

## ROLE OF ENVIRONMENT ON DYNAMICS OF HOUSE DUST MITES (HDM) AT PUNE

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### ABSTRACT

Fortnightly intramural dust sample study, for two consecutive years from June 2011 to May 2013, at Pune, encountered 700 specimens of house dust mites included young ones, adult males & females and few larvae & nymphs. In all 10 genera and 12 species have been identified using authentic literature. Most of them have been found to be proved allergens causing allergy (health hazards) among sensitive persons.

These investigations explored interesting findings. Some HDM like *Dermatophagoides*, *Blomia*, *Acarus*, *Cheyletus* etc. have been found to be delicate and exhibited tremendous impact of environmental parameters like temperature, relative humidity and rainfall. Moderate temperature around 25°C and relative humidity (RH) around 80%, indirectly aided by frequent rains played significant role in hatching of eggs, larvae and nymphs growing into adults, subsequently leading to breeding and increase in mite load of intramural environment at Pune. Colonization and increase of mites had been found to be continued as long as optimum conditions prevailed during rainy season.

These HDM have been found to be thermo sensitive and their population decreased at low (10-15°C) or high temperature (35°C & above) and low relative humidity below 25% found during winter and Summer, with little or no rain fall exhibiting adverse effects on HDM proving their thermo sensitivity and seasonal fluctuations of population dynamics following the concept of seasonal variations.

While rat mites like *Echinolaelapse chidninus* (Berlese 1887) and common rodent mite like *Haemolaesaps glasgowi* (Ewing, 1925) (Fa: -*Laelaptidae*) have been recorded round the year in abundance, with minimum fluctuation in the mites population dynamics irrespective of seasons and fluctuations in environmental factors, thus disobeyed the concept of thermosensitivity.

*Dermatophagoides* (Hughes) was dominant followed by *Haemolaesaps glasgowi* (Ewing, 1925), *Cheyletus* (Schrank), *Acarus*, *Blomia* (Bronswijk, Oshima), *Caloglyphus* (Zachvakin) etc. *Tyrophagus* was reported as fungal culture contaminant, *Proctolaelaps* in *Drosophila* culture and *Dermanyssus gallinae* poultry mite

### KEYWORDS

Mites, Intramural environment, allergy, allergens and health hazards.

### INTRODUCTION

Allergy is any altered capacity of the human body to react to a foreign substance subsequently resulting into some symptoms as an anaphylactic response. During 19<sup>th</sup> century it was considered for long time that it may be caused due to house dust. But Kern (1921) from America, was the first to prove that a mite, *Dermatophagoides pteronyssinus*, from house dust was the major potential cause of causation of allergy in sensitive persons and not the house dust proper (victims). Then scientists from America, Asia, Europe, Australia and Africa came forward and investigated 36 mite species as indoor allergens in the house dust world over, 29 India from Kolkata (Modak 1991), 23 from Bangalore (Krushna Rao 1981), 20 from Aurangabad (Jogdand 2012) and 17 from Calicut (Haq and Ramani 2010). Jogdand(1986), Tilak and

Jogdand(1989), Tilak et al(1994), Jogdand (1994, 1995, 1996, 1997, 1997, 2000, 2007), Tilak and Jogdand(2009), Tilak and Jogdand(2010) , Jogdand (2012) carried extensive work on various aspects of house dust mites, their vertical profiles , environmental dynamics etc., gave marvelous contribution and advanced the knowledge in this science.

Similarly in Foreign countries kern (1921) was the first to find out *Dermatophagoides farinae* and mold as potential allergens from house dust. Then Fain (1957), Miyamoto et al, 1969), Spieksma (1997), Torey ER et al (1981) and Shivpuri (1977), studied different genera of house dust mites, worked out different aspects, developed skin testing techniques and other methods for diagnosis of allergic manifestations. Subsequently developed ideal keys for identification of house dust mites and evolved many reference books.

## MATERIALS AND METHODS

**Collection of house dust samples:** Different sources: House dust samples are collected from the following sources 1) Floor 2) bed 3) sofa set 4) mattress and 5) cotton tape cot.

**Techniques used:** since the vacuum cleaners are not used in Indian homes therefore, dust is collected manually, by sweeping, brushing, dusting and shaking the different articles.

a) Collection of floor dust: It is collected by sweeping the floor, room corners and underneath the cot, trunks from the bed rooms. Collected dust is put in a small, clean, dry injection bottle with a little space, stoppered and labeled properly giving the source, date, name and type of home.

b) Collection of bed dust: Bed is brushed by a cleaning brush. Dust is collected in the center of the bed over the cot and taken on a small paper and put in a clean dry bottle. It is labeled as mentioned above.

c) Vacuum cleaner technique: Apart from manual collection of house dust, it can also be collected by vacuum cleaner, an electricity operated machine. We may collect different types of dust samples by this machine. In this machine, when it is on, air is sucked in through a regulated pipe. When tip of the pipe is fixed on the bed or any surface containing the dust, along with the air, dust is also sucked in through the pipe. Another end of this sucking pipe is connected to a vasculum polythene bag inside the box of the vacuum cleaner pump, where dust is collected. Different bags must be used for different dust samples and fresh dust must be used for scanning or its analysis.

