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Effect of some housing criteria and seasonal variations on indoor prevalence and distribution of dust mite populations in Sharkia Governorate, Egypt

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Abstract: The medical importance of dust mites as a predisposing factor for allergy in human has gained the attention of researchers over last two decades. These organisms spread in any site where dust can accumulate causing different types of allergies in a remarkable number of populations all over the world. This study was designed to investigate the effect of housing criteria and seasonal climatic changes on mite populations in dust samples isolated from different sites in rural and urban houses in Sharkia Governorate, Egypt. 33 houses representing different geographical areas in Sharkia Governorate were included and investigated for the presence of domestic mites. 66 dust samples were taken from floors of bed rooms, living rooms, kitchen and animal/poultry/bird breeding sites and examined for detection of mites using floatation method. 26 (78.8%) of houses showed positive results for mites. A statistically significant relationship was recorded between residence in rural areas, presence of birds nest or poultry in home, old furniture and dusty floor of houses, damp homes and large family size and the presence of mites in dust samples. 26(50%) of mite positive samples were isolated from bed rooms. Spring and winter had the most positive influence on mite population. 52 (78.8%) of samples collected were found positive for dust mites. Mean mite count per gram dust recorded high in spring samples (13 mite/gm dust) followed by winter and autumn samples (12 and 10 mite/gm dust respectively). Summer samples recorded lowest mite number in dust (6 mite/gm dust). Density of mites in dust samples recorded non-significant relationship with site of collection and seasonal variation. The result of our study confirm that housing criteria greatly determine mite occurrence in indoor environment.

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1. Introduction:

The term domestic mites (DM) applies to any mite species infest in or isolated from household environment and has the ability to elicit significant allergic reactions. Dust mite population consists of two groups, house dust mites (HDMs) and storage mites (SMs) (Arlian and Morgan, 2003). Based on the number of body regions and abdominal segmentation patterns, different mite species are belong to the families Pyrogyphidae, Acaridae, Glycyphagidae, Echymopodidae, Chortoglyphidae, Cheyletidae, and Tarsonemidae (Colloff and Spieksma, 1992). However, the family Pyrogyphidae is the most important one, to which the widely distributed species Dermatophagoidespteronyssinus (D. pteronyssinus) and Dermatophagoidesfarinae (D. farinae) belong to representing 80-90% of the house dust acarofauna (Arlian *et al.,* 2002). The term "house dust mite" generally refers to these two species. Also, Blomiatropicalis (Bt), Turophapusputerscentias (Tp) are another two common species of storage mites (SMs) found abundantly in food storage areas.

Dust mites are 4 pair leg animals belong to the phylum Arthropoda (jointed limbs animals or insects). The taxonomic and morphological classification of dust mites is completely different from insects as they belong to the sub-order Astigmata which lack specialized respiratory organs (Colloff, 1998). For this, house dust mite populations respond ineffectively to common insecticides that used successfully to kill insects (Arlian and Platts-Mills, 2001). The entire sexual cycle of house dust mite occur in dust circulating between adult (male and female), egg and different nymph stages that completes in a period ranging between 2 to 6 weeks depending on surrounding temperature and humidity. Protein detritus in household environment formed mainly of shed scales of human skins and any organic substance (Colloff, 1988) represent valid food for mites to maintain its population fauna. Molva *et al.,* (2019) considered some bacterial and fungal species as an important food source for dust mites (Molva *et al.*, 2019). Being associated with dust in houses, workplaces, hospitals and bird nests, these insects are

nearly distributed worldwide and no place is immune against infection with these animals (Damle *et al.,* 2016). Dust mites can be isolated from the environment using different methods such as floating method or detect their presence in blood by using monoclonal antibodies (Yu *et al.,* 2014).

