



ISSN: 0974 - 0376

The Ecoscan : Special issue, Vol. IX: 721-726: 2016
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES
www.theecoscan.com

HOUSE DUST MITE STUDIES IN AND AROUND THE COALFIELD AREAS OF DHANBAD DISTRICT, JHARKHAND

Manju Kumari Saw *et al.*,

KEYWORDS

House Dust Mites
Allergic disorders
Coalfields
Seasonal variation

Proceedings of National Conference on
Harmony with Nature in Context of
Resource Conservation and Climate Change
(HARMONY - 2016)
October 22 - 24, 2016, Hazaribag,
organized by
Department of Zoology, Botany, Biotechnology & Geology
Vinoba Bhave University,
Hazaribag (Jharkhand) 825301
in association with
NATIONAL ENVIRONMENTALISTS ASSOCIATION, INDIA
www.neaindia.org



MANJU KUMARI SAW*, SUDHIR KRISHNA BHARATI¹, AND SHAILENDRA KUMAR SINHA²

¹Industrial Biotechnology and Waste Utilisation Division,
CSIR-Central Institute of Mining and Fuel Research, Digwadih Campus, Dhanbad - 828 108, Jharkhand,

²Department of Zoology, P. K. Roy Memorial College (P.G Centre), Dhanbad - 826 004, Jharkhand.
e-mail: manjukrisaw@gmail.com

ABSTRACT

Allergic disorders like allergic asthma, allergic rhinitis, allergic conjunctivitis and eczema, are caused by allergens. The most common allergens in house dust are house dust mites. Mites grow well in the house dust and cause various allergic disorders. Studies for qualitative and quantitative estimation of House Dust Mites in intramural environs of coal mining areas of Dhanbad district was carried out for the period July 2015 to June 2016. Altogether 12 species of house dust mites have been found during the present studies which are prevalent in the house dust of Coalfields of Dhanbad. Out of which *Dermatophagoides* spp. (43.09%) were the dominant species followed by *Dermatophagoides gallinae* (21.92%), *Austroglycyphagus orientalis* (17.92%) and *Cheyletus* spp. (10.75%) at all selected sites. The concentration of house dust mites was found to be maximum during the rainy season (57.7%) when the relative humidity was high followed by winter (38.4%) and lowest in summer (3.9%). House Dust Mites play an important role in causing various allergic symptoms in a susceptible human being. The above study may be helpful to the patients to take proper medication to avoid the symptoms of allergic reaction caused by these house dust mite species.

INTRODUCTION

House dust mites belonging to the subclass Acari are members of arachnid organisms. Their body size is approximately 100-400 μm in size. In houses, they are found in house dust, carpets and fabric-covered furniture, in beds, pillows, sheets etc. Their basic food sources are protein and lipid-rich human skin rashes. The term "House dust mites" is used to describe the mite species that are found in house dust like *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, and *Euroglyphus maynei*, which live in house dust inside house. These mites transform from the egg stage to the adult stage within 3 to 4 weeks under humid conditions at temperature of 25-30°C. The average lifetime of adult house dust mites is about 4-6 weeks. The female mite produces approximately about 40-80 eggs during this period, which helps house dust mites to maintain their population.

Allergic disorders like allergic asthma, allergic rhinitis, allergic conjunctivitis, and eczema, are caused by allergens. The most common allergens in house dust are house dust mites. The impact of these mites as allergens results from their stools of 20–50 μm , which are digestive tract residues. Colloff (1998) cited from a study by Tovey *et al.* (1981) that mites defecate a mean of 20 times a day. These stools containing various chemicals belonging to mites remain suspended in air for a while depending on several activities in houses and are then taken into the body by inhalation. As a result, these stools stimulate the immune system in atopic (prone to allergy) individuals, initiating allergic reactions (Colloff, 2009).

Approximately, 1-2% (65-130 million people) of the world population are suffering from house dust allergens (Colloff, 2009). In sensitized patients, house dust mites exacerbate several allergy based diseases like asthma bronchiole, rhinitis, conjunctivitis, etc. (Paufler *et al.*, 2001). Data published by the World Health Organization says that 235 million people in total in the world are asthmatics, with children being the most commonly affected, followed by adults. It was also mentioned that more than 80% of deaths from asthma occur in low-and middle-income countries of the world (WHO, 2014).

