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P. 325

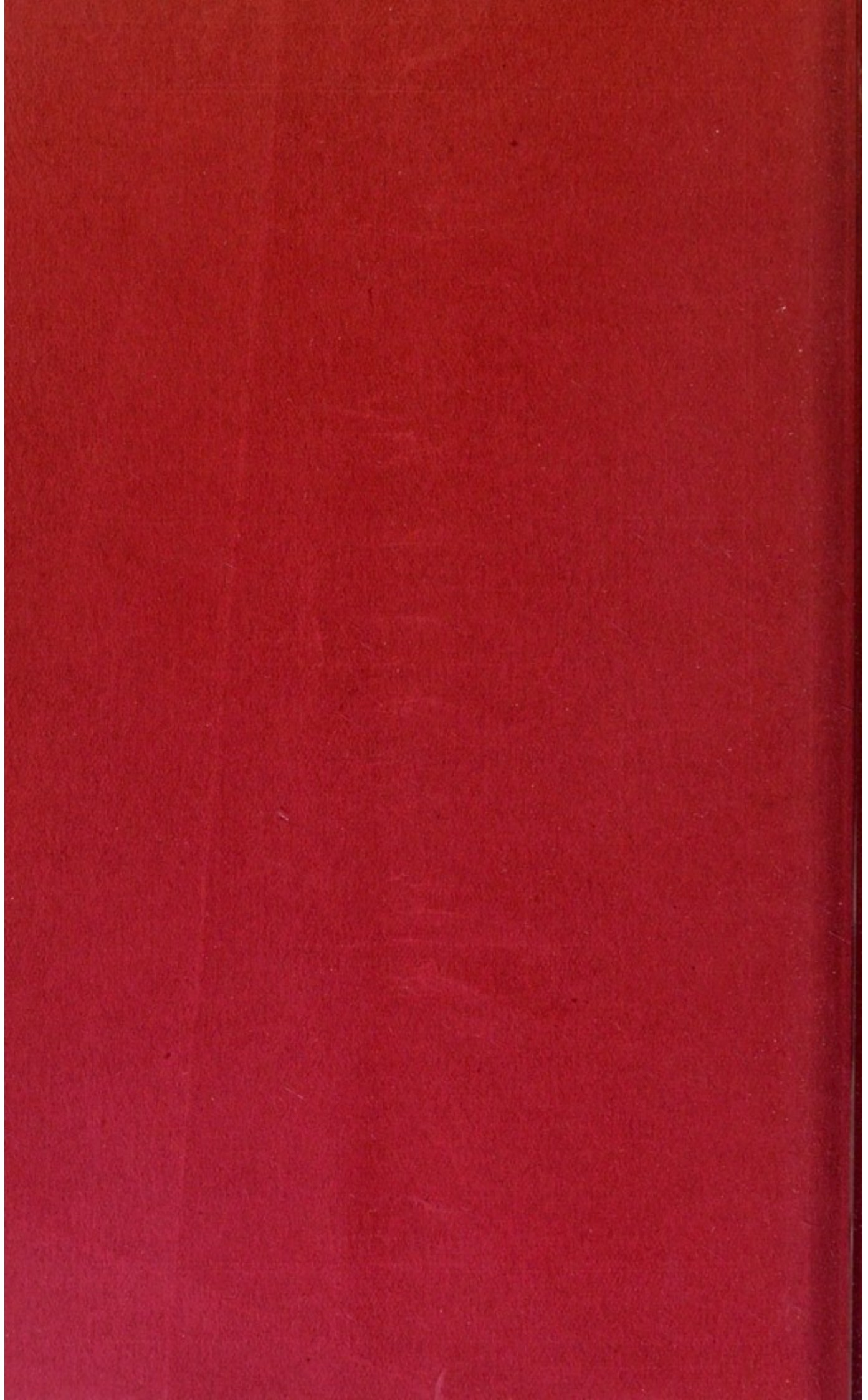
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The British South Africa Company,
Administration of Northern Rhodesia.

REPORT
ON
**SLEEPING
SICKNESS**
IN
NORTHERN RHODESIA
TO
DECEMBER, 1913.

By A. MAY, M.D.,
Principal Medical Officer, Northern Rhodesia.





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LUAPULA MWERU AND TANGANYIKA AREAS.

A very satisfactory position as regards the prevalence of sleeping sickness in these areas now exists, the whole country to the East of the Luapula and Lake Mweru has been depopulated and it may now be reasonably considered that practically all risk of the extension of the disease is at an end.

One case only of the disease has been discovered during the past year (this was in a native of Shiwiri's village which had been removed from the Congo border north of Lake Mweru).

There are now twenty-three cases under treatment, namely ten at Fort Rosebery, six at Kawambwa, and seven at Abercorn, and it seems improbable that this number will be increased except by the addition of a few who may possibly have escaped detection in the moved villages.

Restrictions on the movements of the natives of these areas need now aim only at the prevention of their return to foci of infection, i.e., *Glossina Palpalis* areas, and for this purpose it will be sufficient to include as closed area only those parts of the Luapula, Mweru and Tanganyika districts which have been depopulated.

It has therefore been recommended that the restrictions formerly in force in these areas should be dispensed with and the following have been adopted in their place.

Boundary Lines for the Luapula (Fort Rosebery) District.

