it into a crumbly small broken grain-like pellets suitable to the size of the chick. These 32 chicks were receiving the first mash for the first ten days after hatching. They were divided into two groups. Both groups of chicks weighed on an average 57.5 grams each, when they were started on the two

TABLE IV
Feed Formula Working Sheet for Making 2000 pounds Chick-Starting Mash.

Trade name of feed	Date formulated	Date registered	Pounds.										Vg.	
			Amt.	Prot.	Fibre.	Fat.	NFE.	Calc.	Phos.	Salt.	Mang.	Ribo.	I.C.	I.C.U.
Ingredients.													Vit. A.	Vit. D.
Ground yellow corn.	400	35.5	8.0	15.6	275.6	1.08	1.62	1.08	1.62	1.08	1.62	200	887000	—
Ground milo.	600	67.8	13.2	17.4	427.8	1.18	1.86	1.18	1.86	1.18	1.86	240	—	—
Pulverized oats.	200	24.0	22.0	9.2	117.2	1.18	1.86	1.18	1.86	1.18	1.86	80	—	—
Wheat gray shorts.	200	35.2	13.4	10.0	115.2	1.18	1.86	1.18	1.86	1.18	1.86	160	—	—
Soybean oil meal.	300	132.6	16.8	15.9	89.7	1.18	1.86	1.18	1.86	1.18	1.86	600	—	—
Fish meal.	150	93.3	1.1	12.8	6.3	1.18	1.86	1.18	1.86	1.18	1.86	3.0	10000000	—
Alfalfa leaf meal.	100	20.9	19.8	2.0	38.2	1.18	1.86	1.18	1.86	1.18	1.86	7.40	—	—
Special steamed bone meal.	20	2.7	1.2	1.9	1.2	1.18	1.86	1.18	1.86	1.18	1.86	1.02	—	—
Chick size oyster shell.	20	—	—	—	—	1.18	1.86	1.18	1.86	1.18	1.86	—	—	—
Salt.	10	—	—	—	—	—	—	—	—	—	—	—	—	—
Manganese sulphate.	25	—	—	—	—	—	—	—	—	—	—	—	—	—
Activated animal sterol.	50	—	—	—	—	—	—	—	—	—	—	—	—	—
Riboflavin carrier.	—	—	—	—	—	—	—	—	—	—	—	1512	—	—
Total of feed.	2000.25	412.1	94.5	85.7	1068.2	24.23	15.53	10	15.53	10	15.53	4234	10887000	337500
Nutritional allowance.	2000	400	—	—	—	20.0	12.0	10	12.0	10	12.0	3200	4000000	270000

mashes. The first group continued to get the first mash and the second group was fed the second mash for the next 10 days. Both groups were fed *ad libitum* with plenty of clean permanganate coloured water to drink and were kept under identical conditions. The chicks were weighed daily and their droppings were also examined once in two or three days. After ten days of feeding with these two different mashes the average weights of chicks were 94 and 122 grams respectively in the first and second groups. The increases in their respective average weights were 36.5 and 64.5 grams for the first and second mashes fed chicks. Expressing the gain in weight as percentage of their initial average weights, they were 63% and 112% over the second ten day period of their life. The second mash has produced 49% or nearly about 50% more growth over the increase in weight obtained with the first mash.

Not only the chicks fed with the second mash were better in health and appearance, but also there was no mortality nor any ill health among them as compared with a mortality of one in the first group of 16 chicks which were also poorer in appearance and growth. There was no incidence of coccidiosis in the second mash fed group upto seven weeks till now, nor they were treated with any sulpha drugs as a preventive measure. But the first mash fed group of chicks and two other groups of chicks on different diets at the same time, suffered from coccidiosis and they had to be treated with sulphamezathine.

Therefore, the second mash, which has been proved to be superior under the above conditions has been continued upto 7 weeks now for the second group of chicks some of which weigh as much as 500 grams or one pound and two ounces at 6 weeks and 630 grams or one pound and six ounces at 7 weeks. Comparing these results with those obtained by others recently, it is found that the best of the three mashes with vitamin B₁₂ and antibiotic feed supplement tried by workers in Phillipines at the Alabang Stock Farm gave with White Leghorn chicks, the average weights of 396.36 and 511.11 grams at six and seven weeks respectively. (The Phillipine Journal of Animal Industry, 1954, Vol, 14, pp. 273.) The weights obtained at the college with the second mash appear as good maximum obtainable at this age. All chicks in this mash fed group have grown well and gained considerable weights with no symptom of any disease. Hence the second mash is recommended as a good starting mash for chicks to obtain rapid growth and good results.

Acknowledgment

Grateful acknowledgment is recorded to the Principal, Madras Veterinary College for his keen interest, besides the facilities provided and to Sri. R. Venkatakrishnan, veterinary assistant surgeon, for the technical help rendered in feeding chicks.

MILCH GOATS OF MALABAR AND THEIR DEVELOPMENT.

By

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There are about 4.5 million goats in the Madras State according to the recent census and these form no inconsiderable part of the livestock wealth of India and of Madras in particular. They are valuable from the point of their manure, flesh and skins. They constitute an important economic holding to the backward peasantry of the rural areas. Apart from the use of their manure and mutton, the skin of goats has earned for Madras a place in International trade. The cash value of our goat population may be assessed at Rupees 4.5 Crores taking the average price of a goat at Rs. 10/-. A livestock industry of such immense possibilities needs our careful attention and study.

Type of goats in Management

There is no recognised breed of goats in this State and the common type found throughout the State is mostly black in colour and is of the mutton type and is indigenous to the several local areas, varying in size and weight. There are, however, certain areas in the west coast of Madras where goats known as 'Malabar' goats are a great source of milk supply to human population.

Management:—The goat plays an important role in the rural economy of the State. In many villages it may be seen that those who have little or no holding of lands take to goat rearing. Due to its multiparity and ready market for sale near its home, it pays a very high dividend to its owner and that is the reason why it is popular among the poor peasantry to supplement their income.

The size of the herd varies from a few to hundreds. They are kept in the open and thrive on leaves of bushes, of live fences and of tender branches of trees cut for the purpose. They pick up grass by way of grazing also. Because of the habit of goats eating the tender leaves and buds of plants, they are considered as destroyers of plants and forests and justifiably enough they are not permitted into reserved forests for grazing purposes; but the rearing of goats is to be done in such a way that they do not become a menace to the vegetation all round. The indigenous goat is non-descript in character. They are leggy and are of various shades of colour with a pre-ponderance of black. The head is small and pointed, most of them have horns and are of a

Milch Goats of Malabar and their Development

By

D. Pattabhiraman



Fig. 1
Udder before milking.



Fig. 2
Udder after milking.



Fig. 3
Cutch ewes. Note the broad ears and well developed udder.



Fig. 4
Cutch Doe.

Milch Goats of Malabar and their Development

By
D. Pattabhiraman



Fig. 5
Tellicherry Doe. Note the udder.



Fig. 6
Tellicherry Adult Buck.



Fig. 7
Tellicherry Does. White colour is generally preferred in the area.

small type. Udder is not well developed and consequently they are poor milkers. They are multiparous animals, generally dropping twins.

No systematic attempt has been made hitherto for improvement of goats on a large scale. Such attempts that have been made in the past were few and far between. Foreigners in the past brought some goats of exotic origin which were noted for milk quality. A certain amount of cross breeding of the indigenous with the imported ones had occurred in and around towns or hill stations. As the efforts were not systematic and sustained, no large scale improvement has resulted. The only place where attempts were made to introduce Jamnapari, Surti (North Indian breeds) or a Nubian, from foreign place was at Katpadi in North Arcot district and in Madurai district. Mr. J. J. De'Valois a missionary of the American Arcot Mission, Katpadi, has been doing some cross breeding work with the locals and such breeds as Jamnapari or imported Nubian. It is again a feeble attempt and requires expansion.

The Animal Husbandry Department considered about the problem of goat development and took steps to popularise where possible, the milch goats as a first step. Malabar and South Kanara are the only two districts where one finds a large number of goats noted for milk yielding qualities.

Malabar Goats :—The origin of what is now popularly known as Malabar otherwise called "Tellicherry goats" is interesting. In former times the type of goats in the west coast was also of the usual desi type as now prevalent in other parts of the State. People who were trading on merchandise in the country sailing vessels between the ports of Calicut—Kathiawar and other places brought with them goats of heavy milking qualities for purposes of milk and mutton during their voyages. The imported goats mixed freely with the indigenous goats in the coastal areas. Though no systematic breeding was undertaken by any body in such areas, indiscriminate cross-breeding with the indigenous goats and in-breeding among the progenies, were taking place and thus a new type was in the offing. This new type a shade better in its conformation than the indigenous goat, fortunately inherited a good proportion and percentage of milk strain from the imported parents. As a large number of such animals are to be seen in and around Tellicherry the people of that district in way of distinction, began calling this new small type of goats with good milch strain, as "Tellicherry goats". All the other goats having the blood of imported ones, other than Tellicherry, are known as "Cutch cross" goats. In fact two types are noticed among Malabar goats, one is called the "Cutch" and the other as "Tellicherry" as stated above.

1. *Cutch*:—This type is bigger in size and its natural colour is light dark brown with a few black or red spots on the body. Though a few pure black ones are also to be seen, in fact the colour does not seem to be characteristic. It may be of any colour from light to black. The hairs are long and shiny. The head is pointed, a roman nose, horns are long, ears are pendulous and the presence of a pair of tassels are not uncommon. The body is wedge shape, Udder is well formed with good size teats.

2. *Tellicherry*:—These are comparatively small size animals and perhaps go to possess this name since they are prominent in Tellicherry and its surroundings. The hairs are shiny, short and placed close to the skin. The general colour is white or black. The head is pointed, nose is small, ears are short. Presence of pendulants is not uncommon. The body is wedge shape. Udder is well formed with good size teats.

With a view to improve the goats found in Malabar district a goat breeding section was added on in 1951 at the District Livestock Farm, Malabar with a few animals of both the above varieties found in the district as foundation stock with the following objects:

1. To evolve and fix a type called Malabar goats suitable to the locality and economical to maintain, homogenetic to colour, size, confirmation, milk yield, etc.
2. To produce bucks of good milch strain and make them available to the breeders in the district to improve the local goats.
3. To study the disease problems connected with these goats.
4. To disseminate the knowledge and the experience gained with regard to feeding, management, disease control etc.

Measurements of goats as observed at the farm are:—

1. *Cutch*

Adult she goats.

Weight 87 lbs.
Length of face 9"×6"
Ears 9½"×3½"
Height 30"
Front height 29"
Length 25"
Girth 30"
Tail 5½"

2. *Tellicherry*

Adult she goats.

79 lbs.
7"×4"
6"×3"
26"
25"
26"
28"
4½"

Kiddings:—Generally the births are twins. The average weight of a male kid is 5 lbs., and that of a female kid is 4.6 lbs., and one doe gave birth to 4 kids.

Statement showing the individual milk yield of goats which completed their lactation during 1953-54, District Livestock Farm, Malabar.

Breed	No. of goats	Lactation completed during the year.				Stage of the milk yield how many days after calving.	Remarks
		Days in milk	Milk yield in lbs.	Daily average in lbs.	Average fat %	Daily maximum peak yield.	
Kutcheri	4	192	402—8 lbs.	2.0	..	3	28
"	2	117	425—8 lbs.	3.6	..	2—8 lbs	33
"	7	134	324—0 lbs.	2.4	1.6	3	49
"	17	155	366—4 lbs.	2.3	..	3—8 lbs	48
"	18	165	293—8 lbs.	1.7	2.4	3	43
"	21	158	329—8 lbs.	2.0	..	4	36
"	19	177	462—12	2.0	1.8	4—8	37
"	1	157	388—8	2.4	2.8	4—8	55
"	4	150	323—0	2.1	..	3—8	48
"	2	160	376—4	2.3	1.8	1—8	38
"	2	292	727—12	2.4	2.0	2—8	64
"	12	179	414—8	2.3	1.9	3—8	33
"	23	170	213—0	1.2	2.0	1—8	55
"	16	29	773—12	2.3	2.7	4—4	45



Statement showing the individual milk yield of goats which completed their lactation during 1953-54,
District Livestock Farm, Malabar.

