Miscellany: Sleeping Sickness

Publication/Creation

1906-1911

Persistent URL

https://wellcomecollection.org/works/t5k4uwcy

License and attribution

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

J6.8Old.

Notes with reference to Sleeping Sickness: Northern Marimba, December 1910, and return journey to Zomba, January 1911.

6Old

LOCALITY.
DIFFICULTIES.

At the beginning of the month I remained at my Bua camp, and afterwards wished to work the country north as far as the Dwangwa River, but had several difficulties and interruptions. After the 14th. December I only had one machilaman, as neither the Resident at Kota Kota nor Dowa could send me any men, owing to taxes having been paid, gardening, and refusal to work. The same difficulties were encountered with regard to carriers required for one or two days' work; they would be written on but the next day at starting time often none appeared at the camp, and could not be found by the policeman. I was also requested to come to Kota Kota twice from the Bua, viz., once to see the Acting Deputy Governor, who had been landed from the steamer with Fever, and once to see one of the Hospital (Mission) nurses with troublesome Remittent Fever. Then, when I reached the Dwangwa, I was again called urgently to Kota Kota because 7 persons had died in one day at a village 10 miles south of that town, apparently from poisoning. These interruptions, together with an order to proceed to Ngara because of a case of Sleeping Sickness, which I questioned the utility of and regarding which I fruitlessly awaited an answer at Kota Kota, caused many days' loss to my investigation work.

BADLY EQUIPPED.

2. Unfortunately I did not get a microscope and other elementary necessaries from Zomba together until December 14th. when I was preparing to start from the Bua for the northern portion of the district as far as the Dwangwa River, and most of the other apparatus had not arrived when I left for Zomba, so only in a few cases of illness and ill-health could the blood be examined: this

was generally done in fresh ringed preparations, and, although clumping of red cells was seen, no Trypanosome was discovered by examining one slide carefully in each case.

NATIVE INDIFFERENCE.

3. As I had doubts of the veracity of some village headmen, I had recent graves counted in a great many instances; some men refused to show their burial places and others were found to have told untruths, so several of them were fined a 1/- each by the Resident, at my instigation.

NO HEAVY MORTALITY.

4. Although the death-rate in many villages was higher than it ought to be, yet, especially about the parts investigated at the Bua, it cannot be said that there was evidence of a suspected serious epidemic of Sleeping Sickness.

LOCALITIES INVESTIGATED.

5. The following are the localities where village investigations were made, viz., (a) south of Karongo stream: (b) from Karongo stream to Bua-mufu stream; (c) south and south-west of Bua River (in para.8 of my November report I said there were no villages near the south bank of the Bua, but on an extended inquiry 3 were discovered beyond the area previously explored); (d) near my Bua camp; (e) north of mouth of Bua; (f) north of Bua, where the road crosses it; (g) Lualadzi stream; (h) south of Dwangwa river (at Nkasi, Nkono, and in higher country some miles from the Lake).

RESULT LISTS.

6. Below is given the information obtained.

No. of villages examined.	No. of deaths about last 2 years.	Causes of deaths:
47	92	Pneumonia 5.
		Parturition 5.
		Bronchitis 12.
		Dysentery 14.
		Heart 5.
		Snake bite 1.
		Crocodiles 3.
		(mutu) Fever 5.

Diarrhoea 9.
Ascites 3.
Syphilis 1.
"Kasipa" 23.
Fracture 1.
Haematuria 2.
Fits 2.
Toothache 1.

1 village has 35 graves in 15 years from crocodiles' kills.

Sick at present time:14. Diseases: Ulcer 2.
Wasting 1.
Bronchitis 4.
Cystitis 1.
"Kasipa" 3.
(mutu) Fever 1.
Pneumonia and Dilated Heart 1.
Fever and Bronchitis 1.

Hut-vermin (9 villages not examined). Tsetse at villages:22
(Floor-maggots, human ticks, bugs and cockroaches).
Floor maggots 5 villages.
Human ticks 29 "
Bugs 24 "
Cockroaches 8 "

Goats and Dogs:
8 Goats
10 Dogs.

"KASIPA". 7. While from the above it will be seen that the several diseases are generally distributed over cases, yet there is one disease known to the natives of northern Marimba in which deaths total nearly double those of any other two diseases: that disease is called by them "Kasipa". I had actually arranged to examine 2 of the above 3 cases of "Kasipa" by the microscope on the day that I had an urgent call to return to Kota Kota at once, as above recorded, and on arrival there I also found a telegram ordering me to hurry back to Zomba to act as

Principal Medical Officer, so as I had already walked both ways between the Bua and Dwangwa Rivers, I had to content myself by obtaining temporary carriers to fetch my loads at my 2 camps at the Bua and Dwangwa localities. Thus it is advisable that Dr. Sanderson be asked to make a journey to the mouth of the Dwangwa River and just examine with the microscope cases of "Kasipa" which I have located during November and December, and certain other ones, working back to Kota Kota, and he could also again see those cases (about 5)which he suspected might be Sleeping Sickness, and which he found in south Marimba in October 1910 (I have requested the Resident at Kota Kota to send a Vaccinator to visit these latter during January).

TSETSE. 8. TseTse (G. morsitans, apparently) were caught in, or at, 22 villages, although often they were probably only brought in by fire-wood cutters, and others, from the adjoining forest. I have had them inside my mosquito net by day and noted them in my tent at daybreak, having probably slept there; they also frequently bit inside my reed and grass, hut, camp shelters, which were not plastered. The clearing for kassava around villages certainly seemed to have an effect in making them few in numbers in villages. A headman at Dwangwa lake shore stated that they had only been noted at his village during the last two years; I did not see any there, but at a considerable distance from it. I have seen them in long grass in open plain, probably carried by game or man from surrounding forest. Although their favourite biting sites are the back of neck and back, yet I have several times seen them trying to bite through my putties, especially when sitting down, but on these occasions they seem to give less trouble. Between the Chipoli rice plain and the Lualadzi River I have caught them at the Lake water's edge, occasionally, for some miles; here there were only fairly

thin reeds and thorn (or mimosa), with swamp in the height of the Rains, near the Dwangwa they seemed further distant from the Lake.

BREEDING GROUND OBSCURE.

9. I made some attempt to find breeding grounds of TseTse, but as this takes up so much time, and would lead to a Medical Officer having nothing to report, not much effort was made in this direction. Where tsetse were plentiful the following were searched, dry sand on the bank of the Bua river, dry leaves at the base of trees, and cracked, decayed, and distorted bark at the angle of tree-branches; also the angle of palm tree (wild date) branches for G. fusca; no pupae were found.

GLOSSINA FUSCA.

10. I only actually saw, and caught, two specimens of Glossina fusca; one of these was on my mosquito net at 10 p.m., in the fringe of forest near Runda's village, bordering the rice plain at the Bua. I noticed that its proboscis contained pink blood serum, and then one of my boys stated that he felt something bite the back of his neck there at 8 p.m. (lantern-light), and that he brushed it off. I caught the other at about mid-day, on a boy's shirt (white), amongst this mimosa bush, bordering the lake shore, where shown on my map; it was distinctly smaller than the above specimen.

OLD CASE OF SLEEPING SICKNESS.

11. I discovered a brother of the case of Sleeping Sickness from the Bua, who was found in Kota Kota Hospital and removed to Dowa Sleeping Sickness camp; this man told me that his brother had been back 3 months from the Katanga mines before becoming ill, that what he was suffering from was "Heart", and that no person since, in his village, had been ill; they lived at Mlira, by the south bank of the Bua.

ORIENTAL SORE.

12. I had not an opportunity to examine with the microscope the 3 cases of "Nchenya" reported in one village in November; natives consider it highly contagious, and conveyed from an infected sore to any

person with an abrasion by common flies; as they have no remedy and the disease shows no tendency to spontaneous cure, they shun an infected village. It is probably due to a species of Leishman body.

NATIVE MORTALITY.

13. The headman on the lake side of Kampalala told me that the chief causes of death amongst natives in his parts, in former years, were as follows, viz., (a) Small-pox, (b) Chisonono" (apparently cystitis from various causes), (c) a disease characterized by severe pain in the back ("Kasipa"), and (d) chest complaints.

OLD HISTORY.

14. Chief Runda, living in the fringe of the forest bordering the west and south of the rice plain at the Bua, who is a man of 60, says that he can remember when this rice plain, some 3 miles wide, was a permanent sheet of water, a lagoon or harbour like Kota Kota is; this shows how the Lake has receded in area. The country from there to the Hills, now all forest, was then nothing but a series of gardens, and the population had to go to the hills to get firewood. He and many of these people, who were not killed, were carried away prisoners by Mombera's Angoni, and he worked as a cattle boy for them for years. He states that in his early days game, in the hills, was far more plentiful than now, but they did not damage the gardens because they shot at them.

"KASIPA".

15. In paras. 6, 7 and 13, and in a letter written on January 29th., 1911, to you, I have referred to a disease called by the natives "Kasipa". The Kampalala and Bua headmen, referred to, gave me the following information last November regarding it, as seen in Marimba District. The duration may be for various periods up to 2 or 3 years, with pains in the back, legs, and arms, increased on pressure, swelling of the legs, and finally terminating with dysentery. They scarify the legs, and very dark blood is said to exude.

"KASIPA".

16. There is another disease known to the natives

of the Shire Highlands and River, called "Kasipa", but it is evidently a distinct one: they say that it is characterized by some swelling of the lower limbs, with an appearance of minute punctures, accompanied by a burning sensation; these punctures last 2 or 3 days and are followed by a fresh crop; this may be ankylostomiasis.

OLD EPIDEMIC.

17. Chief Runda, mentioned above, referred to the following epidemics engraved on his memory, in the following order or priority, (1) a widespread epidemic of Small-pox, (2) Rinderpest, (3) "Kasipa". He stated that the Rinderpest devastated the big game including elephants, in the Marimba hills. He described the pain in the back of "Kasipa", holding the flat of his hand on one loin and bending sideways and backwards as the sufferer would, at the same time crying out "kasipa", it would have made a typical advertisement picture for somebody's backache remedy. He said the disease was fatal in from 2 months. He then lived on the elevated ground north of, and on, the swamp, now a rice marsh (Chipoli and Chicumba) in the Rains. He could suggest no cause of the disease, but stated that it killed a good many of his relations. Probably the rinderpest was from 18 to 20 years ago, but he could not give any other period than by saying that it was after it. He stated that species of Tabanus flies were plentiful in those days in his locality, but he did not remember the distinct fly "TseTse", now known to them, in common with the above, as "chimpanga". TseTse are now not far from his village garden, about ½ a mile away in the forest, and are brought to the village by wood-carriers, etc. He is now south west of the above rice plain, having gone there from his old village site after the epidemic of "kasipa". He stated that at a thickly forested place on the Lake, in the West Nyasa District, were numbers of a species of "chimpanga" which bit badly in the evenings, around fires.

"KASIPA".

OLD EPIDEMIC OF "KASIPA".

18. Having heard that a village site had been deserted several years ago, on account of an epidemic of disease, I made enquiries and found that the village was called Katimbira, and was situated at Mlira, not far from the south-west bank of the Bua river, perhaps 1 to 2 miles from the road, Kota Kota to Runda's. There were 25 inhabitants and of these 19 died in one year, as below, viz., Pneumonia 5, Bronchitis 4, "Kasipa" 10, and crocodile 1. It is possible that the two first causes may have been complications masking incipient "kasipa". I obtained the information from a headman, still living on the south-west bank of the Bua, called Nsunga, whose daughter, then an infant, is one of the survivors (she is about 13 years old).

Of the survivors, the headman's sister, the present Katimbira, and two others, went to Kota Kota, where they are still living. The names of the deceased were enumerated. Nsunga stated that the symptoms of "kasipa" were pains in head (pain in the temples is known as "Lisipa"), back, and limbs, fever, wasting, and swelling of the feet and legs, the illness lasting 2 months. He stated that he did not remember the TseTse flies, as shown to him now, there at the time, but bush pigs continued to come to the gardens there, after the rinderpest. He recognises that TseTse are now all around his village. No one has since lived on the deserted village site.

OLD EPIDEMIC.

19. Mr. G.F.Manning, the Resident at Kota Kota, told me that some years ago probably 200 natives died at the Lualadzi stream, in the northern part of Marimba district, of "mbikasa" (Atonga language, the people I have previously referred to being of quite another tribe): it was considered to be an "mfeti" disease, and the old man accused of being the cause of it is still alive; the stream has been quite deserted ever since, as the

survivors went to another district. I found three small villages at the place, people having returned there within the last few years. I questioned Ntambuka, one of the present headmen; he denied that he and the present people were of the old population, but the former headman was called Ntambuka, so he was evidently declaring an untruth, being suspicious of the reason of my enquiry. He acknowledged acquaintance with the facts above related and that the sufferers had wasting and swelling of the feet. It seems that this disease was about the same period as "kasipa" further south, and may have been identical.

RELATION OF "KASIPA" TO SLEEPING SICKNESS.

20. What is "Kasipa" and "Mbikasa"? The two diseases Beri Beri and Trypanosomiasis occur to me. Beri Beri was not supposed to be a disease of this country until the King's African Rifles brought it from East Africa in recent years. How could it be Trypanosomiasis? The road from Kasungu to Kota Kota was an old slave road, along which ivory and slaves were brought from the territory now known as North-Eastern Rhodesia, and beyond, to Kota-Kota, for Zanzibar; it does not seem too much to conjecture that cases of incipient Sleeping Sickness may have occasionally been present amongst gangs of slaves and their drivers, and that local infections may then, as now, have occurred amongst the Lake population, and possibly have persisted until the present day. Unless any person is able to offer a better explanation as to what "kasipa" was, and is, I consider medical effort should be directed, without delay, to further inquire into the question which I have so far worked at in Marimba, and which I had not the opportunity and equipment to complete.

ENCOURAGE COTTON GROWING.

21. I would remark on the insufficient population along the forest side of the Bua rice plain (Chisumba) and as the TseTse containing forest comes to the very

edge of it, where the villages are, I wish to propose that natives from Mombera, some of whom were originally of the Lake tribe, be invited to make villages there and grow cotton: thus they would destroy TseTse and very likely the Sleeping Sickness danger of the future, and probably permit of domestic stock, now impossible, being kept. The same applies to some of the other parts I have reported on here and in my November report.

BLOOD-SUCKING FLIES.

22. Many species of the common TseTse have been collected, with other biting flies, ticks, etc., as well as abdominal worms of big game, and will be sent to the Entomological Research Committee. Tabanus was uncommon in December, but one or two specimens of a few species were caught in one or other of the places visited, Stomoxys was hardly seen and it was the wrong season for haematopota. No Pangonia or Chrysops was seen. When travelling through the highlands to Zomba, in January, via Dowa, Dedza, Ncheu and Liwonde, the rains having produced rank green grass, haematopota of 2 species were in very great numbers and a great pest, and some species of Tabanus became plentiful from Ncheu to Liquano. A boy assisting me said he saw a G. fusca some 3 miles along the road, on the Ngara side of the Kaombi river, on the bottom of the trunk of a tree at a drinking pool (Kalakata). He had seen my specimens, said he did not disturb them, and could not collect them as he had nothing with him. I also am sure I saw one on the inside of the canvas near the foot of my machilla on the Ncheu road, several miles from Liwonde; it was only in sight for a few seconds and disappeared while I was scrutinising it.

TSETSE HABITS.

23. In my 3rd. report in connection with Sleeping Sickness, written at Kota Kota on my arrival there at the end of October 1910, I reported on the prevalence of TseTse there, along the road from Ngara, that month. At

the end of December I only saw some ½ dozen along the same road, on a fine but cloudy day in the rains. It is known that G. morsitans disappear when the Rainy Season starts; what becomes of them? do they fly away or die? I am inclined to think that many, at any rate, must seek shelter at or in the tree-tops, as the other suppositions seem too strange. I saw a fair number of TseTse along the road between Ncheu (14 miles from) and Liwonde later on, in the middle of January 1911, where I only saw one the previous September. I caught some of them in the verandah of Balaka Rest House. I never saw haematopota more numerous than here, especially in the road at 5.30 a.m.; they were nearly as numerous at the Diampwi river, Central Angoniland. I saw an occasional TseTse for some miles along the road from Liwonde, yet I did not see any there in September 1910.

MAP. 24. From my rough survey of the country between Kota Kota and the Dwangwa River, which has never been done by a Surveyor, I have sketched a map to particularly show the distribution of TseTse and villages. The Deputy Director of the Public Works Department is making copies. This shows where the only path going north and south terminates; north of this point one has to walk through bush and reeds, or patches of sand at the water's edge, but near and north of the Lualadzi stream one can keep to the sandy beach, in the Dry Season, to the Dwangwa River. Local travellers walk along there just as I did, but long distance travellers, going to and from Kota Kota and, say, Bandawe, West Nyasa, travel along the telegraph line clearing, I ascertained, between the Lualadzi and Dwangwa, in the midst of TseTse, and it is probable many do also along the Kota Kota portion. It is important to remember this when the question of the role of G. morsitans and G. fusca, respectively, in Sleeping Sickness, has been settled. I think a careful search should be

ROADS AND TSETSE.

made for G. fusca, say, in April, when they may be prevalent, which they were not in November and December.

TRAPPING FLIES.

25. With thin bird-lime made according to prescriptions given in my first report in connection with Sleeping Sickness, written at Dowa, Maldonado's experiment was tried by smearing some on black calico, and getting a small fly-boy to wear it on his back; numerous flies were caught by this plan, including TseTse in smaller numbers, and they were quite unable to free themselves. I consider it well worth while that the method be applied on a large scale along TseTse roads and villages, I having been ordered in October to desist from active measures.

K.S. Ord,

Medical Officer.

To The Principal Medical Officer,

Zomba.

1754

Observations made on the Life-history of Glossina palpalis during our stay in the Sleeping-Sickness Laboratory at Entebbe, Uganda Protectorate, carried out under the Direction of Prof. E. A. Minchin, M.A. (Oxf.) by Edward Degen, F.Z.S.

Contents:

Preliminary Statement.

Of seemingly minor consequence, as a more comprehensive knowledge however, of its habits, ~~and the~~ life history of Glossina palpalis, should form a further desirable adjunct to an eventual satisfactory solution in the highly complex problem surrounding the disease produced by this species of Tse-tse fly, known as Trypanosomiasis.

In the subtended Report no account is taken of the many & varried statements made in regard to their habits by numerous authors on the subject, as embodied f. i. in Austen's Monograph on the Tsetse Fly; the following observations being the results obtained by the writer from experiments suggested mainly by Prof. Minchin.

A. Planning of the Installation for the Purpose of propagating this Species in Captivity.

In order to further this desirable object the adoption of a definite system for allowing the study of the habits of these flies, their Captivity seemed to be the only course open; in as much as individual Insects in their natural state preclude accurate observation, in despite of their great numbers prevalent at all times and seasons of the year.

Plans to this end had already been laid down, either by our predecessors, or had been practically instituted since by

at the time engaged with the investigation of the problem of the disease.

Cages had been devised for the purpose of breeding and rearing a progeny of this species of Tsetse-fly, destined to serve for inoculating experiments on their infectious qualities. It was in details only that these contrivances have been made the subject of modifications since, based upon accumulated experience. Otherwise their original plan has been adhered to as answering nearly all the requirements. A description of this plant accompanied by plans and sections will form the contents of the following Chapter.

B. Structure of the Breeding Apparatus.

This contrivance consists of an oblong cube, whose upright components of the principal frame-work, by projecting below for about 2 inches, serving as feet, form its supports. Three of its sides are transparent viz. 1.) a glass front as a window, and 2). the back, as also 3) its right side, consisting of wire-gauge of a fine mesh.

The left side, with the exception that it contains the large appertune, and further provided on its inside with a sliding glass-shutter, for all intents and purposes is a closed portion, as is also the bottom of the cage which is fitted with a tray in the shape of a drawer.

The top of this structure conveniently may consist of canvas admitting both sufficient air and affording shelter from an excess of sun during the hottest hours of the day. For this see also Fig. IV.

General Description of the Cage.

