

House dust mites in Iran

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Summary

In the Caspian Sea region of Iran asthma seems closely related to house dust allergy. Since a high proportion of house dust sensitive patients appear to be sensitive to house dust mites, an investigation was carried out to determine the occurrence, distribution and abundance of these species in Iranian house dust in order to assess their role and clinical importance in house dust allergy in Iran. Thirty-five samples of house dust collected from houses in the Caspian Sea region and five samples from other areas were examined for mites. The three pyroglyphid species *Dermatophagoides pteronyssinus*, *D. farinae* and *Euroglyphus maynei*, reported by European and Japanese workers to be common in house dust and to be a major source of house dust allergens, were found to occur in Iranian house dust and to account for nearly two-thirds of the total mite population present in the dust. *Dermatophagoides pteronyssinus* was the most frequent and most numerous species recorded, occurring in 90% of the samples examined and forming 94% of the pyroglyphid and 60% of the total mite population. The frequency with which house dust mites were found in the Iranian Caspian Sea region coupled with the relatively high frequency of allergic bronchial asthma in this area suggests that they may well be an important precipitating factor in asthma in Iran.

Introduction

House dust is a ubiquitous and highly variable material which has long been known as a common and serious cause of allergic asthma and rhinitis. In spite of its heterogeneous composition, however, it appears to contain a specific allergen, the presence of which was first demonstrated by Kern (1921) and Cooke (1922) more than 50 years ago. During the four decades which followed publication of their work, numerous attempts were made to identify the nature and source of the house dust allergen but conflicting results led to widely differing conclusions and uncertainty about house dust allergy persisted because of the extremely variable nature of the material, the

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wide variations in the allergenicity of its extracts and the failure to demonstrate an acceptable major source of the house dust allergen.

In 1964, renewed interest in the problem was stimulated by a report from Holland (Voorhorst, Spieksma-Boezeman & Spieksma, 1964) which suggested that the occurrence in house dust of a then hitherto little known pyroglyphid mite—*Dermatophagoides pteronyssinus*—was the chief cause of its allergenicity. Further studies by the Dutch team (Spieksma & Spieksma-Boezeman, 1967; Voorhorst *et al.*, 1967; Voorhorst, Spieksma & Varekamp, 1969), and by workers in Great Britain (Maunsell, 1967; Wraith, 1967; Cunningham, 1967; Maunsell, Wraith & Cunningham, 1968; Pepys, Chan & Hargreaves, 1968) and Japan (Ishizaki, Miyamoto & Oshima, 1967; Miyamoto *et al.*, 1968) and later by those in other countries, confirmed these findings and it is now generally accepted that house dust mites, chiefly *Dermatophagoides* species, are a major source of the house dust allergen.

Three pyroglyphid species, *D. pteronyssinus*, *D. farinae* and *Euroglyphus maynei*, occur commonly in house dust. They appear to be cosmopolitan in distribution but some zoogeographical or ecological differences may exist and different localities show a different balance in the proportion of these and other pyroglyphid species present. *Dermatophagoides pteronyssinus* has been found to be the major species present in most countries but *D. farinae* has been reported to be predominant in the U.S.A. (Larson, Mitchell & Wharton, 1969), Egypt (Frankland & El-Hefney, 1971), Czechoslovakia (Samsinak, Dusabek & Vobrazkova, 1972) and India (Dar *et al.*, 1973).

During the summer of 1974, small numbers of *Dermatophagoides* spp. were found in samples of house dust collected from a few localities mainly bordering the southern (Iranian) shore of the Caspian Sea. Bronchial asthma is relatively common in Iran and in these coastal areas seems to be closely associated with house dust allergy. In view of the important role which these mites play in the aetiology of house dust asthma, a more detailed study was undertaken, the results of which are given below, to determine the occurrence, distribution and relative abundance of house dust mites in these areas and to assess their clinical importance and relationship to bronchial asthma in Iran.

Materials and methods

The survey, carried out during September 1974–March 1976, was based on the examination of forty samples of house dust collected from the following localities: (i) thirty-five samples from the Iranian southern Caspian Sea region extending from Bandar Pahlavi in the west to Sari in the east, and (ii) five samples from other areas including three from Tehran, one from Shahrood and one from Khorram-abad. Of the samples in group (i), twenty were collected by asthma patients from their own homes and fifteen by staff of the Public Health Station in Shahsavari from houses selected at random from within this locality. Retrospectively, only five patients had been skin tested, of whom four gave positive reactions to extracts of house dust and to *D. pteronyssinus*: two also gave reactions to hay dust. No other reactions to any of the common allergens tested were observed in these patients.

