Prevalence of Dust Mites in Three Different Geographic Regions ofSaudi Arabia: Taif, Al-Baha and Abha

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Abstract: A study was conducted on the population dynamics of house dust mites and the impact of geographic distribution in three cities located in the southern and southwestern regions of the Kingdom of Saudi Arabia. Some of their affiliated villages and outskirts were also studied over a nine-month period from April to December 2012, covering the autumn, spring and summer seasons. These seasons are typically characterized by heavy rainfall, relative equinox, and varying temperatures. Those provided appropriate environmental conditions for the growth and proliferation of house dust mite species. Each region was divided into three smaller regions. Ten houses were selected in each small region affiliated to the selected major regions in each city on a case-by-case basis. Total house for the entire study were 90. Site visits and surveys were conducted twice a month using a standard vacuum cleaner with paper collection bags, used only one time. Bags were kept in a deep freezer untilwe were able to count the mites and identify the species for each region. Overall, the three major regions were found to have three species with proportions of 36.73 (*T. putrescentiae*), 23.93 (*B.tropicali)* and 8.33 (*A. siro*). The *T.putrescentiae*species had the highest population in Abha and Taif, while the *B tropicalis*species showed was the highest in Taif. These differences are attributable to climate differences, proximity of houses to grain storage warehouses and silos, living conditions, population dynamics, house age, house type, age of furniture, number of occupying individuals, and cleanliness level. Farmers' houses marked the highest population dynamics at an arithmetic mean of 29.27, followed by public houses at 22.67. Houses of the wealthy ranked last with 17.07. The Abha region showed the highest diversity of house dust mite species as well as the highest population dynamics compared to the other regions. This is attributable to its location, climate and the similarity to the climate of tropical regions, in terms of dynamics and diversity of species.

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1.Introduction:

House dustis an important factor in the environment. Human's skin and lungs areexposed to dust many hours a day. Asthma is often associated with atopy. Particularly in children asthma, specific IgE antibodies to several inhalantallergens are observed. There is evidence that the development of allergen-specific antibodies and the risk to develop asthma is associated with allergenexposure. The major allergen Dep1 has been found in foetal amniotic fluid at 16-17week gestation and in the cord blood of some babies at birth (Jones*etal.,*2000). Allergen avoidance reduces clinical symptoms in atopic asthma. Therefore, reducing exposure to allergens, including the dust mite, is anobvious approach for treatment of allergic disorders (Hans *et al.*, 1994). One ofthe most important events in the history of allergic disease was the discoveryby Voorhorst*et al.,* 1967 as he stated that dust mites are the major source of allergen inhouse dust. Sensitization to allergens derived from dust mite in stronglyassociated with asthma, perennial rhinitis, and atopic dermatitis.The mites*Tyrophagusputrescentiae* and *Blomiatropicalis*may occasionally exist in housedust in significant numbers along with the common house dust mites of the genus Dermatophagoides spp. when relative humidity is high and cereal and flourproducts are available as a source of food.More importantly, these mites arevery common in grain storage, transfer facilities, barns, hay, straw andhay and grain dust. Exposure to these mites and their products may occur inhomes, and significant occupational exposure among agricultural and greenelevator workers does occur. Many studies have suggested that *T.putrescentiae* and *B.tropicalis* areconsidered as allergenically important mite. Crossed immunoelectrophoresis and Crosse-radioimmunoelectrophoresis results indicate that mite bodies and faces containas many as 20 antigens and five allergens (Arlian*et al.*, 1984).

