

A-84

~~THE~~ Indian Veterinary
Journal

VOL XXIX 341
Jan 1953

JL-
KZm2, N24
NS3-29-4
79579

782

THE
INDIAN VETERINARY JOURNAL

PUBLISHED BI-MONTHLY

(THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION)

26, WALLAJAH ROAD, MADRAS-2 (S. INDIA)

Vol. XXIX

JANUARY, 1953

484

No. 4

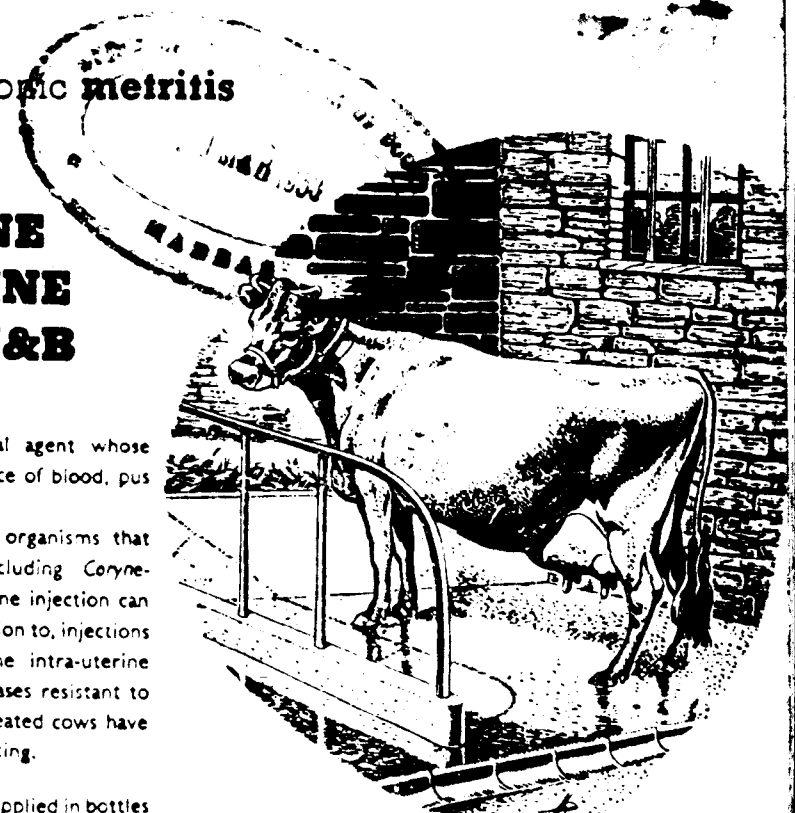
for sub-acute and chronic **metritis**
in cows and mares

**PROPAMIDINE
INTRA-UTERINE
INJECTION - M&B**

Propamide is a potent antibacterial agent whose activity is not inhibited by the presence of blood, pus or tissue fluids.

Propamide is active against all the organisms that commonly cause this condition, including *Corynebacterium pyogenes*, and the intra-uterine injection can therefore be used in place of, or in addition to, injections of iodine. In field trials propamide intra-uterine injection has been found effective in cases resistant to iodine and stilboestrol therapy, and treated cows have become pregnant after subsequent mating.

Propamide Intra-uterine Injection is supplied in bottles of 26 fl. oz.



Manufactured by

MAY & BAKER LTD

Distributed by MAY & BAKER (INDIA) LTD., BOMBAY • CALCUTTA • GAUMATI • LUCKNOW • MADRAS • NEW DELHI

BOOTS PRODUCTS IN VETERINARY PRACTICE



HORMONES

'Antostat' brand Serum Gonadotrophin.
Hexoestrol Implantation Tablets.
Stilboestrol Oral Tablets.
Stilboestrol Dipropionate Injection.
Stilboestrol Implantation Tablets.

PENICILLIN PREPARATIONS

Penicillin Crystalline G.
Penicillin Intramammary Suspension.
Procaine Penicillin G.
Penicillin Ointment and Eye Ointment.

SULPHONAMIDES

Sulphanilamide—Tablets, Ointment and Sterilized Powder.
Sulphaguanidine—Tablets.
Sulphathiazole—Tablets, Ointment and Sterilized Powder.
Sulphacetamide Eye Ointment.

TURK-E-SAN

(Solution Tablets of Acetarsol Sodium)
for the prevention of blackhead in Turkeys.

For further details, please write to

BOOTS PURE DRUG CO. (INDIA) LTD.

P. O. Box 680, BOMBAY 1.

When writing to advertisers, please mention *The Indian Veterinary Journal*.

Vol. XXIX

January, 1953

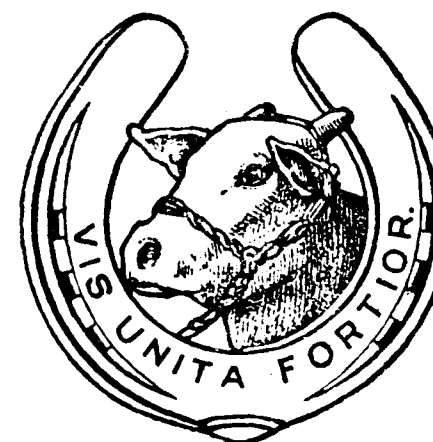
No. 4

THE INDIAN VETERINARY JOURNAL

[THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION]

PUBLISHED ON ALTERNATE MONTHS

A BI-MONTHLY
RECORD OF
VETERINARY
SCIENCE.



DEVOTED TO THE
CAUSE OF THE
VETERINARY
PROFESSION

(ESTD. 1924)

EDITOR

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

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



All communications should be addressed to the Editor.

Advertisements should be in the hands of the Editor not later than the 25th of the preceding month.

Subscription payable in advance	{	Rs. 6 or 10s. per annum to members of profession. Single copy Rs. 1-8-0 or 2s. 4d.
		Rs. 10 or 18s. per annum to Governments and all public institutions. Single copy Rs. 2 or 3s. 4d.

Members who do not receive the Journal regularly, or who find it wrongly addressed, are requested to communicate their correct address to the Editor at once. Non-receipt of a particular issue should be intimated before the receipt of the subsequent issue; otherwise, it will be charged for.

ADVERTISEMENTS



**T.C.F. VITAMIN
B-COMPLEX
FOR INJECTION**

The early administration
of high doses of T.C.F.
Vitamin B-Complex in

distemper prevents complications particularly the ner-
vous form, and the whole course of the disease is
favourably influenced.

**T.C.F. KUBISMIDE
KURCHI BISMUTH IODIDE**

For therapy of intestinal disorders, to be given in half
tablets of 100 according to body weight, in a bolus.

T.C.F. BISMUDERM

A dry dusting powder, for skin affections and wound
treatment.

Also suitable for polo ponies.



Products of:
TEDDINGTON CHEMICAL FACTORY LTD., BOMBAY.

Sole Distributors:
W. T. SURÉN & CO., LTD., P. O. BOX 229, BOMBAY, 1.
Branches: CALCUTTA: P. O. Box 672. MADRAS: P. O. Box 1286.

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

Branding Without Heat

WITH

FRANKLIN BRAND-EM-OL

The Original and Proven Chemical Compound Branding Liquid

A New and Better Method of Branding

Franklin Brand-em-ol is a powerful scientific chemical
compound that eats or burns a brand into the surface of the
hide without heat, producing a dry scab that in a few weeks
peels off, leaving a clean-cut, lasting brand. Brand-em-ol con-
tains no acid. It penetrates the hide evenly over the area of
the brand without leaving any deeply burned sore spots as so
often happens with a hot iron. This also lessens the danger
of screw worm infections in warm countries.

Franklin Brand-em-ol is no newcomer to the field of
modern branding. Thousands of dairymen, farmers and horse-
men have found it the ideal way to brand their stock. Enough
Brand-em-ol has been sold to brand more than 12,000,000
heads. One group of dairymen, in progressive Newzealand
during the last 3 years purchased enough Brand-em-ol for
7,50,000 heads. Government Inspectors use it in connection
with T. B. and other diseases control work.

IT IS TIME TESTED, PRACTICAL AND ECONOMICAL

In India Brand-em-ol is now being used all
over the subcontinent with marked success

For further particulars and illustrated literature,
please write to Sole Agents in India for

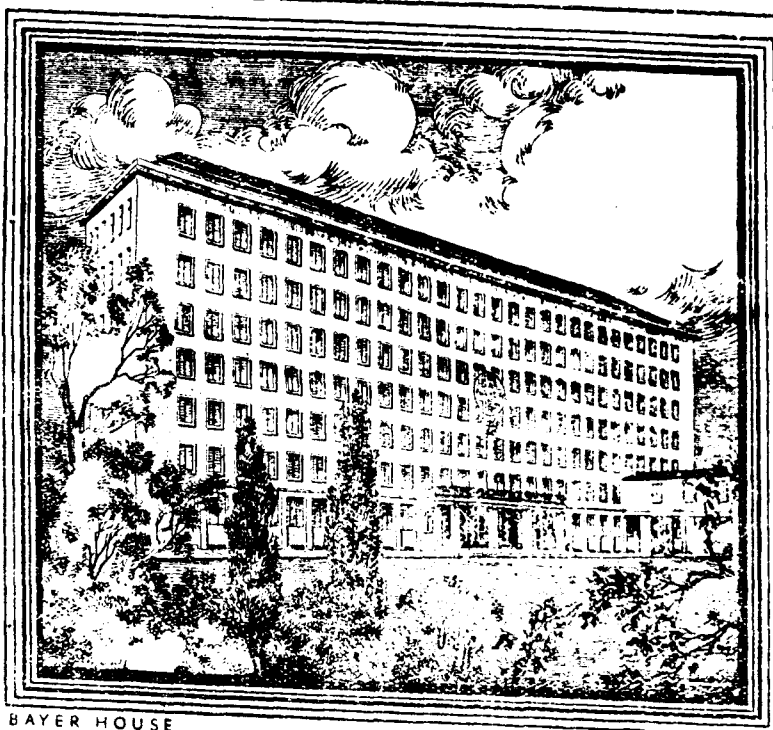
O. M. FRANKLIN SERUM CO., U.S.A.

Cirugia De Lux Ltd.,

24, CHOWRANGHEE ROAD,
CALCUTTA - 13.

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS



BAYER HOUSE

LEVERKUSEN



«Bayer» Leverkusen, Germany

The following well-known Veterinary Specialities
ARE AVAILABLE:—

- ACAPRIN:** Injectable specific for piroplasmiasis.
Boxes of 6 amps. of 6 c.c. (5% solution)
- ANTIMOSAN:** Injectable organic antimonial for bovine schistosomiasis.
Bottles of 500 c.c.
Boxes of 5 amps. of 50 c.c.
- ARICYL:** Arsenical tonic for injection.
Strength 1 for small animals.
Boxes of 10 amps. of 1 c.c.
Strength 11 for large animals.
Boxes of 5 amps. of 10 c.c.
- ODYLEN:** Specific for skin diseases
Bottles of 100 c.c.
- NAGANOL:** The renowned remedy for surra
Bottles of 1/2 oz.
Bottles of 1 oz.



Sole Importers in India

CHOWGULE & CO., (HIND) LTD.
PHARMACEUTICAL DEPARTMENT

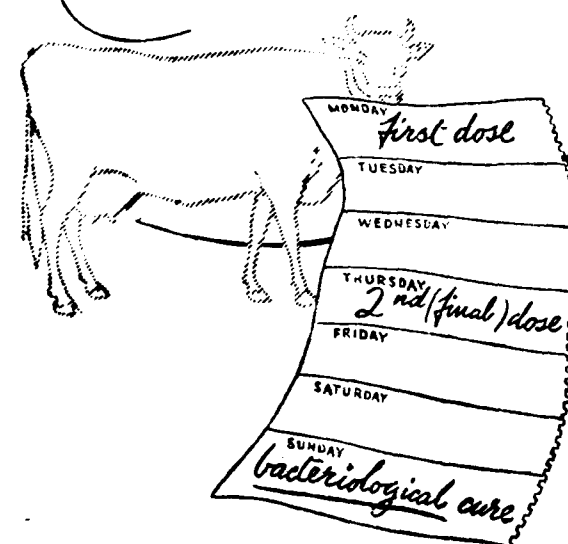
Lentin Chambers, Dalal Street, Post Box 1478, BOMBAY 1.

Branches: Post Box 8943, CALCUTTA 13. Post Box 1743, MADRAS 1.

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

BOVINE MASTITIS?



TWO-DOSE SUCCESS

Potency: 100,000 units penicillin per single dose tube
—the high potency essential for bacteriological cure.

Procedure: one tube per quarter—same again three
days later... the simplest course for every 'penicillin
sensitive' case.



PROCAINE PENICILLIN G VETERINARY CERATE Glaxo

GLAXO LABORATORIES (INDIA) LIMITED • BOMBAY • CALCUTTA • MADRAS

Copyright

LAS. (B)

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

ENTERO-QUINOL

(IODOCHLOROXYQUINOLINE)



Specific for all forms of Amoebiasis and other intestinal infections.

It is chemically 5 Chloro 7 Iodo 8 Oxyquinoline, practically odourless, tasteless, and insoluble in water.

Tubes contain 20 tablets 0.25 grm. each



EAST INDIA PHARMACEUTICAL WORKS LTD.,

Basusree Buildings,
11/1/4, Russa Road (Third Floor),
CALCUTTA. 26.

STANES MINERAL MIXTURE

Staness Sterilised Fine Bonemeal for Cattle

The only Tonic at low prices with high tonic value. Prevents diseases due to deficiency in CALCIUM and PHOSPHORUS. Largely used by all the Agricultural Research Stations in Madras, and by the Veterinary Departments.

Sold in bags of 14 lbs., 28 lbs., for supply in the Madras Presidency.
For further Particulars Apply to:—

T. STANES & CO., LTD.,
COIMBATORE

CANCERINA

(VETERINARY)



Speedy and sure cure for Cancerous horns, within five bandages. It promotes health. Supplied in 6 lbs. internal and 3 lbs. external powder packing. Cost Rs. 15-8-0.

To save unnecessary postage, please write the nearest Railway Station.

Manufacturers:—

DEEBEE BROTHERS
1706, KHADIA JALOWALI NAKA, AHMEDABAD

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

Telegram—CRESCENT

Telephone—JORASANKO 3105

An Appeal

"SAVE INDIAN MONEY BY PATRONISING AN ENTIRELY NATIONAL INDUSTRY - AS ALL SORTS OF VETERINARY INSTRUMENTS AND APPLIANCES ARE MANUFACTURED IN INDIA - IT IS A PRIDE TO INDIA AS IT IS SOLELY AN INDIAN CONCERN

and therefore fervently look forward for kind patronage and generous support from all concerned

ARTIFICIAL INSEMINATION SETS

FOR

CATTLE - SHEEP - HORSES - PIGS - Etc.

Manufacturers of Artificial Insemination Apparatus Sets in India, approved by Dr. P. Bhattacharyya, M.Sc., Ph.D., Officer-in-Charge, Animal Genetics Section, Indian Veterinary Research Institute, Izatnagar, U. P. and suppliers to the Government of India and also to all the Provincial Governments.

SPECULUM for Buffaloe, Heifer, etc. and all spare parts for A. I. Sets are available.

MANUFACTURERS OF:—

G. T. V. Set; Post-Mortem Set; Obstetric Set.

All sorts of Veterinary Instruments and Appliances. Improved pattern Inoculation Syringes 20 c.c. 10 c.c. and 5 c.c.

High Class Stainless Steel- PEW Inoculation Needles- G. T. V. Needles and also all sorts of Needles according to any specification.

UNDERTAKE ALL SORTS OF REPAIRS, RENICKELLING AND RESHARPENING OF VETERINARY INSTRUMENTS AT MODERATE CHARGES.

For further particulars, please apply to:

PAUL'S ELECTRO WORKS

39, JORAPUKER SQUARE
Post Box No. Cal. 11406
CALCUTTA- 6

When writing to advertisers, please mention *The Indian Veterinary Journal*.

The Indian Veterinary Journal

(The Journal of The All-India Veterinary Association)

Vol. XXIX

JANUARY 1953

No. 4

CONTENTS

I. General Articles.

40th Indian Science Congress, Lucknow, 1953, Section of Medical and Veterinary Sciences.—Presidential Address by Dr. S. Datta	265
Pathological effects of Chlordan and Toxaphene ingested in toxic amounts.—By B. Choudhury	279
A Preliminary note on the investigation into bovine paralysis in South Kanara District, Madras State.—By M. Ramakrishnan and K. Ananthapadmanabhan	291
Negative staining of Spermatozoa.—By C. Krishna Rao	303
Suitability of Leishman's, Wright's and Giemsa's Stains for staining semen smears.—By C. Krishna Rao	305
Differential staining of live and dead sperm.—By C. Krishna Rao	307
The economic importance of deworming sheep.—By M. V. Krishna Rao	310
Vaccination of goats against Rinderpest with Glycerinated goat tissue virus vaccine.—By Radhey Mohan Sharma and Tulsi Ram	321
Sexing of small laboratory animals.—By R. D. Katiyar	327
Indian Pig (<i>Sus Scrofa Domestica</i>) as a host for <i>onchocerca</i> Sp. and <i>Enterobius vermicularis</i> .—By G. Ramanujachari and V. S. Alwar	329
Guinea-pig husbandry.—By R. D. Katiyar	330

II. Editorial.

The Five Year Plan	339
The late Dr. J. T. Edwards	344
„ „ B. K. Badami	345
Standardization of Veterinary Biologicals—Union Minister's Address	346
Government of India—Planning Commission—The First Five Year Plan	349

III. Clinical Articles.

Otitis Externa in dogs—Therapy with Aureomycin.—By M. S. Ganapathy M. Ranganathan and V. Ravivarma Hegde	353
--	-----

IV. Correspondence.

'Sulphamezathine' treatment of Bovine Rinderpest—G. V. Short	357
Gammexane in maggotted wounds—By S. Venkata Nasasu	358

V. Abstracts and Extracts.

Thambaiyah V. S.—First case of Swine Erysipelas in Ceylon	358
Easterbrook H. L. and Plastringe, W. N.—Experimental transmission of <i>Vibrio fetus</i> in diluted semen by contact	359
Pritchard W. B. Rehfield C. E. and Sauter, J. H.—Aplastic anaemia of cattle associated with injection of trichlorethylene—extracted Soyabean Meal—	359
XV International Veterinary Congress	360

VI. College News.

Bihar Veterinary College	361
--------------------------	-----

THE Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

Vol. XXIX

JANUARY, 1953

No. 4

General Articles

40TH INDIAN SCIENCE CONGRESS, LUCKNOW, 1953 SECTION OF MEDICAL AND VETERINARY SCIENCES

Presidential Address

By

DR. S. DATTA, D.Sc., M.R.C.V.S., D.T.V.M., F.R.S.E., F.N.I.,

Director,

Indian Veterinary Research Institute, Mukteswar.

I have great pleasure in welcoming you to the deliberations of this Section of Medical and Veterinary Sciences. I must thank the Sectional and the Executive Committees for electing me to preside over the present session. I consider it not only a singular honour but a great privilege and opportunity as well, since it is not often that a scientist in the veterinary field is called upon to do so in this joint Section. This election is obviously a token of the intimate kinship and essential unity of medical and veterinary sciences which make our closer collaboration indispensable, and, in the context of our present day problems, all the more imperative. I take this opportunity, therefore, to make a brief reference to the origin of the healing sciences and to emphasise how the development of one has invariably helped in the development of the other.

The evolution of the conception of disease

Diseases and evolution of measures to fight them have been an ever-engrossing problem since the earliest times. Humanity has been constantly panic-stricken and distressed by the sufferings and destruction of life through epidemics and epizootics. The ancients found themselves helpless and considered these outbreaks as evidence of divine wrath or caused by the 'evil eye'. They could take no active measures to combat them and had to be content with offering tributes to various deities. However, through trial and error, and by casual observation on animals in bad health, the ancient medicine man stumbled on many an antidote or nostrum. The monkey trying to stop with its paws the flow of blood from a wound taught

Delivered at the 40th Indian Science Congress held at Lucknow on 3rd January 1953.

him about blood coagulation; bears eating oakum leaves to cure stomach ache, stags using leaves for curing wounds—such natural observations helped the early experimentalist find out the medicinal properties of herbs and plants, and to apply them to human beings and domestic livestock. The idea that life is a continuous process, and flesh, of man or beast alike, is subject to certain common laws, and suffers similar tribulations finds expression in the following lines written by Solomon, the Wise, some 100 years before the birth of Christ: "For that which befalleth the sons of man befalleth beasts, even one thing befalleth them, as the one dieth, so dieth the other; yea, they have all one breath.....".

The unity of Healing Science

It is well to recall that the medicine of man and animal was born, almost contemporaneously, of the common parentage of credulity and empiricism. The survey of the development and progress of healing science from early beginnings of trials and errors, through different stages up to date reveals that the pioneers in all ages had approached the problem of diseases of the human race or of animal species more or less as single composite study. In the Vedic ages, animal medicine marched hand in hand with human medicine and both were included under *Ayurveda*, the science of life. In later periods also, all pioneer work, for instance, by Leeuwenhoek on microscopy, identification of protozoa and bacteria, etc., or by Pasteur or Koch on bacteriology and immunology, or Koch's postulates or Lister's work on antiseptics, and advances in other epochs have been applicable equally to man and animals, thus bringing out constantly the essential unity of the healing science. It is fortunate that in the understanding of the factors determining health, the disease processes in men and animals have often thrown cross lights, and suggested analogies and have been mutually elucidatory. The understanding of a pathological condition in one species has been made possible only through the study of a similar condition in another species of animal. Whether the medical or the veterinary side has benefitted to a greater extent in this alliance of long standing is immaterial. Suffice it to note and remember that research and experiments upon animals have provided the very basis of modern human medicine in therapeutics, immunology, dietetics, etc., and the contribution to human welfare by animals and animal studies has been of far-reaching consequences and very striking indeed. Sera and vaccines have been made from animals, and animal gland products such as pepsin, insulin, pituitrin, sex hormones, etc., are of constant use and of great value in human therapeutics. The study and understanding of animal diseases has also been of great public health importance as examples of communicable diseases, like glanders, rabies, brucellosis, tuberculosis, etc., are many. Veterinary researches have been essential in the elaboration of efficient public health measures.

This close association of human and veterinary medicine is represented in a practical way in Great Britain in Medical Research Councils, in the Royal Society of Medicine, as well as in the British Medical Association, where veterinarians take active part in developing the subject of comparative medicine. In Universities like Cambridge and Liverpool, classes for medical and veterinary students are held jointly up to certain stages, while in the London University, the Professor of Physiology is the Head of the Department of Physiology in the Royal Veterinary College also. In the London School of Tropical Medicine and in Manchester University, the diploma in bacteriology is being awarded to both medical and veterinary research workers. In the Pasteur Institute of Paris, medical and veterinary researches are conducted side by side.

Turning to our country, not only were the first two Directors, Dr. A. Lingard and Sir Leonard Rogers, of the Imperial Bacteriological Laboratory, as the Indian Veterinary Research Institutes at Mukteswar-Kumaun and Izatnagar were called at first, medical scientists, but several other medical men have made outstanding contributions to veterinary research without going out of their way. It may be interesting to recall here that in 1899 a Committee consisting of Heads of Medical and Veterinary Services was appointed by the Home Department of the Government of India, and this Committee recommended the establishment of a Central Medical Research Laboratory also at Mukteswar, in conjunction with the Veterinary Bacteriological Laboratory already established there some six years previously. While the essential kinship between the two sciences had thus been recognised in India even from the earliest times, it is surprising the two branches have not functioned closer together to mutual advantage, as in other countries. The Indian Science Congress and the National Institute of Sciences have no doubt arranged to bring the two sister sciences together, but even here the objective has not been actively pursued with any degree of continuity. There are clear signs, however, that the specialised agencies of the United Nations have taken the initiative to develop the collaborative efforts on these common problems. For instance, recently a W. H. O./F. A. O. joint panel has recommended the opening in Mukteswar of a brucellosis centre to develop research and training and in the co-ordination of field and laboratory procedures used in brucellosis. Similarly, a scheme for the control of rabies in animals and human beings is being sponsored at Izatnagar. These new projects are now being considered by the Government of India. Such collaborative efforts to benefit the researches in human and veterinary medicine must multiply and the Indian Council of Medical Research will no doubt make this possible. While the immediate concern of medical science is the prevention and cure of disease in man and the building up of public health, the object of veterinary science is also the safeguarding of the health of the community by the elimination of

animal diseases and by the provision of dairy products and other foodstuffs of animal origin essential for the health and stamina of the people. Campaigns of disease prevention such as against malaria, tuberculosis, etc., are necessary but sufficient quantities of highly nutritive foods, e. g. milk and eggs, must be provided to improve the health, development and resistance to disease of the population before the full benefits of these preventive campaigns can be derived. Improvement of livestock is thus of fundamental importance to medical science as well.

Animal Husbandry—Keystone of Indian economy

"The weaker the cattle, the scantier the production, the feebler the nation". Animal husbandry has been a much neglected art and science in India and is generally subordinated to the needs of agriculture rather than be allowed scope for development on its own right according to its intrinsic qualities. There has therefore been no occasion for the livestock industry to prove its highest potentialities on stabilising India's economy, and of making all the difference to the life and happiness of its millions of struggling cultivators. Sir A. V. Hill has rightly pointed out that the neglect of the livestock forms the weakest link in our agricultural economy and grow more food campaigns. The fundamental role played by livestock, and particularly cattle, in the life and prosperity of our people is not appreciated. Until the full statistical data have been collected and marshalled, it will not be possible to enlist effective public interest, and to gain the right emphasis on livestock development in our plans of national rehabilitation.

India possesses over 150 million head of cattle, more than one-fourth the world's total cattle population. In addition, she has 43 million buffaloes, 1½ million horses and ponies, 87 million sheep and goats, 4 million pigs and 73.7 million poultry of all kinds, 1 million donkeys and over ½ million camels. By providing transport for agricultural produce, it is estimated that cattle contribute annually approximately 300 crores of rupees. This sum is obtained by calculating the cost of cartage at the rate of one anna per rupee worth of agricultural products. The equivalent of cattle labour used for ploughing operations works out to be Rs. 1,000 crores. This is based on the fact that a pair of bullocks can plough 10 acres of land and the yearly cost of their maintenance is Rs. 450/-. The cost of ploughing 1 acre is thus Rs. 45/-. so that the cost for 230 million acres of net area sown in the Indian Union is over Rs. 1,000 crores. If we add to this Rs. 200 crores as the economic value of horse and camel transport, the total contribution from animal labour becomes Rs. 1,500 crores. India produces over 480 million maunds of milk per year, of which only 36% is consumed as fluid milk and the rest is converted into ghee or other milk products due to transport and storage difficulties. The price of

this amount of milk and milk bye-products may be conservatively estimated at Rs. 750 crores. The amount of meat consumed in India is about 216 lakhs maunds and its value may be put down at 130 crores of rupees. The number of eggs produced is about 200 crores, so that they also bring about Rs. 40 crores annually. Each year 583 lakhs of hides and skins are produced in our country whose value is over Rs. 40 crores. The annual production of wool is worth about Rs. 3 crores. Our cattle produce about 1,000 million tons of dung per annum, nearly 67% of which is burnt as fuel whereas the rest is generally used as manure. Assuming a value of even Rs. 10/- per ton, the total economic value from this source is Rs. 1,000 crores. All these figures, when added up, put the annual direct contribution from our livestock to be about Rs. 3,500 crores. This figure may be noted and compared to the income from certain industrial and agricultural commodities which loom so large in the popular mind. The iron and steel industry had a net annual earning of Rs. 50 crores in 1949-50, while for the same period cotton textiles and yarn were valued at Rs. 150 crores, jute at Rs. 78.2 crores and sugar at Rs. 54.5 crores. The annual coal production is of the order of 3 million tons, valued at Rs. 500 crores. It is not my aim to slight the vital role played by these commodities in the economic life of a nation and these must receive their fullest share of support to effect the much needed rapid industrialization of the country. What is emphasised here is that livestock and their products form the most valuable and basic national wealth of our country in particular and this represents a fairly large portion of the world's total resources of animals and animal products, the development of which is vital to the interest of human welfare.

The figure of Rs. 3,500 crores given above indicates only the direct annual return from our livestock population, but the indirect profits, much of which is at present potential should not be lost sight of. From time immemorial, man and cow in India have become by long association inseparable entities. Cattle till our land, thrash our grain, invigorate our fields by supplying manure and carry the agricultural products from the field to our homes and bazars. Cattle have to subsist only on the bye-products of human food, namely, straws, bran and oil cakes, and in return for this the cow yields milk which is so vital for human beings, especially for growing children. Other livestock provide meat and eggs—quality food which are essential for our proper nutrition. An unbalanced diet consisting mostly of cereals may appease the hunger but it is a well-known fact that it can not produce peoples of stamina and efficiency. Physicians the world over are agreed that psychological traits, such as, laziness, inability to concentrate the mind, a constant feeling of malaise are caused by a diet lacking in animal proteins. All these go to prove that the welfare of our nation, and in fact of every nation, is correlated vitally with the welfare of

the domestic livestock and one cannot do without the other. During the evolutionary process of industrialization in our country, however, this integration between man and animal has been lost sight of. The urgency to produce more of the bulky food to appease the hunger of the growing population, or the stepping up of the production of such agricultural commodities like tea, cotton, jute to earn ready cash has resulted in the neglect of our cattle. Such land as were previously kept apart for grazing has been brought under the tillage, and the intensive cultivation of cereals and cash crops has resulted in the decline of the fertility of the soil. Cattle have been made to do more work without enough feed, and this has led to the diminution in their productive capacity. This vicious circle has now proceeded so far that "quality" has disappeared from the Indian diet. The loss of vigour in the Indian cattle and other livestock coupled with bad management has made them easier prey to the ravages of epizootic disease, so that the present picture is that of puny, feeble creatures low in all capacities for work or milk or meat production.

Livestock industry in India is undeveloped

It is high time, therefore, that our attention is focussed on the improvement of our livestock, and especially cattle. Even from the present-day degenerate cattle we are getting a value amounting to about Rs. 3,500 crores every year. This figure, though vast, shows only one side of the picture. The earning per head of the cattle works out to be Rs. 120/- per annum. With proper feeds and management, this figure can be improved to Rs. 150/- as it is known that by supplying proper feed the milk yield can be improved by 50% and the working capacity by 20%. The minimum cost of adequate maintenance charge per head of cattle is however Rs. 150/- so that animal husbandry in its present state does not appear to be a paying concern in our country. It is, however, stressed once again that the above figure is that of an under-developed industry where raw materials are the animals which have been rendered degenerate through centuries of neglect.

