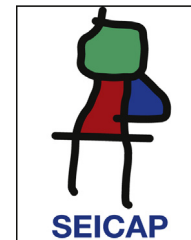




**Allergologia et
immunopathologia**
Sociedad Española de Inmunología Clínica,
Alergología y Asma Pediátrica
www.elsevier.es/ai



REVIEW

A review on emerging frontiers of house dust mite and cockroach allergy research

S. Patel^{a,*}, B.R. Meher^b

^a *Bioinformatics and Medical Informatics Research Center, San Diego State University, San Diego 92182, USA*

^b *Department of Biochemistry, Indian Institute of Science, Bangalore 560012, India*

Received 27 September 2015; accepted 16 November 2015

KEYWORDS

Allergy;
Mite;
Cockroach;
Hypersensitivity;
Serine protease;
Epitope mapping;
Genome wide
association studies;
Metabolomics

Abstract Currently, mankind is afflicted with diversified health issues, allergies being a common, yet little understood malady. Allergies, the outcome of a baffled immune system encompasses myriad allergens and causes an array of health consequences, ranging from transient to recurrent and mild to fatal. Indoor allergy is a serious hypersensitivity in genetically-predisposed people, triggered by ingestion, inhalation or mere contact of allergens, of which mite and cockroaches are one of the most-represented constituents. Arduous to eliminate, these aeroallergens pose constant health challenges, mostly manifested as respiratory and dermatological inflammations, leading to further aggravations if unrestrained. Recent times have seen an unprecedented endeavour to understand the conformation of these allergens, their immune manipulative ploys and other underlying causes of pathogenesis, most importantly therapies. Yet a large section of vulnerable people is ignorant of these innocuous-looking immune irritants, prevailing around them, and continues to suffer. This review aims to expedite this field by a concise, informative account of seminal findings in the past few years, with particular emphasis on leading frontiers like genome-wide association studies (GWAS), epitope mapping, metabolomics etc. Drawbacks linked to current approaches and solutions to overcome them have been proposed.

© 2016 SEICAP. Published by Elsevier España, S.L.U. All rights reserved.

Introduction

Allergies, the pathologic manifestations originated due to a trigger-sensitised immune system have emerged as a bane of current times. Though allergies as health issues are not new to mankind, their severity, owing to pollution, drug

abuse, dietary mistakes and chemical exposure is unprecedented in recent times. Considering that allergies erupt when innocuous foreign components are confused as foes by the immune surveillance,¹ their dynamics has been extensively studied. The immune system is an intricate network of lymphoid organs, lymphocytes, and cytokines, meant to cordon off against all physical invaders and restore homeostasis. By coordination of its two arms, innate and adaptive immunity, it defends the host against the onslaught of pathogens, intent on wreaking havoc.² However, due to

* Corresponding author.

E-mail address: seemabiotech83@gmail.com (S. Patel).

<http://dx.doi.org/10.1016/j.aller.2015.11.001>

0301-0546/© 2016 SEICAP. Published by Elsevier España, S.L.U. All rights reserved.

Please cite this article in press as: Patel S, Meher BR. A review on emerging frontiers of house dust mite and cockroach allergy research. Allergol Immunopathol (Madr). 2016. <http://dx.doi.org/10.1016/j.aller.2015.11.001>

a multitude of reasons, both genetic and environmental factors, the immune system can undergo deviations and prompt allergic reactions.³ Frequent exposure to the allergens leads to allergic manifestations such as asthma, atopic dermatitis, urticaria, rhinitis, sinusitis and conjunctivitis, to name a few, in susceptible individuals.⁴ Some allergens can even induce life-threatening conditions such as anaphylaxis. The basal mechanisms of allergic responses vary depending on a host of factors, predominantly the allergens, cross-reactivity with other allergens and host genetic profile. The general pathway has been ramified based on involvement of immunoglobulin E (IgE), that is immediate (IgE-mediated or humoral) or delayed (non-IgE mediated or cell mediated) type. In the former, allergenicity starts on recognition of allergens by antigen presenting cells (APC) like dendritic cells, which polarises Th differentiation towards Th2, causing excess IgE production.⁵ The allergens bind to IgE, adhered on basophils and mast cells causing their activation, resultant cytokine and chemokine secretion, degranulation and subsequent histamine release.^{6,7} The cytokines converse with other immune cells and mediate inflammations.⁸ In delayed type hypersensitivity, T lymphocytes, eosinophils and basophils are recruited to the site of inflammation.⁹ Most cases of delayed response are associated with drugs.¹⁰ Activation of inflammasome in airway, gut and skin epithelium by both modes of sensitisation has been evidenced.