Figure VI of the accompanying drawings represents such a breeding-cage as adopted with final improvements, in its front elevation and partial side and top view. Its dimensions are:

length: 26 inches
height: 24 "
width: 20 "

These measures are the outcome of adverse experience derived from trials made with either larger or smaller cages of a similar structure.

Details of the Cage.

The glass-frontage, Fig. I, with which the cage is fitted permits of easy inspection of the stock contained in it as it does also for occasional observations on the habits of the flies. In the particular structure described here the frontage is a sheet of glass, and a fixture, same as in the case of a window pane, and therefore inaccessible from the inside for cleaning purposes. To remedy this defect two panes of glass, superposed on each other, might with advantage be substituted, both these sliding in the same grooves and projecting on the right side of the cage, when the inner and soiled one could be withdrawn, without incurring the risk of any fly escaping.

In Fig. II is shown the elevation of the right outside stretched with some fine wire-gauze or a similar material. A reference to the lettering and the table of explanations, will furnish further particulars as to its structural details.

Its left end-side, the elevation of which is seen in Fig III, and containing the principle apperture of access to the inside of the cage, is slightly more complicated; in as much

as it is provided with a shutter consisting of a plain sheet of glass A – A; A' - A', sliding in a slot & correspondingly lettered A in Fig I. This sliding pane has the object of ensuring against the escape of the insects when introducing the food-patient through the amplified muselin-sleeve fastened to the large aperture on its outside. For the latter see Fig. VI.

In the lower part of Fig. III a side section is seen of the bottom drawer C, shown to be partly pulled out and the front-aspect of which is represented also in Fig. I. This drawer is ~~an~~ essential for the convenient collection of any larvae deposited by the flies. The posterior ledge of this drawer, forming a tray, being raised somewhat above its sides & front ledges, and for better comprehension here-marked X as may be seen in its section, acts, when fully drawn out, as a stop at the front of the cage correspondingly marked X, in Fig. III, by simultaneously shutting off the space.

This tray is intended to be filled with fine sand or some other friable substance like light mould kept constantly moist to within a paper-layer's thickness of its capacity. For its efficient working it is well that this drawer-tray should be coated both inside and out with some impervious varnish to prevent its swelling from the moisture and its consequent jamming.

To more ~~read~~ readily detect any larvae or pupae a layer of white filtering or blotting paper placed on the surface of the sand is useful. But in this case a methodical search is a necessity from time to time as many of the larvae are deposited near the edges, or contrive to get there into the underlying material through their own locomotion.

Another extremely useful adjunct to this structure has proved to be the grating made of light wood above the aforesaid drawer. A top-view of this will be found in Fig. V, of the accompanying plans and sections. It rests on the bottom frame-work and is fixed about an inch and an half above the sides of the drawer, permitting the food-patient, such as Guinea pigs, Fowls etc. to be placed on it. Its position may be ascertained also from the end-sections of the Cages in Fig. II and the notches supplied for its support on the inside of its solid side as per Fig. III.

Fig. III illustrates the working of the glass-shutter as indicated by dotted lines on the inner side, either when drawn out or pushed home.

Fig. IV, representing the plan of the top-frame, calls for no special remarks and will explain itself.

Further attention should be called in Fig VI only on account of the sleeve ~~only~~ referred to previously to the outside, ensuring safety against the escape of flies whilst introducing the food-patient.

C. Installation of the Breeding Plant.

Since one of the objects in view is to rear a progeny extending if possible, over several generations in order to eventually test these upon the hereditary properties of the Trypanosoma blood parasite in the Glossina palpalis, the species of tse-tse fly predominant in these parts, it is quite obvious, as has been stated initially that the only chance for achieving this end, would be by means of the captive material.

Hence a great deal of its success or otherwise must needs depend upon as near an approach to the thermal conditions under which this obnoxious insect, so amazingly thrives and perpetuates its race as it does in its free state.

For, even in a tropical climate such as this, thermal conditions are by no means so equable as to be positively conducive to their constitution. Whatever the great value be, of the observations that have been made on the habits of the tse-tse flies by a number of travellers and in the different parts of Africa as well as investigators, — and their number according to Austen's 'Monograph', which is considerable, for the species here referred to at least, the majority of these statements in no way, seem to entirely coincide with the observations made in regard to their haunts here.

For instance, whenever an excursion was made by the members of this Commission, either collectively, or individually, be it on the shore of the mainland, or by visiting some

of the Islands, Their presence seemed to be strictly confined to the immediate fore-shore and the fringe of vegetation such as float-wood trees, which grow in groups and patches in the shallow portions of the water. This should not be interpreted as if these latter were liable to offer any special attraction for the flies; but simply because they seem to grow only in the most sheltered positions. And here it is where the Tse-tse, if any, literally swarms. The air in these places is generally stifling, and it is clear from this as well as from the fact that, with the exception occasionally of a few stray specimens being observed in the adjoining jungle some little distance in-shore or amongst the bigger timber with dense undergrowth, this overheated and vaporous atmosphere apparently to be eminently suited to their well-being and genial to their habits.

From these, and observations made of a similar kind it naturally follows that a plant destined for the rearing of a brood under artificial conditions such as has been mentioned above, should in some manner be a reflex of the surroundings under which they are found, notably so in regard to temperature.

To simulate within some degree these conditions, the position to be assigned to the breeding Cages is as an important item and should be made the leading feature. Though only distant here a mile from the Lake-shore, experience nevertheless has shown this to be

~~can~~ sufficiently more difficult than ~~would~~ appeared at first, for obtaining anything like an easy success; as with the rising of every foot, these conditions alter. Therefore a spot tolerably well ventilated yet presenting the highest shade-temperature obtainable stands a chance at all for achieving something like a result.

In any case ~~too~~ high winds or violent draughts should be rigorously avoided. This may best be accomplished by means of mosquito netting or a brushwood enclosure.

Remarks on the extent which these thermic variations, of a few degrees difference only, exert on the physiological functions of these Insects as far as they have come under personal observation will be considered in connection with the various subjects accordingly.

D. Stocking of the Breeding Cage

1.) Methods adopted and reasons forwarded for same.

In regard to the number of flies to be admitted in a cage of the dimensions given in a previous chapter, this may be said to be practically illimitable and should be determined solely by the size of the live objects serving for food.

An excess however of flies, especially the female sex is dictated by reason of the inevitable daily casualties. Confinement, even under the most favourable conditions, would at all times exert a check upon the reproductive faculties notwithstanding the most liberal food supply. Thus, as on no occasion all the flies are inclined to feed, and as from 30 to 40 ~~flies~~ of them should be considered a maximum for a moderately sized warm-blooded animal, either Mammal or Bird — about 150 - 200 flies are an ample complement. However, if more than one food patient were intended to be introduced per diem then this number might be increased in proportion to it.

But as the breeding stock necessarily depends on the number of flies brought in daily by the people told off for this purpose, which number, according to circumstances may vary from 30 to as many as 100 occasionally, it was not found so easy to keep up the parent

making due allowance for consideration
stock and the time required for separating the sexes in order to keep up the propagating efficiency of the plant. The more so is this the case when the fact is taken into consideration that of the flies brought in daily from about 15 - 20 % on an average are females and a daily average mortality of 10 flies.

2.) Modus operandi for the separation of the sexes.

For safely and expeditiously separating the females from the males, which latter form the bulk of the supply, the small wooden fly-cages used by the catchers, are very convenient. Their size is about 6 inches by 3, and two of their sides opposite sides being open, are covered in with wire gauze. The one end consists of a trap-door sliding in grooves, whilst the other end, being a solid wooden fixture, is provided with a cork-hole. By dexterously removing the cork and quickly inserting into the opening an inverted test-tube, and at the same time covering the box cage with a cloth turning the latter towards a strong light after having covered up the open sides with a cloth, the flies will enter the tube readily. Then, by cautiously withdrawing the tube from the appertune and sliding it on one side, the cork of the box-cage is speedily replaced and this done it is easy to cork up the test-tube also. It is a very rare occurrance for a fly to escape in this manner, and the number

to be admitted to the tube at one time can with some practice be perfectly regulated, or limited at will to a single fly.

From the test-tube, which moreover has the advantage of facilitating the determination of the respective sexes, the flies may be transferred either directly to the breeding cage if females, or preferably, perhaps to one of the Laboratory cages covered with muslin for direct feeding. Males are dealt with in a similar way, particularly robust looking specimens being selected and transferred also to the large breeding cages in adequate proportion to the females.

The male insect being even a more greedy feeder than the female it is judicious to limit their number so as to save the food-patient unnecessary discomfort or superfluous loss of blood.

3.) Precautions in the interest of Self's protection in the manipulation of Tse-tse Flies.

This subject calls for a few remarks only in detail its main points having been touched upon when referring to the various methods adopted in connection with the installation of the plant.

It merely remains to state again that it is a rare occurrence for a fly to escape, and that when such an incident happened the precautions taken in fitting the Laboratory with wire-gauze doors and windows invariably proved quite efficient. Within this

boundary they can be immediately secured by means of the hand-nets constantly kept in readiness.

Through daily contact with them and the knowledge acquired of their habits of these Insects, the operator moreover becomes quite an adept in spotting and tracing an escapee and rarely fails in securing the it.

The only really source of risk run is the one the operator is exposed to by inadvertently being getting stabbed by some particularly vicious & repacious individual when incautiously handling one of the small Laboratory muscline cages.

It may confidently be asserted then, that, with the requisite precautions taken for the operators own safety against direct fly inoculation all danger of infection to the outside community is thus completely removed. as far as the experiments conducted in the Laboratory of the institution are concerned.

E. Relative Number of the Sexes.

Not the least amongst the many peculiarities which distinguish this Genus from the majority of its dipterous congeners, appears to be that of the relative number of the sexes.

The production of only one Larva, at a birth, which ~~in itself alone~~ suffices to characterise it as a remarkably highly specialized type of insect, is by no means the only one. Further, a more minute study of its anatomy and physiology (now in progress or completed as the case may be) has revealed the formation of not more than 3 egg-follicles in the mother fly and this fact becoming known, its individual progeny is limited to this inferior number.

Nothing can be more astonishing therefore than to perceive the superabundance of this species of Tsetse fly alone with such a limited issue, which one meets when putting down foot in any of the fly infected haunts or being reported by reliable informants.

To find the number of females which are of the flies which are brought in daily, and caught indiscriminately almost constantly so greatly below that of the males is, and remains a most perplexing phenomenon. Even the comparatively high number of females for the month of August ~~with~~ giving ~~it~~ nearly 36 % or practically 1 : 3 would scarcely account for the numerical standard reached which, suggests ~~as seen~~ certainly

as nearly even balance of the sexes, if not an excess rather of the females.

On the other hand the seasonal or meteorological changes, with the exception perhaps of slightly exerting a checking for a short time upon the incubation period as dwelled upon further on, are never such in this purely tropical belt as to seriously impede the process of perpetual propagation, ~~in any marked form~~ nor to wholly influences the same in any marked form.

From a perusal of the accompanying Tables giving figures as to the results of an approximate daily control it may at once be perceived that the proportion of females to the males fluctuates very much indeed. For instance in some of the numerically quite inferior consignements such as for April 26th of 12 specimens only, the highest percentage of 71 for females was obtained; whereas the maximum ~~figure~~ was reached ~~with~~ the disproportionate figure of 218·75 % with 35 females out of an average consignement of 51 specimens on July 28th.

But conditions are frequently reversed for approximately the same number of flies. e.g. a single female out of 14 specimens on the previous day (July 27th) and absolute minima occurring also for a total of 6 on April 21st; for a total of 15 specimens of May 12th; for 10 specimens on July 12th etc.

In some of the average, or even larger supplies similar cases may be pointed out of not a single female amongst 40 specimens as on May 19th

Extended over monthly periods, based upon a mean of about 15 days (there are many causes preventing methodical daily attention to this portion of the inquiry) a fairer estimate can be obtained, and, as might be expected giving more level results in regard to percentage figures.

The lowest of these is that for the month of May, with 16 days including also 4 in April and resulting in about 14% of females only out of a total of 807 specimens controlled.

Compared with that of July extending over a corresponding number of days with only 14 specimens less (796), it is in arrear of nearly 6% of that of the latter month. For June, with a total of 857 specimens we acquire a higher figure still with 21.24% or an increase of another 2% compared with that of July; but this increase is due to a difference of 61 flies in excess over those of the following months and quite in proportion.

The highest number is reached in the month of August with over 95%, giving an excess of 16% for only about an hundred more specimens over that of the previous month.

With a considerably larger number, namely 1281 flies the percentage drops down to 21.76 for September approximating the one obtained for June. It also coincides well with that obtained covering the whole period ~~of 22~~ or 22.199% contained for this purpose.

The aggregate of flies for the latter was 4641, of which 3798 were males and 843 females. This mean therefore must be regarded as the net outcome connected with the facts as they

arose along this line of investigation.

Notwithstanding these latter and those described above this result must be accepted with caution. The instances recorded of some casual majority of females on special occasions, ~~not which~~ strongly point to the existence in their natural surroundings of a more even balance between the sexes than that obtained through this medium. Possibly, or probably, rather, that females return during certain periods such as that of gestation ~~return~~ to congregate in more secluded places.

This latter assumption gains support through the few but exceptional cases in which the number of females exceeded that of the males, more particularly so because such a casual surplus of the females over the males was severally ~~instanced~~ in connection with some particular collection cage, and not as might be supposed the result merely of the respective days total capture. The explanation is that as a rule one cage alone is allotted per head of the youth employed in catching these flies and this points to the probability of one of them alighting on such a place of aggregation of females.

It is from subsequent experiments to hand now, of breeding and the raising of a progeny that a more reliable estimate can be formed of the proportion of the sexes. These then point to a perfect equilibrium as, from 23 flies reared (till Sept 25) 11 were females. More satisfactory as may appear this result in the inquiry for a solution of this subject through the latter agency there are reasons still for rejecting as it as wholly conclusive ~~and~~

Anything therefore which might go towards proving the existence of a superiority of numbers for the females would be more acceptable as being better in accord with some observations made on the sexual instincts of the flies.

List of Specimens controlled for the Numerical distribution of the Sexes.

Time. Month	Date	Total for specimens for day.	Sexes. Males.	Females	Percentages for Females. daily	monthly	whole period
April.	20.	31	30	1	3·58		
"	21.	6	6	0	0·00		
"	24.	30	26	4	15·38		
"	26	12	7	5	71·43		
May.	1.	40	33	7	21·22		
"	3.	27	19	8	42·10		
"	4.	70	68	2	2·94		
"	5.	68	52	16	30·76		
"	12.	15	15	0	0·00		
"	16.	80	73	7	9·58		
"	17.	25	25	0	0·00		
"	18.	40	33	7	21·21		
"	19.	40	40	0	0·00		
"	20.	28	26	2	7·69		
"	21.	41	33	8	24·24		
"	22.	45	43	2	4·65		
"	23.	48	41	7	17·07		
"	25.	36	30	6	20·00		
"	26.	39	35	4	11·42		
"	31.	86	73	13	17·94		
Number of days:	20.	807.	708.	99.		13·98%	
	16	726	639	89		13·9%	

List of Specimens continued.

Time		Total for specimens for day.	Sexes		Percentages for Females.		
Month	Date		Males	Females	dailies	monthlies	wholeperiod
June	1.	137	123	14	11·38		
"	5.	48	36	12	33·33		
"	7.	78	70	8	11·42		
"	8.	105	80	25	31·25		
"	9.	54	40	14	35·00		
"	12.	76	70	6	8·88		
"	13.	55	45	10	22·22		
"	14.	45	31	14	45·16		
"	15.	28	25	3	12·00		
"	16.	51	43	8	18·60		
"	19.	59	49	10	20·40		
"	21.	84	67	17	25·37		
"	22.	37	27	10	37·03		
Totals: (N° days:)		13.	857	706	151		21·24%

List of Specimens continued.

Time. Month.	Date	Total of Specimens for day	Sexes. Males	Females	Percentages for Females. dailies.	monthlies.	whole period
July	9.	27	27	0	0.00		
"	10.	53	47	6	12.76		
"	12.	10	10	0	0.00		
"	13.	70	65	5	7.69		
"	18.	60	57	3	5.26		
"	19.	100	90	10	11.11		
"	20.	47	40	7	17.50		
"	21.	83	73	10	13.69		
"	22.	16	13	3	23.07		
"	24.	35	30	5	16.66		
"	25.	75	65	10	15.38		
"	27.	14	13	1	1.68		
"	28.	51	16	35	218.75		
"	29.	71	57	14	24.56		
"	30.	29	18	11	61.11		
"	31.	55	47	8	17.09		
Totals: (days)	16	796	668	128		19.16%	

List of Specimens continued.

Time		Total of specimen for day	Sexes		Percentages for Fem.		
Month	Date		Males.	Females.	dailies.	monthlies.	Whole period
August.	1.	45	35	10	28·57		
"	2.	34	30	4	13·33		
"	3.	36	26	10	38·46		
"	9.	108	75	33	44·00		
"	11.	27	24	3	12·50		
"	14.	57	36	21	58·33		
"	16.	26	22	4	18·18		
"	17.	33	26	7	26·92		
"	19.	23	18	5	27·77		
"	21.	29	17	12	70·58		
"	22.	91	67	24	35·82		
"	23.	42	40	2	5·00		
"	25.	42	32	10	31·25		
"	28.	81	50	31	62·00		
"	29.	86	73	13	17·95		
"	30.	61	36	25	69·44		
"	31.	79	57	22	38·59		
Totals:	(11 days) 17	900	664	236		35·54%	

List of Specimens continued.

Time. Month	Date	Total No. of specimens per day	Sexes. Males.	Females.	Percentages of Fem. daily.	monthly.	whole Period
September.	1.	33	25	8	31·60		
"	5.	25	19	6	36·36		
"	6.	58	48	10	20·83		
"	9.	69	60	9	15·00		
"	10.	88	73	15	20·54		
"	11.	84	65	19	29·07		
"	12.	25	22	3	13·63		
"	13.	52	41	11	26·82		
"	14.	71	60	11	18·33		
"	15.	75	55	20	36·36		
"	17.	87	61	26	43·11		
"	18.	139	114	25	21·05		
"	19.	54	46	8	17·39		
"	20.	87	68	19	27·94		
"	22.	17	12	5	41·65		
"	23.	57	51	6	11·70		
"	26.	62	54	8	14·81		
"	27.	108	100	8	8·00		
"	28.	35	33	2	6·66		
"	29.	55	45	10	22·22		
Totals: (No. of days)		20	1281	1052	229		21·76%

Grand Totals:	No. of days	Total of Spec.	Males.	Females		
	86	4641	3798	843		22·19%

F. Propagation.

I. Copulation.

The mode of contact between the two sexes is the one usually resorted to by dipterous insects. The highly specialized structure of the male copulatory organs, which are provided with two pairs of powerfully acting hooks or claspers makes the contact a very efficient one, calculated to infallably ensure fertilization of the female individual. According to some subsequent experiments made with the freshly emerged flies, when these latter were mated, it was noticed generally that both sexes resorted to the act of copulation previous to being able to be induced to feed. The reason is, as could be further evidenced, that the genitals of the male at any rate, are not only fully developed; but are actually perfected before the mouth parts, the stalking apparatus remaining soft and unfit for purposes of imbition for at least 24 hours after emergence from the pupa-case.

The male when under sexual impulse does this by gathering momentum similar in manner to that when throwing himself on ~~it~~ his prey to satisfy his feeding instincts, ~~He alights on~~ that is alighting on it with that audible flop described by a previous observer. So far as personal observation goes, it is rarely that he ~~should~~ fails in accomplishing

his object. The act of sexual contact may be repeated several times in succession as witnessed by following experiment:

"April 7 females, recently caught, set apart in small canvas cage. Introduced 1 male. This and following day nothing particular coming under observation

April Male observed in cohitus, latter lasting about 10 minutes. Within 1 hour repeats act with 2 other females.

Note. This male survived all the females for several days the latter after for some unaccountable reason dying within a few days after the date mentioned above.

From subsequent observations made on freshly emerged Insects, however it would appear that in the case referred to above, Cohitus was incomplete as the undermentioned experiment has shown in the case of the first female raised in the large breeding cage

Special breeding Experiment No 1.