Breed	No. of goats	Lactation completed during the year.					Stage of the milk yield how many days after calving	Remarks
		Days in milk	Milk yield in lbs.	Daily average in lbs.	Average fat %	Daily maximum peak yield.		
Tellicherry	27	70	227-8	3.2	1.6	4-5	..	
"	28	63	204-12	3.2	1.5	4-0	..	
"	8	153	214-12	1.4	1.8	2-8	32	
"	28	140	213-8	1.8	2.5	2-4	30	
"	27	159	284-4	1.7	2.7	2-8	30	

NASAL GRANULOMA IN THE STATE OF WEST BENGAL STUDIES ON SIXTY-EIGHT CASES

By

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Introduction

A large number of cattle have been suffering in West Bengal from Nasal Granuloma due to the infestation of *Schistosoma nasalis*. The organisms live in the veins of the anterior nasal passage causing a varying degree of chronic proliferative changes of nasal mucosa. It interferes with breathing resulting in a peculiar snoring noise; therefore, it is more commonly known as 'Snoring Disease of Cattle'.

The carabaoes raised in close proximity of the affected cattle do not manifest the disease clinically, hence it seemingly shows that the buffaloes are not naturally infested by the parasites. Similarly it has not been reported among goats and horses in this State.

Krishnamurti (7) reported Rhinosporidium infection in cattle and horses in India. Robinson (11) presented his experimental evidence while investigating the third and fourth cases of nasal granuloma in east central Texas of United States of America, which indicated that a fungus was the causative organism of the disease. Morphologically it resembled with that of the genus Rhinosporidium although it did not seem to be identified to *R. seeberi*. Monnig (9) reported snoring disease of cattle, goats and horses in India and similar cases in Louisiana, U. S. A., caused by *S. nasalis*.

It is, therefore, apparent that there are two etiological agents liable to cause Nasal Granuloma in India, viz., a blood fluke of the genus *Schistosoma* and a sporozoan of the genus *Rhinosporidium*. The experimental evidences do not point at the latter agent to be responsible for nasal granuloma and it is likely to be very uncommon in this State. The former (2, 3) appears to be the specific cause of the disease in almost all the cases in West Bengal.

Incidence of the disease:—The snoring disease of cattle (2) has been reported from all the districts of West Bengal with the exception of those of Darjeeling, Cooch Behar, Jalpaiguri, West Dinajpur and Malda. These districts of higher altitude with rapidly flowing rivers and brooks provide different conditions as regards climate and surroundings, mineral contents of the soil both in nature and proportion, growth of algae and other aquatic plants, which are unsuitable for the multiplication of vector snails in large number and the development of the larval

stages outside the regular host. It is also reported (3) that the clinically diseased cattle when removed to a known clean area, get rid of the parasite and remain no longer the sources of infection to the local stock; likewise the healthy cattle from the so-called naturally immune zones contract nasal schistosomiasis in course of time when brought to the known infected areas.

The distribution of the disease in a district depends on the extent of wet land, nature and proportion of the various mineral contents of the soil, climate, altitude, etc., favouring the growth and multiplication of both the parasite and its snail-vectors. The number of infected cattle in a suitable area to harbour eggs voided by the causal organisms in the nasal discharge and the resultant meracedia to the required species of snails also influence the morbidity of the disease among the previously non-infected local stock. Consequently the approximate rate of infestation among cattle in the areas where the organisms have already been distributed, has a wide range of variation from 0.7 to 60 per cent.

A few cases of snoring disease of cattle due to *S. nasalis* may be reported from the districts of Malda and West Dinajpur in future Bihar. Many of these affected animals are likely to rid of the parasite naturally in course of time owing to the change of surroundings. It is also not unlikely that a few cattle of certain villages of these two districts bordering West Bengal State, may be affected with the disease by grazing in the fallow land close-by of the known infested areas within Bihar.

The clinical manifestations of the diseases are frequently observed in large number of animals and in more acute form towards the end of winter or early spring, every year. The livestock are generally tied up and fed simply on paddy straw with inadequate grazing or fodder substitute and with little or no concentrates from summer to the following spring till the crops in the field are not completely harvested. Consequently the vitality of the regular hosts ebbs to the lowest point towards the end of winter than the rest of the year due to the want of required food, regular exercise, and proper care and management. The systematic resistance of the infected host against the matured parasites, developing from the cercariae taken during the previous grazing season, is overpowered. The adult parasites in sufficient number are then in a position to produce the characteristic syndrome. These infected animals overcome to a certain extent the pathogenicity of the organisms within their system when they get back to pasture again in early spring by rebuilding their partially broken down body resistance with the facility for grazing, exercise, etc. The infection is more frequently encountered

in bullocks than in cows. The reason for victimization of steers with greater ease is that they are employed vigorously in large number to till land for the cultivation of agricultural crops during hotter months every year without the required balanced diet and adequate rest for their extra pressure of work to which they are usually subjected to, all at once.

The disease is most common (2, 3) in those places where the livestock are allowed to graze along the banks of water-logged areas comprising, ponds, tanks, swamps, incompletely silted-up rivers, etc. These marshy lands with luxuriant growth of grasses, algae, and other aquatic plants together with their organic remains form a suitable abode for the propagation of the type-snails which serve as the intermediate hosts of *S. nasalis*. The gradual settlement of higher pasture lands for cultivation to meet the ever increasing requirements of the State people, drives the local cattle, being less imperative, to graze more and more upon the grasses and weeds in the fallow wet land close by. This is simply implied to the upward fluctuation of case numbers from year to year in the known infested areas of the State.

The snails of the species *Limnoea luteola*, *L. acuminata*, and *Indoplanorbis exustus* (9) serve as intermediate host of the *S. nasalis*. The cercaria released from the snail-vectors, swim about in shallow water. The salivary secretion from the cephalic glands of these infective larvae digests the tissues of the final hosts when they come for grazing and drinking in contaminated wet land. Thus the cercaria reach the cutaneous or the abdominal vessels and migrate to the nasal veins through the systemic circulation. Those arriving in the nasal veins directly are likely to develop more rapidly and mature at an earlier date. Others reaching different organs die before they attain the adult stage.

Symptoms.—The clinical manifestation of nasal granuloma is not however detected so long as the hosts are not subjected to heavy infestation with sufficient number of matured parasites causing enough irritation to produce the specific granuloma. The ovigerous females deposit boomerang-shaped eggs in small vessels and capillaries around in the schiniederian membrane and submucosa and a large number of ova pass in the nasal discharge. The parasites and their eggs cause marked irritation with the resultant coryza. The affected cattle (12) show the characteristic wrinklins of the skin surrounding the nasal wings owing to the extra efforts required for breathing. Small abscesses containing eggs of the organisms, are found in the nasal chamber. Later on there are proliferation changes and the ulcerating masses and the mucopurulent discharge in the anterior nasal chambers cause

disturbances in respiration resulting in dyspnoea and snoring or droning sound to be heard from a distance. The affected animals become gradually emaciated and unthrifty mainly due to anaemia. Difficult breathing tends to subside or become more or less dormant during cooler season. They become weak and unfit for their work day by day. The milk yield in lactating cows diminishes quite appreciably. Clinically the disease is manifested in a more acute form towards the end of winter or early spring every year.

Treatment:—Each of four cattle (1) of 500 lbs. live-weight was injected intravenously with Potassium Antimony Tartarate in doses of 1.5 grain per 100 lbs. of body weight at an interval of 48 hours. Alarming symptoms began to usher in from the fourth injection; so the 5th injection was given after 72 hours. The drug proved fatal in 50 per cent of the treated animals which died within 96 hours of the last injection.

In another instance 32 cattle were similarly injected with Potassium Antimony Tartarate. Within 27 hours of the first injection two of the treated animals died as a result of the toxic action of the drug. The toxic symptoms reported were salivation, and death within half an hour of the onset of the symptoms. Further treatment was not attempted in this lot.

But the treatment was resumed with the intravenous injection of Sodium Antimony Tartarate (scale preparation) in doses of 1 grain per 100 lbs. live weight dissolved in 15 to 20 c.c. distilled water. The injections were given at an interval of 96 hours. No untoward reaction was noticed in this drug thereby showing the superiority of this preparation over the Pot. salt and so this drug is recommended in the treatment of Nasal Granuloma in cattle in Bengal.

The beneficial result of treatment with Sodium Antimony Tartarate was characterised by the improvement of general condition of the animal, gradual healing of granulomas, cessation of nasal discharge, relief of breathing difficulties, and the decrease of snoring.

Sixty-eight specimens (2, 3) of the nasal washing in saturated saline solution from the cattle of different districts of West Bengal were examined microscopically. The boomerang-shaped eggs of *S. nasalis* were detected in 50 per cent of the specimens thus examined. The rest yielded negative result. Fifty seven per cent of these positive samples were from the District of Midnapur, especially the Contai and Jhargram sub-divisions. This district appeared to be worst affected of all.

Control measures:—Before the control measures for stamping out or reducing the possibility of parasitic infestation are planned it is wise

to determine the accessible weak points in the life-cycle of helminthic organism responsible for the malady of specific origin. In this particular instance there are two target points to hit vitally on the life-cycle of *S. nasalis*, one is to destroy the snail-vectors and the other is to destroy the adult organisms within the final hosts; thus to put a stop to the discharge of ova of the parasite in the nasal discharge from the infected animals. In short, success of a plan depends on the control and eradication of snails in the infected areas and the treatment of the infected cattle.

Measures for large-scale destruction of snails

The measures for the destruction of snails should be thoroughly analysed in relation to the different aspects of natural local condition in order to synthesize ultimate result to the desired extent. The degree of success achieved in one place with the application of a particular method has the possibility to vary when employed in another place having different topography, climate, etc. The rate of variation of the result is often wide enough. For instance, certain methods, which are quite applicable and effective in South India, may work similarly futile in West Bengal due to the much varied conditions from each other. West Bengal is having an annual rainfall twice as great as South India. It is traversed by a dense net-work of big and small rivers flowing less rapidly all the year round. It also abounds in marshy land and artificially water-logged areas. The surface layer of soil in West Bengal does not lie on the impermeable bed of basalt and permeates water in a much greater depth during rains and thus remains wet for a longer period; moreover, the West Bengal atmosphere is more humid; consequently the rate of evaporation from the soil is slower than that of South India. In West Bengal the higher and better plots of land are utilized for cultivation. The vast area of wet land comprises a considerable portion of the State, which provides the most suitable abode for a large variety of snails including those of the genera *Limnoea* and *Indoplanorbis* to propagate with great rapidity and ease. The local cattle in majority are circumstantially induced to graze upon the grasses and bushes grown in and around the various water-bound and swampy areas closeby and quench their thirst with water from these reservoirs full of fluke cercariae and other contaminations. Many cattle, specially in poor condition, devour snails containing cercariae of the organism while grazing in the field presumably to meet their extra-ordinary systemic demand for proteins during winter when the snails are very active and more so before going underground in dry and hot season every year. This is particularly observed while they are afforded with inadequate grazing facility limited to small pieces of fallow lands, here and there, in order to protect the agricultural crops in the field.

So, it is apparent that an extensive molluscicidal campaign is indispensable; but many a measure for the control of snails suggested so far, appears to be appreciably frail and it does not insure to be 100 per cent effective. A few of such procedures may work somewhat satisfactorily in respect of a place under particular altitude, climate, surroundings, etc.

1. Hand-picking of snails and utilizing their shell for lime-making or burning them straight away by means of blow-lamp, does not seem to be much feasible as it would require an awful lot of men and money. Moreover, the shell-lime industry has a limited scope in the present market and does not show more promise to manufacturers possibly for many years to come.

2. Some aquatic snails and oysters are caught in the fisherman's net while they are out for fishing. These are usually left in the bank of rivers, tanks, and all other like reservoirs. They die naturally in due course and their shells are used for lime-making by a certain class of people to meet the present market demand. Such cottage industry is proportionate to the scope provided in the market from time to time.

3. Duck-rearing by the individual agriculturists in a required number under the existing system for the snails to be devoured upon, is equally unfavourable for fish-spawn and small sized fishes raised in the ponds or tanks and cereal crops cultivated in the fields, close to the dwelling places, which are perpetually haunted by such flocks. These become, now and then, the roots of quarrel between the agriculturists and the owners of flocks. Such bothersome events are not infrequently observed in rural areas of West Bengal. Fenced rearing would restrict movement of the birds to the fixed areas only and likewise would mar the original mission of feeding them at large on snails in sufficient number to get the desired results. Therefore, such a device can hardly flourish in this State where almost all the inhabitants daily consume both the saline and fresh water fishes with their major meals and as such the fish culture is much more imperative to the people in general than duck-rearing.

4. Soap-berry cultivation along the banks of various types of extensive reservoirs in this State, for keeping down successfully the snail population with the extract in required concentration of the fruits dropping naturally from the plants into the water of infested marshes, rivers, tanks, etc., without harming the fishes, will probably remain in a state of plan ever to be applied here. It is also a time factor for its effect to be derived appreciably under the existing condition of West Bengal.