Forsuch reasons, some agricultural areas have been selected in the Southwest andSouth of Saudi Arabia prior to this examination to identify scattered species. In addition, it was noted, beside the presence of speciesbelonging to the pyroglyphidae, the abundance of *B.trobicalis* and *T.putrescentiae*in 100 British bronchial asthma patients. 94% of which gave positive skin test to *Dermatophagoidespterronyssinys*, and 34% to *T. putrescentiae* (Wraith *et al*., 1979) Skin testing of 72 London bronchial asthma or allergic rhinitis patients found 99% positive to *D. pterronyssinys*, 51% to *T.putrescentiae* and 72% to 79% to three other stored-product mites. Extracts of six mite species provokedpositive skin responses in 60 Brunei (South East Asia) asthmatic patients. *D.pterronyssinys* elicited positive skin reactions in 67%, while *T. putrescentiae*elicited positive skin reactions in 50% of patients, while three other storage mites wereallergenic in 35% to45% of the patients. In another study, ninemite species were found in house dust, where highest incidence of skinreactions was elicited by *Euroglyphusmaynei*(85%), *D.pteronyssins* (81%), and *Dermatophagoides. Farina* (74%) whereas *T. putrescentiae* andseveral other species elicited small numbers of positive responses. RAST, leukocytehistamine release, skin, and nasal provocation testing of farmers andgrain handlers indicated that asthma, allergic rhinitis, and respiratorysymptoms can be associated with storage mites present in store grain, strawor hay dust(Arlian*et al.*,1984).This study showed the prevalence of the storage mite, and accordingly, it should be included in the sensitivity tests in Kingdom of Saudi Arabia.

CityGeography and Characteristics:

The city of Abha has great height above sea level. Located in the Sarawat Mountainsin the extreme south-west of the Kingdom of Saudi Arabia, it is one of the most important resorts in the KSA due to its geographical location. The relative abundance ofrainfall and vegetation occurs in the mild climate which can be said to be cool with moderate summer temperatures not exceeding 30°C. In winter, the climate is cold but the temperature does not decline to less than 5 °C. This is unlike the highlands surrounding outward such as Souda where the temperature is sometimes below 0 °C with the Abha monsoon blowing in from the Indian Ocean. Also westerly winds often blow from the Red Sea and are often loaded with the with drawal of rain clouds and increasing rainfall in the city of Abha in the winter. Rain of up to 500 mm annually contributes to the climatic conditions, the diversity of crops, farms with corn, peaches, apricots, pomegranate, grapes, and apples.

Al-Baha city is located inthe Hejaz Mountains of KSA.The topography of the areais divided into plains to the west and low elevations down to the Red Sea coast. The Hejaz Mountains are volcanic and covered almost entirely by coniferforests in addition to the many types of fruit trees and flowers such as Kadi, jasmine, and roses.The climate of Al-Baha area is generally considered dry within theregion with a cool winter climate which is oddly beautiful through the rest of the seasons.Humidity rangesfrom 52% to 67% in the region with average daily temperatures of 23°C to 12°C. The average rainfall is between 229 to 581 mm annually.

The city of Taifis located onthe eastern slopesof the SarawatMountainsin the bosom ofMount Ghazwan at an altitude of1,700mabove sea level. The climate of Taifis characterizedby moderatesummersand cold winters. Taif exhibits diversity ofterrainwhich contrasts from towering mountainsto deepvalleysanddeserts.

2.Material and Methods

Residence Grouping:

In the following, we group the residences where we collected dust mites according to their characteristics.

1-The Wealthy Residence Group:

This group is comprised of 15houses. The buildings, which are all villas, range between three and 10 years Room temperatures from 25 to 30 °C. The humidity level is between 65 and 70%. Each building is comprised of 2 floors, and the floors are mainly ceramic and covered with carpets 4 cm thick. Each room contains one wood bed. The number of the dwellers is generally four to 10 persons per house. The rooms contain modern air conditioning systems. The average amount of dust collected 2 g/m^{2}as rooms are cleaned on a weekly basis using vacuum cleaners, detergent, and liquid cleaners.

2-The Medium Residence Group:

This group is comprised of 15 homes .They are mainly apartments between 15 and25 years .The room temperature ranges between 26 and30 °C while the humidity level between 70 and 78%. Each building consists of 3 floors made of ceramic covered with carpets 2 cm thick. Each room containsone to three wood beds. The number of the dwellers is eight to 14 persons per house. Some roomscontain modern air conditions while others are relatively older. The average amount of dust collected is5-10 g/m^2. Cleaning is done on a weekly using vacuum cleaners, detergent and liquid cleaners.

