THE INCIDENCE OF 'CLIMATE ASTHMA' IN SOUTH AFRICA: ITS RELATION TO THE DISTRIBUTION OF MITES*

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SUMMARY

A survey has been made of the regions of South Africa, from the low coastal altitude to the inland regions of high altitude, in regard to the presence and number of mites in the house dust in connection with 'climate asthma'. The data obtained confirm that the number of mites in the house dust depends upon the relative humidity of the region involved. A number of anomalous findings are reported from inland and coastal regions where unexpectedly high or low mite counts are recorded. They are accounted for, however, by the high or low relative humidity of the area concerned due to the local adjoining warm or cold ocean-currents. This confirms the relationship of the incidence of 'climate asthma' to the factor of relative humidity.

The mite most commonly found in the house dusts in South Africa is Dermatophagoides pteronyssinus. *Other mites found include* Euroglyphus maynei, Chortoglyphus domesticus *and other species.* Dermatophagoides farinae *mites were recovered in scanty numbers from the house dust of only 2 towns.*

In a previous article[1] I summarized the details relating to the evolution in South Africa of the concept of 'climate asthma'. The disease was manifested in persons whose chest symptoms were absent or relatively mild in the inland regions of the country, but in whom symptoms of bronchospasm appeared or were aggravated when they lived at or merely visited the coastal regions of South Africa. Much effort was expended in the attempt to correlate this specific form of asthma with various physical, climatic and other factors. The aerobiology of coastal and inland regions was studied but no significant difference was found in the atmosphere in regard to the presence of pollens or fungi. Attempts were also made to establish whether there were any unusual physical contacts or psychological problems encountered by sufferers during their coastal stay, again without significant results. The most obvious difference between inland and coastal regions appeared to be climate. Many charts were then drawn of the various factors characterizing the climate in these two regions. The most striking difference was revealed in the charts showing the relative humidity and the temperature, as illustrated in Fig. 1.

It will be seen that in the inland regions there is a *wide* range of relative humidity and of temperature diurnally as well as throughout the months of the year, whereas in the coastal areas there is a corresponding *narrow* range.

The author[2,3,4] then attempted during subsequent visits to Europe and the Americas to elicit from medical colleagues there whether similar 'climate asthma' relationships existed. This was found to be the case. Large numbers of climate charts were then drawn of these countries and similar differences were shown in coastal and inland relative-humidity percentage and temperature. (Figs. 2, 3 and 4). It thus soon became evident that 'climate asthma' was of universal occurrence and was associated with the same climate factors. In our previous studies of asthma in South Africa over many years we had established that these asthma patients, worse at the coast, were sensitive to house dust,[5,6] more especially to house dust from coastal areas. Further investigations showed that not only was the skin sensitivity to coastal house dust more pronounced than to inland house dust but desensitization of the patient with extract of coastal house dust proved of greater value. This finding was a striking confirmation of the part played by house dust in 'climate asthma'.

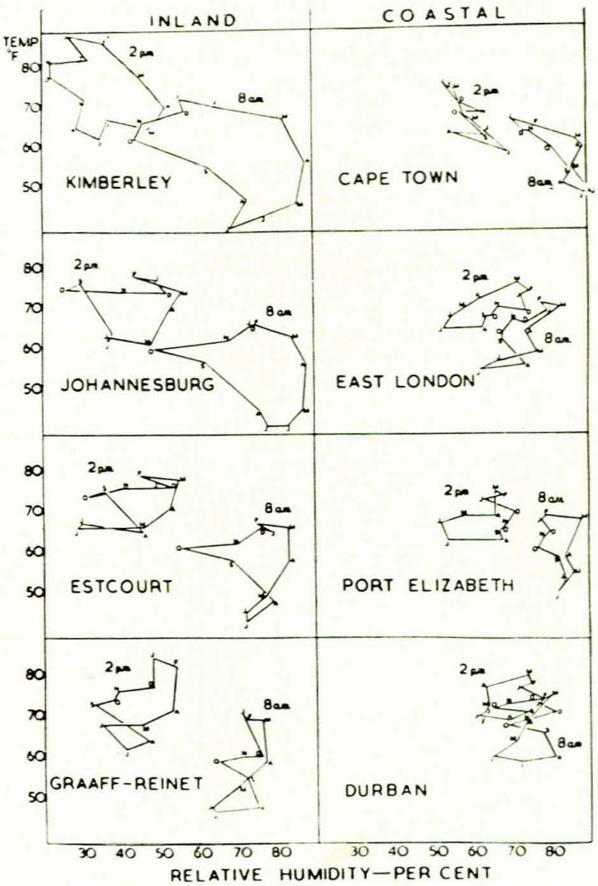

Fig. 1. Comparison of the climate patterns of certain inland and coastal towns in South Africa based on diurnal and monthly figures of temperature (°F) and relative humidity (%).