5. Ammonium Sulphate when it is used as fertilizer also shows a little promise as molluscicide due to the peculiar condition prevailing

in West Bengal with regard to soil, rain-fall, climate, etc., because a large quantity of the chemical in required concentration which is supposed to kill snails, is likely to be washed away by rain water with the advent of the following monsoon. The small proportion of it left behind in the field, has been rendered ineffective owing to various physico-chemical changes in the nature. The snails which have recently come out from the considerable depth of soft, cool, and somewhat impermeable mud under the hard crust of earth on the top in the previously dried up beds of swallow swamps, rivers, ponds etc., escaped the lethal effects of the fertilizer which has already become inert due to the changes in the nature and ultimate dilution in rain water.

6. Construction of adequate number of canals for ensuing proper drainage of stagnant water from the water-logged areas is the most effective method for the general destruction of snails. The complete drainage of these areas is preferred to all other measures. It changes the environment and renders these previously swampy lands impossible for the snails to survive any longer provided the drainage ditches are kept clean and open. Under such conditions the drained lands will ever remain unfavourable for the snails to live in and these will require no further attention. If the canals become re-infested, the treatment of banks with blue stone would easily destroy the snails in the canal water.

Where the drainage project of marshy lands is not possible to give effect inspite of the estimated increased value of the improved lands owing to the more crops to be yielded in future, the plan for the treatment of snail infested areas with Copper Sulphate as an alternative should receive consideration.

The partial drainage of water-logged areas has a great value as well, in reducing the total wet areas specially where complete drainage is impracticable. Under such circumstances a combination of drainage project and Copper Sulphate application to the remaining undrained portions of lands would bring forth the desired result.

7. Copper Sulphate may effectively be used in concentration of 1 to 1,500,000 parts of water. In this proportion it kills snails, miracidia, cercariae, and lower plants in twenty-four hours without any harmful effect on livestock and plants of higher order including grasses and flowering plants. It may kill fishes; but does not injure eggs of *S. nasalis*. A thorough distribution of the chemical in such high dilution is hard to accomplish and usually it is applied in a higher concentration.

When water supply of a streamlet or canal is confined within the banks on either side, sacks containing blue stone crystals may be placed

in the head-water of it. The snails in the banks of such dam may be treated by raising the water level to cover them up with the treated water by controlling the outlet.

Overflowed lands, backed-up water-beds, marshes, tanks, pools, and similar other snail infested areas are most effectively treated with powdered Copper Sulphate. It is mixed with sand or land plaster carrier. The residual chemical should form 1 to 1.8 parts of the carrier depending on the volume of water to be treated. The land plaster is preferred to sand as the former diluent marks the treated area. Copper sulphate and the land plaster should be ground very finely and mixed up thoroughly so that the mixture could be sprayed as dust. Airplanes are generally employed in many countries for broadcasting the chemical as fine dust over the large swamps and other like water-bound areas.

The amount of Copper Sulphate needed for the treatment of water in a stream, is calculated according to the rate of flow per cubic foot per second and the average depth and width of the flowing water. To ascertain this, select a uniform section of the stream of 50 feet long, measure the width and average depth of water, and multiply these to obtain the cross section in square feet. To mark off 50 feet, throw a chip in water at the upper end and determine the number of seconds required for the chip to float a distance of 50 feet. Divide this total time in second by 50 to find the velocity in feet per second. The number of square feet of the cross section multiplied by velocity in feet per second is equal to the approximate rate of flow per cubic feet per second. A 6 feet wide stream has an average depth of 6 inches; the cross section area is 6 times 0.5 or 3 square feet. If the rate of flow is 25 seconds for 50 feet, the velocity is 2 feet per second. Multiply 3 square feet cross section by 2 feet velocity per second. For twenty-four hour treatment at a dilution of 1 to 500,000 parts of water, 12 pounds of Copper Sulphate is required for each cubic feet per second of flow. Therefore, 72 pounds of Copper Sulphate would be required to treat the stream for twenty-four hours. In tanks and ponds which are used for the culture of fishes and their spawns, such treatment of Copper Sulphate may prove to be excessive. So, Copper Sulphate broadcast may conveniently be made along the bank and on a few feet of water around from the edge.

The effect of Copper Sulphate on snails should be checked after a few days of application. One treatment at the right time in a year, is sufficient in most instances; but the existence of live snails after treatment, is indicative of repeating the Copper Sulphate application on water. When once the wet-lands and natural and artificial water reservoirs are infested with snails the Copper Sulphate treatment is

required to be repeated once a year until all the snails are killed. The best time for Copper Sulphate application in West Bengal is during the months of February and March before the snails go under-ground at the advent of hotter and drier season every year, and when the total dimension of different water-beds is considerably reduced.

Mass-Treatment drive against nasal granuloma

The cercariae from the snails, being received by the animal while drinking and grazing, arrive at the seats of predilection which are in this case the nasal veins where they attain maturity and produce the pathologic characteristic to nasal granuloma. Therefore, a mass-treatment drive is required for a period of five years if not more, to start with under a definite scheme where the snoring disease of cattle of such specific origin is known to occur in West Bengal. It has then the greatest possibility of preventing the infested cattle from voiding the eggs of parasites to the exterior in their nasal discharge due to the destruction of the pre-existing matured organisms within their system. There are quite a number of chemotherapeutical agents available in the market for the treatment of nasal schistosomiasis. These are Anthiomaline, Antimosan, Potassium Antimony Tartarate, Sodium Antimony Tartarate, etc. From the points of economy and toxicity Sodium Antimony Tartarate is the drug of choice. It is less toxic than that of Potassium Antimony Tartarate although it may not be so in comparison with Anthiomaline or Antimosan but the high price of the latter two agents render their employment on a mass-scale operation more expensive. Sodium Antimony Tartarate is on the contrary, good enough and serves the purpose of a well planned scheme at a considerably low cost of medicine.

The West Bengal cattle, as narrated before, are mostly having a low resistance to the organism and similarly their tolerance to anthelmintic remains at a unusually low level due to the nature of food they receive and the climate and surroundings to which they are subjected to live in.

Sodium Antimony Tartarate in doses of 1 grain per 100 lbs. live-weight dissolved in 15-20 c.c. of distilled water is given intravenously at an interval of three days till recovery. In already debilitated animals an interval of four days may be allowed at the beginning to avoid the onset of alarming symptoms until they regain their health to the extent of tolerating the drug in a way it ought to be. It has been tried with beneficial results in several clinically affected cases of nasal granuloma. Generally, recovery is effected after the administration of five to seven injections depending on the degree of infestation with the organisms. After the abatement of all the symptoms, the patients are kept under

observation for about a month. Usually animals thus treated do not show clinical manifestation of the disease until they are reinfected with sufficient number of infective larvae of the parasite to grow adult and produce symptoms of nasal granuloma approximately after three to four months of the treatment or longer.

In an infested area some of the apparently healthy animals are supposed to remain as carrier of the organism for a long time before the clinical manifestation of the disease. In these subclinical infestations of animal the parasites, though well established, have not passed the prepatent phase of their life-cycle or the systemic resistance of the hosts does not furnish them with optimum conditions required for laying their eggs to be passed out and demonstrated in the nasal washing. In the circumstances the organisms may as well not be in required number to overpower the resistance afforded by the hosts and produce appreciable symptoms characteristic to nasal schistosomiasis.

Accordingly, such cases escape treatment and serve in future as the reservoirs of the parasites by furnishing meracidia to the vector-snails and likewise cercariae to both the treated and untreated ones of the locality in course of time.

It is, therefore, necessary to induce owners of all pastured animals of such locality to allow Sodium Antimony Tartarate treatment of their cattle to reduce the chances of re-infection to its minimum level. The doses and the mode of administration of Sodium Antimony Tartarate for apparently healthy animals would be similar to those suggested for the clinical cases. As two injections of the drug to these subclinical case at an interval of three days are supposed to destroy all pre-existing larvae or young parasites in the system. Consequently, these sub-clinical cases are to be administered while the fourth and fifth injections are given to the clinical cases of nasal granuloma in an infested area.

This method of application for mass-treatment drive has the greatest possibility of destroying the matured and imatured organisms in all the animals once for all, provided it is coupled with an extensive application of effective measures for the fast reduction of snail population as described before.

Intra-muscular injection of Sodium Antimony Tartarate in any form produces a certain percentage of inflammatory reaction at the site of injection. This is prone to stir the public feelings originating from the repulsive attitude of owners of the cattle thus reacted. Such an attitude is liable to impede the progress of the mass-treatment drive. Therefore, it is wise to avoid such a procedure especially when a rapid progress of the campaign is urgently required in a given area.

Summary

Nasal granuloma affects a large number of cattle of all the districts of West Bengal with the exception of those of Darjeeling, Cooch Behar, Jalpaiguri, West Dinajpur and Malda. It is commonly known as 'snoring disease of cattle' and is due to the infestation of *Schistosoma nasalis*. The organisms live in the veins of the anterior nasal chamber causing a varying degree of proliferative changes in the schneiderian membrane. It has not been observed among local buffaloes, goats and horses.

The snoring disease of cattle has a variable distribution. It is related to the altitude, climate, soil, total dimension of water-logged areas, and other environmental conditions of a place. A clinically affected animal when removed to a clean locality having different natural conditions, rapidly rids of the parasites without any treatment and remains no more a source, danger to the local healthy-stock. It is more common among the cattle of Midnapur district than those of all other districts of West Bengal.

The clinical manifestations of the disease are frequently observed in large number of cattle and in more acute form towards the end of winter or early spring every year.

The disease is more common among bullocks than in cows as the former are subjected to rigorous work for tilling land for the cultivation of various crops without the required balanced feed and rest to combat fatigue.

The measures for stamping out or reducing the possibilities of nasal schistosomiasis depend solely upon the destruction of snail-vectors and the treatment of cattle in already infested areas on a mass-scale. An extensive drainage system to water-logged areas mounted with Copper Sulphate application on the snail infested land and water and an intensive campaign for mass-treatment of cattle with Sodium Antimony Tartarate in the places of West Bengal where the disease has already been distributed, are the means which can thoroughly root out the disease in this state.

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SOME OBSERVATIONS ON THE INCIDENCE OF FLUOROSIS OR FLUORINE POISONING OF BOVINES IN THE STATE OF BOMBAY

By

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Introduction

1. During the year 1940, the then Veterinary Officer, Amreli*, district Amreli, Ex-Baroda State had observed about two hundred cases, mostly in buffaloes affected with rheumatism in a few villages of his jurisdiction. He had tried all remedies advocated for rheumatism without any success.

Similarly in the year 1952, the Veterinary Officer Brandol, district East Khandesh** had submitted a report stating therein that he had seen about five hundred cases mostly in buffaloes in milk affected with chronic rheumatism in his jurisdiction and that there was no cure with usual treatment for rheumatism. Later on, many cases affected with chronic rheumatism were reported by the Veterinary Officers, Savada, Jalgaon, Parola, Yawal and Bhusaval taluka of the same district.

* Amreli is situated at an altitude of about 800 ft. above sea level and near Giranar hills (Saurashtra).

** The affected areas in the East Khandesh district lie between 600 to 1200 ft. above sea level and are in the neighbourhood of the Satpura ranges.

Incidence

2. The disease diagnosed either as rheumatism or chronic rheumatism, was found affecting mostly the buffalo class. Very few cases in working bullocks, however, were reported or seen but majority of the cases observed were in she-buffaloes and particularly in milch animals kept under stall feeding conditions. It was not that only underfed animals were affected but even the animals in the best of health were also the victims of the disease. The condition was observed in all breeds of buffaloes (Surati, Mehsana, Jaffarabadi and non-descript).

Seasonal Occurrence

3. Affected cases have been observed throughout the year but number of cases in rainy season are less than the number of cases found in the hot months of the year. Symptoms exhibited by the animals are more marked in the summer season of the year.

Symptoms

4. Symptoms vary considerably depending upon the amount of fluorine ingested. Symptoms observed were painful joints; temperature normal; stiffness in the legs leading to lameness; lameness in one or more limbs but more often in fore limbs; stiffness of joints as if attacked with rheumatism; difficulty of movements; difficulty in arching back: acute pain while rising and walking; impaired appetite; gradual loss in weight; harsh coat; considerable reduction in milk yield; in advanced stage, deformity of hooves, calluses or exostosis on bones particularly on long ones in the form of nodular prominences or elevations; unable to stand; progressive emaciation and debility; cachexia, hooves twisted, cracked, overgrown, distorted, overlapping and brittle from inside; brown pigmentation, mottling and discolouration of the teeth and in very advanced stage, extreme emaciation; atrophy of the muscles; prostration and death within a period of 6 months to a year.

