HOUSE DUST MITE FAUNA IN THE KLANG VALLEY, MALAYSIA

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Abstract. Allergy to house dust mites (HDM) is an important cause of asthma and rhinitis in Malaysia. This study was carried out to evaluate the dust mite fauna in the Klang Valley. Dust samples were collected from 20 houses from March 1994 to February 1995. Thirty-three dust samples from mattresses were examined monthly for the occurrence of HDM. A total of 22 species in 9 families of HDM was identified. The most common and densely populated species was *Blomia tropicalis* with an average density of 8,934 mites/g of dust. *Dermatophagoides pteronyssinus* was the next in abundance, followed by *Malayoglyphus intermedius*. All houses surveyed were found to be infested with HDM and every house had at least 6 species of HDM. *B. tropicalis* and *D. pteronyssinus* were found in all mattresses. HDM in the Klang Valley were found to be highly prevalent and present in high densities. In this study, counts of *D. pteronyssinus* was found to exceed the proposed exposure threshold of 500 mites/g dust, for triggering acute asthma. Although counts of *B. tropicalis* exceeded *D. pteronyssinus*, no conclusion could be made because there is currently no exposure threshold for triggering acute asthma, for this species. Monthly distribution of *B. tropicalis* and *D. pteronyssinus* showed 2 peaks and 4 peaks, respectively. The major peak for *D. pteronysinus* was in January 1995 whereas for *B. tropicalis*, the major peak was more variable and occurred between November 1994 to January 1995. Both the species showed minor peak in April 1994.

INTRODUCTION

Allergy to HDM is an important cause of asthma and rhinitis in Malaysia (Gan and Rajagopalan, 1987; Ho *et al*, 1995; 1997). Positive skin prick tests with mite extracts have been detected in more than 80% of asthmatic and rhinitis patients.

Earlier extensive mite surveys in Malaysia, conducted more than 20 years ago, had indicated that *Dermatophagoides pteronyssinus* was the most common and abundant species found throughout the country. Predominance of a species is the end result of a complex interplay of many factors and may not be a stable situation. This was shown when *Sturnophagoides brassiliensis* was found to be the most abundant species in dust and revealed a much higher mean number of mites than previously reported in a survey of HDM in Kuala Lumpur (Ho and Mariana, 1994; Mariana and Ho, 1996). However, another survey conducted 2 years later reported another species, *Blomia tropicalis*, as the most common and abundant species of HDM (Mariana and Ho, 1996).

The present study was carried out to evaluate the dust mite fauna in Klang Valley, Malaysia. The results of this study will indicate the current distribution of various species of HDM that are found in mattresses under local conditions. Information on the distribution and abundance of these mites will provide for a better understanding of the possible associations of different families and species of mite; and provide a basis for refinement of their control. Species of mites that are common and abundant have the potential to play an allergenic role and should be investigated further.

MATERIALS AND METHODS

Study design

Dust samples were collected monthly from 33 mattresses in 20 houses located in the Klang Valley, Malaysia. The study was conducted from March 1994 to February 1995. All mattresses sampled were in use during the period of study.

The techniques for collection of dust samples, extraction of mites and preparation of mites for identification, followed those used by Ho and Nadchatram (1984). A 1 m^2 surface area was vacuumed for 3 minutes. The vacuum cleaner was cleaned after each sample to ensure minimum contamination between sampling. Dust was collected over a Whatman no 1 filter paper placed in the collecting chamber of the vacuum cleaner. A clean filter paper was used for each dust sample.

Filter papers with dust samples were folded and sealed in separate plastic vials. Sealed vials were kept in the refrigerator at approximately 7ºC until processed. Previous observations indicated that there was no increase in the mite population at this temperature. The dust was weighed and processed by first passing through a set of sieves of decreasing mesh size in a sieve shaker for 15 minutes. The portion of dust that was retained in the sieve of 75 µ mesh was processed.

The dust was suspended in 90% lactic acid and heated with constant stirring. The beaker was removed from the flame as soon as the suspension began to "bubble". The suspension was left to cool, after which a small volume at a time was transferred to a Petri dish and examined under 20x magnification. Whole mites and mite fragments were picked with a sharpened applicator stick. These were mounted in Hoyer's medium. Mounted slides were dried in an oven at 40ºC for 10-12 days before the mites were identified.

Statistical analysis

Comparisons of mite counts were analysed using Kruskal-Wallis one way analysis of variance test for comparing the medians between groups.