The economic prosperity of several countries has been based on their livestock industry. New Zealand is a small country, roughly the size of Great Britain, but she is the largest producer of dairy products and possesses sheep by the millions. Her two million people possess 16 sheep to every man, woman and child. All her wealth and high standard of living originate from this great pastoral advancement. Similarly, Australia's greatest industry is her wool and her greatest prosperity depends on wool prices, which brought her, during 1950-51, £. 637 million. Australia made its humble beginning only in 1790. When Captain Cook landed at Botany Bay in 1788, there was not a single sheep in Australia. Even taking the case of underdeveloped countries, South-West Africa earned last year £. 6

million by her Persian lambs' industry. There is no reason why India cannot do even better with her enormous natural resources of this under-developed industry which still makes an annual contribution to the tune of Rs. 3,500 crores. Our cattle do not lack the genetic make-up for better production, and breeds of Indian cattle have proved their worth in U. S. A., Australia, East Africa, etc.

Cattle Population—No Surplus

It has been argued by some economists, as well as by some foreign experts, that the large cattle population in India is a great burden, and that the available land is not capable of maintaining both the human and animal population. This statement needs qualification. It is true that India possesses an appreciable proportion of less productive animals. There is certainly a strong case for replacing some of our cattle by better and more highly producing animals to ensure economic return, but for a long time to come we shall require a large number of animals in this country. The total milk production, even if it were consumed wholly as fluid milk, would yield only 5 oz. daily per head of the human population. Modern concept of dietetics places the minimum need at 10 oz, preferably 16 oz. daily per person, so that until the time we have upgraded our milch animals to such an extent that there is a surplus of milk, we cannot think of diminution of the number. Besides, by improved feeding alone these animals are capable of giving better yield of milk. Again, the net sown-area in India at present is about 230 million acres. This area can be increased to 300 million acres by reclaiming some of the cultivable waste land. If from these, 100 million acres may be sown more than once through irrigation, the total available land, i.e. 400 million acres, will be sufficient for both the human and animal needs. In order to cultivate these lands, 60 million working animals are required, and India has got only 60 million bullocks. Thus, neither in the category of milch nor in working animals, is there any real surplus. On the other hand, due to the ravages of epizootics, it appears more than likely that there is really a dearth of all class of producing animals—a fact which is supported by the phenomenal rise in the price of such categories of cattle.

Moreover, it may be stressed emphatically that if proper care is taken in the distribution of land and sowing practices, the yield of nutrients per acre of land may be substantially increased. It has been pointed out before that as a result of continuous non-rotational cultivation, the yield of grain per acre is very low in this country. This has been the experience in other countries also, but by a process of mixed farming, i.e. through the adoption of a grass-grain rotation, the yield of cereals has been improved quite considerably. In Illinois, it was found that when maize was grown continuously in the same land for 39 years, the yield per acre dropped from 41 bushels to 24 bushels. In comparison, 50 bushels of corn per acre was

obtained in a three year rotation following clover. Moreover, in such a mixed farming we get in return for the grasses grown such valuable food products like milk, meat, etc.—products which go a long way to increase the vitality of our people. Thus mixed farming which was the basis of agriculture in old India should be taken recourse to, if we are to improve our physical and economical status. Certain countries have allocated the major portion of the available land for the development of pastures and the growing of fodders for animals rather than for the growing of cereals for human beings, and this has been proved to be in their best interest.

Eradication of diseases

In order to maintain the rhythm of intensive cultivation which is the crying need of our country, it is essential that our animals should be properly managed. Maintenance of health must depend on adequate feeding and eradication of diseases. The question of feeding has already been dealt with. Diseases, not only the virulent epizootics, but helminthiasis, protozoan infections, etc., also sap the vitality of animals and produce stunted growths and degeneration.

I shall try to indicate the ravages that are caused by disease and the economic losses sustained thereby. Statistics are very meagre, but recurring losses are unmistakable. Science has provided us the tools by which these losses can be largely eliminated but what is needed now is a concerted effort to bring the laboratory experience to field practice. The control of snails in long stretches of low-lying areas will certainly save much valuable livestock from the serious depredations of liverflukes and other trematodes, but these field operations must be carried out rationally on a large enough scale as in the campaigns directed against locusts and malaria.

The losses resulting from an outbreak of any epizootic disease are manifold. The net loss due to death can more easily be ascertained. Besides these, a much larger number of affected livestock are rendered immobile or useless for production purposes for a considerable period, and many of them may even after survival become useless burdens due to some permanent physiological damage like sterility. No statistics for such cases are yet available. Neither is it easy to calculate the loss due to impairment in working capacity, loss in milk, meat, egg or wool production by the affected animals. Recently, the Indian Council of Agricultural Research has arranged to compile the vital statistics of animals in the different States of the Indian Union, but only about 50% of the mortality is brought to the notice, while the percentage of affected animals covered by the monthly tables is still smaller. Even then, the reported losses due to the more important animal diseases for the year 1951 is given below and the figures speak for themselves: Rinderpest—46 thousands, Haemorrhagic septicaemia—30 thousands, Blackquarter—18 thousands. The total annual

mortality from infectious diseases alone is given to be a lakh, while the figure for those affected by these diseases is over 5 lakhs, of which more than 3½ lakhs suffer from Foot-and-Mouth disease. Allowing for the unreported cases, we can easily put down the number of deaths at the conservative figure of 2 lakhs and those affected at 20 lakhs. Assuming an average price of an animal at Rs. 150/- the annual loss due to death alone is 3 crores of rupees. If we add to this figure, the invisible losses in food growing and milk production caused by the absence of these animals, this figure may be many times more. The number of affected animals is about 1% of the total livestock population of India. It may be assumed that due to debility, the productive power of the diseased animals is reduced by 30%. In that case, the loss may be taken as 0.3% of the net earning from livestock or in other words about Rs. 12 crores. This figure also does not take into account the unknown number of animals which are rendered permanently unfit for any useful work. Summing up, we may deduce that epizootics alone are costing the country to the tune of Rs. 20 crores annually. Over and above this, a much larger number of animals suffer from various chronic diseases caused by protozoa and helminths. Such diseases also cause considerable debility and quite a large proportion of mortality as well. As no statistics are available for such cases, it is not possible to calculate the losses in rupees, annas and pies. However, as a concrete instance, it may be mentioned that a loss of Rs. 1½ crores is incurred annually through the depreciation in the value of hides by warble-fly infection alone.

Control of Epizootics

It may be of interest here to recount what has been done so far for the control of epizootics. Considering the vast area of India, and its large number of species of livestock under different conditions of soil-climate complex, our country has only one Research Institute to investigate into the nature of prevailing diseases, and to give advanced training in field work, teaching and research. Students have been attracted from the neighbouring countries, and occasionally from long distances. The question of raising the standard of veterinary education and bringing about uniformity is engaging the attention of the Indian Council of Agricultural Education. The staff of this single Institute has never been adequate to cope with the problems of animal preservation and development. Though the Indian Veterinary Research Institute, founded in 1890, is the oldest research institution in the whole country and reflects the urgent necessity of that time for livestock preservation against the widely prevailing animal plagues, the question of the further development of that Institute in particular and Veterinary Science in India in general, has not received the motherly care and protection as their importance in the country's welfare demanded. However, even working under serious limitations, the veterinary scientists have been able to develop effective remedies for the protection

of our livestock against most of the serious animal diseases prevailing in this country, and have undertaken studies on problems of animal nutrition, breeding and technology. In fact, there is more urgency now for further intensified work, and the lines of work which have yet to be undertaken and developed are many. No systematic researches have yet been undertaken in the promising field of the elaboration of cheap and efficacious treatment of animal diseases from the indigenous drug resources. In animal disease control work, the main object is to find out the means of preventing diseases. It is commercially unsound to cure diseased animals, as individual cures might cost more than the patient might be worth to the farmer. In fact, countries have ruthlessly killed all animals suspected of carrying contagious diseases in order to stamp out such maladies like rinderpest or foot-and-mouth disease. Hence prevention rather than cure is the basis of veterinary practice. This fact emphasises the justification for the origin and development of modern immunology in veterinary practices, and prolonged experience has shown this to be a definite advance on the indigenous Yunani or Ayurvedic medicines as far as the rapidly spreading contagious diseases are concerned. These systems have their merits and are valuable in certain chronic maladies, but it must be emphasised here that any haphazard attempt made to utilise these in the control of outbreaks of epizootic diseases such as rinderpest, foot and mouth disease is likely to result only in the wastage of efforts and resources. Therefore, a supply of reliable veterinary biologicals is essential for the needs of the country, and fairly large quantities of over twenty-five different products are produced at Izatnagar and other centres. An Expert Committee for the Standardisation of Veterinary Biologicals has been set up by the Government of India and two eminent medical men have been included in this Committee.

Further, it must be remembered that one has to treat animals in herd or *en masse*. It is necessary that all the useful animals should be protected by a vaccine which should give sound immunity for a long stretch of period. As the number of animals in the country is very great, the price of such biologics should be cheap as otherwise the cost of prevention will be beyond the means of the farmers or the Government. For example, after prolonged periods of research a reliable vaccine giving satisfactory long term immunity against foot-and-mouth disease has been evolved at Mukteswar, but the cost of a single dose is about Rs. 5/-. When the numbers of cattle are considered, it may be seen that to immunise the 200 million head will cost Rs. 100 crores as the price of the vaccine alone. If we take into consideration the expenses for maintaining the personnel for collecting and vaccinating these large herds of animals, the total expenses easily mount up to another 100 crores or more. It is evident that expense on such a scale will be beyond the capacity of the country for some

years to come. Again, there is a comparatively cheap vaccine against haemorrhagic septicaemia which costs only annas two per dose. Unfortunately, however, the immunity that results from this treatment lasts only for three months, so that it is necessary to vaccinate the susceptible animals at least once every year. The huge recurring cost prohibits its use on a mass scale and only organised large farms where valuable animals are maintained can afford to undertake such treatments. Hence our aim has been the production of cheaper and better vaccines and with the technical assistance of the F.A.O. and the U.S.A. arrangements have been made to modernise production procedures and to instal latest equipments at the Central Institute, and at some of the major State centres. How continuous research may help towards this is exemplified in the story of the control of rinderpest.

Control of Rinderpest

Rinderpest is a world problem. It had always been and in fact still continues to be the most important contagious animal disease. It attacks all ruminants and the mortality rate is very large. In the 1860's, rinderpest was ravaging the country-side on a wide scale and was responsible for the loss of nearly ten lakhs of cattle every year. In large areas of the country, agricultural operations came to a dead stop. The Government of the time established the Imperial Bacteriological Laboratory to find a remedy against this fell disease and Robert Koch was invited to Mukteswar to advise. Within nine years of the establishment of the Institute, an anti-rinderpest serum was evolved. This biologic at first was rather costly, and could render the animals immune for short periods only, so that it could be used as a temporary protective only in the actual sites of outbreaks. Further years of research saw the lowering in the cost of production so that the price of one dose came down to one anna only. However, the short period of immunity made this treatment available mostly for use on costly animals in the military and civil dairy farms. In 1927, the virus was fixed in goats and the attenuated vaccine made from goat spleen was found to render life-long immunity in the treated cattle. The price of the vaccine was also cheap, being Re. 1/2/- for 100 doses. This newer tool helped in carrying out large-scale immunisation in all parts of the country, and thereby the deaths from rinderpest have been brought down by 90%. However, this vaccine, which costs about 2.5 pies per animal, has some drawbacks, as it produces high reaction and mortality in buffaloes where it has therefore to be used in conjunction with anti-serum, which increases the cost. These defects have prevented the wholesale immunisation of the animals in India. Recently we have evolved a still cheaper lapinised vaccine, which produces practically no reaction in the immunised animal and yet renders solid immunity. The time has therefore come when a concerted attempt may be made to eradicate the disease from India.

Eradication of Rinderpest

One of the chief handicaps in undertaking any scheme of animal disease eradication has been the paucity of men and finances compared with the vastness of the problems. It is a sad fact that veterinary profession in India has failed so far to attract a large number of students. Economic consideration is the chief reason for this apparent *boycott*, as livestock development has until recent times received only scant attention. The annual budget for veterinary and livestock department in all the provinces of British India for many years had never exceeded 50 lakhs. This works out to be a little over a quarter of a pie per head of animal population. The result is that we have 10 veterinarians per million head of animals compared with 95 in United Kingdom and 248 in Switzerland. Fortunately the public and Government interest in animal husbandry has recently been on the increase. More Veterinary Colleges have been opened and quite a number of schemes for livestock improvement is being undertaken. It is in this context that I took the opportunity to present a ten-year plan for the eradication of rinderpest in India. This plan has been accepted in principle by the Government of India and has been mentioned in the Five Year Plan. The F.A.O. has also agreed to help this plan by supplying expert personnel as well as through procurement of the machinery necessary for the mass scale manufacture of the vaccine.

When the well-being and efficiency of the large number of affected animals, and through them those of their owners, are taken into account, the imperative need for such eradictory measures becomes all too evident. With the experience gathered from this scheme and through continuous research, the path may be opened to the future veterinarians to make India a safe country for all types of domestic animals—a condition that is essential if we are to convert our country into the "Stud Farm of the East".

Ranikhet Disease

I may also mention another achievement of the Institute for which we may be excused reasonable pride. Organised poultry farming in India has always been a hazardous attempt, as the owner used to find one morning that his whole flock had been wiped out through the outbreak of the Ranikhet disease. A vaccine from incubated eggs has fairly recently been evolved, which involves a cost of only 0.5 pies per bird. Extensive field operation in India and abroad has proved the efficacy and usefulness of this vaccine. Poultry farming in India has now been made a safe venture. This has not only paved the path for the establishment of a new industry, but, indirectly, it has provided the nation with the means by which quality foods like meat and eggs can be produced economically in large amounts by the use of electrically operated mammoth incubators. The

prospect of an egg a day for the people of India has been made a reality, so that the deficiency of milk proteins which takes long periods to remove can be made up readily. I leave it to my medical friends to think about the probable impact of this on national health and wellbeing.

I have dwelt at great length on the importance of animal husbandry in the economy of India in the context of the slogan "Produce or Perish". All that I want to stress is that livestock plays a key role in the problems of food production engaging the mind of all thoughtful persons. In order to step up the agricultural production of our country we need sturdy, healthy animals. In fact, unlike other countries agriculture is ancillary to the livestock in this country. The prevention of animal diseases is not only a direct approach towards the smooth functioning of agricultural operations but is also essential for maintaining the morale of our agriculturists, who had often in the past been frustrated in their efforts through the sudden outbreak of diseases. In fact, the suddenness of the epizootic diseases and the mortality rate caused thereby had in no small measure been responsible for the degeneration of our cattle. Once it is ensured that an animal and its off spring are going to live for reasonable periods, the path will be opened for upgrading the future generations so that better productive power may be developed. Improvement of large animals is a time-consuming process, and extreme care is required in choosing the particular breeds which are likely to be the best adapted for different regions. A climatological laboratory is proposed to be set up for testing out the potentialities of each breeds under different environmental factors. The Key Village schemes which have recently been inaugurated in India are an attempt to bring about the prosperity of the rural population through multi-purpose activities, in which livestock preservation and development will play a prominent role. For the whole of India, over 200 such schemes, however, cover little ground.

There are many calls on our budgets, and we cannot expect to start everything all at once. In other countries, private individuals and bodies have always played a large part in livestock improvement. In Great Britain, The Animal Health Trust was started a few years ago as a private body financed entirely by philanthropists. This Trust endows much larger amounts for research and training than has been possible by the Government of the country. India possesses many large-hearted philanthropists and may we not hope they will take more lively interest in livestock improvement work, if only we can draw their attention to the vital necessity for such endeavours in India.

One more theme and then I conclude this address. Within our limited means we veterinarians have managed to achieve some success in the laboratory, but very much more yet remains to be done. In this effort, I feel that our brother scientists can help us a great deal. In

these days, no science stands alone. The task of national regeneration is many sided and colossal, having for its objective the removal of poverty, dirt, disease and ignorance. The present shortages and deficiencies menacing us have to be removed, and the solution of many of India's ills requires a revision of the conventional lines of attack. Projects of public welfare can have no real significance to a people in a sub-human level of nutritional existence. To this end, the resources of all branches of science should be directed in a co-ordinated manner. If the enormous advances made in the physical science can be utilised even in a small measure towards the investigation of veterinary problems, I am sure that will reap great mutual benefit on all sides. Indications are that the resources of X-ray, ultra-violet radiations, ultrasonics, electron microscopy, isotope tracers, antibiotics, etc., if applied to animal physiology and pathology are sure to result in discoveries of great value. Similarly, the greatest stimulus that can be given to the farmer for renewed interest in livestock is to show him that there is money in livestock farming and satisfactory returns from internal and external trade in livestock are likely to follow to improve his economic status. Better utilisation of the farmyard manure, eradication of such pests like ticks, flies and other insects and hygienic management, which can be devised through biological sciences, will help him in this effort. Moreover, he must be assured of speedy despatch of his output in a wholesome form to the consumers, so that maximum monetary gains can be obtained. In these, the resources of the engineering science in providing technical equipment, better transport and refrigeration facilities will be essential. It is in meetings like these of the Indian Science Congress where representatives of all branches of science meet and can take counsel together to evolve a common plan for the scientific development of our animal resources—a plan which will not only primarily help our rural population but in the long run is sure to increase the prosperity and good health of the entire population.

THE
INDIAN VETERINARY JOURNAL

★

VERY FEW COPIES OF BACK VOLUMES AVAILABLE

Rs. 6 Per Volume.

Rs. 1-8-0 Per Issue.

SILVER JUBILEE NUMBER Rs. 4/-

PATHOLOGICAL EFFECTS OF CHLORDAN AND TOXAPHENE
INGESTED IN TOXIC AMOUNTS*

BY

B. CHOUDHURY, G.B.V.C., M.S. (U. S. A.).

Calcutta

Introduction

The importance of arthropod ectoparasites, particularly lice and mites, has constantly been emphasized during wars. This was especially true in World War II. The members of the United States Armed Forces came in contact with many types of insects and mites. There were not only many serious ectoparasites but in addition several were the efficient vectors of quite a number of disease-producing agents. Accordingly, a comparatively large amount of research effort was directed toward developing insecticides and insect repellents that would be highly efficacious yet be less toxic to the host than certain chemicals used in the past. Federal and State entomologists, in co-operation with the Industrial manufacturing chemists, began to explore the possibilities of a great number of chemicals as insect toxicants. Not only were new compounds synthesized but many existing formulations were re-examined and evaluated from the stand point of insect toxicants.

Many products, showing a high degree of toxicity for insects with a maximum of safety to host animal, were found in the organic group commonly termed chlorinated hydrocarbons. Chlordan and toxaphene are the two compounds of the group which are particularly efficient insect toxicants.

The toxic properties of the chlorinated hydrocarbons are yet to be determined for many warm-blooded animals. The object of this investigation is to endeavour to determine the pathological effects produced in goats by administering known amounts of chlordan and toxaphene. Such information is particularly desirable at this time as little information is available as to the pathological changes produced in ruminants by these chemicals.

Chlordan, with the empirical formula $C_{10}H_4Cl_8$, is a chlorinated hydrocarbon. The chemical name is 1, 2, 4, 5, 6, 7 octachloro-4, 7-methane-3a, 4, 7, 7a-tetrahydroindane, Anand (1). It is a viscous compound with slightly pungent odour and available as emulsions or wettable powders.

Toxaphene, Hercules 3956, chlorinated camphener and polychlorobicyclic terphene are the names used to designate another hydrocarbon that is used as an insect toxicant. It has the approximate empirical chemical formula of $C_{10}H_{10}Cl_8$ and is usually identified as chlorinated camphene. It is a light yellow waxy product with a very mild piny odour, contains about 67-69 per cent of chlorine and melts at a temperature of 65-69 degrees Centigrade. It is easily soluble in common organic solvents (14 and 20).

*Condensed from a thesis (A. M. C., Texas, 1948).

The respective preparation used in this experiment contains 40 per cent of each of the above active compounds and 60 percent of non-toxic attapulgite (8).

Attention is now directed towards the study of the clinical symptoms and lesions produced by chlordane and toxaphene. These compounds may be harmful when used indiscriminately in the control of ectoparasites of domestic animals. Accidental poisoning may occur when the livestock are allowed to ingest appreciable amounts of these chlorinated hydrocarbons.

Livestock may be poisoned as a result of eating forage or grazing on fields treated with these compounds. It is not uncommon that the sprayed material be blown by the wind and deposited in adjacent areas. The animals grazing in these areas may pick up little by little the active ingredients of the spray residue and fall sick due to its cumulative toxic action. Not infrequently, animals die due to continued ingestion of small amounts of residual material. Ivy, Parnolia, and Ewing (8) reported that toxaphene was tested against several cotton insects at Waco, Texas. In a field-plot experiment a dust containing 20 per cent of chlorinated camphene gave adequate control of comparatively heavy infestation of boll worms, boll weevils, cotton aphids, and leaf-worms. In large scale experiments, the proportion of spray was 720 pound per acre containing 20 per cent toxaphene. Cotton fields are often used as pasture in the fall and winter after the cotton harvest is completed. This will throw some light on the possible rate of intake of such chemicals by a pastured animal.

The damage caused by the insect toxicants of former days also used to take a heavy toll of animal life. Each year the total loss to livestock owners was £ 168,000,000 in the United States alone as reported by the Julius Hyman Company in 1948 (10). With the discovery and proper use of these newer insect toxicants the rate of loss may be decreased considerably and on the contrary these losses may be converted to profits.

These factors, i.e., both usefulness and shortcomings, emphasize the necessity of adequate investigation to evaluate chlordane and toxaphene in the field of veterinary practice. Also to determine the nature and the extent of unfavourable changes these compounds can possibly produce in the animal system.

REVIEW OF LITERATURE

Chlordane

During recent years, as reported by Shepard (17), an intense interest has been aroused by the successful development of certain synthetic insecticides by chemical industries. As a result a large number of new compounds are now being tested by biological methods for their insecticidal value.

In regard to the utility of the newer insect toxicants, Plumb (15) states that John Schread, Entomologist at the Connecticut Experiment Station at New Haven, used chlordane on a large number of grub infested plots in spring and summer (1947). In treating a plot of land it was used at the rate of five pounds of 5 per cent dust to 1,000 square feet and proved 96 per cent effective in killing grubs.

Chlordane is reported to be helpful in the control of pests among livestock in the veterinary field (9). It is a product of high order of toxicity to a wide range of insects but with mild action on warm-blooded animals. The brown dog tick and other acarina attacking human beings and domestic animals are susceptible to the action of this compound. Its toxicity is reported to be ten times stronger than DDT in combating such parasites.

The control of poultry lice is essential to the economic operation of successful poultry farms. It has been found that, owing to the attack of lice, the vigour of the laying birds is greatly diminished. The breeding capacity of the bird declines due to parasitism. Chlordane was applied to the birds and the result was that the birds enjoyed complete freedom from lice. Creighton and others (5) report that the application of chlorinated hydrocarbons, applied to the soil and the roosts, effectively controlled poultry lice.

Chlordane was used for the treatment of soil in the proportion of 5 pounds of 2 to 5 per cent dust per 1,000 square feet. The birds were protected for a period of 4 to 5 weeks subsequent to the experimental application.

Ingle (7) conducted an elaborate experiment with regard to the toxicity of chlordane to white rats. He records that, since it has been apparent that chlordane has a greater toxicity than that of DDT, it became increasingly important to investigate its toxicity to warm-blooded animals. Since it has been an established fact that warm-blooded animals show susceptibility to DDT, the experiment was a parallel test with that of the same in order to facilitate comparison.

Chlordane was slightly less toxic in higher and lower doses than DDT and slightly more toxic to female rats than to males. Both the treatments with DDT and Chlordane elicited some anorexia and loss of weight. The greater decrease in food consumption was recorded for those receiving chlordane. The decrease in weight occurred within the last 48 hours before death. The compounds appeared to be about equally toxic to white rats under experimental conditions.

When administered intra-gastrically in olive oil, chlordane had about the same degree of toxicity as DDT to white rats. As with DDT, the rats died with typical symptoms of loss of appetite, decrease in food consumption, loss of weight, hyperexcitability, rapid respiration, pronounced tremors, and occasionally clonic convulsions. The symptoms of chlordane were qualitatively

similar to that of DDT. The primary differences were quantitative in that tremors and clonic convulsions which were more severe for chlordan-treated white rats. The convulsions lasted for a minute or two and reappeared after 20 to 30 minutes. Death occurred frequently but not always during the seizure. A marked increase in respiratory efforts were noted within a few minutes of application (to skin or stomach).

Gross pathological findings in skin applications were hyperkeratosis with roughening and brownish discoloration of the skin and evidence of ulceration. Autopsy showed considerable liver damage due to DDT but very little damage as a result of chlordan. The damage was characterized by pallor and occasionally centro-lobular darkening. Evidence of kidney pitting and hemorrhage were noted in both test groups. Chlordan produced more pulmonary damage than DDT as evidenced by edema and hemorrhage. Histological findings were not complete but it appeared that chlordan caused more pulmonary and less liver damage than DDT. Rats represent a wide range of individual susceptibility and so it is difficult to ascertain the minimal lethal dose.

The Julius Hyman Company (10) report in their technical supplement the utility of chlordan in eradicating livestock parasites, e.g., ticks, lice, mites, flies and fleas and is available in the following formulations: (1) emulsifiable concentrate, (2) wettable powders, (3) powders, (4) oil solutions and (5) mixed with DDT and other chemicals. In sheep, the ticks and lice are controlled by spraying or dipping in 0.125% chlordan emulsion or dusting thoroughly with 2% chlordan powder. For wool maggots (fleece-worm) 1 to 2 per cent emulsion gives good control. Similar findings have been reported by Bishop and Knipling (3).

Turk and Batte (21) report that 50 per cent wettable powder of chlordan was given to dogs in single doses up to 200 mg. per kg. of body weight before symptoms were shown. No death was produced up to 700 mg. per kg. of body-weight, although clonic spasms, tremors, and convulsions were produced in some dogs.

In case of dips for ectoparasites, a number of dogs were dipped several times in 0.42 per cent solution. No evidence of toxicity was observed. Some cats were re-dipped 7 days and 23 days later without showing any local or systemic disturbance. It appears that the drug is quite effective for the eradication of ectoparasites at concentrations that produce no detrimental action on the host.

Radeleff (16) describes the symptomology produced in sheep and goats by dipping in 1.5 per cent concentration of either wettable powder suspension or emulsion of chlordan. The applications were repeated every fourth day. The cattle were sprayed with 2.0 per cent concentration of chlordan wettable powder at an interval of a fortnight.

Certain symptoms and lesions were characteristic to chlordan poisoning. In acute clinical cases, the onset was sudden. The animals usually were down with agony, bleating, groaning, grinding of teeth, blindness, violent paddling, opisthotonos, and ultimate cyanosis before death. Subacute or chronic cases did not show pathognomonic symptoms. Partial or complete blindness and locomotor ataxia gradually set in. Individual animals circled, jumped, staggered, or might have convulsions or show a combination of symptoms.

Autopsy findings were petechial hemorrhages and larger hemorrhagic patches sub-serously in the small and large intestines and in the sub-epicardium together with some swelling and enlargement of liver with histo-pathological changes. Petechiae usually are not found other than in the heart and intestines in chlordan poisoning. There were erosions of gastric mucosa, increased peritoneal effusion, enlarged spleen, and gastro-enteritis. Occasionally lungs failed to collapse when thorax was opened.

The incomplete histopathological examination revealed that there was relatively constant fatty changes in the liver. Central and midzonal hepatic lobular necrosis was present in one sheep while in one goat, involvement of kidneys with fat deposits in the convoluted tubules was observed. In the brain of some goats neuron involvement, hemorrhage, and congestion were noted; whereas in others the brain revealed only congestion. The symptoms and lesions were in many respects similar to sodium chloride, chloroform, cocklebur, DDT, santonin, and chloride poisoning.

Welch (22) made certain toxicity tests of chlordan. The objects of the test were to determine:

1. The maximum safe dose for each insecticide for sheep.
2. The maximum safe dose of each insecticide for cattle.
3. The effect of daily dosages of each insecticide for sheep for 60 days.
4. The effect of grazing sheep on pasture sprayed with chlordan.

The maximum safe dose for sheep was that which could be administered to sheep in one dose without any toxic symptoms. The doses used in each case were stated on the basis of 2 grams of insecticide per kilogram of body-weight of the sheep followed by the smaller doses.

For a 100 lb. sheep the dose of 4.5 grams represents 0.1 gram per kilogram. Smaller dosages of chlordan were administered to another lot of two sheep, the quantity was adjusted as to the reaction of the sheep in the tests to determine maximum safe single dosages.

The sheep, one weighing 100 pounds and the other 92 pounds, each received a capsule containing 3.5 grams of chlordan and 1 gram of xylene 8 a.m. By 5 p.m. both sheep were visibly poisoned and showed extreme incoordination and jerking of muscles. After a wait of 10 days for symptoms to disappear, the daily capsule was resumed using approximately half the original

dose. On the next day symptoms reappeared and were so pronounced that the treatment was again stooped. After 5 days a capsule containing 1 gram of chlordan-xylene mixture was started. After 7 days the former died suddenly. Post mortem examination disclosed extensive liver necrosis which might not have been caused by chlordan. The 1 gram dose was continued to the latter, and, it on the 15th day, was discontinued for 2 days to allow symptoms to subside. Treatment was resumed and continued until the end of a 60 day period with intermittent recurrence of nervousness. The final weight of the sheep was 85 pounds.

Chlordan, in the dosage used, would have killed both the sheep had the 4.5 gram dose been continued. The reduced dose, 1 gram of the chlordan-xylene mixture or about .018 grams of chlordan per kg., produced visible symptoms of poisoning at intervals.

A capsule of 3.5 grams of the mixture of chlordan in xylene was extremely toxic and half of this dose proved about as toxic. A dose of .77 grams chlordan was continued to the end of the experiment producing only mild symptoms.

Toxaphene

Toxaphene was reported for the first time by Stearns *et al* (19 and 20) on April 5, 1946 and was first used as a larvicide for both culicine and anopheline mosquitoes. It is also effective in the control of certain fruit and vegetable insects. Evidence thus far indicates that toxaphene will prove to be a valuable addition to the rapidly growing list of insect toxicants available for household, livestock, and plant.

Parker and Beacher (14) made an extensive study of toxaphene. They found it toxic to household insect pests in space spray formulations and as a residual insecticide. High kills with low concentrations of toxaphene are obtained in the case of the house fly, the German cockroach, bed bug, and certain fabric pests.

Toxaphene is toxic to agricultural insects. As regards mammalian toxicology, it has been tested on 200 human subjects showing that it is neither a skin irritant nor a skin sensitizer.

Studies on the chronic toxicity of toxaphene to laboratory animals are in progress to determine whether ingested toxaphene is stored in the body fat or appears in the milk of the cow.

Toxaphene in deodorized kerosene is considerably less toxic to white rats than toxaphene in corn oil. It kills dogs by stimulation of the central nervous system.

Until complete information on the toxicity of toxaphene is available, it is suggested that the product should be treated as a toxic material.