Among the enormous aeroallergens in most temperate humid areas of the world, house dust mites are the most frequently encountered. The proteins of alive and dead mites' bodies and mite faeces rich in digestive enzymes are the sources of these allergens (Arlian and Platts-Mills, 2001). These allergens can induce hypersensitization in humans who comes in close contact with them. Dust mite have been implicated in different types of allergies including bronchial asthma, perennial rhinitis, conjunctivitis and atopic dermatitis (Platts-Mills and Chapman, 1987). A severe form of allergy in the form of anaphylactic shock has been reported in sensitized individuals when they consumed storage mite-contaminated food (Takahashi *et al.,* 2014 and Sánchez-Machin *et al.,* 2010). Since early twenties of last century when actual interest in house dust mite being documented, many papers in the literature have been done all over the world investigating the effect of dust mite on human health as a risk factor of allergy (Arlian and Platts-Mills, 2001)

In Egypt, few recent studies over the last ten years have been devoted to study the prevalence of dust mites' allergens in the blood and houses of sensitized individuals. Different mite species have been recorded and associated with many types of human allergies in different ages and localities in Egypt (El Kersh *et al.,* 2019, Taha *et al.,* 2018, Al-Dhduh *et al.,* 2015, Hosny *et al.,* 2014, Antonios *et al.,* 2012 and Yassin *et al.,* 2009). This is very important as sound knowledge about seasons and areas where mite exposure and sensitization are high is a prerequisite for any successful future control measure aims to decrease house dust mite allergy between population. So continues tracing and successful identification of house dust mite in different objectives and habitats that the human come in contact with, will give a balanced view of indoor mite distribution and diversity that human can avoid exposure to these allergens.

The aim of this study was to investigate the prevalence and distribution of mites' populations in dust samples isolated from different sites in some homes in Sharkia governorate, Egypt with special references to housing conditions and seasonal variation as a potential risk factors that affect abundance and occurrence of mite fauna.

2. Subjects and methods

Study design and Population study:

This cross-sectional study was carried out from May 2017 to April 2018. A total of 66 dust samples collected from randomly selected 33 houses located in rural and urban areas in Sharkia governorate, Egypt. The owners of these houses signed an informed consent on approval to share in the study. The aim and method of the study were explained to them. The study was approved by the Committee of Research, Publications and Ethics of the College of Medicine, Zagazig University, Egypt. Free medical samples and fee-free desensitization sessions for allergic patients have been offered as an incentives to share in the study.

For each house, full data was obtained including: residence (rural/urban), presence of poultry/pets or bird nest at home (absent/present), Furniture age (<10 years/> 10 years), Floor type (Dust floor/Tile-coated), availability of vacuum cleaning (Yes/No), home aeration style (Damp/Sunny), number of inhabitants (< 4 members/> 4 members), allergic individuals to house dust mite proved by skin prick test (present/absent) and family history of allergy (present/absent).

Dust sample collection:

Before sampling, the participants were asked to avoid sweeping or vacuuming the area of dust collection for 3 to 5 days. Two samples from each home were collected at the same time giving a total of 66 samples during the study period. The participants were asked to bring one sample from bedroom floor and to collect other sample from any place where dust accumulate. Three locations (living room/kitchen/area of poultry, animal or bird nest) were recommended. For those who have vacuum cleaner were guided to wash its bag before collecting the sample then use it on high power for 2 minutes. For homes not having vacuum cleaner, the individuals were asked to sweep the area of sampling with clean brush. All samples were collected in clean plastic bags then closed and transferred to Medical parasitology department, Faculty of medicine, Zagazig University where each sample was labelled considering location inside home, date of collection, humidity amount and temperature at time of collection. The samples were processed at once or properly kept at -20°C to avoid mite proliferation and stored for later analysis.

Identification and counting of mites in dust samples

Each sample was sieved separately using a wide-pored sieve to remove large debris and hard particles and were weighed using digital scale for grams. Each sample was divided into aliquots of one gram each. Mites were recovered using a floatation method (El Kersh et al., 2019 & Krantz and Walter, 2009). This

method involves placing each dust sample (one gram) in a Petri dish then adding ethanol or sodium chloride solution then the sample was examined under stereomicroscope mite identification and light microscope using 10-40 x magnification for mite counting. We were able to detect mites according to the general criteria stated by Colloff and Spieksma (1992). Both male and female adult house dust mites are globular in shape, creamy white and both have a striated cuticle and four pairs of legs **(fig: 1)**

Statistical methods

The data obtained in this study were recorded on excel sheet and statistically analysed using the SPSS program (Statistical Package for Social Science), version 18.0. Data were expressed as numbers and relative percentages. Chi-square test was used to evaluate the variables correlations. The significant statistical level in this test was considered when P value recorded < 0.05.