RESULTS

Distribution and species composition of mites fauna

HDM were present in all houses and mattresses surveyed (Tables 1, 2). These mites were found to be highly prevalent and present in high densities in the Klang Valley. All houses surveyed were found to be infested with HDM, with the majority of them (90%) having more than 2,000 mites/g of dust (Table 3). Density above 18,000 mites/g dust were found in 20% of the houses. Total average densities of mites recovered from the houses ranged from 394 to 27,399 mites/g of dust (Table 3). Every house had at least 6 species of HDM. *Cheyletus malaccensis, Blomia tropicalis, Dermatophagoides farinae, Dermatophagoides pteronyssinus, Malayoglyphus intermedius* and *Sturnophagoides brassiliensis* were recovered from all houses. Of these species, only 2 species (*B. tropicalis* and *D. pteronyssinus*) were found in all mattresses (Table 4).

The majority of the mites recovered were from the families Glycyphagidae, Pyroglyphidae, Cheyletidae, Saproglyphidae and Tarsonemidae. The Glycyphagids were most frequently collected, followed by Pyroglyphids and Cheyletids. The Glycyphagid mite, *B. tropicalis,* was the most common and abundant species recovered in this study with an average density of 8,934 mites/g of dust (Table 4). *B. tropicalis* counts were found to be significantly different from all the other species ($p < 0.05$) except *D. pteronyssinus*. Densities of *B. tropicalis* and *D. pteronyssinus* in the Klang Valley were not significantly different ($p = 0.508$).

Although less frequently collected, Pyroglyphids represented the most number of species recovered with a total of 6 species identified. The most common and abundant species in this family was *D. pteronyssinus* with an average mean density of 4,553 mites/g of dust (Table 4). Another species, *M. intermedius,* was as common but its average mean density was lower (1,020 mites/g of dust*). D. farinae* and *S. brassiliensis* were not so frequently found. *E. maynei* and *H. domicola* were found less often and also in small numbers; both species were collected from only one house.

Many of the Cheyletid mites found were immature specimens and could not be identified to species level. Three Cheyletid species that could be identified were *Cheyletus fortis, C. malaccensis* and *C. malayensis*. Among these species, *C. malaccensis* was most often recovered and had a comparatively higher density (83 mites/g of dust) than the other two species (Table 4).

Suidasia nesbitti and *S. pontifica* were the only 2 species of Saproglyphids found. The average mean density for the latter species was about double the former species (Table 4).

Other mites identified from this study were from the family Tetranychidae, Tydeidae and Tarsonemidae. *Tarsonemus* spp was the most often recovered compared to *Tetranychid* spp and *Tydeid* spp (Table 4).

Distribution patterns

Monthly distribution of common allergen producing mites, *B. tropicalis, D. pteronyssinus* and *D. farinae* are shown in Fig 1. The density of *B. tropicalis* was much higher than the 2 species of *Dermatophagoides* at all time during the period of study. The distribution of *B. tropicalis* and *D. pteronyssinus* followed each other rather closely

Table 1
Houses in the Klang Valley where HDM had been found in mattress dust (March 1994-February 1995).

Species	Houses surveyed																				Total house positive
	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	
Acaridae																					
Acarus spp																				+	1
Tyrophagus putrescentiae	+	+	+	+	+	+	+		+		+	+			+	+					12
Cheyletidae																					
Cheyletus fortis		+	+	+	+	+	+		+		+	+	+		+		+		+		13
Cheyletus malaccensis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Cheyletus malayensis	+	+	+	+	+	+	+			+	+	+			+		+	+	+	+	15
Cheyletus spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Chortoglyphidae																					
Chortoglyphus arcuatus												+									1
Glycyphagidae																					
Austroglycyphagus malaysiensis	+	+	+	+			+									+	+			+	8
Blomia tropicalis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Trophilicus aframericanus			+	+	+								+		+						5
Pyroglyphidae																					
Dermatophagoides farinae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Dermatophagoides pteronyssinus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Euroglyphus maynei														+							1
Hirstia domicola	+																				1
Malayoglyphus intermedius	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Sturnophagoides brassiliensis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Saproglyphidae																					
Suidasia nesbitti			+				+			+	+	+	+			+			+		8
Suidasia pontifica	+	+	+	+	+	+	+		+	+	+	+	+		+	+			+	+	16
Suidasia spp		+	+																		2
Tetranychidae																					
Tetranychid spp		+		+											+		+				4
Tydeidae																					
Tydeid spp		+		+											+						3
Tarsonomedae																					
Tarsonemus spp	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	19
Total number species	13	16	16	16	13	12	14	7	11	11	13	14	12	9	15	12	12	9	12	12	

Table 2
Mattresses in the Klang Valley where HDM had been found (March 1994-February 1995).