The original closed area extending between the Luera on the South and the Luango on the North has with the exception of one village namely 'Chansa-Kafushya' on the Kashya stream been depopulated. *Glossina Palpalis* exists on the Mansa river to within a few miles of Fort Rosebery station, it would therefore be difficult without making a separate closed area for the Mansa to reduce the extent of the original closed area and it has been recommended that it be allowed to stand as at present.

Mweru District.

As the only object of future restrictions will be the prevention of the return of the population to dangerous areas, it does not seem necessary to include the large area to the East of Mweru marsh and between there and Lake Tanganyika. Thus a narrow stretch of country running along the East bank of the Luapula and the shores of Lake Mweru has been adopted as a closed area.

The Mweru and Tanganyika closed areas are now completely separated and restrictions have been removed from the Mweru swamp and surrounding country between Lakes Mweru and Tanganyika.

Tanganyika District.

The boundary of the closed area in this district has been fixed at a distance of ten miles from the shores of the Lake and a similar distance from the Lovu River as far up stream as the crossing of the Abercorn-Mporokoso Road.

Restrictions as to Movement &c., in these Closed Areas

The following have been approved.

- (1) That no natives be permitted to live within these closed areas.
- (2) That no native be allowed to enter these areas except at the discretion of the District official or Medical Officer.

TANGANYIKA DISTRICT.

Dr. W. H. T. Storrs.

No fresh case of the disease has been found since October, 1910.

Segregation Camp.

Since the establishment of this Camp the total number of cases admitted has been 34. Of these, five were found West of the Lovu River—from Niamkolo and Kasakalawe on the Lake shore.

There are now six patients in this Camp, none of whom have for some time shown any signs of the disease, and it is anticipated that these can shortly be discharged with safety and the Camp closed.

Glossina Palpalis. Distribution.

The Lovu River has been examined by Dr. Storrs, from the crossing of the Mporokoso-Abercorn Road down stream to the Lukwesa crossing. No fly was found up to a point about six miles North of this crossing, thus there has been no extension of fly up stream since the limit was defined by Dr. Leach, (1909).

The Lake shore was also examined from Kasakalawe to Kituta, and also some six or seven miles up the Lunzua River. Fly was found to be abundant at both Kasakalawe and Niamkolo. No fly was found at Kituta.

Clearings.

The Mwepwe and Kanone Clearings on the Lovu River are still maintained.

MWERU DISTRICT.

The Late Dr. D. C. Master.

One new case of the disease has been found during the last 18 months that of 'Nampweto' (mother of a former patient). This infection was in all probability contracted at Shiwiri's village on the Northern Border where this woman lived before the removal of the village.

Owing to the complete removal of the population from Glossina Palpalis areas it is unlikely that more than a very few other cases which may up to the present have escaped detection, will be found in this district.

Segregation Camp, (Kawambwa).

There are at present six cases in this Camp, namely :

			Tryps. last found.
Kaneke ...	...	...	5/1/13. Glands only.
Casimota	...	...	1/3/13. " "
Moa	...	...	April, 1912. " "
Wauni	...	...	" " " "
Kabwe (female)	...	...	1/2/13. " "
Nampweto (female)	...	...	1/3/13. Glands & blood.

Treatment.

Atoxyl injections.

Glossina Palpalis. Distribution.

No change has taken place in that previously recorded with the exception that during July, as reported by Dr. G. E. Storrs, no fly could be found at the mouth of the Luao River.

This is probably a seasonal change only in the distribution of this species; fly was numerous at this place during the preceding February.

Kilwa Island.

A careful palpation of the population of this island did not lead to the discovery of any case of the disease.

Fly is numerous on the Belgian shore in close proximity to the island. The absence of the disease is a strong argument in favour of this fly being uninfected.

These people are now recruited for local labour.

Moved Villages.

Conditions are reported as satisfactory.

LUAPULA DIVISION.

Dr. E. G. Storrs.

Glossina Palpalis. Distribution.

No extension of fly has occurred on the Luango and Mansa Rivers.

The clearing at the Mansa—Chifosi junction has been maintained.

Removal of Villages.

The villages recently removed from the Sleeping Sickness area are as follows :

Chisunka Group.

Chisensela
Katanga

Muntante
Marapula

were removed to a site about 3 miles East of Kasempa on the Luafumu River.

Chemesi Group.

Musekwa

Kapoli

Muloshi

have been removed on to the Chofosi stream about $1\frac{1}{2}$ miles North of Chemesi.

There is now only one village, Chansa, on the Kashya stream, a tributary of the Lukundushi River, remaining in the Sleeping Sickness area.

Kapwepwe, Kapolwa, Mutando and Musakanga have moved into Congo territory.

Segregation Camp. Fort Rosebery.

Fifteen cases have recently been discharged as cured ; they are still under supervision. None of these cases had exhibited Trypanosomes for at least two years. Eight cases terminated fatally, and one escaped into the Congo.

Of the remaining cases it is hoped that three will be discharged cured within the next few months.

Treatment.

Atoxyl and Mercury.

GLOSSINA MORSITANS TRANSMITTED HUMAN TRYPANOSOMIASIS.

The present Position of the Disease in Northern Rhodesia.