June 23. Upon introduction of a robust looking male into special cage containing female No 1, emerged from pupa on June 22, the former immediately resorted to Copulation. Pair remaining in Cohitu uninterruptedly from 9. 35 a. m till 11. 45 a. m. = 1 hour 50 minutes."

Several further, last attempts made by this male upon the female during the remainder of the morning were ineffectual.

"June 24. This same male repeats these attempts at Congress during morning of this day which also are generally rejected by female.

Note. It should be understood that a trial made for feeding this experimental female were of no avail till 4.30 evening of June 23, when it showed signs by stabbing the hand proffered for the purpose; but when being put on a fowl it fed very slightly only and to all appearance reluctantly as yet.

"June 26. Both female and male feeding on fowls, the former again not to full extent."

Special breeding Experiment No 2, with a female specimen emerged June 27. —

"Mated with a male immediately and kept under close observation. No signs of attempt at copulation until 4.30 p.m. when male resorts to act. Duration of latter amounting to 20 minutes in this case."

Note. This No 2 experimental female reared in the Laboratory, and which from the beginning was a weakly individual died, July 4 notwithstanding careful attention paid for feeding the same.

Special breeding Experiment No 3. with the first male specimen bred in the establishment emerging late evening July 11.

"July 12. This experimental male feeding reluctantly & partially only when tried first time on morning of this day."

Note. It should be stated here that this male was kept in a state of celebacy purposely being reserved for mating same with a female bred on the premises. Eventually (Aug. 23) it was united with experimental female No 4 the latter having survived 2 outside males with which

she had previously been mated.

Note. Both experimental female No 1, and experimental male No 3 eventually died on the same day (Sept. 21) the latter first.

Of course that a greater number of cases of copulation had been observed than those ~~named~~ specified above, but these occurred spontaneously in the larger breeding or general collecting cages which latter for accurate observations are unsuitable owing to the constant movement and general commotion of amongst a great number of flies they contain.

One other special case however deserves mention as it also has reference to the relative development of the natural instincts of a male fly of 2nd. generation which emerged on September 26. This latter, when mated with a female emerged on September 6 also of 2nd. generation, conformed to the impulse of copulation two days before evincing an inclination to feed. It was not till the third day when it could be induced to feed.

As a set-off to the polygamic instincts observed in connection with the general Experiment of April there is one to be recorded also of poly in the case of experimental female No 4 and dated "August 9. Experimental female No 4 in cohitus with two males during afternoon."

II. Gestation.

Beyond the mere mention of the bare fact in regard to a first and only record there is little to be said on this head.

And here again it was reserved for experimental female No 1 of June 22, to supply the desired information which led to this satisfactory result. Further products of the breeding plant were required either for other Laboratory experiments connected with the pathogenic features of the research-work, or else collapsed resultless.

June 23d. Mated, as already stated, on June 23, and subsequently signs of gravity making themselves manifest in the altering contours of the abdomen it bore a healthy and normally developed Larva on July 15. The entry made in the diary kept gives the following particulars:

Exp. Female No 1.

July 15. "Larva, (2d. Generation) freshly expelled, found in water of porcelain dish over which the cage had been placed. Probably wriggled itself, or had been dropped by Mother-fly through the morning. Larva not case-hardened yet."

Sept 7 As the pupa of this Larva has in its turn been hatched out since (Sept. 7) and moreover giving rise to a female, this will fix the period of gestation at from 21 to 22 days.

July 27 On July 27, or a lapse of another 12 days, this same mother-fly immaculately brought forth another though considerably undersized Larva, which it expelled during the process of feeding. This latter being something of an

abortion nothing so far resulted from it, nor was such expected to do.

Eventually this identical female fly gave birth to a third Larva of quite premature development. The number of days intervening between this latter abortion and the previous one could not even approximately guessed much less ascertained as on account of its minute size, it was discovered only by accident some time after, or on Aug. 23, when transferring experimental male No 3 to its special cage.

III. Incubation.

a) Effect of Captivity on the Growth of Larvae

From time to time healthy and full grown larvae or mostly their converted pupae-forms are discovered in the small collecting cages, where they have been deposited by the female flies being in the last stages of gravity. These constitute a welcome addition to the experimental portion of the live-stock.

More frequently however, quite immature ~~larvae products if not~~ expelled or half-grown maggots are found in them, which goes to show that the female insects, though freshly caught, when disturbed readily part with and extrude the embryo. It should not astonish therefore when a large portion of the female flies kept in captivity show a similar tendency of prematurely parting with the larvae which they in reality do, this latter event being one of the most trying incidents in the raising of stock.

Occasionally that complete metamorphosis does ensue in one or another of these immature larval products if not too degenerate in size. In the latter case however, the imago is generally deformed and rarely lives long enough to be induced to take nourishment.

In connection with the above an annotation might be quoted of a case dealing of special observation on the emergence of a fly from the pupa, dated June 22.

"At first the emerging insect has all the appearance of being an abortion, its abdomen being folded yet underneath the thorax portion of the body and almost flat and empty.

The wings too seemed crumpled up, and its whole condition gave it the appearance of an deformed product. About an hour afterwards the abdomen assumed its normal shape and position, air probably being drawn in through the trachea and the sucking stomach inflated & which totally altered its aspect. The colour of the underneath part was a whitish grey and very different from the dirty of ochre yellow seen in old specimens.

Attempts to feed it, carried out imediately and continued at intervals through the day, were of no avail whatever.

6.) Method of treatment for the Chrysalis and detection thereof.

In the absence as yet of any definite information in regard to the precise places selected for the deposition of the larvae by the flies in a free state the only likely inference derived is that from analogy in captivity which point to a fairly dry and friable loam or possibly some decayed vegetable matter. The results obtained from a wet method in the case of trials made at incubation under artificial conditions have not been very satisfactory. The Chrysalis are readily attacked by fungi when treated in this manner which points to the fact the the animal has been destroyed inside; whereas from those kept in a dry condition, as has been similarly recommended by previous investigators, have on the whole contributed by far the larger ~~proportion~~ portion to brood raised in the

the beginning.

One other serious drawback to artificial incubation are the great number of Ants, these latter readily attacking the pupae unless these are well protected against their depredations. From these and similar observations it is permissible to conjecture that the localities ~~selected by the~~ for the deposition of their larvae by the female Tsetse flies in a free state would be some tolerably free from this pest.

C.) Range of incubation period.

For the purpose of obtaining additional information ~~a series of careful and special observations were inaugurated~~ for the period required of the development of the imago from its larval condition a series of carefully dated cages for their reception from the large breeding apparatus were installed. Their free larval state is of short duration varying from a few minutes to an hour only ~~during~~ which time is occupied by the awkwardly moving maggot in search of a convenient hiding place only but not ~~for any~~ in search of food. Exhaustion soon sets in and the outer integument so assumes first a light horny aspect shortly afterwards darkening to a dense brown colour. The latter varys much in shade some individual pupae remaining light, whilst others assuming the too dark brown appearance and even black.

In the appended list the great variation in existing in the time required for their metamorphosis may be seen and found very surprising.

These are set out so as to show both the dates of their extrusion and those of their emergence. The number of days thus occupied in their metamorphosis is indicated in another column and further accompanied by remarks if any, having reference to them.

They extend to August 27. only in the case of their Chrysalis form, being 28 in number; and to September 7. in regard to their full development 24 of these reaching the latter stage of those specially observed, a sufficient number in order to show the variable range.

Later additions, to the amount of 136 (end of October, the time of writing) for pupae recovered from the breeding plant on account either of limited accommodation or ~~for~~ devoted to some special requirements were dealt with in another manner.

There were two only, viz. that of June 5— and June 20. within a minimum time of 17 and 21 days respectively, or approximately the time which had been ascribed to their hatching period by some previous observer. The first pupa viz. that of May 19. has not come to perfection, remaining a blank. The next lowest on the list is that for July 14.— Aug 17 or 34 days. All the remaining ones vary from between 39 to 48 days and the mean is conspicuous with the extraordinary maximum of 54 days of arrested development. ~~It~~

The question of how much that would have to be placed on account of the latter, and how much on that of confinement amongst artificial

surroundings with its accompanying tendency for degeneration of the Species must remain unsolved for the present and is somewhat difficult to elucidate. A considerable share however of this arrested development must be ascribed to variation in the thermic conditions by which these insects are so readily affected as has frequently been instanced in the case of their feeding propensities as may be gathered further on when dealing with these.

d.) Effect of meteorological variations on the development of the Imago during its Chrysalis Stage.

Annent the extracts from the Meteorological Observations taken at Entebbe, and kindly supplied for the purpose by the Officer in charge of the Scientific and Forestry Department, Mr. E. Brown, the latter certainly go to endorse fully personal observations made on this point.

The experimental plant unfortunately not having been established until towards the end of the first semestrial rainy seasons there are two instances only to be quoted in favour of this contention and falling within this period and showing the minimum time required for their hatching viz. those already alluded to, that of June 5 – 22 with 17 days and that of June 20 – July 21 with 21 days respectively. They coincide with the months showing the greatest averages of Rainfall, May 8·24 inches and June 6·66 inches.

The readings of them further show a ~~mi~~ minimum of sunshine for May with 90 hours 25 minutes and of June one of 142 hours 32 minutes. Correspondingly there is a gradual diminution in the mean temperatur of the 7 a.m. records to be noted, 69·4 ~~for~~ degrees for April; 67·5° for May; 66·8° for June; 65·3° for July and 64·7° for August. (September records not available as yet but desirable.) The difference of 4·7 degrees only within a range of minimum temperatur of 61° to that of a maximum of 80° does not at first strike one as in any way considerable; but knowing how much and quickly a slight reduction in the temperatur of the middle day is capable to affect the feeding propensities of this fly, its far reading influence on the period of incubation is sufficiently explicable.

A reading of temperatur with the sun above the horizone for one hour as per official records cannot be regarded as an adequate index of the lowest temperatur of the 24 hours. There being therefore no night readings available through this source a few such registred privately at ~~midnight~~ during

~~Similar conditions~~ A few readings taken at midnight privately during July showed somewhat lower records than those extracted above and similar conditions prevailed through the greater part of August with the result of a prolongation of the incubating period of from 39 to 54 days as shown in the list appended. Though a greater amount of sunshine is registried during the last two named months, 196 hours for July, and 192 hours for August, these are characterised nevertheless by high winds, a cool S. W. for the daytime and a remarkably chill one N. E during the night.

List of Larvae & Pupae ~~kept~~ incubated ~~for~~ experimentally for periodicity.

Time of deposition			Time of emergence		Period.	
Month.	Date	Sex.	Month	Date	No. of days	
May	19.	♀	—	—	—	
June	5.	♀	June	22.	17	Experimental specimen No 1 (2d Gen.)
"	20.	♂	July	11.	21	" " No 2 2d Gen.
"	26.	♀	August	8	43	" " ~~No 2~~
"	"	♂	"	8	43	
"	"	♂	"	12	46	
"	"	♂	"	15	49	
"	30.	♂	"	8	40	
"	30.	♂	"	15	46	
July	1	♂	"	17	49	
"	3	♀	—	—	—	
"	4	♂	August	14	41	
"	5	♀	"	14	40	
"	6	♀	"	15	40	
"	7	♀	"	15	39	
"	10	♀	"	26	47	
"	"	♀	"	"	47	
"	11.	♂	"	21	40	Experm. Specimen No 3 (2d Gen.)
"	"	♂	"	24	44	
"	"	♂	"	25	45	
"	13	♀	"	26	44	
"	"	♀	—	—	—	
"	14	♀	August	17	34	
"	15	♂	"	28	44	
"	"	♂	"	29	45	
"	"	♀	September	7	54	& 2d generation
"	27	♀	"	"	40	2d generation (aborted)
August	8	♂	October	19	72	2d generation
Sept	29	♂	Octo	29	30	
"	"	♀	"	"	"	

The number of larvae deposited during August and up to the end of September amounted to something like one hundred, but having been dealt with collectively their entiistory could be of no particular interest. Many of these latter proved sterile or never came to perfection at all which has to be ascribed chiefly the inclemency of the season.

With September 7 on which date a female of third generation emerged fo renewed interest attaches itself to the experiments which was further augmented by the emergence from a Pupa of a male fly of 3d Generation on Sept. 26, which was mated at once with the female referred to above. This male could not be induced to feed and died on the 4th day, the female shortly afterwards too.

On September 27 4 Pupa were found deposited of 3d Generation two of which emerged on the same date of the following month October the period of their incubation being thus reduced again to 30 days which reduction coincides with the renewal of the raing, and consequently milder season. These two products of 3d generation a male and a female, are full grown and robust looking individuals were mated on the October 30, and may be looked forward to, circumstances being favourable for giving rise to experimentally to a fourth generation. On October 19 a male of 3d Generation whose Larva was deposited on August 8, constitutes the maximum record of meteorological check exerted on metamorphosis with 72 days, since quoting the case of 54 days.

G. Alimentation of Captive Tsetse Flies.

I. Initial remarks on the Food Question.

Since a very modest success for their propagation under artificial conditions, beyond a first progeny, has been the only reward for a series of tedious trials - which were accompanied invariably by as many disappointments -, it would not be unreasonable to assert that a considerable amount of the latter arose from the difficulty of a satisfactory solution of the food problem.

Although warm-blooded animals have so far constituted the mainstay of the flies kept in captivity it does not precisely follow that these flies are dependant on this diet alone, to judge alone from the great number of well fed and conditioned individuals Tsetse flies of this species that amounting to many thousands that have been brought into this institution. The idea of their all and sundry to have fed on warm-blooded animals and mammalian blood in particular is almost inconceivable. Particularly so as on the occasion of some casual visits to the fly infested shores of some of the smaller and uninhabited Islands they seem to be thriving amazingly in despite of a complete absence of Cattle, Goats & Sheep, and where no other mammals except Rodents such as Wood & Field Mice, Rats, Ground Squirrels or a few Fruit-eating Bats occasionally may be seen or merely suspected to exist.

A substitute for blood, if any, would needs have to be ~~one~~ a fluid one as the structure of the mouth-parts and suctorial apparatus precludes the imbition of any solid matter. Yet from various foodstuffs offered them in the course of the investigation not single case of a fly partaking of any substance other than blood could be observed. Although the union of the sexes takes precedence over the act of feeding in the first instance, yet, once this impulse having been complied with the tsetse fly, both male and female deprived of its natural food ceases to live longer than 4 days at the utmost or having strength enough left for doing so at the end of this period after its emergence from the chrysalis stage.

Thus it will be seen that the perpetuation of this species of tsetse fly depends, as far as could be ascertained on hand of experiment, on a prolonged and liberal supply of a diet consisting of blood.

II. ~~Experiments with different kind of food.~~

II. Experiments made with various kind of foods.

---

1. Vegetable matter.

This consisted of the

a. the various kind of fruit as obtainable here e.g.

fresh: Plantains, Papaw, Passion fruit } left positively untouched.

preserved: Figs, Dates } ditto.

b. Substances of chiefly saccarine properties e.g.

Lump sugar, molasses, glucose, dextrine } eyes have not the least attraction for them.

2. Animal matter. (dead).

a. Raw meat from freshly killed animals. Repeated attempts made with these, such as of Monkey, Sheep, Fowl etc. when yet in a bleeding condition utterly failed to tempt any fly when tried; nor did it form a sufficient inducement to them to even attract any near it.

c. 3. Live Animals ~~matter~~ (~~lice~~)

d. Fishes. June 10.

Introduced to live specimens of Lung-fish (Protopterus aethiopicus) into large breeding Cage containing about 150 flies. No notice taken of the objects at all by any during time of exposure or a single fly alighting on or near it.

Batrachians.

e. Tree frog ? April 14.

10 flies all engorged previously were closeted with this animal. 7 of these gorged themselves on it. Frog found dead next morning as the result of the loss of blood.

f. Frog (Rana ?) April 17.

Of the 9 flies introduced to cage containg the animal only 2 having fed on it seemingly late evening or early morning but not during time of observation. These on examination showed frog's blood in their entestines. The remainder of the flies had died following day, also the frog.

Reptiles.

g. Lizards May 10 etc.

(Varanidae ? spec ?)

These when tried were found to prey on the flies introduced, though a few of the latter managed to draw blood occasionally from them.

h. Chamaleon. April 12.

Of two wounded flies introduced the animal disposed ~~off~~ by swallowing same.

~~dito~~ April 13.

Chamaleon transferred to cage containing a 25 tsetse flies. 6 of these immediately attacking the animal, gorging themselves rapidly. The frog ~~patient~~ seemed quite exhausted soon after, and collapsed within ½ an hour after. Found dead next morning.

i. Snakes.

Trials made with a few of the smaller species of these Reptiles both venomous and non-venomous as well as the young of the Puff-adder remained negative in their results. It is safe to conclude that the Tsetse does not molest these animals.

Though some of the special experiments as well as general observations made in the field by previous investigators have demonstrated the fact that the Tse-tse does attack, and is capable of piercing with its proboscis such of the tougher epidermal and cuticular integuments as those of Batrachians and some Reptiles and moreover able to derive suction nourishment by means of suction between on the folds between the coarse scales of the latter to the full extent of their intestinal capacity, there are not a few of these battles who cannot easily ward off their molestations either entirely, or but even prey with impunity to themselves on the flies in return as has been instanced. The same might be asserted in the case of the majority of Birds.

The former mentioned animals, for some of the reasons stated, not being considered very suitable material for practical purposes, recourse was had to keep up the Stock on Fowl as principally being the most convenient eating. The precaution of cutting away their plumage close to the body, in order to give the flies more ready access to the food-portion.

To vary the diet Guinea-Pig was substituted from time to time with good results.

3.) Feeding propensities of the Tsetse.

Robust looking flies, freshly caught as a rule feed freely on, and up to a day or two after their capture. They generally do so by pouncing upon their victim with great vehemence and vigour, rarely failing to fill themselves to almost bursting point on the one place they alight. Not so all the flies that have been kept in captivity for some time. A characteristic change in the form of indifference can often be seen in the latter, either partial or complete lethargy making itself manifest frequently in seemingly hungry individuals. In such a case they irresolutely shift their position, probe and sample different spots, or busy themselves with cleansing and brushing wings & body.

Flies in a poor and emaciated condition rarely can be induced to feed; do not recover, and die from exhaustion subsequent of starvation.

The time occupied in imbibing the blood and filling the digestive organs to the full extent of the abdominal cavity considerably varies according to individuals and possibly inclination. Healthy insects doing so in the minimum time of 20 seconds; whereas some of the aforementioned may require as many minutes for the process.

A noticible peculiarity is that they will not feed as a rule until all previous nourishment

has been entirely dissimilated, and particularly ravenous individuals frequently interrupt the commenced suction by complete evacuation of the rectal portion of the intestine without withdrawing the protoscis.

The time devoted to the process of thorough digestion and dissimilation is about 3 days, before this they rarely feed willingly. They evince a marked dislike to any animal which has turned sick and quite unmistakably shun also substances nauseous to human conception also.

4.) Manner of feeding.

Hungry flies assume a perfectly squatt position for the purpose of imbition at first. Then the abdomen is lowered and the head & thorax portion slightly raised in a straight line which forms the longitudinal axis running through the body of the insect. This position constitutes an acute angle posteriorly with the base-line formed by the object they feed on. Next the palpi are opened out and raised encovering the protoscis. Then for inserting the latter the head & thorax portion is lowered at the same time as slightly raising the abdomen, thus shifting the angle in opposition to the one previously described. This they do by employing the middle pair of legs as a fulcrum, alternately using the front pair and or the hindlegs as the levers wherewith to execute this movement which is almost imperceptible.

The front and hind legs are spread ~~back~~forwards and backwards respectively with the digital joints placed equidistantly from the middle pair which latter extends laterally and nearly rectangular to the body. The wings are kept in their normal ~~condition~~ position during the process of imbibition, and flies which have gorged themselves to the utmost of their capacity, often remain apparently helpless in this position for some time after; unless disturbed, when they, by a sharp movement take to flight. It happens sometimes that they overbalance themselves being unable to controll the over-filled abdomen, which, owing to its transparency assumes the colour of the blood.