There are many chemicals, reported by Batte and Trunk (2) that give promise of controlling more important ecto-parasites of animals. Some of them are tested and approved for use on animals. Others are in the experimental stage and must be tested for their toxicity before being recommended for general use. Their experiment was to determine the toxicity of some chemicals to dogs which had shown promise as insecticides.

The smallest dose of toxaphene given was a total of .636 grams of 25% active ingredient or 20 mg/kg of live-weight. This did not produce death but brought about convulsions. Because of the high toxicity it is not recommended.

The several hundred insects and related parasites attacking livestock, as stated by Bishop and Knipling (3), show great diversity in their life history and habits and a wide range of tolerance to insecticides. For these reasons many problems arise in connection with their control, and a variety of insecticides or insect repellents is necessary to provide satisfactory control by chemical methods.

Toxaphene is now being tested in the field in comparison with DDT. The action of toxaphene against lice on cattle, sheep and goats seems to be comparable with DDT, although an extensive field test has not yet been conducted. It is superior to DDT in killing fleas, the lone-star tick, and brown winter tick. It prevents screw worms and fleece worms from attacking livestock. The result of primary investigation was satisfactory.

Materials and methods of experiment

The object of this experiment is to determine the amount and the extent of pathological conditions which a known quantity of each of chlordan and toxaphene may produce in ruminants. The study is primarily limited to symptoms and lesions produced with the ingestion of the chemicals in toxic amounts. No attempt is made to establish the minimum lethal dose. It has already been reported that these chlorinated hydrocarbons are toxic to animals. The study of pathologies which they produce from time to time has become absolutely necessary to make the account of these compounds complete.

Among the polygastric animals, seven goats are selected for the research to avoid excessive cost of the experiment. Attempts are made to record the morbid changes in the vital organs of a set of three goats used for each compound in comparison with the normal tissues from a goat. During the period of experiment the goats are fed on alfalfa hay. Experimental procedure is as follows:

1. Three goats are administered orally chlordan in gelatin capsule.
2. Three goats are given orally toxaphene in gelatin capsule.
3. Doses are calculated in milligrams per kilogram of live-weight.
4. The respective goat is weighed every alternate day during the period of treatment.

5. Sufficiently large doses are given to insure the onset of clinical symptoms and the production of lesions in various organs due to the damages caused by these chemicals. The initial dose is not large enough to produce marked symptoms; but the doses are gradually increased every second day until symptoms are produced; thus to allow the maximum amount of morbid changes to take place in the affected organs. The doses of chlordan and toxaphene are calculated respectively on the following basis:

A. The dosage of chlordan:

1. First and second days—750 mgs. per kg. of live-weight; if surviving,
2. Third and fourth days—1,000 mgs. per kg. of live-weight; if surviving,
3. Fifth and sixth days—1,500 mgs. per kg. of live-weight.

B. The dosage of toxaphene:

I. For the first goat,—

1. First to fourth days—25 mgs. per kg. of live-weight; if surviving,
2. Fifth and sixth days—37.5 mgs. per kg. of live-weight; if surviving,
3. Seventh day—50 mgs. per kg. of live-weight; if surviving,
4. Eighth day—75 mgs. per kg. of live-weight; if surviving,
5. Ninth and tenth days—100 mgs. per kg. of live-weight; if surviving,
6. Eleventh day—150 mgs. per kg. of live-weight.

II. For the second goat.—

1. First and second days—100 mgs. per kg. of live-weight; if surviving,
2. Third and fourth days—150 mgs. per kg. of live-weight.

III. For the third goat.—

1. First day—150 mgs. per kg. of live-weight. If surviving, the dosage would be increased accordingly.

The comparative study of toxicity of toxaphene by Batte and Turk (2) reveals that as small a dose as 20 mg/kg produced clinical symptoms in dogs in 12 hours; accordingly the initial dose of 25 mg/kg is thought to be safe enough for the first goat at the beginning for the purpose of the production of sufficient pathology and simultaneously to throw light on the toxicity, cumulative effect of the compound and tolerance in polygastric animals such as goats. Thus the experience which has been acquired is employed in dosing the successive other two goats. This fact accounts for the wide variation in dosages of toxaphene between the first and second and third goats.

Toxaphene, as reported by Batte and Turk (2), is approximately ten times more toxic to dogs than chlordan; hence the dosages of the former are gradually and cautiously stepped up.

6. Forty per cent of the active ingredients of either chlordan or toxaphene are used in this experiment in a non-toxic diluent viz., atta clay.

The doses are calculated on the active chemical contents of each of the preparations. The wettable powders of these compounds are obtained through the courtesy of the Departments of Entomology and Veterinary Parasitology, A. M. C., Texas.

7. Efforts are made as far as practicable to dose the goats concerned between 8 and 9 a.m. every day during the period of the experiment. An autopsy will be made immediately after death, or sacrifice of the moribund animal, to avoid possible post-mortem changes. All gross lesions noted will be recorded and tissues will be taken for histological study.

8. One healthy goat is sacrificed for the sake of collecting normal tissues for comparative study.

Observation and results of experiments

Three goats were administered lethal quantities of chlordan and three were administered lethal quantities of toxaphene as outlined previously. The animals were observed closely for clinical symptoms and these were recorded individually. Post-mortem examinations were performed and the macroscopic lesions were observed and recorded. Histopathological slides were prepared from the various vital organs of the body and studied for evidence of microscopic lesions. (See Tables I and II for details).

1. Chlordan

Three goats were dosed orally with 40 per cent wettable chlordan powder in gelatin capsules. The capsules were coated with paraffinum molle (petrolatum) in order to facilitate deglutition. The dosage was calculated in milligrams per kilogram of live weight (See Table I.).

Twenty-four hours after the first dose, the following symptoms were observed, dullness, partial loss of appetite, hyperesthesia on being touched or exposed to loud noises, slightly dilated pupil, and occasional groaning or bleating. After 48 hours there were complete anorexia, slight loss of weight, hunched appearance with tucked-up flanks. Widely dilated pupils were evident in goat Nos. 1 and 3. The animals manifested restlessness, staggering gait, muscular stiffness of the hind legs, circling (in goat No. 3), grinding of the teeth, frequent attempts at micturition and increased nervous reflexes. Paroxysms of convulsion, lasting 2 to 3 minutes or more, usually resulted when attempts were made to secure them for dosing or examination.

During convulsions they fell to the ground on the side, drawing head towards the back and shaking it. The legs were either stretched out or there was paddling. Sometimes there was champing of the jaws and discharge of frothy saliva. Respiration was shallow and rapid. Dyspnea was pronounced before death. The convulsions were more frequent as death supervened. The animals became weak due to anorexia, dehydration, anoxia, and repeated

TABLE I
Results of feeding goats with Chlordan (40% wettable powder)

Serial No. of goat.	Day of experiment.	Age of animal.	Live weight in kg.	Active ingredient in mg. per kg. of body weight.	Total quantity of active ingredient in mg.	Total quantity of 40% preparation of the active ingredient given.	Clinical results.
1	1	1 yr.	17.95	750	13,462.5	33,656.25	No effect.
	2	"	"	"	"	"	Hunched up appearance, dullness, dilated pupil, occasional groaning or bleating, slightly increased reflex, inappetency and rapid respiration.
	3	"	17.5	"	13,125	32,812.5	Complete anorexia, loss of weight, staggering gait, muscular stiffness of hind quarters, restlessness, increased reflex, convulsion, dyspnea, asphyxia and death at the 70th hour.
3	1	2 yrs.	22	"	16,500	41,250	No effect.
	2	"	"	"	"	"	Symptoms were similar to those of goat No. 1.
	3	"	20.45	"	15,337.5	38,343.75	Symptoms were similar to those of goat No. 1. Circling was noticed after 48 hours and the animal died at the 68th hour.
4	1	1 yr.	20	"	15,000	37,500	Slight nervous irritability.
	2	"	"	"	"	"	Symptoms were similar to those of goat Nos. 1 and 3 but more severe and the animal died at the 28th hour.

convulsions. They eventually lay down and were disinclined to move. When urged to move they usually went into convulsions. Ultimately they became cyanotic and died from asphyxia due to pulmonary edema.

Macroscopic appearance

There was extensive pulmonary edema evidenced by a large quantity of frothy serous exudate which seemingly filled the alveoli, bronchioles, bronchi and partially occluded the trachea. There were focal areas of pulmonary emphysema and the lungs failed to collapse on opening the thorax. The pulmonary vessels were engorged with blood and the bronchial lymph nodes were edematous. The right side of the heart was distended and there was an excess of pericardial fluid.

The abomasum exhibited irregular areas of congestion. These were large, small or splotchy and were more pronounced near the pyloric orifice.

The small intestine was congested throughout. The presence of catarrhal and hemorrhagic inflammation of the mucosae was evident. The epithelium was coated with tenacious mucus tinged with blood and eroded in places. The large intestine contained a few dead nodular and whip worms. The mesenteric lymph nodes were swollen and edematous.

The liver was hyperemic, swollen, friable, and glossy; indicating the presence of cloudy swelling and fatty metamorphosis. Ecchymosis of the gall bladders of goat Nos. 1 and 3 was noticed.

The kidneys showed irregular haemorrhagic areas on the cut surface continuous with cortex and medulla.

The blood vessels of the meninges and brain were distended and there seemed to be an excess of cerebro-spinal fluid. The brain and spinal cord appeared to be slightly softened where sliced. There was nothing indicative of cerebro-spinal hemorrhage.

Histopathology

Brain and spinal cord.—There were changes both in the blood vessels and in the brain and spinal cord proper. The vessels were engorged with blood. There were perivascular edema, capillary thrombosis, and migration of a number of round cells throughout the brain. The nerve cells and fibres showed degenerative changes, in some cases even to the point of disintegration. There were small areas of softening and edema. The degeneration appeared to be mainly due to thrombosis, congestion, edema, and compression of the brain substance. The changes were marked both in the grey and white matter. The degenerative process of neuron and ganglion cell was accompanied by neuronophagia which was indicated by the infiltration of microglia in considerable number.

Heart.—There was edema of the muscular septa and cloudy swelling of muscle cells with a tendency to fatty metamorphosis. Moderate focal and diffuse neutrophilic and round cell infiltrations were observed throughout the myocardium. There was edema and neutrophilic infiltrations in the sub-endocardial space.

Lungs.—Both lungs were edematous, congested, and hemorrhagic. Most of the alveoli were filled with frothy serous exudate and desquamated epithelium. Other alveoli were either emphysematous or atelectatic. There was a marked neutrophilic and round cell infiltration. The inter-alveolar septa were thickened and edematous except in some areas of emphysema. A considerable amount of hemosiderin was present. The exudate filled most of the alveoli, bronchioles, and bronchi. It consisted of a fluid rich in protein, desquamated epithelium, round cells and neutrophils.

Lymph nodes—Both the mesenteric and bronchial lymph nodes were involved. There were edema and capillary congestion. Hemosiderosis of both the mesenteric and bronchial lymph nodes was marked. Changes were more severe in the bronchial nodes.

Spleen.—The changes in the spleen were more or less similar to those found in the bronchial and mesenteric lymph nodes. The reticulo-endothelial cells were proliferated. Phagocytosis of cell debris, mild neutrophilia and hemosiderosis were present. There were numerous chromatin fragments evidently resulting from excessive cellular destruction.

Adrenals.—Infiltration of a few round cells, congestion, slight hemorrhage, edema, and cloudy swelling were noticed both in the cortex and medulla of suprarenals.

Kidneys.—The acute glomerulo-nephritis and changes in the tubular epithelium was most outstanding. The glomeruli were distended with some sloughed epithelial cells and coagulated protein. Occlusion of many uriniferous tubules with cellular and granular casts was evident. This resulted in the distension of many of the proximal tubules and Bowman's space. Both cortical and medullary portions were congested and intertubularly infiltrated with round cells. The tubular epithelium had undergone cloudy swelling, fatty metamorphosis, coagulation necrosis, and desquamation. The intertubular capillaries were distended with blood which compressed the tubules on either side. At different points the vessels gave way and the red blood corpuscles were lodged in the interstices or in the tubular lumen. The endothelial cells of the capillary tufts in the glomeruli were multiplied, swollen and completely filled in the Bowman's capsule in many instances. Some vacuoles were formed in the capillary tufts and certain amounts of protein accumulated in them.

Abomasum.—Congestion, edema, round cell infiltration, and mild excoriation of mucous membrane were observed.

Small Intestine.—All layers of the small intestines were swollen, edematous, and infiltrated with many round cells, some neutrophils, and plasma cells. Some capillaries of the mucosa muscularis were plugged with thrombi. The mucous membrane was swollen, excoriated at different places, and contained some irregular hemorrhagic areas. The edema was mostly restricted to the submucous layer. The mucous surface was covered with an exudate composed of desquamated epithelium, round cells, neutrophils, plasma cells, and mucin. The capillaries were engorged and the tips of the villi sloughed off. The catarrhal exudate covered the mucous surface which was spotted with necrosed areas.

Liver.—The liver represented a picture of acute hepatitis with the infiltration of round cells, cloudy swelling, fatty metamorphosis and focal coagulation necrosis. The vacant spaces caused by necrosis of the hepatic cells were filled in with protein fragments of the degenerated cells. The necrosis was most pronounced around the central veins. Some of the hepatic cells shrank which resulted in the atrophy of the hepatic cord. The atrophy and degeneration of the hepatic cord caused the sinusoid to distend and engorge with blood and cell debris. There was engorgement of the larger vessels with blood, and the endothelial cells were swollen and increased in number.

(To be continued)

A Preliminary note on THE INVESTIGATION INTO BOVINE PARALYSIS IN SOUTH KANARA DISTRICT, MADRAS STATE

By

M. RAMAKRISHNAN, G.M.V.C.,

Veterinary Investigation Officer,

and

K. ANANTHAPADMANABHAN, G.M.V.C.,

Assistant to the Veterinary Investigation Officer,
Ranipet, Madras.

Introduction

The condition provisionally termed as Bovine Paraplegia or Bovine Paralysis prevailing in South Kanara District of the Madras State was brought to light just a decade ago. Since then, it has been suspected by different observers for different conditions such as Chronic Haemorrhagic septicaemia, Contagious bovine pleuro pneumonia, Acute amphistomiasis, Botulism, Acute fasciolasis, Theileriasis, Anaplasmosis, latent Trypanosomiasis and Hydrocyanic acid poisoning. Viswanathan (1943) was the first to take cognizance of the condition and though, in his opinion, this disease resembled Haemorrhagic septicaemia, he was more inclined to think that it was Bovine pleuro-pneumonia. It was possible

for him to get three cases for postmortem and, in them, he noticed varying degrees of pleurisy and pneumonia. Opinion on the results of histo-pathological examination was, however, divided between the Principal, Madras Veterinary College, and the Director, Indian Veterinary Research Institute, Mukteswar. While the former confirmed it as Contagious Bovine pleuro-pneumonia, the latter gave a negative result. Further, biological test conducted on one calf with pleuritic effusion proved negative. Sastry (1948) recorded some of his observations and those of the members of his staff on the above condition under the heading "A hidden disease of bovines in South Kanara District." In this article, he merely gives a topographical and climatological description of the district with symptoms and postmortem appearances as observed by some of the members of his staff. No mention is made about the etiology of the disease. Hurley (1949) after going through the report of the District Veterinary Officer, South Kanara, was of opinion that the condition resembled Acute amphistomiasis and issued instructions to the departmental staff to eliminate the same. But, from the investigations conducted by either of the present authors, their predecessor or by any of the members of the staff, this condition does not seem to have been met with.

Ramakrishnan (1949) was of the opinion that this may be a form of Botulism and conducted experiments (to be described later) by actual feeding of bone emulsion from the affected locality on cattle and buffaloes with negative results. Rajagopalan (1950), while issuing instructions to eliminate the condition for Acute amphistomiasis, Fascioliasis, Theileriasis etc, laid special stress that this may be due to hydrocyanic acid poisoning and that it should be eliminated by sending as many materials for chemical analysis as possible. Materials from a number of affected cases were sent for chemical analysis; but all proved negative.

Attempts were made by the present authors to eliminate the condition for a number of other causes like ergot, nuxvomica, and other plant poisoning by conducting feeding experiments on cattle and buffaloes and laboratory animals. All proved negative excepting ergot; the results of which are noted separately under 'experiments conducted'. Experiments were also conducted with a view to eliminating Trypanosomes and Encephalomyelitis.

Finally, during the last attempt in 1952, one of the authors was able to get microfilaria in the peripheral blood of three affected bovines and it is now his suspicion, in the light of recent publication, whether this is similar to the condition of Lumbar Paralysis of goats in Ceylon due to microfilaria (McGaughey, 1951).

Though no definite conclusion has been arrived at on the etiology of the disease an attempt is made in this paper to describe the condition in all its epizootological aspects together with the symptoms

noticed and the nature of work so far done on the same, so that further work may be facilitated.

The district of South Kanara has the Arabian Sea on the west and the Western Ghats on the east. The land between the sea and the foot of the hills measures from twenty to seventy miles in breadth and about hundred and twenty miles in length. While the coastal belt is sandy, the land as it proceeds eastwards becomes gradually elevated and is interspersed with hills and dales with extensive evergreen vegetations and perennial rivers till it reaches the Western Ghats. The elevation may vary from 1000 to 3000 feet, being lowest at the coast and highest at the foot of the hills. The area at the foot of the hills is full of valleys and dense jungles. These valleys contain patches of wet cultivation such as paddy, plantains, and pepper together with areca and coconut. The minimum and maximum temperatures as recorded from December to Feb. 1950, range from 24 to 26 degrees and 30 to 32 degrees centigrade respectively. A maximum rainfall of 55.85 inches for July and a minimum of 2 inches for April have been recorded for 1950. The average annual rainfall may go up to 150 inches. The monsoon months are June to October and the period from November to April is practically dry excepting for a few showers now and then. The winter or the dew season sets in by the end of October and continues till the end of January.

While all the urban centres are situated along the coast, small villages or groups of houses are found in the interior valleys described above. People graze their cattle in the adjoining hills and jungles and carry on cultivation in the valleys. *Heteropogon contortus* and *Brachiaria ramosa* are the common grasses found in the grazing area. If the pasture gets dried up, animals take to eating leaves from bushes and trees in the jungle. Nuxvomica is one of the trees, the leaves and fruits of which, are commonly eaten by animals.

The method of sheltering animals during nights is peculiar to South Kanara District. It is a sort of loose-box system. The cattle sheds are generally lower than the ground level. A layer of green leaves is spread within the stall to about one foot height and the animals are allowed to stand over the same. Dung and urine get mixed with the leaves. After about a fortnight or so, another layer of leaves is spread over this. Thus they go on adding to this bedding till the cultivation season when the whole lot is removed and used as manure. The accumulation again starts for the next season similarly. This method of stalling animals is even suspected as one of the probable causes for paralysis, since, during rainy and dew seasons, the animals lie down on the leaves soaked with dung and urine and consequently get exposed to dampness and moisture.

The method of disposal of dead animals also requires special mention. Carcasses of animals died of disease or other causes are neither buried or

skinned and cut. They are taken a little to the interior of the forest and thrown away for vultures and wild games for disposal. Thus what remains of a carcass after a few hours is nothing but a heap of bones with hooves and horns. Being naturally in a mineral deficient area, the cattle of South Kanara District have a tendency to chew bones, and these "cattle bites" are readily available in the jungle due to improper disposal of carcasses as mentioned above. It is mostly in such interior villages as described above that this bovine paralysis is commonly found though other places are not entirely free. This was the main reason for one of the authors to suspect the disease for Botulism.

The disease has a distinct seasonal incidence which closely coincides with the winter months i.e. from October to February. In other words, the disease starts just after the rainy season is over. Thus, out of statistics collected for 63 villages, the following are the details of month-wise reports :—

Month	No. of reports.	Month	No. of reports
January	9	July	1
February	4	August	2
March	2	September	9
April	1	October	20
May	—	November	11
June	—	December	4

From the above figures it would appear that the disease just commences in September, reaches its peak in October and gradually fades away by February. The period from March to August appears to be practically free excepting for very few outbreaks here and there.

Endemicity of the outbreak

Out of 63 villages investigated, the disease was found to occur more than once during the past nine years in the following villages as per details given below :—

Name of village	Number of times the disease was noticed
1. Madamakki	4
2. Kuchur	3
3. Albadi	3
4. Belluvoi	3
5. Belve	2
6. Hengavalli	2
7. Belanji	2
8. Belliyaru	2

Note.—It is likely that the disease might have occurred more number of times than mentioned above and some more villages may be included in the above list, but figures are furnished so far as they have come to the notice of the authors.

Kind of animals affected

Both cattle and buffaloes are equally affected. The proportion varied in the different species according to availability of animals in the locality. Thus if cattle are more in a certain village, the number of attacks and deaths were more in that species; and likewise in buffaloes. In both the species, calves were not affected as the disease was purely confined to adult animals. The disease was not noticed in other animals like sheep, goats etc.

Mortality

Out of statistics collected for 63 villages, there were 387 attacks and 282 deaths. Thus the mortality works upto about 75%.

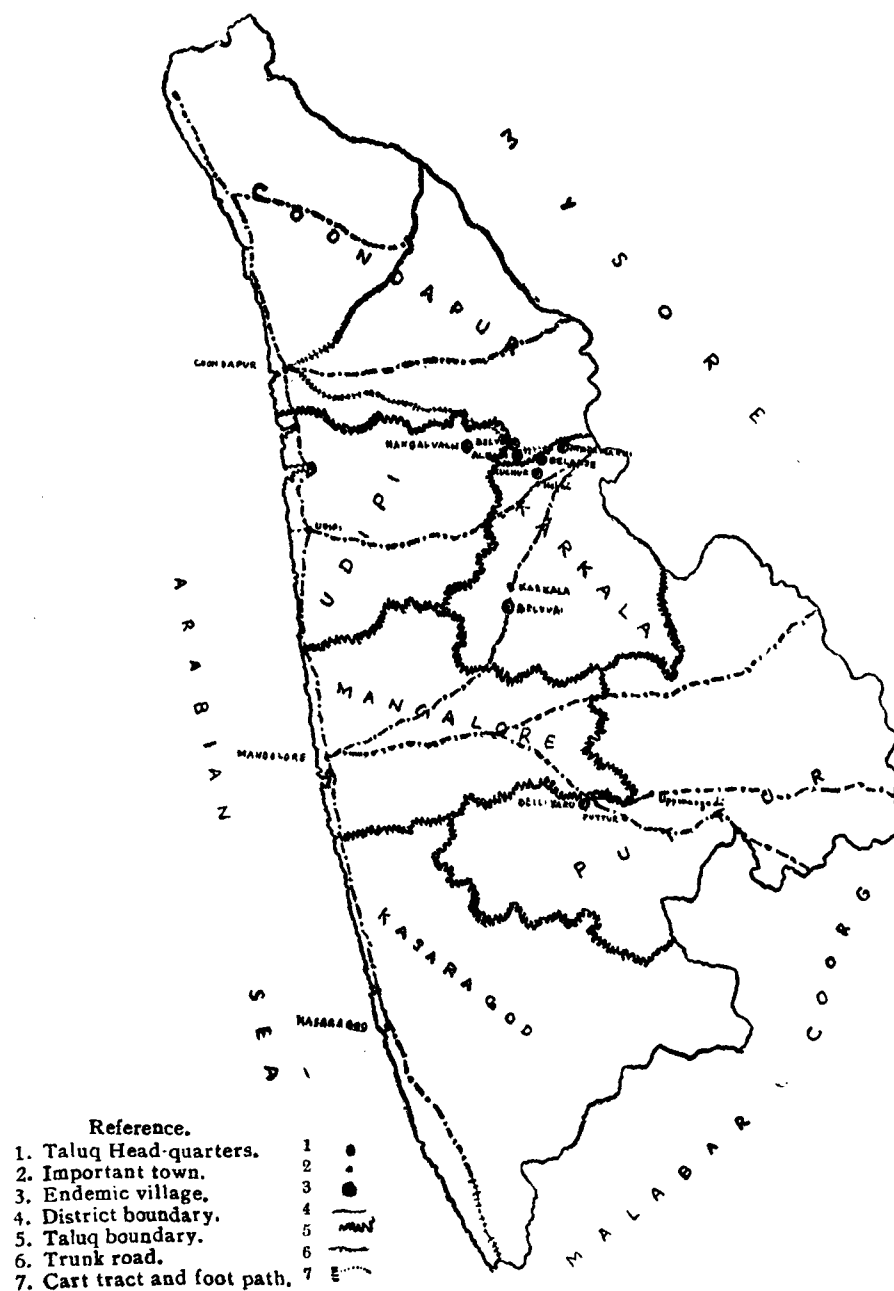
Symptoms

The disease may be classified, according to the symptoms, as hyperacute, acute, sub-acute, and chronic. In hyperacute cases, deaths are instantaneous or very sudden—there being no opportunity to observe any symptoms at all. In the acute type, symptoms are sudden shivering, unsteadiness of the limbs, staggering gait, rolling of the eyes, vacant look, profuse salivation, paralysis of the tongue which is protruded or hanging to one side and inactivity of the masseter muscles leading to inability to masticate or swallow. By this time prostration sets in and the animal lies down folding its neck to one side. If the neck is straightened, it can be kept in position till held in support and again it returns to its original conditions when released. *The folded condition of the neck to one side and profuse salivation are very diagnostic of the acute type.* The animal dies in convulsions in one to two hours from the onset of the first symptoms in some of the cases. In the majority, deaths take place within about 4 to 6 hours. In the above instances, animals are either found dead in the stalls or while going for grazing or in the grazing area itself. It is in this type of illness, that acute toxæmia is suspected. In exceptional cases, deaths may be delayed from 12 to 24 hours.

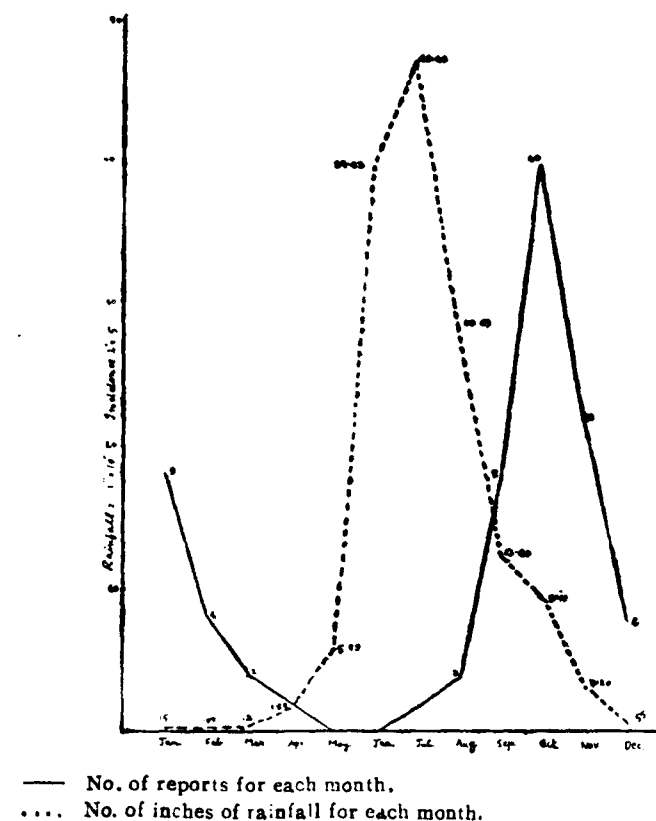
In the subacute form, immobility of the tail is the first symptom that is noticed. Such animals when carefully watched are noticed to frequently lie down when grazing. When goaded, they get up, graze for a while and again lie down. In these animals, no abnormality of any kind is noticed excepting weakness of the hind quarters. The animal has quite a healthy look and the feeding is normal (see Fig. No. 1).

There is no rise of temperature. The expression is quite lively with its pricked up ears and alertness of the eyes. If lifted up, the legs are found

Map showing the endemic areas of Bovine Paralysis in South Kanara District.



Graph showing the incidence of the disease with corresponding rainfall for the months



paralysed, fetlocks are folded, tendons and ligaments are in a state of relaxation (see Figs. 2 and 3).

If the legs are massaged and given support the animal stands for a while in a characteristic pose wherein the back is arched and the hind limbs are drawn forwards close to the fore limbs. The tail is hanging loose. Though there is a slight response to pin-prick yet there is not the ready switching of tail as we find in normal animals. In the initial stages micturition is normal but, later on, suppression takes place and the animal passes urine in drops with much difficulty and after great straining. At this stage, constipation with tympany also sets in, dung being passed in pellets with frequent passing of flatus. In this condition it may continue for 3 to 4 days or even up to a week. Up to this period the appetite is unaffected. The look of the animal continues to be bright. There is no discharge from the mouth, nostrils or eyes. Then slowly anterior paralysis sets in. Neck muscles and tongue get paralysed and there is an involuntary flow of saliva.

The neck is bent sideways and the tongue is hanging to one side. Mastigation and deglutition are interfered with and the animal dies of inanition by the ninth or tenth day.

Chronic type

This is only a prolongation of the sub-acute type. The animal can live up to one or two months and may even recover but the weakness and unthrifty condition continue for months thereby making the animal economically useless (see Fig. No. 4).

The above animal was examined by one of the authors two months after it recovered from the illness. When slight pressure was applied to the lumbar region it evinced excruciating pain by depressing its back and finally fell down. Once the disease is noticed, the owner himself knows that it is immaterial whether the animal recovers or not as it will not be of much use to him afterwards. Thus, this disease leaves almost a permanent mark by way of hind weakness and unthriftiness. Only from this last group of chronic cases, recovery, if any, takes place.

Note.—In addition to the symptoms enumerated above, our predecessor appears to have met with some cases of pleuro-pneumonia in the early days of investigation. But from the ten postmortem examinations conducted and a number of sick animals examined neither pleurisy nor pneumonia was met with in any stage. Since we had no opportunity of seeing even a single case of that type, we could not give any description of such cases in this paper.

Diagnosis

During the course of investigation the following materials were collected for diagnostic purposes:—Ticks—5, skin pieces—8, smears 159, dung samples—37, spinal fluid—16, pleuritic effusion—1, blood samples—20, sera—25, plants 29, and materials for chemico-legal analysis—7.

Ticks.—Five samples of ticks were collected and they were all identified as *Boophilus annulatus*.

Skin pieces.—Out of biological tests conducted with eight materials two proved positive for Anthrax.

Smears.—Out of 159 smears examined, three were positive for microfilaria, one was positive for Anthrax, one for Blackquarter, one for *Tryps*, 15 for *T. mutans* and twenty revealed anaemic changes. The rest were negative.

Dung.—Out of 37 samples examined ten were positive for strongyle species, five for fasciola, six for amphistomes and the rest were negative.

Spinal fluid.—16 samples were collected and examined, both as wet film and after staining, and before and after centrifuging. All proved negative.

The details of tests conducted with other materials like pleuritic effusion, blood, serum etc. are described under the following head.

