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OF

THE SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION

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G. M. Horne, 61, Simmonds St., Johannesburg.

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CONTENTS.

EDITORIAL.

IN this number of the Journal many interesting papers are presented dealing with some of the obscure diseases of sheep. It has been shown that several of them are often responsible for enormous annual losses. The majority of these diseases seem to be intimately associated with the veld, e.g. Geilsiekte, Waterpens, Dikkopsiekte, Domsiekte, Enzootic Icterus, etc. Vegetable poisoning in its various phases is becoming more acute, probably due to the increasing system of overstocking, prolonged drought, and more intensive methods of farming. Certain forms of vegetable poisoning in stock are undoubtedly governed to a large extent by climatic, and probably also by telluric conditions, and in virtue of this, the study of these diseases becomes exceedingly complicated.

Various phases of this problem have been, and are being investigated in the Union, but the necessity for more extensive field observations and experiments is felt, especially in regard to the aetiology of these diseases. It has been shown that some forms of subcutaneous oedema and skin lesions seen here, undoubtedly occur in Australia, and probably also in some of the other subtropical countries. South Africa with its well-equipped Veterinary Laboratories and field organisations, offers in this important field a splendid opportunity for intensive research work. In this respect it ought to form an important centre in the proposed chain of tropical and subtropical stations recently considered by the Imperial Agricultural Research Conference.

In the case of Poultry Husbandry, such diseases as Bacillary White Diarrhoea and Neuro-lymphomatosis (Fowl-paralysis), are also referred to in this Journal. In view of the recent high state of development of the Poultry Industry in the Union, the incidence of disease seems to have become more prominent. Veterinarians here are beginning to realise that poultry diseases should engage the attention, not only of the Research Worker, but also of the Field Officer to a greater extent in the future than has been the case in the past. Furthermore, ways and means of disease control should be introduced, more or less similar to those which safeguard the other branches of animal husbandry in South Africa.

THE ASSOCIATION.

SOUTH AFRICAN VETERINARY MEDICAL ASSOCIATION.

Membership of the S.A.V.M.A., formed in 1920 as a result of the amalgamation of the Natal, Cape and Transvaal bodies, is open to any veterinary surgeon (a) whose qualifications are deemed satisfactory by the Council and (b) who, as a result of ballot, receives four-fifths of the votes of the members and Honorary Life Vice-Presidents present. **The annual subscription is one guinea (£1 1s. 0d.), which is due in advance on 1st June of each year.**

Members are expected to inform the Secretary (A. C. Kirkpatrick, Esq., M.R.C.V.S., Box 1620, Johannesburg) of any change of address.

PAST AND PRESENT OFFICERS.

Past Presidents.

Major R. Eustace Montgomery 1920-21.

Col. Jas. Irvine Smith 1921-24.

Dr. P.J. du Toit 1924-28.

Past Hon. Secretary.

A. C. Kirkpatrick 1920-28.

Past Hon. Treasurer.

Col. J.G. Bush 1920-28.

YEAR 1928-29.

President.

Dr. P. J. du Toit.

Hon. Secretary.

A. C. Kirkpatrick.

(Box 1620, Johannesburg).

Hon. Treasurer.

Dr. J. B. Quinlan.

(During Dr. Quinlan's absence in Europe Dr. H. H. Curson is deputising).

Although the Rules provide for a Vice-President, one was not elected this year.

Members of Council.

Messrs. Bush, Chalmers, Curson, de Kock, Garraway, Goodall, Mitchell, Power and Spreull.

Status of Profession Committee.

Messrs P. J. du Toit, Chalmers, Fourie, Goodall, Johnston, Kirkpatrick, Quin and P. R. Viljoen.

Parliamentary Committee.

Messrs. P. J. du Toit, de Kock, Goodall, Kirkpatrick and Spreull.

Financial Committee.

Messrs. P. J. du Toit, Curson and de Kock.

Editorial Committee.

Messrs. Curson, de Kock, Goodall and Kirkpatrick.

Bankers.

The Standard Bank of S. Africa, Church Square, Pretoria.

JOURNAL.

The Journal of the South African Veterinary Medical Association is owned by the S.A.V.M.A., which body is entirely responsible for control. At present are published mainly addresses delivered at the Spring General Meeting which usually takes the form of a scientific gathering. An editorial Committee, appointed by the Council of the Association and approved of at a General Meeting, is responsible for publication.

A copy of each issue is posted to every Honorary Associate, Honorary Life Vice-President and Member, with the exception of those Members who have not paid their annual subscription for three years. Contributors receive free of charge 25 reprints, but an additional number can be supplied at cost price provided members apply on submitting a communication. The price of a single copy is 5/- post free.

Communications.

Communications should be complete and concisely written, preferably typewritten, and full details supplied as to photographs, figures and references. References should be given thus : (a) In text, merely the name of the author, followed, in brackets, by the year of publication, e.g., " The cause of Gousiekte in sheep was definitely established by Theiler, du Toit, and Mitchell (1924) twelve years ago."

(b) In the concluding section of References or Bibliography, the above citation would be placed **in alphabetical order** thus :—

THEILER, A., DU TOIT, P.J., and MITCHELL, D. T., (1924). Gousiekte in Sheep. *9th and 10th Rpts. Dir. Vet. Educ. Res.* 9. U.S. Africa.

In print the above references would appear as follows :—Authors and initials in capital letters, year of publication within brackets, title of paper in small type, name of report in italics, page in Arabic numerals, and country in small print.

Where a periodical is cited, the number of the volume in Roman characters, with the page in Arabic numerals suffices. If a textbook is quoted, it would appear italicised and the name of publishers and town of publishing added, e.g.:—

QUIN, J. I. (1927). The Toxicity of Ornithogalum saundersiae. *S. African Jl. Sc.* XXIV. 431.

KNUTH, P., and DU TOIT, P. J., (1921). *Meuse's Handbuch der Tropen Krankheiten.* Tropen-Krankheiten der Haustiere. VI. 196. Johann Ambrosius Barth., Leipzig.

Abbreviations, as indicated below, should be adopted where possilbe:
Abt. Acad. Adv. Agr. Amer. Anat. Ann. Appl.
Bact. Biol. Brit. Bull. Bur. Bijdr.
Centralbl. Ch. Chem. Chirug. Clin. Coll. Comp.
Dept. Deut. Dierk. Dir. Dis. Diss. Div.
Educ. Embry. Entom. Exot. Expt.
Forsch.
Gaz. Gen. Geneesk. Gesell. Govt.
Haem. Haust. Helminth. Hist. Hyg.
Ibid. Immun. Inaug. Ind. Infek. Inst.
Jl.
Klin. Königr. Krankh.
Lab.

Mag. Med. Mem. Micro. Min. Mitt. Monatsch. Mycol.
Nat. Nederl.
Orig.
Parasit. Path. Pharm. Phil. Phys. Prakt. Publ.
Quart.
Rec. Ref. Rend. Res. Rev. Revist. Roy. Rpt.
San. Sc. Sch. Serol. Serv. Soc. Supt. Surg.
Therap. Tierärz. Tierheilk. Trans. Trop. Tijdsch.
Univ.
Verhdl. Vergel. Vet.
Wissen. Wochensch.
Zeitsch. Zool.

It may be accepted as a rule that initials are used only geographically, e.g. N.Z., U.S.A., N.S.W., &c. When applied to the names of journals e.g. B.M.J. (Brit. Med. Jl.) or designations of officials e.g. D.V.S. (Dir. Vet. Serv.) difficulty in interpretation may be experienced by workers in foreign countries.

AUTUMN GENERAL MEETING.

The Autumn General Meeting was held in the Committee Room of the Witwatersrand Agricultural Society (Show Grounds) Johannesburg on 5th April, 1928, at 2 p.m., the President occupying the chair, and 19 members being present.

At this purely business gathering, the following matters were dealt with :—(a) The Minutes of the Spring General Meeting held at Pretoria (18/8/27) were confirmed. (b) The names of the office-bearers for the year 1928-29 were announced. (c) Affiliation wtih the National Veterinary Medical Association was agreed to. (c) A donation of fifty pounds (£50) to the Royal Veterinary College, London, Rebuilding Fund was sanctioned. (e) A Status of Profession Committee was appointed. (f) Sir Arnold Theiler and Mr. Borthwick were elected Honorary Life Vice-Presidents. (g) Messrs. R. du Toit, Franz, Peddie, Ryksen, Stonier, and Miss Morice were elected Members, and (h) Rule 8 was revised by the addition of the following :—

> "Any Member three years in arrears with his annual subscription shall receive from the Treasurer a letter sent by Registered Post requesting payment before the next Annual General Meeting, and if such Member does not pay before such Meeting or give a reasonable excuse to the satisfaction of the Council, his name be removed from the Membership list. No Member so removed from the list shall be reinstated until his arrears have been paid."

SPRING GENERAL MEETING.

The Spring General Meeting was held at the T.U.C. Extra-Mural Buildings, Pretoria, on 24th July, 1928, which is earlier than usual; but this opportunity was taken owing to the fact that many members were present in Pretoria at the same time for the first triennial Inter-divisional Conference of the Department of Agriculture. The President was in the chair and 55 members were present.

The following business was dealt with :—(a) The Minutes of the Autum General Meeting held at Johannesburg (5/4/28) were passed. (b) It was agreed that Hon. Life Vice-Presidents do not pay subscriptions, and this to apply retrospectively. (c) The resignation of Mr. J. I. Edgar was accepted. (d) Remuneration for Clerical assistants to Hon. Secretary and Hon. Treasurer was laid down (for the next six months) at the rate of £15/15/- and £10/10/- per annum respectively. (e) The names of Messrs. Fourie and Quin were added to the Status of Profession Committee. (f) Rule 15(e) was revised by the deletion of the words " without nomination, and their names shall appear on the voting paper in the event of an election being held." (g) An honorarium was voted to Col. J. G. Bush, who was Hon. Treasurer not only to the S.A.V.M.A. for the period 1920-28, but also to the Transvaal body from 1914-20, having succeeded the late Mr. J. M. Christy. (Prior to this (1908-14) Col. Bush was Secretary of the T.V.M.A.). (h) A Financial Committee was appointed. (i) It was agreed to send a letter of condolence to the mother of Professor Kehoe, whose death on 6/5/28 at Dublin is much lamented. (j) A sum not exceeding £100 was sanctioned for the next issue of the Journal of the S.A.V.M.A., which should be edited by the Committee appointed for the previous year. (Dr. Curson's name has been subsequently added by Editorial Committee). (k) Sir Francis Duck, K.C.B., and Sir Frederick Smith, K.C.M.G., were elected Hon. Associates. (1) Dr. Kind and Messrs. Sterne and N. F. Viljoen were elected members; (m) the Financial Statement for the period 1st June 1927—31st May 1928, was presented and approved. A sum of £1,000 is on fixed deposit at the Standard Bank Pretoria, while the current account is £169/19/11. (On 7/8/28 a sum of £100 was invested in Union Loan Certificates). (n) The President explained the position with regard to the Veterinary Bill. He intimated that as the M.L.A. who had promised to sponsor the measure was apparently unable to do so, it was the intention of the Parliamentary Committee to seek the advice of the Minister of Agriculture. (o) Drs. de Kock and Curson gave notice of motion concerning the amending of certain rules at the next General Meeting, and (p) The name of Mr. Spreull was added to the Parliamentary Committee.

The papers read by members at the Dept. of Agriculture Conference (23rd-28th July) are published in this issue, in some cases with the addition of photographs.

We regret to note that only one " field " colleague submitted a paper, but trust for the next number that more material in the form of Clinical Articles will be forthcoming. It is essential that all sections of the profession should feel that the Journal is at their disposal. In point of fact the issue of the Agenda for the last Spring General Meeting was delayed hoping that other Government Veterinary Officers would have papers for the gathering.

PROFESSIONAL COMMENTS.

Mr. H. Graf who has been deputising for Dr. Green since August 1927, was appointed a Lecturer in the Faculty of Veterinary Science (T.U.C.) in February last.

Dr. de Kock is to be congratulated on obtaining the D.Sc. of the University of the Witwatersrand. His thesis was entitled " The Reticulo-endothelial System of the Sheep."

The profession is delighted at the honour accorded Sir Arnold Theiler who is the first recipient of the Laveran Gold Medal awarded by the Pasteur Institute, Paris. The presentation was made on 14th December, 1927 in Paris.

The degree of B.V.Sc. has this year been conferred on the following :—Miss Morice and Messrs. R. du Toit, Franz, Reid, Ryksen, Stonier and Sterne.

Miss J. A. Morice, our only lady graduate, has settled at Parktown North, where she hopes to establish a practice. We wish her every success.

Mr. Max Sterne has accepted an appointment with a ranching company in Katanga, Belgian Congo. He is thus the second S. African trained graduate to obtain a position outside the Union. (Mr. D. H. Lawerence, who graduated in 1926, was appointed as Research Officer in Southern Rhodesia in 1926).

Mr. N. R. Reid is at the Royal Veterinary College, London, where he hopes to obtain his M.R.C.V.S. shortly. It is likely he will enter the Colonial Service.

The following appointments in the Department of Agriculture Union of S. Africa, have been made :—

R. du Toit, V.R.O. 6/1/28.

H. G. J. Franz, G.V.O. 1/5/28.

W. J. Ryksen, G.V.O. 1/5/28.

L. Stonier, G.V.O. 1/5/28.

Mr. Grist, who came to S. Africa as a civil veterinary surgeon during the 2nd Anglo-Boer War (1899-1902) and was later Chief Veterinary Officer of the Orange River Colony, retired from the Division of Veterinary Services on 1/1/28. Since Union he has been Senior Veterinary Officer, Orange Free State, except for the last one and half years when he was Senior Veterinary Officer of the Cape Eastern Area. We are pleased to know he is remaining in this country.

Mr. Edgar, who also came to S. Africa during the 2nd Anglo-Boer War as a civil veterinary surgeon, and was later appointed Government Veterinary Officer under the Transvaal Government, left the Division of Veterinary Services on superannuation on 16/5/28. After unification, when he was transferred to the service of the Union Government, he remained at his old station Pietersburg, until two years ago when he was transferred to Port Elizabeth. May he be spared many years to enjoy his well earned pension.

The Veterinary Medical Association of Ireland propose to institute a memorial to the late Professor D. Kehoe. Will members who intend subscribing kindly send remittances (not exceeding 10/-) to the Hon. Secretary, S.A.V.M.A. who will forward these to Dublin ?

THE VETERINARY SERVICE OF THE UNION OF SOUTH AFRICA.

By Dr. P. J. du Toit, Director of Veterinary Services.

It is the duty of the State to protect farmers against the ravages of epizootic diseases amongst their domestic stock, just as much as it is to protect the human population against epidemics. This duty becomes all the more imperative in warm climates like that of South Africa, where insect-borne diseases may spread with amazing rapidity and even universal diseases like anthrax present a far greater danger to the community at large than in the colder climes of Europe and North America. The extent to which a modern State succeeds in controlling these diseases may well serve as an indication of its general efficiency.

Naturally, the State does not, and cannot, undertake to look after the health of the individual animal just as little as it concerns itself with the state of health of the individual citizen. This truth, obvious though it may seem, has to be repeated from time to time, as many farmers in South Africa have come to regard the State as the foster-mother of every animal on their farms, and to call on her for assistance whenever there is a case of illness among their herds or flocks.

Before dealing with the State Veterinary Service of South Africa, it may be well to analyse this attitude which is characteristic of so large a proportion of farmers in our country. The explanation for it is not far to seek, and will become apparent if we again compare the position as regards human health with that of the health of animals. In the case of the former, the country is well served by the members of the medical profession, who to-day number about 3,000 and are distributed over the length and breadth of the country. Even in the remotest corner of the Union the farmer whose child is taken ill will send for the nearest doctor, and will not expect the State to provide free medical attendance.

On the other hand, the entire Veterinary profession in South Africa consists of approximately 80 State veterinarians and another few dozen private practitioners and municipal employees, which latter groups are confined to the larger towns. In the country districts there are no private practitioners, and the farmer therefore cannot call in private aid in case of illness amongst his animals. Frequently the Government Veterinary Officer is within reasonable distance, and gradually the farmer has come to regard it as his right to demand the services of the State official in all such cases. Bearing in mind the peculiar condition of the country, the Government has taken up a sympathetic attitude towards this call on its officials and has attempted to render aid wherever possible. But, generally speaking, there would seem to be no more justification for State aid if an ox breaks its leg or contracts pneumonia than if the farmer himself is afflicted in this way.

It may be asked what is the farmer to do if he cannot obtain the services of a private veterinarian, even though he may be willing to pay therefor. And the answer is that the Government will probably

continue to treat all such cases sympathetically and allow its officers to assist the farmer so long as circumstances remain as at present. However, such assistance must always be regarded as quite distinct from the proper function of the State veterinarian, and should really form a charge against the farmer. Wherever the density of the animal population and the economic position of the farming community is such that a private practitioner can earn a living, the Government Veterinary Officer should be debarred from undertaking such duties in that area, although under South African conditions no rigid rules could be imposed.

Probably the ideal solution for the future in the large rural areas, where the cost of transport would render private practice impossible, would be to let the Government officers undertake ordinary veterinary work against payment, so long as it does not interfere with their duties in connection with infectious diseases, which should always have prior claim.

Alternatively, the Government might, in certain areas, pay officers a part-salary for State services and allow them to supplement their budget by means of private practice.

However, the first concern of a State Veterinary Service should always be the control of those diseases which threaten the whole or parts of the country.

In South Africa all State veterinary services come under the control of one Division of the Department of Agriculture, whose activities comprise the following:—

(*a*) The control of all important epizootic diseases, especially those enumerated in the Stock Diseases Act.

(*b*) Research work into animal diseases and general problems affecting the health of animals.

(*c*) Production of certain vaccines, sera, remedies, and other articles used in treating animal diseases.

(*d*) Advice to farmers and general propaganda work on veterinary matters.

A further function, which partly falls under the University of South Africa, is—

(*e*) The training of veterinarians—for which purpose certain officers of the Division constitute the Faculty of Veterinary Science.

It is not the purpose of this short address to analyse in detail the various functions of the Division of Veterinary Services, but merely to focus attention on certain aspects of the work and to emphasize the need for and the value of such a service.

I.—Research Work.

Let us consider in the first place the research activities of the Division and the value of this work to the country. South Africa has indeed been fortunate in the type of veterinary pioneer which it attracted from overseas. Hutcheon and his co-workers, Borthwick, Dixon, Spreull, etc., in the Cape, Watkins-Pitchford and others in Natal, and, above all, Theiler and his associates in the Transvaal, succeeded in establishing for South Africa a reputation as one of the leading countries in the field of veterinary research. These men found big problems, which they tackled in a big-hearted fashion, and the successes they achieved were often in proportion to the dimension of the task they undertook.

Probably no event brought home so clearly the necessity for research and for State veterinary control as the *rinderpest* epizootic, which spread over South Africa during the closing years of last century and killed off in the neighbourhood of two million head of cattle. Investigators from various parts of the world were invited to study the disease, and the methods then evolved here in South Africa still form the basis of present-day control of this disease. It is safe to say that the knowledge gained during those years has enabled us to keep the disease out of the country during all these intervening years, and the money spent on that research has undoubtedly been repaid a thousandfold and more.

A few years later—soon after the close of the Anglo-Boer War—*East Coast fever* invaded South Africa, and again a period of intensive research began. It was during this period that Theiler laid the foundations of a research institution which was to culminate in the present Onderstepoort Laboratory. The researches of Theiler, Gonder, Stockman, Watkins-Pitchford and others elucidated all the main facts in connection with the nature and mode of spread of East Coast fever, and all subsequent legislative measures were based on the scientific data then accumulated. If we have not been successful in the course of the last twenty-five years in completely stamping out this disease, the fault does not lie in our lack of knowledge, but in the almost insuperable practical difficulties attending the measures of eradication. Nevertheless, sight should not be lost of the fact that, in the case of this disease too, the direct result of research work has been a saving of enormous sums to the country. What the position of the beef and dairy industries would have been to-day if the disease had never been investigated, it is difficult to estimate. Only ignorance of the true facts can explain the statements which are still sometimes made, that it would be better to remove all restrictions and let the disease run its course.

The history of veterinary research in South Africa during the last twenty-five years is closely associated with the name of Sir Arnold Theiler. First at Daspoort and later at Onderstepoort, he and his co-workers investigated all the important South African stock diseases. A complete review of this work would fill a volume, but a few examples may be selected to illustrate the value of this service to the country.

(1) *Blue-tongue.*—This disease has probably been present in South Africa as long as sheep farming has been practised. Investigations were begun by Theiler in 1903, and in 1907 a vaccine was issued which conferred a protection against the disease. Since that date more than 23 million doses have been issued, the annual figure reaching nearly 2½ million during the financial year 1927-28. If now we make a conservative estimate and reckon that 15 million out of the 23 million sheep were actually exposed to natural blue-tongue infection, and if we place the mortality from natural blue-tongue at the low figure of 20 per cent., we arrive at the conclusion that probably 3 million sheep have been saved during those years as a result of the preventive inoculation.

On the same conservative basis we may assume that at present at least 300,000 sheep are saved annually from certain death. If half of these are ewes, it will be seen that the saving of lambs is also very considerable.

Further, it should be remembered that blue-tongue, apart from the mortality it causes and the retarding effect it has on the sheep which recover, seriously affects the growth of the wool, so that from this point of view too a very large sum of money must be saved annually as a result of the inoculation of 2 or 2½ million sheep in blue-tongue areas.

It is probably no exaggeration to say that this discovery alone has repaid South Africa many times over the total expenditure on research.

(2) *Wireworm Infection.*—With the growth of the sheep and wool industry in South Africa, it soon became apparent that there were very serious dangers threatening this industry and that intensive research was necessary to find means of combating these dangers. One of the most serious diseases was the wireworm infection of sheep. The research work, especially of *Green* on the biochemical and of *Veglia* on the helminthological side, was crowned with success, and in 1917 a remedy was placed on the market which gave eminently satisfactory results. This so-called "Government Wireworm Remedy" soon became generally known, and during the eleven years since its introduction no less than 107 million doses have been issued. Last season the sale of this remedy reached the amazing figure of 23,704,000 doses.

It is difficult to estimate with any degree of accuracy the saving to the country due to this treatment. When we take into consideration the serious losses from this disease which sheep farmers suffered prior to the discovery of this remedy, and the losses which occur in other countries to this day, it is safe to say that the benefit to South Africa may be calculated in hundreds of thousands, if not millions, of pounds annually. In many parts of the country profitable sheep farming would be impossible without this remedy.

The results of the research work on the other worm parasites of sheep, which is still proceeding, have not been so spectacular, nor are their benefits so easily demonstrable as in the case of the wireworm, but nevertheless the masses of data obtained have been of great value and have enabled us to make recommendations which have reduced the losses from those parasites very considerably.

(3) *Anthrax.*—Although this disease is of world-wide occurrence, the conditions prevailing in South Africa are such that much research was needed to place its control on a satisfactory basis. At first vaccines were imported from Europe, but, owing to the distance the vaccine had to be transported, the local conditions under which it had to be applied, and other factors, the results were not altogether satisfactory. In 1915 a beginning was made to manufacture vaccine at Onderstepoort, and the demand for this vaccine has steadily increased. Altogether over 17 million doses have been issued, the annual demand during the last five years varying between 2 and 2½ million doses.

There are few animal diseases where the need for State control is so great as in the case of anthrax. In the first place it should be remembered that anthrax in a warm country like South Africa is a much more dangerous disease than in the colder European countries. In these latter countries the disease always appears sporadically and, even if no precautions were taken, it would probably never assume alarming proportions, whereas in South Africa it would spread like any other epizootic and would work havoc amongst the stock and cause serious mortality among the human beings.

In the case of anthrax, it is again very difficult to calculate the benefit to the country of research and State control, but, in view of the fact that the disease is almost invariably fatal, the direct saving of animal life must be very considerable. The vast majority of the 2 to 2½ million animals vaccinated annually are exposed to infection, and if we assume that only a quarter of them would actually have contracted the disease had they not been immunized, we arrive at a saving of half a million animals annually.

The fact, too, that anthrax is communicable to human beings and that the disease in the human subject is of a very grave nature, renders State control all the more imperative and the value of the campaign all the greater.

But, apart from the direct saving of human and animal life, the campaign against anthrax is of great economic value to the animal industry of the country. The Health Section of the League of Nations and other international bodies are keeping a very watchful eye on those countries where anthrax is prevalent. If the position in any such country should be regarded as unsatisafctory, the sterilization of wool, hides, and other products for export may be demanded. Now, in South Africa, the annual wool clip is in the neighbourhood of 200,000,000 lb., and if sterilization should only add one penny per lb. to the cost of production the total loss to the country, if this measure had to be enforced, would be nearly a million pounds sterling per annum.

(4) *Anaplasmosis.*—One of the most serious diseases of cattle in South Africa is true gall-sickness due to *Anaplasma marginale.* It is prevalent in some of the best cattle districts of the Union and greatly impedes the progress of the industry.

In 1911 Theiler made the discovery that there were two types of parasites causing the disease. *Anaplasma centrale* produces a mild attack of gall-sickness which renders the animals immune against the more virulent form of the disease due to *Anaplasma marginale.* Blood containing the former parasite was accordingly used as a vaccine, and since 1911 about a quarter of a million doses have been issued, the annual amount varying between about 10,000 and 30,000. These figures are not as imposing as in the case of some of the other vaccines, but when it is considered that this vaccine is chiefly used for the protection of better class stock which are introduced into gall-sickness areas, its value to the cattle industry must have been very considerable. In the general campaign for the improvement of our breeds of cattle this vaccine is indispensable.

(5) *Horse-sickness.*—The parlous state of the horse industry in South Africa to-day must partly be ascribed to the prevalence of horse-sickness. Much time and energy have been devoted to the study of this disease, the main object being to find a satisfactory method of immunization. The immunization of mules has been eminently satisfactory, and since 1903 many thousands of mules have been immunized with excellent results. It has been stated that, if Onderstepoort had achieved nothing else than the immunization of mules against horse-sickness, it would have justified its existence.

In the case of horses the method has not been so successful, it being much more difficult to immunize a horse than a mule. Nevertheless, during the last ten years, thousands of horses have been immunized, and this has proved a great blessing to farmers in those areas where susceptible horses almost invariably die of horse-sickness.

(6) *Lamsiekte.*—This disease is known to have existed in South Africa 150 years ago, and the losses for which it was responsible must have been very great indeed. In many parts of the country cattle breeding became practically impossible on account of this mysterious disease.

For 35 years and more research work was done in connection with lamsiekte, and in 1919 the solution was found.

At that time the position of the cattle industry in Bechuanaland, where the disease had been particularly bad, was most precarious. Many farmers had given up cattle farming altogether, and the value of land had sunk almost to zero.

The result of the discovery of the cause of lamsiekte and of successful measures for its control soon altered this state of affairs. Farmers again acquired cattle, and in the space of less than ten years Bechuanaland emerged from a state of virtual bankruptcy, as far as cattle farming was concerned, and became one of the chief milk-producing areas in South Africa.

It is no exaggeration to say that the research work on lamsiekte carried out at Armoedsvlakte has been the salvation of large portions of South Africa, and that its value to the country must again be reckoned in hundreds of thousands, if not millions, of pounds.