Since the date of the last Report (February 1912), twenty-nine cases of the disease have been found, namely :

European.

Ndola District	1	case
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Natives.

Petauke District	9	cases
Fundu Detention Camp	4	„
Mpika District.					
Plateau Area	1	„
Valley „	...	...	...	2	„
Chinsali District	...	...	...	1	„
Lundazi District	5	„
Serenje (Plateau Area)	2	„
Ndola District	2	„
Mkushi „	2	„

	Total			29	cases
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The total number of cases found since August, 1909, therefore now amounts to ninety-five; sixty-six of these have previously been reported.

Petauke District.

1. An examination of the Northern part of this district during November and December last year resulted in the finding of nine cases or three less than a similar examination carried out during the previous year.

Mpika District. (Valley Area).

2. Examined by Dr. Kinghorn, June, 1913; 91 per cent. of the censused population was seen. Two cases of the disease were found.

This identical area examined at periods varying from 18 to 24 months previously had resulted in the discovery of 8 cases.

Lundazi District.

3. The examination of the Southern third of this district was carried out during July and August by Dr. Kinghorn, five cases were found, a result which is identical with that of an examination carried out there by Dr. A. F. Wallace during December, 1911, and January, 1912.

Chinunda and Rukusi Areas.

These were examined by Dr. H. Leach during August of this year.

No cases of Trypanosomiasis were found.

The ground covered was practically identical with that covered in the earlier part of 1911, when five cases were found.

Fundu Detention Camp.

Some 17,000 natives from the various parts of the Luangwa closed area and Nyasaland have passed through this Camp, en route for Southern Rhodesia, and elsewhere. Four cases of the disease have been found amongst them.

Fundu and Southern Border Road Area

Was examined by Dr. R. S. White during September and October, 1912. 2,300 people were seen, one case only of the disease was found.

Lukasashi Valley

Was examined by Drs. F. O. Stohr and A. D. Edington during June, and July, 1912, no case of the disease was found.

PLATEAU.

West Serenje District.

Lulimala and Lukulu Rivers. The fly area in the neighbourhood of the Lulimala and Lukulu Rivers to the East of Lake Bangweolo was examined by Dr. G. W. Ellacombe during October and November, 1912.

Twenty-four villages were visited and 3,247 people examined.

One case of Trypanosomiasis was found at Chitambo's village.

Dr. Ellacombe draws attention to the fact that of the only two cases of Trypanosomiasis previously found in this fly area, one 'Nandwe' (Case No. 3, 1910 Report), was also a native of Chitambo's village. The other 'Ngalandi', (treated by Dr. Brown at the Chitambo Mission) came from Chimesi's village about 8 miles away, and suggests that there is a focus of infection in this locality.

Fly Distribution. (West Serenje District).

With occasional interruptions due to the nature of the country (swamp and open plain) fly is numerous throughout this area. The fly belt extends roughly from the neighbourhood of the Livingstone Memorial on the East, to the Bangweolo swamps on the West.

This district was previously examined by the late Dr. D. C. Master in July, 1909. No cases were then found.

Mpika District.

Ngoa-Chambezi Fly belt

This was examined by Dr. Kinghorn in February of this year. 1,038 people were seen (census population 1,041).

No case of the disease was found.

Dr. Kinghorn gives the following table of the relative incidence of glandular enlargement in men, women and children in this area.

	GLANDS.				TOTALS.	PER CENT. WITH GLANDS.
	X	X -	X - -	- - -		
Men ...	0	2	115	119	236	49.5
Women ...	0	0	131	219	350	37.4
Children ...	0	0	253	199	452	55.9
TOTALS	0	2	499	537	1,038	48.2

Luano Valley District.

Examined by Dr. D. S. MacKnight during September, 1912.

One case of the disease was found.

Mpika.

The Mpika portion of the Luanwa closed area was examined by Dr. Kinghorn in May and June, 1913. All villages in this area were visited and all available natives examined.

The examination of this district was carefully controlled by the census returns, to which Dr. Kinghorn applied the requisite corrections for death, numbers working elsewhere, families who had left the district either temporarily or permanently, &c., and it is estimated that 91 per cent of the total adult population were palpated. The death rate for the district is estimated from the figures available at 37.8 per 1000.

The chief causes of death mentioned were :

Accidental.

(Snakes, Lions, Crocodiles) ...	...	12
Intestinal ...	...	30
Chest ...	...	4
Leprosy ...	...	2
Old age ...	...	2
Sleeping Sickness, (Diagnosed), ...	...	2
Unknown ...	...	47

Dr. Kinghorn states :

“In only one village, Kapitis, was the statement definitely made that two of the three deaths there had been due to ‘Chiloteria’. In a few instances the symptoms mentioned—Emaciation, œdema, headache—were suspicious of Sleeping Sickness but from the meagre amount of detail available no definite conclusion could be drawn. The large number of deaths due to intestinal disorders was, to a very large extent, attributed directly to the lack of proper food, the result of last year’s drought.”

In discussing the discrepancy which exists between the censused population and the numbers examined, Dr. Kinghorn remarks. “While I regret this discrepancy I think that the results are sufficiently exhaustive to afford a fair index of the prevalence of Sleeping Sickness in this portion of the Valley at the present time”.

The total number palpated was 2,613. Details are given in the following table.

