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ECOFRIENDLY ENVIRONMENTAL DYNAMICS OF HOUSE DUST MITES AND THEIR ROLE IN MANIFESTATION OF ALLERGY , DIAGNOSIS AND THERAPY

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INTRODUCTION

Intramural environment in the dwellings of allergy patients consists of house dust in their beds and bedrooms, air in the bedrooms, mattresses, beddings, pillows, bed sheets, curtains, dandruff and skin scales, fallen hair, shoes, socks, gloves, racks, cupboards, furniture, upholsters, A.C. or fans etc., which together cumulatively harbour abundant biomaterial round the year, preferably during rainy season in the bed dust and house dust, when the prevailing environment conditions in patients' bed room are congenial or most favourable. Investigations of such biomaterials in the house dust have revealed the presence of moulds, bacterial and recently explored House Dust Mites (HDM).Mould and bacterial diseases among the human populations are well known now.

Kern (1921), an American scientist , was the first to discover *Dermatophagoides pteronyssinnus* as prominent casual bioagent responsible for manifestation of allergic symptoms, in addition to moulds among sensitive individuals.Till then house dust itself was considered to be an allergen, But this discovery proved beyond doubt that it is not the dust but biocomponents or biomaterial in the dust which are potential cause of allergic manifestations like rhinitis, cough, fever, nasal allergy, bronchial allergy, naso-bronchial allergy or sometimes skin allergy; not in all, but only in sensitive individuals.

At present 36species of HDM are on world record, responsible for causation of different types of allergies in sensitive persons of which 29 spp. (Modak *et al*.,1991)have been recorded at Kolkata, 23 spp.(Rangnath *et al*., 1982)at Bengaluru, 20 (Jogdand,1987) at Aurangabad and 17 (Haq and Ramani,2010) at Calicut (kerala) which have been found to be potential allergens.

Population density of these indoor bioallergens (HDM) has been found to be immensely affected, influenced and predominantly determined by environmental parameters like temperature, relative humidity, rainfall, accumulated dust, dandruff, skin scales, convections, fan currents and A.C in the patients dwellings. Accordingly, HDM exhibit population dynamics, variation, fluctuation and abundance along with favourable or unfavourable environmental parameters round the year. Population dynamics have shown prominent variations according to seasons in Marathwada region at Aurangabad, revealing high density of population during rainy season, moderate during winter and minimum during summer season (Jogdand,1989). As the rainfall begins during June-July, encysted eggs hatch larval and nymphal stages developing into adults subsequently leading to increase in population during August-September due to their progressive fast breeding reaching at the highest peak as long as rains are continued, followed by decrease in population due to impact of winter conditions and then followed by further decrease due to summer conditions.

Copulation, mating, egg laying, hatching of eggs into larvae and nymphal stages and their moulting into adults have been governed and promoted by moderate temperature, high relative humidity and frequent rainfall maintaining congenial environmental conditions for their breeding, reproduction, multiplication and abundant colonization in undisturbed dust deposition in the bedrooms of patients described above, preferably during rainy season, i.e. from June to October (Jogdand,1987).

Environmental conditions during winter, i.e., low temperature, lower relative humidity and lack of rainfall have been found to prohibit HDM breeding; hence density of population is brought down suddenly and many of them die due to these unfavourable conditions. These dead mites , their parts , debris and excreta mixed in the house dust are inhaled during free breathing of the patient while at sleep during night. Next morning the sensitive persons provoke or exhibit asthmatic symptoms mildly or acutely depending upon their degree of sensitivity to HDM (1+ to 4+) or sometimes there may be a severe attack which leads to confinement of the patient in ICU or on Oxygen (ventilator).

While 35ºC during summer season high temperatures above 35ºC, lower relative humidity below 30% and absence of rainfall create extremely unfavourable hot and dry conditions for HDM survival. Almost they die and perish .But encysted eggs hibernate during summer and hatch to develop new progenies at the first inception of rains during rainy months, i.e., June to October.

Thus HDM population dynamics fluctuates with environmental fluctuations and varies with seasons with different sets of environmental parameters during three seasons in India. In contrast to these findings of seasonal fluctuations, fortnightly

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observations for two consecutive years in rat house of Poona College of Pharmacy, Erandawane, Pune, evolved a new concept, i.e., irrespective of seasons and variations in the environmental parameters, incidence of rat mites occur in good numbers throughout the year in all the months even under varying environmental parameters . These are rodent mites i.e., *Haemolaesaps glasgow* (Ewing, 1925), Spiny and rat mite, i.e., *Echinolaelaps echidninus* (Berlese,1887), Family: Laelaptidae.

