

## FAUNAL DIVERSITY AND HABITAT PREFERENCE OF HOUSE DUST MITES IN WEST BENGAL IN RELATION TO NASOBRONCHIAL ALLERGIC DISORDERS

A. MODAK, G. K. SAHA\*, N. TANDON AND S. K. GUPTA\*\*

*Department of Medical Entomology, School of Tropical Medicine,  
Kolkata-700 073, West Bengal*

*\*Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road,  
Kolkata-700 019, West Bengal*

*\*\* Zoological Survey of India, M Block, New Alipur, Kolkata-700 053*

### INTRODUCTION

Mites are ubiquitous in distribution and are reported to be present almost in all the habitats. An intricate association between mites and human beings are also noticed from long back. A large number of people are reported to suffer from several nasobronchial allergic complaints due to inhalation of mites present in the house dust. It is well documented that mites of the family Pyroglyphidae, particularly the genus *Dermatophagoides* are considered to be the most potent allergen in house dust responsible for asthma and other allergic manifestations (Voorhorst *et al.*, 1964 and Pepys *et al.*, 1968). Saha (1993, 1994, 1995 and 1997) and Saha *et al.*, (1995 a,b, & c) confirmed that *Dermatophagoides* mites are the main source of allergen in house dust responsible for asthmatic problems in at least 80% of the sensitive patients of Calcutta.

Mites in house dust date back to seventeenth century (Leeuwenhoek, 1694). More than 130 species of mites have so far been isolated from the house dust samples all over the world since 1983 (Zheltikova *et al.*, 1985). The first report on the occurrence of mites in Indian house dust was made by Krishna Rao *et al.*, (1973). Since then studies on the house dust mite fauna have been conducted in different parts of the country from time to time and the presence of varying number of species of mites have been reported (Dixit and Mehta, 1973; Dar and Gupta, 1979; Krishna Rao *et al.*, 1981; Maurya and Jamil, 1982; Tripathi and Parikh, 1983; Kumar *et al.*, 1988; Kumud *et al.*, 1988; Modak *et al.*, 1991, 1995 and Saha *et al.*, 1995b). However, a comprehensive knowledge on the house dust mite fauna of West Bengal is still fragmentary. Earlier, Gupta and Datta Roy (1975) isolated 12 species of mites from mattress dust of patients with respiratory troubles from six different

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\*Corresponding Author : Dr. G. K. Saha, Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Kolkata-700 019.

districts of the state. In recent past, Modak *et al.*, (1991) in a comparative study reported the presence of 54 species from house dust samples collected from 24 Parganas, Burdwan and Calcutta and highest number of species were encountered from Calcutta metropolis. The present study has been designed to gain an insight into the faunal diversity of house dust mites in 14 different districts of West Bengal and to assess their habitat preference.

### MATERIALS AND METHODS

Dust samples from two different habitats namely bed and bedroom floor were collected manually from houses of 85 established cases of bronchial asthma patients residing in 14 different districts of West Bengal, namely, Calcutta, South 24 Parganas, North 24 Parganas, Howrah, Hooghly, Burdwan, Bankura, Birbhum, Purulia, Midnapur, Murshidabad, Malda, Coochbehar and Jalpaiguri. Patients were selected from Asthma Clinic of Calcutta School of Tropical Medicine and District Health Centres of respective districts following the criteria mentioned earlier (Saha, 1993 and 1994).

Dust samples were also collected from the houses of fifty healthy individuals to serve as control. Floor dust samples were collected by sweeping the floors while bed dust samples were obtained by brushing the mattresses, bed covers, pillows on clean sheets of newspapers, kept in separate polythene packets, labeled properly. Extraction of mites were done following the method of Channa Basavanna *et al.*, (1985). Isolated mites were cleared and mounted temporarily in lactic acid and identified following the classification of Hughes (1976).

