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A GLANCE AT THE NITTY-GRITTY ASPECTS OF COCKROACH CLINICAL ALLERGY

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ABSTRACT

Cockroach allergen is a well-recognized trigger for asthma and allergic rhinitis, but the clinical significance of isolated cockroach sensitization remains poorly understood. Sensitization does not always equate to clinically relevant allergy. **Objective:** To assess the prevalence, clinical profile, co-sensitization patterns, pseudopod behaviour, and statistical associations related to cockroach sensitization among young adults undergoing skin prick testing (SPT) in a tertiary centre. **METHODS:** A cross-sectional analysis of 97 valid SPTs performed at AIMSR, Hyderabad. Participants were categorized into: (1) Isolated cockroach sensitization, (2) Cockroach + other allergens, (3) Non-cockroach sensitizations. Clinical characteristics were extracted from standardized questionnaires. Sensitization associations were analysed using Fisher's exact test and odds ratios. **Results:** Cockroach sensitization was observed in 40.2% (39/97). Only 20.5% (8/39) exhibited isolated cockroach sensitization, most of whom were asymptomatic. In contrast, polysensitized subjects (n=31) demonstrated high rates of persistent rhinitis, wheeze/asthma, skin symptoms, and strong family history. Cockroach-specific pseudopods occurred in 64.1% of sensitized participants. The only statistically significant co-sensitization was with **Dermatophagoides pteronyssinus (Dp)** (OR=2.7, p=0.04). Chenopodium and Ricinus showed borderline trends. No systemic reactions occurred. **Conclusion:** Isolated cockroach sensitization represents silent IgE positivity without clinical disease in most cases, whereas cockroach sensitization within a polysensitized profile identifies a high-risk atopic phenotype. Cockroach SPT positivity must be interpreted with careful clinical correlation.

KEYWORDS: Cockroach allergy, sensitization, polysensitization, skin prick test, pseudopods, Indian population.

INTRODUCTION

Cockroach is one of the most important indoor allergens worldwide, especially in tropical and humid regions.[1]

Exposure to *Blattella germanica* and *Periplaneta americana* allergens has been strongly associated with asthma morbidity, airway hyperresponsiveness, and hospitalization in multiple epidemiological studies.[2,3]

In India, high cockroach exposure is common due to housing patterns, indoor humidity, and ventilation characteristics.[4]

Despite this, not all SPT-positive patients develop clinical allergy — highlighting the crucial distinction between **sensitization and clinically relevant allergy.[5]**

Evidence shows that cockroach allergens share structural homology with house dust mite allergens, especially tropomyosin, resulting in co-sensitization or cross-reactivity.[6,7]

Cockroach allergy is an important health problem that can lead to the development of asthma and/or rhinitis. Exposure and sensitization to cockroach allergens are two factors strongly associated with high morbidity among inner-city children with asthma.[8]

The profile of immunoglobulin E (IgE) sensitization to cockroach allergens is unique for each patient.[9,10]

Unlike allergies to cat or mite, that are mostly associated with sensitization to the major allergens Fel d 1 or Der p 1 and Der p 2, respectively, no immunodominant allergens have been found for cockroach.[11]
Bla g 2 has been considered the major cockroach allergen in the U.S.[12]
Bla g 5, with prevalences of IgE sensitization of 42–70% and 35–68%, respectively.[13]

Children with asthma have a high prevalence of environmental allergies, especially to indoor allergens. (dust mites, cat, dog, cockroach, and molds).[14]

AIT effectiveness has been demonstrated in seasonal and perennial allergies, and insect stings. However, data and studies in AIT relative to cockroach (CR) allergy are relatively scarce.[15]

However, the exact contribution of cockroach sensitization to symptoms remains unclear in the Indian context, particularly among young adults.

This study aimed to:

1. Assess the prevalence of cockroach sensitization.
2. Characterize isolated vs polysensitized cockroach phenotypes.
3. Analyse clinical correlations including nasal, skin, food, and respiratory symptoms.
4. Evaluate pseudopod behaviour.
5. Determine statistical associations with other aeroallergens.