The region of the stomach is the first to show colouration, the imbibed blood however passing from there into the long and strongly convoluted small intestine which soon after shows the same intense colour. In a very few hours already after, this transparency gives way to the usual yellowish-white opacity of the abdomen which still retains its globular shape. When in this stage, only the practised eye is able to discriminate between a recently fed up individual and a pregnant female fly.

In both cases the slightly pyriform spore is the predominant principle; but ~~while~~ in the first instance a slight, but distinct apex lies in the direction of the posterior segments, in the latter a scarcely noticible one is directed forwards and the posterior portion of the body forms a slightly more regular oval.

Highly gravid females feed more lightly, and

in instalments as it were; but vigorously again after parturition.

Tsetse in the open, on warm and genial days are active till the late hours of the evening and keenly follow one, eager at any time for an opportunity to satisfy their appetite.

Those in captivity, on the other hand, show a great disinclination for feeding before 10 a.m. and after the hour of 4 in the afternoon. Especially was this the case during the cool and windy period of July and August, when on many days during that season, they, with great difficulty could be induced to take up nourishment, much to the detriment of the stock; or what just as frequently occurred, refraining from feeding altogether, with the accompanying increase of casualities.

With the reappearance however of the rainy season and the milder weather this state of affairs began to mend and greater avidity manifested itself among the flies brought in and added to the stock. Not only that the more normal conditions of the numerical reproduction of the larvae, was the immediate outcome, but with the further consequences that the hatching period again shortened appreciably as later larval products show, to revert once more to a normal state.

This abstinence from feeding therefore synchronizes with the same period during which such a remarkable check was experienced in the metamorphosis which the maggot undergoes in its chrysalis-stage.

Finally two instances of observed parturition may be quoted here.

The first of these concerns a case of a premature larva, the mother-fly expelling the embryo whilst adhering to the glas-front of the cage holding on by the front and middle pair of legs. With the hindlegs the insect vigorously squeezed the abdomen by a stroking movement concurrently with repeated contractions & dilations of the abdominal segments, after the manner in which a maggot propels itself. The two blunt horny black appendages which characterise the larva of this genus appeared first, the body, worm-like elongated, rapidly following suit when on the complete extrusion the embryo contracted to assume a more oval shape, falling to the ground after the manner of a drop of liquid. For a few seconds of time only the mother-fly remained in a seemingly exhausted condition but soon changed her position getting on the wing and mingling with the other flies.

In the other case, observed at some inconvenient distance, being in the centre of the cage, the mother-fly was in a squatting position on the ledge of the tray which supports the food-patient. Here the same movements were in evidence as those described, only that the labours seemed to be greater and more protracted owing to the full-sized condition of the larva, which latter soon wriggled itself by some awkward contortions some little distance away, only to remain there, where, within an hour after it turned into a pupa. The motherfly appeared greatly exhausted in this case, remaining for a considerable time longer in the original place than the former.

History.

It is impossible to trace the history of the introdection and progress of Sleeping Sickness in the Lado Enclave, the natives' idea of time is so entirely inaccurate, and Belgian Reports would seem to be as unreliable.

I. The usual native story is that Sleeping Sickness was introduced by the Congolese Soldiers who also brought with them Congoli (Venereal disease) and Jiggers.

Incidentally, I only saw one case of Syphilis a Greek merchant, but I had personal experience of Jiggers.

2. A Madjulu told me that some years ago "all the men and wild beasts were very strong, a disease attacked the beasts - Elephants and Antelope died in great numbers, suddenly the disease left the beasts and attacked man".

3. A Belgian Report on the UELE River District (with which the Enclave was then incorporated) for 1908, stated that the District with the possible exception of a few sporadic cases was free from Sleeping Sickness.

It will be remembered that Boyd-Alexander reported the disease in the Yei Valley, and that KAPEH, the Nakaraka Sheikh, told Captain Hadow in 1909, that his village had been infected for some time.

There can, I think, be little doubt that the disease was introduced from the Congo, that it became established in Yei, and possibly Kagulu, that the natives who were called into these places as labourers carried infection back into their villages.

A potent factor in the establishment of Sleeping Sickness as an Endemic disease has undoubtedly been the unchecked invasion of the country by cosmopolitan Traders and their agents with caravans of Uganda porters.

Extent of Disease and Fly.

The shaded area on the attached rough map represents, I believe, the Sleeping Sickness area in that part of the Enclave at present being administered.

It is the area suggested by Captain Mackenzie, and may be summed up in a circle with Yei as its centre and a 35 mile radius. Only six cases were found in the villages South of the Road.

Glossina Papalis apparently exists along the whole length of the River Yei, in the large Khors communicating with the River, and in practically all the Khors which cross the Automobile Road between GENZI and LIBOGO on the Congo Frontier.

I never saw Glossina Morsitans on the Automobile Road, but they are to be found Nor-th of, and a few miles off the Road.

31 transport donkeys which accompanied me were very much bitten by a fly - genus Haematopota - during September 1910, especially on the West side of the River Yei.

This Haematopota swarmed during the end of the wet season but I did not see any during and after December. Nine of these donkeys died soon after they returned from the west side of the River and after I had detached them for work on the Loka Rejaf Road.

Blood films were sent to me, but examination for Haematozoa was negative.

I have no observations to make on the "Fly" except that it is, I believe, unusual to be attacked by Glossina Palpalis at night, on a moonlit night a fly came into my house where I was reading by candle light and settled on my hand.

Major Conry told me that he was viciously attacked by G. Morsitans while trekking by moonlight.

Mulazim Awil Baz Effendi, who did admirable work in supervising the clearing of the River banks, spent much time searching for pupae without success.

Sheikhs and People.

The people living between LOKA and LIBOGO on the Congo Nile watershed are of the MADJULU, KAKWA, MUNDU, MAKARAKA, AVUCAIVA, and MORU tribes.

The Sheikhs as a rule recognise the disease and are afraid of it. They are willing and anxious to do what they are told to minimise their danger.

The attitude of the people towards their Sheikhs which was most unsatisfactory at the time of our occupation, has been enormously improved by the work of the Major Percival and Captain Dove.

The undisputed authority of the Sheikh over his people is an all important factor in dealing with a disease such as Sleeping Sickness, in which the people must help themselves to work out their own salvation.

The fact that Sheikhs recognise the disease and report their cases is of the greatest assistance to the work of the Sleeping Sickness Commission, I have usually found the Sheikhs estimate to be correct or nearly so.

A sign they frequently quote:-

"He suddenly began to eat a very great deal,

to drink a very great deal, and all the while he became thin"?

It is significant that all the Sheikhs speak of the big mortality as being of the past, of the disease being on the wane, of less infection taking place year by year.

The men proved themselves to be magnificent labourers, they quickly adapted themselves to the long-handled felling axes, and did amazing work with their hands and hoes when three swamps uncomfortably near the houses in Yei had to be drained.

The native head men supervised the work exceedingly well so long as they in their turn were instructed and supervised, but they lack the gift of sustained application, and the necessity for adequate white supervision in work of this sort cannot be too often or too strongly emphasised.

Clearing Work.

It will be seen from the map that Yei occupies a position which makes it the ideal administrative centre of the most thickly populated part of the Lado Enclave, besides being the key of the Sleeping Sickness area, and that the clearing of Yei to render it a fit site for a Segregation Camp would not only establish Sleeping Sickness Head quarters, but would also render the place fit for the Yei River District Markaz.

The houses and stores in Yei had not been valued by taking over Commission on account of Yei's evil reputation.

YEI.

The River banks for four miles were entirely cleared - the clearing extending 50 to 100 yards

back from the water's edge -, all trees and bushes were cut down, all the grass hoed, the wood and grass were piled at the edge of the clearing and burnt, the tangle of roots on the face of the banks were cleared away, and when the River became shallow enough the trees and debris which had been toppled into the water were lifted out and burnt.

The islands in the River were completely cleared and the Khors communicating with the River cleared for a distance of 500 yards from the point of communication with the River.

A big Khor leading from the River to the village (I I/2 miles) was carefully cleared, and two streams opening into this Khor were treated in the same way.

These swamps were drained.

The banana plantations which had overgrown the place, and been planted near a fly infested stream within 200 yards of the houses were extirpated root and branch.

The whole of this work can now be completely revised every month by a gang of 50 men, and I am in favour of the work being thus revised in preference to the planting of a ground crop or Citronella grass, at all events until more information as to the efficacy of the latter is forthcoming.

A space of I20,000 square yards was cleared for the Segregation Camp, and on this site were erected:-

Grass tukls - in each of which five native beds were made.

A Hospital - with 20 beds.

A tukl for cooking purposes.

A latrine.

Three tukls for use of the Camp staff who were selected from the Yei employes.

A large cleared space remains round the Camp

which the patients will plant, and doubtless before long the Camp will be self supporting.

KAGULU.

Khor Kagulu was completely cleared as far as the farm was effected - a distance of two miles.

In Kagulu again Banana plantations near the water were totally destroyed, and the dense tangle of trees and under-growth cut away and burnt.

Mr. D.S.Corlett - Superintendent of the farm supervised the work with great energy and success, and rendered most valuable help to the Sleeping Sickness Commission by arranging for supplies of Cassava to feed the labourers at Yei and Kagulu.

Automobile Road.

Two Khors on the Automobile Road east of Loka were cleared and work is being done on the 13 Khors between Loka and Yei. 100 yards on each side of the point where road crosses and 50 yards back from the water's edge.

Individual.

Axes were lent to Sheikhs in rotation to clear the place whence the water for the village was drawn.

Some excellent work was done by some of the Sheikhs who were quite enthusiastic about it.

Moving Villages.

It will be necessary to move several villages from their present site, particularly those which depend upon the River for their water supply.

Sheikh Ramadallah, whose people defied his orders to clear the drinking place, was moved at once to

site 6 miles away from the River.

Sheikhs KAPEH, BRIMOOI, LUA and others will probably be moved after the next harvest.

A number of villages already depend upon water holes.

Infected Villages, Number of cases from each

Sheikh Ramadallah	10
" Abdullah	6
" Kamkura	5
" Lasoba	5
" Sei	3
" Torrenjo	3
" Watta	2
" Lua	1
" Lakenjo	3
" Lugalin	2
" Murrjan	3
" Addeh	2
" Metassa	3
" Wai Wai	1

Cases.

The Camp was built by the end of January, 1911, and then cases were collected from the villages and segregated.

By 23rd. March, when I left Yei, all the villages shown in the shaded area on the map had been visited, and 51 cases had been admitted. Of these 40 were males, 11 were females, and there were two instances of man and wife being infected.

Diagnosis was made by gland puncture, and six cases, in whose blood or gland juice Trypanosomes were not seen, were diagnosed on clinical signs and symptoms. No Cerebro-Spinal fluid was taken.

Four cases died shortly after admission.

Three steps which led up to a Verandah on which the Microscope work was done provided a diagnostic sign which never failed during my short experience.

An individual who came up the steps on all fours always showed Trypanosomes in the gland juice.

Some cases, of course, were able to walk up, but these adopted the all fours method were invariably positive. Several cases came into Yei of their own accord for examination.

In the majority of these cases the character of the enlarged glands was suggestive, but there were three cases in which puncture of one gland revealed no Trypanosomes in two separate fills, while puncture of another apparently similar gland on the same or the other side of the neck showed several Trypanosomes.

Presumably, infection from another source: eg; a septic focus on the scalp, can defeat the Trypanosomes in one gland and leave them in another unaffected.

Clothes and Diet.

The patients were given clothes of white American cloth.

A large piece of sugar and some salt was given to each individual every morning:- they were given meat when any was available.

The addition of sugar to their usual dietary of Dura flour, Sesame, Beans etc. seemed to have an extraordinary effect in several cases who filled out almost visibly.

The sugar certainly adds to the patients content, and doubtless improves his powers of resistance.

Treatment.

I was privileged in being enabled to use an

antimony preparation (Plimmer) with which much experimental work has been done by Fry, Plimmer and Ranken.

This was injected intravenously, but a short seven weeks experience of treatment does not justify inclusion in this report.

Some cases were undergoing a course of Atoxylate of Mercury at the time of my departure from Yei.

One cannot attempt to forecast the result of the campaign which has been so recently begun, but there are several points about Sleeping Sickness in the Lado Enclave which cannot but make one think that success may be possible.

I. The restricted area beyond which the disease has apparently not spread.

2. The attitude of the people who are willing to help themselves.

Their strong attachment to their houses which to a great extent precludes their wandering out of or into infected districts.

3. The general story that the disease is on the Wane, and that the number of cases is far less now than formerly.

Now that administrative measures have been started to deal with this Sleeping Sickness area, that villages are being moved from infected sites, that rules excluding porters from the Congo entering the Enclave are being enforced, there is an opportunity of stamping out the disease.

A real effort made at the beginning is manifestly more useful than support after the opportunity has been lost, and insufficient measures cannot be satisfactory to those responsible for them or encouraging to those who carry them out.

It must be realised that to support the effort

to stamp out Sleeping Sickness, the Trade of, or any hope of profit from the infected Province has to be a secondary consideration until the disease has been dealt with.

(Signed) R.J.C.Thompson Capt.
R.A.M.C.
attached E.A.

7187

Rapport de la mission d'etudes dans la Zambézie Portugaise, á propos de la maladie du sommeil par le médecin colonial J. F. Sant'Anna.

Resumé.

Dans la prémiére partie de ce rapport on fait une esquisse de la marche de la maladie du sommeil depuis la cote occidentale de l'Afrique jusqu'á la région des laes de l'Afrique Centrale, pour méttre en relief le role des cours d'eau navigables et des déplacements des populations indigénes. L'infection ayant atteint en 1907 les vaux du Luapula et du Lualaba, et les rives du Mweru et du Tanganyika, son rayonnement vers le Sud et l'Est jusqu'au delta du Zambeze etait ménacant, vu les connexions de ces systémes hydrographiques avec les tributaires du Nyassa et du Zambeze, et les migrations et les divagations des naturels.

Deux ans se sont écoulés pendant lesquels á la Rhodesia du Nord-Est et au Nyassaland out apparu seulement des cas d'importation du Congo et du Tanganyika, quand on a découvert une importante aire inféctée dans la vallée de l'Aruangua, affluent du Zambéze, et apres peu de temps quelques cas acquis, presque certainement, dans les rives du Nyassa. Les faits ulterieurs, et depuis peu la découverte de une zone infectée dans le Nyassa, prochaine de la mission de Mvera, n'out fait que confirmer les primitifs soupçons et précisé le siége de la maladie; il faut donc reconnaitre que la province de Moçambique se trouve en risque de une invasion, menacée au même temps dans la frontiére occidentale du district de Tête par le fleuve Aruangua, et par le Chire, la route la plus courte pour le Nyassa, dans la frontiére de Quilimane.

Il parait que dans les zones depuis peu envahies de l'Afrique Centrale, il n'ya que la glossine morsitans, et la fusca, étant absente la glossine palpalis; les choses sont égaux dans la Zambézie portugaise et nulle difference ou a pu remarquer encore á l'egard les vehicles probables de la trypanosomiase humaine.

1 - La zone infestée c'est une petite aire prés Domira Bay, Lac Nyassa; selon les derniers informations officiels le nombre total des cases dans le Nyasaland, pendant la dernière année a été de onze.

Les conditions regionales de la vallée du Zambeze et sa faune hemato phage,ont été le sujet de quelques études qui viennent exposés dans la seconde partie du rapport.

Dans le Zambeze on doit regarder á part la section de son cours qui reste en amont de la Lupata et celle qui reste en aval de cette chai ne de montagnes. Dans la prémiére,depuis le Zumbo jusqu'á Bandar, la vallée du fleuve est formée par des terrains arides de végétation pauvre et chétive,qui dans la saison séche se depouille de feuillage et se réduit á des troncs et des branches denués.

Dans la plus grande partie de l'année les morceaux de végétation puissante et les abris propres pour l'éxistence des glossines,et surtout de la palpalis,sont tres rares,même auprés de l'eau.

Le climat dans cette partie de la vallée du Zambeze c'est dune séche resse extrême;les pluies font en général défaut et aprés la saison pluvieuse,de Novembre á Février,il n'y a pas de précipitation apreciable dans le reste de l'année. C'est une région sans broillards ni rosées.

Les températures moyennes sont trés élevées pendant tout l'année; dans la saison séche les abaissements nocturnes ne sont jamais trop grands et les différences nyctemerales sont toujours restreintes.

Dans les rivages du fleuve on ne rencontre pas de glossines,aussi bien que dans l'Aruangua inférieur,dont les conditions en sont tout semblables;prés du fleuve il ya beaucoup de troupeaux de boefs parmi lesquels aucune infection hématique a été observée dans les dérniers années.

En toute l'étendue des terrains marginals jusqu'á une altitude moyen ne de 500 á 600 métres et dans une largeur toujours supérieure á 25 kilométres,de chaque côté,les conditions d'aridité du sol, le type de végétation et la séchérésse du climat se mantiennent,et nulle part, avant de transposer la ligne des altitudes qui délimitent la vallée du fleuve,se trouvent les conditions les plus propres pour la vie des glossines;on n'a pas découvert lá aucune aire de tsé-tsé,pas même on a obtenu quelques références sur le sujet.

En aval de la Lupata les rivages sout plaines et le sol formé d'allu vions assez riches en humus. Ce sont des terrains féconds et humides mais de formation récent;la végétation herbacée est abondante, mais

la zone forestiére demeure en régle loin de la rivage. Il y a des points où la forêt vient près de l'eau, comme dans l'Ankuasi, mais celui ci c'est le cas le moins fréquent. Même dans ce point, il parait que les glossines ne s'approchent beaucoup de la rivage, quoique on soupçonne que quelques fois elles ont fait des émigrations temporaires de ses gîtes de l'interieur et qu'ont victimé par des trypanosomiases le bétail, dont l'élévage a prouvé impossible même dans la zone marginale de ce Prazo.

En Tambara, Chupanga et dans quelques autres lieux, on dit que la tsé tsé demeure dans les forêts, á l'interieur, loin de la rivage.

Au Nord du district de Tete il y a quelques aires de glossines; on a fait la reconnaissance de deux de celles-ci prés les fleuves qui forment le système du Chirisse, et de deux autres dans des affluents du Revugué.

La plus importante d'entre toutes demeure dans la rive droite du Vubué, pour l'Ouest, dans une extension de 5 a 6 kilométres; une autre se trouve au delá du Mangadzi, entre ce fleuve et le Capoche, dans une contrée assez abondante en eau.

Les affluents du Revugué prés desquels on a vu des glossines, ont été le Lingove et l'Inhamadzi, dans la route de Tête pour l'Angonia.

La seule spécie vue a été la morsitans.

La végétation des terrains fréquentés par ces glossines consiste en forêt d'arbres de petite grandeur, avec feuillage pauvre, et en végétation herbacée (capim) plutôt courte et clairsemée, avec peu d'arbustes, sans buisson touffu. Les glossines sont en général trés peu nombreuses dans ces aires; je n'ai jamais obtenu plus que six exemplaires dans quelques heures de recherches, et en certains endroits j'ai vu seulement deux ou trois.

On pointe d'autres aires de glossines á Tête, par exemple près du fleuve Chirisse, du Mavuse, dans le Sud du Zambeze entre Chicôa et Boroma, etc; la presence des glossines dans ces endroits et dans d'autres places n'est pas constante et parait être dans la dépendance de causes incomplètement connues. On croit généralement q'elles sout apportées par les troupeaux des buffalos souvages et qu'elles les suivent partout dans ses migrations, doctrine aujourd'hui inacceptable.

En aval de la Lupata on rencontre une aire de glossines dans l'Ankua si dont l'importance est bien plus grande que celle desquelles que nous avons visité dans le Nord du district de Tete. Elle est assez éloignée de la rivage, certainement plus que 20 kilométres, et demeure vers la frontiére du Nyassaland dans une region peuplée. Parmi quelques dizaines d'éxemplaires de cette origine j'ai vu seulement la Glossina morsitans.