### OBSERVATIONS

A total of about 1,31,531 mites were isolated from 270 samples of dust collected from 14 different districts of West Bengal. As many as 68 species of mites belonging to 44 genera, 25 families and 3 orders namely Astigmata, Prostigmata and Mesostigmata (Table 1) have been isolated. A large number of Cryptostigmatids were also found but they were not identified. Among 68 species of mites, 26 species of mites were reported for the first time from Indian house dust samples, of which 6 species are new to science. Among 14 different districts surveyed, Calcutta holds maximum variety (47) of mites, followed by Burdwan (40) and North 24-Parganas (33) and least number of species was isolated from Birbhum District. *Dermatophagoides pteronyssinus* was the most dominating species comprising 69% of the total number of mites isolated followed by *D. farinae* (14%) and *Hirstia domicola* (13%). It is interesting to note that all the well known allergenic mites viz. *D. pteronyssinus*, *D. farinae*, *Euroglyphus maynei*, *Tyrophagus putrescentiae*, *Acarus siro* and *Glycyphagus domesticus* (Voorhorst and Spieksma, 1973) were present in large number in the state. Almost all the dust samples collected were positive for the presence of mites and 90% of the samples were positive for *D. pteronyssinus*. It was further noticed that the maximum number

**Table 1.** Mite fauna isolated from dust samples of different districts of West Bengal.**A. ASTIGMATA**

Pyroglyphidae	<i>Dermatophagoides farinae</i> Hughes <i>D. pteronyssinus</i> (Trouessart) <i>Hirstia domicola</i> Fain, Oshima & Bronswijk <i>Malayoglyphus intermedius</i> Fain, Cunnington & Spieksma <i>Euroglyphus maynei</i> (Cooreman)
Chortoglyphidae	<i>Chortoglyphus arcuatus</i> (Troupeau)
Acaridae	<i>Tyrophagus putrescentiae</i> (Schrank) * <i>T. tropicus</i> Robertson * <i>T. brevicrinatus</i> Robertson <i>Tyrophagus</i> sp. <i>Rhizoglyphus robini</i> Claparede <i>Caloglyphus</i> sp. <i>Acarus siro</i> Linnaeus <i>Acarus</i> sp. <i>Suidasia nesbitti</i> Hughes <i>S. medanensis</i> Oudemans
Glycyphagidae	<i>Glycyphagus domesticus</i> (De Geer) * <i>G. bicaudatus</i> Hughes ** <i>Austroglycyphagus</i> sp. nov. <i>Blomia tropicalis</i> (Bronswijk, Cook & Oshima) <i>B. freemani</i> Hughes
Anoetidae	<i>Histiostoma</i> sp.

**B. PROSTIGMATA**

Tydeidae	* <i>Pronematus elongates</i> Baker <i>Tydeus</i> sp.
Tarsonemidae	<i>Tarsonemus granarius</i> Lindquist
Pyemotidae	<i>Pyemotes ventricosus</i> (Newport)
Cheyletidae	<i>Cheyletus malaccensis</i> Oudemans <i>C. eruditus</i> (Schrank) * <i>C. trouessarti</i> Oudemans

Table 1. Cont'd.

	* <i>C. malayensis</i> Cunliffe
	<i>C. fortis</i> Oudemans
	* <i>Bak deleoni</i> Yunker
	** <i>Bak</i> sp. nov.
	<i>Grallacheles bakeri</i> De Leon
	** <i>Hemicheyletia</i> sp. nov.
Raphignathidae	** <i>Raphignathus</i> sp. nov.
Tenuipalpidae	* <i>Raoiella indica</i> Hirst
	<i>Raoiella</i> . sp.
	* <i>Brevipalpus phoenicis</i> (Geijekes)
Tetranychidae	* <i>Oligonychus indicus</i> (Hirst)
	<i>Eutetranychus orientalis</i> (Klein)
Cunaxidae	<i>Cunaxa setirostris</i> (Hermann)
	<i>Neocunaxoides</i> sp.
Pseudocheyletidae	<i>Anoplocheylus</i> sp.
Erythraeidae	* <i>Leptus giganticus</i> Khot
Stigmaeidae	** <i>Zetzellia</i> sp. nov.
Scutacaridae	** <i>Imparipes</i> sp. nov.
	<i>Scutacarus</i> sp.
Trombidiidae	<i>Trombidium</i> sp.
<b>C. MESOSTIGMATA</b>	
Ascidae	<i>Blattisocius mali</i> (Oudemans)
	* <i>B. keegani</i> Fox
	* <i>B. dentriticus</i> (Berlese)
	* <i>B. tarsalis</i> (Berlese)
	* <i>Lasioseius quadrisetosus</i> Chant
Ameroseiidae	<i>Klemania plumosus</i> (Oudemans)
	* <i>K. plumigera</i> (Oudemans)
	<i>Klemania</i> sp.
Dermanyssidae	<i>Hypoaspis miles</i> Berlese
	* <i>H. lubrica</i> Voigts & Oudemans
	* <i>H. sardoa</i> Berlese
	<i>Hypoaspis</i> . sp.