Species	Mattresses surveyed																																Total mattress positive
	A	B	C	D1	D2	D3	E1	E2	F	G	H	J	K	L	M1	M2	N1	N2	N3	O1	O2	O3	O4	O5	P1	P2	Q	R	S	T1	T2	U1	U2	
Acaridae																																	
Acarus spp																															+		1
Tyrophagus putrescentiae	+	+	+	+			+	+	+	+		+	+		+											+	+						13
Cheyletidae																																	
Cheyletus fortis		+	+	+			+		+	+		+	+		+	+	+	+								+		+		+			15
Cheyletus malaccensis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+					+	+	+	+		+	+		26
Cheyletus malayensis	+	+	+		+			+	+	+			+	+	+											+		+	+		+	+		15
Cheyletus spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	33
Chortoglyphidae																																	
Chortoglyphus arcuatus																+	+																	2
Glycyphagidae																																	
Austroglycyphagus malaysiensis	+	+	+	+						+																	+	+				+		8
Blomia tropicalis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	33
Trophilicus aframericanus			+		+		+									+	+									+	+							7
Pyroglyphidae																																	
Dermatophagoides farinae	+	+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				+	+	+	+	+	+	+	+	28
Dermatophagoides pteronyssinus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	33
Euroglyphus maynei												+								+														2
Hirstia domicola	+																																	1
Malayoglyphus intermedius	+	+	+	+	+		+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	30
Sturnophagoides brassiliensis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				+	+	+	+	+	+		+	+	+	+		+	+		27
Saproglyphidae																																	
Suidasia nesbitti			+							+		+	+	+	+											+				+			8
Suidasia pontifica	+	+	+	+	+	+	+		+	+		+	+	+	+			+	+						+	+	+			+	+	+	+	22
Suidasia spp		+	+																															2
Tetranychidae																																	
Tetranychid spp		+			+																					+		+						4
Tydeidae																																	
Tydeid spp		+			+																					+								3
Tarsonomedae																																	
Tarsonemus spp	+	+	+	+	+	+	+	+	+	+		+	+	+	+		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	30
Total number species	13	16	16	12	12	7	12	10	12	14	7	13	13	11	14	7	9	10	9	8	8	7	6	4	7	16	11	12	9	8	11	12	7	

Table 3
Average densities of HDM per gram of dust and total number recovered from houses surveyed (n=20) in the Klang Valley (March 1994-February 1995).