A'Quilimane, la région explorée a été la Maganja da Costa. Toute cette region constitue, avec petites interruptions, un vast champ de glossines, mesurant plus de 300 kilométres carrés de surface. Dans le sens paralléle á la côte ce champ commence un peu aprés du fleuve Lycungo, puisqu'il y a déjà des glossines dans l'aringa, á Villa J. Coutinho, et on dit de les avoir vu dans la route de la Maganja, entre le Lycungo e l'aringa, et se prolonge au dela du N'pyode, á 60 kilométres de Villa Coutinho. Pour l'intérieur outrepasse la confluence du Lugella avec le Lycungo, et embrasse encore une partie considérable des territoires de la concession du Lugella.

Toute cette région est couverte de forêt presque partout assez dense et avec abondante végétation arbustive.

Les chaumiéres des indigénes se trouvent répandues dans la forêt et sont trés frequentées par les glossines. Le nombre des glossines qui poursuivent partout le voyageur est vraiment prodigieux et c'est grande la peine qu'elles lui produisent.

L'éspéce la plus abondante c'est la morsitans, mais pour l'intérieur de la Maganja, dans la route de Mocubella a Mugeba, dans une zone pauvre en eau, avec haut foin (capim) et assez séche, peuplée d'arbres rares et chétives, j'ai vu quelques exemplaires de Glossina fusca; l'éspéce est toutefois assez rare et existait á côté de la morsitans.

Nous avons obtenu plusieurs espéces de Tabanidae dans toute la Zambézie portugaise. Ont été classées les suivantes: Tab.taeniola, Tab. par, Tab.ditaeniatus, Tab.africanus, Tab.fraternus, Tab.biguttatus et Tab.gratus; trois autres espéces n'out été classées.

Les Hematopota sout trés frequentes dans la Muchêna, au Nord de Tete et dans tous les affluents du Chirisse; nous avons collectioné huit ~~quatre~~ éspéces dont nous doutons la classification.

Les Pangonia abondent dans le Nord du district de Tête, entre les fleuves Chirisse et Capoche; nous en avons obtenu trois éspéces.
Les Simulium nous ont apparu en nuages sur le Zambéze, depuis la Chicôa jusqu'en amont de la Cachomba. Phlebotomus sont trés communs partout. Les Stomoxys sont aussi vulgaires, mais l'espéce calcitrans est presque la seule.
Les chaumiéres des naturels sont presque partout invasées par les larves hematophages de l'Auchméromyia lutéola qui se montrent parfois dans un nombre prodigieux. Le fait est vulgaire autant dans la Zambézie Inférieure que dans la Supérieure (Tête).
L'Ornithodorus moubata est de haute fréquence dans la Zambézie Inférieure, ou la fievre récurrent (Tick fever) fait des ravages importants. A Tête le parasite est aujourdhui assez rare, bien que autre-fois la ville a été régardée comme un grand foyer de la fiévre du carrapato.

L'inspection médical des populations indigénes de la Zambézie Supérieure, ne vous a pas montré rien de positif. Faute de temps et la tâche de parcourir de grandes extensions, ne nous a pas permis de faire des examens méthodiques. Nous avons vérifié que les engorgements ganglionaires du triangle cervical postérieur sont trés vulgaires dans les enfants et dans les adolescents, mais rares dans les adultes. Ces pleiades ganglionaires paraissent avoir son origine dans des lésions et infections diverses du cuir chévelu, qui sont de courante observation dans les prémieres âges. Dans les adultes on trouve surtout des grossissements ganglionaires á l'aine, presque toujours en correspondance avec plaies et infections des extrémités inférieures produites par la marche á pieds nus. Quelques cas de tumefactions ganglionaires du cou s'expliquaient par des caries et infections dentaires.
Les examens microscopiques du sang en quelques cas suspects, ou en maladies mal définiès, ont été négatifs. Dans ces cas iln'y avait pas des ganglions qui se prêtaient á l'examen du jus.
Dans la Zambézie Inférieure on voit souvent une forme clinique attenuée de la fievre récurrent qui se manifeste par un grand assoupissement; c'est un syndrôme curable dans un court délai, et qui maintes fois signale la phase inicial de l'infection.
Les deux indigénes qui out mouru dans le territoire anglais avec la

maladie du sommeil,l'un á Blantyre et l'autre á Kota-Kota,á propos desquels on a suspecté de la Zambézie portugaise,il parait que n'aut pas contracté ici l'infection. Le prémier des deux était un naturel de l'Angonie portugaise qui avait l'habitude d'aller dans les dernié res années chercher emploi pour Blantyre et qui avait été á la fabri que de sucre de Mopêa peu de temps avant de mourir á l'hopital de Blantyre. Le plateau de l'Angonie,oú il avait sa demeure,c'est une région sans glossines,et dans la Mopêa les recherchers entreprises par Mr. le médicin de la compagnie out été également négatives á ce propos. Étant connu que l'emploi préféré par les angonis qui vont chercher travail pour Blantyre c'est celui de chargeurs,et qu'ils visitent frequemment dans sa tache la rivage Sud du lac Nyassa,il no us paraitra plus vraisemblable que cet homme ait acquis sa maladie au lac. Il est singulier que sa femme que d'habitude le suivait dans ses voyages au Nyassaland,sans jamais avoir allé á Mopêa,a mouru dans sa village,et selon racontent ses parents d'une maladie que l'attenait dormant le plus du temps.

Le malade de Kota-Kota avait parcouru dans les derniéres années de sa vie Fort Jameson,Tete et Sassare;peu de temps aprés avoir retourné de Sassare,ou s'employait dans une mine d'or,á sa village,quelques heures éloignée de Kota-Kota,il a éprouvé les prémiéres manifés tation de la maladie,dont le diagnostic a été fait á l'hopital de celieu. Puisqu'on connait aujourd'hui l'infection de la vallée de l'Aruangua et des rivages du Nyassa,il est facile de croire que l'un ou l'autre de ces lieux out été le point d'origine de la maladie; Sassare demeure prés la vallée de l'Aruangua et Kota-Kota dans le Nyassa. Le soupçon sur le territoire portugais ná,en effet,grande raizon pour étre soutenu,á l'heure actuelle.

Les mouvements migratoires produits actuellement dans l'Afrique Centrale,et qui peuvent avoir influence dans la pathologie de la Zambezie portugaise,se font ordinairement du Nord, pour le Sud, occasionant le déplacement des populations de la Rhodésie du Nord,du Nord'Est et du Nyassaland vers les régions auriféres de la Rhodesie du Sud,Transvaal,et encore pour les explorations agricoles de la Zam

maladie du sommeil,l'un á Blantyre et l'autre á Kota-Kota,á propos desquels on a suspecté de la Zambézie portugaise,il parait que n'aut pas contracté ici l'infection. Le prémier des deux était un naturel de l'Angonie portugaise qui avait l'habitude d'aller dans les dernié res années chercher emploi pour Blantyre et qui avait été á la fabri que de sucre de Mopêa peu de temps avant de mourir á l'hopital de Blantyre. Le plateau de l'Angonie,oú il avait sa demeure,c'est une région sans glossines,et dans la Mopêa les recherchers entreprises par Mr. le médicin de la compagnie out été également négatives á ce propos. Étant connu que l'emploi préféré par les angonis qui vont chercher travail pour Blantyre c'est celui de chargeurs,et qu'ils visitent frequemment dans sa tache la rivage Sud du lac Nyassa,il no us paraitra plus vraisemblable que cet homme ait acquis sa maladie au lac. Il est singulier que sa femme que d'habitude le suivait dans ses voyages au Nyassaland,sans jamais avoir allé á Mopêa,a mouru dans sa village,et selon racontent ses parents d'une maladie que l'attenait dormant le plus du temps.

Le malade de Kota-Kota avait parcouru dans les derniéres années de sa vie Fort Jameson,Tete et Sassare;peu de temps aprés avoir retourné de Sassare,ou s'employait dans une mine d'or,á sa village,quelques heures éloignée de Kota-Kota,il a éprouvé les prémiéres manifés tation de la maladie,dont le diagnostic a été fait á l'hopital de celieu. Puisqu'on connait aujourd'hui l'infection de la vallée de l'Aruangua et des rivages du Nyassa,il est facile de croire que l'un ou l'autre de ces lieux out été le point d'origine de la maladie; Sassare demeure prés la vallée de l'Aruangua et Kota-Kota dans le Nyassa. Le soupçon sur le territoire portugais ná,en effet,grande raizon pour étre soutenu,á l'heure actuelle.

Les mouvements migratoires produits actuellement dans l'Afrique Centrale,et qui peuvent avoir influence dans la pathologie de la Zambezie portugaise,se font ordinairement du Nord, pour le Sud, occasionant le déplacement des populations de la Rhodésie du Nord,du Nord'Est et du Nyassaland vers les régions auriféres de la Rhodesie du Sud,Transvaal,et encore pour les explorations agricoles de la Zam

bézie Inférieure. Le sens de ces mouvements est particulierement favorable á la diffusion de la maladie du sommeil dans le Zambéze; celle-ci,déja fixée dans l'Aruangua et dans le Nyassa,ménace incessa ment d'invaser la vallée du Zambeze et son delta,aprés avoir transpo sé la division des eaux du Congo et du Zambeze.

C'est vrai que la plus grande facilité des routes et des chemins de fer de la Rhodésie ont détourné le transit qui avait lieu peu dans prés á travers le district de Tête selon la plus courte distance,mais á present il y persiste comme un dangereux attonchement celui des émigrants pour Salisbury dans sa passage á travers l'angle Nord-Est du district de Tête,avant l'inspection á la Feira,et la traversée po ur Tete des gens contractées au Nyassa pour le Transvaal,sans compter les mouvements irréguliers á travers la frontiére.

Les sérviteurs pour la Zambézie Inférieure et pour la Compagnie de Moçambique,sout fréquemment importés de l'Angonie et du Nyassaland, et prennent ordinairement le chemin de Blantyre,Chire Inferieure et Zambeze pour se rendre á sa destinée. Cette courant migratoire se passe sans une inspection médicale réguliére. Quelques entreprises ont son medicin privatif mais ses observations ne sont pas en général communiquées á les autorités sanitaires.

La situation présente de la Zambézie portugaise se rapportant á la maladie du sommeil,on peut la résumer ainsi: dans le district de Tête l'importation de quelques cas de l'infection á travers la frontiére du Nord étant presque inevitable,ses conditions régionales,á cause la rareté des aires de glossines et de son absence á la vallée du Zambéze,ne paraissent trés favorables á une large propagation de la maladie;á Quilimane, les immigrations réguliéres qui ont lieu dans le district pourront étre soumises á une vigilance sanitaire assez rai sonable,mais par contre l'importance et la grande extension des aires de glossines et d'autres circonstances de milieu,rendent plus redoutable une invasion épidémique,dés que les espéces morsitans et fusca se montrent aptes pour la propagation de la maladie.

Les mesures que nous avons proposé regardent surtout l'empéchement de l'entrée dans le territoire portugais des noirs originiraires des régions limitrophes infectées et cherchent á reussir une certaine vigilance des populations indigénes de maniére que soit possible d'avoir connaissance de tous les faits anormaux touchant le sujet.

Á l'égard de la prémiére partée nous avons conseillé la limitation ou même la prohibition de l'enrolement á Tete pour le Transvaal des indigénes venus du Nord, du Nyassaland, la prohibition de la traversée pour la région portugaise de l'Aruangua des émigrants pour la Rhodesia du Sud avant l'inspection médical qui a lieu á la Feira, le réglement de l'usage de chargeurs des colonies voisines dans la Zambezie portugaise et l'inspection médicale obligatoire et officiel des serviteurs contractés dans le Nord pour les exploitations de la Zambézie Inférieure et Compagnie de Moçambique.

La seconde partie, attendu que le personel médical est á présent insuffisant pour pourvoir les postes de l'interieur, notre avis c'est qu'on peut approcher indirêctement le but par l'inspection officiel et rigoureuse des indigénes contractés pour le Transvaal, venus de differents points de l'interieur, dans le siége des délégations de santé, et directement par la diffusion de postes d'infermiers dans les régions ménacées, possédant des instructions spéciales et une certaine apprentissage sur les symptômes précoces de la maladie, sur les procés de faire des récoltes pour les recherches microscopiques et sur les caractéres de la tsé-tsé; les missions pour l'enseignement et la catechése, les chargés de l'autorité, les chefs des circunscriptions et les rentiers des prazos, pourraient aussi étre des aides précieux pour le renseignement des autorités sanitaires.

L'organisation des reserves de gibier dans des aires deshabitées et sa libre poursuite aux autres lieux, surtout la chasse des grands antilopes et des bovines sauvages, out été pointés comme des mesures d'une certaine importance pour méttre les populations indigénes á l'abri des invasions de la tsé-tsé.

Certainement d'autres mésures devront étre mises á la pratique lors d'une invasion de la maladie, comme les déboisements, le déplacement des populations des aires de glossines et bien d'autres, mais pour le moment il nous a paru que le plus important et éxecutable serait la limitation des mouvements dangereux et la surveillance, tant soit possible compléte, des immigrants et des peuplades indigénes.

Further Medical Report

on the

Gonja District, Northern Territories,

with special reference to

Sleeping Sickness and Tsetse Flies.

With Compliments
from F. J. A. Beringer
Medical Officer, W. African Med. Staff
Salaga, Gold Coast.

FURTHER MEDICAL REPORT ON THE GONJA DISTRICT, NORTHERN TERRITORIES, WITH SPECIAL REFERENCE TO SLEEPING SICKNESS AND TSETSE FLIES. (SOUTH-EAST AND EAST)

I. This report should be read in conjunction with my "Medical Report of a tour through the Centre and West of the Gonja District with special reference to Sleeping Sickness" dated the I4th of March ~~1920~~ 1910.

2. The present report is the result of a tour of ten days' duration from the I2th. to the 2Ist. of April - through the South-eastern and Eastern portions of the district: the distance covered was about I80 miles.

3. The conditions found confirm the conclusion, previously arrived at, that Sleeping Sickness is, and has been, wide-spread throughout the Gonja district.

4. The ~~conditions~~ rough sketch map (Appendix A) indicates the routes of both the present and the previous tour. Information is given similar to that on the map attached to the previous report. (See para.3 of that report.)

SANITATION.

5. Little need be added under this head: most villages were again found to be generally very dirty. Pit latrines were more used. The water in villages near the Daka River was naturally plentiful and of better quality: but in several instances it was found that rather than go to the river for clear water the Natives would use the muddy water from some filthy animal and man polluted water-hole if it happened to be a little nearer the village.

6. Makongo, Bulumpe, Masaka and Dogonkade were inspected with the special object of seeing how far the instructions given at my previous visit (see paras. 6&7 of my first report) had been carried out. Little or nothing had been done. (The chiefs or headmen of these villages have now been summoned before the District Commissioner, convicted and fined.) This is a good example of the futility of

expecting even simple elementary sanitary measures to be carried out in the villages of this district unless subsequent visits are made. That my instructions were fully understood is well illustrated by the fact that in 3 out of the 4 villages named hasty measures to carry out these instructions were taken as soon as it could have been known that I should go again. In one village quite newly cut posts had just been placed in position as sign posts for rubbish heaps and a few handfuls of fresh sweepings deposited! The deception was obvious!

7. The District Commissioner has promised his hearty co-operation by inspecting the villages through which he may pass and punishing the chiefs & headmen who have not carried out my instructions.

SMALL-POX.

8. As during the previous tour, no case of Small-pox was seen or reported.

9. The epidemic of last year extended to Kuri on the Makongo-Pajai road and to Dindumpe, Latumpa & Kadenge, villages North-east of Degankade and near the river Daka.

IO. At the other villages passed through, with the exception of Sabungida, where it was said that the disease had never been, Small-pox was said to have prevailed "long ago" or not since periods variously stated to be 5 to more than 20 years ago.

SLEEPING SICKNESS.

II. Once again it is necessary to emphasize the difficulty of obtaining reliable information in regard to Sleeping Sickness. Without doubt it is due to the desire of the Natives to conceal their knowledge of the existence of the disease, present and past, due no doubt, and naturally, to fear of possible unpalatable measures that may be taken by the White Man. Most emphatically it is not due to ignorance of the disease: the more prominent symptoms are well known - they have been graphically described to me - and

the Natives rightly fear it. A good example of barefaced lying in this connection is given in para. I4 of my first report.

I2. Such positive evidence as I have been able to collect is consequently in all probability reliable at least so far as the existence of the disease is concerned: numbers and dates are necessarily unreliable as these factors are beyond the comprehension of the illiterate Natives of this district. Statements to the effect that there is or has been no case of Sleeping Sickness in a village is of no value whatever. I may instance that on my arrival at Mabum I was told by the chief that he knew the disease but that there had been no case in his village. The constable who accompanied me then informed me that he thought he had seen two cases in the village on a previous occasion. When taxed the chief produced both cases though I had to wait more than two hours for one of them.

I3. In Appendix C. is given a list of villages visited during the two tours, in which Sleeping Sickness was reported or found, together with the source and nature of the information obtained. A few villages are included in which Sleeping Sickness was reported though they were not visited. (See also the map attached.)

I4. The following figures do not include Sangrawla Tamale nor Yamalaga as these places are not in the Gonja district and observations were not made there. One or two of the villages immediately to the South-west of Sangrawla are also, I believe, not in the Gonja district but as they are on a direct road out of that district and not on any main road in the Tamale district to which, I believe, they belong and as they form a continuation of the chain of villages in which I had made my observations they are included in my report.

No. of villages visited & examined: 44

- - - in which Trypanosomiasis reported: I5

- - - - - - found: 5

One case was found in each of the villages: in 4 of the cases no clinical symptoms were noticed but Trypanosomes were found: in the other case the symptoms of Sleeping Sickness were evident but Trypanosomes were not found in the single blood film taken. A 2nd. but doubtful case of Sleeping Sickness was shewn in the same village.

I5. A large number of deserted villages were found in various stages of ruin, from these recently deserted, in which walls were still more or less perfect, to those which must have been left many years ago and in which the only traces observed were rubbish heaps with remains of pots and other native domestic utensils together with suspicions of cleared areas and of mounds on which once had stood huts. Disease and wars were the reasons generally given for the desertion of these villages. They are at least significant of the former existence of some virulent disease though no evidence could as a rule be gatherd as to its nature. It seemed especially pathetic to find traces of what was evidently a thickly populated area between Krupi and Kyaire in what is now, and is shewn as such on the Ordnance map, uninhabited bush. Two ruined villages a little to the West of Butuku were definitely stated to have been deserted on account of Sleeping Sickness and the people were said to have migrated to Mabum, the village in which 2 cases of Sleeping Sickness were shewn to me. It must however be remembered that along the Anglo-German frontier it seems to be a not uncommon occurrence for a whole village to migrate from either to the other side of the border and that the whole community will sometimes do so more than once, backwards and forwards.

I6. If it is admitted, and I think the evidence is sufficiently strong, that the disease is and has been wide-spread throughout the district and in view of the wide-spread prevalence of Glossina palpalis one cannot but be struck with the fact, especially on comparison with the epidemic in Uganda with its enormous death rate, that there

appear to be so few cases and that they are mostly isolated cases although the disease is of such long standing and is still so wide-spread.

17. I suggest that at an earlier period the disease began in a virulent form but that in the course of time it has become attenuated either through a gradual diminution of the virulence of the organism or through an increased immunity of the survivors. That a disease newly introduced into a community may be of enormously greater virulence than when it is habitually present is well known: though not strictly comparable, one may yet instance the case of Measles. On the other hand the possibility of infection through some channel other than that of the Tsetse fly must not be lost sight of. Has it been proved that Glossina palpalis var. wellmani can convey the Trypanosoma gambiense as well as the typical G. palpalis?

CLINICAL AND BLOOD EXAMINATIONS.

18. In every village all sick were asked for but in nearly every case it was denied that there were any sick at all, a statement that was generally found to be untrue. The huts were then visited and all the sick who could be found were examined and the cervical glands of many of the apparently healthy were palpated. In some villages where there appeared little doubt that Sleeping Sickness had existed an endeavour was made to see all the inhabitants: the majority were generally found. But it can be readily understood that with the time at my disposal - an average distance of about 18 miles was covered daily and 2 or 3 villages visited besides search being made for Tsetse flies at many pools and other places - not more than a very casual examination was possible. The object of the tour was not to make an exhaustive and systematic search for all cases of Sleeping Sickness but rather to gather information as to whether the disease existed at all and if so as to the

likelihood of its being wide-spread. That object has, I think, been achieved: a preliminary survey has been made and the way paved for a more systematic and thorough examination.

