Original Communications.

THE COASTAL CLIMATE OF TROPICAL QUEENSLAND.

Meteorological Observations taken at Townsville.

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From the commencement of April, 1913, daily observations of the local meteorological conditions have been taken at the Australian Institute of Tropical Medicine, Townsville, North Queensland, and the records obtained are summarized in the following tables.

The instruments employed were supplied by the Commonwealth Bureau of Meteorology, Melbourne, and were of the standard pattern in use at the various weather stations throughout Australia.

These observations extending over thirteen months show two distinct seasons, each of six months' duration, the cooler season commencing towards the end of April, and the hotter season towards the end of October. The averages of the temperature records

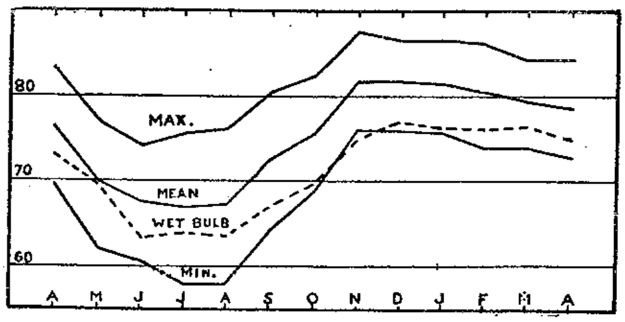

Fig. 1.

during May were markedly lower than those of the previous months, whilst during June and July the temperature still decreased, but the fall was much more gradual. Simultaneously with the fall in temperature the relative humidity of the air showed an analogous decrease, most pronounced between April and May.

The wet season proper finished about the end of April, only light rains occurring in May and June to the extent of 1·64 and 0·54 in. respectively, whilst from July until the middle of December only 0·32 in. were registered.

Between October and November a marked rise was observed in the averages of the readings of the maximum, minimum, wet and dry bulb thermometers. The hot season thus commenced towards the end of October and the high temperature continued from then, with no great variation, until the end of April, 1914. The relative humidity did not rise correspondingly in November, due to the fact that the thunderstorms and rain, which usually occur on the coastal area of North Queensland in October and November, did not commence until December. Only 0·31 and 0·01 in. of rain were recorded in October and November respectively, whereas from the records kept in Townsville for the past forty-two years the average rainfall for these months is 1·39 in. and 1·70 in.

The heavy rains commenced in December, and 45·59 in. were registered from then until the end of April, 1914.

This division into two seasons is readily seen from the accompanying graphs (fig. 1), in which are plotted the means of the average temperature, the maximum, minimum and wet bulb (3 p.m.) readings for each month.

For the sake of comparing the conditions at Townsville with those prevalent in other parts of the tropics where the climate is more generally known, in Table II are given the averages for Townsville for the whole year (May, 1913, to April, 1914), for the two periods of six months corresponding to the two seasons, and the yearly averages for Colombo, Ceylon [1]. For further comparison the temperatures for Bombay [2] are included in the table, since both Bombay and Townsville are situated in monsoon districts where the chief rains occur during the warmer months. It will be observed that during the hot season, November to

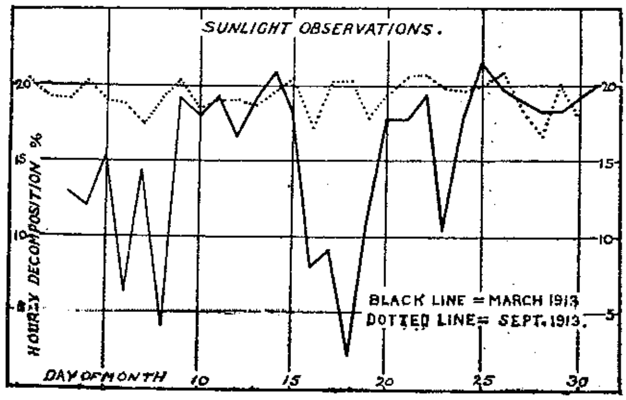

Fig. 2.

April, the meteorological conditions in Townsville are approximate to those which obtain throughout the whole year in Colombo. In Colombo, however, the temperatures do not vary to any great extent; the rainfall is much greater and is distributed over the whole year.