3. Results

Potential risk factors that predispose to spread of house dust mite in 33 randomly selected houses were investigated in this study (Table: 1). 26 (78.8%) of these homes recorded positive for house dust mite at least in one sample. 7 (21.2 %) recorded negative for mite in both samples. Mites positive samples were detected more frequently in rural houses 22 (84.62%) than urban ones 4 (15.4%). 24 (92.3%) out of 26 mite positive homes had bird nests or poultry/animal breeding places. A significant association was detected between age of furniture and occurrence of mite population. High percentage of positive mites samples were isolated from old furnished homes (>10 years old) 22 (84.6%). 17(51.55%) of houses included in this study were non tile coated (dusty floor). 16 (61.55%) of these homes recorded positive results for mite detection. In this study, most of mite positive samples were isolated from homes 24 (92.3%) that lack vacuum cleaning facility with non-significant association (p>0.05). 23 (88.55%) out of 26 homes that showed mite positive results were damp. Homes with family members more than 4 person were found positive for dust mites 19 (73.1%) more than families that have few population number. Family size was significantly associated with mite fauna. 22(66.7%) of homes included in this study had at least one sensitized individuals to mite allergen proved by skin prick test. 19(73.1%) of these homes recorded positive for mites detection. positive family history for allergy was recorded in 16 (48.5%) of included homes. We were able to detect house dust mite with statistically significant association in 15 (58%) of these houses.

Table (1): prevalence of mites in studied houses in relation to residence, housing criteria, family allergy history and cleaning habits of houses and homes included in the study (Total=33).

Variable		House dust mite results		Total	Chi-square X^2	P value
		Positive N. (%)	Negative N. (%)			
Residence	-Rural	22 (84.6)	1 (14.3)	23 (67)	12.91	**.000***
	-Urban	4 (15.4)	6 (85.7)	10 (30.3)		
Bird nest	-Yes	24 (92.3)	2 (28.6)	26 (78.8)	13.40	**.000***
	-No	2 (7.7)	5 (71.4)	7 (21.2)		
Furniture age	- <10 years	4 (15.4)	4 (57)	8 (24.2)	5.23	**.022***
	- > 10 years	22 (84.6)	3 (43)	25 (75.8)		
Floor type	-Dust floor	16 (61.5)	1 (14.3)	17 (51.5)	4.93	**.026***
	-Tile-coated	10 (38.5)	6 (85.7)	16 (48.5)		
Vacuum cleaning	-Yes	2 (7.7)	2 (28.6)	4 (12.1)	2.25	**.133**
	-No	24 (92.3)	5 (71.4)	29 (87.9)		
Aeration style	-Damp	23 (88.5)	3 (43)	26 (78.8)	6.86	**.008***
	-Sunny	3 (11.5)	4 (57)	7 (21.2)		
Family size	-< 4 members	7 (26.9)	6 (85.7)	13 (39.4)	7.98	**.004***
	-> 4 members	19 (73.1)	1 (14.3)	20 (60.6)		
Allergic patients	-Present	19 (73.1)	3 (43)	22 (66.7)	2.26	**.132**
	-Absent	7 (26.9)	4 (57)	11 (33.3)		
Familial allergy	-Present	15 (58)	1 (14.3)	16 (48.5)	4.16	**.041***
	-Absent	11 (42)	6 (85.7)	17 (51.5)		
Total		**26 (78.8)**	**7 (21.2)**	**33 (100)**		