3-Lower End Farmers and Workers Residence Group:

15houses were selected in areas of a low quality living conditions, in the three cities, and are older than 25 years. The room temperature in these buildings between 20 and 30°C. The humidity level between 72 and 75%. The buildings are usually comprised of three floors and each is made of cement covered with older rugs. Rug thicknessesare 3 cm. Each room contains four wood beds. During the school season, the average number of the dwellers is20persons per house. Some of the rooms contain fans, while others contain older air condition units. The average amount of dust collected round10-15 g/m^2. Cleaning is done once or twice a month; using vacuum cleanerswithout regular use any detergents.

Dust Collection:

Dust wascollected twice a month during a period of nine months. Mites were separated using a modified Berleses funnel as recommended by Al-Assiuty*et al.*(1993) and Edrees (2009).

Experiment Strategy:

The houses weredivided into three smaller categories: popular houses inhabited by regular families, new villas inhabitedby wealthy people, and houses on nearby farms inhabited by workers of farms. Warehouses and reconstructed houses varied fromthree to twenty-fiveyears old, workers' houses occupied initially in terms of age followed bythe popular houses, and finally homes of individuals with high income (richpeople).

The house dust mite samples were collected from 45 houses inhabited by different numbers of people. Using a vacuum cleaner (Boch191T) withdisposable bag, dust was sampled from carpet in bedrooms and living rooms during a 5-min sweep. The samples were collected twice a monthoverninemonths(April to December 2012). Mites were separated using modified Berleses funnels asrecommended by Al-Assiuty*etal.* (1993) and Edrees(2009).

3.Results:

We outline our results by analyzing data in various tables below.

Table 1: Comparison between the three regions (Taif, Al-Baha and Abha)

It was found that the data distribution is not identical to natural distribution; thus the Kruskal-Wallis test was conducted to compare the amount of Arthropod dust mite species between the three regions (Taif, Al-Baha and Abha). The results show that the probability value 0.000 which is lesser than thelevel of significance standing of 5%. Thus, the null hypothesis that the mean number of dust mites in the three regions is equal is rejected because there are differences with statistical significance among means of the three regions. Results show that the largest number of dust mites is located in Abha, followed by Al-Baha and Taif.

Table 2: Comparison between two regions

To determine the source of difference, a Mann-Whitney analysis was conducted for two regions of the three: the above results show that the probability value is 0.000 which is lesser than the level of significance standing at 5%, thus, there are differences with statistical significance among mean number of dust mites between each two regions of the three.

Table 3: Comparison of population dynamics on the ground of standard of living

It was found that data distribution was not identical to natural distribution. Thus, it was decided to resort to nonparametric analytical methods and a Kruskal-Wallis test was conducted to compare the species of dust mites for the three standards of living (rural, popular and rich). The results show that the probability value is 0.039 which is less than the level of significance standing at 5%. Thus, the null hypothesis saying that the mean number of dust mites in the three residential levels is equal is rejected because there are differences with statistical significance among means of the three standards of living. Results show that the largest number of dust mites is at the rural locations followed by the popular and rich ones.

Table 4: Comparison between each two of the three standards of living

To determine the source of difference, a Mann-Whitney analysis was conducted for each two standards of the three. The results show that the P. Value exceeded 0.05 concerning tests between the rural and popular standards of living and tests between popular and rich standards of living, consequently, we posit that there are no differences with statistical significant among the mean number of dust mites at such standards of living. Differences in the number of dust mites occurred between the rural and rich standards of living, as it is notable that the *P* Value is 0.019, less than 0.05. Consequently, there are differences with statistical significance in the number of dust mites in those two standards of living.

Table 5: Comparison of population dynamics on the ground of dust mite species

Again, it was found that the data distribution is not identical to natural distribution; thus, it was decided to resort to nonparametric analytical methods and the Kruskal-Wallis test was conducted to compare between the numbers of types of dust mites which involved eight: *D.farinae, Cheyletu malaccensis, B.tropicalis, Suidasianesbetti, Blomiafreemani, Acarussiro, D.pteronyssinus, T.putrescentiae*.