Earlier concepts about HDM revealed that they occur mostly in temperate countries of the world . But above findings have proved that they are equally abundant in sub tropical and tropical countries of the world. HDM have also been reported to exhibit tremendous nutritional adaptability and maximum environmental adaptability. Hence they have been found to feed on any type of food and adapt to tremendous variations in the extreme environments.

Recently poultry mites, birds mites, rat mites, pig mites, and domestic animal mites, etc., have been found to occur as HDM and may be responsible for causation of allergy in sensitive victims. These observations have revealed that various extramural mites have been shifted to intramural environment and cause allergy (Jogdand 1996,1997).Vertical profile studies of HDM have revealed that they decrease in number progressively with height but have been found associated with human habitat even at that height (Jogdand,1998).

Some of the extramural mites have been found underneath the ice logs at Antarctica. While some mites may occur as aquatics in fresh water or marine environment and may be found even in hot springs. Other mites may be free living, surface dwellers,ectozoic, ectoparasitic, endoparasitic, phytophagoids, oribatids (soil borne), air borne,etc; responsible for various roles like biodegradation, humus development, increase in soil fertility, bio-control of weeds, control of fungal allergens in patients' dwellings, as vectors, recycling of biological materials in the forest and other ecosystems,etc. Mites have been reported on the eggs and legs of adult honeybees decreasing honey production by 50% in U.P. Some of them may be considered as suspected allergens. Recently Bastwade and Das(2007)reported a rare mite *Indiacarus pratyushi* from Lohagadh, Lonavala, Pune. In all 50,000 species of different mites are on record world over, which may be due to their maximum environmental and nutritional adaptability.

CLINICAL BIOMEDICAL ENGINEERING TECHNOLOGY

Anton Van Parquet (1906) coined the term allergy to denote any altered capacity of the body to react to a foreign substance (allergen) when it comes in contact , inhaled ,ingested or injected, leading to development of certain symptoms called as allergy symptoms, also called as anaphylactic symptoms.

Clinical Biomedical Engineering Technology includes :

(a) Clinical investigations of the patient,
(b) Investigations of house dust mites,
(c) Antigen testing method of biomedical diagnostics,
(d) Selection of drugs or antigens for treatment as per the extent of sensitivity in the patient
(e) Selection of method of treatment,
(f) Actual treatment using immunotherapy, yoga therapy, etc., and
(g) Subsequent success for curing allergy patients.

Biomedical Diagnostics: Intradermal Antigen Skin Testing Protocol :

a. Negative Control: Buffered saline.
b. Positive control: Histamine acid phosphate with buffered saline, 100mg/ml.
c. Dose: 0.01 ml.
d. Concentration of extract of antigen:1:500.
e. Type of test: Intradermal skin testing of antigen.
f. Recording of observations: 15 minutes after testing.
g. Recording of late reactions: 08 hours after testing.
h. Finding: 44% of the tested 101 patients showed +ve reactions to HDM.
i. After correct identification of allergens, correct diagnosis have been confirmed.
j. Immunotherapy treatment had been adopted among ten allergy cases with 1+ to 4+ positivity for two consecutive years. 80% patients have been fully cured and got rid of all symptoms.

Result and Discussion:

House dust mite survey of 201 allergy patients revealed that over 75% of the bed and floor dust samples in the dwellings were dominated by HDM, irrespective of sex and age depending on quality of dwellings. These results are supported by those of Shivpuri(1997) and Channabasawanna *et al*.(1981).

Dermatophagoides pteronyssinus, *Trouessart* (bed mite), *Dermatophagoides farinae Hughes* (Floor mite), *Blomia tropicalis, Bronswinjk cock, Oshima, Goheria fusca, Oudemans, Cheyletus erudatus, Dermanyssus gallinae, Acarus siro, Caloglyphus oudemansi, Haemolaesaps glasgowi* (Ewing 1925), spiny mite, *Echinalaelaps echidninus* (Berlese, 1987) etc. have been encountered frequentely.

While dermatophagoides pteronyssinus and Dermatophagoides farinae have been found most common in almost all samples and others were frequent.All these species are responsible for allergic manifestations in sensitive individuals.

Biomedical Therapy: Immunotherapy Techniques

Individuals suffering from allergy were treated with immunotherapy for desensitization. They have been immunized twice a week , once a week and after 2, 3 and 4 weeks intervals respectively.