Experimental

The following experiments were conducted to eliminate the conditions enumerated below:—

1. **Contagious Bovine Pleuro-Pneumonia.**—One calf (cattle), aged 17 months, was injected on 14-4-47 subcutaneously in the shoulder region with 7 c.c. of the pleuritic effusion obtained from a cow which died on 12-4-47. The calf was observed till 3-5-47. Daily temperatures were recorded. Since no symptoms developed, the calf was discharged. (This experiment was carried out by the District Veterinary Officer, South Kanara, under instructions from Sri G. R. Viswanathan, the then Veterinary Investigation Officer, Madras).

2. **Botulism.**—One bull calf (cattle) weighing 112 lbs. was drenched with four ounces of powered bones obtained from the affected locality in 24 ounces of water. Altogether, four samples were used at the rate of four consecutive feedings for the first, two for the second, five for the third, and four for the fourth. Feeding commenced on 1-12-47 and, since no symptoms developed, the calf was discharged on 31-12-47.

3. **Encephalomyelitis.**—1 c.c. of spinal fluid drawn from an ailing animal was injected intrathecally into two buffaloes and one bull. One of the buffaloes showed signs of hind weakness on the 23rd day and died two days later. Postmortem revealed slight congestion of the spinal cord at the lumbar region, but sections of brain and spinal cord sent to the Indian Veterinary Research Institute, Mukteswar were declared negative for encephalomyelitis. Cultures were negative for any bacterial infection. The other buffalo died on the ninth day without any symptoms and sections of brain and spinal cord sent from this animal also to the Indian Veterinary Research Institute, Mukteswar, were declared negative for encephalomyelitis. The bull showed no symptoms and the same was discharged on the 36th day.

Nine rabbits were injected intrathecally with nine samples of spinal fluids obtained from two affected and seven recovered animals in 0.25 c.c. to 1 c.c. doses. Only one rabbit showed slight hind weakness just before death and died on the 25th day. Postmortem revealed nothing of unusual importance. Since the carcass was highly decomposed, no further passage was attempted. The remaining eight rabbits showed no symptoms and hence they were discharged after a month.

4. *Trypanosomiasis*.—Ten white rats, three mice, eight guineapigs and one rabbit were used for this experiment. Of these, ten white rats, three mice, four guineapigs were injected subcutaneously with 1 c.c. of blood from two ailing and seventeen recovered animals. Daily examination of blood was continued for fifteen days. All proved negative for Trypanosomiasis. Two guineapigs were injected with blood and spinal fluid on each side and blood examination of these animals also proved negative for Tryps. One rabbit was injected with 1 c.c. of blood from an ailing case subcutaneously. Two guineapigs were injected both intraspinally and subcutaneously with spinal fluid from an ailing case. Results were negative for Tryps in all these cases. Apart from this, 25 samples of sera (from four sick, nine recovered, and twelve incontact animals) were collected and sent to the Indian Veterinary Research Institute, Mukteswar, for complement fixation test, of which eleven animals (three sick, five recovered and three incontacts) proved positive for Tryps.

Six animals were subjected to allergic test with Trypsin obtained from the Indian Veterinary Research Institute, Mukteswar. All proved negative.

5. *Bacterial infection*.—2 c.c. of the emulsion of cocco-bacillary culture isolated from one of the spinal fluids drawn from an ailing animal was injected subcutaneously into a rabbit. This rabbit died after 40 days and post-mortem revealed nothing unusual. Cultures also were negative.

6. *Nuxvomica poisoning*.—Feeding experiments were conducted with nuxvomica leaves and fruits. Four buffaloes and four cattle were used for the experiment. Two buffaloes and two white cattle were given daily doses of 8 and 2 ounces respectively of crushed nuxvomica fruits and two buffaloes and two white cattle were given 8 and 2 ounces of nuxvomica leaves. All these animals were given the above doses for 57 days. Later, one buffalo and one cattle, which were getting 8 ounces of fruits each, were given increased dose of one pound of fruit each and fed accordingly for another 18 days.

Of the above, one heifer fed with 2 ounces of nuxvomica fruit developed slight rheumatic lameness on the left shoulder and showed discharge from the eyes on the 20th day but recovered after six days.

All these experimental animals showed unthriftiness, dirty coat and severe constipation about a fortnight after the commencement of the experiment and continued throughout the period. Bowels came to normal after about ten days from the stopping of nuxvomica feeding. No other symptoms were noticed. The animals were discharged after three months from the commencement of the experiment.

7. *Dacheena poisoning*.—29 samples of plants were collected from the affected locality and sent to the Systematic Botanist, Coimbatore, of

which, three samples (*Cinnamum macrocarpum*, *Malastomum malabaricum*, and *Eugenia species*) were declared to be poisonous to cattle as reported in Queensland.

Of the above plants, *Cinnamum macrocarpum* otherwise called Dacheena was fed in eight ounces doses daily, for 15 days to one buffalo and one bull. No symptoms developed. Hence both animals were discharged after a month.

8. *Ergot poisoning*.—In seven villages, ergot was detected in the common fodder grasses, *Heteropogon contortus* and *Brachiaria ramosa*. The first was reported to contain only traces of the alkaloid while the second was reported to contain a high percentage of alkaloid content calculated as Ergotoxine. 3 grams of ergot fungus collected from the above plants were fed to two guineapigs in daily doses for three days. One guineapig died on the third day showing paralysis of all the legs. Postmortem revealed nothing of importance. The other guineapig was discharged after one month and nothing unusual was noticed.

9. *Chemicolegal*.—Ruminal contents from seven animals were collected and sent to the Chemical Examiner to Government for analysis to eliminate hydrocyanic acid poisoning. All proved negative.

Autopsy

During the time of investigation by the present authors, postmortems were conducted on ten animals and the lesions studied. In none of the animals, lesions of pleuro-pneumonia were noticed as described by our predecessor. In fact, no abnormality of any kind was noticed in any of the organs excepting slight congestion of the spinal cord in three cases and of the meninges and brain in four cases. In one case, blood clots were seen in the ventricles.

Histopathological examination of the brain and spinal cord was negative for encephalomyelitis.

Treatment

The treatment adopted was only symptomatic. Various drugs such as Antrypol, Hexamine, Sodii salicylas, Calcium gluconate and camphor together with purgatives, diuretics and general stimulants were employed and the results on the whole were unsatisfactory.

Discussion

From the clinical symptoms and postmortem appearances, the disease seems to be an affection of the brain and spinal cord. In hyper-acute and acute cases, the affection probably starts in the brain itself directly, while in the sub-acute and chronic cases, the affection starts from the posterior aspect and proceeds forwards towards the brain. This can be explained by the fact, that while in some animals, deaths occur very suddenly due to paralysis of the tongue, head and neck, in others, the paralysis starts at the tail and proceeds

slowly forwards affecting the hind limbs, forelimbs, neck, head etc. in which latter case deaths are invariably delayed. Thus from the clinical manifestation of the disease, it would appear that there are two different types of affections, one starting at the head and the other starting at the tail; but both, in the opinion of the authors, appear to be an affection of the nervous tissue.

From the exhaustive microscopical and biological tests conducted, it has not been possible to detect the cause as either of protozoan, bacterial or of virus origin excepting for the presence of specific organisms like Tryps, *T. mutans*, Anthrax etc in stray outbreaks as detailed already. But during the time of the last investigation, out of 50 wet films examined, from affected herds, three proved positive for microfilaria in peripheral blood. Though this is said to be sometimes normally found in general circulation, some importance is being attached and the subject will be pursued, owing to the likelihood of its being found in the brain and spinal cord also, especially in view of the recent publication on Lumbar Paralysis of Goats in Ceylon by McGaughey. It is to be admitted that since our attention was not specially focussed on this point at the time we conducted the investigation the search made was probably not enough to bring out the presence of the parasite by detailed histopathological examination. In this connection, it should be remembered that the microfilaria in brain and spinal cord in such cases happen to be very few in number and unless a thorough and vigilant search is made, it is not always possible to detect its presence.

In addition to the above, the positive findings of complement fixation test by the Indian Veterinary Research Institute, Mukteswar, in 11 out of 25 samples of sera sent deserves consideration to still eliminate Trypanosomiasis of the Cerebro-spinal type.

Summary of Findings

1. A general description of the 'Hidden disease' in South Kanara District is given.
2. The disease occurs mostly during winter months in villages situated in valleys in the midst of dense jungles.
3. Both cattle and buffaloes are equally affected.
4. The disease affects only adult animals.
5. Duration of illness varies from a few minutes up to weeks.
6. The mortality is 75 percent.
7. The affection occurs in four forms Viz Hyper-acute, acute, sub-acute and chronic.
8. Profuse salivation and anterior paralysis are the chief symptoms of hyper acute and acute forms.
9. Tail weakness and posterior paralysis are those of subacute and chronic forms.

10. Congestion of the brain and spinal cord are the chief postmortem lesions.

11. The etiology of the disease still remains a mystery.

12. The condition has been eliminated for bovine pleuro-pneumonia, botulism, encephalomyelitis, bacterial infection, hydrocyanic and other plant poisonings.

13. From the clinical symptoms and postmortem appearances, the disease appears to be a nervous affection involving the brain and spinal cord.

14. From the various experiments conducted, it looks highly suspicious, whether the disease may be a microfilarial affection of the brain and spinal cord or a cerebro-spinal form of Trypanosomiasis.

Conclusion

In the presence of the above findings, it would do well to eliminate the condition by a thorough microscopical and histo-pathological examination of the brain and spinal cord for cerebrospinal Trypanosomiasis and microfilaria.

REFERENCES

1. Hurley T. J. (1949) Personal communication.
2. McGaughey G. A. (1951) British Veterinary Journal Vol. 107—11—Nov. 1951.
3. Rajagopalan V. R. (1950) Three personal communications.
4. Ramakrishnan, M. (1948) Progress report of the Veterinary Investigation scheme for the year 1947 to 48—Page 12.
5. Sastry, S. A. (1948) Indian Veterinary Journal Vol. XXIV—No. 7—pages 296 to 298.
6. Viswanathan, G. R. (1946) Progress report of the Veterinary Investigation scheme for 1946 to 47, Pp. 11 to 13.

NEGATIVE STAINING OF SPERMATOZOA**

By

C. KRISHNA RAO, C.M.V.C., B.V.Sc., M.S. (Calif),
Lecturer in Animal Husbandry, Madras Veterinary College, Madras.

(Received for publication on 7-6-52)

Several stains were introduced in the past for the negative staining of micro-organisms. India ink (Burri 1909, Cumley 1935, Niklitschek 1939), collargol (Harrison 1912), nigrosin (Dorner 1922, Defflanche 1929, Anselmier 1930, Dorner 1930, Cumley 1935, Dienst 1936, 1938, Fleming 1941), congo red (Maneval 1934, Benian) and collargolum (Kniesly 1939) were all proposed as negative stains for various types of micro-organisms. Cumley (1935) reported good results on negative staining of bacteria using a large number of stains. Lagerlöf (1934) introduced opal blue (Bresslau) for the demonstration of cytoplasmic drops in bull semen and Rao and Hart (1948)

** The author desires to express his gratitude to Dr. I. M. Azizuddin, Principal, Madras Veterinary College, for his encouragement and to Dr. V. R. Rajagopalan, Director, Madras Animal Husbandry Department, for his kind permission to publish this paper.

employed this technique for the study of sperm morphology. Rao (1951) reported the use of India ink as a negative stain for spermatozoa. Negative staining of spermatozoa has several advantages some of these being, the simplicity of the technique, rapidity of the staining process, permanency of the preparations and the striking manner in which sperm morphology is brought out. In view of these considerations aqueous solutions of various strengths of a large number of stains were tried to determine their suitability for use as negative stains for sperm. The following is an account of the preliminary work in this field.

The semen of the buffalo-bull and the bull and the epididymal contents of these species as well as the stallion, ram, buck and boar were used in this study. The semen was always used fresh after collection and epididymides recovered from slaughtered animals and their contents examined within a couple of hours after the death of the animals. The actual staining process consists of rapidly mixing a drop of semen or material from the tail of the epididymis with a drop or two of the stain solution on a clean slide and making smears from this semen-stain mixture.

5 to 10 per cent nigrosin w. s. (B.D.H.), 5 to 7.5 per cent indulin (B.D.H.), 5 to 7.5 per cent aniline blue w. s. (Harleco), 5 to 7.5 per cent methyl blue (B.D.H.), 3 to 5 per cent china blue, 5 to 10 per cent trypan blue (B.D.H.), 3 to 5 per cent new black (F.&G.)† all gave excellent results as negative stains for sperm. Preparations made with 2 per cent aqueous solution of congo red (B.D.H.) post-treated with 1 per cent aqueous or alcoholic HCL or with concentrated HCL fumes were also satisfactory. 5 per cent toluidine blue and saturated aqueous solution of methylene blue (B.D.H.) gave erratic results and were not dependable. Various strengths of night blue in water as well as the saturated aqueous solution were unsatisfactory. All the stains mentioned above served as negative stains not only for sperm but also for any bacteria that were present in semen. The type of background obtained varied with the particular stain employed, but in all cases with fresh semen or fresh epididymal material spermatozoa were prominently visible as unstained, whitish structures against a dark-coloured background. Cytoplasmic drops when present were brought out remarkably well as whitish granules. With normal, fresh semen only the dead sperm appear to take the stain while the live sperm remain unstained. The number of stained sperm increases with longer storage of semen samples. Smears remain without fading for over one year except in the case of Congo red preparations. In Congo red preparations, an orange red background was obtained which turned deep blue on exposure to HCL. This blue colour fades rapidly in a few hours but can be restored by retreatment with HCL as and when required.

†Flatters and Garnet.

Negative staining of sperm has several advantages as already mentioned and could be satisfactorily employed for the routine morphological study of sperm in artificial insemination work and also by students in animal breeding classes. The entire staining process is completed in a few seconds and preparations so obtained are excellent.

REFERENCES

1. Anselmier, Hélène. 1930. Recherche sur la coloration rapid des cils des Ciliés, Pharmaceutica Acta Helveticae, 5, 33-41.
2. Benian: Cited by F. B. Mallory in "Pathological Technique," 1938, W. B. Saunders Co., Philadelphia.
3. Burri, R. 1909. Das Tuschenverfahren als einfaches Mittel zur Lösung einiger Aufgaben der Bakterioskopie. G. Fischer, Jena.
4. Cumley, R. W. 1935. Negative staining in the demonstration of bacteria., Stain Techn., 10, 53-56.
5. Deflanche, G. 1929. Sur l' introduction de la nigrosine dans la technique des frottis de Infusores. Ann. Protist., 2, 121-124.
6. Dienst, R. B., and Sanderson, E. S. 1936. Use of nigrosin to demonstrate Treponema pallidum in syphilitic lesions. Amer. J. Pub. Health., 26, 910.
7. Dienst, R. B. 1938. Further observations on the use of nigrosin to demonstrate Treponema pallidum in syphilitic lesions. J. Lab. and Clin. Med., 23, 646-648.
8. Dorner, W. 1922. Ein neues Verfahren für isolierte Sporenfärbung. Jahrb. Schweiz., 36, 595-597.
9. Dorner, W. C. 1930. The negative staining of bacteria., Stain. Techn., 5, 25-27.
10. Fleming, A. 1941. Some uses of nigrosin in bacteriology., J. Path. and Bact., 53, 293-296.
11. Harrison, D. W. 1912. A modification of the Burri method of demonstrating Spirochaeta pallida., Brit. Med. J., 2, 1547.
12. Knisely, M. J. 1939. A simple and time saving procedure for the identification of Treponema pallidum., J. Lab. and Clin. Med., 24, 1309.
13. Lagerlöf, N. 1934. Morphologische Untersuchungen über Veränderungen in Spermabild und in den Hoden beim Bullen mit verminderter oder aufgehobener Fertilität. Acta. Path. et Microbiol. Scand. Sup. 19, 254.
14. Maneval, W. E. 1934. Rapid staining methods. Science, 80, 292-294.
15. Niklitschek, A. 1939. Das Tuschrpräparat., Mikrokosmos, 33, 27.
16. Rao, C. K., and G. H. Hart. 1948. Morphology of bovine spermatozoa., Amer. J. Vet. Res., 9, 117-124.
17. Rao, C. K. 1951. India ink as a semen stain., Current sci., 20, 211.

SUITABILITY OF LEISHMAN'S, WRIGHT'S AND GIEMSA'S STAINS FOR STAINING SEMEN SMEARS**

By

C. KRISHNA RAO, G.M.V.C., B.V.Sc., M.S. (Calif),
Lecturer in Animal Husbandry, Madras Veterinary College, Madras.

(Received for publication 12-6-52)

Sperm morphology is a good index of the reproductive health of breeding males and is very helpful in semen evaluation. Several techniques for the staining of semen smears have been described and many of the earlier techniques are complicated and tedious involving several steps

*The author desires to express his appreciation of the interest shown by Dr. I. M. Azizuddin, Principal, Madras Veterinary College, in this work and wishes to thank Dr. V. R. Rajagopalan, Director of Animal Husbandry, Madras, for kind permission to publish this note.

in the staining process. The author is not aware of any systematic study of Leishman's, Wright's and Giemsa's stains to assess their value as semen stains. In so far as these stains are readily available in all veterinary and biological laboratories it was considered useful to investigate the possibilities of using these common stains for spermatozoan staining and the following is an account of the preliminary work in this field.

The semen of the buffalo-bull and the bull were used for this study. Smears which were prepared one or more days prior to staining were designated as "old smears," while those prepared within an hour before staining were designated as "fresh smears." Simple air-drying was employed for fixing semen smears. When necessary clearing of smears was done with saturated aqueous solution of chlorazene for one-half minute (Rao and Berry 1950) and washed before staining. Stained smears were washed in running tap water and later dried in air or by blotting. With all the three stains smears were stained by four different techniques:

1. Staining with the stock stain solution.
2. Staining with stock solution for one minute followed by dilution with equal amount of distilled water and allowing the diluted stain to act.
3. Staining of cleared smears with stock solution.
4. Staining of cleared smears by method No. 2.

With all the three stains, when both fresh and old smears were stained by the first method, the results were unsatisfactory, the background taking a much deeper colour than the sperm. When fresh smears were stained by the second method using Leishman's and Wright's stains and allowing the diluted stain to act on the smears for one to two minutes the results were very good. The spermatozoa and any cytoplasmic drops present were very lightly stained and whitish looking against a deep violet background and were clearly visible. This method was unsatisfactory with "old smears." Staining with Giemsa's stain by this method produced very light and unsatisfactory staining. Cleared fresh and old smears stained with all the three stains by the third method for about five minutes gave satisfactory results. However, results obtained with Giemsa's stain were inferior to those obtained with the other two stains. The sperm head took a light violet colour while the tail took a reddish violet colour. When cleared fresh and old smears were stained by the fourth method with all the three stains for five minutes the results were superior to those obtained with the third method. Giemsa's stain was slightly inferior to the other two in the results produced by this method. With Leishman's and Wright's stains, the acrosome and tail took a deep reddish violet colour while the post-nuclear cap took a light bluish violet colour.

When Leishman's and Wright's stains are used the best technique of staining "fresh smears" appears to be the second method, the results being

comparable to those obtained with negative stains (Rao 1951, 1952). With these two stains the best technique of staining "old smears" is by the fourth method which is equally good for "fresh smears" as well. Giemsa's stain is inferior to the other two stains.

REFERENCES

1. Rao, C. K. and Berry, R. O. 1950. Staining techniques for the study of the cytoplasmic drop and the cytoplasmic cap in spermatozoa. *Ind. Vet. J.* 26.
2. Rao, C. K. 1951. India Ink as a semen stain. *Current Sci.*, 20, 211.
3. Rao, C. K. 1952. Negative staining of spermatozoa. *Ind. Vet. J.*, XXIX, 4.

DIFFERENTIAL STAINING OF LIVE AND DEAD SPERM*

By

C. KRISHNA RAO, G.M.V.C., B.V.Sc., M.S., (Calif),

Lecturer in Animal Husbandry, Madras Veterinary College, Madras.

(Received for publication on 27-6-52)

The determination of the percentage of live sperm in semen samples has great practical application in artificial insemination work. Semen samples can be graded on the basis of their live sperm content in conjunction with other quality tests for semen and the breeding worth of males can be assessed more satisfactorily. Further, this technique should be of considerable value in studies on sperm metabolism.

Several techniques had been introduced in the past for the differential staining of live and dead sperm. Lasley *et al* (1942) first introduced opal blue-eosin for the differentiation of live and dead ram sperm which was later modified (Lasley and Bogart, 1943) for use with bull semen. Revector soluble blue counterstained by neutral red was introduced by Crooke and Mandl (1947) for assessing the viability of human sperm. Mayer *et al* (1947) introduced fast green-eosin and Shaffer and Almquist (1948) recommended aniline blue-eosin for the same purpose. Blom (1950) introduced nigrosin-eosin mixture for the differentiation of live from dead sperm and this technique was subjected to a critical study and modified by Swanson and Bearden (1951). Mayer *et al* (1951) presented a detailed analysis of the optimum requirements of any staining technique for the differentiation of live and dead sperm. The author had been working for a considerable time on the background staining of sperm (Rao 1951, 1952) and also on the differential staining of live and dead sperm and the following is a preliminary note on the work done in this direction.

* The author is thankful to Dr. I. M. Azizuddin, Principal, Madras Veterinary College for his keen interest in this study and to Dr. V. R. Rajagopalan, Director of Animal Husbandry, Madras, for kind permission to publish this paper.

Materials and Methods

The semen of the bull and the buffalo-bull was used in this investigation, the semen having been collected by the artificial vagina. A very large number of stains were used in this study to determine their selective penetrability to dead sperm and their suitability as background stains. The stain solutions were made in different strengths in 3 per cent sodium citrate (dihydrate), M/8 phosphate buffer solution and 0.9 per cent sodium chloride separately, these solutions having been made in double-distilled water. The technique of making smears is as follows:

The tip of a clean glass rod is dipped in semen and the semen sticking to the glass rod is mixed rapidly with a drop of stain placed towards one end of a clean glass slide. Another clean glass slide is placed on the top of the first slide, the semen-stain mixture allowed to spread between the two, any excess oozing from the sides being wiped with a clean cloth and the two slides quickly but gently separated and rapidly dried underneath a fast-moving fan. To facilitate obtaining thin and uniform smears with a homogeneous background, the stained slides are kept in a slanting position while drying.

Results

A large number of stains were found to be satisfactory as background stains, some of these being methyl blue, china blue, soluble blue, trypan blue, aniline blue w.s., nigrosin w.s., and indulin. As primary stains for the staining of sperm, eosin B, eosin Y, erythrosin and mercurochrome were satisfactory. All the background stains mentioned earlier as well as opal blue (Bresslau) were found to be capable of staining the dead sperm in the same manner as the primary stains mentioned above. The type of background obtained varied with the type of stain employed as well as the concentration of the stain. Nigrosin w.s. gave a brownish violet background, while indulin and trypan blue gave a bluish violet background. Aniline blue w.s., methyl blue, china blue and soluble blue gave a deep blue background comparable to that obtained with opal blue (Bresslau). Nigrosin w.s. and trypan blue gave a satisfactory background in the differential stain at 5 to 10 per cent level, while indulin, aniline blue w.s., methyl blue and soluble blue were satisfactory at 5 to 7.5 per cent concentration and china blue gave good results at 3 to 5 per cent level. All the primary stains employed, which were mentioned earlier were satisfactory at 1 per cent concentration.

Both the primary stain and the background stain were dissolved in each of the following diluents separately: M/8 phosphate buffer, 3 per cent sodium citrate (dihydrate) and 0.9 per cent sodium chloride. At the present stage results indicate that the diluents mentioned above can be substituted for one another without markedly affecting the results of the differential

perm count. 2 per cent Congo red in any of the diluents mentioned above proved satisfactory but to obtain a deep blue background the dried smears should be dipped in 1 per cent aqueous or alcoholic HCL and dried without further washing (Rao 1952). A better and time-saving procedure would be to expose the wet, freshly made smears to HCL fumes. This single stain method can be satisfactorily employed for the differentiation of live and dead sperm, the live sperm remaining unstained, while the dead sperm takes a blue colour, particularly in the tail and the post-nuclear cap. These smears fade to the brown colour in a few hours but blue colour can be restored by repeating the acid treatment.

In the other techniques mentioned, the live sperms remain unstained while the dead sperm take a red colour, both types of sperm standing out prominently against a dark background the colour of which varies with the background stain employed. All the stains mentioned above have proved satisfactory and gave results comparable to those obtained with other differential staining techniques like fast green-eosin, aniline blue-eosin and nigrosin-eosin methods. Further investigation is in progress and detailed data will be presented in due course.

REFERENCES

1. Blom, E. 1950. En Hurtig-farvenings method til adskillelse af levende og døde spermier ved hjælp af eosin-nigrosin—Nord. Vet. Med. 2: 58.
2. Crooke, A. C. and A. M. Mandl. 1947—A rapid supra-vital staining method for assessing the viability of human spermatozoa. Nature. 159: 749.
3. Lasley, J. F., G. T. Easley and F. F. McKenzie 1942. A staining method for the differentiation of live and dead spermatozoa I. Applicability to the staining of ram spermatozoa. Anat. Rec. 82: 167.
4. Lasley, J. F. and Ralph Bogart, 1943—Some factors influencing reproductive efficiency of range cattle under artificial and natural breeding conditions. Mo. Agri. Exp. Sta. Res. Bul. 376.
5. Mayer, Dennis T., C. D. Squiers, Ralph Bogart, and Mohammed M. Oloufa 1951. The technique of characterising mammalian spermatozoa as dead or living by differential staining. Journal of Animal Science. 10: 226-235.
6. Mayer, Dennis T., C. D. Squiers and Ralph Bogart 1947. An investigation of the staining principle and background stain in the differentiation of live from dead spermatozoa (Abstract) Journal of Animal Science 6: 499.
7. Rao, C. K. 1951—India ink as a semen stain. Current Sci., 20: 211.
8. Rao, C. K. 1952—d. Negative staining of spermatozoa. Ind. Vet. J. XXIX, No. 4.
9. Shaffer, H. E., and J. O. Almquist 1948. Vital staining of bovine spermatozoa with an eosin-aniline blue staining mixture. Jour. Dairy Sci. 31: 677.
10. Swanson, Eric W., and H. J. Bearden 1951. An eosin-nigrosin stain for differentiating live and dead bovine spermatozoa. Journal of Animal Science. 10: 981-987.

THE ECONOMIC IMPORTANCE OF DEWORMING SHEEP

By

M. V. KRISHNA RAO, G.M.V.C., P.G.,

Sheep and Goat Development Officer,

Hosur Cattle Farm, Madras.

Introduction

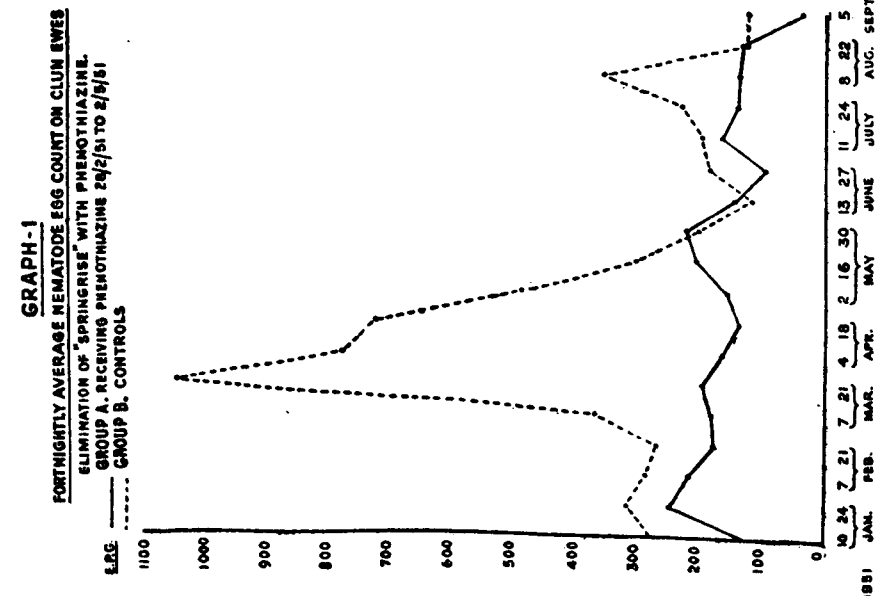
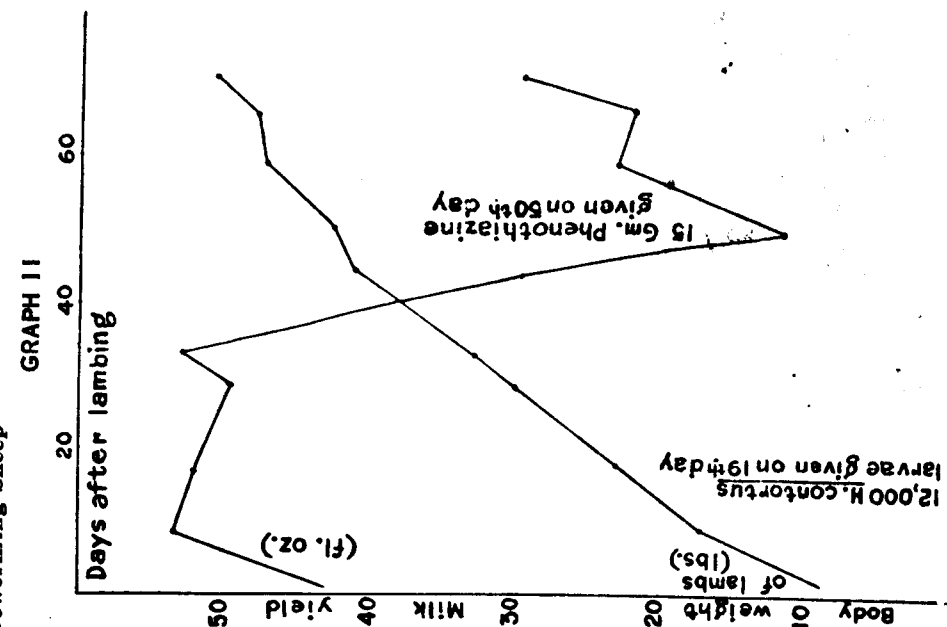
Sheep Husbandry is an important industry in the rural economy of the Madras State which has a population of about 4½ millions of woolly sheep and 6 millions of mutton sheep. Apart from the sheep breeding work carried out in the Government farms at Hosur, Kurikuppi and Ootacamund, the Animal Husbandry Department has been doing propaganda to develop the incentive of the villagers themselves towards better sheep husbandry. The Sheep and Goat Development Officer is in charge of this development work and he is assisted by the Veterinary Assistant Surgeons in charge of Sheep Demonstration Units in the field. These units were only two for the whole State till recently and they have now been increased to six with a jurisdiction of about 4 districts each. The Units carry on propaganda on scientific methods of breeding, management and treatment of sheep and also shearing with improved implements, classifying of wool, etc; they also make a study of the various factors affecting this industry.

