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PRELIMINARY REPORT.

INFECTION RATES IN G.morsitans AT REKOMITJIE

AND THEIR MEANING IN TERMS OF THE INCIDENCE OF TRYPANOSOMIASIS

IN CATTLE

The infection rate in G.morsitans has been determined by dissection of a sample of 400 flies each month for a period of a year (June 1960 to July 1961). In an attempt to eliminate possible variations due to the type of habitat in which the flies were caught, each sample of 400 was composed of four samples of approximately 100 flies from four different areas representing:-

i) riverine (Rekomitjie)
ii) drainage line bordered by thicket (Site IV)
iii) mopane bordered by thicket (Chikwira)
iv) mopane woodland types of vegetation. (Chitaki)

RESULTS

Seasonal variations

It would appear from Figure 1, which is a graph of the infection rates plotted against the months of the year, that there are seasonal variations in the incidence of trypanosomes in G.morsitans. The highest rate of infection was found to occur in August, a month of no rain, and the lowest infection was found to occur in January, March and April, the months of maximum rainfall.

While it is not possible to demonstrate a significant statistical differnece between the infection rates for each month compared with that following or previous to it, that in August is nevertheless significantly higher than that for January, and, similaryly analysis shows, that the infection rate in flies caught over the six months period June to November 1960 (inclusive) is higher than that for the period December, 1960, to May, 1961.

Habitat variations

Table 1 show the infection rate over one year for each of the four vegetation types chosen. It will be seen, on examination of this table, that over this period G.morsitans caught in riverine vegetation or drainage line thicket show a higher infection rate than those caught in mopane or mopane/thicket contact. There is, however, quite a considerable seasonal variation in the infection rates from each of these habitats.

TABLE 1.

	Rekomitjie(i)		Site IV(ii)		Chikwira(iii)		Chitaki(iv)	
	no.exam.	%inf.	no.exam.	%inf.	no.exam.	%inf.	no.exam.	%inf.
G.morsitans.	1225	21.6	996	19.3	1153	17.3	1132	16.3

Figure 2 shows the infection rates from the riverine(i) and mopane woodland(iv) areas plotted against the months of

at the station. It will be noted, on examination of this figure, that during the months from June to October (inclusive) the rate of infection in flies from mopane woodland(iv) is very significantly lower than it is in flies caught in riverine vegetation. During the other months of the year there is, however, no significant difference between the two areas. The period September to November is interesting for it is at this time that the infection rate in the riverine area showed a marked drop and that in the open mopane woodland a sudden rise.

DISCUSSION

Let us now examine the apparent effects of the various factors which are likely to influence the rate of infection in tsetse flies under the following headings:-

1. Climate
2. Age composition of the fly population
3. Frequency of feeds i.e. the mean hunger cycle
4. Game reservoir.
5. Vegetation

1. Climate.

When dealing with the climatic factors, temperature, humidity and rain-fall, it is not always easy in the field to distinguish the direct and indirect effects since these factors influence all those listed above. However, in the laboratory, Burtt (1946) has shown that tsetse flies (G.morsitans) from pupae which had been kept at a relatively high temperature (30C) gave a higher transmission rate of trypanosomes (T.rhodesiense) than from untreated pupae.

In the present investigation this effect of high temperatures on rate of infection was not generally apparent since the highest infection rate was encountered in August and September before the maximum daily temperatures were reached.

With humidity and rainfall it is again difficult to see any direct effects. The Maximum humidity and rainfall did coincide with the lowest infection rate but the minimum humidity did not occur at the same time as the greatest rate of infection.

2. Age composition of the fly population

It is reasonable to suppose that the older the tsetse fly the more chances it has had of aquiring infection. Now one would expect the mean age of a fly population to be greatest during the cooler and wetter months, yet from December to April, the period of the rains, the infection rate is minimal and only in May, June and July, the coldest months, does it begin to show an increase.

The effect of the age composition of the population nevertheless probably plays a part in determining the infection rate in certain localities. The mopane woodland area (iv) becomes very dry and shadeless in August, September and October and during the course of the experiment it became increasingly hard to obtain flies for dissection from this sampling site. It is likely that the death rate among flies in this type of vegetation is high at this time of year and the consequent low mean age of the population will contribute to the decreasing infection rate noted in figure 2.