Course of the disease

5. It runs from a few months to a year or so.

Post—Mortem Findings

6. There was so far no opportunity to conduct postmortem on an animal died of this disease condition.

Etiological factors

7. From the clinical symptoms observed the rheumatism affection was considered to be either due to (1) Aphosphoris condition, (2) Imbalance of diet with regard to its mineral contents, (3) Vitamin deficiency, and (4) Fluorine poisoning or combination of one, two or more.

Investigation carried out at Amreli (Saurashtra) in 1940

8. A few samples of soil, cattle drinking water, feeds and fodders and samples of blood and sera etc., were forwarded to the Indian Veterinary Research Institute for necessary analysis and to determine as to whether the disease condition was due to any mineral deficiency or poisoning or otherwise.

The reports received from the above Institute revealed medium high range of fluorine contents in water in toxic concentration, phosphorus contents extremely low in feeds and fodders, increased fluorine content in the soil and serum-phosphorus abnormally low in the serum samples.

Fluorine poisoning of animals was therefore taken to be the cause of this so called "Chronic Rheumatism."

Investigations conducted in the East Khandesh district & Surat district during the year 1952-1953

9. The following samples collected from a few affected areas were forwarded for requisite analysis :—

Sample	Results
1. Samples of Sera from ten affected buffaloes.	The blood inorganic phosphorus values in the normal range.
2. Sample of water from 6 affected areas in the East Khandesh & one from Surat district.	Out of 7 samples, in four samples (3 from East Khandesh & One from Surat district) fluorine content ranging from 1 to 2, 3 per million parts which is highly suspicious or productive of fluorosis was observed.
3. Two samples of fodder.	P O : 0.33% on air dry. 25 : 0.29 sample.

The disease was therefore, provisionally diagnosed as fluorosis.

The disease in East Khandesh, is still under study and many more samples of soil, blood, bones, teeth, water, feeds and fodders etc. from different affected areas require to be analysed.

In addition vitamin 'A' deficiency has been also strongly suspected to play a part in causing this disease condition as number of cases are found less in rainy season when the animals consume plenty of green fodder.

Treatment

10. Encouraging results have been obtained particularly in early stages of the disease by treating the affected animals with sterilised bone meal and churn brand mineral supplement (I. C. I.).

As a preventive measure, the same has been recommended for the animals of the affected areas.

Consequences

11. Cases of sterility, lowered fertility and delayed oestrus have been observed and these may be the consequences due to fluorine poisoning.

Summary

1. The disease has been first recorded in the Bombay State in 1940 in the Amreli district and in the East Khandesh and Surat district in the year 1952-53.

2. There is no seasonal incidence of the disease. It runs a chronic course. 5 to 10 per cent of the buffaloes are affected in enzootic areas.

3. Some villages have been affected whereas there is no incidence of this disease in other villages and sometimes in the nearby villages.

4. Main aetiological factors involved appear to be (a) presence of fluorine content in an abnormal quantity in the soil pasture, in water, food stuffs and fodder associated with Aphosphoris and vitamin deficiency.

5. Symptoms akin to chronic rheumatism are noticed with anatomical abnormalities such as bony exostosis in the form of nodular prominences or elevations; overgrowth and deformity of the hooves and typical changes in the teeth.

6. Majority of the cases have been observed in she-buffaloes in milk probably because of their enhanced need of calcium.

OBSERVATIONS ON THE CURATIVE TREATMENT OF CONTAGIOUS CAPRINE PLEURO PNEUMONIA

By

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This contagious, enzootic, seasonal and species specific disease of goats has been recorded year after year to be taking a fairly heavy toll of goat population from many of the States in India, including the Bombay State.

So far there has been no drug—a chemotherapeutic agent of any proved value. The cost of the latest antibiotics is prohibitive for their use on a large scale in veterinary practice and to assess their value as a curative in such diseases is still beyond the reach of veterinarians.

Crawford in Ceylon, Gopalkrishnan in Assam and a few other workers from different States in India have advocated the use of N. A. B. (M. & B.) as a curative and have claimed a fair amount of success with this drug, but their findings have not yet been sufficiently corroborated by the research workers at the Indian Veterinary Research Institute. The author's experience with different chemotherapeutic agents including N. A. B. during the last 3 years, on over 210 cases, are rather very much disappointing even when used in the very early stages of the disease. In fact some of these drugs have been used in experimentally infected goats immediately after the infective dose was administered with no effect.

It is a well known fact that the disease runs a prolonged course—say from 7 days to 3 weeks. Hence it was decided to use different drugs - chemotherapeutic as well as the latest antibiotics - in as many cases as possible.

The following chemotherapeutic agents were given a trial in 211 cases.

(1) Novarsenobillon: N. A. B. (May & Baker) alone in 0.15 gms. dose irrespective of animal's weight, in 15 c. c. of Aqua distillata - intravenously.

(2) N. A. B. alone - 1st dose 0.45 gms. in 15 c. c. of Aqua distillata on the 2nd day and 0.15 gms. in 15 c. c. on the 3rd day intravenously.

(3) N. A. B. (M. & B.) in combination with Soluseptacine 0.15 gms. in 5 c. c. of Aqua distillata and 10 c. c. of 20% Soluseptacine irrespective of body weight - intravenously.

(4) Soluseptacine 20% solution alone. 10 c. c. to be injected intramuscularly every 8th hour for 3 or 4 days.

(5) Penicillin sodium G. Salt. 4 lakh units per day to be repeated for 4 days - intramuscularly. The following table No. I will give an idea.

Number of cases treated by the first method during the three years was 96 and the number of deaths amounted to 90. The percentage of deaths being 93.7.

Number of cases treated by the second method was 21 and 18 of them died from the 4th day onwards. The percentage of deaths in this case works out to 85.7.

TABLE I

Showing the chemotherapeutic drugs used, and the number of cases treated and deaths amongst those goats.

S. No.	Name of the drug.	Dose & route of administration.	Year in which cases were treated.		Total No. of goats treated.	Total No. of goats died.	Percentage of death amongst treated.									
			No. of goats treated.	No. of deaths amongst treated.												
1.	Novarsenobillon (N.A.B.) alone	0.15 gms. in 15 c.c. aqua-distillata intravenously	1951-52 38 1952-53 40 1953-54 18	1951-52 37 1952-53 36 1953-54 17	96	90	93.7									
2.	Novarsenobillon (N.A.B.) alone	1st dose 0.45 gms. in 15 c.c. aqua distillata 2nd dose 0.30 gms. in 15 c.c. 3rd dose 0.15 gms. in 15 c.c. aqua distillata intravenously for 3 days	1951-52 12 1952-53 4 1953-54 5	1951-52 11 1952-53 4 1953-54 3				21	18	85.7						
3.	N.A.B. in combination with soluseptacine 20% solution	0.15 gms. in 5 c.c. & 10 c.c. of Soluseptacine intravenously for 4 days.	1951-52 16 1952-53 8 1953-54 4	1951-52 13 1952-53 7 1953-54 4							28	24	85.7			
4.	Soluseptacine 20% solution alone	10 c.c. every 8 hours intravenously	1951-52 10 1952-53 4 1953-54 3	1951-52 10 1952-53 3 1953-54 3										17	16	94.1
5.	Penicillin Sodium G. salt	4 lakh units per day one injection intramuscularly	1951-52 6 1952-53 8 1953-54 3	1951-52 6 1952-53 7 1953-54 2												
6.	M. & B. 693 alone orally	3 gms. per goat weighing about 70 lbs. orally (6 tablets every 4 hours)	1951-52 5 1952-53 9 1953-54 2	1951-52 5 1952-53 8 1953-54 2	16	15	93.7									
7.	M. & B. 693 soluble	Intravenously	1951-52 9 1952-53 6 1953-54 1	1951-52 8 1952-53 6 1953-54 1				16	15	93.7						
Total ...			211	193												

In the third line of treatment i.e. N. A. B. in combination with Soluseptacine 28 goats were treated out of which 24 died giving the percentage of 85.7.

Out of the 17 goats treated with 20% solution of Soluseptacine, alone, 16 died. The death percentage works out to 94.1.

Penicillin also had no effect as a curative, since out of the 12 cases treated 10 died on the 5th, 6th and the 7th day from the onset of the symptoms. Death percentage in this case was 83.3.

Similarly M. & B. 693 - either by injection or orally had no effect.

It will not be out of place, if mention is made here that many of these cases were treated right from the day of the observable symptoms, i.e. treatment was commenced in the very initial stage of the disease. On every occasion attempts were made to confirm the disease, clinically by the finding of post-mortem lesions and by isolation of the causative organisms. The deaths in the natural outbreaks in untreated flocks are almost cent per cent. From the data given above, which the author feels is quite representative, it can be said that these chemotherapeutic drugs have no definite curative value, though there is a certain percent of cases cured amongst the treated.

Having failed to find out a really effective curative chemotherapeutic drug, resort was taken to try the following antibiotics :—

(1) Synthomycetine : This is the synthetic form of Chloremphenicol manufactured by M/s. Lepetit & Co.

(2) Terramycin : Chas Pfizer & Co.

(3) Aureomycin : Lederle Laboratories.

In vitro trials of these antibiotics were taken in different dilutions and after definitely ascertaining their value, field trials were taken, which are described below :—

In outbreak of Contagious caprine pleuro pneumonia attended recently in the Anreli district 21 goats were detected to be affected with the infection and these were seen to be in various stages of the disease. Out of these 4 goats were kept untreated as controls.

The remaining 17 goats were treated with above mentioned antibiotics as detailed below.

Group No. I: Five goats were treated with Synthomycetine (Lepetit). Each goat was taken to be weighing about 55 lbs. The dose was arbitrarily adjusted as suggested in the pamphlet for human treatment. It is 50 mg. per kilo gram body weight.

Thus each goat should have been administered 1250 mgms. per day and as the capsule contains 250 mgms. each goat was administered orally 4 capsules during the period of 24 hours. The treatment was continued for 4 days and all the goats got cured, the temperature falling down to within the normal range on the 3rd day after the start of the treatment. One Nany goat aborted on the 4th day.

The untreated control, however, died on the 4th day.

Group No. II:—Another batch of 5 goats was treated with Terramycin (Pfizer). For this trial also goats were considered to be of about 55 lbs. in body weight and the dose was similarly adjusted arbitrarily as per pamphlet for human beings, i.e. 30 mgms. per kilo gram body weight i.e. 750 mg. per goat in 24 hours. The treatment was continued for 5 days. Each goat was administered orally 3 tablets per diem at an interval of 8 hours.

In this case also, all the 5 goats recovered without any loss. Two goats aborted on the 5th day after treatment. Their fever came down to normal on the 4th day. The untreated controls died on the 4th day.

Group No. III:—Since the author had a very limited quota of Aureomycin only 2 goats were taken up for treatment. The pamphlet gives the dose as 5 mgm. per lb. body weight. This is of course for human beings. However, taking that each goat weighed about 55 lbs. the dose adjusted should have been 275 mgms. per goat but as each capsule contained 250 mgms. each goat was orally administered 2 capsules each day i.e. 500 mgm. in 24 hours.

One goat died the next day after the commencement of the treatment. The second goat was treated for 4 days, and it got over the disease. Its temperature came down to normal on the 4th day and remained within the normal range for the remaining period. The untreated control, however, died.

TABLE II
Table showing No. of cases treated in 1953-54.

Name of the Antibiotic.	No. of cases treated.	No. of cases died amongst treated.	Remarks.
1. Synthomycetine	5	Nil	One abortion
2. Terramycin	5	Nil	Two abortions
3. Aureomycin	2	1	Nil

The rest of the 5 goats were treated with N. A. B. alone and have been accounted for in the Table No. I under N. A. B. alone treatment.

The temperature charts will give an idea about the effectiveness of the drugs.

From the above experience, hopes are raised by these new antibiotics as curatives against this dreaded disease. Synthomycetine and Terramycin have definitely proved to be efficacious as a curative. I am fully conscious that more trials with these antibiotics are necessary to establish this claim.

The abortions that were noted in 3 goats—1 in the group treated with Synthomycetine and 2 in the group treated with Terramycin cannot be said to be due to the effect of these antibiotic drugs. These might have been due to pyrexia and debility.

Economics of the treatment :—While treating these goats, the cost of these antibiotics was not at all taken into consideration as the author feels that, in due course of time as the supply increases and the markets are flooded with these drugs, the cost will definitely fall down and come within the easy reach of the flock owners.

However, the cost of the treatment of a goat for a complete cure will be as follows :—

Synthomycetine :—Each goat was given 20 capsules of 250 mgms. each during 4 days i.e. 4 capsules per day. The cost of a vial containing 12 capsules of 250 mgms. is roughly about Rs. 12/- thus the cost of whole treatment works out to Rs. 20/- per goat.