House Dust Mites play an important role in causing allergic symptoms of the bronchial asthma, allergic rhinitis, conjunctivitis, sinusitis, atopic dermatitis or various combinations of these in a susceptible human being. Kern (1921) was the first to prove that a mite, *Dermatophagoides pteronyssinus*, from house dust was the foremost potential cause of allergy in sensitive persons and not the house dust. Fain (1957), Miyamoto *et al.* (1969), Shivpuri (1977), Spieksma (1997) and Torey *et al.* (1981) from various part of the world studied on various aspects of house dust mites. Shivpuri D.N. (1977), Jogdand (1986, 1994, 1995, 1997, 2012), Tilak and Jogdand (1989), Tilak *et al.* (1994), carried extensive work on various aspects of house dust mites gave excellent contribution and advanced the knowledge in this field of science. Till date various studies investigated around 36 mite species as indoor allergens in the house dust worldwide, in India, 29 species from Kolkata (Modak, 1991), 23 from Bangalore (Krishna Rao, 1981), 20 from Aurangabad (Jogdand, 2012), 17 from Calicut (Haq and Ramani, 2010), 12 from Dhanbad

*Corresponding author

(Rumi Ranjan *et al.*, 2012) and 9 from Pune (Bansod V. *et al.*, 2015) are reported.

Although some studies have been conducted in and around Dhanbad district on house dust mites, but they are not sufficient and in-depth studies are required. Coalfields of Dhanbad are important coal mine blocks in India spreading several districts of Jharkhand. It plays an important role in economic development of the nation. Dhanbad has been reported as one of the most polluted area in India and high incidence of lung ailments including pneumonia and bronchitis are reported from the region. The high incidence of allergic ailments necessitates the distribution analysis of dust mites in Dhanbad coalfield area. This study reveals the qualitative and the quantitative estimation of dust mites along with their correlation with the temperature, humidity and rainfall in different environs of the coalfields in Dhanbad district of Jharkhand, India.

MATERIALS AND METHODS

Site selection and collection of the house dust samples

The dust samples were collected weekly throughout the year from July 2015 to June 2016 from different intramural selected sites. Sampling was carried out on weekly basis from selected sites. About 240 samples were collected during the study. 500 mg of the indoor house dust samples were collected manually following the method described by Jogdand and Tilak (1987) from the floor of the selected sites. Samples were

collected in autoclaved plastic container. Large particles and fibrous material in the dust were separated by sieving through 300 mesh special brass sieve of 6 mm diameter and examined under Nikon trinocular research microscope for identification. Daily recode of environmental parameters like temperature, relative humidity and rainfall was maintained during the study carried out at various selected environs in and around the coalfields of Dhanbad district of Jharkhand.

Examination of house dust samples

Sieved house dust samples were examined same day of collection visually for movement analysis as well as microscopically for further identification. For movement analysis, sample was spreaded evenly over a petridish (5.5cm diameter) as a thin layer and examined microscopically using Nikon Trinocular research microscope as discussed by Tilak and Jogdand (1987). For further identification, mites were isolated from the dust sample manually with the help of needle and mounted using glycerin jelly over a glass slide after clearing by 50% lactic acid and examined under scanning microscope (Tilak and Jogdand, 1987). Mites were identified with the help of reference slides and available literature (Fain, 1957; Hughes, 1961; Tilak and Jogdand, 1987; Colloff, 1998) and were categorized according to their genus during the study.

RESULTS

House dust samples were screened and the population of house dust mites was observed. After screening 12 species of

Table 1: Monthly percentage contribution of house dust mites in relation with meteorological parameters in year 2015-16