The important question, however, still remained: what is it in the dust of coastal areas that precipitates bronchospasm in the 'climate asthma' patient? In the same way

* Date received: 2 March 1971.

as it is not sufficient to declare that 'summer hay-fever' is due to the 'climate' of the summer season, when, in fact, grass pollen is the direct trigger factor, so there had to be something more intimately connected with the precipitation of 'climate asthma'.

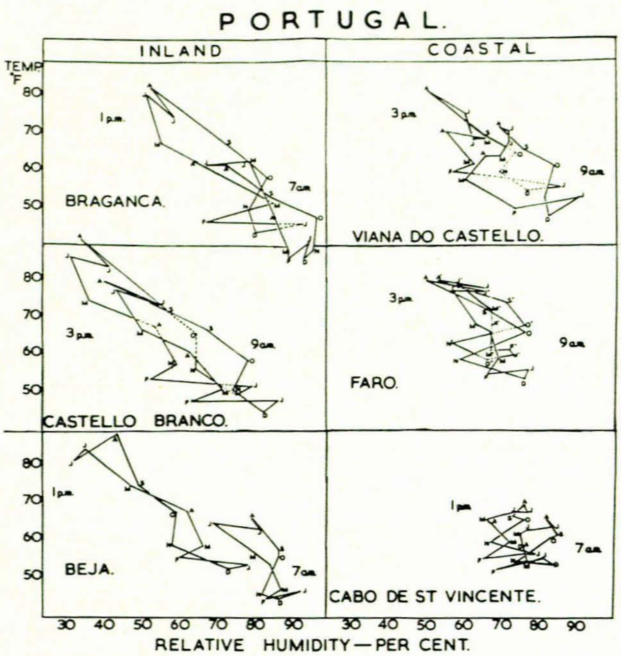

Fig. 2. Comparison of the climate patterns of certain inland and coastal towns of Portugal based on diurnal and monthly figures of temperature (°F) and relative humidity (%).

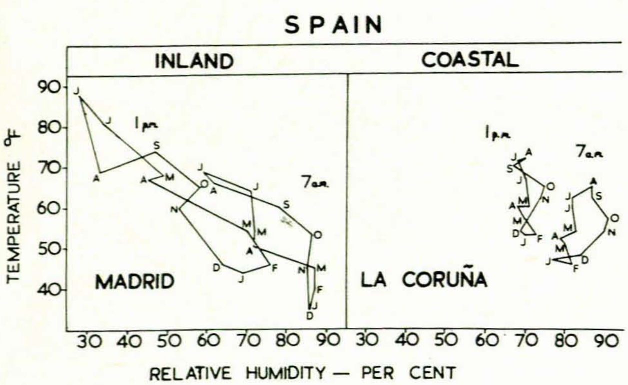

Fig. 3. Comparison of the climate patterns of the inland town of Madrid and the coastal town of La Corũna in Spain based on diurnal and monthly figures of temperature (°F) and relative humidity (%).

The trigger factor in coastal house dust was not established until 1964 when Voorhorst[7] and his co-workers in the Netherlands found that mites (Acaridiae), especially *Dermatophagoides pteronyssinus,* were the specific agents in house dust affecting 'climate asthma' patients. Hence it was confirmed that this mite was characteristically present in districts where the relative-humidity percentage was high. Houses situated in damp surroundings, for example, and on rivers and canals had house dust with a higher mite content than that from houses situated in drier areas.[8,9,10] Indeed, it was shown that by comparative skin tests with extract of house dust and with extract of mites, that the latter produced more significant reactions.[8,9] Maunsell *et al.*[11] as well as other workers in England and elsewhere[12,13,14] confirmed these findings. From all these investigations there was little doubt that this mite, relatively abundant in humid regions, and not the house dust *per se,* was the true aetiological agent in 'climate asthma'.