(7) *Animal Nutrition.*—One of the measures recommended to prevent lamsiekte was the feeding of bone-meal in order to supply the deficient phosphorus to the animals. The investigations into this and allied matters brought to light a mass of most interesting and valuable information on the mineral requirements of animals. It was found that the addition of a small quantity of phosphorus (for instance, in the form of bone-meal) to the daily ration of an animal not only corrected its perverted appetite for rotten bones, but led to a most remarkable rate of increase in body-weight when compared with animals similarly treated but receiving no phosphorus. Indeed, it may be said that this discovery revolutionized the beef industry on the luxuriant but phosphorus deficient veld of Bechuanaland and other parts.

A further development of this work has been an investigation into the possibility of rearing pure breeds of cattle on the deficient pastures of our country. The experiments will continue for several years, but already it may be stated that the results have been most valuable. The differences between groups of animals receiving bone-meal and others receiving no bone-meal as regards weight, body structure, health, fertility, etc., have been most startling.

These investigations open up a completely new vista for the cattle industry in South Africa.

The above illustrations may serve to show that the money which has been spent on research in South Africa has been a sound investment which has yielded handsome dividends. There can be no doubt that South Africa would have been a poorer country to-day if there had been no veterinary research. There has at times been adverse criticism in regard to the amount of money spent on research, but the above figures prove that that criticism was ill-founded and short-sighted. The Government of South Africa has displayed a wise and far-sighted policy in fostering its research institutions, and it has been equally wise in the way it has given the heads of those institutions a free hand in the direction of research. Nothing would kill the spirit of scientific research sooner than an attempt to limit its activities to so-called

economic issues. All " applied " science is founded on the principles of " pure " science, and all true research must begin at the basic problems. For instance, if an attempt is to be made to discover a method of immunization against any particular disease, it would be necessary to study, on the one hand, the cause of the disease in all its aspects and, on the other hand, the basic problems of immunity, even though such study might, to the uninitiated, appear academic. The reason why Onderstepoort has been so successful in its investigation of animal diseases is that this spirit of true scientific research was never lost.

But let us turn for a moment to the actual cost of veterinary research in the Union of South Africa. The total annual expenditure on the research section of the Veterinary Division has, for some years past, been in the neighbourhood of £90,000, of which approximately half represents salaries. But the activities of the Research Division are by no means confined to research. In broad outline these activities may be said to include (1) research, (2) vaccine production, (3) free services to farmers, and (4) veterinary education.

Naturally, it is not easy to allocate the proportionate amounts of the total expenditure, but approximately the sub-division amongst these four headings works out as follows:—

(1) Research	£40,000
(2) Vaccine production	25,000
(3) Free services	18,500
(4) Veterinary education	6,500

It would be a bold critic who would maintain that South Africa was not getting its £40,000 worth per annum out of veterinary research.

The other items mentioned here may also be considered briefly.

The production and dispatch of all the *vaccines, sera, and other substances* issued by Onderstepoort costs the country about £25,000 per annum. About the same amount is obtained from the sale of these products, so that in reality it costs the taxpayer nothing to supply the farmer with vaccines. But this does not give quite a true picture of the position. Only some of the vaccines are charged for—in the majority of cases considerably below their market value, while others, notably anthrax vaccines, are issued entirely free of charge. This means that the potential revenue from this source is considerably higher than £25,000; as a matter of fact, a fairly conservative estimate shows that, if all laboratory products were sold at ordinary commercial prices, the annual income of the Institution would be at least £90,000. In other words, the Veterinary Research Institute at Onderstepoort could probably be made to yield a profit if it were run on commercial lines.

It is not suggested for one moment that such an attempt should be made. To issue vaccines at or below cost price, or entirely free, is a sound policy which need not be defended here. The above figures are merely quoted to show that the expenditure on the Veterinary Research Laboratory is a thoroughly economical investment.

Free services to farmers include the examination of blood-smears and pathological specimens, the analysis of dips and poisonous substances, the giving of advice on all veterinary matters, and so forth.

In South Africa, where blood diseases play so important a rôle, the examination of blood-smears is a most important service, without

which the campaign against East Coast fever, anthrax, and some other diseases would become impossible. Hence farmers are continually urged to send in smears from all animals which die on their farms or show signs of illness.

As a result of propaganda work, the number of smears submitted for examination has increased enormously during the last few years, and has imposed a severe strain on the examining officers. Last year over 100,000 smears were examined and reported on. What this means can only be appreciated by those who have actually taken part in the work.

In human pathology, where the examination of blood-smears and other specimens is also frequently necessary, a substantial fee is usually charged for this work, whereas in the case of animal diseases the entire diagnostic service is undertaken free of charge.

II.—Field Work.

The work of the entire field staff which is engaged on the control of animal diseases, and the general administration of the Stock Diseases Act, may also be regarded as a free service to the farming community. Dr. Viljoen will deal more fully with this aspect of our work in a separate paper, but a few general remarks on the value of this service may be included here.

This service costs the State over £300,000 annually, and it may be asked whether the country gets an adequate return for this expenditure. In order to answer this question, it would be necessary to try and picture what the state of the country would be, from the point of view of animal diseases, if this service were withdrawn. The first result would undoubtedly be that East Coast fever would sweep over the greater part of South Africa, and would probably become so firmly established that it would never be eradicated again. We should then have a state of affairs comparable with that existing in several of the other African territories to-day. The effect on the beef and dairy industries would be ruinous.

The same position would arise in the sheep industry. Scab, anthrax, and other diseases would spread unchecked and would soon show their effects on the sheep and wool industries. Pig diseases, over which a constant watch is now kept, would appear everywhere and spread over the country; and in the poultry industry the many diseases which threaten our birds would soon work havoc.

Other diseases, such as the insidious and deadly glanders, which has practically been eradicated from South Africa, would immediately flare up again and threaten not only the horse industry, but man himself. Epizootic lymphangitis would reappear and mange would become a serious menace to our horse population.

Furthermore, those diseases we have succeeded in keeping out of the country so far would, without the slightest doubt, invade our shores and threaten our live stock industry. All those who witnessed the rinderpest invasion of 1896 will appreciate the service rendered to South Africa by the Veterinary Division in keeping this dreaded disease out of the country. To-day an invasion would be very much worse than thirty years ago, in view of our larger and far more valuable cattle population. The same remarks apply to lung-sickness, which was eradicated from South Africa some fifteen years ago, and has been kept out ever since. Its reintroduction would be in the nature of a national calamity.

Another disease which would spell disaster if it were introduced, and which has been kept out of South Africa solely through the vigilance of the veterinary staff, is foot-and-mouth disease. This disease has cost England several million pounds during the last few years, and there is no reason to think that its suppression and eradication would prove a lighter task in this country.

We all hope that progress in the control and eradication of diseases, especially East Coast fever and scab, will enable us to reduce our expenditure on veterinary field work in the future. However, under present conditions an attempt to save on this vote would be short-sighted in the extreme. And even if these two diseases should be stamped out completely a strong veterinary staff would still be necessary to protect the country against the many diseases mentioned above which constantly threaten our stock.

South Africa is not an El Dorado for stock farming. Even the successful farmer often comes perilously near the brink of failure. If the safeguard which the Veterinary Service of the State now ensures be removed, his position would soon become unbearable.

III.—Veterinary Education.

In conclusion, a few words may be said about the third great function of the Division of Veterinary Services in its capacity as Faculty of Veterinary Science, namely, the training of veterinarians for State service.

Ten years ago the Government appointed a commission to inquire into the advisability of establishing a veterinary faculty in South Africa. At that time grave doubts were expressed on many sides about the wisdom of such a step. To-day we know that the faculty has been a success, and we feel confident that the country will reap the benefit of its existence more and more.

The idea on which the faculty at Onderstepoort was founded, namely, the close association between research and teaching, has proved to be sound. As a result of this association the standard of teaching has been maintained at a high level, and many of the students at the completion of the course have proved themselves to be capable of independent research or field administrative work. It is a fine testimony to the work of the faculty in the early years of its existence that from amongst the first graduates several have been selected for apointment in the faculty from which they had just graduated. These men have fully justified their appointment and would be a credit to any veterinary faculty in the world.

The foregoing pages may serve to show that the task of the Division of Veterinary Services is large and arduous. The duties devolving on the officers of the Division are invariably of a very exacting nature. Frequently the officers, especially those in the field, have to enforce regulations, the significance of which is not quite understood by the general public, and the result of it is that the officers become very unpopular.

However, these disadvantages are outweighed by the conviction that the task is a noble one, and that the service is essential to the stock industry upon the success of which the prosperity of South Africa must ultimately depend.

STATE CONTROL OF STOCK DISEASES.

By Dr. P. R. Viljoen, Deputy-Director of Veterinary Services.

In the ordinary sense State control of disease entails prohibitive, suppressive, and eradicative measures in respect of certain infectious diseases that constitute a danger to the country. In South Africa the State does very much more than this, but with the time at our disposal, it is not possible for Dr. Du Toit and myself to discuss all the different activities of the State Veterinary Services of this country.

When considering State control of disease we must never forget the fundamental laws and principles on which civilized communities have been established. I refer particularly to the world-wide sense of freedom and security enjoyed by civilized countries and individuals in those countries. Every individual must have a sense of freedom in his normal habit of life and actions, and must feel secure in, and master of, his own property.

Generally speaking, the State does not and must not interfere with the liberty or property of its citizens. It is only when the actions of the individual—through ignorance or carelessness or wilfulness—constitute a danger to his fellow-citizens or to the country as a whole, that the State must interfere and lay down laws and regulations for the purpose of controlling or preventing such actions.

In the case of animal diseases the same rule applies, namely, that if every owner carried out his duties in so far as the control and eradication of infectious diseases were concerned, there would be no need for interference and for the numerous regulations now in existence. The human race is, however, very imperfect, with the result that in every community are found persons who are careless in their actions, show wilful disregard of all accepted principles, and are " up agin the Government " of the day. To protect the public against such persons, legislative measures are necessary.

Quite apart from this, there are certain dangerous diseases which spread rapidly, and create such tremendous losses and are of such great economic importance, that efforts at eradication by individuals are of very little use. In such cases it becomes a national matter, and the State must step in to save the community at large.

State interference or assistance is indicated in the following cases:—

(*a*) When the disease is of a highly infectious nature and through its rapid spread constitutes a danger to the whole country. In such cases the individual owner is in a helpless position, and can do nothing. The State must step in, and by well organized effort stem the tide. As an example may be quoted such a highly infectious and dangerous disease as rinderpest.

(*b*) To protect the public against infectious diseases which are transmissible from animals to man. In these cases the State *must* assume control in the interests of its own

citizens. To make the point clear, I need only mention such diseases as anthrax, glanders, rabies, foot-and-mouth disease, and tuberculosis.

(*c*) When the disease, although not highly infectious or dangerous, may result in great economic loss to the community. Such a disease is *scab* in sheep, which does not spread rapidly from one place to another, but which nevertheless can have the greatest economic effects on the country. *Scab* has cost this country thousands, perhaps millions, of pounds, but when we look at the sheep industry to-day we can say, without hesitation, that this money has been well spent.

(*d*) The State alone is in the position to control *movements* of stock. This it can do by interfering with the liberty of the subject, i.e. by laying down certain rules and regulations. Generally speaking, we can say that most diseases are carried from one place to another by the susceptible animals themselves, and hence on the outbreak of disease one of the first measures taken by the State is to prohibit or control movement of the stock concerned. An owner of stock can—quite innocently or wilfully—move or sell stock infected with disease, and in this way be responsible for the spread of disease far and wide.

(*e*) Lastly, the State alone can prohibit or control the importation of stock from other countries. How this is carried out and with what results will be discussed later.

The examples given here should be sufficient to show the necessity of State control in certain cases.

History of State Control.—Even the old Greeks and Romans adopted some measure of State control over certain stock diseases; for instance, isolation of sick animals, prohibition of common grazing for sick and healthy animals, slaughter and burning of infected animals, etc. At that time, and for many centuries later, it was, however, not possible to base any measures of control on scientific knowledge. Even during the eighteenth century people in Europe were groping in the dark but, owing to the ravages of rinderpest, clamoured for State assistance. The Governments of those days were in a helpless position, because nobody had any special knowledge of stock diseases. This led up to the establishment of veterinary schools, the first of which was started at Lyons in 1761.

Even with facilities for veterinary training in different parts of Europe, no real progress was made in the control of animal diseases for more than 100 years, not until towards the end of the nineteenth century, when certain important discoveries in connection with the biology of living organisms or microbes had been made and scientific knowledge of disease thereafter advanced enormously. It was only then that legislative measures could be based on proper scientific knowledge.

Time does not permit to discuss, even briefly, the early history of veterinary legislation in other parts of the world, but with your permission, I should like to mention a few interesting episodes in our own history.

As long ago as 1693, *scab* was heard of in South Africa. Simon v. d. Stel then issued a proclamation dealing with this disease. The measures taken were drastic, namely:—

(*a*) Compulsory notification of the existence of scab to the landdrost, on pain of a heavy fine.
(*b*) *Slaughter* of infected animals.

The first legislative measure in connection with stock diseases was passed by the Cape Legislative Assembly in 1844, and this was to control *glanders* in horses and to prevent human beings becoming infected. Provision was made—

(*a*) to prohibit the use of infected horses for threshing wheat;
(*b*) to isolate such animals; and
(*c*) to destroy infected horses if found unattended on public roads.

In *1853 lung-sickness* broke out in the Cape, and legislative measures were passed to deal with it.

During the following year we find that lung-sickness was threatening the Transvaal, and General Pretorius issued a proclamation—

(*a*) prohibiting the entry of cattle over the Vaal River from the South, excepting after 40 days' quarantine;
(*b*) slaughter of infected herds.

In spite of these precautions the disease entered the Transvaal soon after.

During the years 1865 and 1866 rinderpest played havoc among cattle in Europe, and consequently we find that in *1865* our first legislative measure dealing with the *importation* of animals from Europe was introduced. By this law the importation of cattle into the Cape from Europe was totally prohibited. In 1868 a new law was passed giving the Governor the following powers:—

(*a*) To proclaim any country from which the importation of animals was prohibited.
(*b*) To allow importation under the condition that the animals were quarantined on *Robben Island*, or another place, for three months. If after that period the animals remained healthy, they could be brought to the mainland under certain conditions.

In 1870—it is interesting to record—the Volksraad of the Transvaal passed its first piece of legislation in connection with stock diseases, and that was in connection with *lung-sickness*. In spite of the absence of technical advice, the provisions of this Act were quite sound.

Much is to be learnt from the numerous legislative measures passed by the different South African States during the nineteenth century, but time does not permit of further reference being made to the historical aspect. I must, however, mention the following outstanding facts:—

(1) Scab in sheep received a tremendous lot of attention, especially in the Cape. It would seem to have played a great part in shaping politics at different times.

(2) The period 1896-97 was an extremely interesting one, although trying to the different South African Governments. During those years rinderpest played havoc among cattle, and thousands of pounds were spent in eradicative and control measures by the different South African States.

(3) The period 1902-10 produced numerous legislative measures in connection with East Coast fever, a disease which unfortunately is still with us.

Diseases controlled by the State.—I shall mention first those which come under State control *all over the world.* They are:—Rinderpest, foot-and-mouth disease, lung-sickness, rabies, sheep-pox, anthrax, glanders, sheep scab, and swine fever. South Africa is supposed to be overrun with *dangerous stock diseases,* but you will probably be greatly surprised to hear that of the above-mentioned dangerous diseases we *have still to contend with only three*, namely, *anthrax, glanders,* and *sheep scab.* All the others have been here at different times, but have been eradicated completely. It must be admitted, therefore, that the Veterinary Services of this country have achieved something!

Of the three remaining ones, glanders is only rarely seen, and would have been eradicated if it had not been for the disorganization resulting from the last war. Anthrax is under good control, while scab is on its last legs.

Apart from these diseases (which come under State control in all parts of the world) we have in South Africa the following:—

(*a*) *East Coast fever*—to be discussed later.
(*b*) *Epizootic lymphangitis,* a disease of equines which is now practically extinct and requires no serious attention.
(*c*) *Mange in equines,* which is still prevalent, especially in native territories, but which is not of great economic value.
(*d*) *Tuberculosis,* less prevalent here than in other parts of the world, but which requires urgent attention.
(*e*) *Trypanosomiasis*—in the form of Nagana—which is restricted to parts of Zululand.
(*f*) *Sheep-pox,* swine erysipelas and ulcerative lymphangitis, which are all absent from the Union.

It will be seen, therefore, that so far as State-controlled diseases are concerned, we in South Africa are in a very good position, and that at present we have to deal with only *two* big problems, namely, East Coast fever and scab, and two less difficult ones, namely, anthrax and tuberculosis. I promise to say a little more about these two big problems at a later stage.

Methods adopted by the State.—Measures for state control of disease fall under two main headings, namely:—

(*a*) Those intended to keep infectious diseases out of the country; and
(*b*) those adopted for the control and eradication of diseases already in the country.

I propose discussing the first-mentioned group first.

A.—*Measures taken to keep Infectious Diseases out of the Country.*

It is hardly necessary to explain the necessity for adopting such measures—the underlying reasons are patent to everybody. It is sufficient to point out that it would be absurd for the State to spend thousands of pounds in eradicative measures if no adequate steps were taken to keep disease out of the country. These measures are therefore of the utmost importance, and to them must be ascribed the absence of many dangerous diseases from the Union of South Africa. To the casual onlooker or listener, it might appear to be a very easy matter to keep disease out of the country, for could this not be done effectively by the simple process of total prohibition of importation? The answer is no! Nowadays international trade has developed so tremendously and has such wide ramifications that importation and exportation of animals take place in practically every country of the world. For political, commercial, or diplomatic reasons it would be extremely difficult to place a total embargo on any country. Moreover, in a country like ours, fresh blood is continually required for the improvement of our local stock. The measures taken by the State are based on the following principles:—

1. *Total permanent prohibition* is exercised in respect of countries where diseases are prevalent and where proper State control cannot or is not carried out.

The following examples may be given:—

(*a*) European States do not allow importation of animals from Russia, on account of the prevalance of such diseases as rinderpest, lung-sickness, and sheep-pox.

(*b*) We have total prohibition of *dogs* from all European countries, except Great Britain and Ireland; this is on account of the existence of rabies.

(*c*) We do not allow *any animals* to come into the Union from Mozambique and all territories north thereof and north of Southern Rhodesia and South-West Africa. In other words, we have a total embargo on all animals coming from central, east, west, and north Africa. This is on account of the existence of certain dangerous diseases.

(*d*) Similarly, we have total prohibition against the importation of all animals from India and Asia.

2. *Total temporary prohibition* is exercised whenever a dangerous disease makes its appearance in a country from which importation had previously been allowed. The best example to quote is the case of Great Britain, from which the importation of cattle, sheep, and pigs was stopped last year on account of the prevalence of foot-and-mouth disease.

3. *Importation with control on the Border.*—This is allowed from countries where infectious diseases are absent or are under proper State control. We have full power under the Stock Diseases Act to impose any conditions we like, and of course the severity of the restrictions or conditions that are imposed depends entirely on the state of disease and veterinary control in the country from which the animals are to come. In order to control such importations, animals are allowed to cross our borders only at certain convenient places, which are called and proclaimed *ports of entry*. A large number of these exist at different places on our borders. It would take too long

to detail all the import regulations in respect of the different animals from different countries, and hence I shall refer only to a few outstanding examples:—

(1) Owing to the prevalence of tuberculosis in Europe and to our desire to keep this country as free from it as possible, *cattle* are allowed to come in only after they have successfully passed the tuberculin test, either immediately prior to export or after their arrival at the Union port.

(2) Owing to the prevalance of foot-and-mouth disease in Europe, cattle, sheep, goats, and pigs are allowed to come into the Union only under certain severe restrictions and safeguards, such as—

(*a*) quarantine at other end;
(*b*) certificate from the country of origin stating that they are healthy and had not been exposed to foot-and-mouth disease infection for sixty days immediately prior to removal;
(*c*) a further period of quarantine at the Union port of entry.

(3) Regarding stock in territories adjoining the Union, different regulations exist, but, briefly put, the position is as follows:—

(*a*) *Cattle* from Rhodesia, Bechuanaland, Basutoland, and Swaziland are prohibited except—

(i) pure-bred stock;
(ii) cattle for exhibition purposes;
(iii) cattle for immediate slaughter, under certain weight restrictions, or for export.

(*b*) Small stock are allowed in provided they are—

(i) free from scab;
(ii) accompanied by a declaration that they had not been exposed to infection during a period of thirty days prior to importation;
(iii) given two dippings under official supervision at the border or one dipping prior to removal by rail to the abattoirs.

Certain exceptions and differences exist, but these are the general provisions.

B.—*Control and Eradication of Disease in the Country.*

There is so much to be said about this tremendous subject that it is difficult for me, in the short time at my disposal, to know how to begin or where to end. For the purpose of fighting disease in the country the State has a vast organization, consisting of a relatively small technical staff assisted by an enormous lay staff, numbering about 800 persons. When we come to analyse the position we find that this tremendously large lay staff is employed almost exclusively in supervising measures for the control and eradication of only two diseases, namely *scab* and *East Coast fever*. These two diseases are of such great economic importance that the thousands of pounds spent annually on measures for their eradication are fully justified.

I have no hesitation in saying that South Africa could never have built up its great sheep industry if active steps had not been taken in the past for the eradication of scab. At one time the country was full of scab and our flocks had very little value, but now that the disease has practically disappeared and we see before us the tremendous improvement in our flocks, we are inclined to overlook the fact that all this progress was made possible only by the active campaign against scab.

That great progress has been made in scab eradication is clear to everybody. In some parts of the Union scab has completely disappeared, and farmers there, especially the young ones, are no longer able to recognize the disease. Taking the figures for only the last ten years, we find that the percentage of infected flocks has been reduced from 6 to 1. This 1 per cent. infected flocks includes *native* sheep and *goats*. One can safely say that in so far as the real *sheep districts* are concerned scab is a thing of the past, but its final eradication is made difficult by persons, especially *natives*, keeping a few useless animals (bastard or kaffir sheep) in which they have no real interest and which bring them practically no income. These native sheep are not properly looked after, are often kept in inaccessible places, hidden from our inspectors, and in this way the disease may remain undetected. Sooner or later the parasites will be spread, and may be carried long distances, especially by *trek* sheep.

We are, however, very hopeful and feel confident that by strenuous efforts all our difficulties will be overcome and that within a few years South Africa will be rid of this pest and of the tremendous expense involved.

In regard to expenditure, I should add that by means of the reorganization that has taken place in the Department during the past four years, the annual expenditure on scab eradication has been reduced by about £50,000.

In regard to East Coast fever, which has been with us for the past twenty-five years, a great deal can be said, but here again I must be brief.

Like scab, it is a disease which is carried from place to place almost exclusively by the infected animal. If all movement of cattle could be stopped completely and every beast accounted for, say, for two years, there would be every chance of eradicating the disease quickly, but this is hardly practicable, since farming operations would practically have to be suspended. When the disease first appeared in the country, it was hoped to regulate and control the movement of cattle in a safe manner under the so-called *permit system*, but its good effects have been and are being neutralized by illegal movements which are carried out in such a cunning way that the perpetrators are rarely brought to book. Apart from this difficulty, the efforts of our officers are further neutralized by careless or dishonest cattle owners, especially natives, who do not look after their cattle properly and do not report sickness or deaths, and when they do, only after a heavy mortality had occurred and after the infection had been there for many months. The result is that we get mysterious outbreaks of the disease in most unexpected places and on farms where it has previously been apparently completely

eradicated. To counteract these difficulties, a comparatively large staff of lay inspectors has to be employed, their main duties being—

(*a*) to keep an accurate count of cattle on the farms, a duty which many stock owners, especially natives, cannot or will not perform accurately themselves;

(*b*) to obtain blood-smears for examination from sick and dead cattle;

(*c*) to assist in dipping operations, whereby tick-life is diminished;

(*d*) to be on the look out for illegal or stray movements of cattle.

These duties appear to be so simple, and yet in practice we have the greatest difficulty in getting them carried out efficiently in any particular area!

The chief trouble is that the work is monotonous, and because this close supervision has to be continued over the same farms for at least eighteen months, it would appear to be beyond the endurance of the ordinary person. Sir Arnold Theiler put the position very aptly when he ascribed our failures to the "human element." This "human element" makes itself apparent in our inspectors, farmers, and natives, any or all of whom may at some time or other let us down very badly.

In spite of these difficulties of which I have given only a slight indication, good progress has been made in the eradication of East Coast fever, sufficiently so to inspire us with confidence in the future. We are constantly organizing in the direction of eliminating the weak points in our campaign and, as far as the "human element" is concerned, we try to minimize its evil effects by more and better supervisory work.

We have come to realize more and more the weaknesses inherent in the *dipping method* of eradicating the disease, and with the Minister's continued support, hope to be able to resort more often to *slaughtering* of all cattle on infected farms. The tremendous advantage of this method is that all cattle are removed immediately from the infected farm, and in this way not only is further spread of the infection avoided, but the infected ticks which remained on the farm would be either dead or would have cleaned themselves of infection after a period of fifteen months.

There cannot be the least doubt that the method of slaughter would be cheaper in the long run. By the present rather uncertain methods, the campaign must necessarily be a long one with a heavy annual expenditure, whereas by the slaughtering process the campaign would be cut short, with heavy expenditure for only a short period (a few years). What is strongly in favour of a slaughtering policy is the low value of our scrub cattle, in which East Coast fever usually makes its appearance. The country as a whole will certainly not suffer any loss through the destruction of such animals, while the individual owner, through the compensation he receives from the State and by cutting his expenses connected with dipping, etc., will also not be any worse off financially, although he may think so at the time.

I am perfectly convinced that the time has arrived for drastic measures to be taken and that it will repay the Union handsomely if it went all out for the eradication of East Coast fever during the next year or two.

Lastly, I wish to pay a tribute to the veterinary officer engaged in East Coast fever work. There is no officer in the Department who works under greater difficulties and who is exposed to so much criticism from both sides, i.e. from the members of the public on the one side and from his superior officers on the other. If he carries out his duties strictly and conscientiously, he annoys the farmers, and if he does not, he may be hauled over the coals by his superior officer. A district veterinary officer must possess and exercise infinite tact and patience at all times and under all sorts of conditions. Where and when he makes a success of his job, he certainly deserves well of his country.

The East Coast fever campaign is, however, not restricted to the field officer. It also extends right into our laboratories, where research officers are sometimes literally buried under "smears" sent in from the districts for the purpose of diagnosing East Coast fever. These officers have very monotonous and trying work to perform, and for this they carry away our thanks and appreciation. I mention these things, gentlemen, because we have to make a further appeal to all officers concerned with East Coast fever work to do even more than they have done in the past. That they will respond to this appeal, we need not have the least doubt.

Finally, gentlemen, I wish to give you the assurance that when these few outstanding veterinary problems have been solved, there will be more opportunity to do constructive work, to deal with the smaller disease problems, and in this way to clear the road for development of the finest sheep and cattle industry in the world.

DISEASES OF SHEEP IN RELATION TO THE PASTURE UNDER SOUTH AFRICAN CONDITIONS.

By Dr. G. de Kock, Sub-Director, Veterinary Services.

The veld plays a most important role in sheep farming, which has become one of the most valuable industries of the Union. South Africa is well adapted for sheep breeding, in spite of the fact that it is periodically faced with difficulties which at the time appear to be insurmountable. Extensive studies have been made in the improvement of the sheep and the class of wool. Much attention has been paid to breeding, improvement of the flock, etc., whereas the veld, on which the health of the sheep depends, and the mainstay of the sheep farmer, has been badly neglected. There has been an utter lack of appreciation of the nutritive requirements of the sheep.