In addition to the foregoing, daily observations were made of the intensity of the sunlight, as regards those rays in the violet and ultra-violet portions of the solar spectrum. The method employed was that recommended by the late Paul Freer, of the Bureau of Science, Manila [3]. This depends upon the photocatalytic decomposition of oxalic acid into carbon monoxide, carbon dioxide and water in the presence of a uranium salt, a reaction which is brought about solely by the rays in question.

By this method daily determinations are made of the decomposition which takes place in a standard mixture of these substances when exposed in standard vessels to the sunlight during a definite interval, and the figures thus obtained may be compared with those found under identical conditions in other parts of the world.

TABLE I.

	1913									1914			
	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April
Mean dry bulb, 9 a.m. (degrees)	76·6	69·2	66·8	66·9	69·5	75·2	77·7	83·0	82·2	82·4	81·8	80·5	79·9
Mean wet bulb, 9 a.m. (degrees)	70·0	61·6	59·9	60·2	61·2	65·8	68·7	73·3	75·6	75·6	74·5	75·5	74·0
Mean dry bulb, 3 p.m. (degrees)	76·1	75·2	72·5	73·3	73·2	77·5	79·1	84·1	84·6	84·3	84·0	82·4	82·1
Mean wet bulb, 3 p.m. (degrees)	72·9	69·6	63·9	63·9	63·6	66·9	69·4	74·7	76·7	76·1	76·1	76·4	74·9
Mean dry bulb, 6 p.m. (degrees)	76·9	69·8	68·0	68·2	69·2	72·7	75·0	80·1	81·1	81·6	80·5	79·5	78·7
Mean wet bulb, 6 p.m. (degrees)	71·2	63·4	62·2	62·3	62·2	65·9	68·1	73·2	75·4	75·2	74·7	74·9	72·9
Mean maximum ,,	83·2	77·4	74·4	75·8	76·4	80·4	82·2	87·5	86·8	86·8	86·1	84·5	84·3
Mean minimum ,,	73·1	62·0	60·5	57·5	57·5	64·2	68·7	75·4	76·2	75·9	74·4	74·0	72·9
Maximum recorded ,,	88·7	84·2	80·5	78·3	81·7	84·7	88·9	99·5	91·2	91·3	92·3	87·4	86·2
Minimum recorded ,,	65·3	49·7	48·7	46·5	49·0	57·5	61·0	70·1	68·2	71·9	71·0	70·6	68·9
Mean daily range ,,	13·3	15·3	13·9	19·3	18·5	15·7	13·8	12·1	10·7	10·9	11·6	10·5	11·4
Extreme daily range (degrees)	21·0	22·7	25·8	34·9	25·0	26·2	20·8	24·3	17·1	13·8	17·8	15·0	16·1
Extreme monthly range (degrees)	23·4	34·5	31·8	31·8	32·7	27·2	27·9	29·4	23·0	19·4	21·3	16·8	17·3
Mean maximum solar (degrees)	134·5	125·3	120·2	127·9	129·6	136·7	140·8	147·1	146·9	144·0	146·7	140·1	139·2
Total rainfall (inches) ..	7·75	1·64	0·54	—	—	—	0·31	0·01	6·58	14·39	5·61	13·76	5·25
Number of wet days ..	6	7	4	—	—	—	3	1	18	15	13	16	8
Average fall on wet days (inches)	1·29	0·23	0·13	—	—	—	0·10	0·01	0·36	0·96	0·41	0·86	0·67
Greatest fall in 24 hours (inches)	3·96	0·84	0·25	—	—	—	0·19	0·01	1·60	5·53	2·38	2·75	2·35
Mean monthly relative humidity (per cent.)	70·9	63·3	62·8	60·5	60·6	60·2	63·2	64·5	72·6	71·8	70·6	77·7	73·7
Highest daily relative humidity (per cent.)	95·0	95·0	94·0	75·0	80·0	73·0	77·0	79·0	87·0	95·0	86·0	95·0	95·0
Lowest daily relative humidity (per cent.)	51·0	32·0	29·0	45·0	33·0	19·0	41·0	38·0	58·0	57·0	59·0	66·0	67 0

The determinations were carried out under the exact conditions recommended, and the standard flasks used were supplied by the Manila Bureau of Science. Mixtures of 5 c.c. 10 per cent. oxalic acid, 5 c.c. 1 per cent. uranyl acetate and 20 c.c. water were exposed daily from 9 a.m. until noon, and the oxalic acid remaining estimated by titration with standard potassium permanganate.