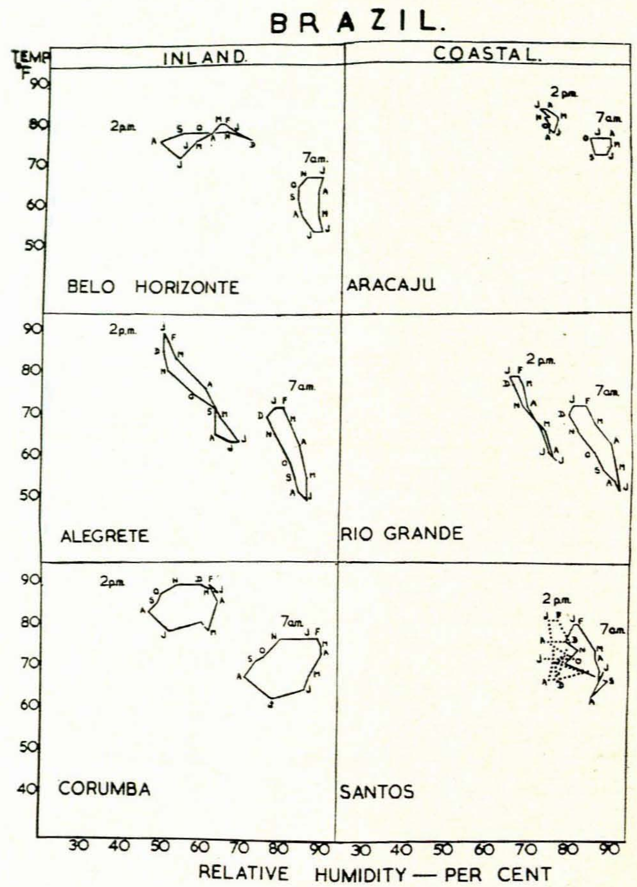

Fig. 4. Comparison of the climate patterns of certain inland and coastal towns of Brazil based on diurnal and monthly figures of temperature (°F) and relative humidity (%).

It was later reported[15] that in the USA species of mites other than *Dermatophagoides pteronyssinus* could also be responsible for house dust sensitivity. There it was found that *Dermatophagoides farinae* was the dominant mite concerned. In addition, other species of mites collected from samples of house dust in humid regions, were found to be of clinical significance in 'climate asthma' but to a lesser extent.[11,16]

As a result of these findings it was decided to pursue our own investigations as to whether in South Africa a

TABLE I. MITE COUNTS PER 5 G OF HOUSE DUST SAMPLES COLLECTED FROM TOWNS IN SOUTH AFRICA

Town	*Height above sea-level (ft)**	*Annual average relative humidity*		*No. of samples*	*Average mite count*		
		8 a.m.	*2 p.m.*		*Dermatophagoides pteronyssinus*	*Other mite species*	*Total No.*
Morgan Bay	6	—	—	1	12	9	21
Lambert's Bay	6	90	78	4	54	9	63
Knysna	12	84	—	3	26	3	29
Oranjemund	12	83	59	3	35	6	41
Wilderness	12	84	—	1	17	3	20
Durban	22	75	70	7	125	15	140
Jeffrey's Bay	27	91	82	3	126	18	144
Humansdorp	27	91	82	3	34	3	37
Margate	50	80	78	4	125	19	144
Cape Town	52	79	54	10	65	41	106
Stanger	140	—	—	4	39	8	47
Bredasdorp	169	87	73	3	32	4	36
Port Elizabeth	181	81	63	12	201	23	224
Mossel Bay	200	82	69	4	180	19	199
Port Alfred	200	78	—	4	9	4	13
Empangeni	210	—	—	2	65	29	94
Clanwilliam	245	—	—	1	5	7	12
East London	328	72	65	5	295	134	429
Uitenhage	358	—	—	4	59	12	71
Citrusdal	566	—	—	4	13	4	17
Worcester	815	84	45	4	2	2	4
George	831	76	62	1	111	17	128
0 - 1 000 ft		82	68		74	17	91
Oudtshoorn	1 090	79	44	5	1	2	3
King William's Town	1 230	72	44	5	9	2	11
Ceres	1 497	77	—	5	2	1	3
Messina	1 704	71	46	3	29	7	36
1 000 - 2 000 ft		75	45		10	3	13
Nelspruit	2 180	76	45	5	4	2	6
Laingsburg	2 193	—	—	2	0	0	0
Umtata	2 228	79	48	3	17	2	19
Steytlerville	—	—	—	3	2	3	5
Graaff-Reinet	2 400	66	37	5	1	1	2
Somerset East	2 514	67	39	2	1	5	6
Upington	2 620	55	24	6	0	1	1
Beaufort West	2 860	63	30	4	1	0	1
Cradock	2 860	72	34	2	1	0	1
Barberton	2 906	79	47	6	9	3	12
2 000 - 3 000 ft		70	38		2	1	3
Louis Trichardt	3 145	83	—	4	68	65	133
Calvinia	3 270	71	38	3	0	1	1
Ladysmith	3 284	75	41	1	1	0	1
Queenstown	3 533	71	37	6	1	0	1
Barkly West	3 590	59	29	3	0	1	1
Greytown	3 607	77	55	4	63	9	72
Estcourt	3 803	72	41	4	48	10	58
Warmbaths	3 853	61	—	4	0	1	1
Vryburg	3 900	64	30	3	1	0	1
Vryheid	3 917	80	—	1	115	85	200
Kimberley	3 996	59	29	4	1	1	2
3 000 - 4 000 ft		70	38		27	16	43
Victoria West	4 129	68	30	4	0	0	0
De Aar	4 143	66	30	3	1	0	1
Mafeking	4 169	65	34	3	1	0	1
Piet Retief	4 171	75	46	1	5	1	6
Pietersburg	4 244	72	41	4	2	1	3
Postmasburg	4 345	53	28	3	0	1	1
Klerksdorp	4 347	60	—	3	3	5	8
Aliwal North	4 367	72	37	2	0	1	1
Welkom	4 390	74	—	5	1	0	1
Kroonstad	4 423	75	36	4	1	1	2
Potchefstroom	4 424	66	35	3	0	0	0
Burghersdorp	4 554	87	73	1	3	1	4
Richmond	4 530	—	—	3	0	0	0
Pretoria	4 524	69	39	2	2	3	5
Bloemfontein	4 583	64	33	4	0	0	0
Witbank	4 823	73	41	3	0	0	0
4 000 - 5 000 ft		69	39		1	1	2
Volksrust	5 110	72	44	3	23	5	28
Springs	5 538	70	41	1	4	5	9
Ermelo	5 689	78	—	1	48	5	53
Johannesburg	5 860	71	41	9	1	0	1
5 000 - 6 000 ft		73	42		19	4	23