Literature survey reflects that roughly 30% of the world population suffers from allergies.¹¹ Although there exist a plethora of allergens, food, pollen, insects, latex, drugs, cosmetics, metal have been recognised as the most frequent causal agents.¹² However, the list of allergens can be overwhelming and our current knowledge on their repertoire is only the tip of the iceberg.¹³ In current times, allergic instances are rising dramatically, due to many unspecified but suspected reasons. The degrading quality of environment is assumed to be one of the fundamental reasons, as diesel exhaust particle-caused pollen rupture and resultant airway inflammation has been verified.^{14,15} Also, alterations in lifestyle and dietary habits, higher reliance on processed and preserved foods are assumed to have increased the allergic prevalence.¹⁶ A surge in chemical exposure has been incriminated to provoke allergic reactions.¹⁷ As allergy is essentially a health exacerbation in atopic individuals, conspired by genetic makeup and environment, it is imperative to decipher both host and allergen aspects and their nexus from the perspective of different allergens. Here, we are discussing the major arthropod-origin indoor allergens, dissecting their diverse standpoints, aimed at their alleviation by promoting awareness.

Arthropods are the largest animal phylum and they sustain a huge diversity.¹⁸ It is not in the best interest of human health that several classes of this phylum such as Insecta, Crustacea, Arachnida and Chilopoda have been recognised as allergens.¹⁹ In fact, ingestion, inhalation, sting or contact allergy to arthropods poses a significant social, economic, and medical burden across the globe.¹⁹ Allergies to house dust mites, cockroaches, hymenopterans, and crustaceans have been frequently documented, as the allergens sensitise and induce IgE-mediated hypersensitivity in predisposed individuals.^{20,21} Ingestion-caused allergies, as is the case with shrimp, lobsters or crabs can be easily tackled, by simple elimination of the risky diet.²² Sting arthropods can

also be avoided by proper precaution.²³ However, house dust mites and cockroaches, as indoor allergens, are difficult to get rid of, as these pesky allergens occur in nooks and crannies of houses, and heighten the risk of asthma, dermatitis, sinusitis, rhinitis, and otitis, among other inflammations.²⁴ Not only in houses, but these allergens have been detected in most school samples, which can jeopardise the health of children, rendering them vulnerable to future health consequences.²⁵ The dust mite and cockroach allergies are not restricted to low-income, rural areas in developing countries, but they have been documented in urban areas, in fact more commonly in the latter.^{26,27} Also, they are not endemic or climate-controlled, but occur globally such as in geographically-segregated countries like Vietnam,²⁶ Thailand,²⁸ Brazil,²⁹ Italy,³⁰ Croatia,²⁷ China,³¹ to name a few. Eradication of this problem necessitates effective remediation, allergen characterisation and novel therapeutic modalities. To contribute in that direction, by dissemination of knowledge, identification of gaps and stimulation of research, this review has been formulated.

Mite allergens and their mechanisms

Mites are microscopic arachnids causing allergy worldwide, the major culprits being house dust mite *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*.^{4,32,33} The two species vary in their allergenic diversity, yet show cross-reactivity.³⁴ Also, *Euroglyphus maynei* and *Blomia tropicalis* are common mites in humid parts of the world, which we are not discussing here.³⁵ Also studies on storage mites like *Tyrophagus putrescentiae*, *Lepidoglyphus destructor*, *Glycyphagus domesticus*, *Aleuroglyphus ovatus*, *Acarus siro*, *Suidasia medanensis* have been conducted for richer insights on arthropod-caused allergy, which is beyond the scope of the current discussion.³⁶ Although invisible to unaided eyes, mites are harboured in millions on house furnishings, bedding and clothing, which sustain on discarded human cells.^{35,37} The recent finding of their occurrence in food articles, like cooking flour, leading to ingestion-related anaphylaxis has raised further concern.^{38,39}

Almost all body parts of the mites, including the gut (oesophagus, proventriculus and other digestive parts), faeces, cuticles and eggs are allergens, triggering allergy in 85% of asthmatics.⁴⁰ More than 20 house dust mite allergens have been characterised so far, classified into many groups.⁴ Most of them are proteins, either cysteine proteases belonging to group 1 (papain-like family), or serine proteases belonging to group 2, 3, 6, and 9 (trypsin, chymotrypsin, and collagenase).⁴¹ Recently, α -actinin has been identified as a new type of house dust mite allergen.⁴² Cysteine proteases Der p 1 (from *D. pteronyssinus*) and Der f 1 (from *D. farinae*) have been verified to regulate proteolytic activities of all other groups of allergens by zymogen activations, so they have been well-defined.⁴³⁻⁴⁵ Evidence suggests that allergenicity can arise from mite-associated bacterial and fungal products as well,⁴⁰ although they have not been well-explored. Even though explicit allergy elicitation pathways are obscure, the proteases are suspected to be recognised by susceptible individuals' cell pattern recognition receptors (PRR) such as Toll-like receptors (TLRs), C-type lectin receptors (CLRs), retinoic

Download English Version:

<https://daneshyari.com/en/article/8736167>

Download Persian Version:

<https://daneshyari.com/article/8736167>

[Daneshyari.com](https://daneshyari.com)