3. Mean hunger cycle.

The frequency at which a tsetse fly will take a blood meal will depend primarily on two factors. The climatic environment will control the rate of utilization of the feed, and hence the length of the hunger cycle; and the density of available host animals will determine the ease with which the blood meal will be obtained when it is required.

In an area away from drainage line or riverine vegetation such as the mopane woodland, host animals may not be readily available during the hot dry months when food and water for them are at a premium. This factor, together with the short hunger cycle in the flies at this time of year, will have the effect of shortening the life of the tsetse and hence contribute to the decline in the infection rate (iv) noted in figure 2.

4. Game reservoir.

When dealing with infection rates in tsetse flies, it must be born in mind that the game animals which act as the main source of food for the fly are not necessarily those which are most important as carriers of trypanosomes. Certain animals such as elephant, buffalo, eland and kudu show seasonal differences in their distribution and might be expected to act as hosts for tsetse flies to different extents at different times of the year. Animals such as kudu which have been shown by Ashcorft (1959) to be fairly frequent carriers of trypanosomes, are not found in dry mopane woodland areas during the months September, October and November. With the onset of the rains, however, they tend to move away from the drainage lines and rivers and seek food in the open mopane areas where water is now readily available. These animals can then be expected to act, at least to some extent, as a food source for the fly, a fact which may cause the infection rate to rise in November, in (iv) as noted in figure 2. Similarly, fewer flies in the riverine areas may be feeding on kudu just before and during the rains because this species is no longer present in such large numbers and the decline in infection rate in area (i) may be due in part to this game movement.

The identification of blood meals collected in the two areas, which have been sent to Dr. Weitz, should throw some light on this subject. It will, nevertheless, be hard to draw conclusions owing to our lack of knowledge of the trypanosome infections in game animals in the area studied.

5. Vegetation.

The sampling sites used in the investigation were chosen mainly on the basis of their different vegetation types and presumed differences in ecological associations. Climate wil naturally affect the vegetation and the extent to which the former affects the tsetse will depend on the type of the latter. Again seasonal changes in the vegetation will affect the distribution of host animals which in turn will affect the fly. The indirect effect of of vegetation will therefore be seen to have already been discussed.

FACTORS INFLUENCING THE INCIDENCE OF TRYPANOSOMIASIS IN CATTLE

The degree to which an animal is exposed to being infected in nature is defined as the 'Trypanosome risk', this term to replace 'trypanosome challenge' which was formerly used. The