**Table 1. Cont'd.**

Pachylaelapidae	* <i>Pachylaelaps dorsalis</i> Bhattacharyya
Phytoseiidae	<i>Amblyseius largoensis</i> (Muma)
	<i>A. indicus</i> (Narayanan & Kaur)
	* <i>A. zwoelferi</i> Dosse
Uropodidae	<i>Trichouropoda</i> sp.
	<i>Leiodinychus</i> sp.
Macrochelidae	<i>Macrocheles</i> sp.

\* First report from India

\*\* New to science

of mites (13,750/gm of dust) was isolated from a bed dust sample collected from Calcutta during the month of November, while the minimum (2/gm of dust) was reported from one bed room floor dust sample of Bankura during the month of July. Among two different habitats examined, bed and bed room floor, apparently the former contained higher mite densities than the corresponding bed room floor dust samples, though the difference was not statistically significant.

## DISCUSSION

Studies on the house dust mite fauna have been explored in other parts of the country from time to time and the presence of varying number of species have been reported by several workers. To the best of our knowledge, other than the state of West Bengal, a maximum of 27 mite species distributed over 21 genera and 10 families have been reported from Punjab and Himachal Pradesh by Kumar *et al.*, (1988). Therefore, it is interesting to note that West Bengal is extremely rich in house dust mite fauna as was also observed in our earlier reports (Modak *et al.*, 1991). This may presumably be attributed to the presence of ideal climatic conditions particularly the temperature and high humidity prevailing in this state as also suggested by Bronswijk and Sinha (1971) and Wharton (1976) in their studies.

Isolation of exceptionally large numbers of *Dermatophagoides* mites is an interesting finding which may be due to extremely favourable conditions to the survival of these mites in respect to temperature, RH and ample supply of food. It has been recognized that temperature and RH are the two most important limiting factors in controlling mite infestations.

Our study further reveals that members of the family Pyroglyphidae predominated in both bed and bedroom floor-dust samples. Predominance of Pyroglyphid mites in house dust was also observed by Dixit and Mehta (1973), Krishna Rao *et al.*, (1981), Modak *et al.*, (1991) and Kumud *et al.*, (1988). Among different species of Pyroglyphidae the most predominant one is

*D. pteronyssinus* (69%) followed by *D. farinae* (14%) and *Hirstia domicola* (13%). Several authors from different parts of the country also reported the dominance of *D. pteronyssinus* over *D. farinae* (Dixit and Mehta 1973; Nayar *et al.*, 1974; Krishna Rao *et al.*, 1981; Maurya *et al.*, 1983 and Kumud *et al.*, 1988). Similar observations have been reported from different parts of the globe and they constitute 42.32% to 92.61% of the total mite population depending on the geographical location. In contrast, Dar *et al.* (1973), Jamil and Maurya (1981) and Tripathi and Parikh (1983) reported the predominance of *D. farinae* from other parts of the country.

The present study reveals that cent percent dust samples were positive for the presence of mites and the rate of occurrence of *D. pteronyssinus* was 90%, which confirms the earlier observation of Spieksma (1967) and Sesay and Dobson (1972). Dar and Gupta (1979) reported that 64.3% dust samples from Uttar Pradesh, 61% from Punjab, 60% from Chandigarh, 54.9% from Delhi and 45.5% from Haryana were positive for the presence of mites. They further opined that *Dermatophagoides* spp. were present in 100% mite positive dust samples while Tripathi and Parikh (1983) reported 92% positivity among them from Mumbai.