Species	Average densities of HDM (mites/g) in house																			
	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U
Acaridae																				
Acarus spp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	2.50
Tyrophagus putrescentiae	8.33	1.67	15.00	20.00	63.33	1.67	13.33	0.00	1.67	1.67	0.00	6.67	0.00	0.00	16.67	4.17	0.00	0.00	0.00	0.00
Cheyletidae																				
Cheyletus fortis	0.00	40.83	5.00	2.50	13.75	15.00	3.33	0.00	1.67	6.67	0.00	3.33	2.78	0.00	11.25	0.00	1.67	0.00	0.83	0.00
Cheyletus malaccensis	68.33	177.50	120.00	46.11	53.33	94.17	37.50	0.83	6.67	26.67	53.33	15.00	23.06	1.00	97.92	8.33	34.17	8.33	5.00	9.17
Cheyletus malayensis	20.83	6.67	6.67	4.17	8.33	40.83	15.83	0.00	0.00	1.67	4.17	1.67	0.00	0.00	20.83	0.00	15.83	1.67	2.50	2.92
Cheyletus spp	216.67	1,177.50	711.67	176.94	496.25	539.17	371.67	15.00	59.17	221.67	132.50	73.33	100.56	10.00	772.92	19.17	225.00	86.67	24.17	35.83
Chortoglyphidae																				
Chortoglyphus arcuatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Glycyphagidae																				
Austroglycyphagus malaysiensis	22.50	1.67	8.33	1.67	0.00	0.00	9.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.17	8.33	0.00	0.00	1.67
Blomia tropicalis	2,396.67	13,144.17	21,899.17	2,800.83	14,311.25	3,106.67	5,150.00	158.33	850.83	1,932.50	1,059.17	766.25	1,663.89	375.00	9,047.92	442.50	917.50	376.67	792.08	422.08
Trophilicus aframericanus	0.00	0.00	2.50	0.83	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.44	0.00	296.67	0.00	0.00	0.00	0.00	0.00
Pyroglyphidae																				
Dermatophagoides farinae	142.50	28.33	314.17	2.22	352.92	134.17	102.50	24.17	39.17	77.50	53.33	82.92	43.89	1.50	30.83	41.67	48.33	193.33	56.67	283.75
Dermatophagoides pteronyssinus	3,632.50	6,518.33	4,095.83	5,302.50	3,007.50	2,800.00	1,399.17	162.50	1,330.00	1,175.00	1,442.50	1,082.50	885.83	430.83	4,375.42	1,119.17	4,070.83	1,880.00	1,094.17	2,281.67
Euroglyphus maynei	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Hirstia domicola	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malayoglyphus intermedius	11,664.17	111.67	169.17	41.11	115.00	314.17	269.17	30.00	5.00	436.67	10.00	7.50	21.11	33.50	17.08	1.67	15.00	448.33	173.33	47.50
Sturnophagoides brassiliensis	5.83	23.33	15.83	6.39	33.75	47.50	38.33	3.33	3.33	63.33	228.33	12.08	2.78	1.33	25.00	1075.83	562.50	18.33	2.50	8.33
Saproglyphidae																				
Suidasia nesbitti	0.00	0.00	2.50	0.00	0.00	0.00	1.67	0.00	0.83	1.67	135.00	8.33	0.00	0.00	2.50	0.00	0.00	0.00	11.25	0.00
Suidasia pontifica	10.00	24.17	13.33	4.72	10.83	11.67	9.17	0.00	50.00	19.17	3.33	1.67	3.89	0.00	18.75	14.17	0.00	0.00	48.75	11.25
Suidasia spp	0.00	0.83	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tetranychidae																				
Tetranychid spp	0.00	1.67	0.00	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	3.33	0.00	0.00	0.00
Tydeidae																				
Tydeid spp	0.00	1.67	0.00	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00
Tarsonomedae																				
Tarsonemus spp	56.67	22.50	16.67	16.67	12.92	15.83	12.50	0.00	5.00	11.67	24.17	6.67	10.56	2.17	10.42	12.50	11.67	5.00	12.08	12.08
Total dust load (g)	1.24	1.17	0.41	0.65	0.37	0.56	1.09	1.38	1.45	0.06	0.47	3.20	2.59	1.42	2.79	0.24	0.32	0.38	0.83	1.33
Total average densities of HDM (mites/g per month)	18,247	21,283	27,399	8,432	18,480	7,121	7,433	394	2,355	3,976	3,146	2,070	2,763	856	14,746	2,743	5,914	3,018	2,223	3,119
Total number of HDM recovered	10,019	20,801	10,988	6,721	7,566	4,322	7,463	640	4,900	3,686	1,646	10,030	1,943	3,515	59,943	783	1,710	2,877	3,348	6,420

Table 4
Distribution of HDM in mattresses (n=33) and houses (n=20) in the Klang Valley (March 1994 - February 1995).