Terramycin :—Every goat was given 15 Crystalline Terramycin tablets of 250 mgms. each, during 5 days of treatment i.e. 3 tablets per day per goat. A vial of 16 such tablets costs Rs. 36/-. Thus the cost of the treatment with this drug comes to Rs. 36/-.

Aureamycin :—Each goat was given 500 mgms. per day i.e. 2 capsules of 250 mgms. per day. One vial contains 8 capsules and one such vial is quite sufficient for the complete treatment which costs Rs. 14/-.

As said already, the idea of the author in trying these drugs was to see whether any of these antibiotics could be of any help and a few trials have shown that these drugs - especially Synthomycetine and Terramycin might prove as the antibiotics of choice.

Conclusion

1. Chemotherapeutic agents have not been found to be of any great value.

2. Antibiotics were tried only on 12 cases and has given promising results.

3. Before discarding or advocating any drugs either - chemotherapeutic or antibiotics - many more trials will have to be taken in a definitely enzootic area in cases where the disease has been diagnosed as Contagious - caprine pleuro pneumonia.

Summary

(1) The treatment suggested by various workers has been reviewed.

(2) Description of the trials taken with different chemotherapeutic agents - as (a) N. A. B., (b) N. A. B. in first heavy dose followed by decreasing dose for 3 or 4 days, (c) N. A. B. in combination with 20% solution of Soluseptacine, (d) Soluseptacine 20% alone in 10 c. c. injected every 8 hours for 4 days, (e) Penicillin Sodium G. Salt 4 lakh units and reviewed that none of these drugs have given really any tangible results.

(3) Trials in a few cases with success with antibiotics are described.

(4) Synthomycetine appears to be the cheapest, less toxic and better of the drugs.

Acknowledgments

The author acknowledges with deep sense of gratitude M/s. Lepetit & Co., (represented by M/s. Ranbaxy & Co., New Delhi, sole representatives in India), Chas Pfizer and Co., and the Lederle Laboratories for supplying their costly antibiotics free of charge for these trial treatments.

The author's thanks are also due to the Veterinary Officers who had reported and helped him in these trial treatments.

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INFECTIOUS STREPTOCOCCAL SEPTICAEMIA IN SHEEP AND GOATS

By

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Animal Husbandry Officer, Himachal Pradesh.

Received for Publication 4-6-54

History :—Infectious Streptococcal Septicaemia has been known to exist amongst sheep and goats for quite a long time, but no outbreaks of this disease have been recorded in the Hilly tracts or any where else in this country. Three outbreaks of this disease were reported amongst Gaddi flocks in Suket forests, Distt. Mandi, Himachal Pradesh. During the months of January and February, 1953, which gave me an opportunity to study the various aspects of the disease. The following record of my observations in the field will, I am sure, be found interesting.

Infectious Streptococcal Septicaemia in Sheep and Goats is characterised by high fever with catarrhal symptoms affecting the respiratory and digestive organs and Lymphatic glands showing septicaemic manifestations associated with Pleuro-Pneumonia.

Aetiology :—The causal bacterium is a Diplostreptococcus which is present in large number in pathological materials both in the form of diplococci and in chains. It is gram positive and grows on the usual Agar culture.

The disease runs acute, subacute and chronic forms. Lambs and Kids show acute form although Sheep and Goats of all ages are equally susceptible to natural infection. The disease is experimentally transmissible to Sheep, Goats and Rabbits. The acute course of the disease may take one to three days. In the sub-acute and chronic forms the course may run from four to eight days and a week to three weeks respectively, either terminating in protracted recovery or death. Mortality varies according to age and severity of symptoms and ranges from 40 to 60 percent. Outbreaks of the disease are generally reported on the return of the migratory flocks to winter runs in the low ranges after seasonal grazing in Alpine pastures. Exposure to inclement weather during the winter months combined with scarcity of grazing influence the course of the disease very much. Himalayan Goats exhibit more severe reaction than the sheep.

Symptoms :—The onset of the disease is characterised by high fever; affected animals in flock lag behind; mucous membranes injected; catarrhal watery discharge followed by one of muco-purulent nature from

both the eyes and nostrils; cessation of feeding and rumination; stiff gait; pulse and respiration accelerated; inflammatory swelling of the submaxillary and parotid glands associated with pleuro-pneumonic complications involving both lungs and pleural cavities. Septicaemic symptoms set in, involving other serous cavities and tracts. Almost all the Lymphatic glands are affected and show inflammatory changes. Cases of abortion in Ewes and She-Goats in advanced stage of pregnancy are frequently reported. The mortality is high in flocks which are under-run due to constant strain of journeys, inadequate feeding and exposure to inclement weather.

Differential diagnosis :—This disease closely resembles Haemorrhagic Septicaemia in the acute form. Blood smears and smears from other tissues and exudates on microscopic examination are negative to bi-polar organisms. The diplostreptococci (which is Gram positive) occur in chains in smears of Lung exudate and Lymphatic glands, while in the blood smears, the chains are broken and they appear in pairs.

The disease may also be confused with acute Broncho-pneumonia of verminous origin (Ova of nematode worm, *Vare-Storonylus pneumonicus*) in the chronic form as this parasitical disease is not uncommon in Hilly tracts but the absence of septicaemic manifestations and the course of the disease as compared with the protracted course of verminous disease can easily establish differential diagnosis. This parasitical disease may complicate the course of infectious septicaemia but the former disease is not infectious and is not transmissible to other-susceptible animals.

In Goats, the disease may also be confused with contagious Caprine pleuro-pneumonia but the latter disease is only communicable to Goats and not Sheep.

Pathogenicity :—The disease is transmissible to Sheep and Goats by intravenous injection of blood from the affected animals. Experimental inoculation of 5. C.C. of blood intraperitoneally to rabbits proved fatal in 24 to 36 hours.

Post-mortem findings :—On autopsy, the thoracic cavity is found to contain sero-gelatinous exudate. The trachea, roots of bronchi, lungs and pleural cavities contain purulent exudate of yellowish green colour of offensive odour. Small blood effusions in the serous membranes. The pericardial sac is distended and contains sero-gelatinous exudate. The peritoneal cavity also shows lesions of haemorrhagic infiltration. Pieces of lung tissue on histopathological examination at the I. V. R I., Izatnagar, revealed changes associated with fibrinous pneumonia and necrotic lesions accompanied with extensive destruction of lung paren-

chyma, emphysematous and compensatory collapse. The spleen tissue was markedly haemorrhagic with enlargement of malpighian corpuscles. Kidneys showed focal congestion. Liver revealed marked portal cirrhosis and distension of bile duct. The Laboratory report indicated septicæmic changes caused by Gram positive Cocci.

Treatment and Control measures:—As a prophylactic measure, it was proposed to give a trial to vaccine prepared from the cultures of *Diplostreptococci* cultured from the blood sent from the actual field of outbreak but these cultures were discarded by the time the requisition for the vaccine was made to the Institute. The use of streptococcal vaccine, pneumococcus immunogen combined, polyvalent streptococcal vaccine (Bacterin) and Antistreptococcal serum polyvalent may, however, prove useful in immunising the stock in dealing with wide spread outbreaks of this disease. The treatment of clinical cases with sulphamezathine (I. C. L.) in early stages of the disease gave encouraging results.

More information on this disease will be collected as and when such outbreaks are reported again.

Acknowledgments

The author is greatly indebted to Mr. P. R. Krishna Iyer, Research officer Disease Investigation and his staff at the I. V. R. I., Izatnagar, for their valuable assistance in examining the Laboratory specimens. Thanks are also due to Messrs Inder Singh Kapur, L. V. P. and G. C. Negi, B. V. Sc., members of the staff for their close co-operation and assistance in the control of outbreaks.

HAZARDS OF GAMMAXENE WITH REFERENCE TO TREATMENT OF PEDICULOSIS IN GOATS

BY

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“Gammexane” product Dust .025 and Water Dispersable Powder of Imperial Chemical Industries are said to be a persistent insecticide for the control of *domestic* and *industrial pests*. They are used in veterinary field against poultry ticks and lice, sheep cab, cattle ticks and other external parasites. “Gammexane” W. D. P. (6.5% gamma *Benzene Hexachloride*) at a concentration of one part in 40 parts of water (i.e., 4 oz. to one gallon) which is equivalent to 0.16% gamma B.H.C. is used in adult cattle, while calves are more sensitive than adult cattle to gamma B.H.C. The concentration, should not, therefore, exceed $2\frac{1}{2}$ oz. to 5 gallons of water which is equivalent to 0.02% gamma

B.H.C. The use of “Gammexane” W.D.P. at the same concentration as for adult cattle is indicated in the “Psoroptic Mange” in sheep. Indication on the use of any of these Gammexane products in goats, to the knowledge of the author, is lacking in the literature.

Misra (1954) used a 5% “Gammexane” W.D.P. emulsion in two healthy Haryana calves in good condition, at the District Livestock Breeding Farm, Angul against Trichophytosis in 1951. He used this emulsion for 5 consecutive days. On the 5th day of treatment these two calves developed “Gammexane” poisoning characterised by apyrexia and salivation. Salivation was mild at the beginning but it was profuse towards the later stage of the attack. There was shivering at the onset followed by stiffness of the body affecting neck, body, limbs and tail. Tetany set in rapidly. They were subsequently treated with calcium gluconate intravenously and Mag. sulph. subcutaneously. But the onset was so rapid that this treatment could prove of no avail.

Das (1954) used a 3% solution of “Gammexane” W.D.P. externally in two emaciated calves against pediculosis in 1953 at Sambalpur, Orissa, India. One calf was a year old and the second calf was about 5–6 month old. They were local country-bred calves. He gave one application in the morning. One hour after application the animals were thoroughly washed with pure water. Toxic symptoms set in about 8–10 hours after the application of this emulsion. The clinical symptoms, he observed in those calves, were apyrexia, salivation; dilatation of the eyeballs and pupils followed by general stiffness of the body and staggering gait. The symptoms developed so suddenly and death supervened so rapidly that he could not adopt any medicaments to combat the toxic symptoms. Prusti (1955) had a sad experience of Gammexane P 520 on a cow and a bullock, which succumbed one and four hours after treatment, respectively. He, on another occasion, used a 5% emulsion of Gammexane P 520 on a three year old Red Sindhi bull against lice infestation. When one hour after application the bull shivered and fell down unconscious, he poured cold water over the body and washed it thoroughly. The bull survived. Hermes (1939) reported the goats are very commonly enormously infected with biting lice.

Herein, a severe infestation with lice in a flock of 44 Beetal Bucks belonging to U.G.S. Orissa stationed at Patha—a distance of 6 miles from Cuttack Town, is reported. The affected bucks showed marked rubbing. The irritation produced by lice particularly in some of these bucks caused the animals to rub against the walls of the shed, nearby landing-mat fences and even bite themselves so much that the hairs were matted and pulled out, resulting in considerable loss. While in other animals hairs were falling down, probably due to weakness

produced by gnawing of the lice. The glossiness of hairs in some of these affected animals disappeared. When hairs were turned against their opposite direction large amount of scales were falling down. The author, being attracted by the varied uses of "Gammexane", especially protecting the domestic animals from ectoparasitic infestation, used "Gammexane" W.D.P. as a dust against both biting and sucking lice. The specimens of lice collected at random from some of these affected bucks, were confirmed to be as *Bovicola Caprae* (Gurlt) and *Linognathus* sp., by the Head of the Division of Parasitology, Indian Veterinary Research Institute, Izatnagar.

Delousing was done on November 21, 1954 noon by simple rubbing the "Gammexane" W.D.P. as a dust against the opposite direction of hairs on the surface of the body, affected areas of the face and ears. The animals were allowed to stay in the shed for 2 hours, after which they were let off to the adjoining jungle for browsing. When examined on November 22, 1954 the adult lice were found dead i.e., 24 hours after interval. However, Gammexane did not appear to have any effect on nits as they were seen still adherant to hairs. Gammexane treated animals did not show any untoward symptoms till November 23, 1954 evening.