Of the two different habitats examined to study the habitat preference of *Dermatophagoides* mites, it was observed that bed dust contained higher densities of mites than the corresponding bed-room floor dust, though, not statistically significant. Ho and Nadchatram (1984) also did not observe significant difference in mite densities between different niches. In contrast, Sesay and Dobson (1972) and Tripathi and Parikh (1983) observed significant difference between these two habitats. Saha *et al.*, (1995b) also observed that of the two different habitats examined, the bed dust contained significantly higher ( $p < 0.01$ ) mite density than the corresponding bed-room floor dust samples of patients. Higher mite densities in bed dust samples are attributed to the presence of ideal ecological conditions such as favourable temperature, required humidity and available food. Mites usually feed on human skin scales (Spieksma, 1968 and Wharton, 1976), which is present in abundance in the beds. Moreover, since the beds are occupied by human beings for about 1/3 of the day, the required optimum temperature and RH and sufficient amount of human skin scales are automatically provided (Mulla and Medina, 1980). Secondly, the beds provide an undisturbed habitat in comparison to the corresponding bed-room floors which are frequently cleaned and moped (Blythe, 1976 and Mulla and Medina, 1980).

Observations regarding mite densities in house dust samples of individuals, hypersensitive to dust inhalation and control subjects residing in Calcutta metropolis and adjoining suburban areas of West Bengal were made. The study indicates that in the suburbs, the difference in the total number of mites/gm of dust in allergic and control subjects were not significant. However, the difference was significant in Calcutta population. Dixit and Mehta (1973), Nayar *et al.*, (1974), Murten and Madden (1977), Tripathi and Parikh (1983) and Korsgaard (1983) also reported that apparently the mean number of total mites as well as *Dermatophagoides* mites/gm of dust was greater in houses of asthmatics, though such difference was not statistically significant.

Saha *et al.* (1995a & b) was of the opinion that in Calcutta *Dermatophagoides* alone constituted more than 60% of the total mites isolated and patients' bed contained significantly higher ( $p < 0.02$ ) mite population than the control subjects' bed dust.

It is worth mentioning that the maximum and minimum number of mites recorded during the course of present study were 13,750 and 2/gm of dust respectively. Observations in these respects have also been made in other parts of the globe and the maximum and minimum number of the mites recorded so far were between 7000-8000/gm and 5-8/gm of dust respectively (Oshima 1970, Blythe *et al.*, 1975 and Arlian *et al.*, 1983).

In view of increasing trends in the incidence of nasobronchial allergic manifestations due to dust inhalation, the mite fauna of house dust has gained considerable attention throughout the country. Since the house dust mites particularly the genus *Dermatophagoides* present in the house dust are considered as the sole potent allergen responsible for nasobronchial allergic disorders, a detailed knowledge on the diversity and other ecological requirements of this mite species are of urgent need for better understanding of the disease pathogenesis. Saha (1994) further opined that the degree of house dust allergenicity is closely related to the density of mite populations prevalent in patients environment and thus it is reasonable to think that the physical appearance of these mites in higher concentration in the patients' environment may remind us to search for an allergic etiology towards these species of mites.

## SUMMARY

House dust mite fauna in the state of West Bengal comprises of 68 species of mites belonging to 44 genera 25 families and 3 orders. Among those 6 species appeared to be new to science and another 20 species are reported for the first time from Indian house dust samples. *Dermatophagoides pteronyssinus* was the most predominating species comprising 69% of the total mite population followed by *D. farinae* (14%) and *Hirstia domicola* (13%). The relative density varies from 13,750/g to 2/g of dust. Interestingly, all the well known allergen producing mites namely, *D. pteronyssinus*, *D. farinae*, *Euroglyphus maynei*, *Tyrophagus putrescentiae*, *Acarus siro* and *Glycyphagus domesticus* are present in the house dust collected from different districts of the state. Among two different habitats examined, the bed dust harbour comparatively higher mite population than the corresponding bedroom floor dust samples and their density being higher in dust samples collected from homes of asthmatic patients than non-sensitive control individuals.

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