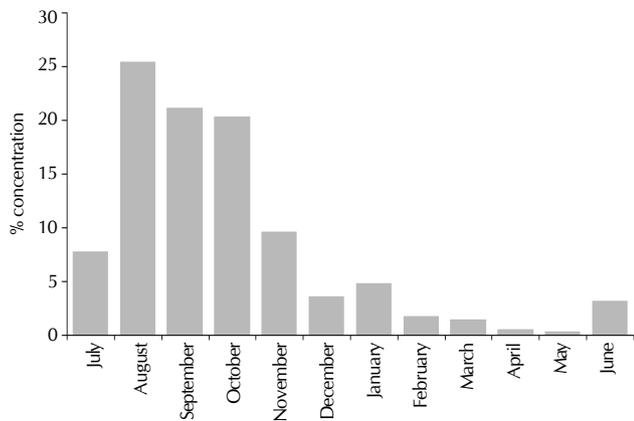
Year2015-16	Monthly % contribution of HDM	Maximum Temp. °C	Minimum Temp. °C	Rainfall In mm	Average RH %
July	7.8	36	24	576	83
August	25.5	35	24	189	78
September	21.2	37	24	489	75
October	20.4	36	18	44	69
November	9.6	33	15	0	72
December	3.6	32	8	8	73
January	4.8	30	9	20	64
February	1.7	38	12	5	62
March	1.4	40	18	5	44
April	0.5	46	24	7	36
May	0.3	44	20	172	60
June	3.2	41	22	225	71

Table 2: Statistical relevance (Correlation coefficient)

Correlation coefficient (r) Month 2015-16	Relative Humidity	Temperature	Rainfall
July	0.64	0.20	0.15
August	0.34	0.23	0.39
September	0.04	0.67	0.37
October	0.24	0.52	0.34
November	0.56	0.70	0
December	0.63	0.11	0.45
January	0.84	0.07	0.52
February	0.33	0.32	0.48
March	0.66	0.31	0.58
April	0.03	0.62	0.47
May	0.05	0.23	0.01
June	0.35	0.11	0.12



Figure 1: Map of Dhanbad district showing sampling site

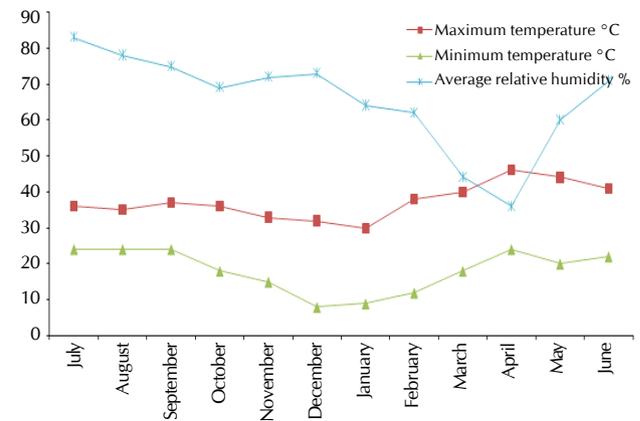


Graph 1: Monthly percentage contribution of House dust mites during the year 2015-16

house dust mites were found out of which 10 species were identified during the study are *Acarus* spp., *Austroglycyphagus orientalis*, *Blomia* spp., *Cheyletus eruditus*, *Campylochrius* spp., *Caloglyphus oudemansi*, *Dermayssus gallinae*, *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, *Protaphagus strictus* and two species were unidentified.

House Dust Mites population shows seasonal variation round the year both qualitatively and quantitatively. (Table: 1, Graph: 3). They were found significantly high from July to October, during which the atmospheric relative humidity and rainfall were maximum and moderate in November to January and comparatively less in February to May particularly lowest in April to May. (Table: 1, Graph - 1&3)

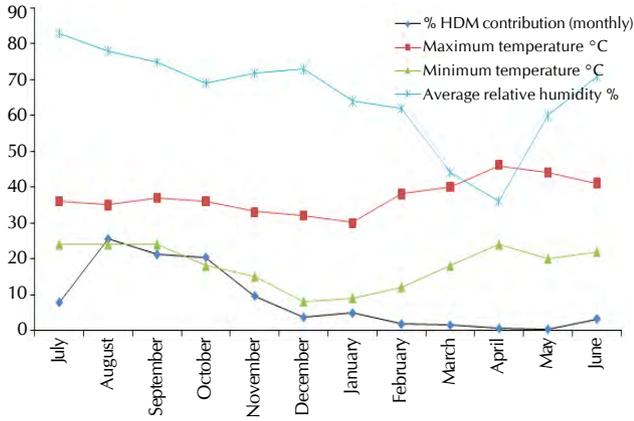
It also showed the maximum density 57.7% of total house dust mites population when the atmospheric relative humidity