One of the most important factors affecting the growth and development of sheep has been found to be verminous infestation. This has been responsible for the reduced vitality and low output by the individual sheep in general. In other countries also verminous infestation of sheep has been found to be a vital factor affecting the development of sheep husbandry. This has been well demonstrated in Australia by Gordon and others by extensive experiments.

They have shown by faecal counts of helminth ova that 100 female *Haemonchus contortus* worms will produce an average of 7,50,000 eggs daily, and that to do so they will suck 4 c.c. of blood daily from the intestinal mucosa. 100 females is a *light* infestation, the average parasitic burden being 1,000-1,500 females which will take 40-60 c.c. of blood daily for egg production. The total loss of blood, however, is much greater since the punctures in the mucosa left by these worms continue to bleed for as long as 7 minutes after they have fed.

The rapid rise in the parasitic burden to be expected under optimum conditions of heat and humidity is clearly shown in graph 1, while the effect of the associated anaemia on the milk flow of nursing ewes is demonstrated in graph II.

The Economic Importance of Deworming Sheep



In this State also, a need for such demonstrations had become necessary. Many Government stud rams which had been distributed to to shepherds for breeding purposes have died of heavy parasitic infestation and these have been confirmed on post-mortem. The custodians of these animals as well as other sheep owners had to be convinced by ocular demonstrations about the extensive harm done by helminthic infestations and the advantages that would accrue by periodical dosing of these animals for worms. With this object in view, the following work was undertaken with the hearty co-operation of the Imperial Chemical Industries (India) Ltd. and a planned study and demonstration was carried out by the sheep and goat development section of the Madras Animal Husbandry Dept. during the year 1951-1952.

Plan of work.—12 centres in the State, where helminthic infestation was considered to be prevalent, were surveyed in the beginning. Three of them were chosen for demonstration work for want of facilities to carry out the work simultaneously in all of the 12 centres scattered throughout the State. The 3 centres chosen were in different parts of the State, representing 3 different sets of climatic and grazing conditions and types of sheep as shown below :

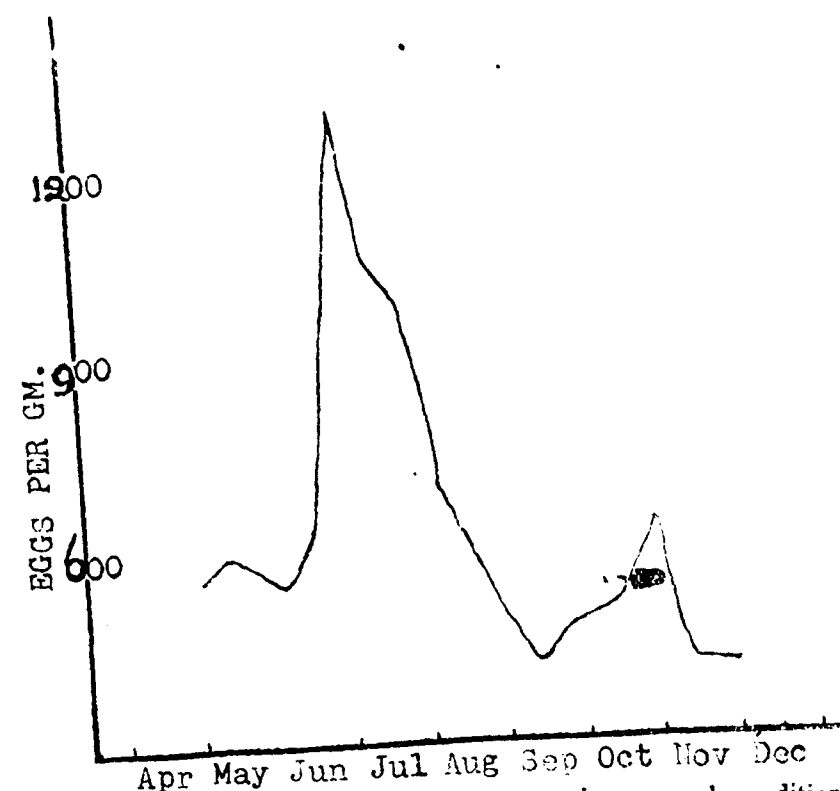
- | | | |
|----------------------------------|---|--|
| 1. Krishna District (a) Gunadala | } | Rainfall 35" per year. Hot and humid climate partly deltaic with canals running across. The sheep are of non-descript mutton type. |
| (b) Mutyalampadu | | |
| (c) Konduru | | |
| 2. Bellary District (a) Arikere | } | Rainfall 21" per year. Dry climate and dry farming conditions. The sheep are the Bellary breed of woolly sheep. |
| (b) Hulebeedu | | |
| 3. Tiruchirapalli Dt. Muruguru | } | Rainfall 25" per year. Dry climate and dry farming conditions. The sheep are of non-descript woolly type and very small size. |

Random samples of faeces from the flocks were examined and almost all were found to contain ova of the strongyle species in varying concentrations. A total of 80 sheep, mostly yearlings, was selected in each centre; weighed individually, and divided into two groups of 40 each, making sure that the total weights of the two groups were approximately equal. The sheep were ear-tagged with numbers punched on aluminium strips, the treated groups on the left ear and the controls on the right. The sheep owners agreed, after some difficulty, to keep all the numbered sheep under identical conditions of grazing, penning etc. and not to dispose of them until the work was completed. 'Phenovis' brand of phenothiazine was selected for use in the form of powder mixed with water.

The general rise in nematode infestation in Madras State will be approximately as shown in Graph III below considering the life history of the worms and the climatic and pasture conditions in the State, though there will be slight variations in different tracts. The worm life-cycle depends on the weather and we should forestall it by strategic drenching in the appropriate seasons. Tactical dosing means attacking outbreaks of the disease which may occur in spite of strategic dosing, and which are due to unusual local climatic conditions, such as an abnormally early or long monsoon, or heavy overcrowding of pastures by sheep, etc.

Our knowledge of the seasonal occurrence of worm infestations demands that we should adopt strategic and tactical drenching of sheep against the worms.

Suggested strategic and tactical drenching.—Seasonal drenching prevents the seasonal rise. If we accept the findings of graph I, and apply them to Indian conditions, we get an approximate infestation rise as shown in graph III below.



Considering the species of the ova, the general conditions of humidity prevailing in different months in the centres, as well as the need

for economy it was decided that 4 dosings in the year should be enough to achieve the objective. The first dose to the treated group was given just before the onset of the monsoon, i.e., at the end of May, 1951 or early in June, 1951 to eliminate the existing worm burden, except in one place where the work was started late. The second dose was given about six weeks later, i.e. to eliminate the infestation due to the voided ova on the pasture becoming infective under the optimum conditions of humidity and warmth prevailing after the first showers. This is just the time when the sheep would also be grazing intensively on the pastures covered with a short growth of new grasses, thus exposing themselves to heavier infestation.

The third and fourth doses were also given at an interval of about 6 to 8 weeks, thus covering the entire rainy season and eliminating further risk of heavier infestation. The last dosing was done at the end of the rainy season, after which the general climate in the centres would be hot and drier and less conducive to the development of helminth ova, until the onset of the next monsoon.

The dose given to the treated sheep varied from 7 to 12 grammes depending upon the size and weight of the sheep and worked out to an average of 10 grammes. The weights of all the sheep in the treated and control groups were recorded at each time of dosing and also about 2 months after the last dosing, except in one centre Hulebeedu. The weight records and other data for the centres are appended below. Thanks to the co-operation of the flock owners, the treated and control groups were kept under normal and identical conditions with the other sheep, thus facilitating the demonstrations. Messrs. Imperial Chemical Industries (India) Ltd., supplied the 'Phenovis' and the ear tags free of cost.

Demonstration:—The flock owners in each centre were instructed on the object of the demonstrations and were present at each dosing and weighing. Their co-operation gradually increased with the progress of the work. The dosing was carried out by drenching the sheep with the drug suspended in water. The weighing of the sheep was done with a spring balance, and the readings on the dial were watched by the owners, who were also instructed to watch carefully the general appearance, smartness, and behaviour of the treated sheep at pasture and elsewhere as against the control group. As the work progressed the treated sheep attracted the attention of the owners, who began to appreciate the results and started drenching the sheep themselves.

To give a finishing touch to the demonstrations, a meeting of the flock-owners and others of each centre and the surrounding villages, was arranged on the day of the final weighing, at which the benefits of deworming and scientific methods of breeding, etc., were explained by

The economic importance of deworming sheep

ECONOMICS OF DEWORMING			
MURUGURU - MACHYDT			
DATE	PARTICULARS	TREATED	CONTROL
16.5.51	INITIAL WEIGHT (KG)	29.07	29.16
26.7.51	FINAL " "	37.19	35.46
	WEIGHT GAIN	8.12	6.30
DIFFERENCE			
	PRICE/LB LIVE WEIGHT	Rs. 0-8-0	
	+ INCREASED FARMING	Rs. 1-11-0	
	COST OF TREATMENT (L.A. 0.005)	Rs. 0-10-0	
	NET PROFIT	Rs. 1-11-0	
	% INTEREST ON INVESTMENT	176%	



Fig. 1.

The economic importance of deworming sheep



Fig. II.

various speakers of the departmental staff. A film show on the deworming treatment in sheep and sterility in cattle, kindly arranged by Messrs. Imperial Chemical Industries (India) Ltd., was also given with commentaries in the local languages through loudspeakers. Important officials of the Revenue and Agricultural Departments, etc., also attended the final functions. The methods of drenching sheep for worms, spraying sheep against ticks, shearing with improved shears for increased output of wool, and classification of wool were also demonstrated. The economics of the deworming treatment, as detailed below, were also explained with the aid of figures on a blackboard.

The District Veterinary Officers, Trichy, Bezawada and Bellary attended the final meetings. The Sheep and Goat Development Officer addressed the gathering at the Bellary centre while the Veterinary Assistant Surgeons, who conducted the demonstrations, addressed the gatherings in their respective centres.

Weight Records:—The weight records of different centres for the treated and control groups are given in Table No. I. Photos of the treated and control sheep in the 3 centres are shown in Fig. I, II and III.

The weights at the fourth weighing are taken as the final weight in Hulebeedu of Bellary District as Rinderpest broke out in the village causing mortality in the flock including some of the experimental animals. The total period of the demonstration therefore covered only 6 months and the economics were calculated on 3 doses.

Severe drought conditions prevailed in Muruguru centre of Tiruchirappalli district from August 1951 with the result that the weight increases recorded during the 3rd and 4th dosing were less than those at the 2nd dosing. With the improvement of grazing condition the sheep again gained in weight during January and February 1952. It is interesting to note that the treated sheep continued to show higher weight gain than the controls, indicating that sheep on poor pastures thrive much better if they are relieved of these internal parasites.

The age/sex composition of the treated and control flocks is given in Table II. The gain in weight of the treated group is uniformly observed in both the sexes of different ages.

The Economics of the 'Phenovis' treatment have also been worked out and are given in Table III.

The photos of the treated and control sheep with the weight gains at 3 of the centres, viz., Konduru, Krishna District, Muruguru, Trichirappalli District and Arikere, Bellary District, recorded on the black-board at the centres are also appended below.

Conclusions

From the above data it is seen that :

- (1) There is definite improvement in body weight by regular deworming in sheep with 'Phenovis' where there is strongylosis :
- (2) The range of increase in Krishna District where the breed is of mutton type is from 7.34 lbs. to 8 lbs. per head for the whole period more than the 'Controls'.
- (3) The increase in Bellary District where the breed is of woolly type ranges from 5.85 lbs. to 7.35 lbs. over 'Controls'.
- (4) The gain in Tiruchirapalli District where the sheep are of non-descript woolly type and puny in size is 3.44 lbs. per head over 'Controls'.
- (5) In spite of the drought conditions that prevailed in the centre at Tiruchirapalli district it is seen that the treated groups recorded comparatively higher weights than the control groups.
- (6) The average body weight of sheep before treatment in different places is also observed to be as follows :

(i) Krishna District ...	Gunadala	lbs.	39.11
	Mutyalampadu	"	42.52
	Konduru	"	39.36
(ii) Trichy District ...	Muruguru	lbs.	29.07
(iii) Bellary District ...	Arikere	"	51.65
	Hulebeedu	"	50.12

- (7) The average weekly rate of growth under village conditions in these centres is also seen to be as follows from the weights of control groups as against the treated groups.

		Control lbs.	Treated lbs.
(i) Krishna District ...	Gunadala	0.12	0.34
	Mutyalampadu	0.08	0.28
	Konduru	0.08	0.31
(ii) Trichy District ...	Muruguru	0.14	0.23
(iii) Bellary District ...	Arikere	0.29	0.51
	Hulebeedu	0.29	0.52

- (8) The rates of increase of different categories of sheep sexwise are also available from the above data as shown in Table II.
- (9) The general condition, the smartness and the behaviour of the treated sheep are superior to those of the control group and these factors have been well appreciated by the flockowners.

The economic importance of deworming sheep

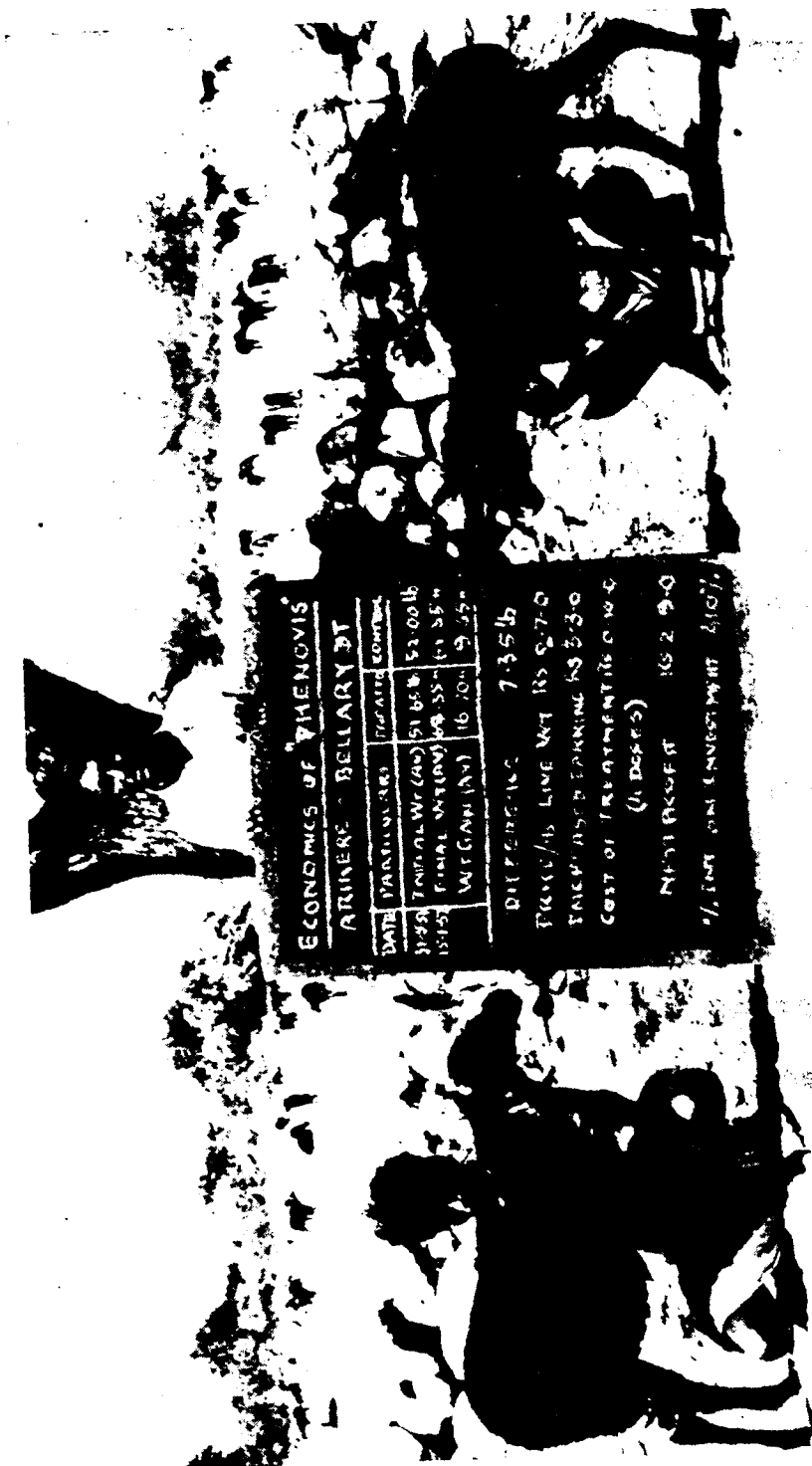


Fig. III.

Photograph of a sick bull taken at MaJamakki village of Karkal taluk on 27-10-49 showing normal feeding and lively expression inspite of hind weakness.



Same animal as in Fig. No. 1 showing weakness
of the limbs when lifted



Same as Nos. I & II but symptoms more advanced. Note the support given on both sides at the head and tail. Note also the flexion of the fetlock.



Photograph of a recovered cow taken at Elamand of Chondapoor tank on 3/1/49 showing unhealthy condition and short length of the hind leg.

Illustrating article on page 291.

TABLE I

(¹ Phienovis' Demonstration Bull Weight Gains—Madras State—(May 1951—Jan. 1952))

District and Village	Total Weight lbs.				Final Total wt. 2 months later	Average Weight lbs.				Final Av. weight 2 months later	Average weight gain lbs.	% weight gain	% weight gain (a) : (b)	% weight gain (a) over (b)
	1st Dose	2nd Dose	3rd Dose	4th Dose		1st Dose	2nd Dose	3rd Dose	4th Dose					
A. Kistna Dt.														
1. Gundala (20 sheep)	(a) 1017	1039	1106	1134	1322	39.11	39.96	42.53	43.61	50.84	11.73	30	284.7	184.7
	(b) 932	962	974	983	1059	36.61	37.00	37.46	37.80	40.73	4.12	11		
	(c) +65	77	132	151	263	+2.50	2.96	5.07	5.81	10.11	+7.61	—		
2. Mutvalam-padu (29 sheep)	(a) 1233	1256	1302	1350	1524	42.52	43.31	44.89	46.55	52.55	10.03	23.5	372.8	272.8
	(b) 1214	1224	1243	1265	1292	41.86	42.27	42.86	43.62	44.55	2.69	6.4		
	(c) +19	32	59	85	232	+0.66	1.04	2.03	2.93	8.00	+7.34	—		
3. Konduru (25 sheep)	(a) 984	1005	1049	1097	1258	39.36	40.20	41.96	43.88	50.32	10.96	27.8	370.2	270.2
	(b) 1009	1015	1022	1038	1083	40.36	40.60	40.88	41.52	43.32	2.96	7.3		
	(c) —25	—10	+27	59	175	—1.00	—0.40	+1.08	2.36	7.00	+8.00	—		
B. Bellary Dt.														
1. Arikere (40 sheep)	(a) 2066	2258	2328	2551	2734	51.65	56.37	58.20	63.77	68.35	16.70	32.3	178.6	78.6
	(b) 2080	2139	2185	2316	2454	52.00	53.47	54.62	57.90	61.35	9.35	17.9		
	(c) —14	+119	143	235	280	—0.35	+2.90	3.58	5.87	7.00	+7.35	—		
2. Hulebedu (40 sheep)	(a) 2005	2190	2381	2550	—	50.12	54.75	59.52	63.75	—	13.63	27.2	175.2	75.2
	(b) 2027	2140	2227	2338	—	50.67	53.50	55.67	58.45	—	7.78	15.3		
	(c) —22	+50	154	212	—	—0.55	+1.25	3.85	5.30	—	+5.85	—		
C. Trichy Dt.														
Muruguru (79 sheep)	2297	2377	2672	2806	2946	29.07	36.41	33.82	35.52	37.29	8.22	28.2	171.9	71.9
In control only	7304	2770	2496	2637	2648	29.16	35.06	31.59	33.80	33.94	4.78	16.3		
78 sheep for IV & final weight.	—7	+107	176	169	298	—0.09	—1.35	2.23	1.72	3.35	3.44	—		

TABLE II

'Phenovis' Sheep Demonstrations—Weight Gains
Madras State—(May 1951 to Jan. 1952)
(a) Lambs at Weaning (b) Rams (c) Ewes

District	Village	No. of Animals	Particulars	Average Initial Body Weight lbs.	Average Final Body Weight lbs.	Average Weight Gain lbs.	% Weight Gain	% Weight Gain Over 'Control'
A. Kistna	1. Gunadala	13	(a) Treated	28.57	40.92	12.35	43.22	189.2
		11	Control	32.27	36.54	4.27	13.23	
		2	(b) Treated	59.00	70.00	11.00	18.64	154.0
		3	Control	40.44	44.33	4.33	10.77	
		11	(c) Treated	49.90	60.90	11.00	22.04	181.3
		12	Control	39.75	43.66	3.91	9.83	
	2. Mutyalampadu	9	(a) Treated	32.77	42.44	9.67	29.50	167.1
		8	Control	33.00	36.62	3.62	10.97	
		8	(b) Treated	54.87	66.00	11.13	20.28	189.0
		7	Control	41.43	45.28	3.85	9.29	
		12	(c) Treated	41.58	51.16	9.58	23.04	163.2
		14	Control	43.64	47.28	3.64	8.34	
	3. Konduru	7	(a) Treated	35.00	45.43	10.43	29.80	229.0
		6	Control	33.16	36.33	3.17	9.55	
		4	(b) Treated	43.75	54.50	10.75	24.57	159.6
B. Bellary	1. Arikere	7	Control	45.00	49.14	4.14	9.20	
		14	(c) Treated	40.28	51.57	11.29	28.02	422.6
		12	Control	41.25	43.41	2.16	5.23	
		10	(a) Treated	40.40	57.20	16.80	41.58	64.7
		10	Control	40.20	50.40	10.20	25.37	
		3	(b) Treated	75.66	90.66	15.00	19.82	71.4
	2. Hulebeedu	4	Control	65.50	74.25	8.75	13.35	
		27	(c) Treated	52.60	69.36	16.76	31.86	77.5
		26	Control	54.20	63.64	9.44	17.41	
		32	(a) Treated	46.65	60.15	13.50	28.93	73.0
		30	Control	46.23	54.03	7.80	16.87	
		3	(b) Treated	80.00	92.00	12.00	15.00	182.3
C. Trichy	3. Muruguru	4	Control	77.00	81.25	4.25	5.52	
		5	(c) Treated	53.40	69.80	16.40	30.71	96.8
		6	Control	57.00	65.33	8.33	14.61	
		12	(a) Treated	19.25	33.33	14.08	73.14	60.9
		12	Control	19.58	28.33	8.75	44.68	
		13	(b) Treated	35.15	43.30	8.15	23.18	526.9
		13	Control	34.77	36.07	1.30	3.73	
		54	(c) Treated	29.62	36.42	6.84	23.09	48.3
		53	Control	29.75	34.36	4.61	15.49	

TABLE III

'Phenovis' Economics (Madras State)

District	Krishna I			Bellary II		Trichy III	Remarks
Centre	Gunadala (1)	Mutya- lampadu (2)	Konduru (3)	Arikere (1)	Hule- beedu (2)	Muruguru (1)	
Average weight of Sheep (lbs).	39.11	45.52	39.36	51.65	50.12	29.07	
(a) Average dosage rate (Gm).	10	10	10	10	10	10	
(b) Minimum number of doses per year	4	4	4	4	3	4	
(c) Retail price of pack—1 lb. tin (in Rupees)	7.0.0	7.0.0	7.0.0	7.0.0	7.0.0	7.0.0	
(d) Price per 10 Gm. (in Rupees)	0.2.6	0.2.6	0.2.6	0.2.6	0.2.6	0.2.6	*
(e) Cost of treatment per year (in Rupees)	0.10.0	0.10.0	0.10.0	0.10.0	0.7.6	0.10.0	
(f) Average price per lb. live-weight paid to owner (in Rupees)	0.8.0	0.8.0	0.8.0	0.7.0	0.7.0	.8.0	**
(g) Average increase live weight after treatment lbs.	7.61	7.34	8.00	7.35	5.85	3.44	***
(h) Average increased earnings (Live-weight) (in Rupees)	3.12.0	3.10.0	4.0.0	3.3.0	2.9.0	1.11.0	****
(i) Average net profit col.h—col.e (in Rupees)	3.2.0	3.0.0	3.6.0	2.9.0	2.1.6	1.1.0	*****

REMARKS: * (Col. (d))—Price for 10 Gm. is taken as this was the average dose given.

** (.. (f))—Average price is calculated in live weight and not on mutton weight.

*** (.. (g))—Live-weight increase is taken and not mutton increase.

**** (.. (h))—do. do. do.

***** (.. (i))—This represents only live-weight gains. In the case of woolly sheep the increased wool earnings should also be included.

- (10) The cost of the treatment compares very favourably with the indirect return per head of sheep as seen in the economics worked out for the above centres and shown in Table III.

The study and the demonstration of deworming has been carried out as an extension work in the development of sheep. Apart from the demonstration of the increase in weight to the sheep owners, the work has facilitated the liaison between the department and the poverty-stricken and illiterate sheep-owners. It is considered advantageous, and also necessary, to intensify such demonstrations in as many village as possible before we can expect any radical change in the outlook of the general sheep owners of this State. It is also observed that purchasers do not usually pay higher price to the sheep-owners according to the individual weight of sheep unless the whole flock of the tract is of higher average weight. Thus, unless the deworming operations are practised on a large scale throughout the State, the individual sheep-owners do not get a proper return for their efforts in deworming, owing to the disadvantage of the existing marketing practices as is the case of the other by-products of sheep husbandry, such as wool. However, it is confidently hoped that these conditions will change for the better when the sheep owners themselves begin to realise the advantages of scientific methods of management. It is therefore proposed to carry out more such demonstrations all over the State in future.

The demonstrations were conducted by Sri. A. Rama Murthy and Sri. S. Srinivasa Rao, Veterinary Assistant Surgeons i/c of sheep units, Coimbatore and Anantapur respectively, in Tiruchirapalli and Bellary District. Sri R. Rajagopala Rao, Touring Veterinary Assistant Surgeon, Bezwada, carried out the demonstrations in Krishna District. Veterinary Assistant Surgeon Sri. George Ebenezer was also associated with the demonstration in Tiruchirapalli district in the beginning. Veterinary Assistant Surgeons Sri. A. Ramamurthy, Sri. S. Srinivasa Rao, and Sri. R. Rajagopala Rao carried out the work with enthusiasm under my guidance and are responsible for the preliminary reports about their centres. I express my warm appreciation of their work in making the demonstrations a success.

My thanks are due to the Dt. Veterinary Officers of the three districts and their Veterinary Asst. Surgeons at the centres and also to Messrs. Imperial Chemical Industries (India) Ltd., for the active co-operation rendered through their staff at Madras, and for the supply of 'Phenovis' and the ear tags free of cost; and also for the loan of films on the final days.

Finally I am indebted to Dr. V. R. Rajagopalan, Director of Animal Husbandry, Madras and Major T. Murari, Deputy Director of Animal Husbandry, (Livestock), Madras for readily approving my suggestions and

encouraging me to carry out this small bit of research-cum-extension work, and to the various sheep owners, without whose co-operation the demonstrations could not have been successful.

REFERENCES

1. Carter, H. B., *et al* (1946) The effect on wool production of a mild infestation with *Trichostrongylus colubriformis* in sheep, *Aust. Counc. Sci. & Indus. Res. J.* 19, 61.
2. Davey, D. G., Innes, J. R. M. (1942) The present position of Phenothiazine as an anthelmintic *Vet. Bull. (Brit Vet. J.)* 12.
3. Gordon H. Mcl. (1948) The epidemiology of parasitic diseases, with particular references to studies with nematode parasites of sheep *Aust. Vet. J.* 24, 17.
4. — (1950) Some aspects of gastro-enteritis of sheep. *Ibid.* Feb.-May.
5. — (1948) Animal health laboratory, Sydney, *Queensland Agri. Journal* July '48.
6. Herrick, C. A. (1950) Stomach worms of sheep (Blood losses). *J. A. V. M. A.* 117, 418.
7. Leiper, J. W. G. (1951) A new approach to Phenothiazine therapy in sheep. *Vet. Rec.* 63, 885.
8. Minett, F. C. (1950) Mortality in sheep and goats in India *Ind. J. Vet. Sci. Anim. Hus.* XP, 11, 69.
9. Moghe, M. A. (1945) Nature and incidence of helminth infection. *Ind. J. Vet. Sci. Anim. Hus.* 15, III, 222.
10. Pollard *et al.* (1949) Phenothiazine for the control of Helminthiasis in lambs. *J. Comp. Path.* 59, 54.
11. Sighetti L., Marsh, H. (1947) Experimental treatment of Trichostronglosis in sheep. *Amer. J. Vet. Res.* 8, 186.

VACCINATION OF GOATS AGAINST RINDERPEST WITH GLYCERINISED GOAT TISSUE VIRUS VACCINE

By

RADHEY MOHAN SHARMA, L.V.P.,

and

TULSI RAM, L.V.P., M.Sc., Ph.D.,

Government Livestock Farm, Hissar.

Goat adapted spleen tissue Rinderpest virus, "Goatis", which safely confers solid immunity in cattle against Rinderpest has been reported to cause severe reaction and varying degree of mortality in the vaccinated goats. Haddow and Idnani (1947) reported that vaccination with goat virus alone in goats gave rise to an unpleasantly severe reaction in a large number of cases and that some deaths also occurred depending on local conditions. Lall (1947) mentioned that "Goatis" by itself was of no use as an immunising agent in goats against Rinderpest because of the severe reaction produced by it and recorded two deaths in seven animals which were vaccinated. Efforts have been made by different workers from time to time to devise a suitable means of immunising goats against this disease

Bawa (1940) (cited by Lall) reported that in goats the use of anti-rinderpest serum was not very satisfactory either, mainly because of the short duration of immunity. Lall (*ibid*) reported that anti-rinderpest serum (ordinary) and goat tissue vaccine given simultaneously produced no severe reaction, but at the same time conferred solid immunity in Betal and Hill goats against Rinderpest while the administration of anti-rinderpest serum 24 hours after the vaccination did not prevent a severe reaction. Kakizaki (1948) (cited by Bennett) was the first person who initiated work on the value of glycerinised spleen pulp of infected cattle as a vaccine for cattle-plague. Later, several workers made trials with similar vaccine. Bennett (1936) reported a series of experiments carried out in Sudan. Infected spleens collected at the height of reaction were minced and to this twice the quantity (by weight) of 60% glycerine was added. This product was then aged either at 37°C or at 0°C. Bennett concludes that glycerinised spleen pulp was rendered safe for vaccination purposes by storage either for 3 days at 37°C or for 3 months at 0°C. Stress was laid on dosage—the fresher the vaccine the smaller the dose—but one gm. of spleen pulp per 100 kilogram live-weight was considered suitable. Pffaff (1938) repeated Bennett's experiments and reported that his observation did not confirm Bennett's findings. He mentioned that the dried virus even after storage for 133 days at 5°C was viable enough to kill cattle and that after 4 days' storage at 37°C, the vaccine did not protect against 2 c.cms. virulent blood given 27 days later. He concluded that the vaccine conferred little, if any, immunity. Haddow and Idnani (*ibid*) reported that their experiments confirmed the findings of Bennett, except that higher doses were required for completely satisfactory results in susceptible hill cattle and goats. They added that no opportunity for field trials presented itself, but that, for general purposes, the method would prove too expensive in goats. Stitt, Clough and Branham (1948) state that many viruses retain their viability for long periods in 50% glycerine. Hutyra and Marek (1949) mention that Rinderpest Virus when mixed with glycerine remains virulent at room temperature for 10 days and at 5°C for 55 days.