Species	Houses positive* no. (%)	No. mites/g per house (Mean ± SD)	Mattresses positive* no. (%)	No. mites/g per mattress (Mean ± SD)	No. mites/g per month (Mean ± SD)
Acaridae					
Acarus spp	1 (5.0)	0.13 ± 0.54	1 (3.0)	0.15 ± 0.86	0.17 ± 0.57
Tyrophagus putrescentiae	12 (60.0)	7.71 ± 14.22	13 (39.4)	8.51 ± 23.76	34.60 ± 77.17
Cheyletidae					
Cheyletus fortis	13 (65.0)	5.43 ± 9.30	15 (45.5)	4.49 ± 9.04	12.65 ± 15.34
Cheyletus malaccensis	20 (100.0)	44.32 ± 45.77	26 (78.8)	36.64 ± 49.80	82.93 ± 66.45
Cheyletus malayensis	15 (75.0)	7.73 ± 10.14	15 (45.5)	6.04 ± 10.66	11.64 ± 15.03
Cheyletus spp	20 (100.0)	274.74 ± 307.76	33 (100.0)	227.07 ± 347.43	557.36 ± 431.19
Chortoglyphidae					
Chortoglyphus arcuatus	1 (5.0)	0.13 ± 0.54	2 (6.1)	0.15 ± 0.63	0.16 ± 0.38
Glycyphagidae					
Austroglycyphagus malaysiensis	8 (40.0)	2.88 ± 5.43	8 (24.2)	1.89 ± 4.50	5.82 ± 9.52
Blomia tropicalis	20 (100.0)	4,080.67 ± 5,774.21	33 (100.0)	3,557.05 ± 6,117.75	8,933.51 ± 7,294.11
Trophilicus aframericanus	5 (25.0)	15.28 ± 64.56	7 (21.2)	18.61 ± 95.89	30.67 ± 18.44
Pyroglyphidae					
Dermatophagoides farinae	20 (100.0)	102.69 ± 101.94	28 (84.8)	89.67 ± 125.95	179.93 ± 79.59
Dermatophagoides pteronyssinus	20 (100.0)	2,404.31 ± 1,704.54	33 (100.0)	2,243.26 ± 2,340.05	4,552.65 ± 2,206.2
Euroglyphus maynei	2 (10.0)	0.10 ± 0.37	2 (6.1)	0.10 ± 0.40	0.11 ± 0.37
Hirstia domicola	1 (5.0)	0.08 ± 0.36	1 (3.0)	0.05 ± 0.29	0.05 ± 0.18
Malayoglyphus intermedius	20 (100.0)	696.56 ± 2,519.95	30 (90.9)	440.91 ± 1,987.82	1,020.03 ± 1,187.63
Sturnophagoides brassiliensis	20 (100.0)	108.90 ± 254.93	27 (81.8)	69.19 ± 204.71	105.96 ± 128.50
Saproglyphidae					
Suidasia nesbitti	8 (40.0)	8.19 ± 29.24	8 (24.2)	5.63 ± 23.35	7.12 ± 10.69
Suidasia pontifica	16 (80.0)	12.74 ± 14.01	22 (66.7)	11.01 ± 15.51	17.69 ± 6.23
Suidasia spp	2 (10.0)	0.21 ± 0.74	2 (6.1)	0.13 ± 0.58	0.14 ± 0.36
Tetranychidae					
Tetranychid spp	4 (20.0)	0.43 ± 0.96	4 (12.1)	0.45 ± 1.55	0.67 ± 1.40
Tydeidae					
Tydeid spp	3 (15.0)	0.26 ± 0.70	3 (9.1)	0.35 ± 1.47	0.56 ± 1.42
Tarsonemidae					
Tarsonemus spp	19 (95.0)	13.89 ± 11.43	30 (90.9)	11.97 ± 10.91	19.92 ± 10.85

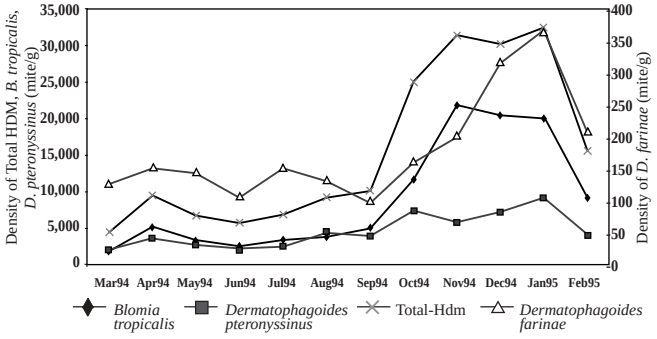

Fig 1–Monthly distribution patterns of densities of total house dust mites, *B. tropicalis*, *D. pteronyssinus* and *D. farinae* in mattress (n=33) in Klang Valley (March 1994-February 1995).

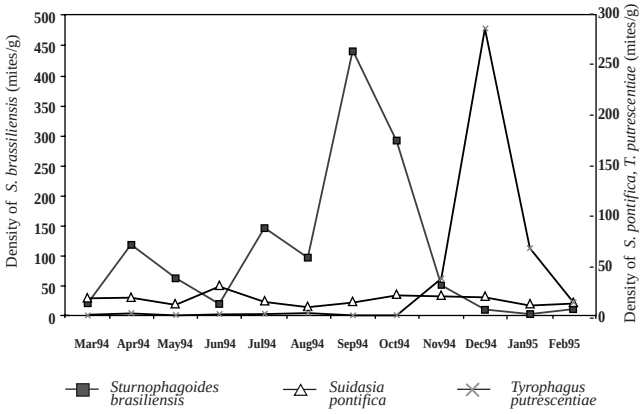

Fig 2–Monthly distribution patterns of densities of *S.brasilliensis*, *S.pontifica* and *T. putrescentiae* in mattress (n=33) in Klang Valley (March 1994-February 1995).