On receipt at the Pest Infestation Control Laboratory, Slough, England, each sample was weighed, dispersed in 90% lactic acid held at 55°C for 24–36 hr and the solution then centrifuged at slow speed (approximately 400 g) for 3–4 min, after which the supernatant and precipitates, the latter further dispersed in distilled water, were poured in thin layers into shallow dishes and examined under a low powered binocular

microscope. The mites were removed and mounted on microscope slides using Swan's modification of Berlese's mountant. After drying and hardening of the mountant at 50°C, the slides were examined under a compound microscope, using phase contrast illumination, and the mites identified and counted.

Geography and climate

In Iran, the coastal region bordering the southern shore of the Caspian Sea is a relatively narrow belt of land with a strip of coastal lowland along its seaward edge some 3–13 miles deep, in which the population is mostly concentrated. It was from localities within these coastal areas that the thirty-five samples in group (i) were collected.

The climate in this coastal region is relatively mild and damp. The annual mean temperature is about 17°C and the mean relative humidity about 75%. The average rainfall—1500 mm per annum—is relatively heavy. The area is mainly agricultural with a scattered rural population which varies in density from 6.2 to 93.5 persons per square mile with a mean of 36.4.

The remainder of the country consists mainly of areas of high tableland where the climate is dry with a wide range of variable temperature, being very cold in winter and very hot in summer. These conditions are illustrated in Table 1 where the altitude, mean annual temperature, relative humidity and rainfall are given for each of the three towns from which the five samples in group ii were collected.

Table 1. Mean annual temperature, relative humidity and rainfall in Tehran, Shahrood and Khorram-abad

	Altitude (m)	Mean annual rainfall (mm)	Temperature (°C)		Relative humidity (%)	
			Mean max.	Mean min.	Mean max. (06.30)	Mean min. (12.30)
Tehran	1200	229	36.9	0.8	48	30
Shahrood	1366	145	33.5	−6.7	65	39
Khorram-abad	1160	516	40	−1.4	61	32

Types of housing and bedding

Considerable differences existed in the types of housing occupied by patients. Dwellings ranged from the small, thatched-roof rustic type of cottage to modern houses or apartments constructed of brick, stone or concrete. Floors were of wooden or solid construction and usually covered with felt or carpet. Mattresses were either of the box spring, foam rubber or foam plastic variety or consisted of a cotton cover filled with flock, straw or other materials. Pillows and cushions were filled either with sponge rubber, feathers or cotton padding. This last product was also used as the filling material in most eiderdowns and quilts.

Results

Examination of the forty samples of Iranian house dust from the Caspian Sea and inland areas revealed the presence of an extensive mite fauna (Tables 2 and 3).

Table 2. The mite fauna of Iranian house dust species and number of mites found in group (i); samples from the Caspian Sea region (35), and group (ii); samples from other areas (5)

Species	No. of times recorded	Total no. found	Estimated mean density per 100 mg dust	Range
Group (i)				
Pyroglyphidae				
<i>Dermatophagoides pteronyssinus</i>	33	2655	197.7	<1-340
<i>D. farinae</i>	13	172	12.5	<1-184
<i>D. evansi</i>	3	7	0.5	<1
<i>Euroglyphus maynei</i>	2	4	0.3	<1
Acaridae				
<i>Acarus siro</i>	15	111	8.1	<1-35.4
<i>A. farris</i>				
<i>A. sp.</i>				
<i>Tyrophagus putrescentiae</i>	23	157	11.4	<1-15.7
<i>Tyrophagus sp.</i>				
<i>Suidasia sp.</i>	9	20	1.5	<1-4.9
<i>Rhizoglyphus sp.</i>	2	2	0.1	<1
Glycyphagidae				
<i>Glycyphagus destructor</i>	22	522	37.9	<1-630
<i>G. domesticus</i>				
<i>Glycyphagus sp.</i>				
<i>Blomia sp.</i>	2	6	0.4	<1
<i>Gohieria sp.</i>	2	2	0.1	<1
Chortoglyphidae				
<i>Chortoglyphus arcuatus</i>	15	238	17.3	<1-35
Carpoglyphidae				
<i>Carpoglyphus lactis</i>	7	382	27.7	<1-606.7
Cheyletidae				
<i>Cheyletus sp.</i>	21	122	8.9	<1-11.8
Miscellaneous spp.	15	52	3.8	—
Group (ii)				
Pyroglyphidae				
<i>D. pteronyssinus</i>	3	12	0.4	0-1.2
Acaridae				
<i>Acarus sp.</i>	3	5	0.2	—
<i>Tyrophagus sp.</i>	1	2	<0.1	—
<i>Suidasia sp.</i>	1	2	<0.1	—
Glycyphagidae				
<i>Glycyphagus sp.</i>	2	6	0.2	—
Miscellaneous spp.	3	3	0.1	—