Nagina Singh (1949) mentioned that 'Goatis' when emulsified with 50% normal saline glycerine could attenuate the virus and that the latter could be used for safe vaccination of goats. He recorded that the reaction in the animals so vaccinated was very mild or even absent. The Animal Diseases and Pests Committee of the Indian Council of Agricultural Research, New Delhi, while considering the Report of the Scheme for the Investigation of Sheep and Goats Diseases in Punjab (India) for the year 1948-49, remarked, "As glycerine is a normal preservative for viruses, the remark that attenuation was brought about by contact with glycerine needs further substantiation." Accordingly, the present experiments were conducted in 1950-51 using 'Goatis' treated with 50% normal saline

glycerine and stored for 48, 72 and 96 hours in refrigerator at 0°C. The results were compared with those obtained with 'Goatis' of the same brew and stored under similar conditions but without the addition of glycerine.

Materials and Methods.—Goat spleen tissue virus vaccine, brew No: 322 dated 11. 12. 1950, obtained from the Punjab Veterinary College, Hissar, was used for vaccinating goats. Four ampoules of one gm. each were obtained and stored in the refrigerator at 0°C. In two of the ampoules, 1 c.c. sterilised 50% normal saline glycerine was added and two were kept without normal saline glycerine. After 48 hours' storage, two ampoules were taken, one containing glycerine and the other without it. 8 Betal kids aged 6 months to 1 year were inoculated with the virus stored in 50% normal saline glycerine, dose being 1 c.c. of 1 in 100 emulsion or 0.01 gm. of the vaccine and 4 kids were vaccinated with "Goatis" from the second ampoule. After 72 hours storage, the remaining two ampoules were taken from the refrigerator and used for inoculating 8 and 4 kids in the same way as mentioned above. These 24 Betal kids were all kept under observation for 10 days after vaccination and their morning temperatures recorded daily. Table 1 shows the reaction observed in the two groups of animals.

TABLE I

Reaction in goats following vaccination with glycerinised Goatis and plain Goatis.

Group of animals	No. of animals in the group	No. of animals which showed thermal reaction 3rd to 7th day	Average thermal reaction	Diarrhoea observed in.	Dullness noticed in.	Type of reaction	No. of deaths	% of mortality
1. Animal vaccinated with glycerinised Goatis.	16	16	104.21°F	3	1	Severe	4	25
2. Animals vaccinated with plain Goatis.	8	8	103.83°F	1	1	Severe	2	25

The above table indicates that all the 16 kids inoculated with glycerinised Goatis showed thermal reaction, the average rise in temperature being 2-3°F. above the normal temperature. Diarrhoea was observed in 3 kids and one of the animals was markedly dull. Four of the 16 kids in this group died of Rinderpest, showing 25% mortality. The reaction recorded was therefore severe. The 8 kids vaccinated with plain goatis

also showed an average thermal rise varying between 2-3°F. above their normal temperature. The reaction observed was severe. One of the animals was very dull and two died out of 8 animals in this group. The percentage of mortality was therefore the same as observed in the first group i.e. 25%. The thermal reactions of these kids were consolidated in a composite chart (Fig. I) which shows that the reaction in the group of animals vaccinated with glycerinised vaccine is in no way less severe than the reaction observed in the group inoculated with plain goatis. Statistical analysis of the data revealed that the mean temperatures during the reaction period (3rd to 7th day after vaccination) worked out to be as under:—

- | | |
|--------------------------------|-----------|
| (1) Glycerinated Goatis group: | 104.21°F. |
| (2) Plain Goatis group: | 103.83°F. |

The difference (0.38°F) in the mean temperatures was found to be non-significant at 5% level of significance, $t_{(21)}$ being: 1.576*.

Since no more than 24 kids (unprotected against Rinderpest) were available on the Farm for experimental vaccination, it was considered desirable to repeat the above experiment in lambs as well with a view to confirm the above findings and to make the results more representative. 130 Bikaneri lambs, age 6 months to 1 year, were taken and divided into two groups of 50 each. The first group was vaccinated with Goatis, brew No: 337 dated 15-12-50 obtained from the Punjab Veterinary College, Hissar. The Goatis used for this group was kept in 50% normal saline glycerine (1 gm. of goatis in 1 c.c. of sterilised 50% normal saline) for 96 hours and stored in the refrigerator at 0°C. The second group of lambs was vaccinated with the vaccine of the same brew and stored under similar conditions but without any glycerine. Four Betal kids, age 6 months to 9 months, were used as controls to test the potency of the virus. Out of these 100 animals, 40 lambs, twenty from each group, were kept under observation and their morning temperatures recorded daily for 10 days after vaccination. Table II shows the reaction observed in the two groups.

Table II shows that all the 20 lambs of the first group kept under observation showed thermal reaction, the average rise being 2-3°F. above their normal temperature. The reaction observed on the whole was moderate as compared to the reaction in goats. Diarrhoea was observed in two lambs but there was no dullness and no inappetence in any of the vaccinated animals. No deaths occurred among the 50 lambs so vaccinated. The second group of lambs vaccinated with plain goatis showed thermal reaction, the average rise being 2°F. above their normal temperature. The reaction noticed was on the whole moderate. Diarrhoea

* One kid from the glycerine treated group died during the reaction period (3rd to 7th day).

Vaccination of Goats against rinderpest with
Glycerinised Goat Tissue virus vaccine

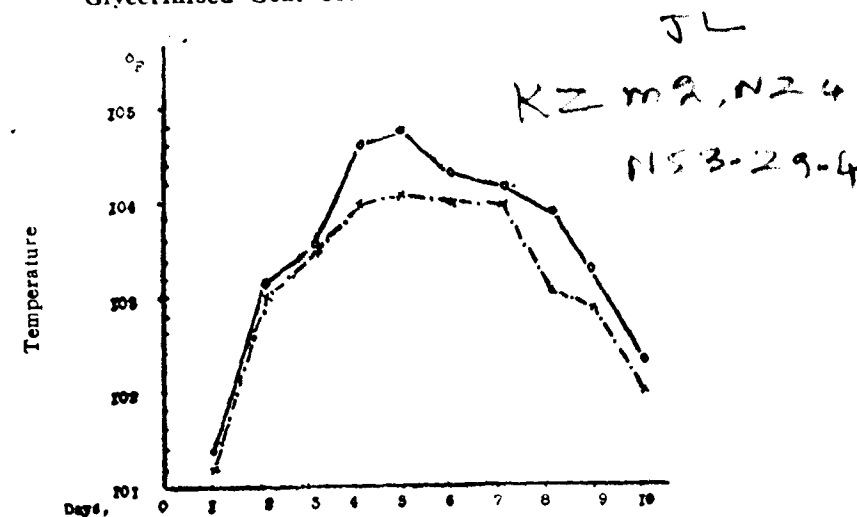


Fig. I

Composite chart showing thermal reaction in the two groups of kids.

— represents reaction with glycerinised Goatis.
- - - represents reaction with plain Goatis.

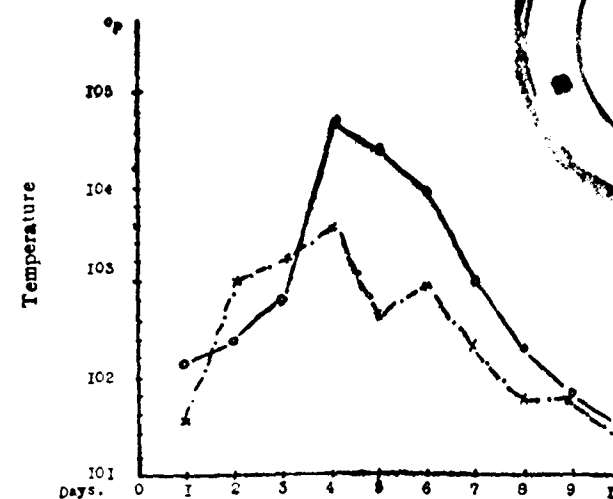


Fig. II

Composite chart showing thermal reaction in the two groups of lambs.

TABLE II

Reaction in sheep following vaccination with glycerinised goatis and plain goatis.

Group of animals.	No. of animals in the group.	No. of animals which showed thermal reaction. (3rd to 7th day)	Average thermal reaction	Diarrhoea observed in.	Dullness noticed in.	Type of reaction	No. of deaths	% of mortality
1. Animals vaccinated with glycerinised goatis.	20	20	103.64°F	2	—	Moderate.	—	—
2. Animals vaccinated with plain goatis.	20	20	103.25°F	3	—	Moderate.	—	—

was observed in 3 lambs. There was no dullness and the animals kept on feeding as usual. None of the vaccinated animals died. Fig II shows the composite chart of thermal reactions observed in the two groups. A comparative study of this chart indicates that the reaction in the lambs vaccinated with glycerinised goatis is in no way milder than the reaction observed in animals vaccinated with plain goatis. Statistical analysis of the data obtained brings out the following conclusion:

Mean temperatures during the reaction period (3rd to 7th day after vaccination) worked out to be:

- (1) Glycerinised Goatis group: 103.64°F.
- (2) Plain Goatis group: 103.25°F.

The difference (0.39°F) in the mean temperatures was found to be non-significant at 5% level of significance, $t_{(38)}$ being: 1.307.

Summary

Results of experiment on glycerinised goat tissue virus vaccine and plain goat tissue virus vaccine in goats and sheep are recorded and compared. The chief points brought out by the experiment are:

- (1) Goatis when stored in 50% normal saline glycerine for 48, 72 and 96 hours in the refrigerator at 0°C does not undergo any attenuation in its viability. 50% normal saline glycerine acts as a preservative and serves to maintain the potency of the virus.
- (2) Glycerinised goatis does not constitute a safe vaccine for immunising goats against Rinderpest. It causes 25% mortality.
- (3) For immunising sheep, glycerinised goatis has the same value as ordinary goatis without glycerine treatment.

Acknowledgments

We are greatly indebted to Major A. C. Aggarwala, B.Sc., (Hons.) M.R.C.V.S., A.I.R.O., Director, Veterinary Services, and Warden of Fisheries, Punjab, and to Shri R. R. Ghulati, M.R.C.V.S., P.V.S.I., Superintendent, Govt. Livestock Farm, Hissar, for valuable help and useful suggestions in the writing of this paper. Thanks are also due to Shri K. N. Vali M.A., C.St., Statistical Assistant, Govt. Livestock Farm, Hissar, for statistical analysis of the data.

REFERENCES

- Bennett, S. C. J. (1936). J. Comp. Path & Therap. 49, I.
 Edwards, J. T. (1927). Trans. Far. East. Ass. Trop. Med. 3,699.
 ——— (1924). Ann. Rep. Ind. Vet. Res. Inst. 32.
 Haddow, J. R. and Idnani, J. A. (1947). Indian J. Vet. Sci. 17, I.
 Huttyra, F. Marek J., & Manninger, R. (1949) Special Pathology and Therapeutics of the Diseases of Domestic Animals, 1949 Ed. 260.
 Kakizaki, C. (1918). Kitasto Arch. Exp. Med. 2,59 cited by Bennett (1936).
 Lall, H. K. (1947). Indian J. Vet. Sci. 17, II.
 Nagina Singh (1949). Ann. Rep. A.D.I.O. (S & G) Punjab, 1948-49.
 Pfaff, G. (1938). Onderstepoort. J. Vet. Sci. II, 263.
 Stitt, E. R. Clough, P. W. Branham, S. E. B. (1948) Practical Bacteriology, Haematology and Parasitology 10th Ed., 1948.

SEXING OF SMALL LABORATORY ANIMALS

By

R. D. KATIYAR, G.B.V.C., P.G.,

Veterinary Officer,

Govt. Vaccine Depot., Patwa Dangar, Nainital, U.P.

Sexing of small laboratory animals plays an important role in the successful husbandry of these animals. Sexing at birth is only important so far as the recording of the male and female ratio of young ones at birth is concerned. Sexing of one day old young ones is rather intricate but with a little experience and practice it can be done easily without much difficulty. Sexes are usually separated at the time of weaning to prevent immature mating and fighting amongst males which is common in the presence of females.

White mice:—The new born litter can be handled gently for weighing and sexing purposes. This should be done as quickly as possible and with a minimum disturbance to the nursing mother and her off-spring.

The male is characterised by a larger genital papilla and a greater distance between the anus and the genital papilla, the latter being the most characteristic and easily appreciable distinguishing feature. Thus by merely lifting a mouse by its tail one can at once spot out the sex.

Below are given the average distances in m.m. between the anus and the genital papilla:—

Age.	Male.	Female.
Newborn	2.5 m.m.	1 m.m.
10 days.	3.5 m.m.	2 m.m.
14 days.	5.0 m.m.	2.5 m.m.
17 days.	5.5 m.m.	3 m.m.
30 days.	13 m.m.	7.5 m.m.
Adults.	21 m.m.	10.6 m.m.

In the mature males there are two protuberances between the anus and genital aperture, one on either side of the ventral median line. These are the testes under the skin.

Guinea-pigs:—One-day old youngs of guinea-pigs can be sexed conveniently. Handle the young with the left hand with its abdomen upwards. Place the index finger of the right hand in front of the normal position of the penis and the thumb behind the rectum. Stretch the skin with the index finger and the thumb. In the case of a male, penis together with the prepuce on it protrudes vertically about 0.2". The opening of the prepuce is hardly visible to the naked eye but it is easily seen by the use of a magnifying lens. In 8-10 days old guinea-pigs, the prepuce opens clearly and penis protrudes through it on being pressed. In the case of a female, no protuberance occurs on stretching the skin.

Rabbits:—7 to 8 weeks old young rabbits can be sexed easily. Sexing of young ones up to the age of 16 days is possible but it requires experience and close observation. Young rabbits are born blind and naked. Eyes open on the 14th day when they start to come out and feed with the dam. Handling of these young ones 1 to 14 days old is risky as the dam gets suspicious and either destroys the litter or neglects it. Attempts to sex the young rabbits below 10 days old is not advisable.

To determine the sex, press around the genital aperture by the thumb and index finger of your right hand. The female is distinguished by the V shaped vagina protruding through the genital aperture. In case of males, a round penis-like structure comes out on pressing the genital aperture.

Acknowledgment

I am highly indebted to Major P. K. Topa, M.B.B.S., D.P.H., Superintendent of the Govt. Vaccine Depot, U.P., Patwa Dangar, Nainital, for his kind permission and valuable suggestions in this work.

INDIAN PIG (*SUS SCROFA DOMESTICA*) AS A HOST FOR *ONCHOCERCA* sp. AND *ENTEROBIUS VERMICULARIS*

By

G. RAMANUJACHARI B.Sc., B.V.Sc. and V. S. ALWAR, B.V.Sc.,

Department of Parasitology,
Madras Veterinary College, Madras.

(Received for publication on 20-1-53)

No species of *Onchocerca* has so far been recorded in pigs either in India (Maplestone, 1930, Baylis, 1939) or elsewhere (Yorke & Maplestone, 1926, Monning, 1949). During our systematic survey of porcine helminths in Madras, two cases of atheromatous lesions on the endothelial surface of aorta were noted. Of the two, one revealed even to the naked eye large areas of characteristic sinuous tracts resembling *Onchocerca armillata* infection of bovines. Two females with only their posterior ends intact and the anterior end alone of another worm were recovered from the lesion by dissection. On examination they were identified as belonging to the genus *Onchocerca* and the exact identification of the species could not be made out since no caudal end of males could be got.

Enterobius vermicularis, the common pin-worm of human beings, is thought to confine itself to its only known natural host-man (Faust, 1949). But during our collection of porcine helminths, we came across a living female specimen of the pin-worm in the colon. This specimen on examination agreed with the description of *E. vermicularis* in all respects (Yorke & Maplestone, 1926).

As infection of pigs with the above mentioned helminths is considered to be new finds, opportunity is taken to record the same.

LITERATURE CITED

1. Baylis, H. A. (1939). *Fauna of British India, Nematoda*, Vol. II Taylor and Francis, Ltd., London.
2. Faust, E. C. (1949). *Human Helminthology*, Lea & Febiger, Philadelphia.
3. Maplestone, P. A. (1930). Nematode parasites of pigs, *Rec. Ind. Mus.* 32:77.
4. Monnig, H. O. (1947). *Vet. Hel. & Ent.* Bailliere, Tindall & Cox, London.
5. Yorke, W. & Maplestone P. A. (1926). *The Nematode parasites of vertebrates*, J. & A. Churchill, London.

Thiamine is an essential nutrient for the young lamb. Young ruminants are susceptible to deficiencies of vitamins of the B. Complex:—*Nutr. Rev.* Dec. 1951: 357-359.

The A. B. R. or ring test (for detection of brucellosis) proved to be slightly more accurate than the capillary tube test. *J.A.V.M.A.*, April 1952; 212.

There seems to be no justification for claims of prophylactic or therapeutic effects of trace mineral supplements on the course of bovine brucellosis. *J.A.V.M.A.* July 1952; 49.

GUINEA-PIG HUSBANDRY

By

R. D. KATIYAR. G.B.V.C., P.G. (Muk.)

*Veterinary Officer,**Govt. Vaccine Depot.**Patwa Dangar, Nainital, U. P.*

Guinea-pig is a laboratory animal which is extensively used for diagnostic purposes and experimental work. Guinea-pigs' serum is one of the best sources of complement for haemolytic tests.

It is desirable to use standard guinea-pigs to avoid variations in the results of experiments. The standard guinea-pigs are those which do not vary much in weight and size at any given age. Uniformity in growth rate, disease resistance and response to any given experimental stimulus is preferable. The proper method of maintenance and handling of guinea-pigs is essential not only on humanitarian grounds but also for ensuring the accuracy of the results of the experiments in which they are used. For the production of the standard healthy guinea-pigs it is best to breed ones' own guinea-pigs under the control of a technically competent person.

Accommodation:—It has been observed that if rats, especially wild rats, are allowed to get inside the guinea-pig house, they destroy the young guinea-pigs and contaminate the food-stuffs. And, therefore, the Animal House in this depot has been constructed rat proof with cement and concrete. It was designed by Major P. K. Topa, M. B. B. S., D. P. H., the present Superintendent of the Depot, who got it constructed under his personal supervision. All hutches both for rabbits and guinea-pigs have been made in cement and concrete with removeable perforated floors and trays for cleaning and disinfection. The cement and concrete parts of the hutches are disinfected by means of a blow lamp. The dimensions of the guinea-pig hutches are 18" x 18" x 12". Now they are only used for segregation purposes and animals under experimentation.

The pen system of housing guinea-pigs has been adopted here since last year and it has given encouraging results. The guinea-pigs are kept in pens with cemented floors. These pens are walled by 15" high cement plastered walls. Each pen is divided into two by removeable galvanised iron partitions. These divisions are lifted and the floors of the pens are cleaned and disinfected in one operation. One sq. ft. of floor space is allowed for each adult guinea-pig in the pens. The number of young growing stock to be kept in a pen depends on their size.

The floors both of pens and hutches should be kept dry since wet warm environments provide a favourable atmosphere for the development of coccidia.

Guinea-pigs are said to thrive best at about a temperature of 65°F with a relative humidity range between 45 and 55 percent. The maximum and

minimum atmospheric temperatures during a year at this place are about 92°F and 40°F respectively. Relative humidity ranges between 56 and 97 percent. The annual rainfall is between 90 to 130 inches. The Animal House is not fitted with a thermostatically controlled heating system. All the same, extremes of hot and cold weather do not seem to influence appreciably the breeding production at this place although the high relative humidity (90 to 97 percent) during the period of 15th June to 15th September reacts unfavourably on the breeding and the growth of the young stock.

Nutrition:—Kind treatment, proper feeding on an adequate balanced diet and maintenance of sanitary conditions are required to maintain the stock of guinea-pigs in a healthy condition. They require concentrated food in addition to green-stuff and hay for consistently successful multiplication. Feeding practices vary greatly according to available foodstuffs.

The following diet has proved satisfactory in this depot for routine purpose:—

Wheat bran	...	50 parts.
Crushed gram	...	30 "
" maize	...	20 "
Common salt	...	1 part.

The above mixture is soaked for 2 to 3 hours and is fed at the rate of one ounce per adult guinea-pig at 12 A.M. Young guinea-pigs are fed according to the size and age as given below:—

Young guinea pigs below 15 days	...	½ ounce per head.
" " between 15-30 days	...	¾ " "
" " " 30-60 days	...	1 " "
" " above 60 days	...	1 " "

An additional feed is given to the pregnant sows in the afternoon at the rate of ½ ounce daily. Linseed cake can be substituted for gram.

Adequate supply of greens to the guinea-pigs is very important. This animal depends for the supply of Vitamin C and other factors on these greens. Inadequate supply of green food generally results in small litters, breeding failures, retarded growth and high mortality among the young ones. Greens are fed at the rate of 4 ounces daily per adult, half in the morning at 10 A.M. and the rest in the evening at 4-30 P.M. Cabbage, berseem, chaulai, lettuce, radish, turnip leaves and their chopped roots are the greens usually used. Lai leaves (a variety of mustard family) are also given. Leguminous hay can be given. Roots and hay as compared to leafy greens are deficient in growth-promoting factors. During summer due to scarcity of greens they are supplemented with tender leaves of trees such as Oak, Nigal, Keoral, Sana and Lobans.

Greens must be fresh and free of all dead leaves. Frosted leaves should be soaked in warm water before being fed to the guinea pigs. Poisonous and fermenting greens should of course be avoided.

One per cent cod-liver oil in the mixture once a week can be given with advantage during winter. Excessive cod-liver oil causes oxidative destruction of the Vitamin E.

Water:—An adequate chlorinated and clean water supply is essential. Adults consume on an average one ounce water daily. Lactating sows require larger quantities of water. Drinking water should be provided regularly at least once a day just previous to feeding, even if the guinea pigs are being fed on ample succulent greens and wet mixture.

Watering and Feeding utensils:—Galvanised iron troughs are used here for feeding the grains mixture in the pens and aluminium cups are used for feeding and watering in the hutches. Water bulbs are preferable to open vessels which are easily upset and get contaminated with faeces. Greens can be saved from being contaminated with faeces and urine by being fed on wire mesh racks.

The feeding utensils are cleaned and boiled daily in water containing bleaching powder.

Bedding:—Pine leaves are used here as bedding. Hay, chaffed straw and saw dust can also be used as bedding material. About 4" bedding is provided in the pens.

Sanitation:—Scrupulous cleanliness, strict attention to environmental hygiene and related factors should be observed.

Here the pens and hutches are scrubbed and cleaned daily. They are dried and disinfected with the help of a blow lamp. The bedding is changed daily. These steps help to keep in check the most dreaded problem of Salmonellosis amongst guinea-pigs.

Breeding:—There are various obvious advantages in using homogeneous standard healthy guinea-pigs in research work. To be sure of constant supply of such animals, a laboratory should breed its own guinea-pigs.

To start with one should purchase the foundation stock from a reliable source where production of guinea-pigs is carried on under technically competent management. The purchased guinea-pigs should be inspected and weighed daily for about a fortnight. Any dull guinea-pig with rough staring coat, sitting in a crouching position with weeping eyes should be segregated. Such an animal usually starts an outbreak. Breeding should be continued only with the healthy stock. Careful selection of the breeding stock, good accommodation, avoidance of too early matings, the maintenance of a strict and hygienic routine lead to the successful production of guinea-pigs. A separate breeding room is desirable.

Guinea-pigs are generally ready for breeding when they are about 5-6 months old. A sow breeds satisfactorily up to the age of 2 years. Three to four litters are obtained from a sow. Males and females are usually mixed in the proportion of 1:5.

The average gestation period as worked out here varies from 64-70 days. If the pregnancy lasts longer than this, the youngs are usually delivered dead at birth. Experience has shown that by keeping pairs in hutches, mating takes place immediately after parturition. This should be avoided as it affects the health of the sow. It would be ideal to give a rest period of a fortnight after the young ones have been weaned before mating the sow again. Guinea-pigs can be bred throughout the year. The months of the rainy season are not, however, favourable for breeding at this place due to high relative humidity. Young ones born during this period do not thrive well. Average weight of the young ones born during the months of July and August was 68 gms. as compared to 73.1 gms. of young ones born in the pens during other months of the year. Mating during the months of May, June and July may be avoided by keeping the different sexes separately. Males and females should be placed together again after 15th August to get litters in the last week of October.

Males and females used are of approximately the same age at the first mating. Boars are changed after one breeding season.

19 females and 4 males of about 5-6 months age were placed in a pen to observe the variations in the size of litters, male and female ratio and percentage of survival in the different parturitions. Table A below gives the results obtained.

TABLE A

	1st parturition of 19	2nd parturition of 18	3rd parturition of 12
Average number born per litter.	1.84	2.9	2.08
Male ratio.	51.4%	41.5%	44%
Female ratio.	49.6%	58.5%	56%
Percentage reared.	90%	90.5%	96%

Systems of breeding.—In-breeding and line-breeding are usually practiced in the breeding of the small laboratory animals. These help in the establishment of a homogeneous stock of standard guinea-pigs. Both the good and bad points are brought out and animals possessing bad points are eliminated.

To improve breeding and reduce mortality among the young ones, different methods of breeding were tried here.

Hutch system of breeding.—The method followed here during the previous years was to keep 3 or 4 sows with a boar in a hutch and allowed to breed. This gave very disappointing results.

Last year six pregnant guinea-pigs were kept with boars separately in six hutches for breeding purposes. It was observed that the males were constantly troubling the pregnant sows with the result that 3 sows aborted. The rest 3 sows delivered normal litters but the growth of the young ones was markedly retarded as compared with the young ones bred in the pens. Four of these conceived out of which 2 again aborted. These guinea-pigs fell an easy victim to Salmonellosis and we lost 8 guinea-pigs.

Another modified system of hutch breeding was also tried in which 4 pregnant sows were kept individually in hutches. On the day the sow littered, a boar was placed in the hutch and allowed to remain for 3 days and then removed. These sows were mated again if found non-pregnant on examination after 15 to 20 days. This modified system also did not give encouraging results.

Low percentage of conception, stunted growth and high mortality among young guinea-pigs and low resistance to infection are the drawbacks seen in the hutch system of breeding.

Pen System.—In this males and females in the right proportion are allowed to run together in a pen. Pregnant sows advanced in pregnancy are removed and placed in a separate pen. Parturition takes place in this pen. Young ones are weaned after a fortnight and sows are returned to the breeding pen with the males.

This system of breeding has given very promising results and has been adopted here as a routine. Weight at birth and subsequent development of youngs is far better as compared to the hutch system. Psychological effect of companionship and ample space for exercise seem to play an important role in the growth of the young guinea-pigs.

To compare the results of the two systems of breeding, 16 females with 3 males, of approximately the same weight, size and age, were selected and allowed to breed in a hutch and a pen. All of them were kept on identical concentrates and greens. The conception as well as the mortality rate both among the adults and youngs in pens was very significant as will be seen from the following figures :—

	Hutch system.	Pen system.
1.	Percentage of conception. ... 60%	100%
2.	Mortality in adults. ... 50%	5%
3.	Mortality in youngs. ... 40%	8%

Table B given below shows the comparative weights of 19 young guinea-pigs at birth and weaning time in each of the two system of breeding :—

Serial No.	Hutch system.		Pen system.	
	Weight at birth in grammes.	Weight at weaning time in grammes.	Weight at birth in grammes.	Weight at weaning time in grammes.
1	63	96	80	02
2	64	92	81	89
3	64	92	70	129
4	64	100	61	123
5	56	83	78	152
6	66	91	82	150
7	80	102	88	140
8	76	92	82	144
9	52	126	65	150
10	52	87	85	150
11	52	110	70	150
12	71	106	76	143
13	76	110	79	134
14	77	94	81	142
15	67	106	57	123
16	59	88	69	122
17	73	92	60	135
18	55	53	78	138
19	59	51	57	130
Average weight per young one.	64.5 grammes.	93.1 grammes.	73.1 grammes.	134 grammes.

Pregnancy diagnosis :—Breeding females should be inspected regularly for signs of pregnancy. Pregnancy can be ascertained early by palpating the abdomen between the thumb and the fingers of the hand. It requires a little experience. The foetuses are most easily felt when they are about 20-25 days old. Increased weight and abdominal enlargement are other signs of pregnancy.

Nursing of young ones :—The newly born young guinea-pigs begin to run about in a cage or pen in 1 or 2 hours after being born. They start feeding on the concentrate if placed within their reach. They can be handled for weighing and examination without any risk of being destroyed or discarded by the sow.

Young ones are weaned when they are two weeks old and placed in a separate pen. Sexes are separated when they are 2 months old.

Handling and management :—The right method of handling a guinea-pig is to place one's right hand on the back near the shoulders with the fingers and thumb around the neck and holding the legs with the left hand. This handling must be done gently and carefully without being rough and violent. Such an approach contributes a great deal to make the guinea-pigs docile.

happy and contented—things essential for successful multiplication of guinea-pigs. They should not be disturbed frequently by visitors. It is observed that when they are disturbed and frightened by unfamiliar faces and noises, they retreat and hide themselves under the bedding. The pen should be spacious enough for their exercise and play with their companions: it should also contain enough bedding to provide a sort of shelter to gratify their instinct of retreat and hide. Provisions of shelters and exclusion of noises and visitors protect the animals from nervous prostration.

A balance, preferably an automatic balance, for weighing the young ones and adults is necessary. Young ones which do not put on progressive weight and adults which lose weight should be segregated. This precaution often helps in limiting the spread of epizootics. Young ones may be weighed once in a week and adults once in a month.

Disease

The guinea-pig is naturally susceptible to a number of infections and contagious diseases. The prevention and control of these diseases is a prerequisite condition for the successful husbandry of guinea-pigs. Small animals fail to show symptoms until they become very bad and even then the symptoms are not pathognomonic. Hence general prophylaxis is of vital importance.

The common fluctuating conditions in the environment of the animal house which act as exciting causes to start epizootics are sudden changes in diet, variations in atmospheric temperatures, high humidity and damp bedding.