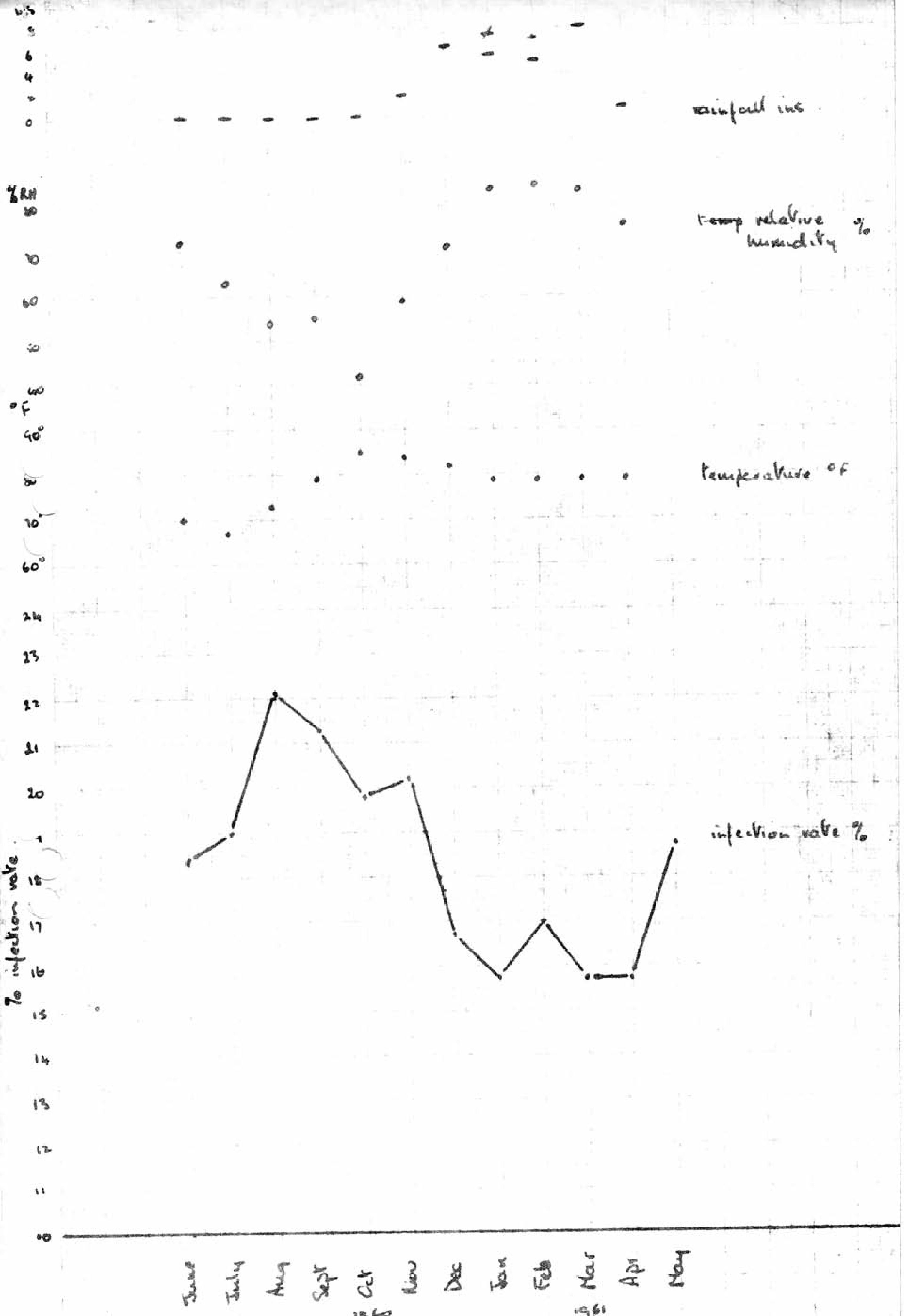
main factors on which the trypanosome risk will depend are those of tsetse fly density, or the frequency with which cattle will come into contact with fly; and the degree to which the fly is acting as a transmitter of trypanosomes, in other words the infection rate. There will, of course, be numerous other contributing factors, such as the state of health of the animals, virulence of the trypanosome strains encountered, variations in prepatent period and the degree to which the cattle are protected by the administration of drugs. These latter, being more or less outside the scope of this discussion, will not be considered in detail, but it should be born in mind that the subject of the epidemiology of cattle trypanosomiasis is one on which it is extremely difficultto make generalised statements.

It has already been noted from figure 1 that the period during which G.morsitans shows the highest rate of infection is that of the late dry season when the distribution of the fly is more or less confined to drainage line areas and thicket. It is reasonable to suppose that cattle, during this period, will be grazing to a large extent along the rivers and to some extent in vleis bordered by Brachystegia or mopane woodland. Where cattle in tsetse areas are grazing along the rivers one would expect them to be in contact with a fairly high density of fly showing a relatively high infection rate, yet the incidence of trypanosomiasis is not particularly great at this time of year. Only with regard to cattle grazing away from rivers and thicket would one expect the fly density and infection rate to be low with consequent low incidence of trypanosomiasis. If we now take into consideration a possible prepatent period of one to two months, one would expect the incidence of trypanosomiasis to be greatest round about December, January and February, an expectation which is to some extent realised in trypanosomiasis surveys. However, from reports so far obtained, the period over which most outbreaks occur is that between March and May, which, from figure 1 would appear to be a period of low infection rate in tsetse flies. It is possible that at this time, and indeed that from the start of the rains (December, January) to the beginning of the hot weather (September), it is the distribution of the fly rather than the infection rate which is the major factor.

Most trypanosomiasis areas a re those in which cattle are being run near, or just within, the limit of tsetse distribution. During the hot, dry weather G.morsitans, which is presumed at its limit to be of fairly low density, will be restricted in distribution, as will be the grazing cattle. It is possible that at this time of year cattle/fly contact is then, to a large extent, broken. With the onset of the rains, the distribution of the fly will extend to areas which it did not occupy during the dry season and in which grazing is now good for the cattle. This will cause an increase in cattle/fly contact and a consequent increase in trypanosomiasis.

CONCLUSIONS.