	X	X -	X - -	- -	TOTALS.
Men ...	3	2	266	342	613
Women ...	2	0	242	755	998
Children ...	0	1	533	468	1002
TOTALS.	4	3	1041	1565	2613
Per cent.	0.15	1.11	39.85	59.89	99.98

All those with x and x-glands were punctured and Trypanosomes were found in the gland juice of two.

These two positive cases were found in Kapampa’s and Msoko’s villages, the first of which lies 7 miles to the North of the old Nawalia Boma, and the other on the Mwalezi river which forms the Mpika-Chinsali boundary.

“So far as it is possible to judge therefore the outlook is distinctly encouraging. The villages in this portion of the Sleeping Sickness area were visited at periods varying from 18-24 months previous to the present occasions, and whereas 8 cases were then diagnosed only two have been isolated this year. Strong support is afforded accordingly to the view that the disease is of old standing in the Luangwa Valley and that it has now reached a state of comparative equilibrium. Were this not the case it might have been expected that the disease would have made more pronounced strides in two years more particularly in view of the general lowering of vitality which must have occurred in the natives during the period of semi-starvation which existed last year.

The general health of the community now appears to be satisfactory.”

Lundazi.

The Southern third of the Lundazi sub-district was examined by Dr. Kinghorn during July and August, 1913. 6,374 natives were seen, and five cases of Trypanosomiasis found.

These results are identical for this part of the division with the condition found by Dr. Wallace who made a similar examination during December, 1911 and January, 1912 (vide last Report page 16). Details of this examination are not as yet to hand.

Luano Valley.

This area was examined by Dr. D. S. MacKnight during September of this year. 1,653 natives were examined of whom 21 had puncturable glands and from 77 others fresh blood films were taken and examined.

One case of Trypanosomiasis was found, (Matowera, of Mwanna's village near the Mwapula stream).

Previous History of the Disease in this Area.

During July and August of this years a series of deaths were reported the cause for which was obscure

A blood smear taken by the Native Commissioner (Mr. E. K. Jordan) from one of these cases was found by Dr. Wallace to contain Trypanosomes.

An examination was recently made by Dr. D. S. MacKnight of the natives living in this valley. Every village was visited and all the inhabitants palpated. A few villages on the Lunsemfwa to the South of the Luano were examined, also a few villages on the plateau to the West.

Dr. MacKnight reports :

GLOSSINA MORSITANS, is by no means numerous in any part of the area, but more plentiful near the Mwapula stream than elsewhere.

The natives state that the fly is always most numerous and most troublesome just before the rains (October and November); they think that during the past year tsetse has been more numerous than usual, and as far as can be ascertained these flies disappear at certain times and do not make the valley their habitat.

Game

Is not by any means plentiful except on the Mwapula near its junction with the Lunsemfwa. Fly at this point was particularly scarce.

Domestic Animals.

In the Mwapula area there were very few dogs and no goats, elsewhere throughout the valley healthy dogs and goats were found in the villages.

Previous History of the Disease.

The natives state that the disease is not by any means a new one; they have known it since they were children. They have never seen or heard of so many cases as have occurred lately. Only two cases have been noticed by them in the five years preceding the one on record. They recognise the disease by the œdema in the legs and talk of it as "The disease in which the legs swell." They have no name for the disease. Many years ago a name was given to it, this has however been dropped. They do not believe that small children ever get the disease. The sickness may be looked for just when the crops begin to grow, that is with the first rains. Somnolence is not recognised as a symptom of the disease.

The number of people who have recently died of the swollen leg sickness is said to be about twenty.

Fundu Medical Examination and Detention Camp.

This Medical station was established in January, 1912, with the object of

- (1) Providing a medical examination and detention for all natives passing South to Southern Rhodesia from the Luangwa closed area and Nyasaland, and so preventing the spread of Trypanosomiasis into that territory.
- (2) Providing a medical station for the Southern part of the Luangwa closed area from which the population of the surrounding district could be periodically examined.
- (3) To provide medical assistance and Hospital treatment for the natives of the surrounding districts.

The station was opened by Dr. Leach who remained in charge pending his transfer to Fort Jameson, until April, 1912. Since that date Dr. R. S. White has been in charge assisted by Dr. F. O. Stohr, and subsequently by Dr. A. D. Edington.

Each native passing through is detained for a minimum of ten days. Daily observations as to temperature are taken, all are carefully palpated. All enlarged glands are punctured, and microscopically examined. A microscopical examination is also made of the blood of all cases showing any rise of temperature.

Since the establishment of this station some 17,000 natives have passed through for work in Southern Rhodesia.

Four cases of Trypanosomiasis have been found at this station, three amongst the natives passing through to the South, one from a neighbouring district.

The disease has not been found in any native subsequent to his having passed through this Camp.

The duties of the Medical Officer stationed at Fundu include, in addition to the examination of all natives passing through to the South, the general medical work of the district (including vaccination) and the examination of the district and the investigation of the position of the disease.

During December and January the villages on the Fundu—Nyanje road, and within a ten mile radius round Nyanje, the Nyanje Petauke, and the Petauke—Kamono roads were examined by Dr. White. 7,122 people were seen, and one case of Trypanosomiasis was found.

The Southern part of the valley of the Lukasashi River was examined in November by Dr. Edington.