MATERIALS AND METHODS

Study Design & Setting

Cross-sectional observational study at AIMSR Department of Allergy & Chest (Nov 2025).

Participants

110 underwent SPT → 97 valid tests included.

Exclusions: dermographism, poor histamine response, early exit before reading.

SPT Procedure

- Performed with 33 standardized aeroallergens
- Histamine 9 mm validates test; saline negative
- Wheals measured after 20 minutes

Grouping

- **Group A:** Cockroach only positive
- **Group B:** Cockroach + ≥1 allergen
- **Group C:** Non-cockroach sensitized

Clinical Data

Extracted from comprehensive questionnaire: nasal, asthma, skin, eye, food allergy, triggers, duration, family history, medications, environment, sleep disturbance.

Statistical Analysis

- Fisher exact test for association
- OR with 95% CI
- $p < 0.05$ significant

RESULTS

1. Prevalence

- Cockroach sensitization: **40.2% (39/97)**
- Cockroach only: **8/39 (20.5%)**
- Cockroach + other allergens: **31/39 (79.5%)**
- Non-cockroach group: **24/97**

2. Pseudopods

- Cockroach pseudopods: **64.1%**
- Strong mast-cell reactivity; no systemic reactions.

3. Co-sensitization

Highest in:

- Dp 69.2%
- Df 66.7%

- Cynodon 43.6%
- Prosopis 38.5%
- Ricinus 30.8%
- Chenopodium 23.1%

TABLE 1. Baseline Characteristics of the Study Cohort (n=97)

Characteristic	Value
Total SPT tests performed	110
Valid SPTs included	**97**
Age group	18–30 years (majority)
Gender	Approx. equal distribution
Cockroach sensitized	**39 (40.2%)**
Cockroach-only sensitization	**8 (20.5% of cockroach-positive)**
Cockroach + other sensitizations	**31 (79.5%)**
Non-cockroach sensitizations	**24**
Pseudopod reactions (any allergen)	~70%
Pseudopods to cockroach (12)	**64.1%**
Systemic reactions	0
Vasovagal reactions	0

TABLE 2. Allergen Sensitization Patterns (n=97)

(Top 12 allergens, % among total cohort)

Allergen No.	Allergen Name	Sensitized n (%)
1	Dermatophagoides farinae (Df)	36%
2	Dermatophagoides pteronyssinus (Dp)	38%
3	Prosopis	25%
4	Cynodon	28%
5	Amaranthus	22%
6	Artemisia	10%
7	Chenopodium	14%
8	Parthenium	16%
9	Ricinus	20%
10	Alternaria	8%
11	Aspergillus	5%
12	Cockroach	**40.2%**

TABLE 3. Clinical Profile Comparison (Group A vs B vs C)

Group A = Cockroach only (n=8)
Group B = Cockroach + others (n=31)
Group C = Non-cockroach (n=24)

Clinical Feature	Group A (%)	Group B (%)	Group C (%)
Any nasal symptoms	25%	**74%**	58%
Asthma / Wheeze	0%	**45%**	38%
Skin symptoms	12%	**61%**	42%
Eye symptoms	0%	**38%**	22%
Food allergy	12%	35%	28%
Sleep disturbance	12%	**48%**	39%
Multiple allergies	0%	**61%**	40%
Family history of allergy	25%	**68%**	48%
Triggered by dust	25%	**71%**	63%
Triggered by weather change	12%	**68%**	52%
Exercise-triggered	0%	22%	16%
Daily pet exposure	0%	10%	8%

TABLE 4. Statistical Association between Cockroach (12) and Other Allergens

Allergen	Name	OR	p-value	Interpretation
1	Df	1.7	>0.05	NS
2	**Dp**	**2.7**	**0.04**	**Significant**
3	Prosopis	1.5	>0.05	NS
4	Cynodon	2.0	>0.05	NS
5	Amaranthus	0.9	>0.05	NS
6	Artemisia	0.6	>0.05	NS
7	Chenopodium	~6	0.07	Borderline
8	Parthenium	1	>0.05	NS
9	Ricinus	~4	0.06	Borderline
10	Alternaria	2–3	>0.05	NS
11	Aspergillus	–	>0.05	NS

Only Dp is significantly associated with cockroach sensitization.