The Results show that the probability value is 0.000 which is lesser than the level of significance standing at 5%; thus, the null hypothesis saying that the mean number of the eight types of dust mites is equal is rejected because there are differences with statistical significance among means of the three standards of living. The above table shows that the *T. putrescentiae*species is the most commonly spread followed by the *B.tropicalis* while the one with the least spread is *A.siro*. Table 6, on the other hand, shows descending order of species of dust mites.

Table 7: Comparison between each two species of dust mites

To determine the source of difference in the numbers of the eight types of dust mites Mann-Whitney analysis was made between each two species of the eight.The results show that the *P*. Value is lesser than 0.05 in all tests conducted between the number of the eight types of dust mites, but between*D.farinae - B. freemani, D.farinae-D.pteronyssinus,C.malaccensis-S. nesbetti and B.freemani-D.pteronyssinus*. Consequently, we deduce that there are no differences with statistical significance between most numbers of the eight species of dust mites.

Table 8: Determination of the highest population dynamics in each of the three cities

Table 8.1: The highest population dynamics in Taif

In Taif, four types of dust mites were found: *C. malaccensis, D.pteronyssinus, D.farinae, and T. putrescentiae*; thehighest population dynamics species was determined through the Kruskal-Wallis test. The following table shows the results showing that the *T. putrescentiae*speciespossess thehighest population dynamicsin Taif, followed by *D.farinae, D. pteronyssinus*and *C.malaccensis*.

Table 8.2: The highest population dynamics in Al-Baha

In Al-Baha, five species of dust mites were found: *B.tropicalis, D.malaccensis,S.nesbetti, C. malaccensis*, and *D.farinae*, and the highest population dynamicsspecies were determined through the Kruskal-Wallis test. The table shows that the *B. tropicalis*speciespossess the highest population dynamicsin Al-Baha followed by *D.pteronyssinus, D. farinae, S.nesbetti*and*C.malaccensis*.

Table 8.3: The highest population dynamics in Abha

Seven types of dust mites were found:*S.nesbetti, B.freemani, A.siro, T.putrescentiae, C.malaccensis, D.farinae, and D.pteronyssinus*; the highest population dynamics for the specieswas determined through the Kruskal-Wallis test. The table shows that the *T.putrescentiae*speciespossessthe highest population dynamicsin Abha followed by *D.pteronyssinus, D.farinae, B.freemani, C.malaccensis, S.nesbetti* and *A.siro*.

Table 9: Determination of the highest population dynamics species in the three standards of living

Table 9.1: The highest population dynamics in regions near the fields

The most scatted types near the fields were determined through the Kruskal-Wallis test. The table shows that the *T.putrescentiae*species is the most spread in such areas followed by *B.tropicalis*, while the least spread is *A*.siro.

Table 9.2: The highest population dynamics popular areas

The highest population dynamicsspecies was determined through the Kruskal-Wallis test. The table shows that the *T.putrescentiae*species is the most spread in popular districts followed by *D.pteronyssinus*, while the least spread is *A.siro*.

Table 9.3: The highest population dynamics in rich areas

Thehighest population dynamicsspecies was determined through the Kruskal-Wallis test. The table shows that the *T.putrescentiae*species is the highest population dynamicsin rich districts followed by *D.farina*, while the least population dynamics is *A.siro*.