Twenty species from eight families were identified plus a few, mainly mesostigmatid and prostigmatid, species not identified below ordinal level. Wide differences, both quantitative and qualitative, were found between samples, a common feature of most house dust mite investigations. Density figures (Table 2) are based on units of 100 mg dust and were calculated from the number/weight ratio of each sample. The highest densities recorded, 539, 866 and 670 mites (all species) per 100 mg dust were

Table 3. The mite fauna of Iranian house dust. Frequency of occurrence and relative abundance of species. Group (i), samples from the Caspian Sea region

Species	Percentage frequency of occurrence $\left(\frac{N}{35} \times 100\right)$	Percentage of total mite population present $\left(\frac{N}{4450} \times 100\right)$
Pyroglyphidae		
<i>Dermatophagoides pteronyssinus</i>	94.3	59.7
<i>D. farinae</i>	37.1	3.9
<i>D. evansi</i>	8.6	0.2
<i>E. maynei</i>	5.7	0.1
Acaridae		
<i>Acarus siro</i>	34.3	2.4
<i>A. farris</i>		
<i>Acarus</i> sp.		
<i>Tyrophagus putrescentiae</i>	62.9	3.5
<i>Tyrophagus</i> sp.		
<i>Suidasia</i> sp.		
<i>Rhizoglyphus</i> sp.	5.7	0.1
Glycyphagidae		
<i>Glycyphagus destructor</i>	57.1	11.7
<i>G. domesticus</i>		
<i>Glycyphagus</i> sp.		
<i>Blomia</i> sp. (<i>tropicalis</i> ?)	5.7	0.1
<i>Gohieria</i> sp.	5.7	0.1
Chortoglyphidae		
<i>Chortoglyphus arcuatus</i>	42.9	5.4
Carpoglyphidae		
<i>Carpoglyphus lactis</i>	20	8.6
Cheyletidae		
<i>Cheyletus</i> sp.	60	2.8
Miscellaneous spp.	—	1.2

found in three samples in which the densities of the pyroglyphid species present—mainly *D. pteronyssinus*—were respectively, 524, 173 and 43. The large differences between densities of pyroglyphid and total mite populations observed in two of the samples were caused by the occurrence of relatively large numbers of the storage species *Glycyphagus destructor* in one and *Carpoglyphus lactis* in the other sample.

The results show that the three pyroglyphid species, *D. pteronyssinus*, *D. farinae* and *Euroglyphus maynei*, which European and Japanese workers have shown are of major importance in the study of house dust allergy, were all present in Iranian house dust. In addition, small numbers of a fourth species, *Dermatophagoides evansi*, which has previously been recorded on a few occasions, were found in a few samples.

The most frequently occurring and most abundant species present was *D. pteronyssinus* which occurred in 90% of samples and accounted for nearly 60% of total mite numbers and 94% of the pyroglyphid population. *Dermatophagoides farinae* occurred much less frequently and was much less abundant than *D. pteronyssinus*. It was found, mostly in small numbers, in only about one-third of the samples where

Table 4. The mite fauna of Iranian house dust. Frequency of occurrence and relative abundance of species. Group (ii), samples from other areas