No case of the disease was found.

The Lukasashi Valley from Fundu to the Mlembo Plantation was examined by Dr. F. O. Stohr during May and June of last year. 1,385 people were seen, no case of the disease was found.

During August and September, the inhabitants of that area known as the Sitchitambo-Kunduza fly belt, were thoroughly examined by Dr. R. S. White; in 310 instances a microscopic examination was made of either the blood or gland juice or both of these people. In no case was the disease found.

No satisfactory explanation can be offered as to the failure of this disease to spread under the seemingly eminently favourable conditions which exist in the greater part of the Luangwa Valley area and elsewhere at similar altitudes, and under which it has been known to exist for at least five years. A large proportion of the game, which is plentiful in these areas, harbours a Trypanosome which is identical morphologically and in all its reactions with the *T. Rhodesiense*. The transmitter, *Glossina Morsitans*, is plentiful and climatic conditions are suitable; notwithstanding which the disease has shown no inclination to spread.

It may however be suggested as a possible explanation that :

- (1) The disease is an old one and had in all probability existed for a considerable number of years before it was recognised, and is endemic and that the bulk of the population is immune.
- (2) The source of supply of the infection, namely the extent to which the game is infected with *T. Rhodesiense* may not be so extensive as is at present thought.
- (3) The tendency of the disease so far as is at present known, to appear localised such as in the neighbourhood of the Luangwa, North and South of Hargreaves, and in the proximity of main roads, and as pointed out by Dr. Ellacombe in the West Serenje District, rather than to be found equally distributed elsewhere where climatic conditions are suitable, and where there are equally favourable conditions as regards the abundance of both transmitter and 'Reservoir', would suggest that there is still a link wanting in the chain of evidence in favour of the 'Fly' and 'Game' Trypanosome being identical with that which causes human Trypanosomiasis.

The Relationship of Human Trypanosomiasis to Game.

It was pointed out in the last Sleeping Sickness Report for this Territory (February, 1912), that in connection with the prophylaxis of the disease game would have to be considered from two practically independent points of view.

The first as offering a means of subsistence to the carrier of the disease, i.e. the *G. Morsitans*.

The second, as reservoirs for the organism causing the disease.

1. The question as to whether game is essential for the maintenance and propagation of the fly is still in exactly the same position as it then was. We are still in ignorance as to what relationship exists, proof is still wanting that any essential relationship does exist.

2. As reservoirs for the organism causing the disease. It has now been accepted by a considerable number of authorities that the Trypanosome first found in the blood of a waterbuck at Nawalia in August, 1911, by Dr. Kinghorn is the same organism which causes that variety of Human Trypanosomiasis met with in *Glossina Morsitans* areas in this Territory. This organism has since then been found by Dr. Kinghorn and the other members of the Luangwa Sleeping Sickness Commission to be widely distributed amongst the fauna of this country, and it has also been shown that its carrier is the *Glossina Morsitans*. The final proof of its identity, i.e its pathogenicity to human beings is however still wanting.

The identity of this Trypanosome is questioned by Dr. Taute of the German East Africa Sleeping Sickness Commission who has recently performed the bold experiment of injecting himself and a series of experimental animals as controls with blood from a naturally infected dog, and of allowing himself to be bitten by flies known to be infected with it.

In the former case all the seven animals used as controls became infected and died.

In the latter experiments also, the control animals became infected and died, whilst the author remained healthy, and has since proved by the inoculation of susceptible animals with his own blood that he did not become infected.

There is therefore some doubt thrown on the identity of the *T. Rhodesiense* and the organism found so widely distributed in Game, and hence on the part which the antelope plays as the reservoir of Sleeping Sickness.

The contention in favour of the non-identity of these Trypanosomes is also supported by the conditions found in association with a heavy infection of the Game with this Trypanosome, and its failure under suitable conditions, to spread to Human beings, these circumstances have been reported elsewhere.

The complete proof of the identity of this Trypanosome, needs a series of experiments such as that carried out by Dr. Taute. No more than an inference as to identity can be drawn from the facts at present available.

It can however be claimed that if the organism be the *T. Rhodesiense*, then the possibility of immunity amongst man is an established fact and one having a most valuable bearing both on the future of the disease and the alleged necessity for drastic preventive measures such as the wholesale destruction of Game.

THE EXPERIMENTAL DETERMINATION OF THE RELATIONSHIP WHICH EXISTS BETWEEN GAME AND FLY, AND INCI- DENTALLY BETWEEN GAME & HUMAN TRYPANOSOMIASIS.

With the object of determining these points, it was proposed that an experiment (vide Report for 1912 page 25) should be undertaken which was to include the complete destruction or removal of all game in the supposed limited and definitely restricted fly belt in the neighbourhood of Sitchitambo's and Kanduza's villages on the Southern Border road, from which it was expected definite conclusions could be drawn as to what effect such destruction had on the life of the fly.

This experiment has not been carried out ; it was found on more careful examination (made by Dr. R. S. White in September, 1912) that this fly belt, formerly thought to be definitely restricted to the area named was not so restricted, but extended on the West to the banks of the Luangwa River and there became continuous with the fly belt running North and South along this river, and on the East and South extended into Portuguese territory. It was also found that game in this area was extremely scarce and consequently its destruction could not be expected to yield the required information ; it was therefore decided that this was not a suitable site for the proposed experiment.

