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RESEARCH ARTICLE

A faunistic survey of house dust mites of Kolkata, West Bengal, India

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ABSTRACT: House dust mites play an important role in causing various allergic disorders. Many factors like temperature, humidity as well as different microclimatic conditions may influence mite growth. The aim of this study was to analyse the mite fauna of Kolkata, West Bengal, India. House dust was collected from 20 selected houses located in and around Kolkata from January 2017 to December 2017. House dust samples were processed following the flotation technique and house dust mites were isolated from all the samples surveyed. A total of 51 species belonging to 34 genera and 17 families were isolated from positive samples. *Dermatophagoides pteronyssinus*, *Blomia tropicalis* and *Cheyletus malaccensis* were present in all positive samples. Most abundant mite in house dust was *Dermatophagoides pteronyssinus*, constitute 47% of the mites collected from dust samples. *Amblyseius longispinosus* was first time reported from Indian house dust.

Keywords: *Dermatophagoides pteronyssinus, D. farinae, Blomia tropicalis, Glycycometus geniculatus*, Acari.
Zoobank: http://zoobank.org/105512C3-6D37-47FD-ABAD-CC25820E41FC

INTRODUCTION

Mites are very diverse and wide spread groups of animals and cosmopolitan in nature. Schauff (2000) estimated more than 48,200 mite species present globally having various feeding habits such as plant feeders, fungivorous, coprophagous, saprophagous, carnivorous etc. while many other feeding habits are still unknown. Many of mite species are free living but there are some which parasitize plants and animal, and also act as reservoirs and vectors of serious pathogens causing rickettsial pox, protozoal, bacterial, spirochaete and viral diseases to livestock and human beings. House dust mites have earned a worldwide interest among acarologists and medical entomologists for their intricate association with human beings by playing a significant role in public health (Smith, 1983; Podder et al., 2006, 2010). Since house dust mites (Acarina: Pyroglyphidae) are known to be the cause of allergic diseases (Voorhorst et al., 1964), many surveys on their diversity and distribution have been carried out in the northern and southern part of India. In India, House dust mite survey was conducted more than 25 years ago and *Dermatophagoides pteronyssinus* was identified as the most common and abundant species (Rao et al., 1975; Tripathi et al., 1983; Valandiker and ChannaBasavanna, 1992; Lakshmi and Haq, 1999). Abundance of species is a dynamic process and depends upon environmental factors (Mariana et al., 2000). This was established when Chaudhury et al. (2005) identified *Dermatophagoides farina* as most abundant species in West Bengal than previously reported survey of Modak et al. (1991) from this state. So, information of regional faunas of the Acari is essential to our understanding of the global acarine diversity. A checklist of described species is necessary for understanding a fauna (Halliday, 1998; Halliday et al., 1999). However full checklists of House dust mites have been produced for only very few countries in the world (e.g. Italy by Bernini et al., 1995; Australia by Halliday, 1998; Mexico by Hoffmann and Lopez-Campos, 2000; New Zealand by Zhang and Rhode, 2003). India being a large country having differences in geographic and climate factors (temperature and humidity) from continental and oceanic climates, house dust mite species may be different in different regions in India (Valandiker and ChannaBasavanna, 1992; Kumar, 1988; Gill and Kaur, 2014). In West Bengal, a very few studies were conducted from last 20 years (Modak et al., 2004; Chaudhury et al., 2005; Kumar et al., 2014). So, monitoring of species diversity of a region enables estimation of the prospective functional roles of the species. In urban ecosystems, monitoring species diversity can be used as a tool to reduce human mismanagement and pollution in urbanized, industrial, rural, and managed areas (Wilson, 1997). Extending this view, the previous data are inadequate and old, without updated taxonomic information of dust mite species. So, the present study was aimed to assess the diversity of dust mite fauna of Kolkata, West Bengal, India. The results of the study are expected to supplement the necessary information on distribution and abundance of various species of dust mite in West Bengal. Information on the distribution and abundance of these mite species will also be helpful for a better refinement of their control. The present study also helps to identify the mite species which are common and abundant and have the potential to play an allergenic role and should be investigated further.