In this respect it is intended to discuss important economic veld problems with which the South African farmer has to contend, under the following heads, viz.:—

I. *Prolonged droughts;*
II. *Poisonous plants,* which are often intimately associated with I.
III. Diseases of unknown origin, probably associated with the grazing.
IV. *Parasitism.*

Under these headings a number of data will be considered pertaining to the mortality of sheep. A brief survey will then be given of the measures to be adopted in order to remedy these conditions.

I and II. These are two immense problems on the majority of sheep farms in the Union. In connection with *drought*, the important question of *overstocking* should be considered.

Overstocking has been the cause of ruin, not only in this country, but also in Australia. One cannot deny the wisdom of the contention that the country, especially in certain parts of the Union, should never be stocked to its maximum, during seasons of plenty. It stands to reason that, if the country is stocked to its utmost during good times, there must be experienced during droughts a corresponding shortage, which, in very many instances, has been disastrous. In the Steytlerville area, and adjoining districts, a very heavy mortality in small ruminants was experienced. There had been an improvement in the pasture after the 1925 rains, and many Angora goat farmers again stocked their farms to the fullest capacity, with the result that disaster, and in some instances complete ruin, followed as soon as the 1926 drought set in. On one farm I have seen as many as 100 dying and dead Angoras from sheer *starvation.* The post-mortems were characterized by marked emaciation, anaemia, and the absence of adipose tissue in the body. There was practically no grazing, and the sufferer survived for a time on its own fat. The adipose tissue being replaced by a fluid-like substance, caused in the sockets of

the eyeball (which lies in a mass of fat) an extensive intraocular pressure. This led to ulceration of the cornea and other eye lesions. This, according to many farmers, constituted a new disease in goats, and a number of them actually queried the correctness of my diagnosis. In some instances it was extremely difficult to convince them of the utter folly of overstocking.

In these parts practically no provision is made either for winter feeding or feeding in times of drought. Farmers are solely dependent on the natural grazing. In one instance the owner lost 50 per cent. of his stock during the drought, and shortly before this had actually sold his wheat crop to obtain ready cash.

The question of grazing during the different seasons is receiving the attention of the Department. Grazing some veld to its maximum capacity year after year without putting anything back, undoubtedly produces a marked decline in its carrying capacity. The deterioration of the veld will show itself: (1) in a decrease of the desirable grasses and other plants readily eaten by sheep, and, (2) in an increase of worthless grasses, weeds, bushes and poisonous plants. This state of affairs becomes greatly exaggerated during a drought. Poisonous plants propagate and spread, and frequently form the only succulent food for the sheep in dry seasons. This has been responsible for heavy mortality amongst small ruminants in times of drought.

Some farms have become overrun by *Geigeria* spp. (Vermeersiekte bossie), and on some of the pastures there was very little else to eat during the dry spell, and then, naturally, with disastrous results.

During the recent drought *geeldikkop* in sheep, caused by the *Tribulus terrestris* (dubbeltjiedoorn), spread through certain districts of the Karroo like an epizootic. The " dubbeltjie " was the only succulent food substance present, and in the wilted state this plant became exceedingly toxic to small ruminants.

In the Uniondale Road area, and in some other parts of the Karroo, small ruminants are affected with a condition known as *waterpens*, i.e., a very extensive ascites. It appears that this condition stands in some relation to a morbid state of the liver (an atrophic or hypertrophic cirrhosis of the liver). Farmers are of the opinion that this condition is caused by *Galenia africana* (geelbos, kraalbos). As a result of overstocking and drought, this plant becomes dominant on some pastures. So far, we have not been able to produce waterpens by feeding *Galenia africana*, but it would seem that large quantities of the bush, which is readily eaten by sheep and goats, must be consumed before symptoms appear. The feeding experiments carried out are, therefore, not conclusive.

Vangueria pygmaea (gousiekte bossie), is the cause of *gousiekte* in sheep. Experiments undertaken, however, with this plant have been unsatisfactory, as its toxicity is a varying factor in different years, and even in one and the same year. This seems to depend on the quantity of the plant eaten, the individual susceptibility of the sheep, and the locality where the plant is grown. Gousiekte in sheep is generally localized to certain farms, but during the recent dry seasons cases of gousiekte occurred in many parts where it was not known before. Is it that the plant is spreading as a result of drought, and overstocking, or is it that it forms the main food on the pasture

during dry spells? As the roots of this plant penetrate deeper into the soil than those of other associated plants, it gets more moisture, and is thus more resistant to drought.

As a result of drought and overstocking, it is said that *Aristida* spp. (steekgras) have spread. They have been the cause of serious injury to the general health and condition of long-woolled sheep. The mature fruit or seed is the part of the plant which causes the injury, and hence " steekgras " becomes troublesome only during the winter months. " Steekgras " has been the cause of a traumatic purulent dermatitis in very young lambs, and was very prevalent on some farms in the Free State a few years ago.

Other Aspects of Plant Poisoning in the Pasture.

Seasonal variation plays a very important part and may sometimes influence good pastures to such an extent that they become highly poisonous. In this respect we may again cite the " dubbeltjie," which in the fresh green succulent state is relished by small stock, without ill-effects. It only becomes highly poisonous, setting up geeldikkop, when fed in the wilted state. Is the pathogenesis of geeldikkop associated with some type of *photosensitization*? It has been known for a long time that certain animals, following the ingestion of various substances, are rendered sensitive to certain types of radiant energy, e.g., sunlight, carbon arc lamp, the quartz mercury vapor arcs, etc. Years ago European stockmen found that in certain animals which had ingested buckwheat (plant or seed), erythema, *oedema*, and convulsions developed, etc., on exposure to out-of-door sunshine. However, untoward symptoms did not arise if the animals were kept indoors . . . . In geeldikkop does the plant produce a toxic substance in the blood which becomes fixed under the influence of the sun's rays and acts on those parts of the body not well protected by wool, e.g., the head? Or is it that out of an inactive circulating substance an active one is formed under the influence of the sun? We know that there are certain poisons which have a predilection for setting up an oedema of the subcutis of the head. Seeing, however, that the " dubbeltjie " only becomes poisonous in a wilted state, is the explanation not that the sun forms such a toxic principle in the plant which is then ingested by the sheep?

Another baffling disease in this respect is *true geilsiekte*. It is a condition which makes its appearance in spring and early summer, when there is a plentiful supply of succulent green feed, which becomes wilted as a result of a spell of hot weather. It is characterized by its sudden onset, rapid course, and practically negative post-mortem findings. Its cause is not well understood, but probably some poisonous substance (e.g., hydrocyanic acid) is formed in the grass in the process of wilting. A very interesting feature in connection with geilsiekte is the fact that it can be prevented by the timely dosing with the Government wireworm remedy (?) and Cooper's powder.

True geilsiekte is sometimes confused for other forms of plant poisons in which a similar history, course, and pathological findings are met with. In this respect one might think of " bietou " (*Dimorphotheca* spp.) poisoning, a condition which is being investigated by Dr. Steyn. There are probably many others, which are at present

not known to us. The question has often been put can *true geilsiekte* be regarded as a disease *sui generis?* Unfortunately there is so little to guide one in arriving at a true diagnosis. There are no characteristic or specific symptoms, or lesions, which are so valuable in the case of infectious disease. In many cases of arsenical poisoning a diagnosis may be doubtful, but the analysis of liver substance, and stomach contents confirms such a diagnosis.

III. Apart from the diseases in sheep caused by known poisonous plants, of which there are many in this country, there are a number of baffling natural and artificial grazing diseases (e.g., *swelled head in stud rams, dikoor in young sheep, enzootic icterus, domsiekte in pregnant ewes, and droë geilsiekte,* probably the same as *galsiekte*), all of which seem in some way or other to be related to the grazing. Are some of these diseases caused by a plant or a collection of plants under certain climatic conditions? Are they becoming more prevalent, or is our pasture, especially during the winter months, becoming more impoverished as as result of continuous grazing, and dry periods? Do some of them belong to the category of *deficiency disease?*

Swelled head in stud rams, from 9 months to two-tooth, is well known in Australia, and seems to be of economic importance there. As far as we know, it is only confined to a few farms in South Africa, and only a limited number of cases have been observed. The disease is characterized by the sudden appearance of an extensive oedema of the subcutis of the head and upper part of the neck. This causes difficulty in respiration. The course of the disease is rapid and mortality fairly high. The interesting feature of this disease is, that it has been observed to occur on a pasture regarded as good artificial grazing (e.g., lucerne, rye), under irrigation. Rams of the same age, and on the same farm on ordinary grass veld did not develop the disease. A few transmission experiments have proved to be negative.

Dikoor, a disease of young sheep, has been mainly encountered on old lands, with a certain amount of young grass previously brought on by a few showers of rain.

Enzootic icterus was for the first time observed at the Laboratory in July, 1924. It is characterized by a rapid course in which a most extensive and characteristic icterus develops as a result of extensive destruction of the red blood cells. It was shown that the lesions in some of the organs were fairly specific. The disease, peculiar to merinos, seems to stand in some relation to the environment of the Karroo, and to the removal of such sheep to other centres. Numerous cases have occurred at the Laboratory in batches of sheep from the Karroo, yet no cases were identified in the areas where the sheep were raised.

Domsiekte in pregnant ewes, perhaps the same as *white liver* in sheep, is another disease which seems to be intimately connected with the natural grazing. It is at present not known whether other classes of sheep are also affected. It is characterized by extensive fatty changes in the liver, from which the disease derives its name. The cause of this condition is still obscure.

It is known that sheep, perhaps more than any other animal, may survive for a long time on very scanty pasture, provided that the well balanced diet (e.g., Karroo bush) remains constant, and that the

sheep are not crowded out and allowed to roam great distances for food. On the other hand, a big change in diet, e.g., from a dry pasture to one rich in succulents, may very soon give rise to such conditions as *hoven*, *scours*, etc., to which the sheep seems to be very susceptible.

There is no doubt that a number of sheep are lost annually from a condition known as *droë geilsiekte* [probably the same as galsiekte (?)]. It seems to be a disease which is dietetically connected with the grazing during the winter months. It is characterized by an extremely rapid course, e.g., sudden death, and impaction of the omasum. Seeing that we know so little about the cause of this condition, it is difficult to say at the present moment, whether it is a disease "*sui generis*," or whether a number of conditions is included under this name.

Considerable areas of country are known where, although the herbage is apparently ample, sheep do not thrive. Again there are districts in which the rate of growth is considerably faster than in others with similar climatic and soil conditions. In other districts the percentage of lambs reared is low. The stated causes of these differences are many and various—the root cause being probably *dietetic*.

It is said that *deficiency diseases* have become more prevalent in recent years, due to the use of artificially prepared concentrates, deficient in some of those mineral and other constituents essential to growth. Two main groups of food constituents which have received the most attention in this connection are:—

(*a*) *The vitamins, and* (*b*), *mineral constituents.*

The literature on vitamin research has become so extensive that it is most difficult to keep pace with the practical importance of these accessory factors. Unfortunately, most of the experimental work has been carried out with small animals (e.g., rats, guinea-pigs), and it does not follow that these results will be applicable to farm stock. It is, however, held that, provided the stock farmer gives his stock free run, so that they may benefit of fresh air and sunlight, and provided, he supplies them with a *mixed diet*, in which is included *a reasonable proportion of fresh green food*, it is doubtful if he need worry himself about vitamins. According to Green, exogenous requirements of cattle for the Vitamins A, B, and C, are so low that they are covered by a few pounds of poor quality roughage. Furthermore, the rapid course of many of these pasture diseases in sheep seem to speak against vitamin deficiencies. Australian investigators believe that adult sheep may be maintained for months on a diet deficient in at least three vitamins, without any apparent ill-effects. However, a piece of evidence that vitamin deficiency does occur at times is illustrated by the poor results obtained by feeding white maize as against yellow maize in the recent Queensland (Australia) drought. The sole difference between yellow and white maize, according to the Australians, seems to be that Vitamin A is present in yellow, and absent from white maize.

The requirements of animals for various *inorganic* salts received but scanty attention until recently. It is now recognized that many problems of animal nutrition bearing upon economical use of foodstuffs, and the incidence of disease, are intimately bound up with

the supply of mineral matter in the food. The two minerals required in largest amount for growth, namely *phosphorus* and *calcium*, have been most studied. Low phosphorus content is a noteworthy feature of South African soils. It was shown that over wide areas in the Union the level of phosphorus reached in the natural vegetation is below the physiological optimum requirement for cattle. At Onderstepoort, it was shown that " *aphosphorosis* " or clinically recognizable phosphorus deficiency disease could be experimentally produced, and that it was identical with the naturally occurring South African disease known as *styfsiekte*. Although it is recognized that the feeding of bone meal is indicated in sheep to maintain the " *constitution*," yet at present there appears to be no parallel in sheep with the known aphosphorosis in cattle (Styfsiekte).

A deficiency of *iron* has been noted in certain parts of New Zealand. A remedial measure for this condition is the administration of a soluble iron salt, such as iron ammonium citrate. Pining of sheep in certain parts of the South of Scotland, is probably due to a similar deficiency, and lends itself to the same treatment. Such an iron deficiency has not yet been recognized in South Africa.

A great deal has appeared in the press recently regarding the possibility of an *iodine* deficiency in the Union. If an iodine deficiency occurs anywhere within the Union, it has so far escaped detection. Furthermore, nowhere does such a deficiency seem to be indicated, e.g., by the occurrence of goitre. It is known that iodine deficiency is the cause of certain goitre-like conditions in man, pigs, sheep and even fish. In Michigan, prior to the discovery of the salt deposits around the Great Lakes, the sheep industry appeared to be hopeless. owing to a goitrous condition, and the difficulty in rearing lambs of affected ewes. The good effects of the salt were subsequently found to be due to an appreciable quantity of iodine as an impurity. The Hairless Pig Malady in the State of Montana, was shown to be due to deficiency of iodine in the ration of the breeding sow. Reports have been received concerning the occurrence of *hairless kids* in certain parts of Willowmore. In the cases investigated the thyroids of affected animals were normal and could not in any way be connected with this condition. Many farmers are of the opinion that very small quantities of potassium iodide added to the salt ration improves the metabolism generally, and stimulates the growth of the body and the wool generally. In this respect the experimental work carried out in other centres have not been very encouraging. The question is, however, being further investigated in South Africa. Farmers should, however, be cautioned about the deleterious effects of potassium iodide if the optimum amount be materially exceeded. (Daily dose should not exceed 4-10 millionths of the live weights of the animal.)

IV. *Parasitism.*—The part played by the pasture in the spread of infectious diseases must be left for a subsequent paper. Similarly, time does not allow a discussion of the role played by:—

(*a*) *ticks* (the paralysis tick, the spinose ear tick, the heartwater tick);

(*b*) *acari* (scab, mange);

(*c*) *insects* (blow fly, nasal fly).

Much has been written about the part played by *Helminths*. Helminths play an important role in the life of the sheep, especially as this species is essentially a pastoral animal. Those familiar with sheep farming are fully aware of the damage done by parasites of which sheep are hosts. Of the parasites which infest sheep, none causes more concern than the *stomach worm* (*Haemonchus contortus*), and the *nodular worm* (*Oesophagostomum columbianum*). Few flocks exist in the Union which are not more or less infected with either one or both of these pests. The worms live on the blood (*Haemonchus*), or produce poisonous substances (*Oesophagostomum*). Weakness, anaemia and emaciation are the common symptoms. The adult worms inhabit the alimentary canal, where they lay thousands of eggs which are passed out on to the pasture with the droppings. It is estimated that a moderately infected sheep may drop as many as 2 million eggs per day. The eggs develop quickly on the veld, especially in warm moist weather, and the mature larvae which infect the sheep may live for a considerable time without its host, if climatic and environmental conditions are favourable.

Another group of Helminths which is responsible for mortality in sheep, comprises the *tapeworms*. The dog is a carrier of several tapeworms which are a source of danger to sheep (e.g., *T. echinococcus, T. multiceps*). The bladder-worm stage of these tapeworms occurs in the sheep and may give rise to severe losses. The sheep becomes infected on the pasture from the droppings of the dogs. If farmers knew more about the possibility of dogs infecting their livestock, and how prevalent dog tapeworms were, they would see that all carriers on their farms were regularly treated for these parasites.

There are some species of tapeworms (*Monezia*) which cause heavy mortality in lambs and young sheep. At present it is not known whether they develop with or without an intermediate host.

Amongst the *Trematodes* (another group of Helminths) the *liver fluke* is responsible for severe losses in sheep in certain parts of the Union. The intermediate host is the fresh water snail. Infection usually takes place during the spring and summer months, and mainly in pastures which are wet and badly drained.

How are these Various Problems to be Remedied?

In order to establish a pasture so that it can be successfully and economically utilized for the rearing of sheep the following points should be considered:—

1. Farming methods to be adopted, especially in respect of camps, overstocking, etc., etc.
2. Natural grazing under various climatic conditions.
3. Measures to be adopted in connection with poisonous plants.
4. Questions of trekking, veld burning, etc., etc.
5. The assistance of Government experts.

1. On many farms routine methods and systems must be altered if we wish to compete for the markets of the world. Enough has been said in the Department's publications about the economical value of netting the farm, the system of camps, fencing of thoroughfares, the importance of shelter in a camp, etc. The great evil of overstocking has frequently been emphasized. In this respect it is essential that the carrying capacity of a farm be determined. The Department is

carrying out experiments to determine this. In South Africa the carrying capacity varies from 2-3 sheep per morgen to 1 sheep per four and more morgen. A decision can only be satisfactorily arrived at from an intimate knowledge of the localities themselves, seasonal variation, and an estimate can only be based on extended periods covering a series of years embracing good and bad seasons.

Small camps are best, and sheep do better running in small mobs in such paddocks. It is maintained that sub-dividing a large run, its carrying capacity is increased. The system of rotation of camps is highly desirable. In this way one can avoid year-long grazing of a paddock, and a proper system of resting overgrazed pastures can be adopted.

The system of rotation is not only a contrivance for nursing the veld, but at the present moment it forms the only practical and reliable method of preventing some of the worm infections in sheep (e.g. nodular worm). Lambs suffer much more than older sheep, and the best results will be obtained if ewes and lambs can be placed in camps where no grazing was allowed the previous summer. During the *winter months* ewes drop worm eggs which do not develop, and as soon as the summer rains begin the ewes must be removed from the "lamb" pasture, so that they cannot infect it. The winter lambs can by that time be weaned and remain on the clean pasture. The Government wireworm remedy for holding the wireworm in check has been used to very great advantage, where regular three to four weeks dosing intervals have been practised. Unfortunately, many farmers wait too long until the sheep show signs of infection, but then it is often too late. The treatment of such sheep on showing signs of ill-health has been the cause of many complaints of mortality, and it is then often maintained that the Government powder is responsible. Medicinal treatment used alone, however, is not sufficient to effect the eradication, nor to prevent infestation entirely. Various forms of farm routine in combination with medicinal treatment have to be adopted in lambs raised from infected ewes.

A very important matter is the source of the drinking water. Vleis, pans, drinking pools, dams, are undoubtedly a great source of danger. The moist patches around them are predilection seats for keeping worm infection rampant. For that reason it is absolutely essential that raised drinking troughs should replace the above in the various camps, and vleis, pans, pools, etc., should be drained or fenced off.

2. In England a good deal of research has been done in connection with the pastoral grasses. Pastoral improvement experiments have also been carried out in New South Wales, especially on the types and qualities of grasses and clovers best suited for pastures in different localities. Experiments have also definitely demonstrated that at practically every centre in New South Wales where these trials are in progress natural pastures can be improved from 200-300 per cent. by top dressing with superphosphate. In South Africa a beginning has been made as regards the determination of the general nutritive value of grasses. Dr. Henrici maintains that the Woolly Finger Grass in its natural surroundings, is more valuable than other grasses. Though it does not keep green during the winter months, but turns brown and dry like other veld grass, yet it provides more nourishment in this condition for stock than any of the other pastoral grasses tested.

With reference to the disastrous effects of drought, the Department is investigating the matter. What is the best routine to follow in those areas subjected to spells of drought? Much is being done in connection with maintenance rations, drought resisting crops, succulent fodders for livestock, ensilage. It has been found that a sheep running on drought parched veld can be maintained on 4 oz. mealies per day (equal to half a bag per annum), provided a liberal water allowance is given. There is little land which is not capable of providing suitable growth for ensilage, which, if properly made, is quite equal to the best natural fodder. Unfortunately, animals are allowed to get too low in condition before resorting to artificial feeding. It is more economical to maintain the condition of sheep than to improve them once they have lost condition.

3.—*How are Poisonous Plants to be Combated?*—One is fully alive to the great difficulties experienced by farmers, but with reference to poisonous plants the Department ought to disillusion them as regards the immediate possibilities of " cures." As soon as a poisonous plant has been identified on a farm, the farmer clamours for a remedy which, when applied to sheep that have been exposed to them, would render the poison inert. To-day very little is known about the toxic principles of plants. They form a very involved and complicated chemical group. Judging, however, from the action of some well known poisons (e.g., arsenic), we know that when once they are fixed in the tissues they cannot be removed. Thus little prospect would appear to exist for many antidotes to be found.

In the case of sheep continually subjected to a pasture overrun with poisonous plants (e.g. dubbeltjie, vermeersiekte bossie), it is ridiculous to expect good results with a cure which will probably have to be given daily. Furthermore, a number of sheep are lost annually by dosing with one or other of the numerous so-called " cures," varying from brandy to most involved decoctions. Far more sheep are killed than cured by dosing with liquids (drenching pneumonia), and the cases that recover, do so in spite of drugs.

The only successful treatment of plant poisoning will be on preventive lines. This is mainly a problem for the farmer and he should lay stress on the following points:—

(*a*) Avoid such pasture either by removing the stock, or camping off the portions affected.
(*b*) Prevent the occurrence of such plants by obviating overstocking, practising a system of rotation of camps, etc.
(*c*) If the plant is not widespread, attempt eradication. This has actually been accomplished in practice.
(*d*) Where it is associated with a drought make immediate provision for artificial feeding with mealies, etc., etc.

4. It is said that hundreds of acres of good grazing are being destroyed annually by the foolish practice of *burning the veld.* It is held that some of the most nutritious grasses, which cannot stand burning, and some which seed late in the season are destroyed by fire. How far this is actually scientifically so, is at present being investigated by the Department.

There is no doubt that the system in vogue of *trekking with sheep* during winter months, or during dry spells should be discouraged. In some parts it has even become impossible, due to the netting of

farms on an extensive scale. During the recent drought in the Karroo it was shown that sheep which had been sent to grass veld had become badly infested with worms and were accordingly far less resistent to geeldikkop than the sheep which had remained in the Karroo.

5. The immense correspondence with farmers about the possible diagnosis of pastoral diseases and their treatment, seems to be absolutely futile in a large percentage of cases. It becomes utterly impossible to recognize the disease from the incomplete descriptions given. Usually symptoms and post-mortem findings are mentioned which are common to a number of diseases, e.g. oedema of the lungs, congestion of various organs, etc., etc. If the farmer does not receive advice as regards treatment, he is dissatisfied and blames the veterinarian for his ignorance. Consider the futility of an immense correspondence by patients in different parts of the Union with the officers of health, of the Department of Interior, as regards their ailments and treatment. Grazing diseases should be studied in loco, and if possible, diagnozed on the spot. If the veterinarian during his investigations on a farm is at a loss to explain the cause of the mortality, the farmer becomes impatient and very often queries his capabilities. It should, however, be remembered that the problems of disease in connection with the veld are most intricate and baffling, and very often do not fall into line with the usual methods of research. The bulk of the veterinarians in the Union are purely associated with routine duties and the varied problems of the pasture are left to a handful of research workers, who are often also handicapped by routine duties. Furthermore, consider the slow progress made by thousands of investigators into such well known problems as cancer and tuberculosis.

The problems of the pasture remaining unsolved were shown to be many and varied. The value of field experiments in connection with a number of pastoral diseases are absolutely essential. The negative feeding experiments with dried plants at the various laboratories are inconclusive. This was clearly demonstrated in the case of gousiekte and geeldikkop. In these diseases positive results were only obtained in the field.

The closest co-operation with the soil chemist, the biochemist, the plant physiologist, and the agricultural chemist, becomes essential, if the quickest and surest results are to be obtained to meet the economic requirements of the farmer in feeding his stock. Intensive research work and team work is necessary. The assistance of the farmer himself in this respect will be a valuable asset to the Department.

SWELLED HEAD, BIG HEAD, OR DIKKOPSIEKTE IN RAMS.

By Dr. G. de Kock, Sub-Director of Veterinary Services.

This paper was written for the purpose of recording the occurrence of swelled head, big head, or dikkopsiekte in rams. The term dikkopsiekte, coined by a farmer, has been retained because it is the Dutch translation of the Australian term " big head " given to a similar condition in Australia. At present we recognize three diseases in sheep in which there is swelling of the head, viz.:—

(*a*) Dikkopsiekte in rams, probably the same as big head in Australia.

(*b*) Dikoor of young sheep, probably the same as yellows or toxaemic jaundice of Australia.

(*c*) Geeldikkop (tribulosis) which, as regards symtoms, character, and distribution of the lesions, is very much like dikoor. This condition in South Africa is definitely caused by *Tribulus terrestris* in a wilted state (Theiler 1918).

Dikkopsiekte seems to be a disease of young rams, and is characterized by its sudden appearance, rapid course, and extensive transudation of a clear fluid into the cutis and subcutis of the head and upper cervical portion of the neck.

Occurrence.—Dikkopsiekte in South Africa was recognized by the veterinary authorities for the first time in June, 1926. So far it has been limited to two farms. This may be due to the fact that it has not been recognized as a separate disease, and that it has been confused for the other forms of swelling of the head in sheep. Mortality has been low, but extremely valuable young rams may be lost.

It was first studied on a farm in the Western Cape Province. According to the owners, the disease was seen by them in 1924, when 1 case occurred amongst 40 young stud rams. In 1925, there were 2 cases amongst 140 young rams, and in 1926, 7 cases (1 in February, 1 in April, 2 in May, and 3 in June) amongst 250 young rams. The disease was noted on this farm before sheep from Australia were introduced. The farm is divided into a number of irrigated and cultivated paddocks sown with clover. The type of grazing was excellent, and even during the winter of 1926, when the writer visited the farm, there was plenty of green food in the various paddocks. The disease only affected stud rams from 8 months to two-tooth. The disease was also encountered on a farm in the Wepener District during the winter of 1926. The owner had had cases of dikkopsiekte in rams for the last ten years, losing annually from 1-3 rams. It made its appearance during the months of July to September, at a time when some of the rams were brought on to artificial grazing (rye). The disease, however, was not observed amongst the majority of young rams which were left on the ordinary dry-grass veld.

Etiology.—From the few observations made by the writer, the following may be noted. It was impossible to trace a specific poisonous plant in the paddocks where the disease made its appearance. Young rams on ordinary grass veld did not contract the disease, whereas it occurred amongst those kept on irrigated paddocks sown with clover or with rye. Blood transfusions made into susceptible sheep proved to be negative. Cultures made from the subcutaneous oedema remained sterile, and some of this fluid injected into other rams had no effect. It is said that the following routine may be regarded as a sure preventive, viz., turn stud rams into ordinary veld for a week every two months.