**Examination of house dust samples** (Jogdand and Tilak 1987): Large particles and fibrous materials in the dust are separated by its sieving through 300 mesh special brass sieve of 6" diameter. Sieved house dust sample is placed in a Petri dish (5.5 cms diameter) for examination. It is spread evenly to form a uniform thin layer and observed through a stereoscopic microscope. Mites are detected by their movements and a path traced by them.

**Isolation of mites:** Mites are isolated from the house dust samples manually with the help of moist short haired fine camel brush or with a needle. Individual mites are picked up and put into a cavity block or cavity slide containing 50% lactic acid as a clearing and killing agent.

**Clearing and mounting:** Isolated mites were made clear by dipping them in 50% lactic acid for 3-5 days or at least 24 hours depending upon sclerotization. Then they were mounted in the center of a clean glass slide in a drop of melted glycerin jelly.

**Identification:** The mites were identified according to the key given by Fain (1957) and according to the criteria of Hughes (1961) and other available literatures

## RESULTS AND DISCUSSION

House dust mites had been considered to occur mostly in the temperate Countries only, but exploration of HDM in various regions of India discarded this assumption and proved beyond doubt that HDM have also been equally found in tropical countries of the world. HDM exhibit alarming environmental adaptability and maximum nutritional adaptability too. Hence other mites have been reported as extremophiles found underneath snow at Antarctica (Satynarayana 1983), as aquatics found in marine and fresh water even in hot water springs, as endoparasites, ectoparasites or surface dwellers on domestic animals, wild animals like rats, birds like cock, hen, peacock, parrot, pigeons, maina etc, insects like wings & leg hairs of honey bees, human beings skin, dandruff & eyelids, in soil litters(orbitids), houses, groceries, godowns, animal sheds, inside the living groundnut pods under the ground and several such varied habitats. Thus mites exhibit prolific diversity.

Some extramural mites like poultry mites, pig mites etc. have been found shifted to intramural environment like human dwellings etc. and inhabited the intramural environment due to their adaptability to environment and nutrition (Jogdand 1996).

However, their population density fluctuates dynamically due to significant impact of environmental parameters. It has been found maximum at moderate temperature (25°C + 2 or -2°C), high relative humidity(around 80 to 90%) and frequent rainfalls, which occur during rainy season and minimum at high temperature(around 35°C to 45°C), low relative humidity(around 25% or less) and rainless, clear days, which occur during summer season. Because they die during hot conditions, only encysted eggs and some sturdy mites survive. During winter due to chilling cold they perish and maintain their moderate or minimum population i.e. at low temperature (below 15°C or less), less relative humidity (40% or less) and rainless days. From these findings it may be interpreted that different environmental parameters like temperature, relative humidity and rainfall play determinative role in maintaining mite population in the patient's dwellings.

Similarly dynamics of mite population also fluctuates with seasons. These findings have revealed that HDM Population has been found to be maximum during rainy season, because the conditions of rainy season have been found to be congenial for their copulation, breeding, multiplication, colonization and population growth. While they have been found moderate or less during winter season, because conditions during winter have been found to be limiting factors for their multiplication and HDM population have been found to be minimum during summer months, because conditions during summer have been found to stop their life activities &

they survive only in the form of encysted egg stage. Thus population dynamics fluctuates according to seasons.

However, mostly the dynamics of population in the case of rat mites does not exhibit such seasonal fluctuations because these mites have been found almost equally during all the seasons, multiplying continuously throughout the year. This may be perhaps because these rat mites appear to be quite bigger in size almost up to 1500um (1.5 mm) in length and 827 um in widths, abundantly spiny & sturdy, hence may be tolerant to extreme conditions. The prominent house dust mites found during these investigations have been reported here. They are *Blomia tropicalis* Bronswijk Cock & Oshima, *Caloglyphus oudemansi* Zachvatkin, *Dermanyssus gallinae* De Geer, *Cheyletus eruditus* Schrank, *Cheyletus malaccensis* Oudemans, *Acarussiro*, *Tyrophagus putrescentiae* Schrank, *Haemolalesaps glasgowi* Ewing, *Echinolaelaps echidninus* Berlese, and *Tetranychus hypogea* Gupta. *Dermatophagoides pteronyssinus* Trouessart, *Dermatopagoides farinae* Hughes.

#### CONCLUSION:

Role of environment on dynamics of house dust mites (HDM) at Pune revealed interesting findings. Environment plays detrimental role in percentage contribution, incidence, load and seasonal dynamics of different mite groups. Rat mites have been newly reported and recorded continuously throughout the year in abundance. Totally 10 genera and 12 species have been reported at Pune in different dust samples. The study is significant from allergy point of view.

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