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Asthma and mites

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Introduction

Dust, especially household dust is a very common cause of respiratory symptoms. Many asthmatic patients will state that dust makes their symptoms worse. Unfortunately it is not easy to decide from the history of the patient, or indeed from simple provocation tests, whether dust is an irritant or an allergen or possibly has both specific as well as non-specific actions on the respiratory mucosa. There are many patients who have a large degree of reversible airways obstruction who may have been called bronchitics, while asthmatic patients who smoke and are liable to infective attacks are often diagnosed as bronchitics since they have a productive cough. An allergist when he is asked to investigate a wheezy patient will have to decide not only from the history but also from special investigations, whether the patient has asthma and if asthma is present whether dust specifically makes it worse. Dust is always an irritant to the mucosa, it may also be an allergen. It will be shown that the household mite is the most important allergen of house dust.

Tests of allergenicity of dust

Intradermal skin tests with extracts of house dust of unknown strength will give very little useful information and I believe should never be done. Many normal as well as asthmatic patients will give a skin response to dust which someone may well call positive. I should like to make the plea that prick or scratch skin tests with adequate controls be performed. At St Mary's Hospital allergy clinics we never use intradermal skin tests. When nasal or lung provocation tests are also used, physiological and not unphysiological strengths of extracts must be used. It does not follow that the more complicated test will give a more accurate answer. Looking for eosinophil cells in nasal secretions, in the sputum or the blood, may be useful and often essential steps in investigating a wheezy patient. It is good advice to tell a wheezy patient to take dust precautions, especially in the bedroom, but it may be bad advice to suggest injections be carried out against a dust allergy when dust is not specifically causing an allergic reaction.

Mites as allergens in dust

As long ago as 1928 Dekker described mites as allergens, but it was not until 1964 that Voorhorst and co-workers re-investigated the allergic importance of domestic mites (Fig. 1). This work has been

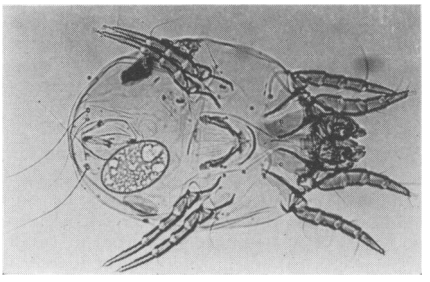

FIG. 1. Female domestic mite.

extended so that a book has been written by Voorhorst and colleagues on the subject (Voorhorst, Spieksma & Varekamp, 1969). McEwen (1968) has shown that the allergen characteristic of the domestic environment is contained in old keratin material, but the possibility that the keratin whether from feathers, hair or human skin scales, served only as a source of foods for mites, was not at that time realized. However within 2 years it had been shown (Frankland, McEwen & Feinberg, 1970) that a mite extract of *Dermatophagoides culinae* (*farinae*) could be used as a diagnostic skin test agent in house dust sensitivity. The presence of mites in household dust has now been described in many parts of the world. In Europe and Japan the common household mite is *D. pteronyssinus*, but in the United Arab Republic it is *D. culinae* (*farinae*) (El-Hefny & Frankland, 1970). The latter mite breeds much faster and it may

be used in hyposensitization in dust-allergic patients (Munro-Ashman *et al.*, 1970). Brown & Filer (1968), Pepys, Chan & Hargreave (1968) and Miyamoto *et al.* (1968) have all reported that *D. culinae* (*farinae*) can be used as a substitute for *D. pteronyssinus*. Workers in Japan (Miyamoto, Oshima & Ishizaki, 1970) state that the allergenicity of house dust is largely determined by the total number of mites contained in it. They found thirty-six species of mites in house dust and concluded that each species of mite had its own characteristic antigen but because of cross antigenicity *D. culinae* (*farinae*) could be used in skin testing for house dust sensitivity. McAllen & Assem (1970) used five different parameters when demonstrating the allergenicity of *D. pteronyssinus*. Colldahl (1970) showed that mite extracts could be used in extreme dilutions to provoke asthma in inhalation tests in dust-sensitive asthmatics.