*1 foot = ·305 metre.

similar 'house dust—mite—climate asthma' relationship existed. For this purpose large numbers of samples of house dust were obtained from different inland and coastal regions of South Africa. From previous studies, it was obvious that coastal regions and other regions of low altitude could be expected to show a high relative-humidity percentage with high mite counts and conversely, low mite counts from regions of high altitude and low relative humidity.

From each sample of dust received 5 g were used for the counting and identification of the mites present therein. Fig. 5 is a map of South Africa indicating the heights above sea-level of the regions from which house dust samples were received and showing the average counts of the mite (*Dermatophagoides pteronyssinus*) in the individual towns.

The number of samples of house dust from each of the 67 towns studied are shown in Table I as well as the average number of mites found in these samples. It will be observed that more than one sample was received from each town for study as it was necessary to consider the 'average' count because of the possibly different sources of the house dusts — damp or dry houses, or from houses in low-lying or high-lying situations. In the table the altitude above sea-level of each town is given as well as the average relative-humidity percentages at 8 a.m. and 2 p.m.

TABLE II. AVERAGE MITE COUNTS PER 5 G OF HOUSE DUST SAMPLES COLLECTED FROM TOWNS IN SOUTH AFRICA OF THE SAME ALTITUDE ABOVE SEA LEVEL

		Average mite count		
Height above sea-level (ft)	*No. of towns*	*Dermatophagoides pteronyssinus*	*Other mites*	*Total No.*
0 - 1 000	22	74	17	91
1 000 - 2 000	4	10	3	13
2 000 - 3 000	10	2	1	3
3 000 - 4 000	11	27	16	43*
4 000 - 5 000	16	1	1	2
Over 5 000	4	19	4	23*

*The reason for these high mite counts in inland regions is, as explained above, due to the high relative humidity in these towns associated with the nearby ocean currents (Fig. 6 and Table III).

The information supplied in Table I was then, for greater simplicity, summarized in Table II where the individual towns are not specifically considered, but where towns of approximately the same altitude above sea-level have been grouped together.

It was found that *Dermatophagoides pteronyssinus* was the dominant mite. Other mites found included *Euroglyphus maynei, Dermatophagoides farinae, Chortoglyphus domesticus* and other species. Of the dusts investigated *Dermatophagoides farinae* mites were found only in the samples from 2 towns — Jeffrey's Bay and Louis Trichardt.