On November 24, 1954 morning at about 3 A.M. Buck No. 38 showed nervous fits. He was found walking in circles, keeping neck to left side, as if, suffering from gid. This was followed by partial stiffness of the neck, body and limbs. He finally fell down. While lying on the floor there was occasional smacking sound of the mouth with profuse salivation and tremours of the lips. Apyrexia was the chief characteristic feature. The rate of respiration and pulsation were high. The dilatation of eye balls and pupils was very marked. Faeces was semi-solid with mucus coated on it. The urine was red colour, but it did not stain the hind quarters, belly or the floor as seen commonly in goats treated with Phenothiazine. The colouration of urine was suggestive of a haematuria. As the animal was lying down the urine sample could not be analysed. He had no tendency to eat or drink. He was given 50 cc. of 25% glucose and 10 cc. of 10% Ca. gluconate intravenously, once a day, continuously for a period of 7 days beginning from November 24, 1954 and Alum gr. XXX and Boric Acid gr. XX in treacle by mouth, once a day continuously for 3 days when the colour of urine became clear. For two days i.e., November 24 and 25, 1954 the buck desisted from feeding. On November 26, 1954 morning he could get up of his own accord but was unable to walk owing to stiffness of limbs. At times he attempted to turn round bending the neck always towards the left side. (Fig. 1) When made to walk he was falling down here and there showing nervous fits. The dilatation of the eye balls and pupils was still

present. On November 27, 1954 i.e., 4th day of the onset of symptoms he could eat (greens) and drink, a little. There was decrease in dilatation of the eye balls and pupils, the gait was not so staggering as it was on previous days (i.e., gait was still incoordinated). However, stretching of the neck towards left side was still present. By November 30, 1954 i.e., 7th day of the onset of symptoms he appeared clinically cured. Now the buck is in perfect condition.

On November 24, 1954 noon another goat (Buck No. 42) showed toxic symptoms similar to those described in Buck No. 38. The symptoms were rather mild in nature. He was given 50 cc. of 25% glucose and 10 cc. of 10% calcium gluconate intravenously and Alum gr. XXX and Boric Acid gr. XX in treacle per os., once a day continuously for 3 days. The colour of urine became normal. The toxic symptoms abated completely by November 27, 1954.

To one's surprise, quite an appreciable percentage of bucks, on a careful examination, showed general uneasiness, red colouration of urine and inappetence within 5 to 7 days of "Gammexane" W.D.P. dusting. A concurrent infection of a possible blood protozoan disease was ruled out by a negative finding of blood smears examination of the bucks passing bloody urine. Urine analysis (Coffin, 1947) of some of the bucks passing bloody urine was made. The result of examination done is given in Table I.

Discussion

Spastic movements, incoordinated gait, tremors and maintenance of normal temperature have been observed in sheep suffering from Rida, a chronic encephalitis of sheep, in Iceland by Sigurdsson (1954). Manifestation of stiffness, incoordinated gait, labial tremors have been observed in buck No. 38 due to "Gammexane" W.D.P. poisoning. In advanced stages of Rida animals do not show the normal interest in food and water and they loose condition (Sigurdsson, 1954), whereas indifference to food and water was seen in the early stage of the onset of toxic symptoms of "Gammexane". Circling movement in sheep and goats has been reported due to cystic stage i.e., *Coenurus cerebralis* of the Tape Worm—*Taenia multiceps* (Monning, 1947). The characteristic symptom is seen from about 2--7 months after infection. In Gammexane treated buck No. 38 the circling movement was seen from the 4th to 7th day of dusting. It is likely that absorption of Gammexane sets up temporary cortical encephalitis. The sudden death reported by Das (1954), Misra (1954) and Prusti (1955) was not encountered in the goats dusted with Gammexane. These authors also did not state the passage of red urine in calves. The passage of red urine in some of the goats (Table I) encountered, is not fully understood, but, nevertheless, may be attributed

TABLE I

Urine examination of bucks dusted with "Gammexane" W.D.P.

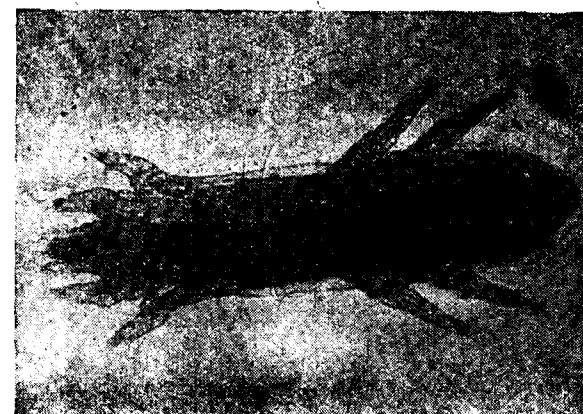
Sl. No.	Buck No.	Details of Examination done								
		Color	Sediment	P.H.	R.B.C.	W.B.C.	Renal epithelial cells	Bladder epithelial cells	CaCO ₃	Amorphous phosphate
1.	23	Brown	Not visible	Alkaline	++	a few	a few	a few		
2.	66	"	"	"	a few	a few			+	
3.	32	"	"	"	++	a few	a few			
4.	24	"	"	"	a few	a few				
5.	63	"	"	"	a few		a few			
6.	36	"	"	"	+++	++	+	a few		a few
7.	60	"	"	"	++	+	+	a few		a few
8.	35	"	"	"	++	+				a few
9.	43	"	"	"	++	+++				a few
10.	44	"	"	"	a few	a few				a few

The flock was given a mass treatment with Alum gr. XXX, Boric Acid gr. XX in treacle each, once a day, on November 26, 27 & 28, 1954 by which time the urine became clear.

to the excretion of Gammexane W.D.P. through kidneys and injuring the renal epithelium. The onset of nervous symptoms took place earlier than that of the passage of bloody urine. This may be so, in that absorption of Gammexane into the central nervous system may be faster than its excretion through the urinary system. However, this statement requires further experimentation. Nandi (1954) investigating into Bovine haematuria in Kalimpong (District Darjeeling), India, stated that certain weeds used as cattle fodder irritate and damage the kidneys during their excretion from the body and play a subsidiary factor in the onset of haematuria. The bucks stationed at Patha had access to varied weeds of the neighbouring jungle on which they browse. The goats had no bloody urine before delousing and after recovery from Gammexane poisoning. Treatment with Alum and Boric Acid gave a good result in checking the passage of red urine in goats as had previously been reported by Ramaiah (1943) and Rahman (1944) in the treatment of bovine piroplasmosis.

A Note on *Syringophilus Bipectinatus* (Heller, 1880)—A Quill Mite of Domestic Fowl in India

By
Dr. S. R. Rao and L. S. Hiregaudkar



Syringophilus Bipectinatus female.

[Illustrating article on Page 432]

Hazards of Gammexane with reference to Treatment of Pediculosis in Goats

By
G. Biswal



Gammexane treated buck showing the stiffness of the limbs and stretching of the neck.

Knuckling at the Fetlock Joint (Congenital) in Calf

By
K. B. Sabharwal

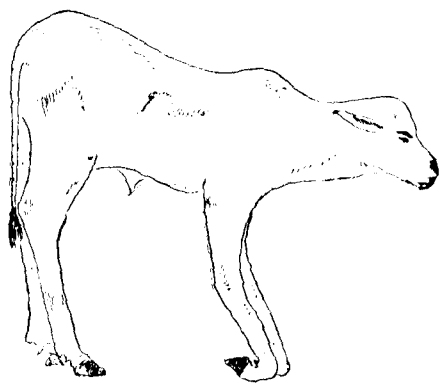


Fig. 1

Congenital Knuckling at the fetlock in a calf
(Drawing).



Fig. 2

The calf before operation.



Fig. 3

The Calf, after the operation,
(with bandages on).



Fig. 4

The Calf, cured, after operation.

[Illustrating article on Page .

Summary

1. Occurrence of a "Gammexane" W.D.P. poisoning in Beetal bucks belonging to Utkal Go Mangal Samiti, Orissa, India, is described.
2. "Gammexane" W.D.P. appears to be highly poisonous and is absorbed through skin.
3. The clinical symptoms observed in goats from "Gammexane" W.D.P. poisoning is furnished in detail.
4. The line of treatment is discussed.

Acknowledgment

The author wishes to acknowledge with thanks the co-operation extended by H. D. Srivastava, Head of the Division, Parasitology, Indian Veterinary Research Institute, Izatnagar for the confirmation of lice, Col. G. V. Short, Imperial Chemical Industries representative at Calcutta for supplying the literature on "Gammexane" and Mr. K. M. Das, Research Assistant, Provincial Veterinary Laboratory, Orissa in the treatment of some of the affected bucks.

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***A NOTE ON *SYRINGOPHILUS BIPECTINATUS* (HELLER, 1880)
—A QUILL MITE OF DOMESTIC FOWL IN INDIA**

By

Dr. S. R. RAO AND L. S. HIREGAUDAR,
Bombay Veterinary College.

Only three species of *Syringophilus* are known so far all over the world. Of these, *S. bipectinatus* is reported from *Gallus domestica* while the other two viz. *S. columbae* and *S. totani* are known from *Columba domestica* and *Totanus totanus* respectively. The genus *Syringophilus* was formerly kept in the family Analgesidae. Radford (1950) placed it under the family Cheylitidae. At present it has been placed under the family Myobiidae by some of the American acarologist as the character of the genus *Syringophilus* agree with some of the characters of the latter.

Syringophilus bipectinatus has eluded the attention of workers in this country for a long time. It has been reported from North America, Europe and South Africa. Its presence in this country was not detected till recently when Dr. T. Ramachandra Rao, Entomologist, Virus Research Institute, Poona drew the attention of the authors towards the existence of this mite in the quills of birds. Later, the same material was received in this laboratory from the Assistant Disease Investigation Officer, Poultry, Bombay State, Poona for specific determination. The authors, therefore, take this opportunity of recording this mite and hope that a closer search might reveal its presence in many places in this country.

The morphological study of this species agrees with the description given by Heller (1880) and Hirst (1922). Kaschula and Stephens (1948) have dealt with in short about the pathogenicity of this mite in in poultry in South Africa.

Habits:—It is usually found in the quills of wing feathers close to the base of the wing. In heavy infection even body feathers show parasites. The mode of infection is still doubtful. The *rhachis* of the heavily infected feathers appear somewhat dried up with a definite posterior opening at the superior umbilicus. By opening the affected quill one can detect a large amount of debris and black faecal matter consisting of casts, dead mites, eggs and sometimes live mites. In the debris all the stages of the mite may also be detected.

Pathogenesis:—These mites are really harmful when the infection is heavy. The affected quill is more or less transparent and divided by septa into various sections. In heavy infections the whole quill is filled with debris, thereby rendering the quill soft and fragile. Sometimes distortions of the feathers take place. Where there is secondary

(* The paper was read at the Ind. Sc. Congress 1955.)

infection by bacteria the papillies of the feather are filled with soft and cheesy material. Due to constant irritation the birds usually pull out the feathers thus causing partial or complete loss of feathers.

Prophylaxis:—The affected quills or feathers should be pulled out and burnt. Gammaxane at the strength of 0.025% when dusted into the feathers of the body and wings every fortnight will have a desired effect in control measures of all mites infecting birds.

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Notes and News

As we go to press, we learn with deep regret that Dr. Albert Einstein has passed away. It was he who gave the world the theory of Relativity 50 years ago and also the key to the secrets of atomic energy. He was one of the great Scientists of modern times and an undisputed genius in his own line. The world is poorer to-day by his death and we mourn his sad demise very much with the rest of the world. May his soul rest in peace!

* * * *

Here is a Reuter's telegram dated 4th April 1955:—

“Mr. F. L. Winter, a Director of the London Corn Exchange, talking to the farmers in London said “This year for the first time since 1941 India is granting export licences for a limited tonnage of groundnut oil seed and cotton seed cake. The tonnage released for export by India was insignificant 75000 tons of groundnut, linseed and cotton seed cake, but it was hoped that was only a beginning and already her re-entry had assisted in easing prices”.

This is a glaring example of how cattle food situation in India is being tackled! Starve still further the already starved cattle of India. That is the grand policy and programme for the development of Cattle in India! This is interesting in the light of what we had written editorially in this issue on “Nutritional Research”.

* * * *

We take the following from the *Madras Mail*, dated 17-4-55:—

Wool Processing Centre. To be established in N. Arcot (Madras) —

A scheme to set up a wool processing centre at Vanimangalam, North Arcot district, jointly by the Governments of Madras and Mysore, has been approved by the Union Government. Mr. Nityanand Kamungo, Deputy Commerce and Industry Minister, informed Mr. Balakrishnan Congress, Madras, in the Lok Sabha today.

The cost of machinery was estimated to be Rs. 5,90,000, and the estimate for the total cost of the scheme was Rs. 11,30,000. One-third of the total cost of the scheme would be borne by the Union and the rest of two-thirds would be shared equally by the Madras and Mysore Governments.

We need hardly say that this very necessary step has not come a day too soon.

Best Results with Hatching. Points in Selection of Eggs—

Poultry keepers will have to pay sufficient attention to the selection of eggs for hatching, if they want the best chickens.