Table 1: Comparison on the ground of the three regions(Taif, Al-Baha and Abha)

Rank means			Statistical Test Statistic (χ^2)	Probability Sig. (P. Value)
Taif	Al-Baha	Abha		
8.33	23.93	36.73	35.181	0.000

Table 2: Comparison between two regions

Between Taif and Al-Baha			
Ranks mean		Statistical Test Statistic ($\chi2$)	Probability Sig. (P. Value)
Taif	Al-Baha		
8.33	22.67	-4.459	0.000
Between Taif and Abha			
Ranks mean		Statistical Test Statistic ($\chi2$)	Probability Sig. (*P*.Value)
Taif	Abha		
8.00	23.00	-4.666	0.000
Between Al-Baha and Abha			
Ranks mean		Statistical Test Statistic ($\chi2$)	Probability Sig. (*P*. Value)
Al-Baha	Abha		
9.27	21.73	-3.878	0.000

Table 3: Comparison of population dynamics on the ground of standard of living

Ranks Mean			StatisticalTest Statistic ($\chi2$)	Probability Sig. (*P*. Value)
Rural	Popular	Rich		
29.27	22.67	17.07	6.486	0.039

Table 4: Comparison of population dynamics between each two of the three standards of living

Between rural and popular standards of living			
Ranks mean		**StatisticalTest Statistic ($\chi2$)**	**Probability Sig. (*P.* Value)**
Rural	**Popular**		
18.00	**13.00**	**-1.555**	**0.120**
Between the rural and rich standards of living:			
Ranks mean		**StatisticalTest Statistic ($\chi2$)**	**Probability Sig. (*P.* Value)**
Rural	**Rich**		
19.27	**11.73**	**-2.344**	**0.019**
Between popular and rich standards of living			
Ranks mean		**StatisticalTest Statistic ($\chi2$)**	**Probability Sig. (*P.* Value)**
Popular	**Rich**		
17.67	**13.33**	**-1.348**	**0.178**

Table 5: Comparison of population dynamics on the ground of types of dust mite species

Ranks mean								**Test Statistic (χ^2)**	**Probability Sig. (*P.* Value)**
T.p	**D.p**	**A.s**	**B.f**	**S.n**	**B.t**	**C.m**	**D.f**		
89.08	**53.33**	**3.50**	**54.50**	**25.42**	**82.50**	**27.28**	**54.89**	**70.518**	**0.000**

.p *:T.putrescentiae,* **B.t***: B.tropicalis,***D.f***: D.farinae,***B.f***B.freemani,***D.p***: D.pteronyssinus,***C.m** *:C.malaccensis,* **C.m** *:S.nesbetti,* **A.s:** *A.siro*

Table 6: The descending order of dust mite species

Rank	**Type**
1	*T.putrescentiae*
2	*B.tropicalis*
3	*D.farinae*
4	*B.freemani*
5	*D.pteronyssinus*
6	*C.malaccensis*
7	*S.nesbetti*
8	*A.siro*

Table 7: Comparison between each two species of dust mites

Probability Sig (P. Value)							
T.p	D.p	A.s	B.f	S.n	B.t	C.m	
0.000	**0.548**	**0.000**	**0.689**	**0.000**	**0.000**	**0.000**	D.f
0.000	**0.004**	**0.000**	**0.001**	**0.966**	**0.000**		C.m
0.005	**0.000**	**0.004**	**0.004**	**0.001**			B.t
0.000	**0.009**	**0.001**	**0.001**				S.n
0.001	**0.230**	**0.004**					B.f
0.001	**0.000**						A.s
0.000							D.p
							T.p

Tables 8: Determination of the highest population dynamic species in each of the three cities 8.1The highest population dynamic species in Taif

Ranks mean				**Test Statistic ($\chi2$)**	**Probability Sig. (*P* . Value)**
T.p	**D.p**	**C.m**	**D.f**		
21.50	**9.50**	**3.50**	**15.50**	**21.600**	**0.000**

Table 8.2: The highest population dynamic species in Al-Baha

Ranks mean					**Test Statistic ($\chi2$)**	**Probability Sig. (*P.* Value)**
D.p	**S.n**	**B.t**	**C.m**	**D.f**		
21.50	**9.50**	**27.50**	**3.50**	**15.50**	**27.871**	**0.000**

Table 8.3: The highest population dynamic species in Abha

Ranks mean							**Test Statistic ($\chi2$)**	**Probability Sig. (*P.* Value)**
T.p	D.p	A.s	B.f	S.n	C.m	D.f		
37.67	34.50	3.50	20.50	9.50	16.50	28.33	**38.713**	**0.000**