TABLE 5. Pseudopod Reactions (n=39 cockroach sensitized)

Reaction Type	n (%)
Pseudopods to cockroach (12)	**25/39 (64.1%)**
Pseudopods to any allergen	29/39 (~74%)
Duration >1 hour	15%
Duration >2 hours	4%
Persistent wheal >1 week	1 case (1.03%)
Systemic reactions	0
Vasovagal reactions	0

TABLE 6. Co-sensitization Frequencies Among Cockroach-Positive Subjects (n=39)

Allergen	n (%)	Comment
Dp	27 (69.2%)	**Strongest association**
Df	26 (66.7%)	Indoor cluster
Cynodon	17 (43.6%)	Grass
Prosopis	15 (38.5%)	Tree
Ricinus	12 (30.8%)	Weed
Parthenium	10 (25.6%)	Weed
Chenopodium	9 (23.1%)	Borderline significance
Amaranthus	9 (23.1%)	Weed
Alternaria	4 (10.3%)	Mold
Artemisia	3 (7.7%)	Weed
Aspergillus	1 (2.6%)	Rare

TABLE 7. Interpretation Summary: When Cockroach Sensitization Matters

Category	Findings	Clinical Meaning
Cockroach-only	Mostly asymptomatic	Silent IgE
Cockroach + many allergens	High rhinitis, asthma, skin disease	**Clinically significant**
Co-sensitization with Dp	OR 2.7	True allergen cluster
Pseudopods	64%	Strong mast cell activation
Systemic reactions	0	SPT safe

4. Statistical Association

Only **Dp** showed significant association (OR≈2.7, p≈0.04).

5. Clinical Phenotypes

Cockroach-only group

- Mostly asymptomatic
- Symptoms attributable to dust/food rather than cockroach
- No cockroach-induced asthma/wheeze

Cockroach+others group (polysensitized)

- High rhinitis
- Asthma/wheeze common
- Skin involvement common
- Strong family history

Non-cockroach group

- Dust/pollen allergy prominent
- Some asymptomatic sensitizations

DISCUSSION

Cockroach allergen is traditionally considered a clinically potent trigger, particularly for asthma.Yet, our findings demonstrate that **sensitization alone does not imply clinical relevance**, especially in young adults with low exposure intensity.

In our study, **isolated cockroach sensitization** was largely a silent immunologic finding without clinical disease. This aligns with EAACI and AAAAI positions that sensitization must always be correlated with symptoms.

Conversely, **cockroach within a polysensitized profile** was strongly associated with high-burden allergic disease. This suggests that cockroach behaves more like a **marker of heavy atopic load**, perhaps due to underlying IgE hyperresponsiveness and cross-reactive tropomyosin pathways.

The strong association with house dust mite (Dp) echoes the well-known HDM–cockroach allergen cluster, reflecting shared indoor microenvironments and cross-reactivity.

High pseudopod frequency (64.1%) demonstrated vigorous local mast cell activation, but **no systemic reactions** occurred, reinforcing the safety of SPT even in high responders.

These results highlight the key take-home message: **Cockroach sensitization matters only when it appears in the context of polysensitization. When isolated, it rarely translates into true clinical allergy.**

CONCLUSION

- Isolated cockroach sensitization = **silent IgE, clinically irrelevant in most cases.**
- Cockroach + other allergens = **high-risk atopic profile.**

- Dp is the only significant co-sensitizer.
- Cockroach pseudopods common but safe.
- Clinical correlation is essential before labeling cockroach allergy.

STRENGTHS

- Real-world Indian data
- Detailed clinical phenotyping
- Pseudopod analysis
- Statistical association performed

LIMITATIONS

- Young adult population only (18-24 Yrs)
- Single centre
- Self-reported clinical data

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