For improved breeds, setting eggs should not be more than two ounces in weight each. The eggs should be of a good regular oval shape. Eggs of an abnormal size or shape, too pointed or round, or otherwise not symmetrical should be avoided. A simple test to find out whether the eggs selected are sound would be to tap two eggs together. If any egg is weak or has a cracked shell, it will produce a dull sound.

Dirty eggs should be avoided for hatching. If a dirty egg is otherwise sound, it should be cleaned with a knife or stiff brush and not by washing.

Eight to ten eggs are a convenient number for setting under Desi hens. Fresh eggs should always be used and they should be stored in a cool and somewhat moist atmosphere. In the winter or in the hills, eggs can be stored for seven to ten days and in the summer or in the plains for three or four days.—ICAR 27.

Farm Fillers—It is preferable to have cows calving at intervals of about 12 months, as this has been found to beneficially effect milk production. A shorter period results in less milk and shortens the period of usefulness of the cow.

The innocent-looking house fly can transmit infection such as of food poisoning, diarrhoea, dysentery, typhoid, cholera, intestinal worms, inflammation of the eye, tuberculosis and possibly infantile paralysis.

Hornless cattle, generally known as polled cattle, were found in Egypt as far back as 2150 B. C.—ICAR 43.

Good Hatching Results. Care of Brooding Hen—With some attention to feeding and care, a brooding hen can give good hatching results.

The hen requires a good amount of grain feed and water before sitting. During the sitting period, she needs plenty of cool water also. When taken out of the nest she should be given whole grains like wheat, maize or *jowar*. The grain should preferably be scattered so as to give her some exercise. Sloppy food such as bran, green or mash or rice should be avoided because they cause loose droppings which soil the eggs. The bird should never be fed or watered when she is in the nest.

The brooding hen should be set towards the evening and not disturbed till the following evening for feeding. She should be let out once a day at a fixed time for food and water. She should be also gently handled by putting one hand underneath her and the other on her back, so that the eggs are not damaged. It is always good to remember that a few eggs may get concealed in her wings—ICAR 44.

The following photo and the note accompanying it must be of great interest to the Veterinarians. It appeared in the "*Hindu*" of Madras dated 19th April 1955.



A Black hen of Arcot Poultry Farm, Pattathanam, Quilon, has laid an abnormal egg, weighing 5 oz. and 30 gms. On either side of it the size of normal standard eggs is shown.

(Courtesy "*The Hindu*")

Clinical Articles

KNUCKLING AT THE FETLOCK JOINT (CONGENITAL) IN A CALF

By

K. B. SABHARWAL, B.V.Sc.,

Demonstrator in Surgery,

Punjab College of Veterinary Science and Animal Husbandry, Hissar.

Knuckling at the fetlock is due to contraction or shortening of the flexor tendons. This is one of those conditions about which there is a dearth of real knowledge. It occurs in all breeds of cattle and in most breeds of horses, although very rarely in ponies.

Murthy (1942) reports of a case of contracted flexor tendons which responded to tenotomy. He gave a longitudinal incision three inches long under local anaesthesia along the tendons and after cutting the flexor tendons in the metacarpal region, was able to extend the joint. The wounds did not heal by first intention and were treated as open wounds. Murthy (1946) cured another similar case by operating on the flexors. He severed both the flexor tendons after giving 1 dram of Liq. Morphinae hydrochloride subcutaneously and was able to extend the joint. He sutured the wounds, kept the legs-extended, fixing them in their normal position with cotton-wool and splints extending from the bend of the knee to the toes. The wounds healed by first intention and the splints were removed on the 15th day.

Pausare (1949) has cited a case in which a year old calf developed this malady after injury caused through the entanglement of its foreleg in a cart wheel. Tenotomy of flexors at the posterior aspect of the fore-pastern effected a complete cure.

Grubb (1951) mentions that many calves have responded rapidly to intramuscular injections of vitamin D₂ and Vitamin E (Myodystrophia due to inadequacy of vitamin D & E during foetal life).

Hastings (1952) observes that the occurrence of knuckling in calves is usually associated with some nutritional deficiency suggestive of disturbance in the metabolism or imbalance of calcium or phosphorus or both. It may also be a symptom of Vitamin A deficiency, which if not corrected, may be accentuated and continue to the stages of paralysis and death.

Mackey (1952) found it following the Septicaemic form of "Shipping Fever".

The case operated upon by the author was Haryana bull-calf 4 days old. It was born with the fetlocks of both fore-legs flexed and was walking with the anterior part of the affected joints (fetlock) resting on the ground. The toes were above ground (Fig. 1). The calf was brought to the Veterinary Hospital on 29-10-1953.

Thorough examination revealed contraction of tendons (Fig. 2). All attempts to extend the foot proved futile. It was then decided to try tenotomy of flexors of one limb—in the first instance and if successful then of the other.

Technique of operation

Left Limb :—The operative area in the middle of the metacarpal region on the medial surface of the limb was clipped, cleaned and washed with soap and water. Procaine hydrochloride with adrenaline (2%) was injected subcutaneously on each side of the tendons. Tincture of Iodine was painted on the site. An incision just sufficient to admit a narrow-bladed scalpel was made along the anterior border of the perforans tendon. The scalpel was inserted in front of the perforans tendon until its point was felt beneath the skin on the other side, then turned the cutting edge towards the tendons and severed both the flexors one by one. This, however, did not extend the foot to its normal position. Sulphanilamide was insufflated in the wound, the incision was sutured and tincture of Iodine painted on the sutured area. The leg was kept extended and fixed in the same position with cotton-wool and splints extending from the bend of the knee to the toes (Fig. 3). The next day, the toe of the foot was touching the ground. Efforts made to bring the foot in the normal position by extending it daily for a week proved futile.

Right limb :—After a week, it was decided to operate on the right limb. In this case all the preliminaries were carried out as for the left limb. After severing both the flexor tendons it was not possible to bring the foot to the normal position and it was then decided to sever the suspensory ligament as well. After severing the latter, it was possible to extend the foot to the normal position. The incisions were then closed with sutures after insufflation of sulphanilamide powder and painted with tincture of iodine. The limb was kept extended and fixed in the normal position with cotton-wool and splints, extending from the bend of the knee to the toe.

After a week, the suspensory ligament of the left limb was also severed, and the foot could be extended to the normal position. The leg was kept extended and fixed as above.

All the wounds healed by first intention, and splints were removed after a month. The cotton-wool padding and bandages alone were then

continued for a fortnight afterwards. It was then possible for the calf to walk and run about like a normal animal without any support. It could bear the weight equally on all the limbs (Fig. 4).

Acknowledgments

My grateful thanks are due to Prof. Dalip Singh and Prof. Karamchand for their constant encouragement and helpful suggestions.

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OMASAL FISTULA IN A BULL-CALF

By

K. B. SABHARWAL B.V.Sc.,

Demonstrator in Surgery,

Punjab College of Veterinary Science and Animal Husbandry, Hissar.

Subject :—A Haryana bull-calf aged 2 years.

History :—The owner stated that the calf developed a swelling in the middle of the chest which had burst of its own accord and the faeces was passing out through it for the last three months. The animal was brought to the College Hospital on 27.2.1954.

On thorough examination the case was diagnosed to be one of Omasal Fistula with an outer opening of about 1½ inches in diameter on the right side of the chest.

The animal was kept on a laxative and restricted diet for two days and no feed on the 3rd day.

2-3-1954. The animal was given chloralhydras in treacle and water. The site of operation was thoroughly cleansed and disinfected. Local anaesthetic procaine hydrochloride 5% with adrenaline was injected around the opening. The adhesions of the skin and omasum were broken and the edges freshened by cutting the skin. On examination some portion of the omasum was found to have sloughed, which was therefore removed. A thread was passed on the sides of the omasum to pull it. Its edges were painted with tincture of Iodine and sulphanilamide powder was insufflated. The omasum was then sutured in lembert's fashion with chromic catgut 20 days No. 00. As there was

no intercostal muscle the skin was painted with tincture of Iodine and sulphanilamide powder was insufflated. The skin was sutured with silk thread leaving an opening at the lower end for any discharge etc. A four tail bandage was applied over the wound to cover it. Procaine Penicillin 12 lakhs units was injected intramuscularly.

The case maintained a steady progress with careful nursing with Milk, Rice gruel, Bran mash, Berseem etc., and local dressing with antiseptics. Two more injections of Procaine Penicillin were given as and when they were indicated and the animal made a perfect recovery.

Acknowledgments

My grateful thanks are due to Prof. Dalip Singh and Prof. Karam Chand for their constant encouragement and helpful suggestions.

A CASE OF VIRGIN COW IN LACTATION

By

HANS RAJ BHATTIA,

Veterinary Assistant Surgeon, Nawanshar.

Cases of non-pregnant cows, virgin heifers and goats yielding milk spontaneously have been recorded in periodicals and journals from time to time. Stilboestrol, a synthetic estrogenic hormone, is being extensively used for the treatment of anæstrus condition in cows, pyometra, retained placenta, etc., and also to induce lactation in sheep, goats and cows and chemical caponisation of poultry all over the world. Luktuke and Bhattacharya (1) successfully induced barren cows and virgin heifers into lactation with a dose of ¼ to 1 gramme of Stilboestrol. Ghulati (2) while treating a cow for anæstrus condition, incidently brought her into lactation with a small dose of 30 milligramme Stilboestrol.

A case of this nature has come to my notice which may be of interest to the readers.

A mixed Sahiwal breed, cow aged 6 years, property of Shri Bahal Singh, Sub-Judge, was brought to a Veterinary Hospital many times for examination for pregnancy and found empty on each occasion. The owner stated that, in spite of good feeding and care, the cow was never observed coming on heat and yet her udder was so well developed as if she was in the advanced stage of pregnancy. Her general condition was also very good. The animal was thoroughly examined per rectum and no abnormality was detected with her ovaries and uterus. Condition of uterus clearly indicated that the cow had never

been pregnant before. Having satisfied that the cow was neither pregnant nor had she shown any signs of oestrus since March, 1953 (when the animal was brought at Nawanshar) and her ovaries were also normal, she was injected Stilboestrol dipropionate 10 c.c. (10 mgm.) intramuscularly on 14.11.1953 with the concurrence of the owner. Before doing so her teats were stripped and a few drops of water like fluid of sticky nature were taken out from all the four quarters.

Four days after the treatment with stilboestrol, i.e., on 19-11-1953, the animal showed signs of heat and was shown to bull and got covered. Three or four days after mating, udder of the cow developed to such an extent that it was considered advisable to relieve her of the burden. She was milked and about 12 lbs. of colostrum was taken out. To the great surprise of the owner, the udder was again found distended and tense on the next day and necessitated relieving. She was milked again and 6 lbs. of milk was removed. Since then the animal is being milked regularly and is yielding 6 lbs. of milk daily upto the day of writing this note. The milk is quite normal in colour, odour, taste and consistency. It is rather rich in fat than an ordinary cow's milk.

The cow has been examined many a time after she was covered on 19-11-1953 but she has not conceived. She has also shown no signs of coming on heat again since then, but is yielding milk.

This case is of special interest for the reason that milk yield was initiated incidently in a virgin cow with a very small dose of Stilboestrol i.e., 10 mgm. only, while she was being treated for anoestrus condition. The smallest dose of stilboestrol that induced lactation under similar circumstances was 30 mgm. as previously recorded by Ghulati (2). The dose of Stilboestrol usually recommended for initiating lactation is from $\frac{1}{4}$ to 1 gm. and is used in the form of pellet placed subcutaneously.

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College News

BENGAL VETERINARY COLLEGE

List of students who passed the Diploma (G.V.Sc.) Examination, 1954-55.

(In order of merit)

- | | |
|---|-------------------------------|
| 1. Nani Gopal Ghoshal | 5. Jackson NDeti Solomon |
| 2. Mapamudiyanselage Sarath Mapagunaratne | Kyengo |
| 3. Santanu Kumar Goswami | 6. Devanullage Upali |
| 4. Ambrose Harry Jesudasan Rajamannan | Lalchandra Perera |
| | 7. Rupert Ilangantileke |
| | 8. Satya Narayan Gangopadhaya |

- | | |
|--------------------------------------|----------------------------------|
| 9. Gandhi Kumar Banerjee | 21. Kashi Nath Mukhopadhaya |
| 10. Mahadev Chandra Mandal | Henry Peter. |
| 11. Sudhindra Nath Nag | 22. Bimal Kumar Das |
| 12. Ashimendu Lal Roy | 23. Ashutosh Mondal |
| 13. Swampillai Francis | 24. Karunabandu Wanigasinghe |
| 14. Jnanananda Chowdhury | 25. Bibhuti Bhusan Mazumdar |
| 15. Bipin Behari Sarkar | 26. Parimal Chandra Talapatra |
| 16. Krishna Dhan Banerjee | 27. Kanan Tripathi |
| 17. Ashit Chandra Panchanan | 28. Lionel Edirisisinghe Bandara |
| 18. Dharendra Nath Biswas | Jayasundera. |
| 19. Bhaskaran Nair Velayudhan Pillai | 29. Salil Kumar Sahoo. |
| 20. Ranajit Kumar Roy | Hari Narayan Sharma. |

Calcutta, }
23-3-'55. }

K. C. MUKERJEE,
Principal, Bengal Veterinary College.

Correspondence

[The views and opinions expressed in correspondence are those of the writers themselves and are not always endorsed by the Editor. Ed. I.V.J.]