TABLE II.—COMPARISON OF TOWNSVILLE WITH OTHER TROPICAL PLACES.

	Mean temperature	Maximum	Minimum	Relative humidity
	Degrees	Degrees	Degrees	Per cent.
Townsville (19°8' S.), yearly average	75·6	81·9	68·3	67·0
Townsville, November to April	80·4	86·0	74·7	72·0
Townsville, May to October	69·8	77·8	61·2	62·0
Colombo, Ceylon (6° 56' N.), yearly average	81·1	87·1	75·9	81·1
Bombay (18° 54' N.), yearly average	79·4	95·0	61·0	—

On every occasion duplicate determinations were made and the mean figures taken.

The results are embodied in Table III, the figures representing the percentage of oxalic acid decomposed per one hour. As this method only gives a comparative measurement, figures are given in Table IV, which have been obtained in a similar manner in other places, and which have been published in the *Philippine Journal of Science* [4].

TABLE III.—MONTHLY AVERAGE OF THE PERCENTAGE OF OXALIC ACID DECOMPOSED PER 1 HOUR.

Month	Average	Maximum	Minimum	Clear days
1913	Per cent.	Per cent.	Per cent.	
March ..	15·4	21·6	2·1	12 out of 29
April ..	17·8	21.6	4·0	22 ,, 30
May ..	15·8	21·4	2·2	15 ,, 31
June ..	15·4	21·4	4·1	19 ,, 29
July ..	18·4	21·0	15·7	18 ,, 31
August ..	18·2	20·7	12·9	16 ,, 31
September	19·3	20·7	16·8	21 ,, 30
October ...	18·2	21·1	8·5	20 ,, 31
November	18·8	20·9	15·7	18 ,, 30
December ..	18·4	21·2	4·0	12 ,, 29
1914				
January ..	17·5	21·1	2·9	16 ,, 29
February ..	18·8	21·4	8·5	16 ,, 28
March ..	15·8	22·0	3·6	18 ,, 29

In the accompanying graphs (fig. 2) are given the daily variations during two months—one, March, 1913, in the wet season with a low average, and the other, September, 1913, in the dry season with a high average.

These results show that the sunlight in Townsville is extremely rich in these rays. The maximum decomposition, 22 per cent., is higher than any of those recorded elsewhere, whilst the average is higher than that recorded at Kuala Lumpur, a place almost on the equator. The figures also demonstrate that there is no difference between the hot and cool seasons as regards the maximum intensity, and that the lower averages which are obtained during the hot wet season are really due to the fact that during this time there are a number of days when the sun is obscured by clouds, which results in a low decomposition. The high yearly average is accounted for by the long dry season with its continuous sunny weather.

TABLE IV.—COMPARISON OF THE AVERAGE PERCENTAGE OF OXALIC ACID DECOMPOSED PER HOUR.

Place	Date	Average	Maximum	Minimum	Period
		Per cent.	Per cent.	Per cent.	Months
Townsville, 19° 8′ S.	1913-14	17·5	22·0	2·1	13
Manila, 14° 36′ N.	1910-11	12·4	17·8	1·1	15
Kuala Lumpur, 3° 10′ N.	1911	15·3	18·1	9·0	7
Honolulu, 21° 18′ N.	1911	13·8	20·8	3·5	10
Bagino (Philippines)	1911	14·2	20·6	6·9	4
Khartoum (Soudan), 15° 36′ N.	1911	17·5	20·8	14·8	3
Washington, 38° 59′ N.	1910-11	10·9	19·1	1·7	11

REFERENCES.