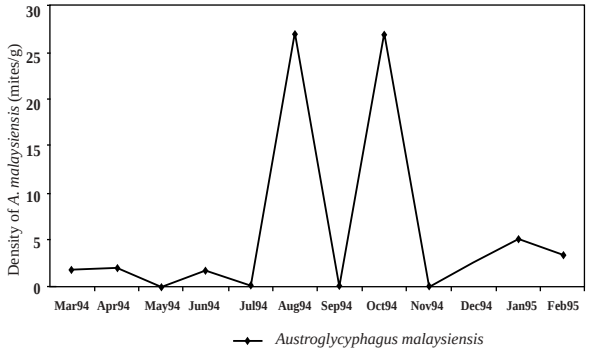

Fig 3–Monthly distribution patterns of densities of *A. malaysiensis* in mattress (n=33) in Klang Valley (March1994 - February 1995).

for the first 7 months before diverging. *B. tropicalis* showed 2 peaks whereas 4 peaks were noted for *D. pteronyssinus* throughout the study. Both the species showed a minor peak in April 1994. The second peak which was the major peak for *B. tropicalis*, occurred between November 1994 to January 1995. The other 3 peaks for *D. pteronyssinus* were in August and October 1994, and in January 1995. The latter peak was the major one for *D. pteronyssinus*. *D. farinae* showed only 3 peaks which were in April and July 1994, and January 1995.

Generally, the monthly distribution of total HDM counts closely followed that of *B. tropicalis* which had 2 peaks (Fig 1). The first peak was in April 1994 and the second in November 1994 to January 1995. Figs 2, 3 show monthly distribution of other less common mites that have been reported to produce allergens. *S. brassiliensis* and *T. putrescentiae* showed only 1 peak in September and December 1994, respectively. However, 2 peaks were noted for *S. pontifica* and *A. malaysiensis*. Distribution of the predatory mites, *C. fortis*, *C. malaccensis* and C. *malayensis* was similar for the first 7 months of the study (Fig 4); later the distribution differed by the number of peaks. The most often recovered species, *C. malaccensis* had 3 peaks. The peaks were in May and October 1994 and December 1994 to January 1995. Two peaks were noted for *C. fortis*; a minor peak in April 1994 and the major one in January 1995. *C. malayensis* showed only 1 peak *ie* in October 1994.

DISCUSSION

The allergen producing mites most commonly found in dwellings worldwide are *D. farinae*, *D. pteronyssinus*, *B. tropicalis* and *E. maynei* (Hurtado and Parini, 1987; Arlian, 1989; Arruda *et al*, 1991; Arlian *et al*, 1992, Stanaland *et al*, 1994). The above species of mites, except for *E. maynei*, occur in all houses surveyed in this study. Since *E. maynei* was found in only one house in this study, it may not be an important health problem in Klang Valley, Malaysia.

B. tropicalis was the most common and numerous HDM recovered during the study; it represented an average of 53% of total HDM collected from mattresses. The percentage differed in different localities in the Klang Valley, ranging from a low 6.3% to 71.3% (Mariana and Ho, 1996). The much shorter development period of

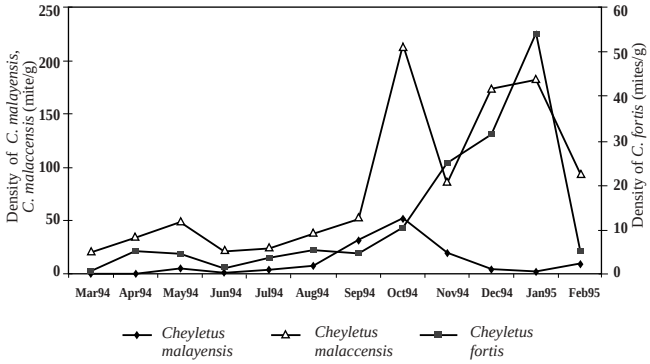

Fig 4–Monthly distribution patterns of densities of predator mites (*C. fortis, C.malaccensis, C.malayensis* and *Cheyletus* spp) in mattress (n=33) in Klang Valley (March 1994-February 1995).

all stages in the life-cycle of *B. tropicalis* compared to *D. pteronyssinus* (Mariana *et al*, 1996; 1998) may appear as an advantage for this species to become more abundant. The species was probably not abundant in the past might be because of the local climatic factors which did not reach the optimal conditions for their population growth, leading to their less inability to survive to adulthood and to reproduce. Minor fluctuations in temperature and humidity in the tropics during development time may affect their survival (Colloff, 1991).