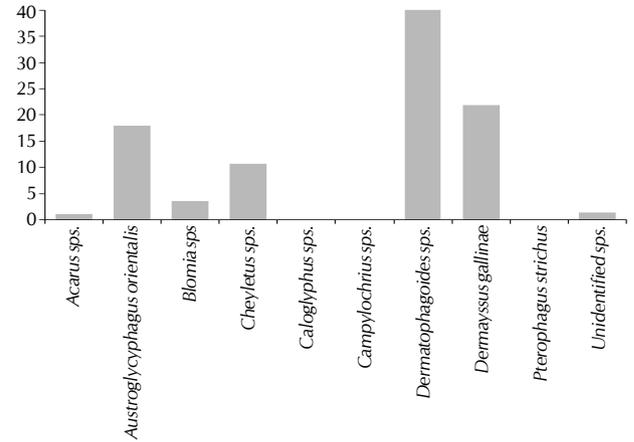
Graph 2: Climatogram from July 2015 to June 2016

and rainfall were maximum in the month of June to September, and the least population was recorded 3.9% during February to May when comparatively relative humidity and rainfall were also recorded minimum (Table 1). The monthly variation in the number of house dust mites indicates the influence of environmental factors such as temperature, humidity and rainfall. Findings revealed that low relative humidity, high temperature, extremely cold condition and rainless days act as adverse condition for the incidence and growth of mites. (Table 1, Graph 3).

From the 10 identified species of the house dust mites from the different environs of coalfield, only four different types of the house dust mites were dominant in the present survey. *Dermatophagoides* spp. (43.09%) were the dominant species in every type of environ followed by *Dermayssus gallinae*



Graph 3: Monthly % contribution of HDM and meteorological parameters for the year 2015-16



Graph 4: Percentage contribution of dominant House dust mites in and around coalfields of Dhanbad



1. *Blomia* sps 2. *Austroglycyphagus orientalis* 3. *Cheyletus eruditus* 4. *Acarus* sps. 5. *Dermatophagoides pteronyssinus* 6. *Dermapyssus gallinae* 7. *Campylochrius* sps. 8. *Dermatophagoides farinae*

Figure 2: Different house dust mite species identified from Dhanbad district.

(21.92%), *Austroglycyphagus orientalis* (17.92%) and *Cheyletus* sps. (10.75%) however, *Blomia* sps. (3.58%), *Acarus* sps. (1.15%), *Caloglyphus* sps. (0.13%), *Pterophagus strictus* and *Campylochrius* sps. (0.06% each) were recorded minimum and two unidentified species (1.34%) was also found (Graph: 4).

The Statistical analysis of the house dust mite population revealed moderate positive correlation with the monthly mean humidity ($r = 0.6$), rainfall ($r = 0.4$) and temperature ($r = 0.1$) during study period. (Table 2)

DISCUSSION

The house dust mite studies carried out at various selected environs of coalfields of Dhanbad district for continues one year revealed presence of different type of mites. During the study four house dust mite species *Dermatophagoides pteronyssinus*, *Dermapyssus gallinae*, *Austroglycyphagus orientalis* and *Cheyletus* were found dominating the mite flora. Dominance of *Dermatophagoides*, *Cheyletus* and *Blomia* in dust sample is well reported from different parts of the world

(Peng *et al.*, 1998; Shah and Bapat, 2006). Concentration of mites population in the dust samples collected from selected sites were found to vary from indoor to indoor, which could be due to the difference in the structure and materials of the buildings, socio-economic status of the individuals, standard of hygiene maintained and difference in the microclimatic conditions that contributes to the higher accumulation of mites in the house dust.

In this study, we found that mite population was higher in Dhanbad coalfield area during July to October with maximum relative humidity and rainfall. The findings correlates with the earlier studies made in and around Dhanbad district (Rumi Ranjan *et al.*, 2012). Thus the impact of seasonal variation on the population of house dust mites is well revealed. Holly (2009) suggested that by taking preventative measures, one can become symptom free. Therefore, some prevention like lowering humidity, avoiding furry or feathered pets, reducing air infiltration, cleaning/heat treatment, select appropriate furnishing vacuuming, chemical treatment will help in reducing mites population and resulting allergic symptoms.