The result is significant at p <.05

From the 33 homes included in this study, 66 samples were obtained with a rate of two samples only from each house. Out of these 66 samples, 52 (78.8%) samples were recorded positive for house dust mite (Table: 2). 26 out of 33 samples collected from bed rooms were recorded positive for mite population representing 50% of the total positive samples. Mean number of mite per one gram dust in bed room was 15 mite. House dust mite were isolated from all 11 samples obtained from sites of bird nests/poultry which represent 19.2% of positive samples with mean mite count around 14 mite per gram dust. 12 and 10 samples were collected from living room and kitchen respectively.10 samples from living rooms and only 5 samples from kitchens were recorded positive for mite populations with a prevalence of 19.2% and 9.6% of positive samples. Their mean mite count were 12 and 6 mite / gm dust respectively. Regarding seasonal variation and its effect on mite count, 20 out of 52 positive samples (38.5%) were collected in winter and all were positive for mite presence with mean mite count 12 mite/gm dust. 10 positive samples were collected in spring (19.2%) and mean mite count in these samples recorded 13 mite /gm dust. Positive samples obtained during summer and autumn represented 30.1% and 19.2% with mean mite count 6 and 10 mite /gm dust respectively. Statistically non-significant relationship were reported in this study regarding occurrence of mites in dust samples and both site or season of collection.

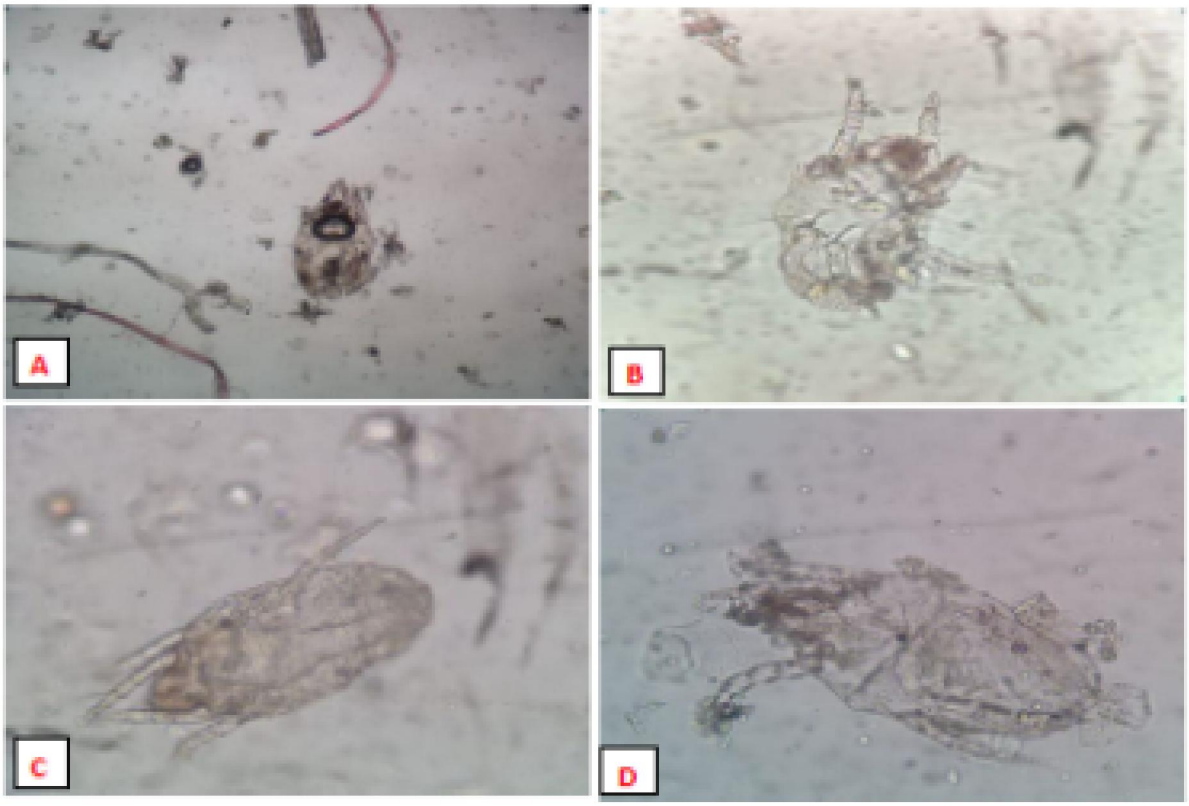

Figure (1): adults of dust mites isolated from dust samples showing globular body feature and articulated pairs of legs.