MATERIALS AND METHODS

Dust samples were collected from 20 houses located in and around Kolkata, West Bengal, from two different habitats, namely bed and bedroom floor once in a month during January 2017 to December 2017. The houses were selected from five different corners of the city namely East, West, North, South and Central region of Kolkata and each region contained four houses and the residents of the houses had history of nasobronchial allergic diseases and also did not use any acaricides during the study period. The verbal consent was taken from the heads of the family for collection of their house dusts. Written consent was obtained from head of the family of each house that they should not change their houses during the study period and also provided with a digital hygrometer and a thermometer for measuring relative humidity and temperature inside the house, respectively at the time of sampling. Floor dust was collected by sweeping the floor, while bed dust was collected by dusting the mattresses, bed linens and pillows on clean sheets of newspaper and kept in separate plastic packets and labelled properly and samples were immediately frozen to avoid mite multiplication. The dust samples were processed by first passing through a set of sieves of decreasing mesh size (2.36 mm., 1.00 mm., 500µ, 75µ, 45µ) in a mechanical sieve shaker for 20 minutes. The portion of dust that was retained in the sieve 75µ and 45 µ mesh size were processed following the flotation method of ChannaBasavanna et al. (1984), with some modifications. One gram of each dust sample was mixed with pure kerosene oil and stirred constantly for 10 mins. on a vortex mixture. The mixture was centrifuged at 2000 r.p.m. for two minutes and the supernatant was filtered using Whatman No.1 filter paper. A mixture of kerosene oil and carbon tetrachloride with specific gravity 1.3 was added to the sediment in the tube and after centrifugation, it was filtered on the same filter paper. This process was repeated twice with a mixture of kerosene oil and carbon tetrachloride having specific gravity 1.4 and 1.5, respectively. The supernatant was filtered again and the residue collected on the filter paper was washed with a fine jet of 70% alcohol and transferred to a Petridish. Mites were picked with a brush and these were mounted in Hoyer's medium. The same process was performed for rest of the dust samples.

Before the mites were identified, mounted slides were dried in an oven at 40°C for 10-15 days. Taxonomic identification was done under research microscope (Olympus CH-20i). Total number of each type of mites was summarized and percentage of each species of mites was calculated and the predominant species was determined. Total number of all the isolated mites was counted with the aid of a compound microscope Solarz (1997) including live mites, dead mites, and incomplete remains, and mite density was calculated as a number of specimens per 1 gram of dust.

The mites in all stages in each sample were counted and identified with the help of Hughes (1961), Krantz (1978), Colloff and Spieksma (1992) and Krantz and Walter (2009). All specimens were deposited in the Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Kolkata-700019, West Bengal, India.

The diversity indices of the dust mite abundance were analyzed using Biodiversity Pro software (McAleece et al., 1997; Biodiversity Professional; Scottish Association for Marine Science and the Natural History Museum, London, UK). Species diversity was calculated using Shannon diversity index [H'= - Σ Pi lnPi) and Shannon Hmax (Hmax = Log10(S)], Shannon evenness was calculated using the formula; J = H' /Hmax, where, H'= information content of sample (bits/individual) or Shannon diversity index, and Pi = proportion of total sample belonging to i^{th} species, S =total number of species in habitat (species richness) (Magurran, 1988).

RESULTS

The present study revealed that the house dust mites were present in all the dust samples surveyed. A total of 51 species belonging to 34 genera and 17 families were identified from house dust as shown in Supp. Table S1. Among these species, only 3 species (*Dermatophagoides pteronyssinus, Blomia tropicalis* and *Cheyletus malaccensis*) were present in all houses.

The maximum number of species recovered was from the families Cheyletidae, Acaridae, Pyroglyphidae and Echimyopodidae. The cheyletids contain 10 species whereas acarids and pyroglyphids share 6 species, followed by Echimyopodidae which contains only 4 species (Table 1).

The pyroglyphid mite, *Dermatophagoides pteronyssinus* was the most dominating one with an average density of 673.35 ± 63.95 /gm dust followed by *Blomia tropicalis* from the family Echimyopodidae with an average mean density of 415.05 ± 162.73/ gm of dust. Another species of pyroglyphid mite, *D. farinae* and aeroglyphid mite, *Glycycometus geniculatus* were common but their average mean density were 157.15 ± 118.06/ gm dust and 117.9 ± 101.71/ gm dust, respectively, while others were present in less densities (Table 2, Fig. 1).

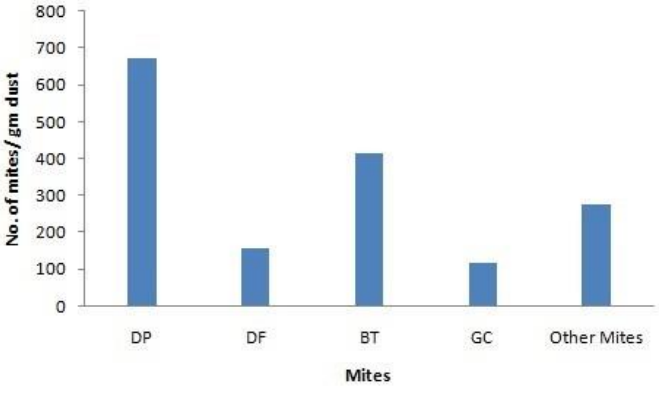

Figure 1. Abundance of four major mites DP (*Dermatophagoides pteronyssinus*), DF (*Dermatophagoides farina*), BT (*Blomia tropicalis*), GC (*Glycycometus domesticus*) along with other mites from Kolkata, West Bengal.

Table 1. House dust mites in different houses (n=20) in West Bengal, India.