The animal house should be rat and fly proof as wild rats and flies play an important part in the dissemination of diseases caused by bacteria and viruses.

The growth rate after weaning, results of breeding and general appearance of health evidenced by the state of fur and the degree of activity should be constantly observed. A sick guinea-pig usually sits hunched up and has a ruffled coat. The eyes may be half-shut and weeping. These are useful indications of illness. Experience is a great asset in detecting unhealthy guinea-pigs.

Detection of carriers, though difficult, is essential to check the severe epizootics. Cultures of the urine, faeces, vaginal and nasal swabs are needed. Palpation of lymph nodes may be done. Still, in spite of all precautions, minor outbreaks are bound to occur. Scientific autopsy with adequate bacteriological investigation coupled with quick control measures, such as destruction of the infected animals, segregation in small lots and strict attention to hygiene, should be carried out to combat the epizootics without waiting for the results of bacteriological examination.

Among the diseases, I shall limit myself to an attempt to outline the signs and symptoms of those conditions which I have met and of conditions of some importance.

Salmonellosis:—Salmonellosis is probably the most important and dreaded disease affecting the guinea pigs. It is caused by members of the Salmonella group, usually *Salmonella typhimurium*, but sometimes *Salmonella enteritidis* is also involved. Infection takes place by ingestion of contaminated food. Rats are a common source of Salmonella infection, they contaminate the food with their excreta.

Some of the guinea-pigs which get cured become carriers. These carriers generally initiate the fresh epizootics when the condition of the stock is lowered by the high humidity in rainy season and the low temperature in winter. The disease may also flare up when new susceptible animals are added to the original stock.

Four outbreaks of Salmonellosis occurred amongst the guinea pigs of this institution during the last 8 years. The average mortality was 82%. Average duration of the outbreak was 32 days. General hygienic and segregation measures helped to save 15 to 20 percent of animals most of which, however, became carriers. In the opinion of the author, once an epizootic of Salmonellosis occurs, it is better to destroy the whole stock and start afresh.

Symptoms:—The disease either takes an acute or chronic form. In the acute form death usually takes place within 24 to 48 hours with few naked eye lesions to be detected at autopsy. In the acute form the spleen is not generally enlarged.

In the chronic form the animal may die in 3–10 days. The following symptoms were observed:—

- (1) Dullness, rough staring coat and emaciation.
- (2) Temperature ranging between 103 to 104°F. In some cases there was no rise of temperature at all.
- (3) Later on diarrhoea with loss of appetite.
- (4) Weeping eyes.
- (5) About 10% of the pregnant sows aborted and Salmonella organisms were isolated by culture from the uterus.

Post-Mortem lesions:—

- (1) Spleen was considerably enlarged and congested and studded with yellowish areas of necrosis which did not project above the surface of the organ.
- (2) Liver showed greyish white foci of necrosis.
- (3) Mesenteric lymph glands were generally enlarged.
- (4) Intestines were injected and showed swollen Peyer's patches.
- (5) Congestion and consolidation of areas of lungs.

- (6) In pregnant sows, metritis.
- (7) Some chronic cases showed plastic peritonitis.
- (8) Rarely, coils of intestines adherent.

Treatment:—Treatment was of no avail and was only symptomatic and palliative. Sulphamerazine 16% solution in drinking water helped in limiting the outbreak.

Prevention:

- (1) Prompt and strict segregation in small lots in the pre-epizootic phase is essential to check the spread of the outbreak.
- (2) Detection of carriers is very important. Carriers should be detected by culturing the faeces and urine on Mac Conkey's agar and doing other tests for identifying the *Salmonella* organisms. Agglutination tests may be applied for eliminating the carriers.
- (3) The animal house should be made rat and fly proof.
- (4) Dry foods can be steamed before being fed.
- (5) All food should be kept in vermin proof metal containers.
- (6) Autogenous vaccination has not given encouraging results here.

II Pneumococcal infection:—Sporadic cases of pneumococcal infection occur among guinea-pigs in winter and early summer. It is spread by carriers. The vitality of the carriers itself may break down due to low atmospheric temperatures during winter and fall prey to infection or the carrier may remain healthy and transmit the disease to others.

The disease occurs in two forms. In the Respiratory form nasal catarrh, pneumonia, pleurisy and peritonitis may all be present. The serous surfaces are covered by a thin fibrinous film with yellowish brown exudate.

In the Uterine form the infection is associated with pregnancy. The pregnant sows abort. Infection is also frequent in females after parturition.

Treatment is difficult as sudden deaths occur without warning. Treatment may be attempted with M and B 693 which has given satisfactory results here.

The initial dose of 2 gm. of M & B 693 was in the form of a drench followed by half the initial dose every 12 hrs.

III Respiratory Infection.—These are accompanied with a watery nasal discharge, coughing, sneezing, loss of appetite, roughened coat and rapid and difficult breathing. High humidity and overcrowding are the pre-disposing causes. The common bacteria causing respiratory infections are *Friedlander's bacillus*, *Brucella bronchiseptica* and *Haemolytic streptococcus*. The causal bacterium can be isolated by cultural method from the blood and internal organs.

The usual preventive methods of isolation of affected guinea pigs, disinfection of the contaminated hutches and pens, feeding and watering

utensils and careful disposal of carcasses should be adopted to combat outbreaks due to these organisms.

Treatment with sulphapyridine and sulphamezathine should be attempted as a curative measure. Sulphamezathine 16% solution is usually given as 2% solution in place of the drinking water. Sulphapyridine is given here as 5% concentration of the mash.

IV Pseudomoniasis.—Pseudomoniasis amongst young guinea pigs was first described by Schergo (1937) as an epizootic septicaemia. He suggested the name of *Pseudomona caviae* for the causal organism. The author diagnosed an epizootic septicaemia due to pseudomoniasis amongst guinea-pigs of this Institute in September 1951. The casual organism isolated by the author differed in its fermentative activities and catalase production from that of *Pseudomona caviae* of Schergo.

Symptoms:—

- (1) Ruffled coat with half-shut weeping eyes.
- (2) In some, trembling.
- (3) Temperature between 104-105°F.
- (4) Sunken eyes and diarrhoea.

The duration of the illness was 2-3 days in acute cases and 7-14 days in chronic cases.

Post-Mortem lesions:—

- (1) General septicaemic congestion of lungs, liver, pleura and spleen.
- (2) Consolidation and hepatization of lungs.
- (3) Small foci of deep necrosis in the liver and spleen.
- (4) Small punctate haemorrhages in the stomach and intestines.

Treatment:—Treatment with sulfa drugs was ineffective.

V Cervical Adenitis:—Cervical Adenitis is the inflammation of the cervical lymph glands leading to abscess formation. The disease is generally chronic and may be confused with pseudo-tuberculosis. Infection possibly takes place through ingestion of contaminated food in the presence of abraded mucous membrane.

- Etiology:**— (1) *Streptobacillus moniliformis*.
(2) *Streptococci of Group C*.

Symptoms.—There are large encapsulated swellings usually unilateral in the region of the neck. These swellings are due to chronic abscesses containing thick creamy pus. This condition occurs sporadically and is more common in the older animals. There is no marked systemic disturbance. Affected animals usually recover spontaneously.

The infection caused by streptococci of group C is more serious and sometimes causes epizootics amongst guinea-pigs. This condition is often called Epizootic Lymphadenitis.

VI *Pseudo-tuberculosis* is caused by *Pasteurella pseudo tuberculosis*, a small coccoid, gram negative, non-motile and distinctly bi-polar organism. It is characterised by emaciation and enlargement of lymph glands specially mesenteric glands.

Three distinct types have been recognised.

(1) *Acute septicæmic type*:—Rapid death in one or two days with few naked eye lesions on post-mortem examination.

(2) *Diarrhoea type*:—Emaciation, diarrhoea and death in 3 or 4 weeks.

(3) *Glandular type*.—Involves the lymph glands in the cervical region.

Lesions.—The mesenteric lymph glands are always enlarged and are caseous. Sometimes they become confluent. Spleen and liver may have numerous miliary tubercles which project above the surface of the organs.

Control.—The affected sow and affected litter-mates should be destroyed.

VII *Infectious Paralysis*.—It is a virus disease characterised by a gradually increasing muscular weakness, particularly of the hind quarters and hind legs. Affected animals should be destroyed as no effective treatment is known.

VIII *Coccidiosis*.—Coccidiosis in guinea-pigs is caused by *Eimeria caviae*. It does not cause mortality in adults. In young guinea-pigs coccidiosis may cause epizootics but it is never so serious as it is amongst rabbits. Signs of infection are diarrhoea, wasting and loss of appetite.

For prevention of coccidiosis, daily removal of faeces from the pens and hutches, strict attention to hygiene are necessary. Sulphamezathene 16% solution administered as a 0.2% solution in place of the drinking water has given very encouraging results.

Acknowledgment

I am highly indebted to Major P. K. Topa, M.B., B.S., D.P.H., Superintendent of the Government Vaccine Depot, Patwa Dangar, (Nainital.) for the facilities and encouragement provided and the valuable suggestions in writing this article. My thanks are also due to Srimant H. D. Thapliyal, M. D. Tewari and T. C. Tripathy, the Laboratory Assistants, who helped me ungrudgingly.

REFERENCES

- (1) BULLOUGS W. S.:—Vertebrate sexual cycles.
- (2) KATIYAR R. D.:—Pseudomoniasis in Guinea pigs. *The Indian Veterinary Journal*, Vol. XXVIII, No. 6, May 1952.
- (3) TOPLEY AND WILSON:—The principles of bacteriology and immunity.
- (4) The U.F.A.W. Handbook on the care and management of laboratory animals.

ADVERTISEMENTS



VETERINARY BRAND

Pure SHARK LIVER OIL

1500 POTENCY OIL,

An essential food for all livestock.

Ideally suited for Poultry and Dairy Farms.

Specially prepared, Tested & Standardised to contain 1500 International Units per Gramme of Vitamin A and 150 International Units per Gramme of Vitamin D.

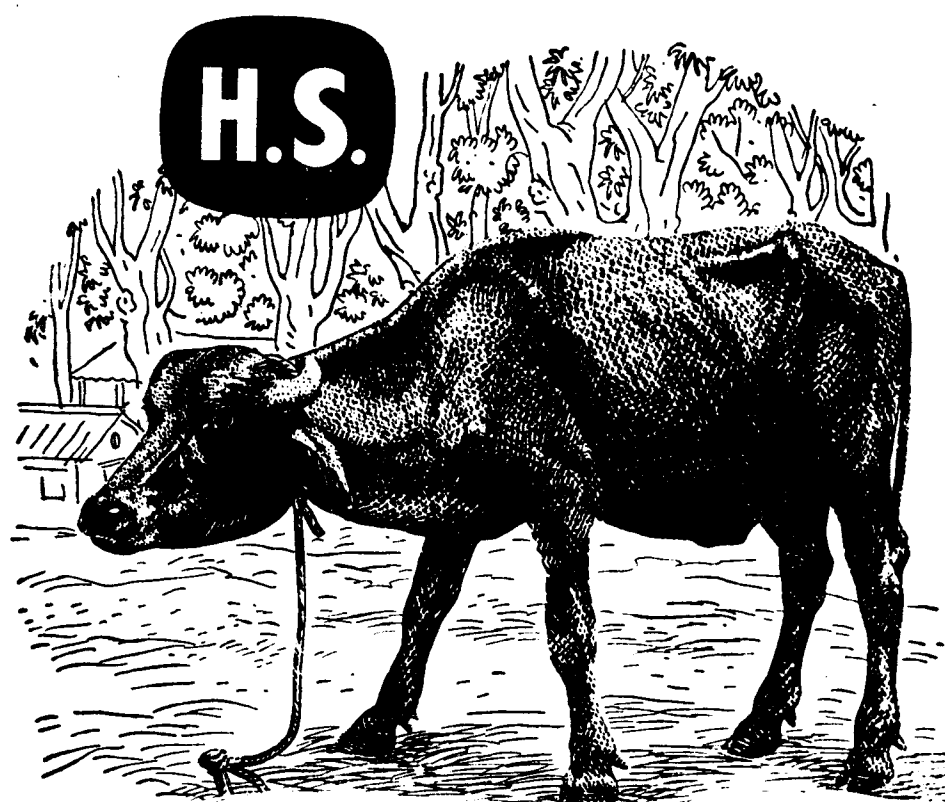
Equivalent to 40,000 International Units of Vitamin A per Fluid Ounce & 4,000 International Units of Vitamin D per Fluid Ounce

GOVERNMENT OIL FACTORY
KOZHIKODE.

A Division of the Department of
Industries and Commerce, Madras.

GO-18

When writing to advertisers, please mention *The Indian Veterinary Journal*.



... or Haemorrhagic Septicaemia, is a seasonal disease well known to veterinarians. Treatment must be prompt to be successful.

'Sulphamezathine' Sodium 33.1/3% Solution is specifically active against the pathogens *Pasteurella bovis* and *P. bubaliseptica* in cattle and buffaloes respectively. 60 c.c. to 100 c.c. intravenously or subcutaneously, repeated in half-doses at daily intervals if required, will effectively control the infection.



'SULPHAMEZATHINE'
sodium 33 $\frac{1}{3}$ % solution

IMPERIAL CHEMICAL INDUSTRIES (INDIA) LTD.
Calcutta Bombay Madras Cochin New Delhi Kanpur

KY 133

When writing to advertisers, please mention *The Indian Veterinary Journal*.

THE Indian Veterinary Journal

(The Journal of the All-India Veterinary Association)

Vol. XXIX

JANUARY, 1953

No. 4

Editorial

THE FIVE YEAR PLAN

"The central objective of planning in India is to raise the standard of living of the people and to open out to them opportunities for a richer and more varied life. Planning must therefore, aim both at utilising more effectively the resources, human and material, available to the community so as to obtain from them a larger output of goods and services and also at reducing inequalities of income, wealth and opportunity." With these observations, the Planning Commission of the Government of India has published the Five Year Plan giving out an outline of the shape of things visualised for the future welfare and prosperity of the country. It is the first attempt, in the words of our Prime Minister, to bring the whole picture of India, agricultural, industrial, social, economic and the rest in one framework of thinking, and, consequently, it has been described as a mighty theme of a nation building itself, re-making itself. It has also received the approval of the Parliament and the people have been exhorted and enjoined to work the plan with zest and enthusiasm and make it a success. Going through the summary of the Plan, which is the only publication available on the subject at present, we find that the programme of action contained in this Plan for the development of our livestock wealth is more or less on the lines of the Draft Outline of the Plan of Development published in July 1951 and which was reviewed in these pages in September 1951. In that review, we pointed out quite clearly that, although the report admitted the fact that, through-out the country, agriculture and animal husbandry were complementary to each other, no plans had been suggested for an all-round

development of animal husbandry and veterinary science. We had, therefore, suggested various ways in which the veterinary organisation should be developed and also the methods in which the immediate livestock problems should be tackled. The All-India Veterinary Association also, as the only representative body of the Veterinarians in this country, had similarly criticised the report and submitted a special memorandum containing recommendations for an effective development of the livestock wealth of the country. The Association had further reiterated the observations of the FAO that livestock improvement work is fundamental to the improvement of agriculture in any country both to ensure proper balance in the diets of the people and to ensure adequate humus for the soil, and strongly pleaded for incorporating its recommendations in the final development plans. These were subsequently confirmed in the All-India Veterinary Conference held at Bombay under the presidency of Dr. S. Datta, Director of the Indian Veterinary Research Institute, Mukteswar. Still, in spite of all these endeavours of the veterinary profession for the inclusion of livestock development work, it is very unfortunate that the authors of the Planning Commission have not cared to do so. The suggestions for the improvements of Veterinary Colleges and the Veterinary Services and also for providing adequate facilities for Veterinary Research have not received any consideration at all in the Five Year Plan; nor the recommendation for improving our fodder problem, as will be seen from the extract of its section on Animal Husbandry and Dairying published in this issue. Such an attitude does not augur well, we are constrained to say, for the successful development of agriculture which is greatly dependent upon animal power for its various operations; nor does it help to improve the health and stamina of the people by providing them with adequate *protective* foods. In this connection, it may be interesting to know what they think of the veterinary profession in the United States of America whose advice and help are now freely drawn upon now in this country for the various developmental schemes. In the course of a communication to us sometime back, Dr. D. M. Campbell, Editor of the *Veterinary Medicine*, Chicago, has written as follows.—

“American Veterinarians often say a Veterinary service is as important as food! Without the control of animal diseases, which is impossible in the absence of a skilled professional veterinary service, there can be no assurance of an adequate food supply. Great numbers of animals are essential to a high standard of nutrition and to land cultivation and fertility. Except animal diseases are eradicated, prevented or the losses they cause limited to proportions that are tolerable, the agglomeration of more animals means not more food but more losses. Hence an adequate veterinary service is as important to a Nation as an adequate food supply, because it cannot have one without the other”.

Even in this country, quite recently, our own Union Minister for agriculture, Dr. Punjabrao Deshmukh, expressed himself as follows while inaugurating the meeting of the veterinary biological experts committee:—

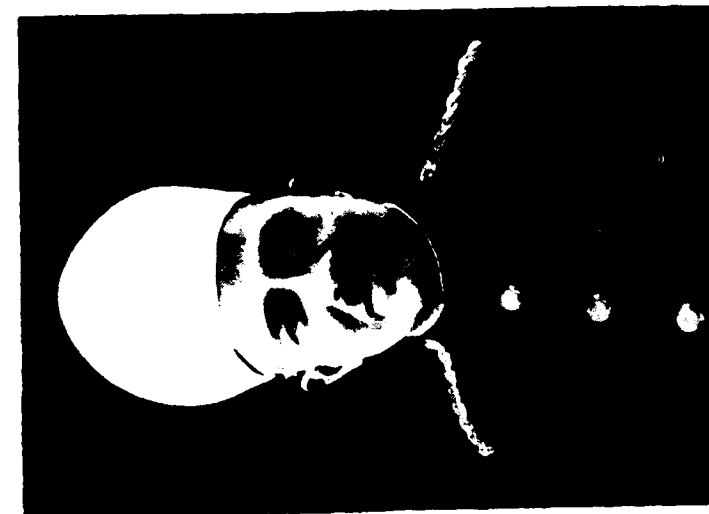
“The responsibilities of Veterinarians are in no sense less than those of surgeons and physicians who attend on human-beings. Human ill-health rouses the conscience more quickly and powerfully than diseases and epidemics among cattle. But this does not detract from the importance of the health of cattle for the stability and prosperity of an agricultural country like ours”.

These are words of wisdom, no doubt, but then, they carry us nowhere if they are not translated into action. As would be seen from the comments of the *Madras Mail* extracted elsewhere, the Veterinary profession remains a neglected profession in this country, starved of funds and shorn of adequate technical personnel. It is denied of opportunities for progress and development and is made unattractive to the intelligentsia. Many a livestock problem remains a mystery for want of facilities for research. And the common ryot for whose chief benefit the Five Year Plan is said to have been mainly intended is denied the help and advice of the Doctor of the Farm and is made to suffer, for want of timely veterinary aid, from the ravages of epidemics amongst his livestock which periodically levy a heavy toll in his farm. And yet the Five Year Plan has made no suggestions and recommendation for

developing the veterinary profession and for an all-round development of our livestock. How 'the objective of planning to raise the standard of living of the people and to open out to them opportunities for a richer and varied life' is going to be achieved by ignoring our livestock and how our food production is going to be stepped up without 'utilising more effectively our resources in our livestock passes our comprehension'. The few animal husbandry and veterinary spheres of work suggested in the Plan like Community Centres, Key Villages and Centres of Artificial Insemination scarcely come anywhere near our requirements and we are greatly disappointed that the welfare of our livestock and their development have not received the consideration they deserve at the hands of the Planning authorities. This is, indeed, a great pity. We do not know who is responsible for this omission. But, whoever is at fault, the F. Y. P. suffers seriously from this lacuna in its scheme of things. We, still, fervently hope that better counsels will prevail and that adequate provision will still be found for developing the veterinary profession and the livestock wealth of the country, as otherwise our aim for increased production of our food requirements and our desire for building up a healthy and strong Nation will be impossible of achievement.

THE LATE Dr. J. T. EDWARDS

It is with a deep sense of sorrow and regret that we have to record the passing away of Dr. J. T. Edwards, a great international luminary in the veterinary world, on the 7th November 1952. By his death, the veterinary profession has lost one of its gifted outstanding personalities who laboured hard, by precept and example, to raise its level and standard and put it on a high pedestal. He belonged to a long line of great Veterinarians in the United Kingdom who inspired the profession to great achievements in many parts of the world. We, in this country, have been fortunate in having had Dr. Edwards at the Indian Veterinary Research Institute, Mukteswar, from 1921 to 1929, first as its Bacteriologist and then as its Director. His work at this Institute has been unique, especially his researches



B. K. Badami, G.B.V.C.,
Retired Director,
Civil Veterinary Department, Hyderabad-Dn.
who died on 29.11.52



Dr. J. T. Edwards, D.Sc., M.R.C.V.S.,
whose death occurred on 7.11.52

INDIAN VETERINARY RESEARCH INSTITUTE, MUKTESWAR
OFFICERS' UNDER TRAINING - INVESTIGATION OF ANAEROBIC INFECTIONS IN FARM ANIMALS
BATCH II - 1952



Standing - V. B. Kulkarni (Bombay) M. Y. Y. Bhatawdekar (Bombay) L. C. Dora (Assam) M. R. Dhanda H. D. Pathi & Bact.
Sitting - M. S. Javaraman (R. A. Anandji) Dr. H. N. Rav (H. D. Parasitology) P. K. Nilakantan (A. R. O. Anandji)

to adopt the Rinderpest Virus first 'into rabbits and then, more successfully, into goats' which have revolutionised the approach to the combating of that epidemic in this land, and his name will for ever be remembered in this connection. His work on other problems also have been quite outstanding and he had, to quote his own words, 'bequeathed to Indian people something that in the years to follow would turn out to be a solid contribution towards making their lot a happier and more secure one'. This was no mean achievement: on the contrary, it was of the highest for which we should be, and are, extremely grateful.

Those who have worked with him have expressed, time and again, with great admiration and regard, the unique capacity of Dr. Edwards for sustained devoted work, his scholarship, his scientific equipment and his great eagerness to teach and equip his assistants. He thus endeared himself to one and all and his departure from this country in 1929, after a not too long a stay, was regretted by every one. Besides being a great scientist, Dr. Edwards was a brilliant chronicler and his writings, which were indeed profuse and varied, have always compelled attention and study. He has died full of honours, although it will not be quite correct to say that such great men are dead. Their lives will ever remain an example to the profession.

THE LATE Dr. B. K. BADAMI, G.B.V.C.

We deeply regret to record the death of Dr. B. K. Badami, G.B.V.C., Retired Director of Civil Veterinary Department, Hyderabad-Deccan, which took place quite suddenly on the 29th November 1952 at his residence in Secunderabad in the midst of his family.

A charming personality, gifted with rare persuasive manners, the late Dr. Badami was a familiar figure among the pioneers of the veterinary profession in our country. He was a keen veterinarian and was extremely popular wherever he was. He took a great interest in the activities of All-India Veterinary Association in its formative period and helped to strengthen that organisation in many ways. His death is a great loss to the profession and will be moaned by one and all.

The late Bala Krishna Rao Badami came of a very respectable family in Mysore and had his early education in Bangalore. He then joined the Bombay Veterinary College and took his Diploma in December 1907 with the prize for the best student of that year. Serving for a short term in Bombay as Assistant Veterinary Officer, he joined the H. E. H. the Nizam's Service as Veterinary Inspector in 1909. Later on he was posted to the Hingoli Stud Farm in that State. Thereafter he became the Deputy Superintendent in charge of Gulbarga and Aurangabad Subhas and Stud Farms. Finally he became the Director of the Civil Veterinary Department in 1933 which post he held till 1942. After retirement from service, he was re-appointed as the Adviser to the Director of the Civil Veterinary Department from 1943 to 1944 during which period he put up many schemes for developing the Department and for establishing the present Oosmania Veterinary College at Hyderabad. He was on the All India Cattle Show Committee and represented H. E. H. the Nizams' Government on the Advisory Board of the Imperial Council of Agricultural Research. He was also on the Governing Body of that Council as an elected representative of the Advisory Board and retired from active service in 1945. In appreciation of his services he was awarded the King George VI Coronation Medal and H. E. H. the Nizam's Silver Jubilee Medal and also had the honour of Rao Bahadur conferred on him in July 1942. He was a Steward of the Secunderabad Race Club till his death.

He leaves behind his wife, three sons and three daughters and a host of friends and relatives to bemoan his loss.

Standardisation of Veterinary Biologicals. Inaugural Meeting of the Committee Union Minister's Address.

Addressing the inaugural meeting of the expert committee on the standardisation of veterinary biological products in New Delhi on 14th November 1952 Dr. Panjabrao S. Deshmukh, Union Minister for Agriculture, spoke as follows: "Fundamental research in veterinary science commenced in this country a little over 60 years ago. Since then great advances have been made in the study of animal genetics, nutrition, parasitology, bacteriology and pathology. Our veterinary scientists have made original contributions in these fields and earned recognition for their achievements. As a result of these researches, the country is more or less self-sufficient in the matter of its requirements of veterinary biological products, some of which we also export to some of the neighbouring countries. Production is fairly dispersed as many states have set up manufacturing units. Fortunately, almost the entire production is undertaken in laboratories under the Central and States Governments. The

commercial manufacture of these products in India is un-important. A small quantity of commercially manufactured products is imported.

No Compromise on Quality

"This ought to make your assignment relatively simple. There is no commercial motive in production and, therefore, no incentive to compromise on quality. The fact nevertheless remains that uniform and approved standards of quality to which all products must conform have not yet been laid down. While the absence of the profit motive is a sufficient safeguard against bad quality, it does not necessarily guarantee high quality. Moreover, the nature of the products is such as to demand constant vigilance. It is perhaps not enough to ensure that the quality at the stage of production is above suspicion. The products need to be carefully tested before use, for purity, safety, potency and keeping quality. In this respect it appears other countries have made considerable progress while we have lagged behind. It seems we have taken things too much for granted and treated the production of veterinary biologicals as a routine proposition. During the course of your inspection of the various producing centres and the manufacturing techniques employed by them you may discover many unsatisfactory features. The Government's intention in appointing the Committee is not to discover unsatisfactory operations wherever they be and to pass censure but rather to improve the application of techniques and to ensure that properly trained personnel only is employed on the production of biologicals and invested with satisfactory equipment and other conditions of production. The simplicity and inexpensiveness of production techniques have probably created a belief that no serious risks are being run. The dumbness of cattle is doubtless a factor in preventing discovery of ineffective or harmful products. Were animals endowed with vocal faculties for complaining, they would probably help us to check up on the quality of what is administered to them.

"The responsibilities of veterinarians are in no sense less than those of surgeons and physicians who attend on human beings. Human ill-health rouses the conscience more quickly and powerfully than diseases and epidemics among cattle. But this does not detract from the importance of the health of cattle for the stability and prosperity of an agricultural country like ours.

Personnel and Equipment

"There is a tendency to multiply and set up new institutions without a proper assessment of the possibilities of making more intensive use of the old and established ones. The economics of large scale operation are well known and I would like you to consider whether any of the existing resources cannot be extended to fulfil the requirements of a Central Control Laboratory. We have some excellent veterinary institutes under the Central and States Governments. It will be worthwhile examining from the

financial and technical points of view, the scope for the utilisation of their personnel, equipment and premises, with suitable modification, for control work. This will have the further advantage of proving the permanent merits and ultimate ramifications measures of control, and the need eventually for a separate institute or laboratory for them.

"Likewise with legislation. Unless there is special merit in passing special legislation which will take time, it will be worth your while to consider carefully the advantages of meeting your requirements through a suitable modification of existing legislation on a closely allied subject.

"It is essential also to bear in mind the fact that in trying to implement your recommendations, the Government will have to consider a number of other limiting factors, such as the financial and the scarcity of accommodation and technical personnel of the right calibre. Modern specialisation has created limitations even for experts, who are inclined to prepare grandiose schemes with an idealistic approach. This is partly responsible for so many reports going into cold storage assisted in the process by the inertia of governmental machinery. I would, therefore, plead for a practical approach to your task, with due regard to the limitations of time, money, material and personnel".

Commenting on the above speech of the Union Minister for Agriculture, the *Madras Mail* had the following editorial in its issue dated 15th November 1952.

Equal Work, Unequal Status

The Union Minister of Agriculture spoke wisely, when inaugurating the meeting of the newly constituted Committee on the Standardisation of Veterinary Drugs on 14-11-1952. "The responsibilities of Veterinarians," Dr. Punjabrao Deshmukh said, "are in no sense less than those of surgeons and physicians who attend human patients." Being thus persuaded, he should try to induce Ministers in the States to accept his view, and end a grave anomaly that now exists. Most State Governments are deplorably indifferent to their veterinary departments. They appear to regard animal husbandry as an inferior service, deny veterinarians the status and pay awarded to comparable services such as the medical. Nor do leaders who, in the councils of the country, and on public platforms, insist on the protection of cattle or the improvement of livestock, seem to bestow adequate thought on the needs of those engaged in such work. Insufficient appreciation of its duties, and inadequate salaries, discourage the veterinary service, and makes it unattractive generally to men and women with the highest qualifications.

Dr. Deshmukh pointed out how the stability and prosperity of an agricultural country like India rest on the health of its cattle. This is only one aspect of the work of veterinarians; there are many others to be kept in mind. The health of the people itself is dependent on that of animals,

Only healthy animals provide healthy food; and diseases of cattle and other animals such as anthrax, tuberculosis, and certain kinds of fever, unless controlled, are communicated to human beings. Without a contented, vigilant, competent veterinary service, much of the work of the medical and public health services will be frustrated.

The disparity between the status and salaries of the veterinary and other government departments is nowhere more conspicuous than in Madras. The Animal Husbandry Department here is staffed mainly by graduates in veterinary science, an intensive course extending over 4½ years. They are appointed Veterinary Assistants on a salary of Rs. 140, rising by annual increment of Rs. 5 or 10 to Rs. 250, in 20 years. They are non-gazetted officers, and the great majority are unable to reach Gazetted rank, the latter consisting of a very limited number of posts. Compare this with the pay and positions of Assistant Surgeons in the medical service. We do not say that these are paid well, they are not. Their starting pay is Rs. 200, a considerable sum, more than that of Veterinary Assistants and; they are, too, Gazetted Officers. The Veterinary College which is the only one of its kind in this State occupies the status of an Intermediate College in Arts, having only Lecturers, not Professors. Its teachers are paid less than teachers of the Medical Colleges, inadequate as the salaries of the latter are. It would seem that three years ago a Commission of the University of Madras which inspected the Veterinary College recommended the appointment of Professors on higher salaries, and the proposal was forwarded to the Government, but it has been shelved. The present arrangements should be changed. The least that Government can do is to award the veterinary service and the College the same status as their medical contemporaries on the principle the Union Agriculture Minister enunciated.