Symtoms.—The onset of symptoms was very sudden. In the space of an hour swelling of the head had developed without premonitory symtoms. The swellings were characterized by an extensive transudation into the cutis and subcutis of the eyelids, the frontal, nasal and masseter regions, both lips, the intermandibular space, and extending to the cranial third of the cervical region. As a result of the extensive transudation, the folds of the upper part of the neck become markedly enlarged. The swellings were not of an inflammatory nature, and may be responsible for the closing of one or both eyes. As a result of the marked swelling associated with the upper part of the respiratory tract, breathing was made difficult; in fact, it amounted to a dyspnoea, with a good deal of snoring. The animal may die within 24 hours, but more usually within 48 hours, except for the cases which are said to have recovered. Death probably results from asphyxia and other toxic influences. Transudated fluid may be present on the skin of the parts affected, usually below the nasal canthi in the form of stringy masses. The colour of the fluid is slightly more yellow than usual, but in the cases which came under the observation of the writer a definite diagnosis of icterus could not be made. No temperature was recorded in the few cases under observation.

Pathology.—The oedema escaped freely from the cut skin of the affected parts. Some of it was coagulated in the connective tissues. Oedema was also present in the connective tissues of the ventral aspect of the tongue, pharynx, and larynx. All organs were at one time or another examined. Other changes noted were: Ecchymoses epicardium and right and left endocardium, slight hyperaemia of some of the lymphatic glands, slight hydrothorax, and slight catarrhal enteritis. In the post mortems conducted by the writer icterus as such could not be diagnosed, although the transudate as stated above was slightly more yellow than usual.

Microscopically no specific lesions were seen in any of the organs examined.

The Disease in the Literature.—Seddon (1926) has referred to swelled head in rams in New South Wales. He described a slight but definite jaundice, not very marked in early fatal cases, but in those that lingered on for some days the condition was quite distinct. At any rate the deep yellow colour of unpigmented skin as seen in ordinary obstructive jaundice was not present. The disease therefore he regarded as a toxaemic jaundice, the cause probably being some toxic agent.

Later he (Seddon, 1927) again refers to swelled head in rams and yellows in wethers and ewes. Swelled head and yellows (also a form of toxaemic jaundice), have according to him "many features in common. . . . They are not inoculable, and there is much evidence of the disease being toxic in origin."

Bull (1927) also refers to serious losses in stud Merino flocks in South Australia, caused by big head. The diease is more frequent in autumn than early summer. It attacks only the Merino ram, but a case has been seen in a Dorset horn ram, and a Suffolk ram. It is usually fatal, and the majority of sufferers die in 48 hours. It develops rapidly without premonitory symptoms. The oedema would appear to be due to an injury of the vessel-wall leading to increased permeability. In the same paper Bull describes a condition which undoubtedly corresponds to dikoor.

Discussion.—There is but little doubt that swelled head in rams, seen in New South Wales and South Australia, is identical with the disease dikkopsiekte in South Africa. The following observations in the two countries agree: Rapid course, practically without premonitory symptoms, the susceptibility of young stud rams, the localization and distribution of the lesions, the small number of animals affected, and an autumn rather than a summer occurrence.

There is also present in Australia a condition in young sheep, yellows or toxaemic jaundice, which is apparently identical with dikoor of South Africa and, except for the etiological factor, with geeldikkop. According to Seddon, there are many features in common.

How far are dikoor and dikkopsiekte related? As regards the nature of the lesions and symptoms, there is a very strong resemblance. Both diseases commence with the oedema of the cutis and subcutis. The highly susceptible ram dies during this early stage, whereas the young sheep affected with dikoor passes from the transudation stage to the necrosis of the skin stage, and subsequently there is icterus. Some young sheep may even die in the transudation stage. In the few cases of swelled head seen in South Africa the stage of necrosis or icterus was not reached. All animals died in the transudation stage.

It must not be forgotten that stud rams in this country receive different treatment to the rest of the flock, especially during the winter months, when they are placed on artificial grazing (especially clover, rye, etc.). On the one farm, however, on which 7 cases occurred during the year 1926, all classes of sheep were more or less subjected to the same type of artificial grazing. Nothing of the nature of dikoor was noticed in the lambs of both sexes, whereas swelled head made its appearance only amongst the young rams.

There is evidently a group of toxic principles which may develop in plants, and which has a peculiar predilection seat in the head of sheep. The toxic effects are manifested in the early stage as an extensive oedema of the skin and subcutis, to be followed by a necrosis of these affected parts of the skin. The oedema observed in the early stage is of the nature of a transudation and not inflammatory. Probably it is related to a greater permeability of the vascular system which, as referred to by Bull, has become affected by the toxic substance. Experimental work, however, is being undertaken to

study this question of oedema, and its peculiar distribution under certain seasonal conditions. Moreover, further work will have to be carried out to ascertain whether dikkopsiekte (swelled head) in rams and dikoor in young sheep are the same disease in different stages or not. The exact nature of the icterus in these diseases seems to be obscure. It does not appear to be an obstruction icterus, nor an icterus associated with an haemolysis, as was, for instance, seen in enzootic icterus and bacterial icterus of sheep described by De Kock (1928).

References.

Bull (1927): *Australian Vet. Jl.*, III, 53.
De Kock, G. (1928): The Reticulo-endothelial System of the Sheep, 13*th and* 14*th Reports, D.V.S.*, U. S. Africa.
Seddon, H. R. (1926): *Pastoral Review*, 16th April, 329. Australia.
Seddon, H. R. (1927): *Science Bulletin No.* 29, 13 and 18. New South Wales.
Theiler, A. (1918): Geeldikkop in Sheep. *7th and 8th Reports, D.V.R.*, 1, U. S. Africa.

Swelled Head, Big Head, or Dikkopsiekte in Rams.
By Dr. S. de Kock.

Fig. 5.—"Swelled Head" or "Dikkopsiekte" of rams seen in South Africa. Note the swelling of the eyes, nasal region, etc.

RECENT INVESTIGATIONS INTO GEELDIKKOP AFFECTING SHEEP AND GOATS IN THE CAPE PROVINCE.

By J. I. Quin, B.V.Sc., Veterinary Research Officer, Onderstepoort.

In this short paper mention is to be made of the observations and the results of a few experiments carried out in connection with the true geeldikkop or tribulosis affecting small stock. It is well known either through personal experience or from the numerous press articles (and even discussed in Parliament) that the losses from geeldikkop *per se* or in conjunction with other factors arising from the recent drought have been enormous, the areas suffering most being the North-western Cape, the Cape Midlands, and the Southern Free State. The disease, of course, has been known for a long time, and was described by Hutcheon (1904) and later by Theiler (1918), who carried out experiments. Geeldikkop has meant the loss of many thousands of small stock in this country, and is to this day one of the most serious diseases in certain sheep farming areas of the Union. Certain other forms of dikkop, e.g. the dikkopsiekte of young rams, reported by De Kock and the dikoor described by Steyn, have recently made an appearance in parts far distant from the true geeldikkop areas. The cause of the latter two conditions is as yet altogether unknown, whereas in the case of geeldikkop, there is no doubt that the common "dubbeltjie," *Tribulus terrestris*, is responsible for the disease, but only under certain conditions. Unfortunately, however, all the various factors determining the toxicity of the plant are at present not clearly understood. Whether there are other plants capable of producing symptoms identical to those of geeldikkop, is another point not clearly settled at the moment.

Further, the possibility of a relationship between these various forms of dikkop must be considered, in which case the toxic principle or principles, although present in widely different plants, may produce similar or identical symptoms and lesions, only with a varying severity. Should this be the case, geeldikkop, as well as the other forms of dikkop, will have to be regarded as a symptom complex and not as a disease *per se*. That a certain relationship exists, although the three conditions are met with on totally different types of veld, is shown by the following interesting facts:—

(1) The marked susceptibility of young animals which are, as a rule, the first to show symptoms.

(2) The incidence of these conditions, e.g. after showers of rain followed by spells of hot weather.

(3) The seasonal variations in the severity of these conditions, e.g. while geeldikkop is quiet in the Karroo regions in the winter months, dikoor is practically unheard of in the Transvaal, Free State, and Natal. Again when dikoor was prevalent during the past summer, geeldikkop was raging in the Cape and Southern Free State.

isolated so far, the reason being that it appears to be formed very rapidly, only to be destroyed with equal suddenness whenever conditions change, i.e. it may be present in a highly unstable form. More

(4) The symptoms and post mortem lesions. Here a close relationship exists, the most striking common factor being the sudden onset of a severe oedema of the subcutaneous and intermuscular tissues of the head generally, followed either by death or an equally sudden disappearance of the oedema and in less acute cases by marked sloughing and disfigurement of the face and ears.

With regard to the accompanying icterus, wide variations, however, exist, e.g. in the dikkopsiekte of rams De Kock failed to find any definite jaundice, whereas in dikoor this may be slight to fairly severe. In geeldikkop, as the name suggests, it is evident, varying up to a most intense icterus and noticeable in the skin of the head several yards away. Similarly with regard to post mortem findings, the chief differences are those of degree, especially with regard to the extent of the icterus.

(5) The per cent. mortality varies widely, e.g. in dikoor, it may be up to 25 per cent., although in some outbreaks it was found to be much higher, whereas in geeldikkop, which must be regarded as the most severe of the three conditions, it can be extremely heavy.

Due to the severity of geeldikkop during the past summer, several districts were visited, and a series of experiments carried out in the Victoria West District. Unfortunately, this was done towards the end of the geeldikkop season just before the heavy rains, and hence many important points were not completely cleared up. The following facts, however, were definitely established:—

(1) Sheep allowed to graze on the brown wilted "dubbeltjie" day and night, resulted in 7 out of 10 showing geeldikkop.

(2) Ten sheep grazed on green luxuriant "dubbeltjie," growing along a water-furrow, all remained healthy.

(3) Large areas along the back of several sheep were cleanly shaved and the animals exposed to the sun while feeding on wilted "dubbeltjie." The animals contracted geeldikkop, although no oedema of the shaved parts followed. This strongly suggests a marked vulnerability (perhaps specific) of the tissues of the head and ears to the formation of oedema. This point was clearly demonstrated in the case of rabbits and also in several young lambs, where a marked oedema of the head followed the subcutaneous injection in the hind leg of a solution of a dye stuff paraphenylenediamine (Tainter & Hanzlik, 1924), resulting in death from a glottis oedema and asphyxia, although no oedema is noticed at the site of injection.

(4) Several sun and shade experiments carried out were inconclusive, although these are to be repeated as soon as occasion arises.

Discussion.

It is clearly seen that under certain conditions *Tribulus terrestris* does produce geeldikkop. This elusive toxic principle has not been

work should be undertaken in this direction. Various climatic factors undoubtedly play a rôle in determining the toxicity, while the possibility of photodynamic action cannot be excluded. Whether the oedema and the icterus are both caused by one and the same toxic principle, is a point yet to be proved.

The whole problem of geeldikkop is as important as it is difficult to solve, for the simple reason that under certain peculiar conditions a large part of the grazing in certain sheep areas becomes extremely toxic to small stock. Under ordinary conditions the " dubbeltjie " is a very good sheep food. Its eradication is out of the question, on account of the large areas it covers. Furthermore, it is generally toxic at a time when other food is scarce and, consequently, has to be eaten.

Curative treatment of geeldikkop has so far been unsuccessful and probably will never be a success, seeing that the so-called " cured " animals when again exposed to the same poisonous pasture invariably succumb. Furthermore, it should not be forgotten that the actual damage done to the flocks not only involves the actual deaths, but the permanent disfigurement and unthriftiness of a large percentage of the survivors. The only solution would seem a decrease in the number of sheep kept by individual owners, a different system of grazing and most important of all, the provision of something better than poisonous " dubbeltjie " in the nature of cultivated foodstuffs.

References.

Hutcheon, D. (1904): *Reports of the Chief Veterinary Surgeon and the Assistant Veterinary Surgeons*, half-year ended 30th June, 35. Cape of Good Hope.

Theiler, A. (1918): *7th and 8th Reports of the D. V. R.*, 1. U. S. Africa.

Tainter, M. L., and Hanzlik, P. L. (1924): The Mechanism of Oedema Production by Paraphenylenediamine. *Jl. Pharm. Exper. Therap.*, XXIV, 179.

DIKOOR* IN SHEEP.

By Dr. D. G. Steyn, Veterinary Research Officer, Onderstepoort.

Introduction.—Twenty-four years ago Hutcheon (1904) described a disease in sheep resembling *Tribulosis ovis* (true geeldikkop) very closely, but no *Tribulus terrestris* could be found on the farm.

Whereas geeldikkop is a disease attacking sheep of all ages running in the veld, the chief sufferers in dikoor are young sheep (4 months to 1 year old), and then only those running on old lands. No definite proof has as yet been brought forward that dikoor occurs in sheep running on the open veld.

On most of the farms where the disease was investigated, it was ascertained that the first outbreaks on old lands occurred 3 to 5 days after the first rains, although the sheep had been running on these lands for 14 days or more. No more outbreaks occurred from 3-6 days after the removal of the animals from the old lands to the ordinary veld.

Occurrence of the Disease.—Dikoor has been studied in Natal, Orange Free State, and Transvaal. A disease probably similar to dikoor occurs in Australia under the same circumstances, and is described under the name " yellows " or toxaemic jaundice (Seddon, 1927).

Symptoms.—The disease occurs from November to April. The symptoms may best be described in five different stages. The head only is affected in the first two or three stages or, more correctly, those unwoolled parts of the body directly exposed to the sun's rays.

First Stage (Premonitory Stage).—Before any clinical symptoms are noticeable, the lambs rub the ears, face, and nose against stones, poles, etc., or scratch them with the hind legs. On palpation the skin over this area is warm, but no other macroscopic changes are detectable. Apparently the very first stage of this disease causes irritation (probably itching) of the skin exposed to the sun's ray. No fever is present, and the animals appear lively.

Second Stage.—Within one or two days the animals appear depressed, and the ears, eyelids, face, lips, and intermandinular region are markedly swollen, and on palpation are very warm, painful, and oedematous. The ears, about four times thicker than normal, are drooping. The conjunctiva is red in colour and swollen. The swelling of the eyes can be of such a degree that the palpebral aperture is firmly closed. Owing to the swelling of the nostrils, the animals show dyspnoea, which varies in degree according to the extent of the swelling. In this stage the animals find difficulty in feeding and drinking, both on account of the painfulness of the swellings and for mechanical reasons. In some cases slight febrile temperatures can be recorded.

* *Anglice* Thick ear.

Third Stage.—Here the swellings, which may extend down the ventral aspect of the neck, and even to the front legs, are combined with discharges from the nose, eyes, and lips. The oedematous fluid now oozes through the skin, subsequently drying and forming light yellow to brown crusts. The discharges from the nose, eyes, and lips are at first of a purely serous nature, but in the course of one or two days become purulent. It does occur that affected animals die in this stage from suffocation, probably combined with a general poisoning of the system. Towards the end of this stage the swellings subside, and the eyelids are sealed with a partly dried purulent discharge. The purulent discharge from the nostrils causes a marked dyspnoea, as it blocks the air passages. In this stage, as also in the second stage, the animals can be seen stretching the necks, even bending them right back. This symptom is often regarded as being pathognomonic for *Tribulosis ovis,* but the distressed animals most probably perform this movement with the head in an attempt to inhale more air through the swollen or blocked nasal passages.

The animals rapidly lose condition, and febrile temperatures occur in many cases. A keratitis usually sets in at this stage, later causing complete blindness.

The conjunctivae and visible mucous membranes are now of a light yellow colour.

Fourth Stage.—In this stage the swellings have almost disappeared, and mummification of the skin of the affected parts sets in, causing the face to be hide-bound and rendering movement of the jaws impossible. Consequently the animals are unable to feed or drink. In fact, it is impossible to open the jaws even when force is applied. The hardened skin is covered by dry yellow to dark brown crusts. As the hardness of the skin increases, the sensibility decreases. The condition of the animals is very poor, and fairly high febrile temperatures are recorded. The unwoolled parts of the skin and the visible mucous membranes are coloured intensely yellow, and the purulent discharges from the eyes and nostrils described in the third stage are increased.

Fifth Stage.—The swellings have totally disappeared. The ears and lips are dry and hard, and the former curled up against the head and completely insensitive. The skin over the face, lips, nose, and eyelids, is cardboard-like and sloughs, leaving a red hairless skin. Infection, however, may occur and the result is a purulent dermatitis. The animals are a pitiable sight, the eyelids being completely sealed by a dry yellow or brown exudate. On parting them the cornea is seen to have either burst (and the orbital cavity is one mass of pus) or is totally opaque. In addition, icterus and fever are present. The nostrils are obstructed by the same material as the eyes, causing marked dyspnoea. Many animals die from suffocation or, more often, from starvation. The ears and lips of some of the surviving animals may drop off.

The disease may last from a few days to three weeks, or even longer.

Morbidity and Mortality.—The percentage of affected animals in a flock varies from 1 to 30 or 40 per cent., and the mortality may be as high as 60 per cent. of the affected animals.

Post-mortem Appearances.—They resemble those of tribulosis very closely, and depend on the stage of development of the disease. In the initial stages the skin and subcutis of the affected parts are intensely infiltrated with a light yellow serogelatinous fluid. In the latter stages the post-mortem lesions correspond to the symptoms already described, and icterus is invariably present. No specific lesions were seen on microscopic examination of the organs.

Diagnosis.—In the cases examined the disease was a *dermatitis exudativa acuta* combined with general icterus in the later stages of development and subsequent mummification of the affected areas.

Recommendations:—

(1) Remove the susceptible animals immediately from the old lands.
(2) Keep the animals in the shade.
(3) Feed them artificially.
(4) Treat the affected parts with carron oil.
(5) Cut the affected parts so as to allow the oedematous fluid to escape and then disinfect with potassium permanganate.
(6) Remove the crusts from the skin, nostrils, and eyelids with lukewarm oil.
(7) Remember experience has taught that the disease can be avoided by allowing the animals to run on the old lands every second or third day, and for the rest keeping them on the veld.

Etiology of Dikoor.—Diseases similar to dikoor are caused by the ingestion of several plants in certain stages of growth, and under certain environmental conditions, e.g. *Tribulosis ovis* (*Tribulus terristris*) and *Fagopyrismus* (*Polygonum fagopyrum*). It has also been proved experimentally in Australia (Dodd, 1916) that a disease in sheep resembling big head in rams (Australia), *Tribulosis ovis* (South Africa), and dikoor in young sheep (South Africa) is caused by *Trifolium hydridum*. In America this plant also causes a dermatitis, especially affecting the skin of the limbs and body, stomatitis, and conjunctivitis associated also with general icterus in the later stages.

In dikoor all the evidence is in favour of some plant poison. The symptoms closely resemble those of *Tribulosis oris* and the disease up to the present time has only been seen on old lands. The most suspicious plant, as far as investigations go, is *Panicum maximum* (commonly called "buffel gras" in the Transvaal and "blou saad gras" in the Orange Free State), or other species of *Panicum*. *Panicum maximum* was the only plant common to all the old lands on which dikoor occurred. Even on the old lands in Australia where "yellows" occurred, a species of *Panicum* was found.

The disease is very elusive, appearing suddenly and disappearing just as quickly. These circumstances render the investigation extremely difficult.

Discussion.—Dikoor is most probably caused by the ingestion of one or more plants which, under normal circumstances, are innocuous, but under certain climatic conditions may become poisonous. From the evidence available it seems probable that *Panicum maximum* (or other *Panicum* species or other plants) is liable to cause the above

disease under certain climatic conditions and in certain stages of growth. In all the cases investigated, it has been found that the seeding *Panicum maximum* is badly infected with a smut, which in its youngest stages was detectable only when the grass-stems were examined with the utmost care. The fact that the disease usually makes its appearance a few days after the first summer rains, seems to justify the conclusion that the disease may be caused under one or more of the following conditions:—

(*a*) *Panicum maximum* in its youngest stages on hot summer days in a wilted condition;

(*b*) or (and) the youngest stages of development of the smut or the substances which are formed in the grass by the attack of such a smut;

(*c*) or other plants in a wilted condition or in the young stages of their growth.

There is a probability that the poison is of the nature of paraphenylenediamine, as this substance on subcutaneous injection caused dikkop and death in lambs, as was proved by the experiments of Quin of this institution. The writer is, however, inclined to believe that the disease is of the nature of a photosensitization, as in the case of *Polygonum fagopyrum* poisoning, as the disease occurs on very hot summer days. There is, however, also the possibility that the hot sun only plays a part as far as the production of the toxin in the responsible plant is concerned.

Experiments at Onderstepoort.

Feeding experiments were carried out on young sheep with *Euphorbia striata*, and the dry smutted heads of *Panicum maximum* collected on an old land in the Senekal District, Orange Free State, where 63 lambs, 4-5 months old, were affected with dikoor. Subsequently smutted heads of *Panicum maximum* were obtained from the Eastern Transvaal and fed to young sheep.

The results were in all cases negative, but it must be taken into consideration that the smut had already matured. Blood inoculation experiments likewise proved to be negative.

If positive results are to be achieved, these experiments should be conducted on the farms where the disease occurs.

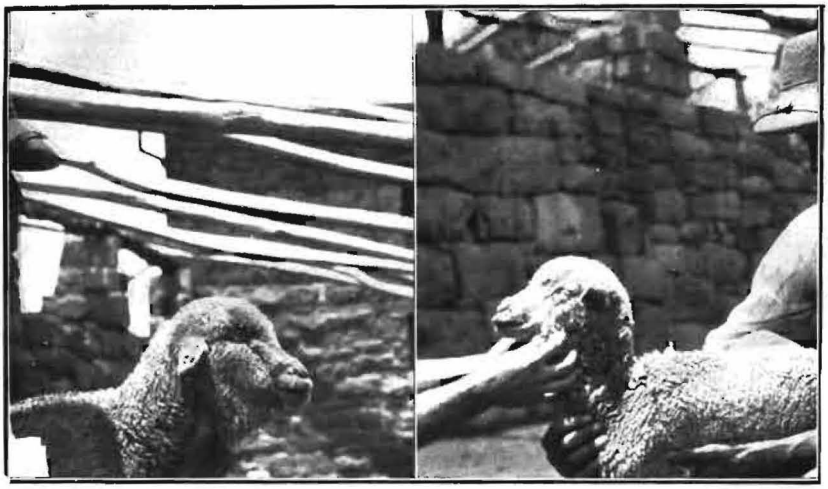
REFERENCES.

Dodd, S. (1916): Trefoil Dermatitis. *Jl. Comp. Path. Therap.*, XXIX, 47.
Hutcheon, D. (1904): *Reports of the Chief Veterinary Surgeon and Assistant Veterinary Surgeons.* Half-year ended 30th June, 35. Cape of Good Hope.
Seddon, H. R. (1927): *Science Bulletin No.* 29, 13 and 18. New South Wales.

DIKOOR IN SHEEP.

BY DR. D. G. STEYN.

Various Stages 2–5 of Dikoor in Sheep.



2nd Stage.—Showing the swelling of the lips, nose, eyelids and ears.

3rd Stage.—Showing the first stages of mummification of the skin.

4th Stage.—Advanced mummification.

5th Stage.—Ears and lips in the process of dropping off.

UNDESCRIBED SKIN DISEASES OF SHEEP IN SOUTH AFRICA.

By J. G. Bekker, B.Sc.Agric., B.V.Sc.

The purpose of this paper is to draw attention to several skin diseases of sheep which have recently been observed in various parts of South Africa. In one case at least the skin disease is fairly widespread, and is of considerable economical importance. In others, the diseases are important as they must be distinguished from ordinary scab. The clinical picture of some cases closely simulates scab (psoroptic and sarcoptic), and one can appreciate the difficulties of the farmers and stock inspectors in not being able to definitely exclude scab. The various diseases will be discussed separately.

Case No. 1.—*Thrombidium infection* (harvest mites or autumn mites). The attention of the Veterinary Department was drawn to a peculiar skin disease in sheep in the Heidelberg (Transvaal) District, in April, 1926. The local sheep inspector was under the impression that he had an outbreak of sarcoptic mange in a flock of sheep in his area. Scrapings were examined and numerous larvae and nymphae of a small mite were found. A personal inspection of the affected flock was carried out, the sheep being kept on a farm bordering the Vaal River. Six sheep in a flock of 400 were showing these peculiar skin lesions, which were confined chiefly to the face and legs, the parts free of wool being especially involved.

The lesions were of an eczematous nature and not of recent origin, as the skin was markedly thickened and covered in parts with hard encrustations. There were also distinct signs of rubbing and biting. On careful examination numerous small red mites were found in the lesions. These mites were very inactive (even less than *Psoroptes communis*). Specimens were collected, and it was determined that they were immature forms of thrombidium, but as no adults were found a specific determination was impossible. The sheep is, of course, an accidental host of these parasites, which normally complete their life history on plants, chiefly grasses.

The local farmers assured the writer that the disease has been noticed amongst their sheep for several years, but they were not alarmed at its presence, as the lesions make their appearance in late summer and autumn and usually disappear with the onset of winter. A dressing of a mixture of paraffin and lubricant oil is, according to them, most effective in clearing up the disease. According to reports, the same condition has been noticed in sheep in other parts of the Highveld of the Transvaal.

One of the affected animals from the above flock was brought to the laboratory for observation. This sheep—D.0.B. 14502—was placed in a sheep box with two normal sheep. The mites gradually decreased in number and after 10 days none could be found. No lesions developed on the animals kept in contact. The lesions on the face and legs of the affected sheep recovered uninterruptedly without any treatment.

In December, 1927, scrapings from a horse, which was supposed to be suffering from mange, also in the Heidelberg District, were examined by Dr. Mönnig. He found *Thrombidium* in the scrapings. This *Thrombidium* infestation in horses was also established. Lesions on other animals have not yet been recorded.

Discussion: There is very little doubt that the lesions in this case were caused by *Thrombidia*. The lesions provoked closely resemble those of sarcoptic infection. It is thus important to bear in mind the possibility of *Thrombidium* infestation in the diagnosis of skin diseases. Fortunately, however, the condition has not assumed alarming proportions, the infection being usually limited and the lesions easily treated.

Case No. 2.—*Tufting of Wool.*—Noted in Sheep D.0.B. 17826. This animal was sent to the laboratory from the Dewetsdorp District, O.F.S., in July, 1927, by the Government Veterinary Officer, Bloemfontein. He describes the condition as existing in other sheep in his area, but the cases are usually isolated, only one or two animals showing the condition in a flock.

It was observed that the wool hangs in tufts from the side of the body, practically the entire side of the animal being affected from immediately behind the shoulder to the side of the hip and thigh. (See photograph.) A thorough examination of the skin of the affected part was made, but no definite skin lesions could be found. There is, however, an abnormal amount of desquamated epithelial flakes on the skin and in the wool, where the wool has become detached. In October, 1927, the animal was shorn. The wool appeared normal until towards the end of February, 1928, when definite signs of tufting of the wool were again noted. The animal was often noticed to bite or rather chew the wool along the sides of the body. In May, 1928, the tufting and ragged appearance of the wool were as marked as in July, 1927.

The animal was kept in close contact with other sheep but these did not show similar symptoms. Sometimes, however, the fleece of sheep, especially when long, becomes slightly ragged (but never so aggravated as in the animal in question) and is chiefly due to the wool becoming torn out with external objects against which they rub.

Discussion: As has been said, no skin lesions could be found to account for any irritation. It appears as if this condition is the result of an *acquired vice* of the animal. An idea of an external factor being involved in provoking the condition must be discarded as the "biting" has persisted in the box and recurred as soon as the fleece was a fair length. The animal might derive pleasure in biting and chewing its wool, as the fleece contains in the yolk a slight amount of salty material.

Tufting of wool as seen in Sheep D.0.B. 17826. (See Fig. 1.)