Table (2): Mean count of mites per one gram dust in positive dust samples in relation to sample site, season (**Total= 52)**

Samples collected	No. of examined samples	No. of positive samples	%	Mean number of mite/ gm dust	Chi-square	P Value
***Site**						
-Bed room	33	26	50	15		
-Other sites						
• bird nest/poultry	11	11	21.2	14		
• Living room	12	10	19.2	12	**1.032**	**.793**
• Kitchen	10	5	9.6	6		
***Season**						
• Winter	20	20	38.5	12		
• Spring	13	10	19.2	13		
• Summer	13	12	30.1 19.2	6		
• Autumn	20	10		10	**2.1337**	**.545**
Total	**66**	**52**	**100**			

*The result is significant at p <.05

4. Discussion

Over the last few years many papers have been published in the literature investigating the occurrence of house dust mite in household environment in different localities in Egypt indicating its importance as the predominant aeroallergen in the Egyptian environment. This is logic and expected since the suitable climatic conditions (which found quite suitable for different mite species to thrive), population density and other factors (sanitary behavior of people, economic level of the family, etc.) were found as important risk factors that increased the chances to detect mite allergens in homes and blood of the Egyptian people (Taha *et al.,* 2108). So this study was designed to throw more light on the risk factors such as housing criteria and seasonal variation that determine the distribution of mite population inside Egyptian homes.

In this study, the influence of some housing conditions and environmental indoor factors on mite population have been investigated. Many factors were found positively influencing mite levels such as residence in rural areas, presence of birds nest or poultry in home, old furniture and dusty floor of houses. Also, damp homes and large family size were found as important factors that increased the chance to detect mites in dust samples. These results come in accordance with those obtained by Taha *et al.,* (2108) and Antonios et al., (2012). The researchers found positive relation between old furniture, crowded homes with low socio-economic level and home dampness as risk factors that positively affected the levels of mite infestations in homes which in turn determined the severity of mite allergy in sensitized populations.

Our results revealed that, 22(84.6%) rural houses included in this study were recoded positive for dust mites. Similar results have been obtained in many studies in nearby Menoufia Governorate. The researchers were able to isolate dust mites from rural houses more frequently than urban ones (El Kersh et al., 2019 and Faheem et al., 2000). On contrary to our result, another study revealed dust mites in urban areas 59.9% more than in rural areas 46.3% in Dakahlia Governorate (El Shazly *et al.,*2006). The high percentage of mites detected in rural areas may be explained upon the fact that agricultural work (main occupation for many people in rural areas) represent a major risk factor for occupational diseases including mite infestation (Solarz and Pająk, 2019b & Berger *et al.,* 2005). In these areas, many agricultural workers and farmers are exposed more to inhalant allergens of both storage mites that usually come from the open cultivated fields into the food stores and house dust mites in bird nests and poultry sites that locate inside or nearby these houses (Hallas and Iversen, 1996 & Solarz and Pająk,2019 a). Another factor that found positively influenced mite population in our study is dusty floor. 16 (61.5%) of mite positive houses had dusty floor while tile coated houses that recorded positive for mite population represented 10 (38.5%) of all positive samples. This result confirm the fact that as long as dust is present, dust mites will be the predominant population.

It is well known that age of dust is greatly affect degree of allergen activity (Arlian and Platts-Mills, 2001). Our results revealed that old furniture is a

factor that largely influence and support mite fauna. 22 (84.6%) of dust mite positive houses were found old furnished more than ten years. It's recorded that mite allergens are closely associated with dust particles greater than 20 µm in diameter that can be easily inhaled due to disturbances. Unfortunately, these particles settle quickly on carpets, draperies, and upholstery fabrics which found to hold moisture and collect detritus providing an ideal habitat for mite reproduction (Arlian and Platts-Mills, 2001). Vaughan *et al.,* (1999) recommended regular vacuuming of furniture such as mattresses, carpets, sofas, and chairs to remove surface alive and dead mites and their allergens. Although we were able to detect dust mites more frequently in samples collected from houses that don't use vacuuming as a routine practice in daily housekeeping, this result was found insignificant. Similar results were obtained by Taha et al., (2108) who reported housekeeping as the least factor that affect distribution of mites inside homes. Since housekeeping removes mites only and does not affect mite reproduction rate, Korsgaard (1982) recommended lowering humidity inside homes over sanitation to slow down multiplication rate of mites' population.