Government of India Planning Commission The First Five Year Plan

11. Animal Husbandry

Nearly 10 per cent. of India's cattle are unserviceable or unproductive. To relieve the pressure on fodder resources the Plan provides for the establishment of 160 *gosadans* (cattle homes) at a cost of about Rs. 1 crore. Old and infirm cattle will be removed to cattle homes in areas where grazing facilities are more easily available.

A scheme known as the Key Village Scheme for improving the breed and productive capacity of cattle at a cost of about Rs. 3 crores has been included in the Plan. About 600 centres each consisting of about three or four villages and including about 500 milch cattle will be selected in different parts of the country. Bulls of inferior variety will be castrated and the breeding will be confined to a few specially selected bulls, and pedigree and milk production

Part 'B' States.

(Figures represent lakhs of rupees)

Head.	Hydera- bad.	Madhya Bharat.	Mysore.	Pepsu.	Rajas- than.	Saurash- tra.	Travan- core Cochin.	Total.	Jammu Kashmir.
Agriculture	346.4	750.0	443.0	364.9	109.2	212.4	545.1	2771.0	22.1
Animal Husbandry	49.6	50.0	53.8	10.0	18.3	10.4	2.5	194.6	15.0
Dairying and Milk Supply	1.7	...	...	...	...	1.6	...	3.3	...

Part 'C' States.

Head.	Ajmer.	Bhopal.	Bilas- pur.	Coorg.	Delhi.	Hima- chal Pradesh.	Kutch.	Mani- pur.	Vindhya Pradesh.	Total.
Agriculture	48.4	173.0	7.0	...	63.6	28.0	60.6	0.8	12.6	204.7
Animal Husbandry	9.6	7.0	1.1	...	9.4	22.4	3.9	2.5	2.8	12.9
Milk supply	...	...	...	1.0	4.9	...	...	...	1.5	7.4

Progress of development expenditure—Central Government

Progress of expenditure.

(Figures represent lakhs of rupees)

Head.	Expenditure in 1950-51.	1951-52 Revised.	1952-53 Budget.	Five Years' Total 1951-56.
Agriculture	244.3	256.2	303.2	5922.2
Animal Husbandry including Dairying	...	...	30.3	412.0

Progress of development expenditure in States by heads of development

Progress of expenditure.

(Figures represent lakhs of rupees)

Head.	Development expenditure 1950-51.	1951-52.	1952-53.	Five Years' Total 1951-56.
Agriculture	2709.2	2274.6	2525.8	12500.0
Animal Husbandry	96.9	123.9	174.8	1085.5
Dairying and Milk supply	122.7	138.9	95.7	781.0

Clinical Article

OTITIS EXTERNA IN DOGS—THERAPY WITH AUREOMYCIN

By

M. S. GANAPATHY, G.M.V.C., B.V.Sc., M. RANGANATHAN, G.M.V.C., B.V.Sc.,
and

V. RAVIVARMA HEGDE, G.M.V.C., B.V.Sc.

Department of Medicine, Madras Veterinary College, & Hospital.

One of the most refractory conditions encountered by the small animal practitioners and dreaded by the dog owners is Otitis Externa, commonly known as Canker of the ear. It is a suppurative inflammation of the tubular portion of the conchal cartilage and skin leading to the middle ear. The condition is said to be frequently unilateral, but, in a number of cases observed in the small animal clinic attached to this College, both ears were found to be involved.

A study of the records in this Clinic for the last five years reveals a high incidence of Canker in dogs—vide Table I.

TABLE I

Year.	Admissions.	No. of E. N. T. cases treated	No. of cases treated for Canker of ears.	Incidence.	
				Percent to total admissions.	Percent to total E.N.T. cases.
1947-48	4,826	220	93	1.93	42.27
1948-49	4,670	109	105	2.25	96.30
1949-50	4,781	130	77	1.61	59.30
1950-51	4,397	188	79	1.75	42.02
1951-52	5,187	191	134	2.58	70.20

Though dogs with long pendulous ears are said to be the common victims, the condition is found to be prevalent in all breeds as Alsations, Fox terriers, Scotties, Bull terriers, Dalmatians and Cocker Spanials. As for the age incidence, among these, the middle-aged and the old are more susceptible.

Causes:—Ordinarily Canker of the ear follows exposure to chill, dirt, soap, sand and water and trauma of various kinds. The long, narrow and tortuous ear canal of the dog provides an excellent situation for the various bacteria which gain entrance to the canal. In young animals, the condition is frequently associated with distemper. The parasitic mite—*Otodectes cyanotis*—is also said to cause the condition. However, in a limited number of cases where the ear wax was examined microscopically, the results were negative. Cultural examination of materials from the affected ears revealed a variety of bacterial flora as detailed in Table II on page 355.

Symptoms:—The common symptoms manifested may be summarised as follows:

Canker is one of the most painful conditions. The hair of the ear flap gets matted with the discharge. Manipulation and pressure at the base of the ear elicits a crackling sound with discharge of greenish offensive pus. When cleaned, the concha shows ulcerations in places particularly in the interior of the aural canal. Disturbances of equilibrium and convulsions are attributed to the parasitic mite. Transient deafness, ulcerations of the middle ear and its rupture in neglected cases are quite likely.

Treatment:—As Ainstead (1951) rightly points out, treatment often fails for two reasons, viz.

- (1) Failure to thoroughly clean the canal before starting treatment; and
- (2) Aggravating the already existing irritation by unwise manipulation or by the use of irritant drugs.

TABLE II

Register No. of cases.	Results of cultural examination.	No. of cases.
2182 154 723 842	Coli aerogenes groups.	4
4301	Coli aerogenes groups and Staphylococci.	1
2650 2576	Pseudomonas aeruginosa.	2
4304 2520	Pseudomonas aeruginosa and Staphylococci.	2
432 2624 4591	Staphylococci.	3
2294 2295	Diphtheroids.	2

The first step in the line of treatment adopted by the authors is to trim the hair in and around the external meatus. Wax, scabs, dirt or pus are then removed by gentle manipulation. If the material in the ear is dry and hard, it is at first softened with a few drops of glycerine—sodium bicarbonate (5%) and, if need be, the dressing is allowed to remain in the ear overnight. In extremely painful cases, addition of 2 or 3 drops of an aqueous solution of 2% cocaine to the ear drops mentioned above, has been found beneficial. After cleaning the ear thoroughly as detailed above one of the following preparations was instilled into the ear as occasion demanded.

1. Dettol glycerine (1 : 1)
2. Phenol glycerine (1 : 1)
3. Boro-iodum (Pot. iodide gr. 5, Iodum gr. 1
Acid boric to 1 ounce) for insufflation into the cavity.
4. Combinations of Sulphonamides as Sulphanerazine and Sulphamezathine in equal proportions.

In chronic refractory cases besides the above line of treatment, autogenous vaccines have been tried successfully. The auto-vaccine

TABLE III

S. No.	Case No.	Bacteria involved.	Results of auto-vaccine therapy.
1.	880	<i>Pseudomonas aeruginosa</i> .	Cured.
2.	2674	do.	Cured, but recurred after 3 months. Cured with Aureomycin.
3.	2736	do.	Discontinued.
4.	3765	do.	Cured.
5.	2133	do.	Cured.
6.	2141	do. & <i>E. Coli</i> .	Discontinued.
7.	2145	<i>Staphylococci</i> .	Cured.

Not entirely satisfied with the above methods of treatment, we investigated the probable use of Aureomycin (Lederle Labs). As many as 20 cases were treated successfully. As a result we are now in a happy position to recommend its use widely in chronic cases of Canker in dogs. The Lederle laboratories have marketed a special preparation—Aureomycin otic—for the ear dressing. The preparation contains a diluent for the crystalline Aureomycin. But we have found the following formula to be effective and economical.

This forms a golden yellow suspension.

On the first day the ear is cleaned of all the pus and dirt. Three drops of the suspension are instilled with an ear dropper and the ear massaged at the base. The owner is then advised to repeat the application of the dressing without cleaning or probing the ear once or twice a day, according to the severity of the condition for the next five days. The dogs were examined after five days' treatment. The condition had healed

Summary

1. A study of the incidence of Canker in dogs in the Madras Veterinary College Hospital is outlined.
2. Some methods of treatment followed in this hospital are given.
3. In the opinion of the authors, chronic refractory cases of Canker in dogs can be cured with Aureomycin hydrochloride dressing.
4. A cheap and effective prescription tried in this hospital on 20 cases is recommended for wide trial.
5. Use of auto.vaccine in chronic cases have been found to be beneficial.

Acknowledgments :

Our thanks are due to the Principal, Dr. I. M. Azizuddin, for his keen interest and for allowing the use of case records. We are also grateful to the staff in the Bacteriology department for the cultural examination of the pus swabs, and supply of auto-vaccine. To Messrs. Lederle Laboratories our thanks are due for placing a supply of Aureomycin at our disposal.

REFERENCES

1. Ainstead, W. W. (1951) American Journal of Veterinary Medical Association January 1951.
2. Witter, R. E. (1949) The Cornell Veterinarian, Vol. XXXIX, No. 1, pp. 11-31.

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.]

“ ‘Sulphamezathine’ treatment of Bovine Rinderpest ”

Sir,

Sir, With reference to this article by R. Rajagopal, B.V.Sc. in the November, 1952 edition, page 251, under the heading "Conclusion", it is stated that the cost of treatment for a 4-day complete course of 100 c.c. of the 33½% Sodium solution and 10 x 5 Gm. tablets is Rs. 12/- and Rs. 13/-, indicating the total cost as Rs. 25. This should read "Rs. 12 to Rs. 13/-" for the average Ongole adult animal, and *pro-rata* cheaper for smaller cattle.

G. V. SHORT.

Calcutta,
December 8, 1952. }

Imperial Chemical Industries (India) Ltd. Calcutta.

Gammaxene in maggotted wounds

Sir,

I used to treat maggotted wounds, like all others, with Turpentine, Phenyle, Nafthaline etc., but no encouraging results were found as it required second or third applications in many cases.

During the year 1950 I was supplied with Gammaxene dispensible powder (I.C.I.) by the Director of Animal Husbandry and Veterinary Services, Orissa, and from that time onwards I am using gammaxene treatment for maggotted wounds with encouraging results. In no case it has damaged the tissues or shown untoward general symptoms of Gammaxene poisoning; on the other hand, it helps to remove the slough.

The method of treatment is very simple and I might have treated nearly one to two thousand cases up till now.

Procedure of treatment.—Pack the maggotted wound with sufficient quantity of gammaxene powder and leave the patient alone for the first day. (It is better to apply a bandage if the wound is in a position to be bandaged). Next day a thorough wash of the wound with N. S. S., or any medicated water as the case may be, may be given. It will be seen that all the dead maggots are washed out and the removal of slough also is very easy. Only one day's treatment with Gammaxene is sufficient in 99% of cases. A second application will be required only in chronic Foot and Mouth disease cases, (with maggots) in which case the maggots would have entered very deep into the tissues.

S. VENKATA NARASU, G.V.Sc.,
Veterinary Asst. Surgeon, Padampur (Orissa).

Abstracts and Extracts

Thambialayah, V. S. (1951).—First case of Swine Erysipelas in Ceylon. *Tropical Agriculturist*, Vol. CVII, No. 2.

T. records what is considered as the first case of Swine Erysipelas in Ceylon. The subject of this case was a sow from an estate in Kandy district brought to the veterinary research laboratory Hospital, Peradeniya, Ceylon, on October 1, 1950. Examination of the animal revealed well defined, somewhat raised rhomboidal and square shaped, dark red and purplish patches almost all over the body with conjunctivitis, dullness and loss of appetite. Microspical cultural and biological tests led to the confirmation of the disease.

The affected animal was treated with Penicillin, 2 lakhs units being administered daily for three days. The skin lesions began to heal but, as the animal had a fracture in its fore-limb, it developed complications and

died after a fortnight of its admission into the hospital. The other contacts in the estate were developing the disease and they were given 2 lakhs units of Penicillin for five days from the onset of symptoms. All the affected animals recovered.

As regards the source of infection, the author opines that the disease might have been introduced into the estate long ago in a mild, imperceptible form by an imported animal, and the organism gradually increased its virulence to give rise to the urticarial form of infection.

— — —
Easterbrook H. L. and Plastringe W. N. (1952).—Experimental transmission of *Vibrio fetus* in diluted semen by contact. *J. A. Vet. Med. Assn. CXX*, 199.

With a view to establish the possibility of artificial infection of *Vibrio fetus* to cows through infected semen used in insemination and infection through contact exposure, E & P conducted an experiment from which they concluded that vibriosis could be transmitted through artificial insemination with *V. fetus* infected semen and that it could be transmitted by vulva-to-vulva contact either by animals licking one another and/or insect vectors.—
G. A. SASTRY.

— — —
Pritchard W. R.; Rehfeld C. E. and Sautter. J. H. (1952).—Aplastic anaemia of cattle associated with injection of Trichlorethylene-extracted soyabean oil meal. *J. A. Vet. Med. Assn. CXXI*, 1 and 73.

Cases of aplastic anaemia with an insidious onset and rather acute course with fatal termination consequent on the feeding of cattle with Trichlorethylene-extracted soyabean oil meal are described. Susceptibility to the disease appeared to be closely associated with age (younger animals being more susceptible) and level of milk production in the case of adult milking cows, heavy milkers and highly-bred cow being affected most. The onset of symptoms appeared any time after 30 days of feeding the meal.

Two types—an acute, rapidly progressive anaemia and an insidious chronic form—were met with. The syndrome of the acute type comprised of the following: high temperature, haemorrhages from natural orifices, petechiae on visible mucous membranes, erythematous eruptions on the skin, intramuscular and subcutaneous haematomas, bearing dead calves and calves dying soon after birth. In the chronic form locomotor ataxia, progressive weakness and occasional petechiae were observed. The peripheral blood changes were those associated with aplastic anaemia: marked and progressive reduction in thrombocytes, early and progressive leukopenia, relative neutropenia, normocytic and normochromic anaemia,

slightly increased sedimentation rate, increased blood clotting time with normal to slightly elevated prothrombin time. Blood glucose, blood urea, serum calcium, magnesium, inorganic phosphorous, and total serum proteins were not altered.

The most frequent findings at autopsy were: extensive haemorrhages in almost all the organs, haemorrhagic infarcts in liver, and ulcers in the bowel. Necrosis of arterioles and small vessels, thrombosis, rupture and fibrosis were the major histological changes noted in the organs showing gross lesions and petechiae in others. Bone marrow was hypoplastic with granulopoiesis practically at a stand still.

Citrated whole blood, Vitamins K C & B sulphonamides had no effect on the course of the disease.

G. A. SASTRY.

XV INTERNATIONAL VETERINARY CONGRESS

The Organizing Committee of the XV International Veterinary Congress in Stockholm, August 9th to 15th, 1953, has extended a cordial invitation to the members of the Veterinary Profession for the Congress.

Colleagues, who are unable to attend the Congress, and veterinary faculties, veterinary colleges, libraries, veterinary authorities, veterinary organizations, etc., which will not be represented at the Congress, may, as Associate Members, receive Parts I and II of the Proceedings of the Congress at a price not yet fixed. Invitations to apply for associate membership will be sent latter. Part I of the Proceedings will contain the sectional reports, and will be published before the beginning of the Congress. Part II will contain the plenary lectures and the contributions to the discussions after the sectional reports. This part of the Proceedings will be published as soon as possible after the Congress.

At the Congress ten plenary lectures will be delivered in the forenoons by specially invited researchers. In the afternoons about 300 reports, many of which will be illustrated by films, will be read by colleagues who have sent in proposals. These reports, distributed into nine sections, will be followed by general discussions. Moreover, films of veterinary interest will be shown. In this way all branches of veterinary medicine and veterinary food hygiene will be dealt with.

In addition to the scientific proceedings, visits will be arranged to the Royal Veterinary College, the State Veterinary Medical Institute, the State Bacteriological Laboratory, the National Institute of Public Health, the Royal Agricultural College, the National Animal Experiment Station, the Animal Breeding Institute, a slaughterhouse, a dairy, an insemination centre, and representative farms.

Sunday, August 9th, is reserved for registration in the Congress Bureau and a reception in the Town Hall of Stockholm. On Monday, August 10th, the official opening of the Congress will take place in the Concert Hall of Stockholm. On the same day the proper work of the Congress will begin. On Tuesday, August 11th, the Congress Banquet and dance will be held. On Wednesday, August 12th, a Night Concert will be given in the National Museum. On Thursday and Friday, August 13th and 14th, visits are planned to the Plate Theatre of Drottningholm (from the 18th century), where excellent entertainment will be offered. On Saturday, August 15th, the official closing meeting will be held.

Daily sightseeing tours by bus and boat in Stockholm and its surroundings are planned for the week of the Congress. A special ladies' programme comprising a luncheon, at which the ladies are guests of the Congress, and visits to places, institutions, etc., of cultural, social, and historic interest is also planned.

Before and after the Congress, tours will be arranged by the official travel bureau of the Congress according to individual wishes. After the Congress, conducted tours are planned to Malmö through South Sweden and to Gothenburg through West Sweden. Prospectuses of these tours will be sent by request in the application form.

The application form for membership and other forms for accommodations should be filled in properly and returned in plenty of time before April 1st, 1953 directly to the XV International Veterinary Congress, Organizing Committee, C/o Isaksson, State Veterinary Medical Institute, Stockholm 50, Sweden.

College News

BIHAR VETERINARY COLLEGE

The following students are declared to have passed the Diploma Examination (Special Supplementary) held in January 1953.

(In order of merit)

- | | | |
|---------------------------|-----|---------------|
| 1. Shiva Kumar Sauri | ... | Bihar Private |
| 2. Jagmohan Prasad Mahata | ... | do. |
| 3. Ashwani Kumar Sinha | ... | do. |
| 4. Krishna Kumar Lal | ... | do. |
| 5. Bhimwali Sharma | ... | do. |
| 6. Vishnu Swaroop Sinha | ... | do. |

Patna, }
January 27, 1953.

H. R. KAPUR, M.R.C.V.S.,
Principal.

5L

KZ m2, N24

N53-29-4

ADVERTISEMENTS

Artificial Insemination & Animal Production A PRACTICAL GUIDE

By

Dr. J. D. Sampath Kumaran, M.A. (Missouri), L.V.P. (Punjab), Ph.D. (Missouri), U.S.A.
GOVT. OF INDIA CATTLE FARM & DAIRY, KARNAL.

This book treats in very great detail the principles relating to very sound and profitable breeding and outstanding works of more than 650 distinguished investigators from various parts of the World have been appropriately and comprehensively cited. Innumerable tables, formulae and illustrations have been judiciously incorporated.

350 Pages and Many Illustrations; Price Rs. 15/- net.

Copies can be had from the author and also from:
The Indian Veterinary Journal, 26, Wallajah Road, Madras-2.

PASU SANKARAMAK ROG CHIKITSAK

(IN HINDI)

An useful book for students, stockmen and lovers of Hindustani language.
Deals with contagious and infectious diseases in animals.

Price Rs. 5-9-0.

Copies can be had from:—SANTOSH KUMAR SINGH.

c/o Dr. R. P. SINGH.

VETERINARY ASSISTANT SURGEON.
BUXAR, P. O. Dt. SHAHABAD. (BIHAR).

Reliable Veterinary Products

For Passive Immunisation
TETANUS ANTITOXIC SERUM
2000 and 6000 I. U.

For Active Immunisation
TETANUS ANATOXIN
in 25 c.c. and 50 c.c. phials

For Active Leucocytosis
NUCLEIN
10% Solution of Nucleinic Acid in 5 c.c. Ampoules

BENGAL CHEMICAL

CALCUTTA

BOMBAY

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

BOOK NEWS

SVASTIK SALES COMPANY

Medical, Veterinary and Scientific Book-Sellers

PAREL, BOMBAY - No. 12

Here are some new arrivals of Veterinary and Allied Books.

	Rs.	As.
ABERCROMBIE: Dictionary of Biology '51 illd.	11	10
ALVERDES: Psychology of Animals in Relation to Human Psychology	7	8
ANDERSON: Semen of Animals & Its Use for Artificial Insemination	16	4
ASHTON: Elements of Animal Nutrition '50	2	8
BAIRD: Care and Handling of Dogs	3	12
BAKER: Biology in Everyday Life 123p.	6	9
BAKER: Cytological Technique	19	8
BARRON: The Dairy Farmers' Vety. Book	33	0
BENJAMIN: Practical Poultry Management	33	0
do. Marketing Poultry Products	52	8
do. Manual of Determinative Bacteriology \$ 15.00	30	8
BERGY: Livestock & Poultry Diseases '47	11	4
BILLINGS: Hen Batteries '51	15	12
BLOUNT: Poultry Diseases '49	16	4
do. Diagnostic Methods in Vety. Medicine	9	6
BODDIE: Anatomy of Animal Types	4	8
BRIGGS: Animals without backbone: in 2 vols. per set	4	14
BUCHSBAUM: Vertebrate Sexual Cycles	4	8
BULLOUGH: Classification of Animals	35	0
CALMAN: Parasites in Domestic Animals '51. 436p. illd.	24	12
CAMERON: Cell Growth & Cell Function '50	3	14
CASPERSON: Poultry Breeding for Egg Production	35	12
CAPPER: Introduction to Parasitology	21	8
CHANDLER: Livestock Management '49 revised edn.	32	8
COFFEY: Adaptive Colouration in Animals	4	6
COTT: Sex Determination	13	2
CREW: Pregnancy Diagnosis Tests	20	0
COWIE: Cow in India. 2 Vols. Over 2000p. illd.	21	8
DAS GUPTA: Livestock Enterprises	19	2
DAVIES: Milk Testing. New Book. '51	21	8
do. Poultry Enterprises	26	4
DICKINSON: Vety. Surgery '52. rp.	19	13
DOLLAR: Textbook of Meat Inspection	42	12
DRABBLE: Physiology of Domestic Animals '51	19	8
DUKE: Producing Livestock	19	8
EDMONDS: Feeding of Farm Livestock '50	44	0
ELLIS: Care & Breeding Laboratory Animals	30	0
FARRIS: Rat in Laboratory Investigation	21	8
do. Dairy Enterprises	13	8
FISHWICK: Dairy Farming '52	13	8
do. Pigs: Their Feeding, Breeding & Management	18	12
do. Vety. Obstetrics '52	26	4
FLEMING: Vety. Pathology & Bacteriology	33	0
GAIGER & DAVIES: Introductory Animal Science '51	13	2
GARRIGUS: Meat Technology	33	0
GERRARD: Dairy Cattle breeding '52	9	8
GILMORE: Diseases of Poultry '52	52	8
GRAY: Infectious Diseases of Domestic Animals '51	1	14
HAGAN: Scientific Principles of Poultry Feeding	31	8
HALNAN: Dairy Bacteriology '48	3	4
HAMMAR: A. I. of Farm Cattle	15	12
do. Fertility & Animal Breeding	27	8
do. Toxemias of Pregnancy (Human & Vety.)	52	8
HENDERSON: Dairy Cattle Feeding & Management	23	12
HESSE: Ecological Animal Geography	31	8
HEUSER: Feeding Poultry '46	32	8
do. Poultry Management '52	26	4
HOARE: Vety. Mat. Medica & Therapeutics	12	3
HOBDAV: Surgical Diseases of the Dog & Cat '52	47	4
HOSKINS: The Biology of Schizophrenia	14	12
HUNGERFORD: Diseases of Poultry '51	13	12
JENSEN: Dairy Bacteriology	32	8
JONES: Care & Training of Dogs	33	0
JUDKINS: Principles of Dairying	39	0
JULL: Poultry Breeding	15	12
do. Poultry Husbandry '51	52	4
KINNGY: How to Raise A Dog illd.	45	0
LEACH & LINTON: Food Inspection & Analysis	3	2
WHITE: Animal Castration illd.	19	8
LIGHTON: Your Dog	18	8
LING: Textbook of Dairy Chemistry in 2 Vols. per set	41	4
BANHAM: Vety. Surgeon's Vade Mecum '52	8	0
THORNTAN: Textbook of Meat Inspection '52	15	0
TWEED: Poultry Keeping in India	20	5
SAMPATH KUMARAN: A. I. & Animal Production '51 New Book	18	12
MILLER & ROBERTSON: Practical Animal Husbandry, revd. & enlarged edn. '52	12	8
MILLER & RAS: Manual of Infertility & A. I. '52, New Book	25	0
BODDIE: Veterinary Therapeutics '52 New Book		
Handbook of Orders relating to Dis. of Animals '52		

ORDER YOUR REQUIREMENTS TODAY

When writing to advertisers, please mention *The Indian Veterinary Journal*.

ADVERTISEMENTS

THE INDIAN VETERINARY JOURNAL

will pay for the following

**Back issues of the
JOURNAL**

Vol. 1, Nos. 2 & 3	Vol. 7, Nos. 1 & 2
" 2, " 1 & 4	" 12, No. 3
" 4, Nos. 1, 2, 3, & 4	" 19, Full volume
" 5, 3 & 4	" 21, Nos. 4, 5, 6
" 6, Nos. 1, 2, 3 & 4	

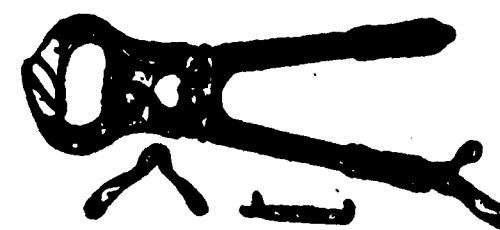
A Few of Dr. Pangal's specialities to all Lovers of Horses, Cattle and Dogs.

1. "Race Horse Brand" Equitone. A valuable blood tonic and conditioner for Race Horses, Polo Ponies, Hunters, etc. Quite indispensable to keep the horses in hard work always fit. Price per 2 lb. tin Rs. 8.
2. "Scented Pulver". Tick specific. A wonderful tick destroyer. Price per big tin Rs. 4. per small tin Rs. 1-4.
3. "Bovotone". Best Tonic Powder for cattle containing minerals and Vitamins. Price per 2 lb. tin Rs. 2.
4. "Dr Pangal's Resolvin". Indicated in absorbing—without firing—Splints, Ring bones, Spavins, Enlarged joints, Sprained Tendons and Ligaments; and cures Sore Shins Capped Elbows and Hocks. Price per 4 oz. bottle Rs. 8.
5. "Dhum-Dhum".—A specific for dhum i.e. heavy breathing so common in horses. Acts like magic. Price per 1-lb. bottle Rs. 3.
6. "Electric Mange Cure".—An excellent remedy for all kinds of mange and is a specific for Follicular Mange. Acts like magic. Price per bottle Rs. 2-8-0. Big bottle Rs. 5.
7. "Cough Electuary".—A specific for cough and catarrh in horses. Price per lb. tin Rs. 8.
8. "Hoof Ointment".—This strengthens the hoof and is a specific against Brittleness, Sand crack and Split hoof. Price per lb. tin Rs. 4.
9. "Dr. Pangal's Embrocation".—Indicated in all sprains and aches in horses and cattle. Price per 4-oz. bottle Rs. 1-8-0. 8 oz. bottle Rs. 3.
10. "Tendon Lotion".—For inflamed and sprained tendons, ligaments and joints in horses. Price per lb. bottle Rs. 2.
11. "Anodyne Paste for Horses".—Indicated in treating Swollen Joints, Inflamed Tendons and Ligaments (work not disturbed). Price per 3 lb. tin Rs. 4.
12. "Canatone".—Vitamin Mineral Food for Dogs. Price per 1½ lb. tin Rs. 1-8-0.
13. "Mange Dressing".—A specific for all kinds of Mange. Price per big bottle Rs. 3. Small bottle Rs. 1-8-0.
14. "Carbolin".—Best healing dressing to dry up all kinds of wounds. Price per 4 oz bottle Rs. 2.
15. "Worm Mixture for Dogs".—A unique preparation to remove all kinds of worms from the system. Price per bottle (8 to 16 doses) Rs. 2.

D. Pangal's VETERINARY INSTITUTE 26, WALLAJAH ROAD, MADRAS-2.

When writing to advertisers, please mention *The Indian Veterinary Journal*.

Burdizzo Castrators with Patent Cord-Stop at Jaws.



Beware of Imitation.

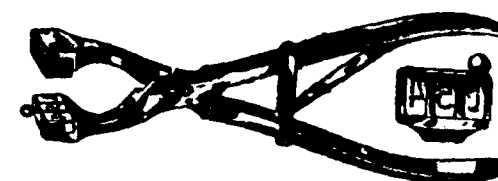
Do not be misled by spurious makes.

Dr. Burdizzo's Bloodless Castrator for the Castration of Bulls, Horses, Sheep, Dogs, Pigs etc., is the only Castrator guaranteed to be of perfect manufacture, built up to a standard not known to price.



Burdizzo Tattooing Forceps.

Official Marker of many Cattle Breeding, Sheep Breeding and Horse Breeding Farms and Cow Testing Associations. With Interchangeable letters and Numbers for marking Cattle, Sheep, etc.



Nickel-plated, three space : in tin box. The usual set consists of a 3 space forceps, 2 sets of Figures, complete Alphabets, and Tattooing ink.

New consignment just arrived.

Further particulars on request from the
Representatives and Distributors:—

Dr. PANGAL'S VETERINARY INSTITUTE

26, Wallajah Road, MADRAS 2, (S. India).

When writing to advertisers, please mention *The Indian Veterinary Journal*.



Antihistamine therapy in veterinary practice

While the mechanism of allergy and anaphylaxis is not fully understood, it is known that in these states there is frequently an excessive liberation of histamine in certain tissues, and that this substance is responsible in many cases for the symptoms of the conditions.

'Anthisan' brand mepyramine maleate and 'Phenergan' brand promethazine hydrochloride protect vulnerable tissues from the effects of histamine overactivity, and thus produce relief.

A high proportion of satisfactory results from the use of these antihistaminics is regularly obtained in

serum sickness and anaphylactic shock, allergic skin conditions including urticaria, acute and chronic eczematous conditions, laminitis, especially the nutritional type and that associated with pregnancy, simple acne, bee-stings, insect bites, acute septic metritis in cows (in conjunction with normal antibacterial measures), retained placenta.

***'ANTHISAN'** brand mepyramine maleate

5 per cent. solution Boxes of 10 x 10 c.c. ampoules



***'PHENERGAN'** brand
promethazine hydrochloride

5 per cent. solution Boxes of 10 x 5 c.c. ampoules

★ trade mark

manufactured by

MAY & BAKER LTD

distributors

MAY & BAKER (INDIA) LTD., BOMBAY - CALCUTTA - MADRAS - NEW DELHI - LUCKNOW - GAUHATI

Printed by T. Kannabiran, at The Paramount Press, (Proprietors: Jaya & Co.,) High Road,
Triplicane and published by Dr. P. Srinivasa Rao, G.M.V.C., Editor,
The Indian Veterinary Journal, 26, Wallajah Road, Madras 2