Case No. 3.—*A dermititis of a chronic verrucose granulating type involving the sides of the face.*—This condition was observed in Sheep 17506, which was sent to the Laboratory from the Kaffir River area, Orange Free State. This was, according to the owner, an isolated case in a large flock. The condition had persisted for some time. The lesions were extensive (see photograph), involving the sides of the face, especially the parts free of wool. The involved area was covered with a thick hard and greyish white encrustation, the skin

underneath having a granulating appearance, slightly covered with pale yellow pus. The lesions did not appear to itch. There was a fairly offensive smell, which attracted flies. A very careful examination for parasites was made, but none were found.

Transmission experiments failed; a bacteriological examination was also carried out, and although numerous organisms were isolated, it was not possible to reproduce the condition.

The animal in question was kept under close examination for about three months, during which time the condition remained unchanged. It was then submitted to treatment, which consisted in cleaning the affected parts and applying Tincture of Iodine, and a small amount of Iodoform ointment. Improvement was rapid and after six weeks the lesions had practically healed.

Discussion: The condition noted in this animal does not appear to be contagious, as all the transmission experiments failed. Such cases have been observed by other workers. It appears as if the condition might be caused by an irritation of the skin from an excessive secretion of the eyes, e.g. during an attack of conjunctivitis, with a secondary invasion by various bacteria.

Ordinary antiseptic wound treatment appears to be successful.

Skin lesions of face of Sheep 17506. (See Fig. 2.)

CASE No. 4.—*A peculiar inflammation of the skin, associated with marked irritation.*—Three sheep, Nos. 17193, 19485 and 18375, from different parts of the Union were sent to the Laboratory. They were found to be suffering from apparently the same condition. This condition is very puzzling to farmers and sheep inspectors, as the lesions closely resemble psoroptic scab and in one case the flock was actually quarantined for this condition by the inspector. The term Australian itch has been applied to the condition, but this term has apparently been coined in South Africa, as in replies received from Australia* the affection is not known there, at any rate under this name. The term Australian itch should, therefore, be avoided, as it will only lead to misunderstanding. It would appear from correspondence that the disease is rare and only isolated cases are seen. There is also no evidence that the disease is infectious.

The three animals, two ewes and a hamel, were received from Robertson, Cape Province, Griqualand East, and Marquard, Orange Free State. The lesions were found in the perineal region and on the posterior portions of the hind limbs, in one case also in the axillary region. The skin is thickened and the wool in the affected parts matted with a tough yellow exudation. The animals frequently bit these parts and there were other symptoms of irritation. Papules containing light yellow pus appear, but these disappear after a time. A very thorough examination for parasites was carried out repeatedly, but none were found. Contact and transmission experiments (with pus and scrapings) were attempted, but with no success. Cultures were also prepared from the pus in the papules (a gram negative coccobacillus and staphylococcus albus were isolated), but it was found impossible to reproduce the condition.

* McEachran, of Sydney, writes (11/8/26) that the term is applied to a skin affection of horses "particularly in the coastal districts."

The three affected animals were kept under constant observation for periods varying from eight months to a year, but in all cases the condition remained unchanged. A piece of affected skin was removed from Sheep 17193 and examined histologically. The epidermis of the skin was markedly thickened and the papillary bodies much enlarged. The superficial layers of the skin down to and including the stratum spinosum were thickened on account of hyperkeratinization and there was a marked infiltration of eosinophiles, round cells and some of these cells partially necrosed. The lower layers of the epidermis were apparently not infiltrated but the cutis and subcutis showed a marked infiltration with eosinophiles. The surface layer of exudate showed the presence of masses of fairly thick and short bacteria. Sheep 17193 was later killed for post-mortem examination. It showed fairly marked verminosis with the accompanying pathological changes. The adrenal glands showed peculiar yellow foci in the medulla. A histological examination revealed the presence of closely packed foci of eosinophiles in the medulla of the adrenal. In the spleen there was also a marked infiltration of eosinophiles in the immediate neighbourhood of the germinal layer.

Photos showing skin lesions in Sheep 17193. (See Fig. 3.) *Note the papules and thickened condition of the skin.* (See Fig. 4.)

Discussion: From all appearances, the condition noted in these three animals is the same. The animals were merinos and the lesions chiefly confined to the perineal region and the inner aspect of the thigh. This must be borne in mind when an explanation is offered.

The eosinophilia noted in the skin, spleen and adrenal glands of Sheep 17193 is peculiar, and no reference to this could be found in the literature. Whether there is any relation to these peculiar lesions and the skin disease is obscure, and more material must be studied before arriving at any conclusions.

No exact reference to this condition was found in the literature. According to Hutyra and Marek (19), seborrhoea, or excessive formation of dandruff, has been noted in the various domestic animals. The *Seborrhoea oleasa* of sheep, as described by them, closely resembles the condition noted in the sheep here. They state that it occur on the parts not covered with wool. There is according to Schindelka a superficial inflammation of the skin which gives rise to an excessive formation of sebum. Irritation may exist.

The exact cause is not known; it occurs more often in anaemiae animals, and it would appear that severe infectious and digestive diseases might form the basis of an attack of seborrhoea. Skiba noted such a skin disease in sheep in Peru, which had recently been introduced from Germany; he maintains that the disease was a result of disturbance of functions of the skin during acclimatization.

It is quite possible that we are also dealing with such a variety of seborrhoea. It is, however, peculiar that in all cases the perineal region or parts of the hind quarters were only affected. When one realises how often animals are treated with various preparations for myiasis, one is inclined to believe that these animals may have previously been " fly struck " and that some irritant preparation was administered. If such were the case a disturbance in function of the skin might give rise to these peculiar lesions.

Case No. 5.—*Sore Head in Sheep*.—The Government Veterinary Officer, Butterworth, Cape Province, first drew the attention of the Department to this disease amongst sheep in his locality. Mr. Bedford, who visited the area and inspected the affected flocks, believed that the condition was not caused by parasites. The disease assumes alarming proportions in some cases. Treatment with various preparations and dips has been of little avail.

Two sheep (Nos. 19620 and 19621) were sent to the Laboratory for examination and observations. These sheep were as usual immediately put into contact with other sheep.

The lesions on these sheep were confined to the head, the poll being chiefly affected. It was obvious that there had previously been a certain amount of irritation and that as a result the animals had rubbed their heads. These parts of the head were devoid of wool and the skin covered with dry scaly material. On close examination small, quick-moving mites were found on the lesions and in the surrounding wool. On one animal there was also a lesion of the left flank somewhat resembling those of the head. This, however, showed no parasites. A careful examination of the rest of the body was made but nothing unusual was found. Both animals, also apparently infected with *Oestrus ovis*, were kept under constant observation, but after a week no more mites were found. The lesions gradually healed and after two months the parts were covered with healthy wool and no more signs of irritation noticed.

Discussion: The observations noted in these two animals differ markedly to the reports received from other sources. It is important to note:—

(i) That small actively moving mites closely resembling the red mites of fowls (*Gamasidae*). A specific determination has not yet been obtained. These mites are certainly blood suckers, as is seen from the structure of their mouth parts and the presence of ingested blood corpuscles.

(ii) The lesions in the animals kept under observation completely healed without treatment. The parasites originally noted disappeared and none could be found after about eight days.

(iii) It was impossible to reproduce the condition in other animals.

From personal observations made, it does not seem possible entirely to exclude the mites found as a cause. It is, however, possible that their presence on the lesions was accidental. It is said that cattle in those parts sometimes show a similar condition, and the lesions are observed at the bases of the horns. More information of this condition is required before any conclusions can be made.

Showing site of lesions. When photos were taken the lesions had partially healed.

Sheep 19621. (See Fig. 5.) *Sheep* 19620. (See Fig. 6.)

Case No. 6.—*Dermatitis apostemosa disseminata traumatica, especially of very young lambs*.—This condition was investigated in 1925. Cases were reported from various centres, e.g. Vryburg, Bethlehem, etc. The condition makes its appearance in late autumn. Very young lambs are chiefly affected. One observes a disseminated

purulent dermatitis (in the form of small abscesses) along the dorsal aspect of the body. As a result of the extensive inflammatory condition of the skin the animals show marked symptoms of pain and are tucked up, disinclined to move or suck. This leads to cachexia and the animals die of toxaemia as a result of the purulent dermatitis.

The abscess formation is seen especially in the corium, and Aristida seeds, " steekgras," are found, either as a foreign body in the abscess, or in the subcutaneous tissues. Numerous seeds are also found in the wool. A streptococcus was isolated from the abscesses and when " steekgras " seeds were infected with this organism more or less similar lesions could be produced in other animals. It appears that this organism is specific in the formation of these abscesses, the lesions produced by the " steekgras " affording a channel of infection.

" Steekgras " (Aristida) is of inferior grazing value and is troublesome in many ways to the sheep farmer. Overstocking is largely responsible for the spread of " steekgras."

Case No. 7.—" *Lumpy Wool.*"—No popular term has come into use for this skin condition noted quite commonly in South Africa, and the term " lumpy wool " is suggested.

Quite a number of cases have come to the notice of the Veterinary Division during the last few years. The condition has been reported from many parts of the Union. It makes its appearance sporadically in merino sheep, especially those with fairly long wool.

One notices hard pyramidial masses in the wool, these varying in size from about ½ in. in diameter to 1½ in. They occur usualy on the dorsal aspect of the body, especially in the lumbar region and vary in number. The lower parts of the body and the legs are unaffected. These lumps formed by the adhesive action of exudate on wool, can be easily pulled off, the skin underneath having an irregular red granulating appearance.

A histological examination of the diseased parts shows that the exudative material in the wool consists of accumulations of hypokeratinised epithelium with marked cellular exudation chiefly neutrophiles. The changes seen in the skin are those of a subacute purulent dermatitis (or eczema), but no other characteristics are to be noted. No special bacterial flora is evident.

In affected animals kept at the Laboratory, one finds that the skin heals after a time and that new healthy wool grows beneath the lumps, which are in this way gradually worked off. In some cases the masses of wool fall off and the skin heals normally with new wool ultimately growing over the areas affected.

Attempts made to establish the cause of the condition and to reproduce it artificially have failed. There is at present no evidence that the condition is infectious. It was thought that the condition might stand in some or other relation to the following predisposing factors:—

(1) " *Steekgras.*"—Although in some cases the seeds of *Heteropogan spp.* are found in the skin of animals affected, in others the condition has occurred on " steekgras-" free veld.

(2) *Excessive Rainfall.*—The condition appears to be more prevalent during very wet seasons, but cases have also occurred during dry years. Artificial experiments with moisture have also failed.

(3) *Certain dip preparations,* especially nicotine preparations. On one or two occasions outbreaks seem to have occurred after dipping in certain commercial dipping preparations, but outbreaks have also occurred when no previous history of dipping is found. Experiments to set up the condition by the use of various dipping preparations have been unsuccessful.

No reference to the condition is to be found in the literature. Hutyra and Marek (1922) describe a condition known as "Regen fäule" occurring in pasture sheep in Europe during the wet and cold weather. The condition is described as an acute wet eczema (*eczema madidans et rubrum*) with marked exudation of serous fluid on the surface and the formation of crusts, whereas in the condition in question the lesions are of a semi-purulent process, and are *disseminated* instead of *diffuse.*

The nature of this peculiar skin disease is thus very puzzling. Unfortunately no very early stages of the disease have been observed, and it has been impossible to study the entire course of the disease. It is of considerable economic importance, as much wool may be damaged and in some cases the disease has been so bad that the general health of the animal has suffered. Mortality has even been ascribed to the condition.

References.

Hutyra & Marek (19—):
Special Path. and Therap. of the Diseases of Domesticated Animals. III, 577, Ballière, Tindall & Cox, London.
(1922): Ekzem der Schafe. *Spec. Path. u. Therap. der Haustiere.* III, 569. Gustav Fischer, Jena.

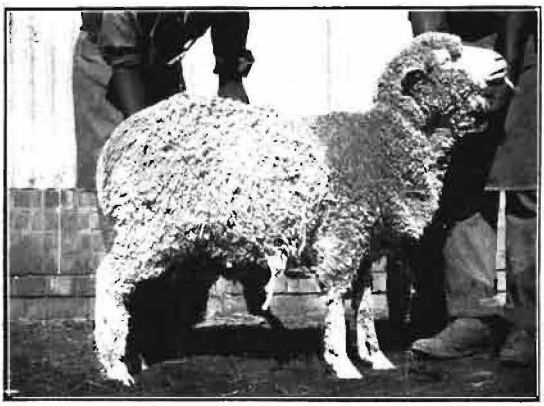


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

THE PROGRESS OF THE SHEEP-MAGGOT FLY INVESTIGATION AT GROOTFONTEIN SCHOOL OF AGRICULTURE.

By Bernard Smit, B.Sc.Agric., M.Sc.(Cornell), Entomologist, Grootfontein School of Agriculture.

The sheep-maggot fly investigation was commenced in 1923 and has been carried on more or less continuously up to the present. Pressure of teaching and extension work has, however, hampered the progress of the investigation. As the problem of sheep-maggot flies is one of the most important problems relating to sheep farming in South Africa, it ought to receive more support, and the work requires at least one officer who should devote his whole time and attention to it. Grootfontein is a very suitable place at which to carry on the work because it is situated in the heart of our sheep area and has all the necessary facilities.

The first step in the investigation was the gathering of all possible information on the subject from the farmers themselves. This was done by sending out a large number of questionaires through secretaries of farmers' associations. Much of this information has been published. (See Dept. Agr., U.S.Africa IX, 384, 1924.)

THE SHEEP BLOW-FLIES.

The next step was to ascertain what species of blow-flies actually attack sheep in South Africa. Large numbers of maggots taken from live sheep all over the country were identified and found to belong to one of the following species:—

Chrysomyia chloropyga,
Chrysomyia albiceps, or
Lucilia sericata.

The maggots of *C. chloropyga* and *L. sericata* were most commonly found, the two species being about equally abundant, while the hairy maggots of *C. albiceps* were much less common. The distribution of these three species has been worked out. It appears from trapping records that they are distributed all over the Union and are also found in South-West Africa. Their distribution over the farm of Grootfontein has been carefully studied. The flies are found to be far more abundant in low-lying sheltered country along rivers and below dams where there is plenty of moisture and vegetation than they are on the open veld or on the hills.

The seasonal distribution of the flies has also been studied and trapping records for three years show that *C. chloropyga* and *L. sericata* reach their maximum abundance in October, November, and December, the former becomes far more abundant than the latter in the Karroo. *C. albiceps* does not appear in the spring until the beginning of November and reaches its maximum in January. During the last week of February and the whole of March all the flies become very scarce but in April and May they increase in numbers

again. They do not become as abundant as in the spring and in winter they almost disappear. Much of this information has been published. (Smit and Du Plessis, 1927.)

The life-histories of the flies have been carefully worked out in the insectary, nine complete generations of *L. sericata* having been reared during a year. The flies have been kept alive in cages for three months. The lengths of the various periods of development at different times of the year have been recorded and a study has been made of the hibernation of the flies. They pass the winter in all stages except the egg stage and breed almost continuously throughout the year. The vast majority, however, winter as puparia. All this information together with a large life-history diagram is to appear shortly as Science Bulletin No. 68.

Control.

Trapping.—Many types of fly-traps have been experimented with and a very efficient trap has been devised. It is made cheaply out of two petrol tins and is used extensively throughout the sheep areas of the country. A firm this is making these traps for farmers sold over 600 in one week in the Cradock District recently. The construction and operation of this trap has been fully described. (Smit, 1926.)

Disposal of Carcasses.—This is the most important control measure since carrion is the natural breeding place of the sheep-maggot flies. Much experimentation has been done in connection with this phase of the problem. Burying of carcasses has proved to be almost useless unless it is done before the flies have laid their eggs on them. This is on account of the burrowing powers of the maggots and newly emerged flies. An effective maggot-trap for destroying carcasses was described in 1926. (Smit, 1926.) The big pit method, tank method, and various other methods of using poison to prevent maggots developing and destroy the flies have been experimented with. A recent article (*Farming in South Africa*, II, 539, 1928) deals with the tank method, which is one of the most practical thus far devised.

Dressings for Infested Sheep.—A study has been made of the conditions under which sheep become infested with sheep maggots.

It has been found that fly eggs or maggots will not always produce infestation if put in the wool of sheep. The best methods of infesting sheep artificially is to allow maggots to liquify hard-boiled white of egg and then to pour this into the wool in which the maggots are placed. Sheep so infested can be used for the testing of dressings a few days later. In this way various dressings have been tested for their larvidical and repellant properties. Previous to this discovery sheep were simply run in a camp and dressed when infested by the flies in the natural way, but this proved a very slow method.

An olfactometer has been devised for testing the reactions of the flies to odours with a view to obtaining laboratory data on the repellant action of various substances. A better method, however, appears to be by the use of traps baited with meat in which tins of the various repellent substances are hung. This is now being carried out on an extensive scale. Pine tar oil and pyridine are among the most promising substances.

The resistance of maggots to many substances both liquids and powders has been tested by dipping batches of maggots into them. The volatile liquids such as petrol, benzine, carbon bi-sulphide, and chloroform are the best larvicides, but it is extraordinary how resistant the maggots are.

Parasites.—The small chalcid *Mormoniella vitripennis* (*Nasonia brevicornis*) is common all over the country, but it does not help much in controlling the flies. This is because it attacks only the puparia and cannot get down to them if they are buried more than half an inch below the surface of the soil. As the habit of the maggots is to burrow well into the soil before pupating most of the puparia escape the attack of this parasite.

The life-history of the parasite has been fully worked out and the advisability of introducing other blow-fly parasites from Europe is now being considered.

Literature.

A bibliography of over 220 references has been compiled and an effort is being made to keep this up to date. A comprehensive Farmers Bulletin on the whole sheep blow-fly problem dealing particularly with methods of control is in the printer's hands and it is hoped will appear shortly.

References.

Smit, B. (1925): Sheep Blow-fly Control. *Jl. Dept. Agr.*, XI, 455, U. S. Africa.
Smit, B. (1926): Sheep Blow-fly Control. *Jl. Dept. Agr.*, XII, 132, U. S. Africa.
Smit, B., and Du Plessis, S. (1927): The Distribution of Blow-flies in South Africa. *Bull.* 13, Dept. Agr., U. S. Africa.

SOME EXPERIMENTS WITH VUILBEK (*ECTHYMA CONTAGIOSUM*).

By I. P. MARAIS, B.Sc.Agr., B.V.Sc., Veterinary Research Officer, Onderstepoort.

Introduction.—This disease has been frequently brought to our notice within recent years. In 1926 Theiler (1928) conducted experiments with the malady when it appeared among sheep and goats at Onderstepoort. According to him the disease has been known for a considerable time under the name of vuilbek. Conditions described as "sore mouth," "malignant aphtha," and "Stomatitis of Angora Goats," are probably identical. Publications on the subject include "Ueber Pocken bei Ziegen Süd-West Afrikas,"* by Zeller (1914), an article by Aynaud of Chartres (1921), and one from Greece by Blanc and others (1922). Theiler adopts the name *Ecthyma contagiosum.*

Description of the Disease.—Under natural conditions one rarely has the opportunity of observing the condition in all its stages. When, however, the virus is applied over a large surface to the skin of sheep or goats accurate observations may be made. An area of the skin over the abdomen is shaved and lightly scarified. Infected material is then rubbed in. On the third day typical changes are seen. After about 24-48 hours the lines of the scarifications become reddened and swollen. Up to this stage no difference can be seen between inoculated and control scarifications. On the third day the skin around the inoculated areas shows small vesicles which soon become filled with pus, changing from a glistening vesicle to a turbid pustule. This increases in circumference and becomes sharply circumscribed. Liquid exudes from the surface of the pustules, and dries to form a yellow crust. The swelling increases in size, more liquid is exuded, and the crust becomes dark brown. If the crust is removed, a varying amount of pus is seen covering very prominent papillae. Later on, the crust cracks in various directions, and oozing, bleeding sores are seen. These lesions gradually dry up and after two to three weeks the crusts begin to peel off, leaving a smooth clean surface.

Microscopically one sees in the early stages a slight thickening of epidermis with a small amount of surface exudate, and a few infiltrative cells in the cutis. Foci of neutrophiles collect in the epidermis, and the epithelium becomes destroyed and replaced by exudate. The skin appears thickened 4-5 times by the infiltration of masses of neutrophiles and round cells. The malphigian layer and papillary bodies are practically obliterated, the round cells being mostly situated near the subcutis, whilst the neutrophiles occupy the upper parts, gradually becoming a mass of necrosed cells towards the surface. The surface is covered with a firm mass of exudate and epithelial cells. Muscular tissue and labial glands are also slightly infiltrated.

* Sigwart, Government Veterinarian at Otjiwarango, forwarded material to Zeller in 1914, and with this experiments were made in Berlin.

Animals Affected.—In nature sheep and goats are susceptible. In our experiments calves did not show typical reactions. Aynaud reports that small laboratory animals are refractory, also pigs, dogs, and horses.

Nature of the Virus.—The disease was produced with glycerinated material which was free from bacteria on microscopic and cultural examination. Filtration experiments with Seitz and Chamberland filters proved negative. Aynaud reports successful filtration using Berkeveld Candle V and Chamberland L 1 and L 1 bis.

Resistance of Virus.—In dry powder the virus has remained virulent for nearly two years, and in 25 per cent. glycerine for several months. In liquid paraffin it was apparently dead after 15 months. Five per cent. carbolic acid kills the virus easily. Preparations of undiluted carbolic dip and tar also kill the virus.

Nature of the Disease.—Zeller described it as "Pocken der Ziegen," but from his description it cannot be identified with sheep-pox, which incidentally has not been described in the Union. Individual eruptions may resemble sheep-pox lesions, but the disease can be distinguished from sheep-pox in that it remains confined to the mouth and udder. Furthermore, high temperature as described in sheep-pox has not been noted.

Immunity.—In the experiments carried out by the author, a number of animals were vaccinated on the neck in such a position that the animal could not lick the site. Vaccination was carried out by the methods employed against smallpox. The animals were then tested for immunity at various intervals. Up to eight days after vaccination lesions could be provoked on the lips. These lesions decreased in severity from the 3rd—8th day. On the 10th day no further lesions could be obtained. After six months mild lesions could again be provoked on previously inoculated goats.

Cross-immunity.—To ascertain if any difference exists between sheep and goat virus, cross-immunity experiments were carried out with virus from goats obtained from Prieska (Cape), and virus from sheep obtained from Bredasdorp (Cape). The experiments showed that sheep virus conferred immunity on both sheep and goats against the goat virus. These experiments were not quite conclusive as slight differences were observed in the various reactions. It is proposed to repeat these experiments.

In two goats inoculated with sheep virus on the neck it was found that a day or so after inoculation on the neck the condition appeared on the mouths of both goats. This may have been accidental, both animals becoming infected from a common outside source. Where the disease is observed under natural conditions, we find that in sheep the whole face from the lips to the eyes is frequently affected. In goats we have rarely seen the conditions except on the lips and the area immediately around.

In a very few cases we have seen lesions on the inside of the lips and on the tongue. In one case in a young kid there were large wart-like growths on the tongue, material from which transmitted the disease to lips of other kids.

Cases of Vuilbek recently brought to our notice.—1. Mr. Van Breda from Bredasdorp, Cape Province, has reported that the disease occurred amongst his sheep in 1927. The lambs in particular were

very severely affected. No deaths directly attributable to the disease were reported, but the disease materially affected the condition of the lambs. Some of the lambs recovered very slowly.

2. Sheep inspector G. I. Purchase, Prieska, in 1927 reported severe outbreaks of the condition in goats in that district, and sent some scabs from the mouth of one case. These cases were investigated during the course of this year, as will be described later.

3. The officer in charge, Allerton, Pitermaritzburg, recently reported on the results of investigations carried out by him in an outbreak of suspected sheep-pox in the Ixopo District. He diagnosed the condition as *Ecthyma contagiosum*, and stated that the sheep were very severely affected and that a few animals had died probably from mal-nutrition, the eyes in some cases being completely closed and the mouth so affected that the animals could not graze.

4. Recently the Government Veterinary Officer, Vryburg, sent some material (crusts) from the mouths of sheep. This was found to contain vuilbek virus.

Importance of the Condition.—Vuilbek has always been regarded as a mild condition which does not require treatment or serious consideration from a State point of view. Broadly speaking this is correct. The condition as it appears periodically in animals at Onderstepoort bears out this conception. In certain cases, however, the disease assumes a serious and even alarming aspect. In young lambs and kids it is frequently serious, the lips become hard, stiff, and immobile, so that sucking or grazing becomes very difficult. The deformation of the lips also irritates the ewes and this further handicaps the proper feeding by the lamb. Such young animals soon show the effects of the disease by their poor condition. Where the disease is severe, deaths from mal-nutrition are not infrequent. A quite alarming condition is seen where the udders of milch goats become effected, as they invariably do when the disease appears during kidding. Secondary invasion causes an acute purulent mammitis affecting one or both halves of the udder. These ewes have to be slaughtered. Deaths in lambs may also occur as a result of sucking from diseased teats owing to alimentary disturbance. Careless handling of diseased udders during milking is another factor in the spread of mammitis. All these conditions were observed during a recent visit to an affected farm in the Prieska District. Last year, 1927, all the ewes had to be sold to the butcher and others bought. The losses amongst the lambs amounted to over 50 per cent. This year again fully half the ewes are useless for milking purposes, and about 20 out of a hundred lambs have died. The ewes that had not lambed were vaccinated, and in a report which has just come to hand from the sheep inspector, it is stated that not one of the vaccinated ewes has as yet shown any sign of the disease in spite of numerous bush scratches on the teats.

Treatment.—The virus is apparently readily killed by ordinary disinfectants. Although no thorough investigations have been carried out with regard to medicinal treatment the following preparations have been used by various people and recommended:—

(1) 1 per cent. carbolic dip, e.g. Hycol.
(2) Pure carbolic dip and stockholm tar.
(3) Sulphur ointment.

The condition seems to call for prevention rather than treatment, and vaccination in cases such as was observed at Prieska appears to be the best remedy. The writer has not yet had an opportunity of observing the disease in a flock of sheep during lambing, but it seems to be reasonable to suppose that a similar state of affairs may manifest itself.

References.

Aynaud, M. (1923): La Stomatite pustuleuse contagieuse des virus. (Chancre du Mouton). *Ann. Inst. Pasteur*, XXXVI, 488.

Blanc, G.; Melandi, C.; Caminopetros, T. (1922): Recherches expérimentales sur une maladie éruptive de la chèvre observée in Grèce. *Ann. Inst.* Pasteur., XXXVI, 614.

Theiler, A. (1928): Ecthyma contagiosum of Sheep and Goats. *13th and 14th Reports, D.V.S.* U. S. Africa.

Zeller, G. (1920): Ueber Pocken bei Ziegen Südwest-Afrikas. *Arbeiten aus dem Reichsgesundheitsamte* LII. 501.

In the discussion which followed, Mr. O. T. de Villiers referred to a condition (also affecting the lips) he had encountered in the Orange Free State. Dr. Steyn suggested that this was due to *B. necrophorus* as he had observed a similar affection in Europe.

LEG-WEAKNESS IN POULTRY.

(A preliminary note on the occurrence of a specific fowl paralysis in South Africa.)

By A. D. Thomas, B.V.Sc., Veterinary Research Officer, Onderstepoort.

