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CRITICAL TEMPERATURES FOR G. MORSITANS

IN SOUTHERN RHODESIA.

R.W. Jack (1941) suggested that the critical mean annual temperatures (Max. + Min. ÷ 2) for G. Morsitans may be 67°F. (19.4°C.) I have recently been using the figure of 20.°C for purposes of discussion and on maps the 20°C (68°F) isotherm. This line fits fairly well to the historical line given by Jack and Chorley in various papers, except in the west. From about the level of Que Que the historical line runs westwards roughly along the 19th Parallel, while the 20° isotherm more or less follows the edge of the high veld to Plumtree. The triangle of land formed by these two lines and the territorial boundry is, of course, occupied by the Kalahari Sands.

Bursell (1960) recently suggested that a controlling factor may be the length of time during the year at which mean temperature is below 16°C (60.8°F). At this temperature the pupal period is just over three months and Bursell has shown that some of the smaller puparia subjected to a temperature of 16°C will have insufficient fatto allow the emerged teneral fly a good chance of finding its first meal.

The attached table analyses some features of winter temperatures at stations of interest because of their positions in regard to tsetse distribution. It is compiled from "Climate - Handbook, Supplememt No.1, Climatological Table for the period July 1931 to June 1951 ", Government Printing and Stationery Department, June 1952.

The numbers of year's records used appear in Column 5 and the second column gives the annual means for the stations listed, based on the means of Maximum and Minimum means. Stations which lie within the historical tsetse line are underlined. Seven of them have mean temperatures below 68°F, while two, which are over 68° , lay outside the historical line. Columns 3 and 4 list the months in which the gross means for the period recorded (generally over 15 years) are under 16 and 17°C respectively. Salisbury data are included for comparison, while Chipinga is included since it falls just within the range of sporadic trypanosomiasis derived from the border flybelt.

It will be seen that if we take long periods only three stations (Salisbury, Chipinga and Sinoia) have three winter months below 16°C. The rest have two months, except Gokwe with only one and Triangle and Chirundu which are well within the fly belt and have none. Rather more stations have three months with a mean under 17°C.

What is likely to be of greater importance in relation to Bursell's criterion, is the frequency with which years having periods of three months with mean temperatures above or below 16°C appear. These are apparent from a comparison of Columns 4 and 5. Salisbury and Chipinga always have a mean temperature below 16°C for the three winter months and therefore (on Bursell's hypothesis) have climates in which populations of G. morsitans could not survive. Chirundu, on the other hand, always has winter months with mean temperatures above the

Critical level / .....

critical level. The intermediate stations are, of course, the interesting ones.

We may consider first those stations which lie outside the limits of the historical belt. Mtoko, which is about twenty miles from the historical fly line has thirteen out of 17 years which were too cold for all morsitans pupas to become fully adult flies, and Sinoia, which is only about five miles from the old fly line has 18 out of 19 years too cold. Miami is of interest, for although it lies well inside the old fly limit, it has 14 out of 17 cold years and R.W.Jack remarked that although certainly cattle were infected at Miami (as they still are) it was unlikely that tsetse could breed there. On the other hand Karoi, only a few miles away and with a mean annual temperature only 0.27°F higher than Miami, is only too cold in one year out of three. Gatooma, within the old fly line by some thirty miles, is too cold in 7 out of 18 years. With Hartley, Sipolilo and QueQue, all three just inside the fly line, we may well wonder whether they supported permanent populations of tsetse, having 14, 12 and 13 years respectively too cold out of 17.

Bikita, the first atation in our list with a mean over 68°F (20°C) has just over 50% of its years favourable to tsetse and, by comparison with, say Gatooma, should have been within the fly line. However, this part of the country was one of the areas in which the Mashona tribes were still surviving in some strength after the Matabele invasion, and it may well be that settlement in the hills around the headwaters of rivers draining into the Sabi and Lundi was excluding G. morsitans at the time of the arrival of the first Europeans, that is, exclusion was not due to climate but to the influence of population on the habitat.

A Chipinga farmer told me once that tsetse had at one time infested New Year's Gift and both on the basis of the mean annual temperature and of the frequency of cold winters, this seems not unlikely. On the other hand, Mount Darwin, although having a relatively high mean annual temperature would seem to be rather doubtfully included in the old fly line.

Of the greatest interest are the records from Gwaai Siding, which, with a mean annual temperature of 70°F (21.1°C) ought to lie within the historical limits. However, the data show that in spite of its high mean temperature, the winters here are too cold on 11 out of 14 occasions. The absence of G. morsitans from the Kalahari Sands is well known and, as noted above, the historical fly line departs from the presumed climate line in this part of the country. Vincent, in the Agricultural Survey of Southern Rhodesia, Part 1 says " In general, sandy soils cool more rapidly than clayey soils. For this reason the incidence of frost is higher on the Kalahari sands which have the lowest clay content of all Rhodesian soils ".

It would be of considerable interest to construct an isopleth delimiting areas having more or less than 50% of winter months below 60.8°F (16°C).

The data discussed lend strong support to the argument often advanced that the early Southern Rhodesian shooting operations achieved success because they took place in areas in which G. morsitans was on the limits of its range. The following passage from Bursell's paper gives the basis of the argument :-

" The larva of the tsetse fly is nourished by a maternal secretion rich in lipoid and at the time of deposition it contains extensive reserves of chloroform-soluble substances, which will henceforth be referred to as fat. This fat constitutes

which remains at the end of development makes up the greater proportion of the food reserves available to the fly prior to its first blood-meal. It is clear that any factor which affects the amount of fat consumed during development will influence the length of life of the newly emerged fly and hence its chance of obtaining a blood-meal. "

It is evident that, in much of the area where the early successes were obtained, during the winter many flies must have emerged with inadequate fat reserves and therefore with a very short interval in which the teneral fly had to find its first meal. A comparatively slight reduction in food supplies would have turned the balance. As we know, at low levels where winters are hotter, much more intensive shooting has not always achieved success. Some officers heard Dr. Bursell deal with this problem from a slightly different angle in last year's Wild Life Conser - vation Course.

(J. Ford).

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Expectation od Critical Temperatures

for Glossina in Southern Rhodesia.

Stations	Mean Annual Temperature.	Months in which means fall below:- 60.8°F (16°C)	62.6°F (17°C)	Number of years:- Recorded.	In which winter mean is below 60.8°F.
Salisbury	65.37	6 7 8	5 6 7 8	19	19
Chipinga	65.65	6 7 8	5 6 7 8	17	17
Mtoko	67.15	6 7	6 7 8	17	13
Miami	67.17	6 7	6 7 8	17	14
Plumtree	67.40	6 7	6 7 8	16	12
Karoi	67.44	6 7	6 7	9	3
Gatooma	67.52	6 7	6 7	18	7
Umtali	67.53	6 7	6 7 8	19	14
Gokwe	67.54	7	6 7	17	1
Sinoia	67.58	6 7 8	6 7 8	19	18
Hartley	67.66	6 7	6 7 8	17	14
Sipolilo	67.73	6 7	6 7 8	17	12
Que Que	67.98	6 7	6 7 8	17	13
Bikita	68.13	6 7	6 7	15	8
New Years Gift.	68.68	6 7	6 7	14	5
Mt. Darwin	69.09	6 7	6 7 8	17	13
Gwaai Sdg.	70.00	6 7	6 7	14	11
Nuanetsi	71.67	6 7	6 7	17	4
Triangle	72.49	--	---	--	--
Chirundu	78.22	--	---	--	--