The Lukasashi Valley, North of the Mkushi-Petauke Road was next examined (by Mr. Ll. Lloyd, October and November, 1912) with a similar object in view, and it was found to be in every respect eminently suitable. The following is an extract from Mr. Lloyd's report :

“From these data it will be seen that tsetse fly exist practically throughout the valley of the Lukasashi in the part examined including part of the Kaombi stream and the Manda as far as the hills.”

“Game is moderately numerous throughout the district. The Fauna is that of the Luangwa Valley rather than that of the Plateau.”

“The secluded position of the valley and its dry condition during the winter render it a specially suitable place for the proposed experiment.”

An experiment of this nature and magnitude required careful consideration in all its aspects before being attempted, i.e. (1) Its cost, (2) The probable result, (3) The possibility of arriving at a correct conclusion as to the interpretation of the result.

ITS COST. The following rough estimate is submitted; it is based on the assumption that the area experimented on should not be less than approximately 400 square miles, and that this area must be effectively fenced in order to prevent the return of the game, and that the experiment will extend over three years.

Estimated Expenditure.

1. Observations on the seasonal variations of the fly in the locality selected for a least one year before the commencement of the experiment ...	£	500
2. FENCING. Original double fence, 100 miles @ £50 per miles ...		5,000
Repairs to fencing during the continuation of the experiment, including material, white and native labour for at least two years. ...		2,000
3. QUARTERS. Erection and maintenance of quarters for European staff ...		500
For Native staff ...		50
4. SALARY. Of trained observers, (Microscopist and Entomologist) engaged in observations as to the results ...		2,000
5. TRANSPORT. ...		400
6. REMOVAL OF GAME ...		100
7. INCIDENTAL EXPENSES. ...		300
Estimated total expenditure ...		£11,350

II. One or other of the following conditions will be found to result from this experiment.

- (a) The total absence of fly from the area cleared of game.
- (b) A diminution in the amount of fly present.
- (c) Unchanged conditions as regards the prevalence of fly.

III. The Interpretation of these Results.

(a) and (b). In the event of either of these results being found to have followed the removal of destruction of game within a given area it will then be necessary to determine :

- (1) Whether the fly has died as the result of the removal of one of its sources of food supply, or
- (2) Whether the fly has migrated in search of food.

Until a method for the determination of these essential points be available an experiment giving these results will be open to grave doubts.

(c) The finding of apparently unchanged conditions after the removal of the game will also not be in any sense conclusive as to the result of the experiment.

The binomics of this fly are as yet but little known, there are reasons to suppose that more than one condition is required for its suitable habitat. At least two conditions may be regarded as essential, namely a food supply and a suitable breeding ground ; one locality may provide one condition, another adjacent one the other. The locality selected for this experiment will in all probability provide both.

On the completion of the experiment food will be sought for elsewhere, possibly where it exists alone. The area over which the experiment was carried out may still be utilised as a breeding ground ; this will necessitate a constant interchange of the insects according as to whether they are in search of one or other condition, and little if any information will be gained from the results of game destruction on the numbers of the flies.

(In carrying out this experiment over a limited and properly fenced area it does not seem necessary that the game should be destroyed, results which will prove to be at least equally instructive could be gained by driving the game from the area under observation).

A study therefore of all the circumstances bearing on the experimental destruction or removal of the game from a selected area owing to the large expenditure involved, our present ignorance of the binomics of this fly, and therefore our inability to correctly interpret the results following this experiments, does not lead to the opinion that this experiment would be justified by its results.

Our knowledge of the facts bearing on the relationship of Sleeping Sickness to big game and our knowledge of the present position of the disease do not justify the agitation which at present exists for the general destruction of game as a preventative of the spread of this disease.

Until there is definite proof (1) That the disease is spreading, (2) That the game is responsible for the maintenance of the fly. (3) That the game is the only reservoir of the disease, or even the chief one, and (4) That the conditions following the destruction of the game will be an improvement on those which at present exist, it is a reasonable conclusion that the presence of this disease as it now exists does not afford sufficient excuse for killing out the game.

Since the date of the last Report on this disease a considerable amount of evidence has been obtained to show that in the eighteen months which have since elapsed there has been no spread of this disease or evidence of a tendency to spread. There is on the other hand increasing reason to think that the disease is an old one and has arrived at a condition of equilibrium, i.e. that it is endemic, and in many respects approximates to the conditions found on the West Coast and that Sporadic cases only will continue to be found.

Its present condition therefore requires no hasty or drastic measures "For extirpating the living reservoirs of Sleeping Sickness" the grounds for which are purely hypothetical and unreliable. All that is required to meet the present situation is a continuation of the work on the lines recommended in the Sleeping Sickness Report for this territory February, 1912, which were as follows (page 27):

1. Natives in fly areas should be prohibited from keeping domestic animals, goats, sheep, dogs, &c.

2. That they should be encouraged by means of trapping, pits, drives, and if possible in being allowed a certain number of firearms, to clear the vicinity of all villages in fly country of

game, and that except in the vicinity of villages game should be as far as possible unmolested in order to prevent their movement into areas free of infection.