The term leg-weakness, as used by poultrymen in South Africa, refers to a state of total or partial paralysis of the limbs in fowls, a condition which seems fairly common. Such a vague and sweeping term naturally comprises morbid states to which several different causes can undoubtedly give rise. The term merely describes the most striking symptom without regard to cause or other characteristic lesions, in this respect being a close parallel to much used and abused terms such as staggers, stiff-sickness, gall-sickness, etc., in other domains of veterinary practice.

Although the use of such a non-committal term is often convenient where proper diagnosis is impossible, or difficult, yet an attempt should be made to differentiate the various types of paralysis so that the problem can be tackled in more than a haphazard way.

Some of the more common conditions of which leg-weakness is one of the main symptoms, are mentioned below: Intestinal worm infestation, chronic coccidiosis, chronic spirochaetosis, external blood-sucking parasites, e.g. ticks, parabotulism, e.g. limber-neck, and avitaminosis, the beri-beri-like disease produced by feeding polished rice alone.

Intestinal worms have been blamed as the cause of a very large proportion of leg-weakness in South Africa, some workers even going as far as to implicate certain definite species. It is quite probable that paralysis, due to other causes, has often been diagnosed as due to worms, since it is rather uncommon to find a bird entirely free of these troublesome parasites.

It is, however, not intended to discuss here any of the foregoing well-known factors, the purpose of this short article being really to draw the attention of those interested to a specific form of leg-weakness or paralysis of fowls which seems, so far, to have escaped the notice of veterinarians in South Africa. This disease, characterized by round cell infiltration of the nervous tissues, probably others also, gives rise to a wide variety of symptoms according to location of lesions, but most commonly manifests itself as a paralysis or paresis of the limbs.

The disease was recognized in December, 1927, in a couple of birds sent for diagnosis to this Institute. The characteristic posture taken up by the birds lying on their breasts, with one leg fully stretched out in front, being so strikingly similar to the description given by Dobberstein and Haupt (1927), led to a closer examination of the nervous system. This revealed typical macroscopic and microscopic lesions as described by the above workers.

All subsequent cases of leg-weakness were then subjected to an histological examination, and in this way a few severe outbreaks were located. The impression received is that the disease is fairly widespread over South Africa and causes in some cases considerable economic losses.

Three of these outbreaks were investigated and altogether some twenty-six clinical cases have been kept under observation to date. Most of them came from the above outbreaks, several were sent in for diagnosis from other places in the Union, and a few developed the disease at Onderstepoort. Material from all these cases was subjected to careful histological examination the result of which, together with the clinical symptoms, seems to leave little doubt that the disease is identical with that described under various names by the following authors:—

Polyneuritis	... Marek (1917)	... Austria.
Neuromyelitis gallinarum	... V. d. Walle & Winkler, J.	... Holland.
Neuritis in chickens ...	... Doyle (1925)	... United States of America.
Neuro-lymphomatosis ...	... Pappenheimer, Dunn & Cone (1926)	United States of America.
Polyneuritis chr. interst	... Dobberstein & Haupt (1927)	... Germany.

The observations made on this disease during the course of the past seven months together with the results of a few experiments on a small scale are given below.

Occurrence.—The first cases were received from Elsenburg, Cape Province, in November, 1927. It was subsequently ascertained that the disease occurred at least in two flocks in the Cape Peninsula, the owner of one maintaining that he lost over 400 birds from this cause.

Of the three outbreaks visited in the Transvaal, one was at Klip River, Heidelberg District, amongst pure-bred Australian Orpingtons. Here a large percentage of the young pullets and capons have died and are still dying from this cause. The trouble started in December, 1927, in a batch of chickens about 2-4 months old, and the birds now contracting the disease are from the same batch and are 10-12 months old. The owner maintains that no birds were introduced to his flock during the 12 months previous to the outbreak and that the disease was unknown to him before, although he has kept poultry for 4 years. The second outbreak was near Johannesburg among pure-bred White Leghorns and Black Orpingtons. These started going lame and dying in January, 1928, at ages ranging from 3 to 5 months. They were all pullets. No further cases were reported after April, 1928. The exact losses were not ascertained but could not have been very high. The third outbreak at Brits, also amongst young White Leghorn pullets, 3-6 months old, lasted for the first three months of 1928 and stopped. Here again the mortality was not very high. With the exception of one adult cock all the birds affected so far have been pullets and capons between the age of 2 to 12 months.

Mortality.—Actual figures are not available, but the mortality seems to vary within wide limits in different flocks.

Symptoms.—The onset of the disease is fairly sudden, in some cases a matter of hours. The first signs noticed have nothing characteristic. The birds appear off colour, stand apart huddled up, feathers ruffled, eyelids closing and opening repeatedly, sometimes with head extended and beak gaping, as if tired. Many birds seem

to recover from this initial stage without showing any further symptoms, while a few develop an *acute* form, characterized by staggering gait, lethargic attitude, complete paralysis in a few hours and death in the course of a day or two. The vast majority of cases, however, develop a *progressive* paralysis of the limbs which lasts for varying periods of time, weeks or months, and usually ends in death; or occasionally in slow recovery, if the bird is able to feed well.

This progressive paralysis shows itself at first in the unsteadiness of gait, the bird walks as if dazed, sometimes with wings drooping, often making sudden movements to retain its equilibrium. Shivering or trembling of whole body is often seen. There is a gradual weakening of the legs, usually one more than the other, so that they sag at the joints and the body weight becomes borne on the hocks. At the same time the digits often assume a clenched position. The bird may retain the use of one of its legs, but more often it lies continuously on its breast or side, usually with one leg stretched out rigidly in front of the other extended behind or flexed under the body, producing a very characteristic attitude.

The affected limbs can still be moved in a rigid incoordinate way, but still with quite a lot of force as is seen for instance when placed under chloroform anaesthesia. It is a very peculiar fact that the right leg is much more frequently affected than the left or if both are affected, it shows paralysis to a higher degree. Out of 26 clinical cases, 15 showed a simple leg paralysis of which 13 were affected more in the right than left leg. Of the remaining 11 cases, two showed wry-neck, one total blindness, and the rest general incoordination and death in the acute form described above.

It is further a striking feature of the disease that in the more common chronic forms, the liveliness of the bird remains practically unchanged. This is sometimes of value in differentiating from the lethargic attitude taken up in debilitating toxic forms of leg-weakness, such as those caused by worms.

The eye usually remains bright and alert, the comb bright red, voice unchanged, and the appetite remains extraordinarily good throughout, the bird feeding as long as it can conveniently reach and take its food. In spite of this, however, the birds rapidly lose weight and die in a state of extreme emaciation, probably muscular atrophy, after a more or less prolonged state of helpless paralysis.

The cases which recover never show very severe symptoms, and good food easily accessible seems to favour recovery in such mild cases.

The affected limbs are usually quite insensitive to pin pricks or pinches, but too much importance cannot be attached to this, as even normal fowls react in a very uncertain way to such stimuli.

The body temperature in all the chronic cases was within the normal range, i.e. up to 108° F. but in the early and acute cases a rise of a few degrees was sometimes noted.

Post-mortem Findings.—As a rule the more protracted the paralysis the greater the emaciation, in some cases the muscular tissue having so much atrophied that the contour of bone could be clearly felt through the skin. In the more acute cases the condition was good. Where a limb, owing to prolonged paralysis remained rigid, e.g. fully extended, it was only by using force that the joints could be flexed

again during life or after death. In one case which remained alive for two months, the right leg was fully extended, joints partly ankylosed, sacral girdle and sternum markedly displaced and spinal column permanently distorted in an S-shaped fashion (Scoliosis). In the recent or acute cases, however, anaesthesia or death produced a state of complete relaxation of these tetanic-like spasms in limb or neck, a fact which points to the purely nervous origin of the paralysis. The viscera presented nothing abnormal as a rule, except that intestinal worms were present in most cases.

On exposing the larger nerve trunks, such as the brachial—and lumbo-sacral plexus, the latter easily viewed after carefully removing the kidneys, one often finds unilateral or unequal bilateral thickening and fusion of the trunks forming the plexuses, so that instead of being about the thickness of a knitting needle or less, the fused trunk may reach the size of a lead pencil. The swelling is usually more marked near the root and about the spinal ganglia, but occasionally one sees a fusiform swelling on the course of a nerve. The intercostal nerves sometimes show nodular swellings at their root and even the vagus has been seen thickened as compared to the normal. Instead of the normal yellowish-grey fibrillar structure, the swollen nerves assume a greyish, moist, translucent homogenous appearance with a tinge of red. Similar greyish translucent lesions in the spinal cord are not so easily distinguished. It should be noted, however, that lesions visible to the naked eye are by no means a constant feature even in chronic cases, since the cellular accumulation which these swellings represent must indeed be very extensive before they are visible to the unaided eye.

Histological Findings.—The greyish thickened portions of nerves and spinal cord described above, are found on section to be densely infiltrated by countless small round cells of the lymphocytic type. The interstitium of the nerve is so packed with these that the nerve fibres and their myelin sheaths are separated and probably suffer considerable pressure since the myelin sheaths show more or less degenerative changes. Dense accumulations of these cells are often seen in section in the form of round or oval foci, with a small blood-vessel as centre, amongst a more diffuse distribution or total absence of cells in the rest of interstitium of nerve. The infiltration of nervous tissue varies widely both as regards intensity and locality. Marked infiltration on the one hand might easily be mistaken for a type of round cell sarcoma, while at the other extreme, a few diffusely scattered or small perivascular aggregations of lymphocytes may be seen. Although the predilection seats of these cellular infiltrations seem to be at the root of spinal nerves and their ganglia, yet the brain, spinal cord, and nerves can also be affected either in a generalized or localized manner. As a matter of fact, more or less extensive foci of similar cells have been seen in some of the various organs and tissues examined which from the perivascular arrangement and nature of cells, certainly suggest a similar origin. Such foci have been found in the liver, heart, skeletal muscle, iris, ciliary body, ovary, adrenal, and thymus.

In one case of total paralysis of limbs, with wry-neck, the spinal cord in the middle cervical region was found to contain in two-thirds of its cross section, dense irregular perivascular foci of round cells. In one case of total blindness originating from an affected flock, the cornea and lens were quite transparent on both sides and the iris was

thickened, greyish, and contracted. On section both optic nerves showed a diffuse cellular infiltration, which was continued on to retina, ciliary body, and iris. Blood-smears from all cases were examined and found negative. Blood counts (differential) in two cases revealed nothing unusual.

Special attention was paid to the intestinal tract. Coccidiosis was not seen in any of the cases. The degree of infestation with worms varied immensely, from a few clean cases, through very light infestations consisting of 2-3 specimens of various kinds to fairly heavy ones. It is noteworthy that *Davainea proglottina* was not found in any of these fowls.

Bacteriological examinations were made repeatedly from blood, affected nerve, spinal fluid, and intestinal contents. Anaerobic and aerobic cultures on ordinary laboratory and special media, e.g. Noguchi's, gave negative results. The intestinal flora was also examined for the presence of organisms of the parabotulism group.

EXPERIMENTS.

Experiment I.—Two young pullets were injected intramuscularly with citrated blood from an affected fowl. One died from impaction of the duodenum, and the other is alive and well after 7 months.

Two young pullets injected intramuscularly with ground saline suspension of affected nerve remain healthy after 7 months.

Two young pullets injected intramuscularly with ground saline suspension of spinal cord continue healthy after 7 months.

Experiment IA.—A red hen injected intraperitoneally with ground nerve suspension is alive after 6 months.

A white hen receiving a subcutaneous injection with blood from the same source contracted typical lameness after 5½ months.

A grey hen injected with blood from the same source (intraperitoneally) is healthy after 6 months.

Experiment II.—Fed 1 lb. grain sent in with affected bird (and on which it had gone lame) to a young chicken without result after 6 months.

Experiment III.—Injected 5 lame chickens with anti-neuritic vitamin extract several times but no improvement noted. Cod liver oil fed in mash also had no effect.

Experiment IV.—Fed whole carcase of affected bird including viscera to two young cockerels. No result after two months.

Experiment V.—Ground spleen emulsion injected intraperitoneally into one pullet and a pigeon, also brain suspension injected intraperitoneally and intramuscularly into two pullets and a pigeon had no effect. Contents of intestinal tract and scraped mucosa drenched to one pullet also produced no result after two months.

Experiment VI.—Contact of healthy pullets with affected birds under laboratory conditions failed to produce clinical symptoms. Three healthy pullets, introduced in active outbreak and kept under same conditions, failed to show symptoms during 3 months.

Experiment VII.—The feeding of apparently healthy pullets from an affected flock (where the disease had stopped) on a mixed diet, with the addition of meat, did not prevent the development of typical clinical symptoms.

No conclusions can be drawn nor any great importance can be attached to the positive cases which occurred above in experimental birds, since quite a few cases developed symptoms and lesions in untreated controls and available birds. Some of the above and more recent experiments are proceeding.

Discussion.

It seems evident that a disease is being dealt with, having peculiarities of its own. It occurs at certain times in the form of an epizootic, at others affecting only one or two birds in a flock, yet contact and ordinary transmission experiments seem to show that if at all transmissible, this is possible only with great difficulty and in a small number of cases. A hypothesis of individual susceptibility or alternately general natural resistance has been advanced to explain this. Evidence so far seems to point against a dietetic cause, but this has not yet been fully investigated.

Some authors consider the condition a type of inflammation of the nerves with degenerative and productive processes, hence the name "polyneuritis" one sees in the literature. Pappenheimer, Dunn & Cone (1926) suggest the term *Neurolymphomatosis gallinarum*, and they consider the process a lymphoid hyperplasia of nervous tissue with degenerative changes as secondary. The latter appears to us to be the better explanation.

Certain pathological aspects of this disease would lead one to believe that it stands in some relationship to that group of ill-defined conditions, the Leukaemias and Aleukaemias on the one hand, and the neoplasms on the other.

In the material studied a whole series of cellular accumulations was found ranging from small lymphoid foci to large sarcoma-like new growths.

Whatever the nature of the process in the nervous system, the similar cellular aggregations in other organs as well as the tumours often found in birds from affected flocks, give one the impression of possible similar origin, a point which has already been suggested by Pappenheimer and co-workers.

Bearing in mind the works of Peyton Rous (1911) and Ellermann (1923) on neoplasms and Leukaemias of the fowl, the present disease may afford a suitable starting point for further investigation into the causes and interrelationship of all these interesting conditions.

Acknowledgment.

I have much pleasure in thanking Messrs. Chalmers and Parkin of Johannesburg and Elsenburg respectively, for their kind assistance in procuring material and supplying information.

References.

Dobberstein & Haupt (1927): Ein Beitrag zur Polyneuritis des Geflügels. *Zeitsch. f. Infek. Krankheiten d. Haustiere*, XXXI, 358-380.

Doyle, L. P. (1925): Neuritis in Chickens. *Jl. A.V.M.A.*, LXVIII. New Ser. 21, 622-630.

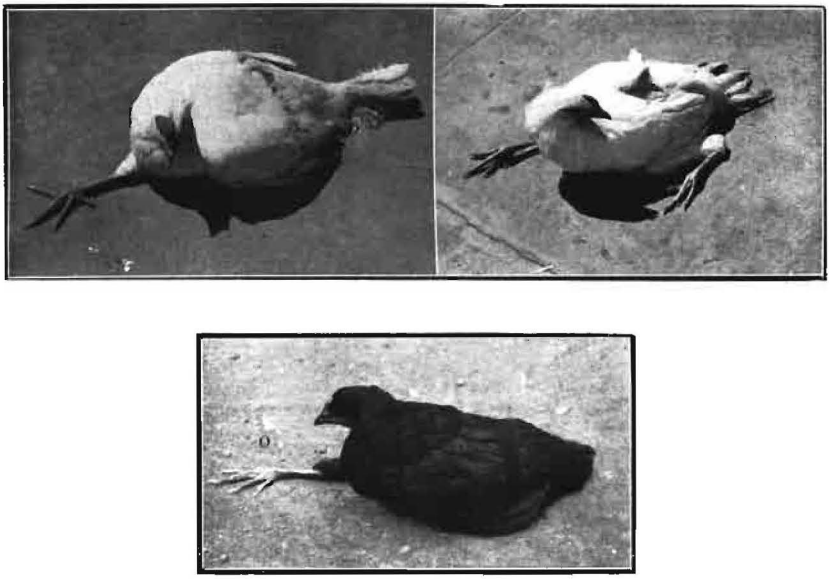
Ellermann (1923): IV. Zusammenfassende Betrachtungen. *Folia Haem. Archiv.*, XXIX, 203.

Marek, J. (1907): Multiple Nervenentzündungen (Polyneuritis) bei Hühnern. *Deut. Tierarz. Woch*, XV Jahrgang, 417-431.

Pappenheimer, Dunn & Cone (1926): A study of Fowl Paralysis. *Bulletin* 143. Storrs Agr. Expt. Station, U.S.A.

Peyton Rous (1911): *Jl. Expt. Med.*, XIII, 397.

Vander Walle & Winkler-Junius (1924): De Neuritis-epizootie by kippen te Barneveld in 1921. *Tydsch. voor Vergel. Geneesk.*, X, 34-39.



Figs. 1, 2, 3.—Typical postures of paralysed chicken.

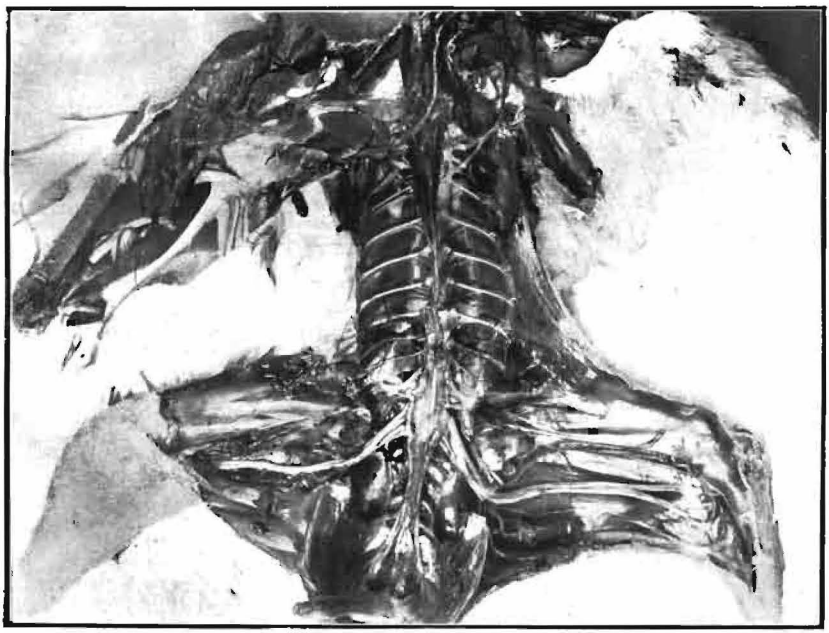


Fig. 4.—Swollen lumbo-sacral plexus and sciatic nerves of fowl affected with bilateral paralysis.

LYMPHOID HYPERPLASIAS AND ALLIED TUMOURS IN THE FOWL.

By Dr. G. DE KOCK, Sub-Director of Veterinary Services, Onderstepoort.

VETERINARY literature contains many references to the occurrence of leucaemia in domestic animals, but, unfortunately, few descriptions of changes in the blood, and lesions of the blood-forming organs are given in sufficient detail to enable one to identify the disease with certainty. It would appear that leucaemias conforming with types found in man occur in many, if not in all, domestic animals. A lymphatic leucaemia (*Lymphocytomatosis*), believed to be enzootic amongst cows in certain districts of East Prussia, is of the nature of a lymphoid hyperplasia, often with tumour formation in the heart-muscle, kidneys, mucosa of the stomach, etc., but with none in the liver, spleen, and bone-marrow (Knuth and Volkmann, 1916) (Du Toit, 1917). Evidence is not wanting that some of the leucaemias in animals can be transferred to other animals of the same species, e.g. East Coast fever and Snotsiekte (Mettam, 1924), both of which may be regarded as of the nature of a lymphatic aleucaemia.

Diseases with close resemblance to those affecting the blood-forming organs of man are frequently observed in fowls. Unlike the leucaemias of man, Ellermann and others succeeded in transmitting myelogenous leucaemia, lymphatic leucaemia, and erythro-leucosis of the fowl. In Ellermann's (1920-22) transmission experiments all these forms appeared in a series of birds inoculated with *one* strain of the virus, which was ultra-microscopic and filtrable. It is maintained that experimental infectious leucaemias are difficult to transmit owing to the small number of birds (perhaps two or three out of twenty) which gave successful " takes."

This may explain why in South Africa the disease has not yet been experimentally reproduced. The number of fowls included in the various transmission experiments was evidently too small.

The three forms of leucaemia recognized by Ellermann may be briefly considered:—

(i) *Lymphatic leucaemia* (leucosis) or lymphatic aleucaemia may, or may not, be accompanied by changes in the blood. The lymphoid hyperplasia, often as greyish-white spots, may occur in the liver, kidneys, bone-marrow (heart-muscle ?), etc. It may even form tumour-like masses, which have also been found in connection with the skin and subcutis.

(ii) *Myelogenous leucaemia* (leucosis) is characterized by an hyperplasia of the tissues dealing with the formation of granular leucocytes. There may be as many as 200,000-600,000 leucocytes per c.mm. of blood.

(iii) *Erythro-leucosis* is identified as an anaemia (and icterus), and by the presence of the " precursors " of the erythrocytes, which are called " lymphoidocytes " by Ellermann. Why this type was designated a leucosis is not clear. It is of the nature of an anaemia, caused by the destruction of the erythrocytes, and regenerated changes with the formation of the " percursors " of erythrocytes in great numbers.

As stated above, the disease as described by Ellermann has not been reproduced in South Africa. Some of the conditions described by him have been observed in some of the material examined here microscopically. These may be briefly mentioned:—

(*a*) One case of lymphatic leucaemia characterized by lymphoid hyperplasia in various organs, e.g. liver, spleen, etc. In the blood vessels of the lung numerous round cells of the lymphocytic series could be recognized.

(*b*) One case of anaemia, with the " precursors " of erythrocytes in the circulation in large numbers, i.e. the erythro-leucosis of Ellermann, was identified for the first time a few days ago. The peculiar anaemic appearance of the comb, so well depicted in the plate given by Bayon (1928), was very characteristic.

(*c*) Myelogenous leucaemia has not been seen yet, and it is difficult to say whether or not the lymphoid hyperplasias seen in the liver and the spleen, together with a fairly extensive number of granulocytes, are to be regarded as a myelogenous aleucaemia. In these cases the liver and spleen are much enlarged, friable, and of a light reddish-brown colour.

(*d*) Hyperplasias of lymphoid tissue in various organs, e.g. liver, spleen, kidney, heart-muscle, etc., with or without the formation of tumours of the skin and subcutis have been met with on innumerable occasions.

Great difficulty has been experienced in deciding whether some of these tumour formations and lymphoid accumulations in various organs are to be regarded: (1) as a leucaemia (leucosis) with *hyperplasia* of lymphoid tissue to the extent of the tumour formation, or (2) as a neoplasm, i.e. a lymphosarcoma with *metastasis* into various organs. To this difficult question Pappenheimer, Dunn, and Cone (1926) refer in their discussion of neuro-lymphomatosis (specific fowl paralysis). These authors maintain that visceral infiltrations occur in practically every chicken, although there is considerable variation in the amount of lymphoid or myeloid tissue present in different organs. Therefore they are of opinion that the diagnosis of Ellermann, with regard to erythro-leucaemia (erythro-leucosis) and aleucaemia, should be accepted with considerable reserve. They are inclined to think that the agent which is responsible for the pathological changes in the nervous system (in specific fowl paralysis) is *not* exclusively " neurotropic." It may stimulate the proliferation of lymphoid cells in the viscera and to a degree assume the character of a neoplasm. Furthermore, some of the cases of aleucaemia may have been instances of paralysis with visceral infiltration.

It is intended to make a careful study of the above conditions occurring in South Africa in order to ascertain—

(1) whether the " inoculable " leucaemias and aleucaemias described by Ellermann occur in South Africa;

(2) to what extent do lymphoid tumours occur as leucaemias or leucoblastomes; and

(3) to what extent are leucaemias, aleucaemias, leucoblastomes, and neuro-lymphomatosis of fowls related?

References.

Bayon (1928): Pathology of certain avain morbid conditions. *Proc. Roy. Soc. Med.* XXI, 1086.

Du Toit (1917): Beitrag zur Morphologie des normalen und des leukaemischen Rinderblutes. *Arch. f. Wissensch. u. Prakt. Tierheilk.* XLIII, 145.

Ellermann (1920-1): I. Myeloische Leukose. II. Erythro-leukose *Folia Haem. Archiv.* XXVI, 135 and 165.

Ellermann (1921-2): III. Lymphatische Leukose. *Folia Haem. Archiv.* XXVII, 171.

Knuth and Volkmann (1916): Untersuchungen über die Lymphozytomatose des Rindes. *Zeitsch. f. Infek. Krankheiten d. Haustiere.* XVII, 393.

Mettam (1924): Snotsiekte in Bovines. *9th and 10th Reports, D. V. E. & R.*, 393, U. S. Africa.

Pappenheimer, Dunn & Cone (1926): A study of Fowl Paralysis. *Bulletin* 143, Storrs Agr. Expt. Station, U.S.A.

FOWL TYPHOID AND BACILLARY WHITE DIARRHŒA.

By G. MARTINAGLIA, M.Sc., B.V.Sc., V.S., Veterinary Research Officer, Onderstepoort.

DURING recent years both veterinary and medical science have thrown much light on poultry diseases, but only within the last two or three years have veterinary practitioners in South Africa taken an interest in the subject. Progress is especially marked in the United States, where the poultry industry has made rapid strides during the last decade. Veterinarians are the rightful guardians of the health of the nation's live stock, and are best qualified to render service where diseases of poultry are concerned.

The object of this article is to describe* two allied bacterial diseases which are assuming economic importance in this country, and in doing so to discuss briefly the findings of workers in other parts of the world.

FOWL TYPHOID.

Definition.—Fowl typhoid is an acute specific communicable disease, having the general characteristics of a septicaemia. It is caused by *B. gallinarum.*

Historical.—This disease, first described by Klein (1889) in Orpington, Kent, England, in 1888, under the name of infectious enteritis of fowls, is still known on the Continent as Klein's disease. He isolated the causal organism which he named *B. gallinarum.* Later, Moore (1895) described an infectious disease of poultry in the United States. He gave a detailed description of the organism, and designated it *Bacterium sanguinarium.* According to Hadley (1918), there is very little doubt but that the organisms isolated by Klein and Moore were identical.

In South Africa the existence of fowl typhoid was bacteriologically established in 1924. Previous to this date it appears to have been confused with fowl cholera.† The writer has isolated and studied over thirty fowl typhoid strains from all Provinces of the Union, and not a single case of fowl cholera has been diagnosed.

Occurrence.—When this disease was first introduced into South Africa is not known, but its circle of distribution in the Union seems to widen each year, being at present one of our most destructive bacterial diseases. The mortality is generally very high, varying that it almost resembles a fowl cholera outbreak. Natural outbreaks in the Union have so far been confined to the common fowl, both from 15-85 per cent., and at times it assumes such a virulent form young and adult birds being affected. The organisms can be isolated in pure culture from the blood and all internal organs. The

* The diseases in question were recorded in South Africa for the first time in 1926 and 1927 respectively. Vide *Jl. Dept. Agr.*, U. S. Africa, XII, 298, and *Farming in S. Africa*, I, 447.