REFERENCES

- Bansod V., Borde S., Thosar A. and Phadke, S. 2015.** Observation of common external parasites, mites in poultry and flour mill from Pune (M.S.) India. *The Ecoscan*. **7**: 193-196.
- Colloff, M. J. 1998.** Taxonomy and identification of dust mites. *Allergy*. **53**: 7-12.
- Colloff, M. J. 2009.** Dust Mites. *CSIRO Publishing, Collingwood, Australia*.
- Fain, A. 1957.** Le genradermatophagoides Bigdonov 1884 Son imp. Dan allergies respiratoireset Cutaneous Chez 1 homme (Psoroptides-Sarcoptiformes). *Acarologia*. **9**: 179-229.
- Haq, M. A. and Ramani, N. 2010.** "Preliminary survey of House Dust Mites at Calicut (Kerla)". *Acarology*. **23**: 223-226.
- Hughes, A. M. 1961.** The Mites of stored food. *Tech. Bull. Minist. Agri. London*. **9**:287.
- Holly, M. 2009.** How to reduce dust mites in your home. *Yahoo contributor network*.
- Jogdand, S. B. 1986.** House Dust mite Allergy in India, Workshop manual on Environment Biopollution. pp. 21-26.
- Jogdand and Tilak 1987.** Airspora at Aurangabad *Ph.D. Thesis submitted Marathwada University Aurangabad*. pp. 309-322.
- Jogdand, S. B. 1994.** Role of House dust mites in Allergy, *Advances in mycol. & Aerobiology*. pp. 323-333.
- Jogdand, S. B. 1995.** A study on dust mite allergens in patients; *Environment, Ind. J. Aerobiol.* **8**: 43-46.
- Jogdand, S. B. 1997.** Recent Trends in House dust mite allergy & Immunology, *Aerobiol. Houston USA*. pp. 267-290.
- Jogdand, S. B. 2012.** Arachnida: Acarina, Astigmata-House Dust Mites; *State Fauna Series: 20:2012. Fauna of Maharashtra Part 2. Invertebrates*. 667-668.
- Krishna Rao, N. S., Ranganath, H. R. and Channabasavanna, G. P. 1981.** House dust mites from India. **5**: 85-94.
- Kern, R. 1921.** Dust sensitization in bronchial asthma. *M. Clin. N. America*. **5**:751-758.
- Miyamoto, T. S. et al. 1969.** Cross-antigenicity among six species of dust mites and house dust antigens. *JH. Allergy*. **44**: 228-238.
- Modak, Saha, Tandonand, N. and Gupta, S. K. 1991.** "Dust mite fauna in houses of bronchial asthma patients: Comparitive study of three zones of India." *Entamol.* **16(2)**: 115-120.
- Paufler, P., Gebel, T. and Dunkelberg, H. 2001.** Quantification of house dust mites allergens in ambient air. *Rev Environ Health*. **16(1)**: 65-80.
- Peng et al. 1998.** Highly sensitive and specific ELISA with monoclonal antibody capture to measure *Dermatophagoides farinae* 1-specific IGE. *Annals of Allergy, Asthma and Immunology*. **80(3)**: 274-278.
- Rumi Ranjan et al. 2012.** Studies On House Dust Mites In Ifferent Environs Of Jharia Coalfields Dhanbad, Jharkhand, Special Issue, The Ecoscan. **1**: 143-146.
- Shah, S. and Bapat, M. M. 2006.** Improper window air-conditioning of home and occurrence of house dust mites allergens infestation in Mumbai city women. *Indian J. of Medical Sciences*. **60(11)**: 472-474.
- Shivpuri, D. N. 1977.** House dust mites allergy in India." *Aspects of allergy and Appl. Immunol.* **5**: 19-35.
- Spieksma 1997.** Domestic mites from an Acarologic Perspective. *Allergy*. **52**: 360-368.
- Tilak, S. T. and Jogdand, S. B. 1989.** Impact of Environment on incidence of mites, *Ind. J. Aerobiol.* **2(1)**: 35-38.
- Tilak, S. T. and Jogdand, S. B. and Singh, N. I. 1994.** Allergy due to house dust mites, *Forontr. Botany Special*. **1**: 16-52.
- Tovey, E. R. et al. 1981.** The faeces are a major source of house dust mite allergens. *Nature*. **289**: 592-3.