3. That natives should be encouraged to protect all cultivated lands, by means of cutting or clearings from fire, with the object of allowing a more complete clearance to be made by means of grass fires. At present in many places the native is reluctant to start a grass fire owing to the danger of losing his crops thereby.

4. That the headman of each village should be encouraged by means of small payment, to rid as far as possible the immediate vicinity of his village of fly by means of mechanical appliances for trapping, &c. The details of this work might be under the supervision of the Medical Officer of the district.

5. That certain routes, to the exclusion of all others, should be used for all natives and others travelling through these areas, and that these routes should as far possible be rendered safe both by the removal of infected cases and by the encouragement of game destruction in their vicinity.

Corrections.

A considerable number of errors have crept into discussions and statements which have recently been made in England on the question of the relationship of game to the spread of Sleeping Sickness.

It is advisable that these should be corrected.

- (1) There is no reason for supposing, as has been done, that Sleeping Sickness had not occurred in Rhodesia prior to 1908 when the first case was discovered. (Proceedings of the Zoological Society of London June, 1913, page 321). There is on the contrary very good reason for thinking that the disease had existed there for many years before that time.
- (2) The unqualified statement has been made that "Sleeping Sickness has already crossed the Zambesi." (Ibid page 328). The present state of our knowledge offers no justification whatever for what is implied by this statement; it might equally well be said that Sleeping Sickness has crossed the Zambesi from the South.

- (3) The available evidence as to the spread of the disease does not "Strongly suggest that during the past few years Sleeping Sickness has been on the increase." (Ibid page 335), on the other hand it shews that the disease has not spread.
- (4) It is difficult to understand how the statement that "The most reliable information is to be obtained from the incidence of the disease in Europeans", can be qualified. To anyone familiar with this country and local conditions it is very evident that the incidence of the disease in Europeans bears no relationship *whatsoever* to its incidence in natives. A devastating epidemic amongst natives might be raging without one per cent. of the European population coming within many hundreds of miles of the possibility of becoming infected.
- (5) The statement that "Since the Luangwa Valley has been closed quite a number of Europeans have contracted the disease in North-Eastern Rhodesia" (Ibid 336), is quite incorrect. Only one case of the disease has occurred since that date.
- (6) The opinion has been expressed that "The spread of Trypanosomiasis South is a thing that at present no adequate attempts have been made to prevent." (Transactions of the Society of Tropical Medicine and Hygiene).

That these remarks are incorrect is sufficiently obvious, and that they could not be made except as the result of ignorance is also obvious. Their object can only be conjectured.

Unqualified and incorrect statements such as the above should not be made. Their publicity gives them an unwarranted significance; their only result is to produce a false impression of what is being done by the Governments concerned and to embarrass those who with advantage of accurate knowledge at their disposal are responsible for and are carrying out the requisite measures for checking the spread of the disease.

THE OCCURRENCE OF *GL. MORSITANS* TRANSMITTED HUMAN TRYPANOSO- MIASIS OUTSIDE THE CONFINES OF THE PRESENT CLOSED AREA.

It was stated in the Sleeping Sickness Report of February 1912, that there was little reason to hope that transmission would be in any way inhibited by the natural conditions existing throughout the territory and consequently that the disease would not prove to be confined to the Luangwa Valley and similar altitudes in Nyasaland and the instance of the discovery that the disease was transmissible in the Chinunda district, (altitude 3,500 feet) was then quoted (vide page 29).

It has since then been found by Dr. Kinghorn and his co-workers on the Luangwa Sleeping Sickness Commission that temperature exercises a very marked influence on the developmental cycle of *T. Rhodesiense* in *Glossina Morsitans*. High temperatures (75° - 85° F) favour the development of the parasites, whilst low temperatures (60° - 70° F) are unfavourable. Cases of the disease have also been found in which the history proved them to be locally infected in various parts of the territory where these unfavourable conditions exist to a greater degree than in the Luangwa Valley.

The disease has been found by Dr. Ellacombe in the Serenje District to the East of Lake Bangweolo, September, 1912, by Dr. Kinghorn in the Mpika District May, 1913, by Dr. Ward in the Ndola District 1912-1913 and by Dr. MacKnight in the Luano Valley September, 1913.

It may therefore be accepted that although certain unfavourable climatic conditions exist to a more marked extent in some districts than in others, transmission is possible wherever there is tsetse fly.

Luangwa Sleeping Sickness Commission.

In April, 1912, this Commission was moved from Nawalia in the Luangwa Valley to Ngoa (Mpika District) on the Congo-Zambesi Watershed with the object of determining what influence climatic conditions have on the transmission of the parasite by *Glossina Morsitans*, and thus determining the possible extent to which the disease could spread.

It was found that :

- (1) "Attempts carried out at laboratory temperature on the Congo-Zambesi Plateau during the cold season to transmit the human Trypanosome by means of *Glossina Morsitans* were invariably unsuccessful, in spite of the fact that 680 flies were used in these experiments."
- (2) "The developmental cycle of *T. Rhodesiense* in *Glossina Morsitans* is to a marked degree influenced by the temperature to which the flies are subjected. High temperatures (75° - 85° F) favour the development of the parasite, whilst low temperatures (60° - 70° F) are unfavourable."
- (3) "The first portion of the developmental cycle can proceed at lower temperatures, but for its completion the higher temperatures are essential."
- (4) "The relative humidity of the atmosphere has apparently no influence on the development of the Trypanosome in *Glossina Morsitans*."