I9. In most of the villages a large proportion - my impression is a majority, though no statistics were kept - of those examined had palpable cervical glands but it was especially noticeable in Latumpa and Dindumpe where many had hard palpable enlarged glands though in no case did I find sufficient enlargement to be readily discernible to sight alone. It seems unlikely that all these persons, nearly all of whom appeared well, are suffering from Trypanosomiasis: for if it were so one would expect to find more cases in the later stages of the disease (i. e. Sleeping Sickness); for the disease is certainly not of recent introduction (see Appendix C. etc.). One would also expect to find Trypanosomes in a greater proportion of the blood films. That any considerable number of cases of Sleeping Sickness were removed and concealed also seems unlikely. The conclusion is forced on me that a very large number have enlarged cervical glands who are not suffering from Trypanosomiasis. Further investigation is however required before any definite conclusion can be arrived at.

20. The finding of such a large proportion of the inhabitants with enlarged cervical glands is in marked contrast to what I found during the previous tour when comparatively few individuals were met with who had easily palpable glands: I am unable to offer any explanation for this though it is of course just possible that with constant practice perception became more acute so that I was able to detect glands which before would have escaped notice: I do not however think that this is the explanation.

2I. Blood was taken from the fingers of 66 persons from I4 villages. Those having the most easily palpable cervical glands were chosen; a finger tip was well cleaned with methylated spirit, the needle sterilized

with carbolic acid; one or two drops of blood were caught on a slide and the blood spread out with the needle. On returning to Salaga the films were fixed in absolute alcohol and stained in Eosin-Azur (Burroughs, Wellcome & Co's ½ Tabloids).

22. Appendix D. gives details of the blood films collected during this and the previous tour. Striking features are the frequent occurrence of Microfilaria perstans and the number showing excess of eosinophile corpuscles and absence of polymorphonuclear leucocytes. Trypanosomes were found on 4 slides from 4 different villages.

23. If the films from the 2 individuals who were stated to be suffering from Sleeping Sickness be excluded, it will be seen that 5.3% of persons with palpable glands but without clinical signs of Sleeping Sickness were found at a first examination to harbour Trypanosomes. Taking into consideration the undoubted endeavours of the inhabitants to conceal cases of Sleeping Sickness, the haphazard method of choosing those from whom blood was taken - there was no selection of cases except only as far as palpable cervical glands were concerned and such glands were apparently of little use as guides to Trypanosomiasis at least during the second tour when 6/7 of the slides were taken - and the difficulty of finding Trypanosomes in peripheral human blood, the finding of Trypanosomes in over 5% of cases is significant of the wide-spread prevalence of Trypanosomiasis.

24. With regard to agglutination it was found that none usually took place in those portions of the film that were thin and dried rapidly. On the other hand in the thicker portions which did not dry so quickly and in which a certain amount of flow took place after the blood had been spread (the films were generally placed in a slightly sloping position immediately after they were taken) the coarsely granular appearance of the blood was very noticeable: the dark clumps could easily be distinguished with the naked eye in the pale coloured serum.(See also Note 2, Appendix D.)

25. From the limited number of observation made it does not appear that there is any relation between clumping and the presence of Trypanosomes or Microfilaria perstans or of an excess of eosinophile corpuscles.

26. I have made a few further observations in apparently healthy individuals: the difference in the behaviour of the blood on the slides is most marked. The finger is cleaned with methylated spirit, the needle passed through a flame and the finger pricked: 2 drops of blood are expressed and taken up by the slide: the blood is then spread with the needle and the slide kept in motion in such a way that the blood at one end of the film is made to flow round and round in a circle. On one slide the blood continues to keep its finely granular appearance until dry, in another, clumps, easily distinguished by the naked eye, are rapidly formed.

27. At Mabum I saw 2 persons who were said to be suffering from Sleeping Sickness. One, a male adult, is, I think, undoubtedly suffering from the disease: he is emaciated and just able to walk with the aid of a stick, he is dull and listless, he either takes no notice when spoken to or only after a good deal of shouting. He said that he had pains all over him. The cervical glands are just palpable. The knee jerks were absent. The second was a boy whose father is said to have died of Sleeping Sickness; he seemed well, he had been working in the fields. It was said that some time ago he used to fall asleep anywhere and at all times but that of late he had much improved: he had not been given any medicine. The cervical glands were somewhat hard and enlarged. Trypanosomes were not found in either of these cases.

RECENT HIGH DEATH RATES.

28. I could hear of no high death rates within recent years such as I found during my earlier tour (see paras. 26 & 27 of that report). At Krupi there were said to have been many deaths (""sick for belly, head and back")

IO years ago.

HORSES.

29. The information obtained as to whether horses die or can live in the various villages is again given on the map.

TSETSE FLIES.

30. 95 Tsetse flies collected during the tour are classified in Appendix B.

3I. In a considerable number of villages along the Daka River it was reported that the flies were not usually found in the village but only at the "water-side": this being the river in most instances. It was also stated that the flies would follow the water carriers and so be at times brought into the village but that they usually went away again.

32. It was generally stated that during the rains the flies were much more numerous: at the time of my visit the country was still very dry though not quite to the same extent as during the previous tour when pretically no rain had fallen for 3 months. There had been some tornadoes, consequently stagnant water was met with here and there especially along the courses of the numerous streams which intersect the flat country of this district and which during a great part of the year are quite dry: nor had marshes yet formed.

33. On examining Appendix B and the corresponding classification attached to the previous report it will be seen that G. morsitans is nearly always found alone whereas G. palpalis v. wellmani and G.tachinoides are nearly always associated. The country in which the first named was found did not seem to differ from that in which the other two species were caught.

34. A series can be constructed from amongst the specimens in my collection in which there is an almost imperceptible gradation of the more prominent characters - that is to say size and general appearance (depth of

colour), colour and markings on legs, abdomen, thorax, etc.- from the typical G. tachinoides to the type of G. palpalis which I find most common in the district and which Mr.Austen kindly informs me is intermediate between G. palpalis and G. palpalis var. wellmani.

CONCLUSIONS.

35. The conclusions arrived at are

(1) Sleeping Sickness is wide-spread throughout the district.

(2) It is in an endemic rather than in an epidemic form.

(3) Glossina palpalis var. wellmani is wide-spread throughout the district.

(4) On account of conditions (1) & (2) there is danger of an epidemic of Sleeping Sickness at any time.

(5) For the same reasons Sleeping Sickness is probably constantly being spread by travellers to other parts.

(6) It is an urgent necessity to stamp out the disease.

RECOMMENDATIONS.

36. There can of course be no separate policy for dealing with Trypanosomiasis in this district. Prophylactic measures must conform with the general scheme that will, I presume, be put into force as soon as the distribution of the disease in the Colony as a whole and its concomitant conditions are more fully known. I restrict myself therefore to putting forward suggestions that appear to apply especially to this district.

37. I must however insist upon the extreme urgency of the situation, upon the certainty that cases of Trypanosomiasis are constantly being brought into being in this district and sent forth into all parts of Africa, upon the ever lurking danger of originating wide-spread epidemics and, in consequence, of the necessity of putting into force preventive measures at the earliest possible moment.

38. Evacuation is an impossibility: Glossina palpalis wellmani is found practically everywhere: the whole district would have to be evacuated.

39. Extermination of the flies is equally impossible.

40. A Sleeping Sickness camp seems to me to be the first essential: here all known cases should be collected : the patients would be encouraged to bring with them their relatives: farms should be started and the camp be made self-supporting. Ordinance No. 2 of 1908 amended by No. 7 of 1909 gives the necessary powers though the utmost endeavours should be made to induce sufferers to come in voluntarily.

41. The utmost care must be taken in choosing a site for such a camp: there must be an ample water supply; there must be no possibility of fly infection. I believe that such a site can be found near Salaga. I have never seen a Tsetse fly in Salaga, in the European quarters or in the constabulary lines. (The European quarters and the constabulary lines are rather more than half a mile to the North-east of the town) Nor have I been able to find any constable or clerk or any of the townspeople who have seen a Tsetse fly in any of the places named. On the other hand I saw a Tsetse fly at the end of last year's exceptionally heavy rains on the Yeji road to the South-west of the town and within 50 yards of the nearest hut. I am now making enquiries at the neighbouring villages as to the existence of the fly.

42. Salaga would be a convenient site for a camp as it is central and being the headquarters of the district the Medical Officer would easily be able to supervise the camp.

43. It is necessary for the whole district to be thoroughly and systematically examined for Trypanosomiasis. For reasons already given (previous report para. 35, a) the Medical Officer is not able to satisfactorily undertake this

work. A Medical Officer who can devote the whole of his time to the work is essential: he would, besides examining every individual at every village, undertake any prophylactic measures that seemed necessary; such as clearing bush round ferry landing places and round the villages and water supplies. He should have powers sufficient to compel all chiefs and headmen to carry out the ordinarry sanitary measures necessary. He could not be expected to send recalcitrant chiefs together with the necessary evidence to the District Commissioner's court perhaps a week's journey away.

44. It is difficult to say how long such a systematic examination of the population of this district would take: I presume from three to six months: it would probably not be necessary to go over the same ground again for two years if all Trypanosomiasis cases were brought to the camp and if occasional flying visits were paid by the Medical Officer stationed at Salaga.

45. I also recommend that a second native subordinate of the Medical department be attached to the district in order that one could constantly be travelling from village to village. It should be his duty to make enquiries as to sickness, see that areas ordered by the Medical Officer to be kept cleared were so kept; he could vaccinate when necessary and generally carry out the duties of a Sanitary Inspector. Without such constant supervision the Natives will not carry out any sanitary measures to which they have not been accustomed from time immemorial.

46. It need hardly be pointed out that the Medical Officer undertaking such duties himself runs considerable risk of becoming infected: he should therefore be provided with some travelling fly proof shelter fitted to withstand the exceptionally violent tornadoes of this district and equally to keep out, as much as possible, the heat of the sun during the dry season and in which he could not only

live but undertake his laboratory work with some degree of comfort.

J. Bentley.

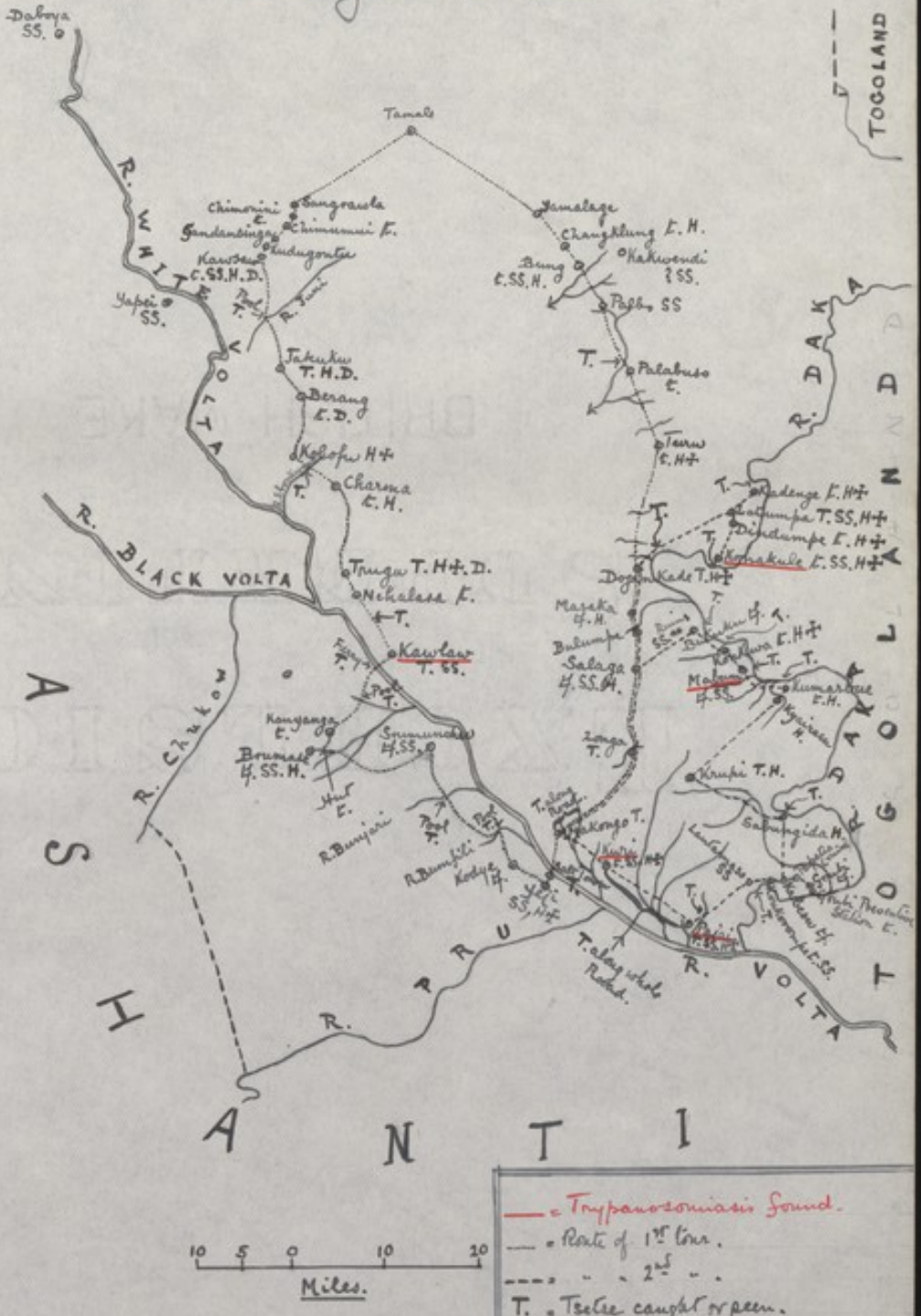
Medical Officer.

SALAGA,

30th. ~~April~~ May I9I0.

Appendix A.

Map of the Gonja District, Northern Territories, Gold Coast, showing the routes followed.



— = Trypanosomiasis found.
— = Route of 1st tour.
---- " " 2nd " .

J. Beringer
M.O.
Salaga 30/5/10

Appendix B.

Classification of Glossinae caught during a tour through the South-East and East of the Gonja District from the 12th to the 21st of April 1910.

Date	Place where caught (Refer to map Appendix A)	Time	G. palpalis ♂	G. Palpalis v. wellmani ♂	G. Palpalis v. wellmani ♀	G. Morsitans ♂	G. Morsitans ♀	G. Tachinoides ♂	G. Tachinoides ♀	Total
12 4/10	Pool: stream bed near large Gonja: about ½ way Salaga & Makongo	11.0 a.m.					1			1
"	Pool: Salaga-Makongo road	1.45 p.m.		1				1		2
"	Salaga-Makongo road: near Makongo no water seen	2.20 p.m.					1		1	2
"	Pool & Stream S of & near Makongo = Makongo water side	afternoon			1			1		2
"	— do —	late p.m.						1		1
"	— do —	4-5.30 p.m.	1	1				2	1	5
"	Makongo	5.30 p.m.		1						1
13 4/10	Pool: Kuri-Pajai road: little beyond Kuri	11.20 a.m.						2		2
"	Kuri-Pajai road: no water seen	12.15 p.m.				1				1
"	" " " : pool: Streambed	1.15 p.m.					1			1
"	" " " : near Pajai	4.50 p.m.				1				1
"	Pajai	late p.m.					2			2
14 4/10	Pajai Gruli road: near Pajai	early a.m.					1			1
15 4/10	Sabungida water side (= R. Daka)	9.30 a.m.			1			2	1	4
16 4/10	Krupi " " (Bagent hole)	early a.m.				2	1			3
"	Kumabue " " (= R. Daka)	early p.m.			2			3	5	10
17 4/10	Mabum " " " "	early a.m.		5	3			1	1	10
"	Konkwa " " " "	midday		11	5			2	1	19
"	Butuku " " "	early p.m.		2	2			2		6
18 4/10	Dogankade " " "	late forenoon		1				7	3	11
19 4/10	Dogankade Latumpa road: near R. Daka	7 a.m.							1	1
"	Latumpa water side: stream bed just camp	midday		2				2		4
"	Kadenge water side (= R. Daka)	2-3 p.m.		1	1					2
20 4/10	Konakuke ~~Gbat~~ " " " "	9.15 a.m.		1					2	3
		Totals:	1	26	15	4	7	26	16	95
			1	41		11		42		

Appendix B.

Notes. 1. By "stream bed" is meant the bed of a stream that is only flowing during part of the rainy season. At the time of my visit these stream beds were dry except for a few pools here and there.

2. A Zongo usually consists of temporary huts used by passing travellers for a single night: there are as a rule no permanent inhabitants.

3. By "water side" is meant the place from which water is obtained whether river, pool, well or other source.

4. In the classification of Glossinae caught during the previous tour (Appendix B of the 1st report) for G. palpalis read G. palpalis v. wellmani. Mr. E. E. Austen has kindly pointed out to me that the specimen — a typical one is of those in my collection — sent to the Director of the Sleeping Sickness Bureau was intermediate between G. palpalis and G. palpalis wellmani. He also very kindly sent me a typical G. palpalis: I am therefore able to state with some confidence that there is only one typical G. palpalis in my collection, the one caught at Makongo water side.

Appendix C.

Villages in which Sleeping Sickness was found or is stated to have occurred.

Village	Informant	Information
Yeji	Hospital record	1 man of Gold Coast Regiment invalided in 1906: he died in Yeji later.
	A sub-chief	2 deaths 6 years ago (Yeji people)
Sramunchu	Chief	1 death many years ago (native of Srumunchu)
Bruemase	Chief	some deaths 10 or more years ago (Kawlaw people)
Akamade (not visited)	Chief of Srumunchu	2 deaths 4 years ago
Kawlaw	Chief of Kawlaw	3 " 3 " " " many deaths before:
	and numerous neighbouring villages	many people left on account of the disease.
Yapei (not visited)	Chief of Kawlaw	2 cases from Kawlaw: 1 died 2 years ago, the other alive + well (old man)
Kawsaw	Chief	1 death many years ago
	Chief of Chinumui	1 " 5 " " (not Kawsaw man)
Daboya (not visited)	Chiefs of Kawsaw and Palbo	the disease at Daboya: Chief of Kawsaw said saw 1 case die many years ago.
Bung	?	disease exists or has existed.
Kakwendi (not visited)	Chief of Latumpsa	see Latumpsa
Palbo	" " Masaka	1 death 4 years ago
Kuri	Chiefs of Kuri and Makongo	1 " 3 weeks " : Chief of Kuri stated 5 deaths 4 years ago: Chief of Makongo saw 2 cases 1 year ago (all Kuri people)
Pajai	Chief	1 death 1 years ago (10 years old: native of Pajai)
	Chief of Kuri	2 deaths
Cantamaso	Chief	1 death 3 years ago (Native of Village)
Konkorompe	Chief	in grandfather's time when Village on German side of frontier.
Mabum	Chief	3 deaths 3 years ago: I saw 2 cases here

Village	Informant	Information
		(1 doubtful) (Mabum people)
Deserted Village to W. of Butuku	Chief of Butuku	Many deaths many years ago: people went to Mabum (q.v.)
Latumpsa	Chief of Latumpsa and Turu	1 woman died 3 years ago: came from Kakwendi
Konakule	Chief	denied that disease ever here: I found Trypanosoma here.
Salaga	Chief of Dogankade	1 death (Salaga man)
	" " Kodye	1 case seen 12 years ago.

Notes. 1. Trypanosoma gambiense was found in villages underlined except in Mabum where in a definite case of Sleeping Sickness the trypanosome was not found on the slide taken.

2. The villages are placed in the order in which they were visited (See the map.)

3. The word "chief" means the chief man of the village whether a recognized chief or only a headman.

4. The figures given by the various informants are unreliable but the fact that Sleeping Sickness has occurred is in all probability correct. (See paragraphs 11 and 12.)