The above discussion has shown some of the difficulties of assessing the part played by the infection in tsetse in the epidemiology of cattle trypanosomiasis. Obviously it must contribute in as much as some areas are probably predisposed to a higher general infection rate than others, but the factors which cause seasonal differences in incidence of trypanosomiasis have yet to be more clearly defined. As noted above, generalisations cannot be made and the problem would seem to be one in which various factors contribute differentially in different areas.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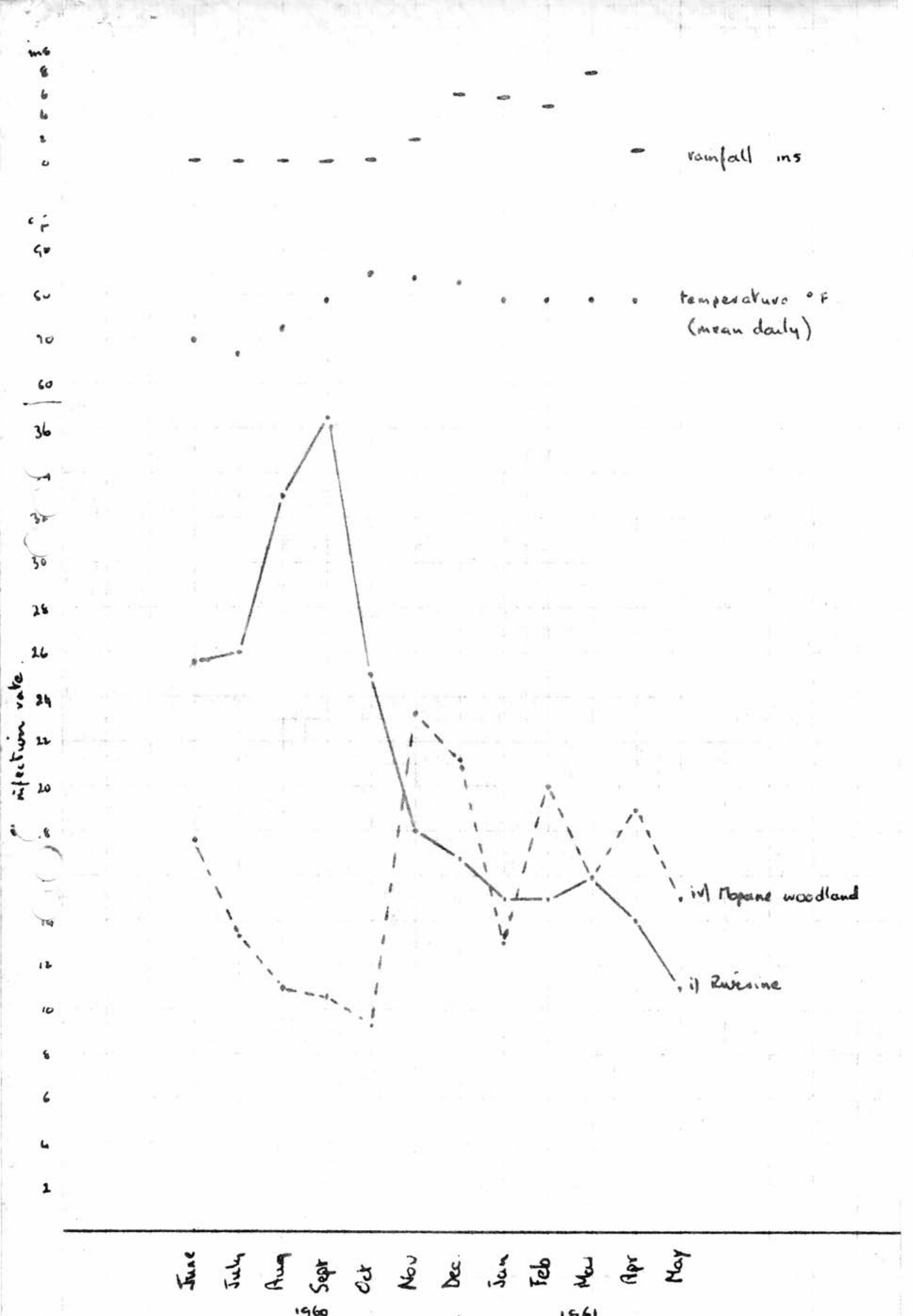
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ii) Mopane woodland
i) Riverine
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