World-wide distribution of the household mite

Most of the work on the importance of mites as the allergen of house dust has come from Europe, especially Holland and Britain, and also from Japan. Ordman (personal communication, 1970) has noted that the coastal areas of South Africa upset many asthmatic patients compared with living away from the coastal plains. He has investigated the mite content of 100 samples from the coastal areas and found a high mite content compared with the dust from Johannesburg. Mites are present in the dust from Barbados (Pearson & Hughes, 1970). In Kenya a feather pillow seemed the only cause of asthma in a patient. The pillow contained large numbers of mites and skin tests showed he was sensitive to mites but not feathers. A recent sample of dust from Hong Kong sent because an atopic child has acute exacerbations of asthma there, but was free of asthma when on holiday in the mountains of Switzerland, microscopically was seen to have a high mite content. In Europe there is definite late summer exacerbation of symptoms in mite sensitive patients. This has been stressed by Voorhorst, Spieksma & Varekamp (1969) and by Frankland (1970). Since mites like heat, moisture and keratin, is it possible that there are places in the world that mites could not flourish? Saudi Arabia would seem to be a particularly dry part of the world, but where man is, there too is water. In a preliminary survey of sixty-seven asthmatic patients in that country in 1970 it was found that nine (11·7%) gave positive skin tests to a mite extract. It was decided to investigate the mite content of the dust of the United Arab Republic, especially as many of the asthmatic patients in that country complained that humidity and dust caused their symptoms. A preliminary report of these findings has already appeared (El-Hefny & Frankland, 1970). It was found that patients from the United Arab Republic and Britain both reacted to dust extract whether it came from Britain or the United Arab Republic. It was noted that patients who reacted on skin testing to mites also reacted to the Egyptian dust extract. This extract did not give a positive response in non-allergic patients or in those who in Britain had summer hay fever only and who were not dust sensitive. The skin response therefore was a specific one and the common factor in the Egyptian dust and the British dust would seem to be the mite content. At the completion of the study a sample of Egyptian dust was studied microscopically (A. M. Cunnington, MRC Pest Infestation Laboratory). It was reported that the Egyptian dust contained the highest content of mites that had ever been seen in a household dust sample, and the number was larger than that reported by Miyamoto *et al.* (1970). The mite was *Dermatophagoides culinae* (*farinae*) and therefore differs from the common mite of household dust reported in Europe and Japan. We can conclude that mites must be a universally important domestic inhalant allergen.

Killing the mite

It might be argued that the easiest way to deal with mites is with pesticides. Unfortunately benzyl benzoate already widely used in the treatment of scabies, like other pesticides, causes irritation and sensitization to the eczematous skin and also irritates the sensitive mucous membranes of the nose and chest. It seems likely that treatment by oiling the bedding (Wright, 1963) may be successful because this kills the mite. Airing of bedding materials in the sun is very effective in killing mites, but this method is not practical in cities or on non-sunny days.

Hyposensitization with mite-enriched dust

A multi-centre hyposensitization trial was carried out in Great Britain in 1970 using alum-precipitated pyridine extract of house dust with *Dermatophagoides culinae* (*farinae*) in fifty-two patients. A preliminary report of this treatment using a commercially available preparation (Mite Fortified House Dust—Dome) has appeared (Munro-Ashman *et al.*, 1970). Good results were obtained in 83% of the patients treated. Four patients abandoned the treatment because of reactions which might have been caused by the injections. Until a double blind trial is carried out, and this is now being undertaken, it is impossible to know the efficacy of mite hyposensitization. It must be remembered that a double blind trial using dust hyposensitization failed to show that this form of therapy gave specific help in dust-sensitive patients (British Tuberculosis Association, 1968).

Mites as an occupational hazard

It could be said that the housewife when bed-making is particularly liable to put into the air mite enriched dust. Dried faecal material, the particle size of which is likely to be 1 μm in diameter, may be inhaled. The atopic eczematous child (or adult) produces many skin scales which are the main food for the household mite. It has been found on skin testing the eczematous child that positive responses are often obtained to a mite extract. Mite sensitization may be one reason why atopic eczematous or asthmatic children when brought into hospital benefit so quickly, since no mites have been found in dust from the children's wards of three London hospitals (R. R. Davies, personal communication).

Some occupations may give rise to mite-induced asthma.

Case report. A grain buyer complained that he always developed asthma when he examined mouldy grain. On skin testing him he did not react to any fungal spore. It was agreed that he would send for examination a grain sample that caused him asthma. In October he sent for microscopical and cultural examination, what he called the most mouldy and asthma-producing grain he had to deal with. It was found to be very heavily contaminated with mites. Skin tests had previously shown he was mite-sensitive, but as he was scientifically trained, it had always been presumed that his description of mouldy grain must represent his specific sensitivities. Skin tests had shown he was not sensitive to any mould and microscopic examinations revealed the allergen to be mites.

There are very many Acari that are horticultural pests in all parts of the world. The fruit and flower grower knows that the red spider mite *Metatetranychus ulmi* can so affect his crop of fruit or flowers that he will spray against this infestation. The mites can become resistant to the sprays and also, since chemical sprays usually kill the predators of the mites, local heavy infestations can occur. A cherry grower developed seasonal rhinitis and asthma in July and August from this cause (Frankland, 1970).

A market gardener living in London had most of his trouble in winter from infestation, by mites, of ornamental fir trees which he was growing in heated glass houses. There seems to be no doubt that the red spider mite which has a world-wide distribution, may be the cause of much uninvestigated allergy. There will be many other mites which will have to be considered as potential allergens.

Conclusions

Household dust is the most important of all inhalant allergens. Skin tests, nasal and lung provocation tests confirm the importance of mites as the ubiquitous allergen of house dust throughout the world. The common house dust mite of Europe and Japan is *Dermatophagoides pteronyssinus*, but in some parts of the world *D. culinae* (*farinae*) is the common mite of house dust. These two mites cross react allergically and the latter can be used diagnostically and therapeutically. Out of doors the red spider mite can cause allergic asthma. There is usually a seasonal exacerbation of symptoms in mite-sensitive patients.

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