Appendix D.

Blood Films obtained during two tours through the Gonja District.

Series Number of Slide	Date taken	Village	Name	Sex (M)(F) = under 14	Trypanosomes	Excess of Eosinophiles	Microfilaria perstans	Agglutination	Cerv. Glands palpable	Remarks
I. 1	19 9/10	Kawlaw	Alpwodi	M		+	+		+	
2.	"	"	Mama	M		+	+		+	
3.	"	"	Mariama	F	+		+		+	See note 4.
4.	"	"	Howa	(F)		+			+	
5.	"	"	Adisa	(F)		+			+	
6.	"	"	Mama	(M)		+	+	+	+	
7.	"	"	Isufu	(M)		+			+	
8.	"	"	Ata	(M)		+			+	
9.	"	"	Saibu	M		+			+	
10.	"	"	Hawa	F		+			+	Blind 4 yrs: pupular rash 1 year.
11.	20 9/10	Charma	Cheobuni	M		+	+			"Sick all over" 11 months: first bitten by snake: tremors of hands
II 1	13 4/10	Kuri	Akosua	F		+	+		+	
2	"	"	Akua	F		+	+	+	+	
3	"	"	Abena	F		+	+	+	+	
4	"	"	Salifu	M		+			+	
5	"	"	Yawa	F		+	+	+	+	
6	"	"	Abena	F		+	+	+	+	
7	"	"	Ajua	F		+	+		+	
8	"	"	Lantaga	F	+	+	+	+	+	
9	"	"	Muimali	(M)		+	+		+	Eosinophiles very numerous
10	"	"	Bukare	M		+	+		+	
11	"	"	Saka	M		+	+		+	
12	"	"	Mama	M					+	
13	"	"	Alasan	M		+	+		+	
14	"	"	Esumana	M		+	+		+	
15	"	Pajai	Kwabina	M		+		+	+	Eosinophiles very numerous. Father of child who died of Sleep? Sickness" "all body sick" 7 months: Emaciated

Series & Number of Slide	Date taken	Village	Name	Sex & (E) if under 14	Trypanosomes	Excess Eosinophiles	Microfilaria perst.	Agglutination	Cervical Glands palpable	Remarks
II 16	13 4/10	Pajai	Ajua	F		+			+	Mother of same child
17	"	"	Abena	(F)		+		+	+	Sister - - " Eosinophiles very numerous
18	"	"	Kofi	(M)		+		+	+	Brother of same child: Eosinophiles numerous.
19	"	"	Kwaku	M		+		+	+	
20	"	"	Akweshi	(M)	+	+	+	+	+	
21	"	"	Kofikuma	M			+	+	+	
22	"	"	Kwakukuma	(M)		+	+	+	+	
23	14 4/10	Lantamaso	Kwabina	(M)		+			+	many Small hard glands
24	"	Konkoampe	Ya	F		+		+	+	
25	15 4/10	Sabungida	Akwasi	M		+			+	4 Yrs ill: unable speak 4 months: large appetite: emaciated.
26	"	Krupi	Salifu	M		+	+		+	
27	"	"	Issa	M		+	+		+	
28	"	"	Kwajo	M		+	+		+	
29	16 4/10	Kumasine	Ebrahima	M		+	+	+	+	Glands hard
30	"	"	Bukare	(M)		+		+	+	Ophthalmia: Eosinophiles very numerous over 100 to a field.
31	17 4/10	Mamboun	Lanta	M			+	+	+	Sleeping Sickness (see $ 24)
32	"	"	Mama	(M)		+		+	+	? Sleeping Sickness (— do —)
33	"	Konkwa	Kofi	(M)		+			+	
34	"	"	Adisa	(F)		+	+	+	+	"Sick for all body"
35	"	"	Kwambera	M		+	+	+	+	
36	"	Butuku	Adisa	F		+		+	+	
37	"	"	Alima	F		+			+	
38	19 4/10	Kadenge (South Compound)	Burlana	M			+		+	Ex Chief-
39	"	"	Mariama	F		+		+	+	
40	"	"	Bentiri	M		+	+		+	
41	"	"	Mina	F		+	+		+	old Keratitis: ? ring worm Rt hand & arm, Rt hand: Trypanosomes in small patches: Eosinophiles numerous.
42	"	"	Alowa	(F)		+		+	+	
43	"	"	Pawkrobo	(F)					+	
44	"	"	Dawkroko	(M)					+	

Appendix D.

Series Number of Slide	Date Taken	Village	Name	Sex (M) or (F) under 14	Trypanosomes	Excess of Eosinophiles	Microfilaria perstans	Agglutination	Cervical Glands palpable	Remarks
II 45	19 4/10	Kadenge (Road Compound)	Saidu	M			+		+	Conjunctivitis & mouth: old: somewhat feeble.
46	"	"	Ajé	(M)		+	+		+	Blind Rt. Eye: rather deaf.
47	"	Katumpa	Singoni	M		+		+	+	Glands of Kantumpa & Konakuli people seemed more easily palpable
48	"	"	Deboba	F		+		+	+	Long ill: Emaciated: pervious limbs
49	"	"	Kireba	F		+	+	+	+	Long ill: old: Thin: Spits blood
50	"	"	Kobi	(F)		+	+	+	+	
51	"	"	Wariké	F		+	+	+	+	
52	"	"	Karba	(F)		+		+	+	
53	"	"	Salifu	(M)		+			+	
54	"	Dindumpe	Alasan	M			+		+	
55	20 4/10	Konakuli	Wuriche	F			+		+	See remarks N°47
56	"	"	Amamata	F	+	+		+	+	
57	"	"	Howa	(F)		+	+	+	+	
58	"	"	Gari	M		+		+	+	
59	"	"	Saka	M		+		+	+	long thin youth
60	"	Dindumpe	Moru	M F					+	
61	"	"	Adisetu	(F)		+		+	+	
62	"	"	Benamasa	F				+	+	
63	"	"	Zenaba	F		+	+	+	+	Thin 3 yrs: Marks of Cut over arms: Native treatment better
64	"	"	Fidi	(M)		+		+	+	now Blind right Eye.
65	"	"	Memela	(F)		+		+	+	
66	"	"	Idrisa	(M)		+		+	+	

39

Notes. 1. **Excess of Eosinophiles**: in some very marked: as many as 30 to 40 in a field (1/6 inch): 100 in one slide.

2. **Agglutination**: in all degrees intermediate between the normal finely granular naked eye appearance with corpuscles seen under the microscope to be in rouleaux or at least in small clumps more or less intimately connected with one

another by a net work of filaments to the coarsely granular – when still fluid, flocculent – with corpuscles massed into dense clumps with clear spaces between them: these spaces are sometimes bridged across by irregular filaments of corpuscles connecting the main masses: at other times there are no filaments, the clumps then form isolated islands. Only those that show definite dense clumps and that are coarsely granular to the naked eye are marked + in the Column "Agglutination." (See paragraphs 23 to 26.) The readiest way of observing this agglutination is by keeping the blood in motion on the slide (825): if the blood remains finely granular until dry there is no agglutination; whilst if flocculesasily distinguished with the naked eye are rapidly formed there is agglutination.

3. Polymorphonuclear leucocytes were seldom seen.

4. Slide I 3 was stated in the 1st report to show "a less marked increase" of Eosinophiles: the increase, especially in contrast with the majority of the other slides, is so small that it is not entered as an excess here.

Yale Massey's Report (with map)

February 14th. 1907.

An account, with map, bringing up to date the Knowledge of the Sleeping-Sickness areas of Katanga, and the distribution of the Glossina palpalis and the Glossina morsitans.

Includes the account of the first discovery, by Wm Arthur Pearson, of the Glossina palpalis in British territory south of the Equator, viz, on the Luapula River in North-Eastern Rhodesia (Jan 1906).

N O T E S TO ACCOMPANY DR YALE MASSEY'S MAP OF FEBRUARY 14/07, SHOWING TRYPANOSOMIASIS AREAS, AND DISTRIBUTION OF GLOSSINA PALPALIS AND MORSITANS.

The area dealt with in this map consists in the territory of the Congo State south of the Junction of the Luapula with the Lualaba River at Ankoro.

1. The areas marked red North of Ankoro and extending east and west, were defined in March 1905, by Doctors Dutton and Todd of the Liverpool School of Tropical Medicine. They found the disease and the Glossina Palpalis in the areas so marked.

2. In September 1905 Dr Ascenso, Medical Officer to the Comité Special du Katanga, sent some specimens of Tsetse Flies to Mr G. Grey, Manager of this Company. These were said to have been collected at the junction of the Dikulwe with Lufira River, and on the west bank of Lake Mweru, and were pronounced by Mr Austen of the British Museum to be of the sub-species Glossina Palpalis Wellmani. It is not known to the writer the exact location on Lake Mweru where the flies were taken. This I believe was the first discovery of the Glossina Palpalis in the region under consideration.

3. In November 1905, the first discovery of the Glossina Palpalis within the limits of the Company's Concessions, was made by Mr G. Grey, at the junction of the Lufupa with the Lualaba River. This fly was of the type species.

4. In January, 1906, Dr Arthur Pearson, Medical Officer to the Tanganyika Concessions Ltd., found specimens of Glossina Palpalis, type species, at Nafunta Falls on

the Luapula River at latitude 10°28' South, a few miles north of Madona. These flies were found on the east bank, and I believe is the first and only recorded discovery of the Glossina Palpalis in Northern Rhodesia.

5. In April, 1906, I was informed by an official of the Comité Spécial du Katanga that he believed that two of his porters were suffering from Sleeping-Sickness. I did not see the cases and cannot say that it was really Sleeping-Sickness. One heard of imported cases at two or three places, but no authentic information was obtainable. I saw none of the cases.

6. In June, 1906, Mr G. Grey found the Glossina Palpalis at Chisamba, then a post of the Comité Spécial on the Lualaba River, in the Baluba Country.

7. In June, 1906, Dr Noble, District Surgeon, North Eastern Rhodesia, confirmed Dr Pearson's discovery of Glossina Palpalis at Nafunta Falls, on the Luapula River.

8. In June, 1906, Dr Noble found the Glossina Palpalis on the Luapula River less than a mile north of Mpweto.

9. In August, 1906, Dr Noble found Glossina Palpalis at Kasenga, a Congo Government Post on the Luapula River about fifteen miles north of Madona. Dr Noble also saw there a soldier with Sleeping-Sickness. He had come from the Lower Congo.

10. In September, 1906, Mr R. R. Sharp, of this Company, sent me some specimens of Glossina Palpalis that he had collected near the Congo Government Post of Kayoyo, on the Mukuleshi River, about latitude 10°40' South.

11. In September, 1906, Mr Charles Grey, of this Company, found the Glossina Palpalis on the South Kaluli

River, two miles from Mazanguli. He also found them on the Luweshe River, about ten miles south-west of Mazenguli.

12. In September, 1906, Mr Anton, of Koni Hill, wrote me that he had found the Glossina Palpalis on the Lufira River at Koni Hill. I have not seen his specimens.

13. In August, 1906, there arrived at Ruwe, 150 workers recruited by the Comité Spécial du Katanga at Kabinda and vicinity. Thirteen of these were found microscopically to harbour trypanosomes. Kabinda is situated about 450 miles North of Ruwe, and in March, 1905, Dr Todd found thirteen per cent of the inhabitants to be in the early stage of sleeping-sickness. All the Kabinda men were at once sent back to their homes.

14. Late in the month of September, 1906, the writer left Ruwe for the purpose of investigating Sleeping-Sickness on the Lower Lualaba. The Manager, Mr George Grey, had arranged that this journey should be made in August, but owing to unforeseen events, it was delayed until October. Arriving at Mazanguli, 80 miles north of Ruwe, I examined 129 carriers from the district of Lake Kasali; fourteen of these were shown microscopically to harbour trypanosomes. In the native villages of Mazanguli and Salabwe, some 300 people were examined, but none of them showed any evidence of trypanosomiasis. One is therefore safe in concluding that the district about Mazanguli is not an infected area, notwithstanding the fact that the Glossina Palpalis is found in the neighbourhood, viz: at the South Kululi crossing.

Proceeding northward, a distance of fifty miles, I reached the Lualaba River, immediately below the Kalenge Rapids. Here was discovered a heavily infected area, men, women and children alike showing trypanosomes on microscopical examination. Going down the river, villages were examined as far as Lake Kabele. A conservative

estimate would put the number of infected persons in these villages at between forty and fifty per cent.

At the Belgian post of Bukama, of 45 soldiers from all parts of the Congo, 10 were shown microscopically to be infected. Natives from various villages on the Lualaba as far down as Lake Kasali were examined, and several were found to harbour trypanosomes. It is therefore believed that the whole district along the Lualaba from the Kalenge Rapids to Lake Kasali, is heavily infected. The Glossina Palpalis was found all along the river, wherever I went. On the Inye River, running into Lake Kabele from the West, they were quite numerous. Natives were examined from villages as far distant as twenty miles on either side, east and west, of the Lualuba, and they were found to harbour trypanosomes. These villages were not visited, and it is impossible to say whether they contracted the disease at their villages or on the Lualaba.

The natives on the Lualaba have observed that the mortality in their villages has increased greatly during the past year. They have not noticed it before to be above the normal. They have also observed that the high mortality is confined more particularly to the villages on the banks of the river, - the villages inland, they say, are more healthy. Hence, quite on their own initiative, the natives are leaving the villages on the banks of the Lualaba, and building inland. This disease of which they are dying is quite new to them; they have no knowledge of sleeping-sickness.

PROBABLE MODE OF INTRODUCTION ON THE LUALABA.

For years past there has been a trade route between Lake Kasali and Kabinda 200 miles north. The Lake Kasali people caught and dried fish which they

carried to Kabinda, where they found a ready market. Dr Todd, in March, 1905, found Kabinda and vicinity heavily infected. The first case to appear at Kabinda was about the year 1900. Two years ago at Kabinda, Dr Todd examined a number of these Lake Kasali fish-traders, but found no trypanosomes. They had no doubt been exposed to infection at Kabinda, but the disease had not yet been developed. I therefore believe that the disease on the Lualaba is of recent introduction, and that it was introduced by the Kasali fish-traders from Kabinda. The disease probably found its way to the Lualaba not more than two years ago. The reason that the disease has not spread to the south of the Kalenge Rapids, I believe to be from the fact that the people below the rapids have practically no intercourse with those above.

It will be noted that no infected areas are known to exist nearer than 130 miles north of Ruwe.

Infected areas had not been before discovered in the Company's Concessions. The disease was not before known to exist south of the Junction of the Lualaba with the Luapula.

15. On February 4th, 1907, at Kambove, I found trypanosomes in three Congo natives, that had been recruited from the district about the junction of the Dikulwe with the Lufira. As before noted, Dr Ascenso found the Glossina Palpalis Wellmani in this locality. If the disease is not already endemic, it will soon become so.

16. On February 6th, 1907, at Kambove, I found the organisms in the neck glands of the wife of a capitao. This woman's home is at Kayumba, near Lake Kasali.

17. Notes 15 and 16 would lay under suspicion the whole Lufira valley from Lake Kasali to Mwend's village near Lukafu.

18. On February 6th, 1907, at Kambove, I found a woman from Kiambi on the Luapula River, to be infected.

19. The distribution of Glossina Morsitans. - The region between the Lufira and the Lualaba, from their junction at the north to the Rhodesian border on the south, has only very localised areas in which the G. Morsitans is not found. In some parts they are exceedingly numerous. The numbers seem to vary with the seasons. As shown by the map, only a few small areas are known west of the Lualaba. The areas east of Lake Mweru and the Luapula were recorded by Dr Noble.

While the Glossina Morsitans may possibly transmit the disease, yet I think that the Glossina Palpalis should be regarded by far the greater offender.

A large Tsetse has been reported from the west side of the Lower Lufira. This is possibly the Glossina Fusca. Koch has recently shown that the G. Fusca can transmit the disease.

From the above observations, it is regarded advisable to consider as dangerous (not necessarily an infected area) all territory north of the following lines:-

A line south-eastward from the Kalenge Rapids to Latitude 10·30' south on the Lufira River, thence east on this latitude to the Luapula River. West of the Lualaba River, a line may be drawn directly west from the Kalenge Rapids. South of these limits is regarded at present as free from any infected areas. It will be observed that these limits are not nearer than 80 miles to Kambove, 120 miles to Ruwe, 180 miles to Kansanshi and 120 miles to the Star of the Congo.

The most effective plan to stem the southward march of the disease would be to establish a cordon along the line indicated above. At present, carriers

are recruited from a heavily infected area on the Lualaba, to carry loads to Kayoyo (where the G. Palpalis is found) to Lulua, to the Railway Survey party at the source of the Lualaba, to Lakufu, and other places in uninfected areas. Such a cordon would necessitate the Belgian Posts in Southern Katanga bringing their goods by way of the Cape instead of Boma. This could easily be done. By this arrangement the intercourse between the infected areas to the north and the uninfected area to the south would be reduced to a minimum.

It will be urged that the native will break through the cordon. This will be done, I believe, to a limited degree only. Transport for the white man has been the principal instrument in the movement of natives, and hence the spread of the disease.

Sleeping-sickness doubtless remained for centuries on the Lower Congo. It was only on the entrance of the white man, who instituted trade routes into the interior, that the disease began to spread inland.

There seems to be little doubt that with prompt and efficient measures, the advance of this terrible disease can be arrested.

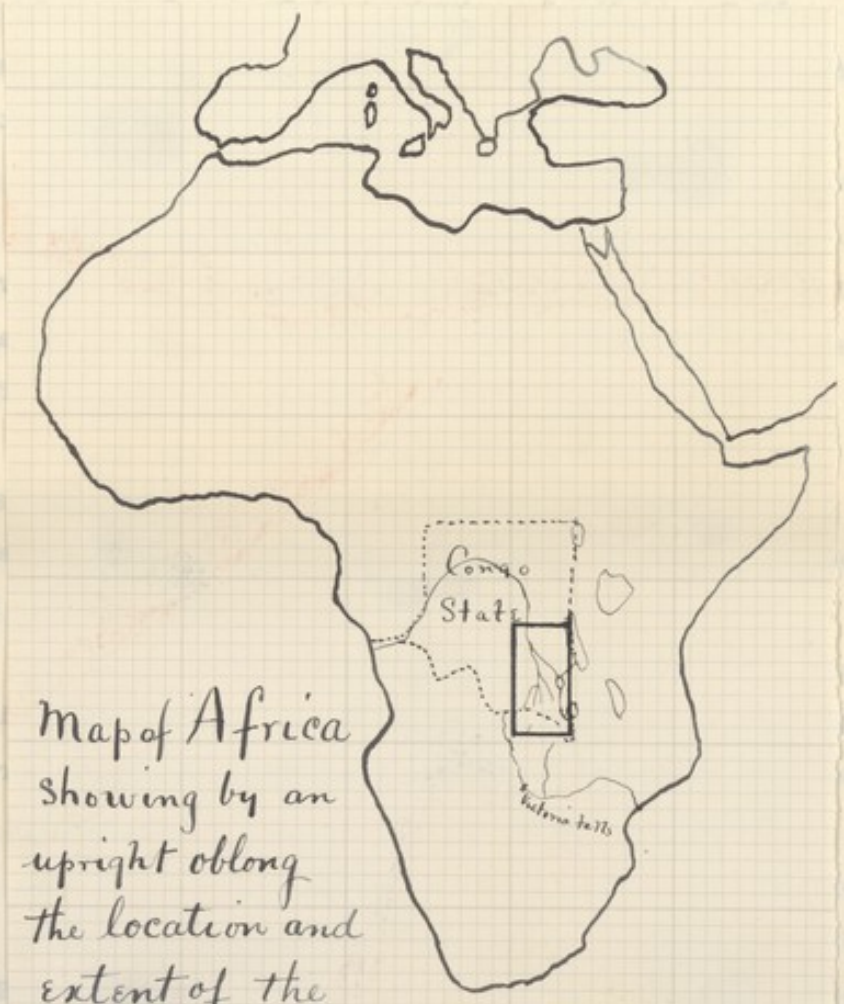
I am,

Yours faithfully,

(Signed) A. YALE MASSEY.
Medical Officer to the
Tanganyika Concessions Ltd.