The object which determined the formation of this Commission, namely the incrimination of *Glossina Morsitans* as the carrier of Human Trypanosomiasis having therefore been accomplished, the work of the Commission came to an end at Ngoa in August, 1912.

Very great credit is due to Dr. Kinghorn, and his co-workers, Drs. W. Yorke and A. F. Wallace, and Mr. Ll. Lloyd, for the rapidity and thoroughness with which this work was accomplished.

MODIFICATIONS IN EXISTING SLEEPING SICKNESS REGULATIONS.

LUAPULA, MWERU AND TANGANYIKA AREAS.

The complete removal of the population from all contact with *Glossina Palpalis* has rendered it necessary only to prevent the return of these natives to the Luapula and to the shores of Lakes Mweru and Tanganyika. A suggested boundary line embodying this recommendation has already been submitted.

Luangwa Closed Area.

The Regulations at present in force in this area were designed to prevent the spread of a disease which was then thought to be confined to this area (1910). More recently it has been found elsewhere, and there is reason to think that its occurrence is possible wherever *Glossina Morsitans* is found. Transmission however being modified by certain climatic conditions, the Luangwa Valley providing more favourable conditions for its transmission than elsewhere in the territory.

It has been found that notwithstanding the known presence of infection in the Luangwa Valley for at least six years and in spite of apparently every necessary condition favourable to its spread being present, there is no evidence of any tendency to spread and that the tendency of the disease is to assume a sporadic character.

It may therefore be expected that since the disease is not spreading in this area, it will not do so under less favourable conditions. For these reasons it is thought that a continuation of the present stringent rules and regulations governing the movements of natives in the Luangwa closed area are no longer necessary and that the restrictions consequent on these to trade and development may now be relaxed.

A recommendation has therefore been submitted for the modification of these regulations.

Entomological.

The following is the general programme of work which has been adopted in connection with the investigations now being carried out.

1. Determination of the relative value of various food supplied with reference to breeding capabilities.

2. Determination of what parasites affect the fly or pupæ.

3. Further investigations into breeding place and habits namely :

Is breeding seasonal ?

Are the pupæ carefully placed or are they deposited at random ?

Are breeding haunts at special places in fly belts which are visited periodically for the purpose of depositing pupæ, or are the pupæ deposited throughout the belt ?

Is there any special relation in the breeding places to

Soil Water Shade ?

4. GENERAL. As to food, water, plant juices, invertebrate animals preferences in food, re small mammals and birds.

5. DISTRIBUTION. Seasonal variations as to shade, water, game, native cultivation, European settlement, reasons for avoidance of certain areas where conditions are apparently favourable.

6. ENEMIES. What animals or insects prey on the fly and its pupæ.

Are there any special enemies apart from parasites (fungi).

What parasites attack the fly.

What parasites attack the pupæ.

7. TRAPPING. Is there a reasonable probability of reducing the number of fly by any forms of trapping.

8. TSETSE FUGES. Are there any such in nature.

THE ENTOMOLOGICAL STAFF. At present consists of Messrs. Ll. Lloyd, H. C. Dollman and R. A. F. Eminson.

Mr. Lloyd since the completion of the work of the Luangwa Sleeping Sickness Commission has been stationed at Ngoa, Mpika District, and has for the most part been engaged (1) On

the determination of the relative values of the various food supplies with reference to breeding capabilities, and (2) In determining whether *Glossina Morsitans* will feed on small mammals, birds, reptiles, or amphibians.

The results of these experiments will be published in detail when the series is completed ; in the meantime, with reference to No. 1 sufficient work has not been done from which to generalize upon. Great difficulty was experienced in getting the flies to breed freely in captivity, and the number of pupæ produced can only be regarded as a fortuitous circumstance as far as the work has gone. However, it would seem that as regards the dimensions of the pupæ produced the mammalian series has the advantage, otherwise it would seem that there is little or no advantage in a mammalian diet.

2. A fairly extensive series of experiments was carried out by Mr. Lloyd to determine whether *Glossina Morsitans* will feed on small mammals, birds, reptiles or amphibians.

Twenty-nine Experiments were carried out which included Lizards, Chameleon, Toad, Fowl, Rat, Mouse, Burrowing Rodent, Mongoose, Bat, Shrew Mouse, Caterpillars, from the result of which it would seem that these animals do not provide a suitable food supply for the fly.

Messrs. Dollman and Eminson have been stationed at Mwengwa near the upper Kafue where they have been inquiring into the seasonal variations, breeding habits, and places, and distribution, their report on which will shortly be available.

The details of a concentrated experiment with the object in view of determining the relationship of fly to game are now under consideration.

It is thought that the conditions which would obtain after the removal of the game can be produced on a small scale and suitably enclosed, and that careful and accurate observations of the result as regards the life and breeding capabilities of the fly will throw some light on what might be expected to happen as the result of the removal of the game.

These particulars, should further consideration show the experiment to be practicable, will be submitted for approval later.

It is also proposed subject to approval to establish a permanent Entomological Camp within easy reach of the Railway, probably on or near the Mulungushi River, to the East of Broken Hill.

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