Tables 9: Determination of the highest population dynamic species in the three standards of living

Table 9.1: The highest population dynamic species in regions near to fields

								Test Statistic	Probability Sig.
T.p	D.p	A.s	B.f	S.n	B.t	C.m	D.f	($\chi 2$)	(*P.* Value)
207.5	155.6	9.5	89.6	67.1	205.5	80.9	165.2	**156.2**	**0.000**

Table 9.2: The highest population dynamic species in popular areas

Ranks mean							Test Statistic	Probability Sig.
T.p	D.p	A.s	B.f	S.n	C.m	D.f	($\chi 2$)	(*P.* Value)
220.6	139.4	10.5	182.6	61.7	90.4	130.3	**141.169**	**0.000**

Table 9.3: The highest population dynamic species in rich areas

Ranks mean							Test Statistic	Probability Sig.
T.p	D.p	A.s	B.f	S.n	C.m	D.f	($\chi 2$)	(*P.* Value)
144.6	130.6	57.7	80.5	9.5	136.4	217.6	**132.876**	**0.000**

4.Discussion:

The study was conducted in three different geographic regions, characterized byhigher elevations. They are mountainous, rainy with moderate temperatures through most of the year's seasons, and are located in the southern and southwestern regions of the Kingdom of Saudi Arabia. The occurrence of species varied in the houses selected for the study due to different conditions, number of individuals, type of furniture, population culture, remoteness or proximity to farms, means of ventilation, age of house, cultural level, and cleanliness in each house and category.

The *T.putrescentiae* species were found to have high population dynamics compared to *D. pteronyssinus* species in both Taif and Abha where it is of medical importance as a source of allergens. The *D.pteronyssinus* species held the highest portion in Al-Baha region and is also of medical importance as a source of allergens and affliction.

In the Taif region, the *T.putrescentiae* species scored the highest in population dynamics followed by the species *D.pteronyssinus, D.farinae* and *C.malaccensis*. In Al-Baha region *B.tropicalis* had the highest population dynamics followed by the *S.nesbetti*, *D.*farinae, *D.pteronyssinus* and *C. malaccensis* species. In Abha region, the *T. putrescentiae* species had the highest population dynamics, followed by *C.malaccensis*, *S.nesbetti*, *B. freemani, D.farinae, D.pteronyssinus* and *A.siro*. The family Pyroglyphidae was present in all regions which is a family medically classified as a source of allergen globally. This species is not the only source of allergic diseases. Arlian*et al*. (1992) pointed out that persons infected with allergic diseases may be affected by multiple species of allergen caused by multiple species of mites. Intensity of the disease for any species may vary in each patient.

Periodic survey which took place during the testing period revealed that there can be differentin a single house. This is generally attributed to the mite's preference to flock together in the furniture and hygroscopic areas. The study revealed different population dynamics in the different regions being studied. These findings are consistent with previous studies that found varied population dynamics due to geographic and climatic difference of regions(James *et al*., 1976., Ines *et al*., 1987., Thomas *et al*., 1992 Chan-Yeung*et al*., 1995;AL-Frayh, *et al*., 1997;; Chew *et al*., 1999)

Comparing between the Taif and Al-Baha regions, our study revealed significantly higher population dynamics of mites in Al-Baha than Taif, significantly higher population dynamics of mites in Abha than Taif, and significantly higher population dynamics in Abha than Al-Baha. This variation is relative to variation in high rainfall rates of these regions throughout the year, where Abha scored the highest rainfall level, followed by Al-Baha with Taif ranking last. Moderate temperatures also helps the mites proliferate.

Differences in the population dynamics of mites among the regions is consistent with the findings of James *et al*. (1976) and AL-Frayh*et al*. (1997), who pointed out that moderate climate and high moisture are factors which support growth. The Abha region is considered as the most adaptable region in terms of climate, followed by Al-Baha and Taif, where the latter is characterized by dryness and high temperature in some seasons as compared to the other regions.

