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Patients' Sensitization to Environmental Allergens – New Combinations and Insights

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Background: Environmental allergens represent a large group of important triggers for seasonal and perennial allergies. Among these, outdoor allergens, comprising both plant pollen and fungal spores, form a distinct category of seasonal allergy triggers that are difficult to avoid during their pollination or sporulation periods. Consequently, patients may be exposed to these allergens for extended periods before symptoms manifest. Recent data suggests that sensitization to environmental allergens, particularly seasonal ones, develops sequentially, where a primary trigger may initiate a chain of sensitization events. Our study aimed to determine the patterns of sensitization development in individuals with tree pollen allergy.
Method: We analyzed data from 7,518 individuals (3,185 adults and 4,333 children under 18) sensitive to 26 molecular components from 19 tree species, tested using the ALEX method across 17 regions of Ukraine during 2020-2022. Agglomerative clustering, Bayesian modeling, and structural protein comparison were employed to identify predominant clusters and relationships between allergenic molecules.
Results: Patients most frequently reacted to established clusters of allergen molecules. PR-10 molecules clustered together, including aeroallergens (Bet v 1, Cor a 1.0103, Fag s 1, Aln g 1, * pollen extract) and related food allergens (Mal d 1, Fra a 1+3, Cor 1.04.01). Another group comprised pectate-lyases (Cry j 1 and Amb a 1). Walnut pollen grouped with profilins (Phl p 12, Cuc m 2, Pho d 2, Mer a 1, Bet v 2, Hev b 8). Act d 1 of green kiwi fruit (Cysteine protease) combined with birch phenylcoumaran benzylic ether reductase (Bet v 6). Additional clusters included Aspergillus fumigatus Asp f 1 (mitogillin family) with Olea europaea pollen Ole e 9 (1,3-beta glucanase), and shrimp allergens (Pen m 3, Cra c 6) combining with platanus pollen Pla a 1 and cockroach epidermis Bla g 1 plus latex Hev b 3.
Bayesian modeling identified Bet v 1 as the key trigger for sensitization to both PR-10 and other tree pollen allergen groups. Structural protein comparison generally confirmed biochemical groupings, with few instances of the unusual combinations seen in agglomerative clustering.
Conclusions:
Sensitization to environmental allergens follows distinct patterns with specific molecular clusters in accordance with their biochemical classes.
Bet v 1 appears to be a primary trigger initiating broader sensitization patterns.
Most allergen clustering follows established biochemical relationships, though some novel combinations were identified.
Cross-reactivity between food and airway allergens demonstrates complex sensitization patterns.
Understanding these patterns may improve diagnosis and treatment strategies for allergic patients.
The findings suggest the importance of early identification of primary sensitizing allergens for better patient management.

Please, submit you abstract

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