In a recent study in a selected rural population in South Poland (Solarz and Pająk 2019a, b), the researchers were able to isolate dust mites especially storage mites from all sites where animals breed including cowsheds, barns and poultry houses. These findings were in line with our results since 24 (92.3%) out of 26 houses with bird nest or poultry/animal house were recorded positive for mites population with a significant relationship. Interestingly, in our study all samples collected from areas of animals/poultry/bird nests were found positive for dust mites indicating the importance of these sites as a major source of mites in Egyptian houses. Dissimilar results in the area of our study were obtained by Taha et al., (2108) who reported poor relationship between presences of bird nests/pets and mite distribution in indoor environment.

In our study we observed that humid houses with poor aeration were more favourable for maintenance of mite colonies than sunny houses with good ventilation. This is because damp houses guarantee the optimum water concentration in the surrounding air which taken up in vapour by the mites (Arlian and Platts-Mills, 2001). These small arthropod-like animals are active at temperatures above 20°C and in humidity above 50% where they can breed and establish their colonies most successfully (Hart, 1998). So it is recommended to reduce indoor humidity as a measure to combat dust mites since these mites stop growing and die at humidity lower than 60% (Spieksma *et al.,* 1971). Similar findings were documented by Taha et al., (2108) in Egypt and Van der Heide *et al.,* (1997) in India. Both studies found an association between damping homes and prevalence of mite fauna.

There is stated that the main food of dust mites in homes is sloughed human skin that shed in a rate of 0.5 to 1.0 gram daily (Arlian and Platts-Mills, 2001). As the number of household inhabitants increases, the amount of food available for mites also increases with more chances for dust mites to establish more colonies in indoor environment with higher allergen concentrations in different dust samples (Chen et al., 2007). Also, more number of individuals in rooms of the same home increase humidity via perspiration and enhance accumulation of more dust over different furniture items. Many studies, including this one, documented a positive association between occurrence of house dust mites and presence of large number of persons in the households (Taha *et al.,* 2108, Hallas and Korsgaard, 1997 & Sakaki and Suto, 1994).

In humid and warm areas, it is well known that exposure to dust mite allergens predispose for sensitization especially in genetically susceptible individuals. (Terreehorst *et al.,* 2002). A very important consideration in this study is that though we were able to detect dust mites in 26 (78.8%) out of 33 of total houses included in this study, only 19 (73.1%) of these houses had an individual complaining of allergic manifestations to mite allergens proved by skin prick test. This result indicate that only those individuals genetically susceptible or sensitive to dust mites are affected. This observation is in agreement with Custovic and Woodcock, (2000) who reported the ability of some patients to react to very low doses of mite allergen, while other patients were found to tolerate rather high doses. Although high concentrations of dust mites allergens were documented in blood among allergic patients in area of our study (Taha *et al.,* 2108), we reported non-significant relationship regarding occurrence of dust mites in homes of allergic and non-allergic individuals. In this study, a significant relationship was found between positive family history for allergic diseases and presence of mites. This observation is in accordance with other studies that document this association in their studied allergic population (El Kersh *et al.,* 2019, Taha *et al.,* 2108 and Antonios *et al.,* 2012). Both familial genetic factors and exposure of all household contacts to the same housing conditions could explain this association (Horwood *et al.,* 1985).

In our survey we assayed mitedensity and prevalence in 66 samples collected form 33rural and urban houses in Sharkia governorate using floatation method. The result showed that the population density of mites was relatively higher in dust collected from