Upon comparing the living conditions (Tables 3,4), the study revealed significant differences in population dynamics attributable to multiple factors: the building's age, type of furniture (age, stuffing, hygroscopic materials), number of individuals living in the building, its proximity to grain silos and farms, level of health awareness, cleanliness, education, and culture. Farmers' houses scored the highest population dynamics. This is attributable to close proximity to grain warehouses and silos and farms, high numbers of individuals per room, type of furniture which is old, low level of cleanliness, and high relative humidity resulting from daily activities; e.g. breathing, washing, floor washing, and cooking in a narrow area. This is in addition to a low level of health awareness, education level and health culture, which play key roles in generating bad health habits; e.g. lack of cleanliness and applying the means necessary to improve the health conditions such as opening the windows, allowing the sun to enter in, regular ventilation, exposing mattresses to direct sunlight, weekly washing with strong detergents and hot water.

All previous factors contribute to raise relative humidity levels, the major factor for increasing the population dynamics of mites (Edrees, 2006, 2008, 2009, 2012, 2013). The resulting health problems are associated with allergy, weakness, general asthenia, varying pains, and frequent absenteeism from work. This causes low productivity in adults, diminished academic achievement of students, and adversely affected activities in general. As ambient air is drawn into the lungs, the medical burdens of families and institutions rise.

In Tables (5,6), the highest population dynamics were noted for the species *T.putrescentiae*, which is consistent with the findings of many studies that marked high population dynamics of this species in the warehouses of stored items and grain silos (AL-Nasser, 2007). This is followed by species *B.tropicalis*, as is consistent with the findings of some studies on its frequency in East Asia countries such as Singapore) Zhang *et al*., 1997). This is attributable to similar climate in these Saudi regions in general. In Abha and Al-Baha in particular, the rainy climate is similar to the tropical and sub-tropical regions. This gives rising of relative humidity, as consistent with conclusions drawn by Arlian*et al*. (1992), pointing out that it is the most prevalent species in the tropical and sub-tropical regions in the world.

The Taif region (Table 8) possessed four species, and the statistical analysis revealed significant increase in population dynamics of species *T.putrescentiae, D. farinae, D.pteronyssinus* and *C.malaccensis* respectively. The increase of species *T.*putrescentiae is attributable to the fact that houses of high-population density are close to stored grains warehouses, which house the most appropriate food for this species and other species of house dust mites (Nada & AL-Uummdi, 2011). The findings also revealed that five species of house dust mite were present in Al-Baha city which had high population dynamics; namely, *B. tropicalis, D.pteronyssinus, D.farinae, S. nesbetti*and *C. malaccensis* in order of prominence; and, as mentioned, the level of *B.tropicalis* species is attributable to the rainy climate that is similar to tropical and sub-tropical climates.

Finally, the findings revealed that Abha region contains seven species of mites, namely, *T. putrescentiae, D.pteronyssinus, D.farinae, B.freemani, C. malaccensis, A.siro*and *S.nesbetti* with highly developed population dynamics. Presence of mites in all seasons covered by the survey, particularly species *B. freemani* and *B.tropicalis,* is again attributable to its similarity of high moisture to the tropical and sub-tropical regions, as the difference in mite density is typically dependent on environmental temperatures as well as seasonal variation which are present in the tropical regions (Platts-Miis, 1987;Li 1994;Zhang *et al*., 1997).

Conclusions:

This study revealed differences in species and population dynamics attributable to seasonal fluctuations among the regions and home interiors factors, and other reasons encountered. For disparity in population dynamics in a single region, it was observed that differences exist between microclimate environments within the houses which may have dramatic effects in determining the population dynamics level of the various mite species. The findings also give indicators of the medical implications of the role played by these species in causing allergic diseases, and the necessity to include them in medical examinations as a key cause of allergies in the region where a particular species is prevalent, while disregarding the inclusion of remaining species for their common role in causing allergy.

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