In Table III where 8 inland towns at altitudes of 2 000 - 6 000 ft above sea-level are listed, the average counts of *Dermatophagoides pteronyssinus* in the samples received were unexpectedly high for, as has been shown above, inland towns of high altitude generally have a low mite count. However, it was through the Weather Bureau in Pretoria that we subsequently learned that these towns fell into an inland region with a high relative-humidity percentage (Fig. 6), due to the warm moist air associated with the adjoining Moçambique current on the East Coast. In the presence of such warmth a greater amount of moisture is retained in the atmosphere resulting in a higher humidity. By the same token certain towns in the south-western Cape Province, Clanwilliam, Citrusdal, Ceres and Worcester on the coastal plain, contrary to expectation, show relatively low mite counts (Table IV). This could be explained by the fact that the relative humidity in this region tends to be low (Fig. 6) because of the influence of the cold Benguela current on the West Coast where the capacity of the atmosphere for the retention of moisture is reduced. It is in this sense that even anomalous findings such as the above help to confirm the humidity - mite theory.

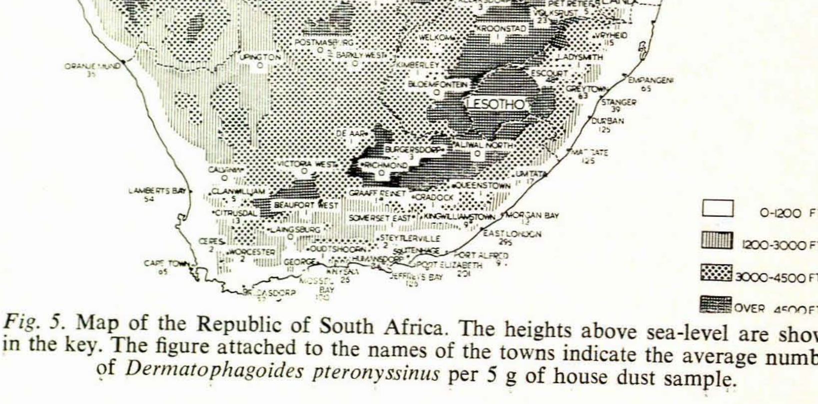

Fig. 5. Map of the Republic of South Africa. The heights above sea-level are shown in the key. The figure attached to the names of the towns indicate the average number of *Dermatophagoides pteronyssinus* per 5 g of house dust sample.

TABLE III. ANOMALOUS HIGH MITE COUNTS IN TOWNS OF HIGH ALTITUDE

Town	Height above sea-level (ft)	No. of samples	Average mite counts (per 5 g of house dust)		
			Dermatophagoides pteronyssinus	Other mite species	Total No.
Messina	1 704	3	29	7	36
Umtata	2 228	3	17	2	19
Louis Trichardt	3 145	4	68	65	133
Greytown	3 607	4	63	9	72
Estcourt	3 803	4	48	10	58
Vryheid	3 917	1	115	85	200
Volksrust	5 110	3	23	5	28
Ermelo	5 689	1	48	5	53

TABLE IV. ANOMALOUS LOW MITE COUNTS IN TOWNS OF LOW ALTITUDE (COASTAL)

Town	Height above sea-level (ft)	No. of samples	Average mite counts (per 5 g of house dust)		
			Dermatophagoides pteronyssinus	Other mite species	Total No.
Clanwilliam	245	1	5	7	12
Citrusdal	566	4	13	4	17
Worcester	815	4	2	2	4
Ceres	1 497	5	2	1	3

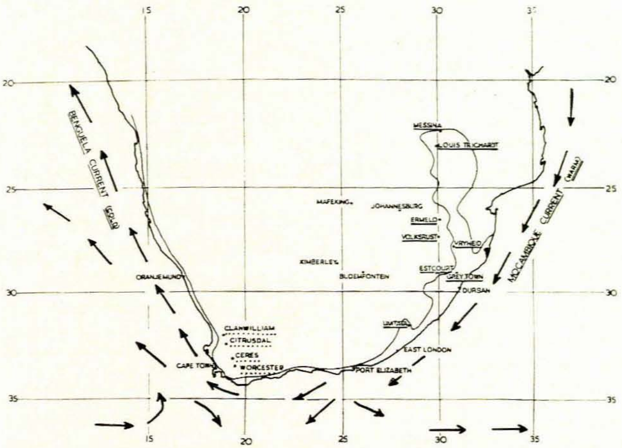

Fig. 6. Map of South Africa indicating the influence of the warm Moçambique current (East Coast) and the cold Benguela current (West Coast) on the relative humidity of adjoining regions: —— inland towns where the humidity is increased (Table III); ...... coastal towns where the humidity is decreased (Table IV).

I should like to thank the medical men throughout the country who kindly arranged for samples of house dust to be collected for study; Dr F. Zumpt for his highly-skilled assistance and the loan of the necessary equipment; and Mrs R. J. Nunnerley for her assistance.

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