Sample no. and locality	Species and no. of mites found			
	Pyroglyphidae (<i>D. pteronyssinus</i>)	Acaridae	Glycyphagidae	Other mites
(6) Tehran	—	—	—	1
(21) Shahrood	3	—	5	1
(24) Khorram-abad	3	1	—	—
(25) Tehran	6	5	1	—
(26) Tehran	—	3	—	1

it made up only 6% of pyroglyphid mite numbers and less than 4% of the total mite population. In only one sample were appreciable numbers of this species recorded. *Dermatophagoides evansi* and *E. maynei* both occurred infrequently and were few in number. The occurrence, but relative scarcity of the latter species in Iranian house dust contrasts with its ecological status in other countries, e.g. Great Britain and Holland, where it has been found to be relatively common and moderately abundant (Maunsell *et al.*, 1968; Blythe, Williams & Morrison Smith, 1974; Spieksma & Spieksma-Boezeman, 1967). Together, the four pyroglyphid species accounted for nearly two-thirds of total mite numbers found in the Iranian samples.

The remaining one-third of the population comprised small to moderate numbers of storage or food mites, mainly acaridae or glycyphagidae, or predator species belonging to the family cheyletidae. Representatives of these groups occur regularly in house dust, usually in small numbers, but occasionally outnumbering all other species in certain situations (Pearson & Cunnington, 1973). Glycyphagid species, chiefly *Glycyphagus domesticus* and *G. destructor*, were the most common and most numerous of these storage mites in Iranian house dust. They occurred in just over 50% of the samples examined and constituted about one-third of the storage mite population and nearly 12% of all mites present. Small numbers of the dried fruit mite *Carpoglyphus lactis* were found in six samples but a seventh sample contained such unusually large numbers of this species as to increase the proportions which it formed of the storage and total mite populations from 2.9 to 26.5% and from 0.8 to 8.6% respectively.

Discussion

The frequency with which house dust mites occur in the lowlands of the Iranian southern Caspian Sea region coupled with the relatively high frequency of allergic bronchial asthma in this area suggests that these species may well be an important precipitating factor in asthma in Iran.

The causal relationship between house dust mites and respiratory allergy is now well established and numerous studies in many countries have confirmed that all but a very small proportion of patients sensitive to house dust are allergic to extracts of *Dermatophagoides* spp. The possibility that hypersensitivity to house dust mites may be a factor in the aetiology of infant cot deaths in Western Australia (Turner, Baldo & Hilton, 1975) has given an increased significance to their role in house dust allergy.

The three pyroglyphid species that occur most commonly in house dust—*D. pteronyssinus*, *D. farinae*, and *Euroglyphus, maynei*—feed chiefly on the desquamated skin scales shed by the human body which is why they are particularly abundant in the surface dust of mattresses (Maunsell *et al.*, 1968), blankets (Sesay & Dobson, 1972) and sometimes in other articles of bedding such as old feather pillows, eider-downs and quilts (Wraith & Cunnington, 1975). As far as is known, they do not feed on any of the materials used in the manufacture of these articles except, possibly, on feathers on which, in laboratory experiments, they have been observed to complete their development. They therefore rarely occur in large numbers inside mattresses unless through age or wear the outer covering becomes sufficiently worn or damaged to allow skin scales and mites to penetrate the fabric and become mixed with the interior filling materials.

Climate and its effect on the physical conditions within the house, the modifying effects of heating, ventilation and the personal life style of the inhabitants and the micro-climate of mattresses and bedding, are among the most important factors influencing the growth and development of house dust mite populations. In the laboratory, the optimum conditions for their development and increase are 80–90% R.H. and 25–30°C. The high moisture requirements of these species explains why large numbers frequently occur in damp or moderately damp situations and few are found where dry conditions prevail. Spielsma (1967) and Maunsell (1971) both found that high humidity levels in houses, whether related to climatic, geographical or geological features or to dampness caused by structural or other defects were associated with high mite numbers in house dust. For part of the year atmospheric temperature and humidity in the southern Caspian Sea region is especially favourable for development of these mites, a factor which has a considerable bearing on their occurrence and distribution in these coastal areas.

The widespread use in Iran of carpet and felt floor coverings may also contribute to the build-up of mite populations within the houses. In Hawaii, Sharp & Haramoto (1970) found that carpet dust, irrespective of whether the carpets were manufactured from wool, cotton or synthetic fibres, invariably contained higher numbers of mites than dust from uncarpeted floors or from those with other types of coverings. They suggested that the large amounts of animal danders, human and animal food particles, fungi, bacteria and other debris found between the carpet fibres provided an excellent protective niche and suitable micro-environment for the development of house dust mites and also for other species.