[1] CASTELLANI and CHALMERS. "Manual of Tropical Medicine," 1913.
[2] HANN. "Handbuch der Klimatologie," 1910.
[3] *Philippine Journal of Science*, 1912, vii, Section B, p. 1.
[4] *Ibid.*

PRELIMINARY NOTES ON ENTAMŒBIASIS.

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AS a result of a systematic examination of the evacuations of all fevers which are not amenable to quinine and are not typical of enteric fever, I have found that infection with the entamœbæ is quite a common disease with a most complex and variable syndrome, entitling it to rank in point of polymorphism along with syphilis. We may call this infection entamœbiasis without qualification, as at present it is not yet possible to say that the general disease is solely due to the *Entamœbæ histolyticæ*.

Entamœbiasic is then an infection of man by any species of pathogenic amœba. So far in my observations the *Entamœbæ histolytica*, or some form closely allied to it, is the cause of symptoms here described.

The primary infection generally occurs by the way of the intestinal canal. It gives rise to the well-known amœbic dysentery as a rule, or it may be located in the biliary passages without giving rise to any intestinal sign or symptom, except gastric irritation in the form of nausea and vomiting and pain in the epigastric region. This hepatic infection is often characterized by an irregular fever which corresponds to that which was described by physicians in India as typho-malarial. This fever, which Rogers clearly recognized, should be called entamœbic fever. It may closely resemble an ague or remittent fever. Under quinine it may even assume a tertian or quartan type, but tends to become remittent. Sometimes it soon shows intestinal signs in the shape of flatulence and diarrhœa, and then is easily mistaken for tropical enteric fever. The urine may show the diazo-reaction, which is not quite typical, inasmuch as the froth is coarse and not pink. The stools are charged with the entamœbæ in one form or another.

Sometimes the hepatic infection is very acute and then we have symptoms of toxæmia characterized by severe urticaria, gastric or hepatic pain, vomiting, choleraic symptoms, collapse, with more or less fever. Until complications set in the pulse is unusually slow (75 to 90 per minute). Both the toxæmia and entamœbic fever may occur without a previous history of dysentery. More rarely multiple abscesses may be the first indication of illness, and as a result there may be developed a distinct form of dermatitis. The abscesses lead to the formation of enormous sinuses and fistulæ in the subcutaneous tissue.

Hepatitis and hepatic abscess is the late manifestation of the entamœbic fever, which may be the primary disease, or which may arise as a sequela of amœbic dysentery. Multiple abscesses may develop under the skin or in the brain or elsewhere.

The protean features of this entamœbic infection may be summarized as follows :—

PRIMARY INFECTION.

Hepatic Passages.—Toxæmia, entamœbic fever, entero-colitis.

Intestinal Canal.—Acute amœbic dysentery.

SECONDARY MANIFESTATIONS (infection spreading from entero-hepatic foci).

Skin Eruptions.—Urticaria, bullous eruption and ulcers, multiple abscesses.

Bronchitis (chronic).

Hepatitis and Hepatic abscess, obscure headaches, neuralgic pains.

Entamœbic Cachexia.—Anæmia, anarsaca, albuminuria, profuse sweats, debility.

Peritonitis, Ascites, Typhlitis (?)

Relapses are very frequent, and one form may pass into another. The primary infection may escape notice altogether. *Death* may result from hyperpyrexia and exhaustion or coma, or from asthenia and cachexia.

Treatment.—The only remedy is emetine chloride by intravenous, intramuscular, or subcutaneous injection. The maximum doses should be given. One grain intramuscularly one to three times a day may be given, and may be repeated until the parasite disappears from the stools. Burroughs Wellcome and Co.'s vapurols have been used throughout.

The emetine chloride given by the mouth, even when keratin coated, gives rise frequently to severe vomiting unless the patient lies in bed and avoids drinking large quantities of fluid.

The entamœbic fever is cured as quickly and effectively as the dysentery. The temperature may come down by crisis with sweating and collapse. With quinine the fever becomes irregular.

Symptomatic treatment for the collateral complications as a result of abscess, anæmia, debility, &c., is always necessary.

Sleeplessness is troublesome. Profuse sweating calls for treatment and is easily amenable to atropine.

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