bed rooms when compared to samples collected form bird /poultry site, living rooms and kitchens without significant difference. Bed rooms and its ecology were investigated by many scientists for the presence and distribution of mites inside it. Different items in the bed room including mattress, bed sheets, floor dust, cushions, sofas and carpets were sampled and found positive for dust mites in numerous studies associating the exposure to mite allergens with the development of allergic symptoms (Cho *et al.,* 2006, Halken *et al.,* 2003, Schei *et al.,* 2002, Huss et al., 2001 and Van der Heide et al., 1997). From these studies a general consensus has been reached that mites are found in habitats intimately associated with man, such as beds, couches, sofas, other upholstered furniture, clothing, floors and they found absent in items not used by human. These discrepancies between the above papers is attributed to species of isolated mites and environmental conditions especially temperature and humidity that make up pattern of mites distribution in any environment. Korsgaard (1998) stated that areas of high use where humans shed skin such as bed rooms are places where highest concentrations of house dust mites could be found. Human clothing can be infested with mite (Hewitt *et al.,* 1973). So, mechanical transmission of these organisms by humans from place to place (Lang and Mulla, 1978 & Nakada and Yoshikawa, 1976) may contribute to the extensive predominance of mites in bed rooms especially when individuals not committed to a special night wear for sleeping. Gamal Eddin et al. (1982) suggest another cause that could explain high predominance of mite populations in bed rooms which is chemotactic response of mites to human sweat gland secretion and sebaceous gland secretion. This suggestion is accepted especially when large number of populations are sharing the same room attracting more mites to different items of bed room.

In the present work seasonal climatic changes contributed to the variation in dust mite concentrations in collected samples. The number of mites fluctuated with seasons, with the highest number of mites being detected in spring and winter while the lowest number of mites were recorded in summer (table: 2). This result is in concordance with results of two studies conducted in Egypt (Antonios *et al.,* 2012 and Yassin *et al.,* 2009) and another study conducted in India (Van der Heide *et al.,* 1997). They recorded high densities of mite population in winter than in summer. This result could be explained on the basis that climatic conditions in summer in the form of high temperature and low humidity are not favourable for mite growth and thriving in dust. In our study, dust mite densities did not show a significant variation between seasons (P value > 0.05). The key determinable factors for this fluctuation across seasons is mainly due to outdoor temperature and indoor humidity (Tilak and Jogdand, 1989). The optimization between these two factors greatly affect rate of reproduction of mite fauna which can complete many cycles of reproduction within months building up large populations and this will in turn be reflected on their rate of detection in dust samples (Andrew *et al.,* 1979). In many studies a significant association between abundance of mites and the percentage of the relative humidity has been documented (Yassin *et al*., 2009, Chew *et al.,* 1999, Cadman *et al.,* 1998 and Murray and Zuk, 1979). Although, the outdoor mean temperatures in our study were recorded around 22 C in winter which is nearly suboptimum to maintain mite reproduction and breeding, we were able to detect mites in all winter samples. This is because an ideal indoor humidity was maintained by household populations who tend to stay at homes for long periods with more individuals sharing bedding areas and items of human rest in living rooms and this had maintained the reproduction rate of mites in household environment. This result is in accordance with Arlian, L. G. (1992) who postulate that relative humidity is directly influence and support feeding rate and allergen production of mite populations.

The main criticism to this survey is the few number of samples obtained and few number of homes included which is not representative to large number of population inhabiting the area of the study. Most studies that investigate the prevalence and distribution of mite fauna inside homes, including this one, have been carried out with small study samples due to the intense labour exhausted during collecting and examining the sample that need recruitment of large number of work forces with heavy budget. And this not available in low income countries like Egypt. Also, bias that occur during sample collection and transportation could give false results about the true fauna distribution indoor. Moreover, the lack of sound data about indoor temperature and humidity in different geographical areas in Egypt represent a complex task facing the researchers when they study mite distribution in household environment. Although we were able to detect dust mites in most studied samples depending on the general morphological criteria under light microscope, however this study did not take into account the species differentiation of mites. This is due to the lack of adequate taxonomic studies of mites species in Egypt based on light microscopic examination. In addition to the poor financial resources that limited our use of electron microscope which is essential for mite species differentiation and identification in such studies.

Conclusion

In conclusion, the basic housing criteria together with continuous climatic changes are the main factors that determine the occurrence and distribution of mites inside houses. So investigating sites of mite breading is expected to be an everlasting field of interest for the coming scholars.

Recommendation

More studies are needed in different geographical areas in Egypt to map the prevalence and distribution of indoor dust mites. Also, more researches are needed to investigate different mite species in the Egyptian environment with establishing documented morphological criteria for its identification.

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