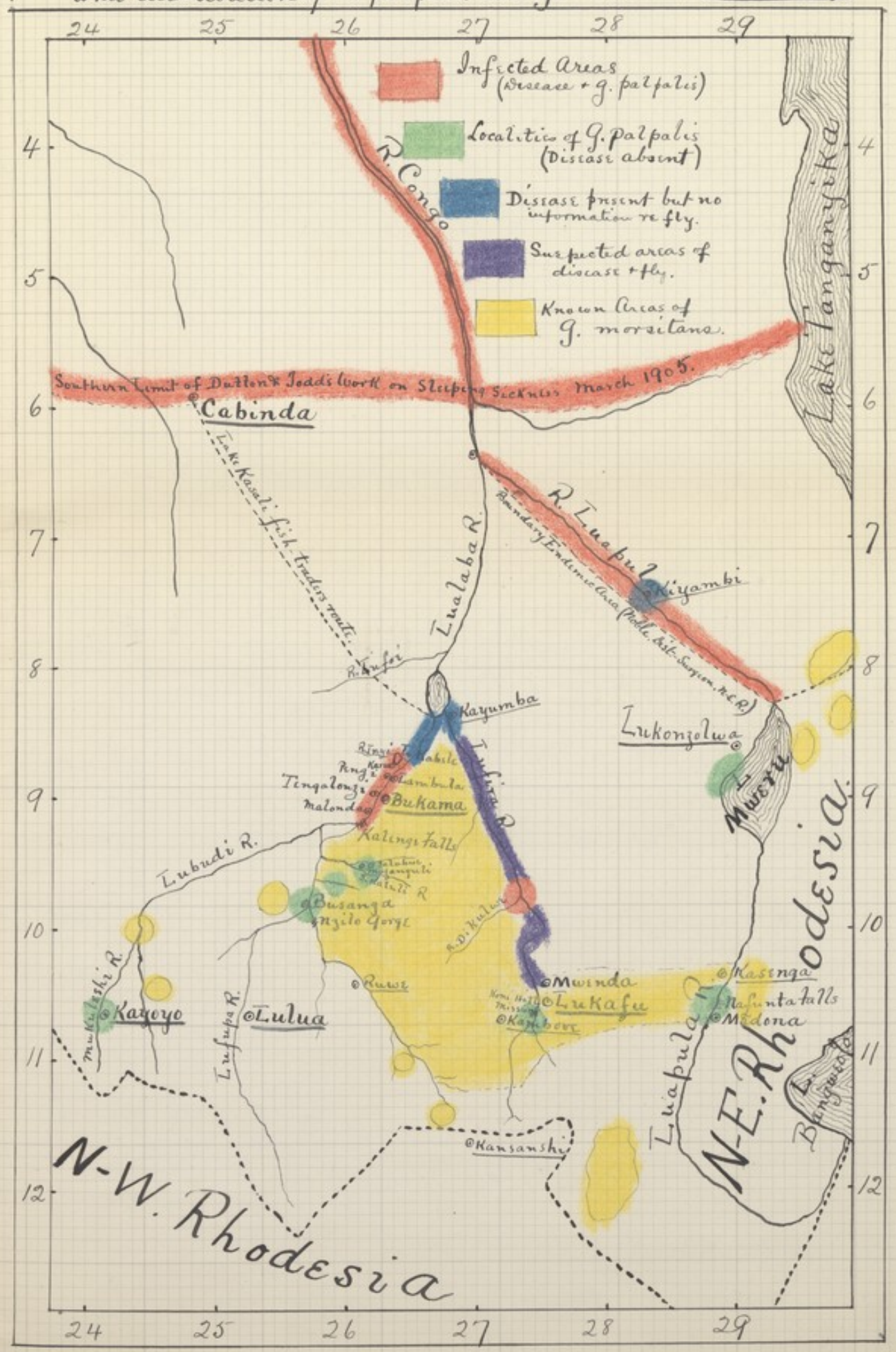
Kambove.

February 14th, 1907.



Map of Africa showing by an upright oblong the location and extent of the map opposite.

Yale Massey's Map showing Trypanosomiasis (human) Areas and distribution of G. palpalis and G. morsitans. Feb 14. 1907.



Markey

1965

Yale Massey's Report (with Map)

also vide "The Lancet" March 30. 1907.

October, 1906

An account of the discovery of the southern limit of the Sleeping-Sickness area of Central Africa.

Heretofore, Sleeping-Sickness investigation had been carried on from the Congo side, that is, from the north. Dutton and Todd had shown in 1905, that the disease prevailed as far south as 6° South Lat. on the Congo River.

Yale Massey approached the Sleeping-Sickness area from the south via North-Western Rhodesia and first discovered the disease on the Lualaba River, immediately north of the Kalonge Rapids 9° 10' S. Lat. The Glossina palpalis was found on the Mukuleshi River within 30 miles of the North-Western Rhodesia border.

Copy.

REPORT

ON AN EXPEDITION TO BALUBALAND TO INVESTIGATE SLEEPING-SICKNESS, OCTOBER 1906.

---

1. Introductory.

The prevalence of sleeping sickness on the Lower Congo, and its rapid extension to the Upper Congo, gave just cause for a desire to know if the disease had reached the territory of the Company's operations. There was no information regarding the country south of Lake Kasali at the junction of the Lualaba with the Lufira. A considerable amount of food was being collected all along the river Lualaba to Lake Kasali; and large numbers of Kasali people were being used as porters, many of them coming as far South as Ruwe.

To prove the presence or absence of sleeping sickness in these parts, it was arranged by the Manager, Mr George Grey, that the Medical Officer should visit the Balubaland and make investigations. It was arranged that this should be done in August, but owing to many delays, it was postponed until October.

In August reports were received from Mr J.H. Hayes, stating that the people in the villages along the Lualaba were dying in large numbers, and Mr Hayes went so far as to say that he believed that they were dying of sleeping sickness.

2. Method of Procedure.

It has now been well established that the earliest evidences of the disease are exhibited in the enlargement of the Lymphatic Glands. The posterior cervical glands of the neck are regarded as most diagnostic, in that they

are least influenced by other causes. We possessed no apparatus for lumbar puncture nor for the centrifugalisation of blood. Hence all our observations are based on gland palpation and gland puncture.

3. Difficulties experienced.

The principal one was lack of time. Then the natives were timid, and the greatest care was necessary to avoid alarming them. At Mazanguli there were about 60 porters from the Lufoi R. west of Kasali. We managed to palpate them, but it was regarded inadvisable to puncture as this was their first visit and might frighten them away. In some places it was even difficult to get near enough to feel their necks. Without a centrifuge it is impossible to make an accurate diagnosis in the advanced stages of the disease.

4. Method of obtaining percentages.

It was quite impossible to see all the persons in a village. However, in each village visited, word was sent ahead to ask them to refrain from going to the fields, yet, no doubt a small percentage, in their superstition, remained away intentionally. All available persons were palpated, only those being counted that evidenced large unmistakable glands. Doubtful cases were not counted. So well chosen were they, that in one village of fourteen taken haphazard from a large number palpated, everyone showed organisms on puncture. In most villages only palpation was carried out. The percentages were found in this way: In a village of 25 of 50 palpated, are found with enlarged glands, hence it is estimated that 50% are infected mentioning at the same time the estimated population of the village. This method is open to obvious errors, but these cannot be great, and

no better method has presented itself to us. That there would be a larger percentage of suspected persons remaining in the village does not obtain, as all our cases are in earlier stages, no physical symptom having yet appeared.

5. The examinations in detail.

At Mazanguli we palpated 129 carriers from Lake Kasali and found 14 with enlarged glands. In each of these were found microscopically the organisms. Of 61 carriers palpated from the Lufoi River, 60 miles west from Lake Kasali, only two showed enlarged glands and they were not quite characteristic. As it was their first trip it was not thought advisable to puncture them. At Mazanguli village were palpated 150 men, women and children; not one showed enlarged glands.

At Salabwe we palpated about 150 men, women and children; not one showing enlarged glands.

In Malonda's village on the Lualaba, of 50 palpated 35 had enlarged glands, and 14 examined microscopically all showed the organisms - 70%. Probably above 60% of the people were seen.

At the Belgian Post, Bukama, of 45 soldiers from all parts of the Congo, 10 were shown microscopically to harbour the organisms in their cervical glands. Of 20 workers from the surrounding districts, 5 were shown microscopically to be infected.

At Tengalonzi's village opposite the Post, of 50 examined, 40 showed unmistakable glands by palpation, and eight had enlarged glands, but not so characteristic - 80%.

Probably above 60% of the people were seen.

At Pengi's village 30 out of 60 were found with enlarged glands. Estimated population 120.

At Lumbula's village, palpated 35 and found 25 with enlarged glands. Estimated population 70.

At Karu on Lake Kavelo, 15 miles west of the Lualaba, 30 were examined by palpation and 6 showed enlarged glands. Karu is a large village of several hundreds of people.

We examined a native from 10 miles west of Karu, who showed sleeping symptoms and the peculiar weak falling attacks. His cervical glands revealed the organisms.

One or two examined from Chibwe, and from the district about Katapena, were also shown to be infected.

6. Conclusions. -

It is very obvious that from the limited amount of work done, it is doubly important that too positive conclusions should not be drawn. It must also be borne in mind that these figures are based largely on palpation. Of 260 people living on the Lualaba that were palpated, 145 had unmistakably enlarged cervical glands, a percentage of fifty-five. Removing all sources of error and making what we believe to be a very conservative estimate, we estimate the proportion in the early stages of sleeping sickness on that part of the Lualaba to be at least between 40 and 50% of the population.

The district about Mazanguli we believe to be free from the disease.

Of the Kasalis examined we found 11% infected.

7. Probable time of introduction, etc.

While it is quite impossible to estimate with any accuracy the time at which the disease was introduced, yet there are a few data. Nearly two years ago Dr Todd examined at Cabinda a number of fish-traders from Lake Kasali, but found none infected. Now of 129 examined, we found 11% infected.

The disease first appeared at Cabinda in 1902,

and at the end of 1904 Dr Todd found 13% of the people infected. It is doubtless at Cabinda that the Lake Kasali fish-dealers came in contact with the disease, who in turn have spread it up the Lualaba. From these considerations we may say that the disease was probably introduced into the Lake Kasali region and southward, about two or three years ago, not more.

It was not until this year that the natives themselves noticed any increase in their death-rate. The chiefs now say that their people are all dying. The evidence of Mr Hayes, of this Company, and that of Mr Heenan, Chief of the Belgian Post at Bukama, was that the villages were becoming depopulated. Many natives are moving away from the river, recognising that it is among the river people that there is so much illness. While proof was not possible, due to lack of apparatus, yet it is our belief that the increased mortality is due to sleeping-sickness.

8. Immunity.

There seems to be good reason to believe that there is a small percentage of recoveries from the disease. On the Lower Congo no doubt a certain immunity has been established in the inhabitants.

It is a rule among diseases that when a new disease is introduced into a country, it enters as an epidemic with a high mortality, only the stronger surviving from the onslaught. The progeny of these are more resistant to the disease. In this manner no doubt the wild game became immune to the Tsetse-fly disease.

9. Districultion of the Glossina Palpalis.

The following localities have been noted:-

1. West side of Lake Mweru.
2. Junction of the Dikulwe with the Lufira.

3. On the Luapula between Mweru and Bangweolo.

4. At Koni Hill on the Lufira.

5. On the Lukulezi River, near the Congo-Zambesi watershed.

6. On the South Kaluli, at the cut road crossing south of Mazanguli.

7. On the Lulaba from the Kalenge Falls north to Chisemba.

8. At the Inje River, running into Lake Kavele.

10. Prevention.

The gist of the measures which have been advised and are law in the Congo Free State, are:- (Firstly) The establishment of posts of inspection along the main roads to prevent the entrance of infected persons into uninfected districts, and (secondly) the removal of infected persons from posts in uninfected districts to places already infected.

The present danger to this Company rests in the passage of infected Kasalis to Ruwe and Busanga. To remedy this, a white man at Mazanguli could palpate each gang, and those with enlarged glands should not be allowed to proceed to Ruwe or Busanga. This would probably incur the turning back of 10 to 12% of the carriers. This would protect the crossing two miles south of Mazanguli, where the fly is present, and also Busanga, where the fly is found in some numbers.

11. Conclusion.

I wish to mention Mr Charles Grey, Local Manager at Mazanguli, and Mr John H. Hayes, Agent of the Company in Balubaland, for the invaluable assistance which they rendered, without which it would have been impossible to accomplish a fraction of what was accomplished.

I am also indebted to the Manager, Mr George Grey, and the Assistant Manager, Mr Herbert Cayley, who made the expedition possible.

The accompanying map will show all the places mentioned in this report.

This Company holds a strategic position. The invasion is only from the North, and it is our duty to do everything in our power to prevent the disease spreading southward. We have no proof that the fly does not exist south of the watershed. That the disease should spread over the watershed into Rhodesia and South Africa, is too terrible to contemplate.

I am,

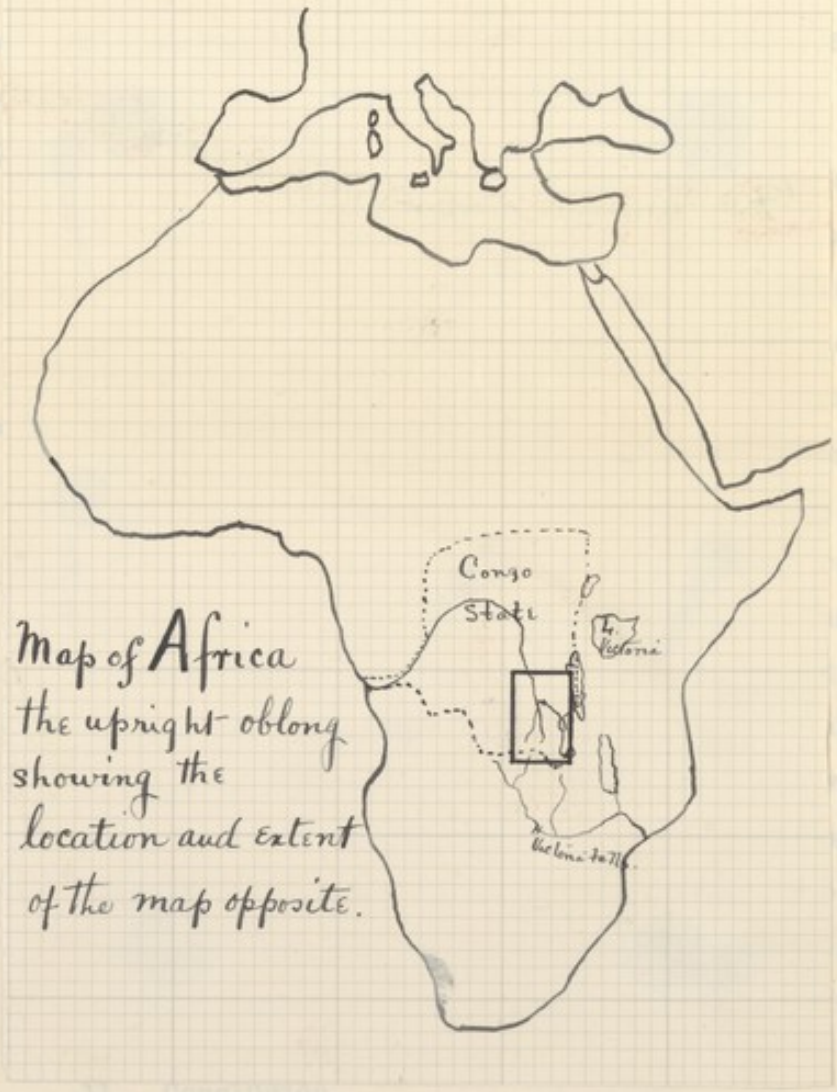
Yours faithfully,

(Signed) A. YALE MASSEY,

Medical Officer Tanganyika Concessions Ltd.

Ruwe.

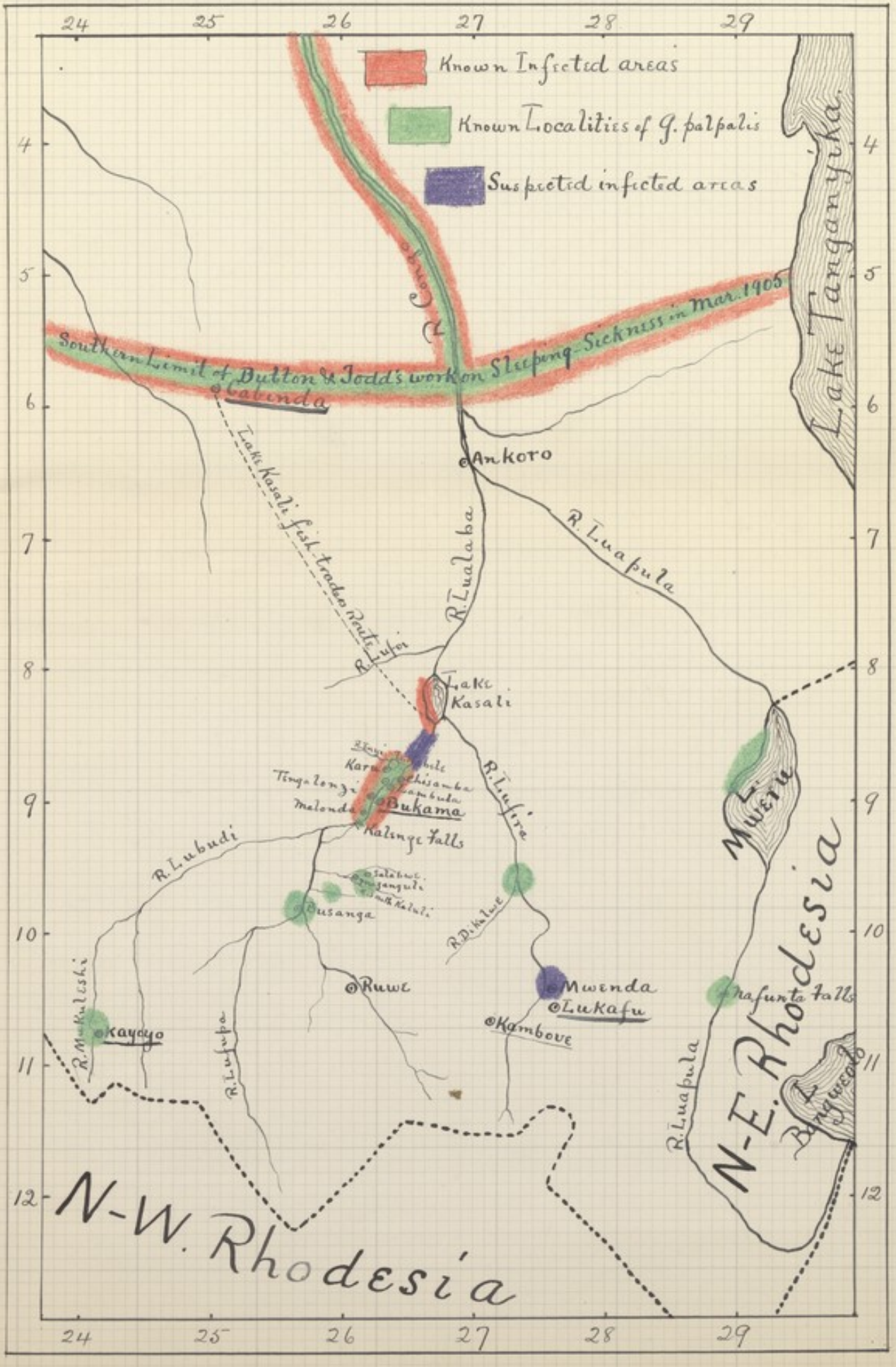
October 30th, 1906.



Map of Africa
the upright oblong
showing the
location and extent
of the map opposite.

Yale Massey's Map to accompany Report on an Expedition to Balubaland to investigate Sleeping-Sickness

October, 1906.



1946