† Spreull, of Capetown, has encountered outbreaks of fowl cholera in the Cape Province, especially in the Peninsula.

Errata.

Journal of the Veterinary Medical Association, Vol. I, August, 1928, No. 2.

Substitute for last paragraph on page 77 the following:—

Occurrence.—When this disease was first introduced into South Africa is not known, but its circle of distribution in the Union seems to widen each year, being at present one of our most destructive bacterial diseases. The mortality is generally very high, varying from 15-85 per cent., and at times it assumes such a virulent form that it almost resembles a fowl cholera outbreak. Natural outbreaks in the Union have so far been confined to the common fowl, both young and adult birds being affected. The organisms can be isolated in pure culture from the blood and all internal organs. The

organisms are never plentiful in a stained blood-smear, but can easily be isolated from the circulation of a sick fowl during the fever reaction.

Symptoms.—The incubation period under experimental conditions varies from two to six days before a rise in temperature is noticed.

There is generally a rapid onset of the disease and fowls die in quick succession until the malady has run its course. The sick birds show diminished appetite, increased thirst, and general dulness. The feathers are ruffled, especially round the neck, and the head is held close to the body. The wings often droop, the sick fowl sometimes stands with closed eyes, assuming a moping appearance, and regurgitating movements are frequently noticed. The droppings are of a greenish-yellow colour, and the feathers round the vent are often tinted with soft faeces. There is a high temperature, varying from 107.5 to 111.5° F. The comb is often cyanotic in appearance, due to the damming up of venous blood, on account of cardiac deficiency, but sometimes the comb, and especially the wattles, may be pale. Microscopic examination of the blood often shows a decrease of the erythrocytes and an increase of the leucocytes, especially the neutrophiles and large mononuclears.

Post-mortem Appearances.—Rigor mortis sets in immediately after death. On opening the abdominal cavity yellow or blood-stained fluid is frequently seen. The liver is the most constantly affected organ, being much enlarged, and the surface displaying irregular hæmorrhages and yellow patches. In some cases it has a characteristic bronze-like tint. If the disease is of more than a week's duration, multiple necrotic foci are often seen in the liver and throughout the parenchyma, being discrete and sometimes very numerous. The liver on incision is soft and friable in consistence. The kidneys are generally slightly swollen, of a yellowish-brown colour, and often soft in consistence. The intestines are as a rule pale, but often a catarrhal condition prevails with isolated hyperaemic patches on the mucous membrane. The cloaca generally contains soft green faecal matter.

Bacteriology.—The organisms isolated and studied in the Union may be briefly described as irregular non-spore-forming non-motile rods. The colonies on plain agar somewhat resemble *B. coli*, but grow less luxuriantly. On broth there is uniform cloudiness with flocculent sediment. Gelatin is not liquified, milk not coagulated, and indol not formed. Litmus milk is turned acid within 24 hours and becomes slowly alkaline from the third day onwards. On a carbohydrate medium, consisting of distilled water containing 2 per cent. peptone, 1 per cent. Andrade's indicator, and 1 per cent. of the test substance, incubated for 15 days gave the following results:—Arabinose, rhamnose, galactose, glucose, mannite, sorbite, maltose, xylose, dulcite, laevulose, mannose, and glycerol were all fermented without gas-production. Saccharose, dextrine, erythrite, inulin, raffinose, salicin, inosite, nutrose, and lactose were not attacked. All strains show group agglutination reaction with a local strain of *B. typhosus* isolated by Dr. Pyper, and with *B. pullorum*. Of a few strains injected into laboratory animals, rabbits succumbed in two to eight days, but guinea-pigs and pigeons (fed *per os*) were refractory.

Differential Diagnosis.—Fowl typhoid should be differentiated from spirochaetosis, leucaemia, fowl cholera, coccidiosis, and a condition of heavy layers associated with ovarian disturbances and abnormal fatness.

Recommendations for Combating the Disease.—As sanitation is of primary importance in controlling epizootics in poultry, the following measures are advised:—

(1) Fowls should be penned off from the free range at the time of the outbreak in order to diminish the danger of spread.

(2) All in-contact fowls should be segregated, the sick birds killed, and the carcasses, with those which have died from the disease, destroyed by burning.

(3) The droppings should be collected daily and burned or sprayed with any of the standard disinfectants.

(4) The walls, floors, and perches of the fowl-house should be sprayed with a pump-spray, using any efficient disinfectant.

(5) Remove all shade-producing vegetation from the old runs and work in (1 to 2 inches deep) unslaked lime, and if possible allow them to remain unoccupied until after the winter.

(6) Add ½ teaspoonful of chloride of lime to every four gallons of drinking water.

(7) All receptacles for food and water should be scalded with boiling water as long as the epizootic rages.

(8) Spreading of the disease by sparrows or other vectors should be guarded against by the use of suitable netting.

(9) Birds which have been purchased from another breeder should be isolated in a separate pen, and removed as far as possible from the fowl-runs for a period of two weeks, in order to guard against the introduction of disease; some fowls undoubtedly act as carriers. Agglutination tests may be carried out to detect carriers.

Vaccine Treatment.—In the past, fowl typhoid vaccine has been issued to poultry men immediately after the disease has been diagnosed, with the request that all healthy fowls be removed to clean ground and vaccinated. Judging from letters received it would appear that vaccine treatment has given encouraging results. The dose prescribed is 1 c.cm. per fowl to be inoculated subcutaneously on the inside of the thigh or under the wing. No experimental evidence has been obtained yet as to the value of the vaccine when used on a large scale.

References.

Hadley (1918): *Bull.* 174, Agr. Exp. Stn., R.I. State College, U.S.A., May, 1918.

Klein (1889): Ueber eine epidemische Krankheit der Huhner verursocht durch eine Bacillus—"Bacillus gallinarum." Central bl. f. Bakt., V, 689.

Moore (1895): Infectious Leukemia in Fowls. *12th and 13th Ann. Rpts., U.S. Dept. Agr. Bur. Animal Indust.*, 185-205.

Bacillary White Diarrhœa of Chickens.

Definition.—Bacillary white diarrhœa, caused by *B. pullorum*, is a highly infectious disease of chicks during the first three days of life. The disease is characterized by severe white diarrhœa, prostration, and high mortality.

Historical.—It was Rettger (1900) who first reported a peculiar disease in chicks. He isolated an organism from various organs and also succeeded in reproducing the disease. Later, he and Harvey (1908) reported further experimental work, and the causal organism was designated *Bacillus pullorum*. Still later it was shown by Gage and Paige (1915) that the organism is localized in the ovary of the hen and transmitted via the egg. Since then Jones (1911-12) and a number of other investigators have substantiated these findings.

The first South African case of white diarrhœa was examined at Onderstepoort during 1926, and had the following history:—The owner bought a batch of day-old chicks. They were sick on arrival, and about 75 per cent. of them died. Later he had bad results from the eggs of the survivors, as, after hatching, the young chicks (one to two days) invariably developed a fatal diarrhoea. The writer examined the last batch of chicks bacteriologically, those examined being from three to ten days old. The clinical picture was that of bacillary white diarrhœa. Cultures were made from the various organs and a non-oerogenous type of *B. pullorum* obtained in pure culture. Sera from four of the six hens responsible for the eggs (from which these chicks were hatched) were submitted to the agglutination test and were markedly positive.

Cause and Nature of the Disease.—The cause of the disease is a minute gram negative bacillus very similar to the typhoid organism of man. It may be grown from various organs and from the blood-stream of affected chickens. Chicks are most susceptible during the first three days after hatching, but seem to acquire more resistance after the fourth day. Those which survive the affection harbour the causal organism in after life and become chronic carriers. The main predilection site in the hen is the ovary. Diseased ova are of a brownish colour and angular in appearance.

Eggs laid by carriers become infected during their formation or during passage along the oviduct. If such eggs are incubated the chicks often die in the shell and those that hatch soon manifest symptoms of the disease. There may be only one infected egg in a brood, but as the organisms are present in great numbers in the droppings, even one chick is a source of infection to the other members of the brood.

This condition may be transmitted in the following ways:—

(1) Through the infected eggs.
(2) Through the infected droppings of sick chicks.
(3) Through contaminated runs and incubators.

In one instance the writer has seen a double infection of *B. gallinarum* and *B. pullorum* in the same hen. A pure culture of *B. gallinarum* was obtained from the heart blood, and from the diseased ova *B. pullorum* was isolated.

According to a recent article by Doyle (1925) the organism is not a normal inhabitant of the chick's intestine. He isolated the organism in 2.6 per cent. of egg-yolks examined, but had no positive

results from the white of eggs. Healthy adult fowls do not become infected from carriers, but may when the chicks heavily infect the ground.

Symptoms.—The disease generally appears a day or two after hatching. The affected chickens are drowsy and listless. They often stand for a long time in the same position or sway backwards and forwards. The main diagnostic feature is the presence of creamy and sticky faeces, resulting in the feathers being often gummed around the vent. The sick chick usually emits a sound of pain during the act of evacuation. The chicks generally die a day or two after the first symptoms have been observed, though sometimes the course is longer. Mortality is very high and is estimated at from 40 to 90 per cent.

Post-mortem Appearances.—The main feature at post-mortem was a slight enlargement of the liver, which displayed minute grey specks, which occur under the capsule and in the liver substance. In one specimen caseous nodules were also seen in the lung. The presence of unabsorbed yolk was a constant feature. In some cases it was adherent to the peritoneum.

Diagnosis.—A definite diagnosis can only be made in the laboratory. A provisional diagnosis may be made on account of the early appearance of the affection, high mortality, white diarrhœa, and the presence of unabsorbed yolk in the abdominal cavity.

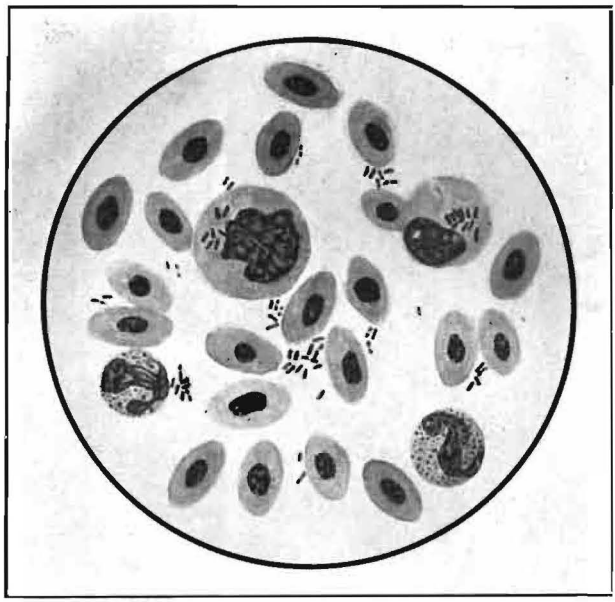
Differential Diagnosis.—Not all cases of white diarrhœa in chicks are due to *B. pullorum* infection. Chills and improper feeding sometimes give rise to similar symptoms. Aspergillosis also shows the presence of a white diarrhœa in older chicks, especially during the later stages of the disease. Further, *Coccidiosis* sometimes simulates bacillary white diarrhoea, but symptoms do not appear so soon after hatching.

Prevention.—The most essential points in the control of bacillary white diarrhœa are the detection and destruction of the adult carriers, which can be detected by means of the agglutination test. A close relationship serologically exists between *B. pullorum* and *B. gallinarum*, but the organisms can be distinguished biochemically by the fact that *B. pullorum* does not ferment maltose or dulcite, whereas *B. gallinarum* does. At present serological tests will not differentiate a carrier of *B. pullorum* from one of *B. gallinarum*, a fact which is not of much practical importance in view of the danger of both diseases. All should be done to protect the newly-hatched healthy chick from picking up infection. This can be done by spraying at regular intervals all contaminated nests and incubators with a 3 per cent. solution of any of the usual carbolic disinfectants, and burning all poultry littler and carcasses. Avoid buying at random not only day-old chicks, but also adult birds. Often the disease is introduced in a healthy flock through the introduction of a single fowl. This can be avoided by having it tested before purchasing.

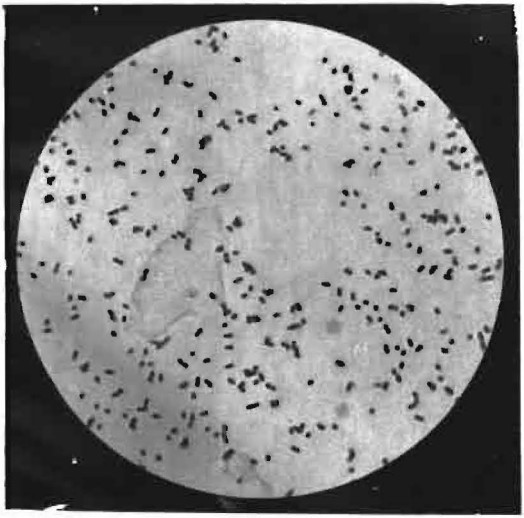
Curative Treatment.—Treatment is not recommended in an outbreak of bacillary white diarrhœa, as the surviving chick may be a reservoir of infection in adult life.

References.

Doyle, T. M. (1925). *Jl. Comp. Path. Therap.*, XXXVIII, 266-282.
Hadley (1918): *Bull.* 174, *Agr. Exp. St., R.I. State Coll.*
Gage, G. E., and H. H. Paige (1915): *Mass. Stn. Bull.*, 163.
Jones, F. S. (1911-12): *New York State Vet. Coll. Rpt.*
Rettger (1900): *New York Med. Journ.*, LXXI, 803.
Rettger & Harvey (1908): *Jl. Med. Res.*, XVIII.



Blood smear in experimental Fowl Typhoid, showing bacteraemia, leucocytosis and phagocytosis. Drawing made from two specially selected fields.



Smear from 24 hour agar culture of Fowl Typhoid organisms first generation. X1000.

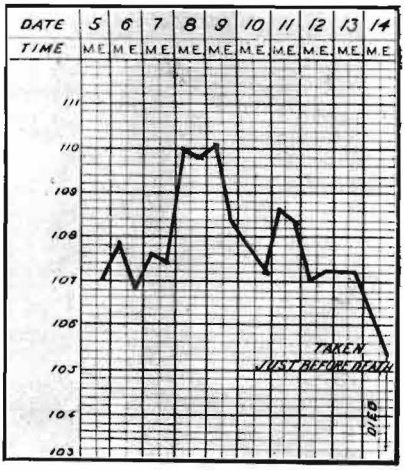


Chart showing fever curve in experimental Fowl Typhoid reaction.

THE PARASITE PROBLEMS OF POULTRY FARMING IN SOUTH AFRICA.

By Dr. H. O. Monning, Veterinary Research Officer, Onderstepoort.

Introduction.

During recent years, with the advance of the poultry industry in various countries, much work has been done on the question of parasites. To us in South Africa, where parasites find a congenial climate, this is a big problem in the poultry industry. In this paper it is intended to give a short review of the more important parasites met with in poultry farming, especially those of fowls. The morphology of the parasites will not be discussed to any extent, as a check-list of the worm parasites found in the domestic animals in South Africa is to appear in the next Report of the Director of Veterinary Services, and in which short descriptions are given.

Internal Parasites.

Trematodes (Flukes) have not been noticed at all,* although in other countries such parasites sometimes cause serious losses. *Prosthogonimus ovatus*, for example, occurs in the oviduct, causing serious inflammation, with consequent trouble in egg-laying, and even death. Species of *Monostomum* cause a nodular dermatitis, especially in turkeys, the condition sometimes leading to serious trouble.

Of *Cestodes* (tapeworms), some 30 species are known from fowls. Of the larger species, growing to 15 inches in length, there are *Raillietina tetragona* and *R. echinobothrida*. The former is the more frequent and is transmitted by the housefly. The latter species is probably transmitted by snails and causes, in its young stages, the so-called "nodular taeniasis," the young tapeworms, about half an inch long, lying with their heads buried deeply in the mucous membrane, while the rest of the body hangs into the lumen of the intestine. These nodules are found especially in the anterior half of the small intestine, while the full grown tapeworms lie further back. *Raillietina cesticillus*, a short, rather stout tapeworm without a thin neck, also transmitted by the house-fly, occurs with moderate frequence. The species of *Hymenolepis*, of which several occur in the fowl, are very slender tapeworms, almost hair-like in fineness; they are found fairly frequently, some being transmitted by flies, others by small crustacea, e.g. water fleas. Of the smaller tapeworms, *Davainea proglottina* is a good example, possessing usually only 2-5 proglottids. It is transmitted by slugs of the genus Limax. *Amoebotaenia sphenoides* is slightly larger, and is transmitted by earthworms. These small tapeworms occur usually in the duodenum. In searching for them the mucous membrane must be scraped and this material examined in a flat dish with a little water, using a hand

* On one occasion a trematode was obtained from a duck but owing to decomposition specific identification was impossible.

lens or dissecting microscope. Of all these tapeworms the most harmful are probably the two large species first mentioned and *Davainea proglottina*.

From a consideration of the life histories of these worms, it is clear that it is a difficult matter to institute preventive measures, especially where fowls run free. Where, however, a definite species causes trouble, and the intermediate host is known, one is not quite at a loss what to do.

For treatment, Kamala in doses of 1 g. is excellent, at least for most species, but it does not seem to have much effect on *Raillietina cesticillus* as we have had occasion to learn. Fowls can stand up to 20 g. and there is thus no danger of overdosing. The drug, administered in a bread pill, also acts as a purgative. Turpentine in doses of 30 minims given with oil, or alone in a bread pill and then followed by 1 oz. Epsom salts per gallon of drinking water as a purgative, also gives good results. Turpentine is used especially when roundworms are also present, as it acts on both. Suitable starvation before treatment is necessary.

The most frequent and harmful of the *Nematodes* (roundworms) is *Ascaridia lineata*, a large white roundworm, which has no intermediate host, infection occurring through the ingestion of the eggs which are fairly resistant. Very similar to this species, at least macroscopically, is *Hartertia gallinarum*, a nematode peculiar to this country, and one transmitted by termites. It is known to occur around Pretoria, and is also frequent in the vicinity of Kroonstad in the Free State. The practice of feeding termites (ant-heaps) to chicks may play a part in increasing the infection. Ant-heaps for this purpose must, therefore, be taken out of the veld where no fowls run, as this worm has so far not been found in any wild birds.

The caecal worms *Heterakis gallinae* and *Subulura suctoria* are very common but are not as harmful as other round-worms. The gape-worm, *Syngamus trachea*, occurs in the Western Cape Province, and has probably been introduced by birds other than fowls, e.g., starlings, which were introduced by Rhodes, and known to be carriers, abound in parts of the Cape. The life history of this parasite was recently studied by Ortlepp,* who found that there was no intermediate host.

Preventive measures in the case of Ascaridia require the regular cleaning of fowl runs and, in small pens, digging of the soil after treatment with lime. For treatment of infested fowls Chenopodium oil in doses of 2 drops per 1 lb. live weight is effective, the drug being best given in a bread pill followed by Epsom salts in the drinking water. Where roundworms and tapeworms co-exist, one might try the effect of Kamala and Chenopodium oil together in a bread pill.

External Parasites.

Among the external parasites, the fowl tick, or so-called "Tampan," *Argas persicus*, is the most dangerous, especially as it is the chief transmitter of fowl Spirochaetosis, a disease which would appear to be on the increase in this country. A species of red mite, *Liponyssus bacoti*, is also fairly common. Both these are temporary parasites, only the larvae of *Argas persicus* remaining attached to the host

* Ortlepp, R. J. (1923): The Life-history of *Syngamus trachealis*, the Gapeworm of Chickens. *J. I. Helminth*, I. 119.

for 5 to 10 days. They hide in crevices of the buildings and under the bark of trees, attacking the birds at night to suck blood, and causing much irritation and severe anaemia as the result. They should, therefore, be looked for in the buildings rather than on the birds. To combat them the fowl-houses should be well built, as free of crevices as possible, painted with tar and regularly disinfected with one of the well known preparations. Attention should further be paid to trees in the vicinity and all rubbish removed.

Lice and fleas which trouble fowls can be fairly easily eradicated by general hygienic measures, the use of sand baths, which contain a small proportion of wood ash and sulphur, and by proper dipping or dusting with a powder, e.g., 1 part of Creosote to 3 of petrol and sufficient plaster of Paris to take up the fluid. Other conditions like scaly-leg, depluming itch, and mosquitoes are sometimes troublesome, but they are well known, and do not require special consideration.

Conclusion.

In concluding, we wish to emphasize the necessity of the further study of this subject. At least one aspect in which everybody can assist, is with regard to a survey of poultry parasites. Specimens collected from all classes of poultry and wild birds and forwarded to Onderstepoort would be much appreciated. Obviously this will be of very great value, as there is otherwise very little opportunity of collecting the necessary material.

TUBERCULOSIS IN WILD BUCK LIVING UNDER NATURAL CONDITIONS.

By R. Paine, F.R.C.V.S., Government Veterinary Officer, Grahamstown, and G. Martinaglia, M.Sc., B.V.Sc., Veterinary Research Officer, Onderstepoort.

Introduction.

The existence of tuberculosis in wild animals living under natural conditions is unique. Actually the rare occurrence of tuberculosis in sheep is attributed to the fact that this species is kept in an environment which approximates more or less that enjoyed by wild animals. That the environment itself, however natural it may be, is not alone sufficient to prevent infection by *B. tuberculosis* will be apparent on perusal of the evidence brought forward in this paper.

Eber (1917) in his exhaustive review on tuberculosis in animals refers to buffaloes slaughtered at the Budapest Abattoirs as being infected to the extent of 0.18 per cent. These animals, however, were undoubtedly domesticated. Further, Calmette (1923), although he states, "Wild animals . . . . never contract tuberculosis spontaneously; but, in captivity, they are susceptible to it," yet he gives a reference (McCoy and Chapin, 1911) where tuberculosis of bovine type apparently existed in ground squirrels. In the case in question, 5 animals out of 225 examined at San Francisco for plague showed lesions of the glands, viscera, and lungs. Finally Fox (1923) adds, "There are no reliable data concerning the existence of tuberculosis in the wild."

Species Affected.—So far the disease has been observed in Kudu (*Strepsiceros strepsiceros*) and a Cape duiker (*Sylvicapra grimmi*), but some farmers claim to have seen similar cases in bushbuck on rare occasions. As kudu have been the commonest subjects brought to our notice, to fully grasp the situation it will be necessary to consider in detail their history and habits.

The kudu is essentially an African animal, ranging from South Africa to Angola, East Africa and Abyssinia; but in former times, according to geological records, it extended far over Europe and Asia. It is, however, important to note that of late years, in the southern Cape Province, they have been confined to the Albany and adjoining districts.

Andreas Sparrman, in 1775, travelling through the Albany district, noted few kudu, Lieut. Paterson passing over the same area in 1779 apparently saw no kudu, and so with many subsequent observers, until Andries Steedman, in 1835, noted that they were becoming scarce. Fortunately about 60 years ago the late Messrs. Knott, Tomlinson, and Buckley, whose properties formed one block in the Koonap area, agreed to rigidly preserve the few remaining kudu, otherwise they would probably have been exterminated. From that time they have continued to increase and spread. Finally by

Act No. 2 of 1900 they were placed under official protection and made Royal Game, an Administrator's permit being now necessary to shoot kudu. Although the number is approximately 2,750, they are seldom seen unless hunted.

The kudu is one of the finest of antelopes, a full grown bull stands about 4 ft. at the withers, weighs about 400-500 lb., and has magnificent horns, while the cow is hornless and weighs from 300 to 400 lb.

A bull is usually accompanied by several cows, and when disturbed, in spite of his huge and wide-spread horns, he is able to travel at a great speed through dense bush, the horns being thrown backward. Both sexes will take any ordinary 5-foot fence in a stride, so that they cannot be confined to any particular camp or farm; but we are inclined to believe that they naturally prefer to remain in one area, and only migrate if conditions are adverse. They do not congregate or live in large herds at any time; and sleep under sheltering trees and bushes.

Details Concerning Habitat of Affected Buck.—The country concerned is rough hilly bush veld in the Albany District of the Cape Province. The altitude is from 1,400 to 2,000 feet, the climate varies from a mild winter to a hot summer (max. about 105°) and the average rainfall for the past six years has been 13.28 inches. The area is in most parts more or less densely covered with bush, very lightly stocked and the ground is hard and stony. The vegetation consists almost entirely of shrubs and low trees ranging up to 15 feet high; some of the bushes are edible, and there is little or no grass or lowlying herbage, the majority of the grazing being from bushes some distance above the ground. The portion of Albany district carrying kudu, which is the principal species under consideration, consists of 59 farms (244,730 acres), 2,841 kudu, 9,544 cattle, and 31,132 small stock.

With regard to the incidence of tuberculosis in the domesticated animals in the above area, as would be expected, this is very low, e.g. at the Grahamstown Abattoirs during the past five and a half years there have only been two cases (one of which was a cow introduced from the Western Cape Province) out of 17,263 cattle slaughtered. This low incidence may be attributed to the following reasons:—(*a*) The cattle are mostly local grade stock; (*b*) they are not housed, and (*c*) the area is very lightly stocked. It must be emphasized that some farmers are unwilling to supply information regarding the health of their herds or to have cattle tested unless compensated in the event of reactors being slaughtered. An example, however, of what may be the true position is furnished by the following:—A farmer who, two years ago, lost two introduced bulls from what was apparently tuberculosis agreed to have eighteen cows and heifers tested. Of four which gave a positive reaction two have been destroyed, in each case lesions being found in the retro-pharyngeal glands. The two remaining reactors have not yet been slaughtered. The owner in question has 800 cattle running on 4,680 acres of bush country similar to that described above.

Descriptions of Cases Encountered.—On 2nd September, 1927, a kudu bull's head was received for examination. The parotid, pharyngeal, and submaxillary areas were a mass of enlarged glands, the contents of which were purulent. Unfortunately no bacteriological examination was made.

On 13th September, 1927, an adult kudu cow was shot on farm P., and a post-mortem examination revealed the following:—Condition of carcass fair, pharyngeal lymphatic glands enlarged, and full of caseous pus: about two-thirds of the entire lung tissue showed very marked pneumonic lesions with caseous centres; advanced lesions were present in the bronchial mediastinal, portal and mesenteric lymph glands, while the prescapular and inguinal glands were enlarged but revealed no definite lesions.

Material from a mesenteric lymph gland was placed in a sterile test tube and examined bacteriologically. Smears made from this tissue revealed many acid-fast organisms (indistinguishable from *B. tuberculosis*) when stained by Ziehl's method. A few contaminating organisms were also present. The remaining material was immediately transferred to a test tube containing 4 per cent. sodium hydroxide to destroy the contaminating organisms. It was placed in an incubator for one hour, centrifugalised and the sediment inoculated on non-glycerinated blood agar and glycerinated Dorset egg medium. The rest of the sediment was inoculated into two guinea pigs intraperitoneally and two fowls subcutaneously. Twenty-eight days after inoculation several flat granular colonies were noticed, on the blood agar. Microscopic examination again showed acid-fast organisms.

One guinea-pig died three weeks after injection, and the other one, a few months after injection, both with generalized tuberculosis. The fowls remained refractory.

Organisms from blood agar were transferred to non-glycerinated egg media and after a month's growth 1 c.cm. saline suspension of the bacilli was injected into one rabbit intraperitoneally, and two rabbits intravenously. Twenty-one days after injection the rabbits which received the intravenous injections died with lesions in the spleen, liver and kidneys and massive infection of the lungs. The rabbit which was injected intraperitoneally died 28 days after injection with marked emaciation, and with numerous tubercules in liver, serosa of intestines, kidneys and spleen. The lungs were one mass of tubercles.

