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SPECIAL ARTICLE

# Aerobiology of Common Environmental Allergens : Sizes of Allergen Carrying Particles

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There is increasing evidence that environmental inhalatory allergens are not exclusively carried in the atmosphere by so-called primary allergen carriers, such as mite faecal balls, pollen grains, etc., of relatively big aerodynamic sizes, but also by secondary allergen carriers, mostly of (much) smaller dimensions. This evidence is illustrated by three examples of common environmental allergens, at least in most of the moderate climate zones of the world: products of mites, of cats, and of grasses. In other climate zones the allergen sources may sometimes be different, but the principles are the same.

### Mite Allergen

Live house dust mites themselves do not get airborne, due to their body size (± 300 μm), but their main primary allergen carrying products are the faecal balls measuring between 10 and 40 μm.[8] These faecal balls can become airborne by heavy disturbance of dust, but their size does not allow them to stay airborne for long periods of time, unless there is continuous turbulence of the air. The presence of allergen carrying particles of smaller sizes can be observed by air sampling with a cascade impactor separating the particles into fractions of different sizes and subsequent assessment of the allergenic acitivity. Observations by Platts-Mils *et al.*,[5] and by de Blay *et al.*,[2] with a low volume cascade impactor with 4 stages (>20-6; 15-2; 5-1; and 2.5-0.3 μm) clearly show that the larger size *Der p* I allergen carrying fraction, containing the intact faecal balls, is airborne only during disturbance and turbulence. Very quickly after cessation of disturbance these bigger particles have dropped to the ground. In the absence of disturbance the amount of airborne *Der P* I is rather low and carried mainly by the size fractions 15-2 and 5-1 μm. The nature and origin of these particles is not yet known.

### Cat Allergen

The situation with the main cat allergen *Fed d* I is slightly different. Just as for the mite allergen, the *Fel d* I allergen during disturbance is also mainly in the large particle size fraction[4] but shortly after cessation of the disturbance the amount of airborne *Fel d* I carried by smaller particles is (much) higher than that of airborne *Der p* II.[2] And after 24 hours there is clearly more airborne cat allergen than mite allergen carried by particles of both small and medium sizes in the indoor air.[7]

### Pollen Allergen

Considering the aerodynamics of airborne pollen allergen we have to do with different atmospheric conditions, because, unlike indoor air, outdoor air is mostly turbulent by wind, convection currents, etc. Ragweed pollen grains, measuring approximately 20 μm, and grass pollen grains of 25-30 μm in diameter, will drop as quickly as mite faecal ball in still air. But in their "natural" environment of outdoor turbulent air they stay in the air for prolonged periods of time. Just as has been done with ragweed pollen allergen[1,3] we have compared the results of pollen counts with the allergenic activity carried by small particles of different sizes. There appears to

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be a good relation between the airborne grass pollen content and the quantity of airborne pollen allergen, not only quite expectedly in the fraction of the pollen grain containing larger particles bigger than 10 μm. Also in the fraction of the smaller particle, eg the fraction of 1.3-2.7 μm there is a substantial amount of allergenic activity,[6] with a weaker relation to the pollen count.

## Conclusion

The evidence of airborne presence of various allergens carried by small particles, and the demonstration of the different relative contributions of particle size fractions depending on stability or turbulence of indoor and outdoor air, has important consequences for the understanding of the dynamics of exposure of the respiratory tract to airborne allergens, and thus of the presentation of symptoms by allergic people.

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