The relative percentage of *B. tropicalis* in the Klang Valley is lower than that in Singapore where the species constituted 62% of total mite counts (Chew *et al*, 1999a). This mite has also been found in house dust in Hong Kong, Brazil, Venezuela, Colombia, Taiwan, Spain, Egypt and Florida in USA (Arlian *et al*, 1992), but not in other nearby countries such as Thailand (Malainual *et al*, 1995) and Indonesia (Woolcock *et al*, 1984). *B. tropicalis* is found in Brunei but in relatively smaller percentages (Woodcock and Cunnington, 1980); the reason for this is not clear. It is possible that differences in the methodology and sampling techniques for the evaluation of mite fauna may be one of the reason as there is little difference in environmental factors.

B. tropicalis was reported to be usually found together with pyroglyphids and other acarids in house dust samples (Oshima, 1970; Bronswijk, 1972; Charlet *et al*, 1977a). The situation is similar in this study where *D. pteronyssinus*, *D. farinae* and *B. tropicalis* were found on the same area in the same mattress in all houses surveyed in the Klang Valley. In all mattresses *D. pteronyssinus* (33% of total mites) was more abundant than *D. farinae* (1% of total mites). Wharton (1973, 1976) mentioned that the behavior of both these *Dermatophagoides* and their population dynamics are different to a degree even though their habitats overlap in certain areas. *D. farinae* which is more mobile and itinerant likes to move within their habitat whereas *D. pteronyssinus* prefer to rest at a certain area (Bischoff *et al*, 1998).

In this study, counts of *D. pteronyssinus* was found to exceed the exposure threshold of 500 mites/g dust for triggering acute asthma (Platts-Mills *et al*, 1992); and counts of *B. tropicalis* to exceed the threshold suggested by Fernandez-Caldas *et al* (1993). The study proposed 150 mites/g dust, to be the exposure threshold associated with sensitization to *B. tropicalis.* So far, there is no threshold level for other species of HDM.

Dust samples were also found to have other less common mites such as *S. brassiliensis*, *S. pontifica*, *T. putrescentiae* and *A. malaysiensis*. Although they were present in relatively lower densities compared to *B. tropicalis*, *D. pteronyssinus* and *D. farinae*, these mites have been reported to produce allergens (Wickman *et al*, 1993; Ebner *et al*, 1994; Ferrandiz *et al*, 1996; Chew *et al*, 1999b). The allergenicity of these mites is not well characterized or studied. It is suggested that the allergenicity of these mites be evaluated and their allergenic components characterized.

High presence of predator mites in the house (65-100%) may have an influence on the eco-biosystem balance within the niche since these mites have been reported to be predacious on several other mite species. Their numbers are always lower than the pyroglyphid or glycyphagid mites. Insertion of the chelicerae of this predator mites followed by injection of saliva had been shown to cause an allergic response and papular formation in humans (Yoshikawa, 1985).

HDM were recovered from all houses and all mattresses surveyed. It appeared that the mites are present wherever conditions are suitable. Further studies should be conducted to determine whether there is any difference in the mites fauna with respect to other parameters such as socio-economic level of family, type and age of house, type and age of mattress, sex and age of mattress occupant, sensitive mattress occupant etc. These parameters may influence the population densities of HDM to a great extent.

This study showed a diverse assemblage of HDM species occurs in mattresses throughout the Klang Valley. The information in this study provides evidence for the prevalence of high populations of allergenic mites in close association with human and this undoubtedly can contribute to the incidence of respiratory problems. The relatively high densities of allergenic mites is a cause for concern. The high abundance and frequency of *B. tropicalis* in dust samples indicate the species plays an allergenic role as important as *D. pteronyssinus* in asthma and allergic rhinitis in Malaysia. Extract of this mite should be considered for diagnostic testing and possible immunotherapy. Some of these allergenic mites show distinct monthly distribution patterns which can be used to forecast their peak abundance and in the process provide an early warning to allergic individuals.

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