Climate in most areas of the Iranian tableland is relatively dry with a wide range of variable temperature, conditions which are unfavourable for the development of house dust mites which require relatively moist and moderately warm conditions for rapid development. It is not surprising, therefore, that the small group of samples collected in Tehran, Shahrood and Khorram-abad contained few mites, but a more thorough investigation based on the examination of much larger groups of samples is needed, since it is possible that favourable micro-environments may exist even where climatic conditions appear unfavourable. High altitude itself is not an inhibiting factor. In the Swiss mountains few mites were found in house dust at high altitudes because the cold atmospheric air when warmed by domestic heating produced very low humidity levels within the houses (Spielsma, Zuidema & Leupen, 1971) whereas at similar high altitudes in the tropics, where much of the year is warm and humid, house dust mites proliferate and are considered to be an important precipitating

factor in bronchial asthma (Gitohu & Rees, 1971; Buchanan & Jones, 1972, 1974).

Although *Dermatophagoides* species play the major role in most house allergy the relative importance of other mites should not be overlooked. Several of the acarid and glycyphagid species found in house dust have been shown to be potent allergens and to provoke strong reactions in sensitized subjects (Voorhorst, 1962; Maunsell *et al.*, 1968; Morrow-Brown & Filer, 1968). Pearson & Cunnington (1973) observed that among Barbadian asthmatics a high proportion of house dust sensitive patients gave positive reactions to several species of storage mites common in Barbadian house dust as well as to *D. pteronyssinus* and *D. farinae*, and concluded that although *D. pteronyssinus* was the prime cause of asthma in Barbados, other mites were an additional cause of symptoms. Many of these storage species, e.g. *Acarus siro*, *Tyrophagus putrescentiae* and *Glycyphagus destructor*, are important pests of stored food-stuffs, particularly cereals and cereal products, and occur commonly in granaries, warehouses, farm stores and similar buildings. Agricultural and other workers predisposed to allergy and handling or exposed to infested products may become sensitized to one or more of these species as well as to house dust mites. Such multiple sensitivities present problems when hyposensitization treatments with *Dermatophagoides* vaccine are considered since house dust sensitive patients may show little improvement if other mite allergens either exclusively or in addition to *D. pteronyssinus* or *D. farinae* are involved as causative agents.

References

- BLYTHE, M.E., WILLIAMS, J.D. & MORRISON SMITH, J. (1974) Distribution of pyroglyphid mites in Birmingham with particular reference to *Euroglyphus maynei*. *Clinical Allergy*, **4**, 25.
- BUCHANAN, D.J. & JONES, I.G. (1972) Allergy to house-dust mites in the tropics. *British Medical Journal*, **3**, 764.
- BUCHANAN, D.J. & JONES, I.G. (1974) Mites and house dust mite allergy in bronchial asthma in Northern Zambia. *Postgraduate Medical Journal*, **50**, 680.
- CUNNINGTON, A.M. (1967) The mite fauna of house dust. *Acta allergologica*, **22**, 415.
- COOK, R.A. (1922) Studies in specific hypersensitiveness. IV. New etiologic factors in bronchial asthma. *Journal of Immunology*, **7**, 147.
- DAR, N., MENON, M.P.S., SHIVPURI, D.N. & GUPTA, V.K. (1973) The mite fauna of Indian house dusts. *Aspects of Allergy & Applied Immunology*, **VI**, 51.
- FRANKLAND, A.W. & EL-HEFNEY, A. (1971) House dust and mites as causes of inhalant allergic problems in the United Arab Republic. *Clinical Allergy*, **1**, 257.
- GITOHU, F. & REES, P. (1971) High altitude and house dust mites. *British Medical Journal*, **3**, 475.
- ISHIZAKI, T., MIYAMOTO, T. & OSHIMA, S. (1967) A similarity of antigenicity between a free living mite (*Dermatophagoides farinae*) and the house dust as the inhalating antigen for asthmatic patients in Japan. *International Congress of Allergology*. Excerpta Medica, International Congress Series No. 144, p. 62.
- KERN, A. (1921) Dust sensitization in bronchial asthma. *Medical Clinics of North America*, **5**, 751.
- LARSON, D.G., MITCHELL, W.F. & WHARTON, G.W. (1969) Preliminary studies on *Dermatophagoides farinae* Hughes, 1961 (Acari) and house dust allergy. *Journal of Medical Entomology*, **6**, 295.
- MAUNSELL, K. (1967) Preparation of mite extracts by separation of mites from media. *Acta allergologica*, **22**, 413.
- MAUNSELL, K. (1971) The impact of aerobiology on allergy. *Acta allergologica*, **26**, 329.
- MAUNSELL, K., WRAITH, D.G. & CUNNINGTON, A.M. (1968) Mites and house dust allergy in bronchial asthma. *Lancet*, **i**, 1267.
- MORROW-BROWN, H. & FILER, J.L. (1968) Role of mites in allergy to house dust. *British Medical Journal*, **3**, 646.
- MIYAMOTO, T., OSHIMA, S., ISHIZAKI, T. & SATO, S. (1968) Allergenic identity between the common floor mite (*Dermatophagoides farinae*, Hughes 1961) and house dust as a causative organism in bronchial asthma. *Journal of Allergy*, **42**, 14.