On 9th December, 1927, we shot a full-grown kudu bull on the same farm, and as it appears to be extremely difficult to ascertain the age by the dentition, the horn measurements will be given. In the case in question they measured 47 in. on the curve, 33 in. straight from base to tip, 16 in. apart at the tips, and 10 in. round the base of the horn. The carcass appeared externally to be in excellent condition, and the only abnormalities present were slight enlargement of the bronchial and mediastinal glands, and a growth ($8\frac{1}{8}$ in. by $3\frac{1}{2}$ in.) under the longissimus dorsi muscle involving the corresponding vertebrae and intercostal lymphatic glands. The intercostal lymph glands were much enlarged and upon incision one of them exposed a dry caseous material.

Guinea-pigs were injected intraperitoneally and subcutaneously with material from this bull. The injection was prepared from a tuberculoma of the spine, adjacent lymph gland and enlarged bronchial lymph glands. All injected guinea pigs developed generalized tuberculosis with ascites in some instances where there was massive infection of liver and lungs.

Cultures were made directly on blood agar from ascitic fluid and infected organs. Tiny colonies of *B. tuberculosis* were noticed and acid fast organisms identified twenty-two days after incubation from both organs and ascitic fluid.

Upon 19th June, 1928, two kudu bulls were shot on the same farm, the one being apparently normal, but the other exhibiting a large swelling under the left ear (see Fig. A). Post-mortem examination revealed:—Condition of carcass good. Caseation of lymph glands in right and left parotid regions, of pharyngeal lymph glands, and consolidated areas, some caseous, of both lungs.

Organs preserved in 50 per cent. glycerine showed the presence of acid-fast organisms on microscopic examination. Guinea-pigs injected from infected material of lung died 28 days and 40 days respectively after injection with generalized tuberculosis. The lungs in particular, were heavily infected. Those injected from bronchial gland were chloroformed six weeks after injection. They also showed the presence of tuberculosis in various organs, but not so extensive as those injected from lung material.

Cultures were obtained directly from the lesions of these guinea pigs.

On 25th June, 1928, we shot an adult kudu cow on farm M.P., but failed to detect any abnormality in the carcase.

On 7th July, 1928, two kudu cows were shot on farm D.F., one of these, about two years old, was apparently healthy, whilst the second cow, which was in milk and in excellent condition, showed a swelling about the size of an egg in the left parotid area. Further examination of this cow showed enlarged pharyngeal, mediastinal, mesenteric and bronchial lymph glands, large consolidated areas in the lungs, and the left prescapular gland, twice the normal size, had a large caseous centre. In the left parotid area the glands were enlarged and in the right parotid area several glands united to form a caseous mass the size of a turkey's egg.

Bronchial and mediastinal lymph glands preserved in 50 per cent. glycerine, showed on microscopic examination the usual acid-fast organisms.

Inoculation of guinea pigs from these specimens confirmed the presence of tuberculosis.

On 1st July, 1928, a sick adult duiker ewe, caught in the veld on farm D.F., died at the Institute the same night.

The post-mortem examination of this animal revealed extreme emaciation, miliary tuberculosis of both lungs, pleurisy, generalized tubercular peritonitis, nodules in the kidney and liver tissue, and diseased mediastinal bronchial portal and prescapular lymph glands. Tubercular lesions were also present in the mesenteric, crural; precrural; popliteal; and pharyngeal glands.

The lungs, glands, and a portion of the peritoneum were preserved in 50 per cent. glycerine.

The lungs and pleura were studded with numerous greyish-white tubercles. The glands were enlarged and hard. The peritoneum displayed numerous greyish-yellow miliary tubercles.

Scrapings from cut surface of lung stained by Ziehl's method revealed numerous acid-fast organisms.

Cultures were made on blood agar and glycerinated Dorset egg media. Three weeks after inoculation tiny flat colonies were seen on blood agar media and microscopically *B. tuberculosis* was observed. Two guinea-pigs and two rabbits were injected intraperitoneally with 1 c.cm. from broth in which a piece of lung tissue had been shaken.

Thirty-seven days after injection one rabbit died with extensive generalized tuberculosis showing numerous tubercles in the lungs, liver, peritoneum, and serosa of intestines. The second died 58 days after injection with similar symptoms. The guinea-pigs killed 56 days after injection showed a massive infection.

Microscopic Appearances.—The microscopic pathology of these cases is typical of bovine tuberculosis. In each instance there were central necrosis, epithelioid cells, and the presence of many Langhans' giant cells.

Probable Methods of Infection.—From the habits of wild buck one feels that ingestion must be the main method of infection, and yet the nature of the grazing tends to minimize this source. It has been suggested, and it appears feasible, that during our recent record drought, the dams and water holes were either dry or very low and that game or stock drinking from such a limited supply contaminated the water and so caused the disease to spread.

In any case it appears as though the disease has found a most susceptible and favourable subject in wild buck in spite of the environment.

Other Wild Game in the Albany District.—Large numbers of springbuck are preserved on several farms adjoining, but not in the kudu area, and until recently one farm carried about 80 blesbuck, but these died out during the late drought. There is no evidence to show that tuberculosis existed amongst the blesbuck nor have cases yet been detected in other local wild animals such as stembuck, rheebuck, wild pig, ostrich, meercat, guinea fowl or jackal.

Public Health Aspect.—In concluding we must bear in mind one serious aspect in this connection, and that is the fact that a considerable amount of biltong (dried meat) is made from raw buck flesh.

Conclusions.—The characters of the strains isolated so far from kudus and a duiker may be summed up as highly pathogenic for rabbits and guinea-pigs. The few fowls tested were refractory. The isolated organisms are dysgonic and non-glycerophilic, especially in the first generation. We have little doubt from the above findings that the organisms studied are strains of *B. tuberculosis bovis.*

REFERENCES.

Calmette, A. (1923): *Tubercle Bacillus Infection and Tuberculosis in Man and Animals.* English Translation. Williams and Wilkins Co., Baltimore, U.S.A.

Eber, A. (1917): "Die Tuberculose der Tiere." *Ergeb. Allgem: Path. patholog. Anat.* Jahrgang XVIII. Abt. II, 1–371.

Fox, H. (1923): *Disease in Captive Wild Mammals and Birds.* Lippincott Co., London.

McCoy and Chapin, Ch. W. (1911).—*Jl. Med. Res. XXV.* 189. Cited by Calmette.

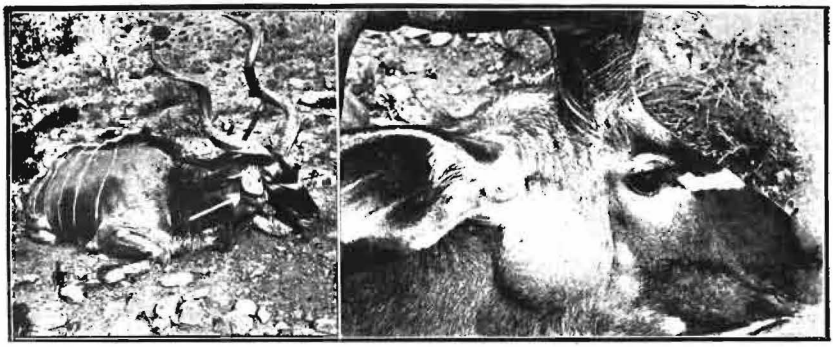


Fig. 1 and 2.—Kudu bull. Strepsiceros strepsiceros. Characteristic swelling of parotid region, Tuberculous Lymphadenitis.

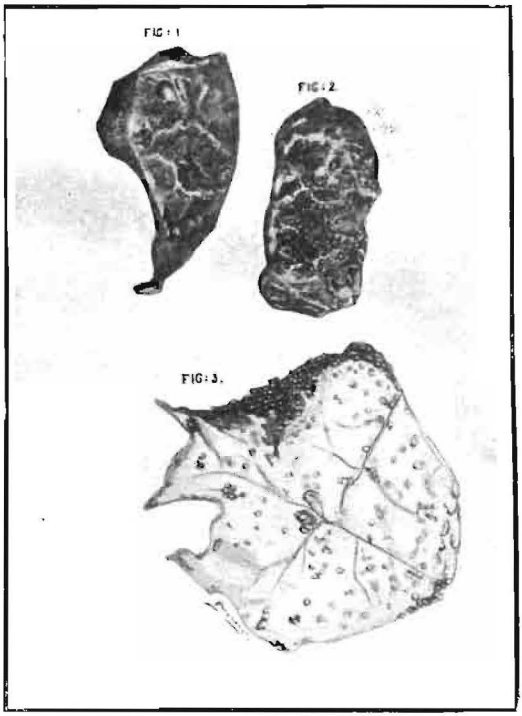


Fig. 3.—Duiker. Sylvicapra grimmi (from drawing). 1. and 2.—Portions of lung showing miliary tubercles on pleura and cut surface. 3.—Peritonium. Miliary tubercles, "Perlsucht."

THE DOSING OF SHEEP WITH THE GOVERNMENT WIREWORM REMEDY.

By. Dr. H. O. MONNIG, Veterinary Research Officer, Onderstepoort.

During the last year or so, the above question has been occupying the minds of those of us, who have to deal with it. Dr. du Toit has therefore asked me to introduce the matter for discussion at this meeting, so that we may be able to get the views of a large number of colleagues, but especially those who have more direct experience of the dosing of sheep by farmers.

During the last financial year 23,704,000 doses of Government Wireworm Remedy were issued. You know of what importance sheep farming is to this country, and what part worm parasities play. No excuse for this discussion is therefore required, because it is evident that any improvement which can be made in the method of administration, or even in the remedy itself, will justify the time and energy spent in achieving it.

When the remedy was first issued, some 12 years ago, certain directions for its use were drawn up, and they have been very little altered since. This is a tribute to those who introduced the Wireworm Remedy.* With the increasing amounts issued it appears as if the method of administration (or the composition of the remedy), may not be quite suitable for, or quite harmless under all the different conditions under which it is used throughout the country. During the last 6 months, we received some 25 complaints of cases where sheep suffered from tympany, or died after treatment. A number of cases have undoubtedly not been reported, but on the whole, the number of instances where adverse results have been encountered is apparently relatively small. Besides, a number of these cases have been investigated and it has invariably been found that the Wireworm Remedy was not at fault. These difficulties, however, occur and they form an argument against the further and more extended use of the Remedy in the minds of those farmers who become acquainted with them.

We consider the Government Wireworm Remedy the best yet introduced against the Wireworm and we know that its regular and systematic use reduces trouble arising from other worms like Trichostrongylus and Nodular worm to a mere fraction, although it does not kill these worms. Hence, we wish to see, in the interest of sheep farming, that the Government Wireworm Remedy is not only more widely adopted but also more regularly employed. Records show that we would have to issue much more than the present 24 million doses annually if the Remedy were used for the regular dosing of all sheep in infested areas. In order then to achieve this state of affairs, the necessary improvements must be made and for this reason we require all the experience and information available.

* See Veglia, F. (1919). Chemotherapy of Haemonchosis in Sheep. 5th and 6th *Rpts. D.V.R., U.S. Africa.* 375.

The prescribed starvation period is frequently stated to be too severe, especially when the grazing is poor. Our own experience leads us to belive that the present system of starvation is one of the chief factors that may cause difficulties, e.g. in the following ways :—

(1) The sheep are so starved that they may afterwards eat too greedily with the result that tympany may develop, especially where they are let out to graze at midday.

(2) If the grazing is poor, the sheep may eat poisonous plants, which they would otherwise not have eaten.

In order to see whether the starvation can be reduced wtihout lessening the efficacy of the treatment, we have carried out a number of tests which, it is believed, show that preliminary starvation is not actually necessary. In these tests we found that starving the sheep for up to 20 hours reduced the ruminal movements only to such a slight extent that it is negligible. From theoretical considerations it is clear that, when the powder falls into the rumen, reduced movements of the latter would bring smaller quantities of ingesta and Remedy into the abomasum over a longer period, which is perhaps not desirable. If the powder falls into the abomasum at once decreased passage of material from the forestomachs to the abomasum may be an advantage; but this cannot be obtained to any appreciable extent by even 20 hours starvation.

In testing the efficacy and safety of the Remedy without previous starvation, we have so far found no difference from the original method. For similar reasons there would probably be as little necessity for starvation after dosing, but it is certainly essential that the sheep should have no water for some time after dosing. Starvation during this period will do no harm, especially if one selects such a time during which the sheep would not graze in any case. We therefore suggest the following scheme for consideration and testing : The sheep, which usually graze during the forenoon and lie down to ruminate in the afternoon, are kraaled about 1 p.m. and left to rest for at least an hour. They should not receive water immediately prior to being kraaled. They are dosed as late as possible in the afternoon, so as to complete operations just before dark, and then left in the kraal until the next morning when they are let out to graze and drink.

It will be observed that this scheme involves no starvation at all, yet the necessary precautions are taken. One factor that may possibly have an adverse effect is that in spring, when the grass is young and succulent, the sheep when dosed, will already have their forestomachs containing a large amount of water. The result may be that the drug will become so diluted that it may be less effective against the parasites and possibly also more toxic to the sheep. To prove whether this factor would really operate, a test was made with 50 heavily infested lambs running under natural conditions. The result seemed to show that there was no danger either way, for the treatment was completely effective and the lambs showed no adverse symptoms. Before such a method can, however, be recommended for general use, it would be necessary to make many more extensive tests and it is hoped to be able to undertake these tests in various parts of the country. A very important factor is the handling of the sheep while dosing and it is advisable to use a crush so that the sheep can be dosed as quietly as possible.

A very important factor is the handling of the sheep while dosing and it is advisable to use a crush so that the sheep can be dosed as quietly as possible.

Now, turning to the composition of the Remedy itself, it can safely be said that for 99 out of a set of 100 different conditions under which the remedy is used, it is safe and effective. It would seem almost impossible, in a country where conditions vary so enormously as in South Africa, to prepare a remedy of poisonous ingredients that would be safe under all conditions. We know very little yet about contra-indications against the use of the Government Wireworm Remedy and the farmer naturally can be expected to notice only the most striking ones, e.g. **extreme poverty.** Further we conclude from field and experimental evidence, that **a heavy infection with Trichostrongylus makes the Wireworm Remedy unsafe,** as is probably more rapidly absorbed through the broken mucous membrane of the intestine. Since we originally believed that Trichostrongylus occurred chiefly in parts of the country where Persian sheep are kept, we recommend that they be given a smaller dose of the Remedy than Merinos. We have proved, that Persians are not more susceptible to poisoning by the Wireworm Remedy than Merinos, and since it is definitely known that Trichostrongylus now occurs also in other parts of the country amongst Merino sheep, the difficulty arises of ascertaining where this contra-indication should be considered. Further, it seems probable that some slightly poisonous plants or small quantities of more poisonous plants could set up an enteritis, which may for similar reasons be dangerous. A test made by giving sheep large doses of Croton oil to cause enteritis and dosing them the next day with Wireworm Remedy, showed that the sheep, although not obviously suffering from arsenical poisoning, purged for a much longer time than would have been expected from the action of the Croton oil alone. In controls that were killed, it was found that the Croton oil had caused only a very slight enteritis.

In all cases where adverse effects are noticed following the administration of Government Wireworm Remedy, the symptoms and lesions are those of arsenical poisoning, while the Bluestone is apparently not harmful. In the United States 1% solution of Copper Sulphate is used against Wireworm, and the dose for adult sheep is 3 oz., i.e., about 1 g. of Copper Sulphate or twice as much as is contained in the largest dose of Wireworm Remedy. We may, therefore, consider the dose of Bluestone sufficiently safe. A study of the dose of Sodium Arsenite in the Government Wireworm Remedy shows that it is rather near to the maximal safe dose.

From these considerations, it appears that it may become desirable to review the composition of the Government Wireworm Remedy and to reduce the amount of Sodium Arsenite by, say, one fifth, so that the largest dose will contain 525 mg. Copper Sulphate and 100 mg. Sodium Arsenite instead of 500 + 125 respectively as at present. It will require extensive testing to determine whether the efficacy would be the same with these altered proportions, although there is not much reason to doubt it, while on the other hand, this slight alteration may just produce that margin which would make the Government Wireworm Remedy safe under all conditions.

RECENT USEFUL REFERENCES.

Note on the variation of Phosphorous Content in South African Vegetation. VAN ZYL, J. P. (1927). *Comm. S. Afr. Chem. Inst.*, 22nd Nov.

Vitamins. FOX, F. W. (1928). *Comm. S. Afr. Chem. Inst.*, 26th June

A preliminary Note on the pharmacological action of H. collina. GUNN, J. W. C. and MIRVISH, L. (1928). *Comm. Roy. Soc. S. Afr.*, 18th August.

Metazoan Parasites from Zululand. CURSON, H. H. (1928). *S. Afr. Jl. Nat. Hist.*, VI., 181.

The Detection by means of the van den Bergh Reaction of Incipient Liver Necrosis due to Antimony Therapy. HORNBY, H. E. (1928). *Vet. Rec.*, VIII., 648.

An examination of the efficacy of Arsenical solutions in the Reclamation of Tsetse Areas. DUKE, H. L., HALL, G. N., and HADDON, E. C. (1928) *Bull. Entom. Res.*, XIX., 7.

Poisonous plants and domestic Animals. METTAM, R. W. ,1928). *Kenya and East African Med. Jl.*, V., 68.

The significance of Zoology in Veterinary Science. DU TOIT, P. J. (1928). *Presidential Address (Section D) S. Afr. Assn. Adv. Sc.*, 29th June—5th July.

A gross Cysticercus Invasion of the Liver of Lambs. THOMAS, A. D. (1928). *Ibid.*

Fat Necrosis of Sheep. DE KOCK, G. (1928). *Ibid.*

Papilloma tuberosum in the rumen of a bovine. FOURIE, P. J. J. (1928). *Ibid.*

Fatty degeneration of the liver in pregnant ewes. DE KOCK, G. (1928). *Ibid.*

Several cases of so-called Bent-leg in Sheep. THOMAS, A. D. (1928). *Ibid.*

Emphysema of the rumen of a calf. THOMAS, A. D. (1928). *Ibid.*

A note on T. melophagi occurring in S. Africa. BEKKER, J. G. and ROBINSON, E. M. (1938). *Ibid.*

Experimental T. vivax disease in Sheep and Goats. CURSON, H. H. (1928). *Ibid.*

A note on Bowiea volubilis Harv. CURSON, H. H. (1928). *Ibid.*

A note on the Longevity of the Brown Tick (R. appendiculatus). DU TOIT, P. J. (1928). *Ibid.*

Observations on Immunity in East Coast Fever. DU TOIT, P. J. (1928). *Ibid.*

A Note on the Adhesion Reaction (Rieckenberg phenomenon) in Trypanosomiasis. E. M. ROBINSON (1928). *Ibid.*

The Toxicity of Cucumis myriocarpus. QUIN, J. (1928). *Ibid.*

The rapid agglutination test in calf paratyphoid. LAWRENCE, D. A. and ROBINSON, E. M. (1928). *Ibid.*

A Note on the Occurrence of B. aertrycke infection of Canaries in South Africa. MARTINAGLIA, G. (1928). *Ibid.*

CLINICAL ARTICLE.

(Contributions to this section, particularly from private practitioners, municipal veterinarians and Government Veterinary Officers, are welcome).

"GUT TIE" OR STRANGULATIO DUCTO-SPERMATICA (Walch) IN A MERINO WETHER.

By Drs. Curson and Quinlan, Onderstepoort.

Anatomical Studies, No. 3 :

The above condition, sometimes incorrectly referred to as a hernia (pelvic hernia), is described in most veterinary text-books as occurring in the ox. As far as we are aware it has not yet been recorded in the sheep. In South Africa it is a condition we have not observed even in the ox. "Gut tie," described as affecting chiefly oxen in mountainous country, occurs on the right side, the rumen probably preventing its occurrence on the left side.

In the case in question (wether) the urogenital fold had ruptured (no connection with castration) and part of the terminal portion of the small intestines had penetrated the rent from behind forwards. About 5 inches of bowel were thus incarcerated, and as strangulation followed, gangrene resulted.

The post mortem examination was conducted by Mr. P. L. le Roux, M.R.C.V.S., and to him we express our thanks for bringing this case to our notice.

NOTES AND NEWS.

We congratulate Dr. Fred. Bullock, the genial Secretary of the Royal College of Veterinary Surgeons, on being awarded the Degree of LL.D University of London.

Among the important International gatherings held this year were (a) The International Conference on Foot and Mouth Disease at Paris, from 15th-20th May, and (b) The World's Dairy Congress held in London from 27th June-July 12th. Forming part of the latter was a Veterinary Section. (From Veterinary Record).

Our President, along with the Secretary of Agriculture, represented South Africa at the Imperial Agriculture Research Conference held in London in October, 1927. It is believed that the Colonial Veterinary Service will be reorganised as a result of the experience gained at the Conferenc.

At the Annual Congress of the National Veterinary Medical Association held at Newcastle-on-Tyne during the first week of September some useful papers were read, particularly (a) one on Lamb Dysentery by T. Dalling, and (b) another on Veterinary Education by Col. Walker.

It is understood that the Sixth Pan-African Veterinary Conference will be held in Pretoria next year. We consider it would be an advantage if the Spring General Meeting of the S.A.V.M.A. could be arranged to take place about the same time.

The next World's Poultry Congress is being held in England in 1930. We trust some of our young poultry specialists will submit papers.

A meeting of the Permanent Committee for International Veterinary Congresses was held in Paris on 14th May. Both Sir John McFadyean and Dr. O. Charnock Bradley were present. It was decided by the above Committee that the next Congress would be held in London in 1930. (Veterinary Record). It will be remembered that the proceedings of the last Veterinary Congress of 1914 were interrupted by the Great War.

At the Annual Meeting of the Low Veld (N.E.) Farmers' Association held in August, 1928, Dr. Viljoen mentioned that in future "Cases of East Coast Fever outbreaks, it was intended to slaughter all the cattle concerned, and so stop infection immediately, instead of playing about with it for one or two years." (Farmers Weekly, 29/8/28).

Recently the local branch of the British Medical Association blacklisted the appointment of a new Medical Officer of Health for Durban on the ground that the proposed salary of £1,200, rising to £1,500, was inadequate.

As an outcome of the discussions between the Association and the Town Council, proposals are to be considered by both bodies, providing that the starting salary shall be £1,500, rising by annual increments of £37 10s. to £1,750, the scale of increments only to come into operation from the date when the first peri-Durban areas becomes incorporated in the borough." (Rand Daily Mail 24/8/28).

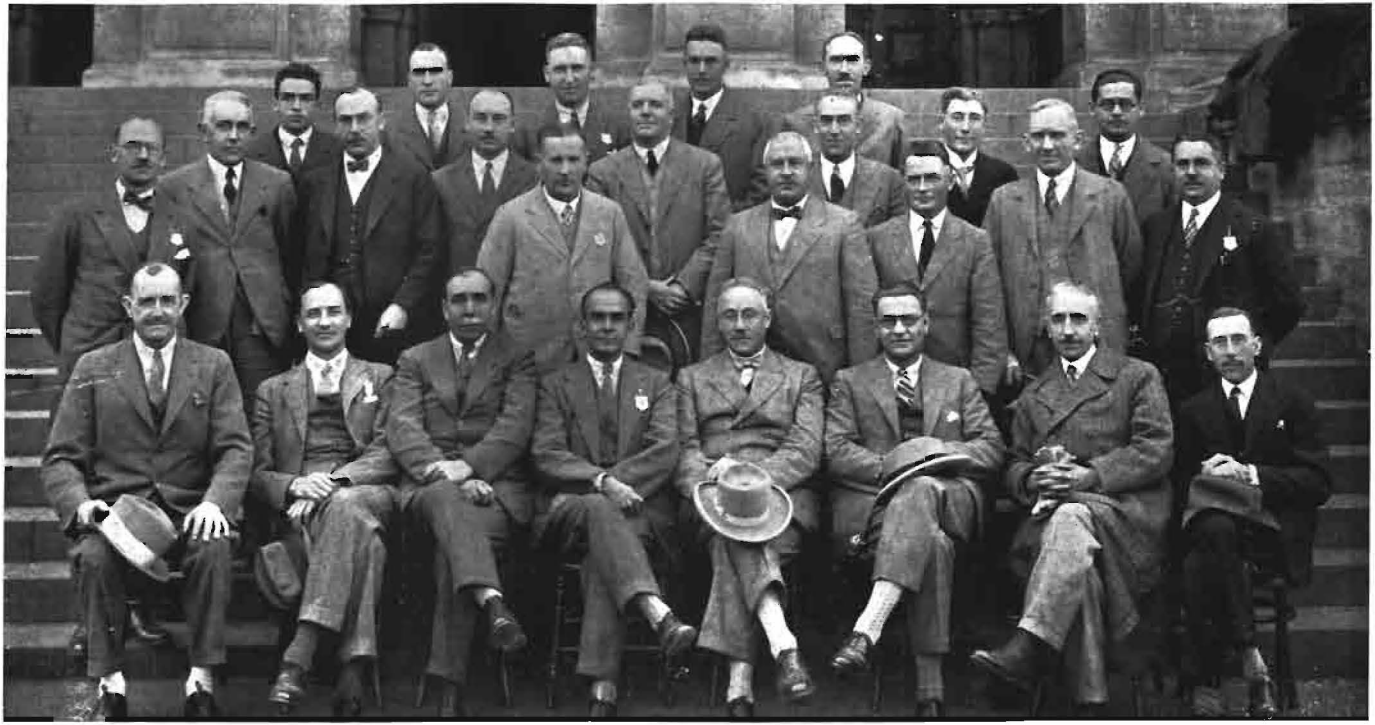
OBITUARY.

Daniel Kehoe M.R.C.V.S. (1888-1928).

Daniel Kehoe, especially well known to the older members of the profession in the Transvaal, died in Dublin on the 6th May. Graduating at the Balls Bridge College in October, 1909, he was the last Research Officer appointed to the staff of the Government Veterinary Bacteriologist, Transvaal (Theiler, Sir Arnold). His period of service dated back to September 1910, that is, 3 months after Union, but reorganisation of the various colonial veterinary services did not commence until the following January. Towards the end of 1918 he returned to Dublin to take up the post of Professor of Histology, Pathology and Bacteriology at his old College. During the eight years he spent in South Africa he built up for himself a worthy reputation as his excellent contributions to veterinary literature will testify. Of a studious disposition, he possessed a thorough grasp of the natural sciences. and was ready at all times to assist his colleagues and students. Through his unassuming nature, his broad mindedness, his friendship and deep sincerity, his memory will be cherished by all who knew him. Members too appreciate the fact that although he left South Africa 10 years ago he retained throughout membership of the S.A.V.M.A.

Thomas le Blanc Revington, M.R.C.V.S. (1887-1928).

Thomas Revington, born 13/6/1887 and a graduate of Dublin (24/7/11), served with the S.A.M.R. during the campaign in German South-West Africa. In December 1915, he received a commission in the S.A.V.C. and took part in the East African Campaign, but later again returned to South-West Africa, this time as an officer. On the establishment of a civil administration in that country, he was appointed (1/4/20) a Government Veterinary Officer, being transferred to the Union Department of Agriculture on 29/12/1924. He resigned on 1/2/1926 and afterwards proceeded to Australia. The Register of the R.C.V.S. records that his death took place in Perth.



MEMBERS OF THE PAN-AFRICAN VETERINARY CONFERENCE HELD AT PRETORIA, AUGUST, 1929.

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