

# PREVENTION AND EXTERMINATION STRATEGIES FOR HOUSE DUST MITES AND THEIR ALLERGENS IN HOME TEXTILES

JOHANNA E.M.H. VAN BRONSWIJK

Center for Biomedical and Health-care Technology, Eindhoven University of Technology,  
PO Box 513, 5600 MB Eindhoven, The Netherlands

**Abstract**—Preventing and exterminating clinically relevant concentrations of house dust mite allergen in the urban environment is one of the more interesting challenges for architects and building engineers, pest control contractors, cleaning services, and sanitary biologists.

When this challenge is not met, up to 40% or more of the human population may be affected by allergic symptoms such as conjunctivitis, rhinitis, asthma or eczema. The actual size of the problem in any given area depends on the massiveness and length of exposure to mite allergens arising from home textiles.

Within Europe the sensitization rate for house dust mites ranges from 5% to 25%, depending on the success of house dust mites (Pyroglyphidae) in dwellings. Yearly cost of allergy in the European Community amount to 9 milliard ECU, half of which is preventable by adequate avoidance measures.

In this report a strategy will be outlined that enables engineers, patients, doctors and nurses to take their part in preventing and clearing allergic symptoms caused by indoor factors. Starting from hygienic limits for allergen exposure, the different effective avoidance measures are systematized and discussed in the context of the technical or clinical discipline concerned.

A step-wise approach is used for every patient: 1. Establishing sensitizations present; 2. Assessing actual exposure; and 3. Preparation and Execution of the Avoidance Plan.

In low risk areas (such as Denmark) introducing only a higher level of ventilation proved successful in diminishing house dust mite allergen exposure to below clinically relevant levels. In high risk areas (such as the Netherlands) strategies advocated by the treating physician include cleaning, (re)furnishing and ventilation.

Clinical results of general advice (handing out pamphlets) are presently so poor that drug treatment of patients has taken preference, and the source of the trouble (allergen exposure) is left untouched. There exists an increasing concern among family physicians, district nurses, economists as well as the general population.

In these high-risk areas isolation and ventilation schemes should be combined with cleaning technologies fitting to the individual household. Parts of this extermination and prevention strategy were tested in (prospective) patient populations, showing a 50% or more reduction of clinical symptoms or disease.

## INTRODUCTION

Preventing and exterminating clinically relevant concentrations of house dust mite allergen in the urban environment is a challenge for architects and building engineers, pest control contractors, cleaning services, and sanitary biologists, as well as patients and physicians. Diminishing (water availability) in home textiles by increasing air-exchange rates and thermal insulation of floors, and special cleaning of home textiles involving killing mites and removing allergenic dirt, are effective approaches (Kniest, 1990; Schober, 1991; Harving *et al.*, 1993).

Energy conservation strategies have led to a decrease in ventilation and an increase in indoor humidity, mite concentration and allergen contamination (Harving *et al.*, 1993). Since this increased indoor pollution was not matched with the overall acceptance of more efficient and innovative pest control and cleaning procedures, it is not surprising that the prevalence of atopic disease in Europe has risen from 6–11% of the population in the time period from 1925–1958 (Fuchs, 1967), to 25–37% nowadays (Kjellman & Croner, 1984; Croner & Kjellman, 1990; Åberg 1989). Affected persons may show symptoms of conjunctivitis, rhinitis, asthma or eczema.

Current yearly costs of allergic disease in the European Community at large can be computed from published figures for the Netherlands and Germany, and amount to 9 milliard ECU (Mölken *et al.* 1989; Deutscher Bundestag 1990).

In this report a strategy will be outlined for preventing and clearing of allergic symptoms caused by indoor factors (Figure 1). Starting from the individual sensitization situation and hygienic limits for allergen exposure, the different effective avoidance measures are systematized and discussed.

**Table 1:** Indoor allergen sources present in 75% or more of Dutch dwellings. CAP-codes of allergen preparations as used by Pharmacia (1992), are added to facilitate the communication between technologists and clinicians (after: Bronswijk and Schober, 1993)

| Allergen Source                       | CAP-code                         |
|---------------------------------------|----------------------------------|
| <b>FUNGI</b>                          |                                  |
| <i>Aspergillus glaucus</i> group      | mx1 (partly)<br>not available, * |
| <i>A. restrictus</i> group            | not available, *                 |
| <i>Cladosporium</i>                   | m2                               |
| <i>Penicillium chrysogenum</i> series | m1                               |
| <i>P. frequentans</i> series          | not available, *                 |
| <i>Phoma</i>                          | m13                              |
| <i>Wallemia</i>                       | not available, *                 |
| <b>INSECTS</b>                        |                                  |
| <i>Blattella germanica</i>            |                                  |
| — German cockroach                    | i6                               |
| Lepismatidae                          |                                  |
| — Silverfish                          | not available, *                 |
| Psocoptera                            |                                  |
| — Dust lice                           | not available, *                 |
| <b>MAMMALS</b>                        |                                  |
| <i>Canis familiaris</i>               |                                  |
| — Dog                                 | e2                               |
| <i>Felis catus</i>                    |                                  |
| — Domestic cat                        | e1                               |
| <i>Mus musculus</i>                   | e88                              |
| — House mouse                         | (or:e71 + e72)                   |
| <i>Rattus norvegicus</i>              | e87                              |
| — Brown rat                           | (or:e73 + e74 + e75)             |
| <b>MITES</b>                          |                                  |
| Acaridae                              |                                  |
| — Storage mites                       | d70, d72                         |
| Glycyphagidae                         |                                  |
| — Storage mites                       | d71, d73                         |
| Pyroglyphidae                         |                                  |
| — House dust mites                    | d1, d2, d3, d74                  |
| Tarsonemidae                          |                                  |
| — Fungal mites                        | not available, *                 |

\*sensitization occurs (Bronswijk, 1981; Bronswijk *et al.*, 1986) but is not tested routinely.

### STEP 1: Offending Allergens

House dust mite allergens occur in the midst of an almost endless list of possible occurring allergens indoors. In the Netherlands about 18 different biological taxa serve as abundant sources, present in at least 75% of the dwellings (Table 1). Not all atopic persons are exposed to the same degree and for the same length of time to all allergens included. Judging from the percentage of patients sensitized, exposure to pets and house dust mites are most common in this part of Europe (Bronswijk *et al.*, 1992). With the rising trend in allergies, a new market may develop for pest control and cleaning contractors specialized in house dust allergen reduction.

In individual cases, all relevant allergens should be assessed for possible sensitization by a physician before measuring exposure, and the development of an individual allergen avoidance plan. When an allergy for house dust mites is present, other allergens associated with humid indoor conditions should not be forgotten in sensitization testing (Kort, 1993). Unfortunately diagnostic preparations are not available for all relevant indoor allergens.

It is the responsibility of the patient to forward the details of his complete sensitization range to his allergen avoidance consultant—the district nurse, pest control contractor or specialized cleaning firm. In fact, the preventive measures that can be taken in the dwelling environment are not of a medical nature, but belong to the domain of housekeeping or building engineering.

The remaining part of this report will be restricted to one allergen source: house dust mites.