Schedule of Immunotherapy Techniques

a. 1ml. dose of 1:500 concentration of mite antigen twice a week for 3 months.

b. 1ml. dose of 1:500 concentration of mite antigen once a week for another 3 months.

c. 1ml. dose of 1:500 concentration of mite antigen fortnightly once, for 3 months.

d. The treatment was carried out in the above sequence, progressively increasing the concentration of single/ composite antigens from 1:500 to 1:50.

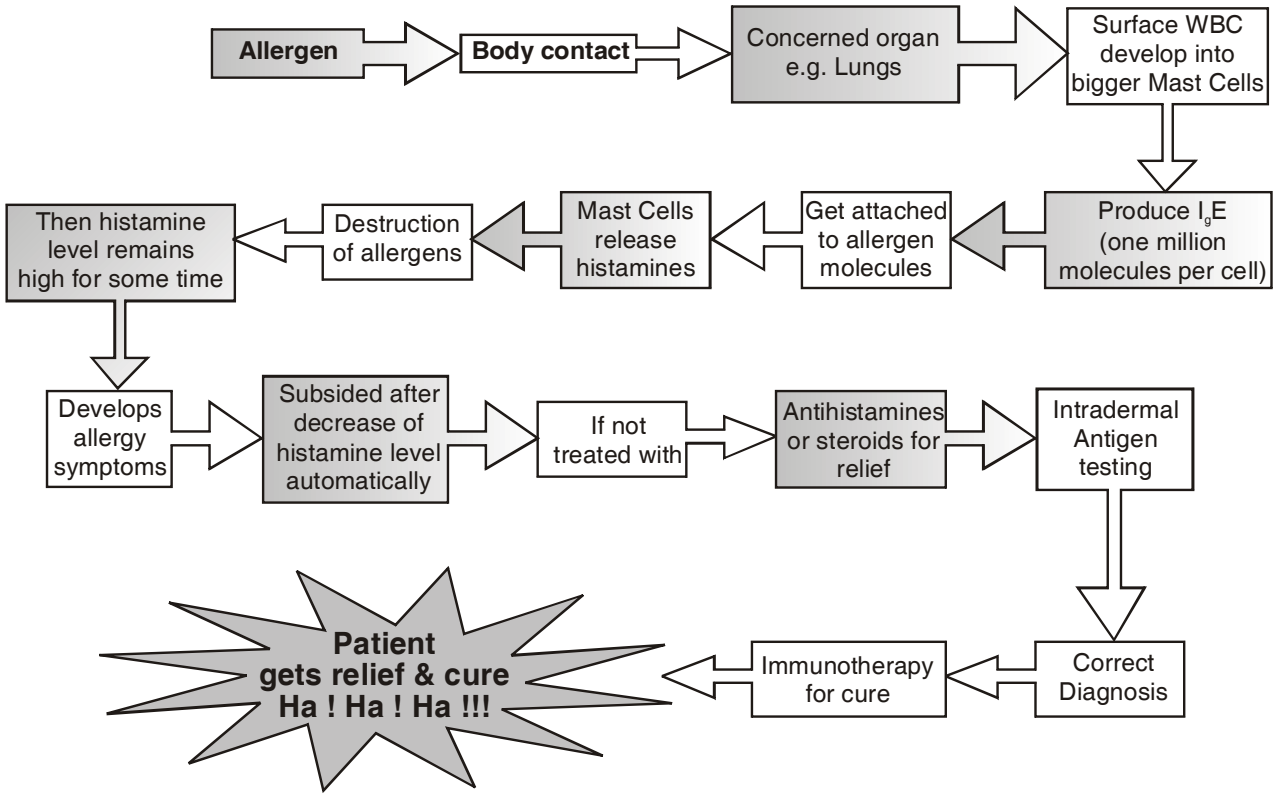
e. Immunotherapy was helpful for desensitization and full relief from allergy .

f. Five cases gave full response, got full relief and there were no symptoms in the following year.

g. Other three patients had a mild attack at the end of the first schedule. So entire schedule was once again repeated. Then they got full relief.

h. Remaining two cases left the treatment incomplete and did not get cured.

Thus use of biomaterials like HDM have been successfully used in biomedical technology, biomedical dianostics and biomedical therapy like immunotherapy in curing asthmatics giving them full relief from allergic manifestations, a sure cure for allergy and asthma in adults as well as in children under this biomedical engineering technology. It has creaed a new horizon to give full relief to 20% ailing population of the world.



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