"Urea Poisoning in the Bovine"

Due to the recent knowledge that urea in small amounts can serve as protein substitute in the rations for ruminants, feed manufacturers have begun to use urea in the mixed feeds intended for dairy cows in the western countries. Three cases of poisoning of dairy herds by urea in feeds are reported by three American Veterinarians, Drs. T. H. Bullington, C. E. Byrd and T. W. Harris, recently in the *North American Veterinarian*, Feb., 1955, (pp. 107-109).

Within 5 minutes of consuming the new feed containing crushed corn, cotton seed meal, crimped oats, chopped hay, urea and perhaps another small grain, the cows grunted, groaned, sweated profusely and were colicky. Two of them died before the doctor arrived. Incoordination, severe pain, tympany of the rumen, salivation and tetany were the symptoms noticed in the other affected animals. Six out of twelve cows in this herd died quickly in spite of immediate treatment.

Only after the unsuccessful emergency treatment of the peracute cases with $\frac{1}{2}$ oz. of chloral hydrate in solution intravenously, 250 c.c. of 50% glucose intravenously, 250 c.c. of calcium gluconate intravenously and $\frac{1}{2}$ gallon of mineral oil by stomach tube to one cow, the feed was suspected, inspected and despatched for analysis by the State chemist. It was found to contain 32 percent of urea which would be fatal to any animal in such concentration. This unduly high amount was due to bad mixing, which led urea to concentrate in certain

bags and was basically responsible for this avoidable situation. The other poisoned cows were treated with 5 pounds of granulated white sugar dissolved in water, by stomach tube and were saved.

Two other cases of fatal poisoning are also reported in other herds by using feeds said to contain 2 percent urea and one of the two cases was by the feed manufacturer himself who used it on his own cows. Even treatment with a large amount of sugar solution could not save many of the poisoned animals. The poor nature of mixing the feed has been recognised to be responsible for the poisoning and rapid symptoms in mostly fatal cases by the urea containing feeds, when the urea is present in sufficient percentage to cause acute deaths in cattle. The owner of the fatally poisoned grade, average dairy cattle promptly received payment in full as compensation from the involved feed mill without delay or question in accordance with the State feed control regulations.

Madras }
10—4—55 }

V. MAHADEVAN,
Professor of Animal Nutrition,
Madras Veterinary College.

Extract

Oral Terramycin in the treatment and prevention of white scour in calves.—J. K. L. PEARSON, *Veterinary Research Laboratories, Stormont, Belfast, Northern Ireland.* *Vet. Record*, 66, 37.

A supply of crystalline terramycin hydrochloride was obtained for the treatment of white scour in young calves, in the autumn of 1953. The terramycin was in oral tablet form, each tablet weighing 1 gramme.

Besides an attempt to treat the calves, six badly affected farms were selected with a view to preventing the disease developing in freshly dropped calves by means of oral therapy.

The results in the prevention and treatment of the disease in 62 calves were so spectacular as to merit a preliminary note on this use of terramycin.

Kafka (1951) has already claimed success in the prevention and treatment of white scour infections and a number of American workers claim that the organism said to be responsible, *Bacillus coli*, is highly susceptible *in vitro* to terramycin salts. Smith (1954) tested 58 strains of *B. coli* and found all sensitive *in vitro* to 1 to 8 μ g. per ml. Comparative tests with other drugs showed chloramphenicol to be slightly less efficient and aureomycin and streptomycin next in line in effectiveness.

Treatment of cases

Forty-one cases were treated, all being 3 to 10 days old when given terramycin. Serological and chemo-therapeutic substances had already been given to a number of cases prior to terramycin treatment, and in those recorded no response or only partial response had been shown.

The 1-gramme tablets were divided and each calf was given 0.5 gramme orally and a similar dose of 0.5 gramme in 24 hours.

Only one calf did not respond fully to treatment and this calf had been sick and scouring for four days previously. It was in very poor condition at the time of terramycin treatment.

The usual finding following treatment was a complete absence of diarrhoea inside 12 to 24 hours and an uneventful recovery following the administration of the second half tablet.

Rectal swabs were taken from a number of cases after treatment but *B. coli* infections were isolated from nearly all cases in spite of the clinical response shown.

Control groups of calves were easily kept owing to the shortage of terramycin material, as other treatments were essential. On one particular farm four cases were seen at the first visit. Terramycin was given to one calf and usual empirical treatments to the other three. The three latter recovered in about three days while the first calf recovered in 24 hours. This quick response to treatment was typical of all cases given terramycin, the scouring symptoms disappearing overnight and complete recovery being shown within a maximum of 36 hours.

Prevention

Twenty one calves on six heavily infected farms were given 0.5 gramme orally within the first 24 hours after birth. A similar dose was given after a further 12 to 24 hours, and no other precautions were taken. The results were quite spectacular; not one case of white scour developed in any of the calves. Untreated control calves were again easy to keep on farms, and cases developed in these in the proportions usual to each farm—in two farms to the extent of 100 per cent.

No other means of prevention was used in the control calves, or coupled with the terramycin in the group under preventive treatment.

Discussion and Summary

An oral form of terramycin hydrochloride was used in an attempt to control white scour infections in young calves. Forty-one clinical cases were given to two doses of 0.5 gramme each, and 40 of these (97

per cent.) recovered completely within 36 hours of treatment starting. The doses given were more than double those used by Kafka (1951), but coliform infection were not eliminated in spite of clinical response.

In the prevention of the disease in 21 calves on six infected farms, two does of 0.5 gramme each were given within the first 36 to 48 hours of life. The results in prevention were 100 per cent. effective.

Acknowledgments

The writer gratefully acknowledges the help given by all practising veterinary surgeons who presented cases for clinical treatment, and calves on infected farms for preventive treatment. Thanks are due also to Messrs. Pfizer, Ltd., for their generous supplies of terramycin.

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Review

Fertility & Infertility in the Domestic Animals.—Dr. L. A. LAING, Ph. D., B.Sc., M.R.C.V.S. 256 pp. 35s. Bailliere, Tindal & Cox, London. 1955.

Dr. John Hammond of the University of Cambridge in his foreward to this publication, has very appropriately stressed on veterinarians not to limit themselves to the prevention and treatment of the various, general and reproductive disorders alone, but to go beyond that and help in the improvement of the animal productive and reproductive abilities, which in turn would help solving the complex food problem. This requires first rate knowledge of the various fundamental principles involved in the problems of fertility and sterility. Although much research has been done and the results published in many periodicals, there are very few books which have consolidated those results and made available in a single volume. Dr. Laing has done a great service in writing this very valuable book which would enable veterinarians and others to understand more thoroughly many problems of fertility and sterility and use that knowledge in solving many of the food problems.

In the first chapter, the author has discussed in a comparative manner, the incidence of infertility and the economic losses to the country, the diagnosis of infertility and the fundamentals of fertility and how this could be controlled. In another 16 illuminating chapters, the author has dealt in a masterly manner various specific subjects. These cover the various phases of the control and physio-pathology of reproduction, the diagnosis of pregnancy, the technique of artificial insemination, specific

diseases like brucellosis, trichomoniasis, vibrio fetus infection, tuberculosis of the generative organs, and other non-specific venereal diseases. Various disorders resulting from vitamin and mineral deficiencies have been discussed in the last chapter. The aetiology, diagnosis and treatment of these disorders have been very thoroughly dealt with. At the end of almost each chapter references to the original publications have been appended. Rare and excellent illustrations adorn the book which has made the subject easy to understand. The general way in which this book has been written is very sound and most systematic.

This book will be very valuable not only to the veterinarians but also to students and research workers who will find a mine of information. The author richly deserves the warmest and heartiest congratulations from his fellow-research workers and veterinarians from all the world over.—J.D.S.

The Practice of Veterinary Medicine.—By D. H. UDALL, Sixth Edition, pp. X. 797. Price 60s Bailliere Tindall & Cox, London.

The sixth edition of the "Practice of Veterinary Medicine" by D. H. Udall, brings to the Veterinary Practitioner and the students another useful treatise on the subject. The writing of text books on Medicine in these fast changing times is by no means an easy task, particularly in this "age of antibiotics". Yet Dr. Udall has blended his ripe experience of the teacher and practitioner very well in this handy volume. However, we in India feel disappointed that some of the latest methods of vaccination against Rinderpest—laponised vaccine and the Chick embryo vaccine—are omitted. We owe our experience of adapting Rinderpest virus to the developing chick embryo to our American counterparts and yet no mention is made of this vaccine in the book. We do not agree that "regardless of effective serum and vaccines 93% of cattle are allowed to face outbreaks without any protection and one of the causes of the chronic indebtedness of the Indian farmer is Rinderpest", though compiled from the report of Zarglar 1950. We have come to the stage where Rinderpest is of secondary importance. Nay, we can safely say that Rinderpest has been eradicated from the Southern Peninsula of this sub-continent, only due to the gradual herd immunity built up and mass inoculations carried out with the serum and virus.

Again we feel "transmissible gastro-enteritis in baby pigs" on pp. 174 and transmissible gastro-enteritis in pigs on pp. 463 might have been clubbed into a single entity.

The general set up of the book is excellent with good illustrations and we commend the book to the profession.—B.A.D.

The Indian Veterinary Journal

NOTICE TO CONTRIBUTORS

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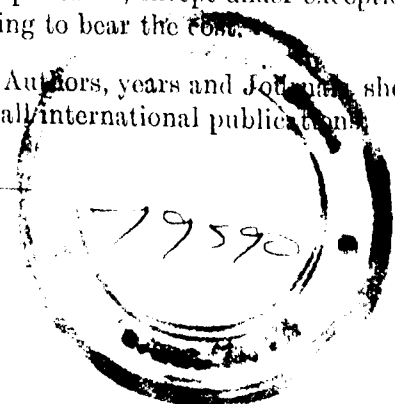
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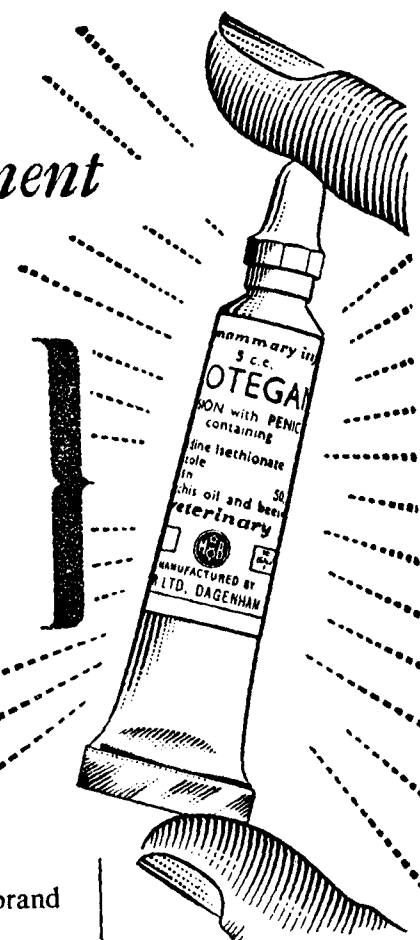
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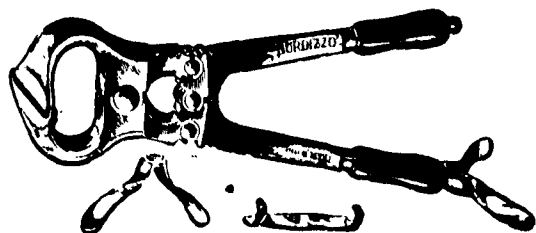
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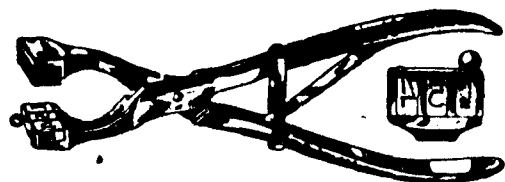
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