- PEARSON, R.S.B. & CUNNINGTON, A.M. (1973) The importance of mites in house dust sensitivity in Barbadian asthmatics. *Clinical Allergy*, **3**, 299.
- PEPYS, J., CHAN, M. & HARGREAVES, F.E. (1968) Mites and house dust allergy. *Lancet*, **i**, 1720.
- SAMSINAK, K., DUSBABEK, F. & VOBRAZKOVA, E. (1972) Note on the house dust mites in Czechoslovakia. *Folia parasitologica (Praha)*, **19**, 383.
- SESAY, H.R. & DOBSON, R.M. (1972) Studies on the mite fauna of house dust in Scotland with special reference to that of bedding. *Acarologia*, **XIV**, 384.
- SHARP, J.L. & HARAMOTO, F.H. (1970) *Dermatophagoides pteronyssinus* (Trouessart) and other acarina in house dust in Hawaii. *Proceedings, Hawaiian Entomological Society*, **XX**, 583.
- SPIEKSM, F.Th.M. (1967) *The house dust mite Dermatophagoides pteronyssinus* (Trouessart 1897) *producer of the house dust allergen*. Thesis, University of Leiden.
- SPIEKSM, F.Th.M. & SPIEKSM-BOEZEMAN, M. (1967) The mite fauna of house dust with particular reference to the house dust mite *Dermatophagoides pteronyssinus* (Trouessart, 1897) (psoroptidae, sarcoptiformes). *Acarologia*, **IX**, 226.
- SPIEKSM, F.Th.M., ZUIDEMA, P. & LEUPEN, M.J. (1971) High altitude and house dust mites. *British Medical Journal*, **1**, 82.
- TURNER, K.J., BALDO, B.A. & HILTON, J.M.N. (1975) IgE antibodies to *Dermatophagoides pteronyssinus* (house dust mite), *Aspergillus fumigatus* and β -lactoglobulin in sudden infant death syndrome. *British Medical Journal*, **1**, 357.
- VOORHORST, R. (1962) *Basic Facts of Allergy*. Stenfert Kroese, Leiden.
- VOORHORST, R., SPIEKSM-BOEZEMAN, M.I.A. & SPIEKSM, F.Th.M. (1964) Is a mite (*Dermatophagoides* sp.) producer of the house dust allergen? *Allergy und Asthma*, **10**, 329.
- VOORHORST, R., SPIEKSM, F.Th.M., VAREKAMP, H., LEUPEN, M.J. & LYKLEMA, A.W. (1967) The house dust mite (*Dermatophagoides pteronyssinus*) and the allergen it produces. Identity with the house dust allergen. *Journal of Allergy*, **39**, 325.
- VOORHORST, R., SPIEKSM, F.Th.M. & VAREKAMP, H. (1969) *House Dust Atopy and the House Dust Mite Dermatophagoides pteronyssinus* (Trouessart 1897). Staffleu's Scientific Publishing Co., Leiden.
- WRAITH, D.G. (1967) Skin tests with extracts of mites. *Acta Allergologica*, **22**, 414.
- WRAITH, D.G. & CUNNINGTON, A.M. (1975) The mite and childhood asthma. *British Medical Journal*, **3**, 766.

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