House Dust Mite Species	H-1	H-2	H-3	H-4	H-5	H-6	H-7	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15	H-16	H-17	H-18	H-19	H-20	Total
Suidasiidae																					
Suidasia nesbitti Hughes		+			+			+			+	+		+					+	+	8
Suidasia medanensis Oudemans	+	+		+			+			+		+				+	+				8
Acaridae																					
Tyrophagus putrescentiae (Schrank)	+	+		+	+		+	+	+				+	+			+			+	11
Tyrophagus longior (Geravis)	+		+	+			+	+	+		+	+			+		+	+		+	12
Tyroborus lini Oudemans							+							+					+		3
Acarus gracilis Hughes		+	+	+			+	+		+	+			+		+	+	+	+		12
Acarus siro Linnaeus	+	+	+	+	+			+			+	+								+	9
Neoacotyledon rhizoglyphoides (Zachvatkin)	+	+			+	+	+	+				+	+		+	+	+			+	12
Lardoglyphidae																					
Lardoglyphus zacheri Oudemans		+	+	+					+	+	+				+						7
Pyroglyphidae																					
Hirstia domicola Fain	+			+	+			+	+	+		+	+				+	+	+		11
Euroglyphus maynei Cooreman		+	+	+	+	+	+		+	+			+	+		+		+	+	+	14
Dermatophagoides farinae Hughes	+	+	+	+	+	+	+		+		+	+		+	+	+				+	14
D. pteronyssinus Trouessart	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Sturnophagoides sp.*															+					+	20
Pyroglyphus sp.*					+						+								+		3
Glycyphagidae																					
Glycyphagus ornatus Kramer			+						+				+	+				+			5
Glycyphagus sp.*	+	+													+		+				4
Lepidoglyphus destructor (Schrank)		+	+		+	+	+				+		+	+			+			+	0
Aeroglyphidae																					
Glycycometus geniculatus Vitzthum	+	+				+	+	+		+	+	+	+					+	+	+	12

*They could not be identified to species level as they were immature or fragmented condition.

H: House

Table 1. Continued...

House Dust Mite Species	H-1	H-2	H-3	H-4	H-5	H-6	H-7	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15	H-16	H-17	H-18	H-19	H-20	Total
Echimyopodidae																					
Blomia tropicalis Bronswijk (Bronswijk, Cock & Oshima)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
B. kulagini Zachvatkin		+		+			+		+										+		5
B. tijiboda Oudemans	+			+		+	+														4
B. freemani Hughes	+																+				2
Ascidae																					
Proctolaelaps sp. *			+												+					+	3
Lasioseius americanus Chant	+	+							+												3
L. mcgregori Chant							+									+					2
Phytoseiidae																					
Amblyseius longispinosus Evans *																		+	+		2
A. indicus Narayanan and Kaur *			+																		1
Ameroseiidae																					
Kleemannia plumosus Oudemans	+			+	+												+			+	5
Typhlodromus sp.																		+			1
Tydeidae																					
Pronematus mcgregori Baker							+	+					+	+							4
Tydeus sp.*						+						+	+								3
Stigmaeidae																					
Cheylostigmaeus sp.	+								+												2
Mediolata serrata Podder, Saha and Gupta																			+		1
M. simplex Wood			+	+			+	+	+				+					+	+		8
Cheyletidae																					
Cheyletus malaccensis Oudemans	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20

*They could not be identified to species level as they were immature or fragmented condition.

H: House

Table 1. Continued...

House Dust Mite Species	H-1	H-2	H-3	H-4	H-5	H-6	H-7	H-8	H-9	H-10	H-11	H-12	H-13	H-14	H-15	H-16	H-17	H-18	H-19	H-20	Total
C. trouessearti Oudemans		+	+		+			+	+						+			+	+		8
C. carnifex (Zachvatkin)		+														+	+	+		+	5
Chelacaropsis moorei Baker					+		+			+	+			+	+				+	+	8
C. neomoorei Podder, Saha and Gupta							+														1
Acaropsis sollers Kuzin								+	+												2
Eucheyletia sp.*			+							+								+			3
Grallacheles indicus Podder, Gupta and Saha															+	+					2
Grallacheles bakeri De Leon			+													+		+	+		4
Tormbiculidae																					
Trombicula sp*		+			+														+	+	4
Tarosonemidae																					
Fungitarsonemus sp.*	+							+	+												3
Tarsonemus kolkataensis Podder, Gupta and Saha					+									+	+						3
Tarsonemus granarius Lindquist	+				+							+					+			+	4
Alycidae																					
Pachygnathus sp *				+	+				+				+				+				5
Raphignathidae																					
Raphignathus broomicus Podder, Gupta and Saha *sp. inq.*											+										1
Total Number of species	**22**	**19**	**16**	**20**	**21**	**11**	**20**	**19**	**20**	**12**	**13**	**15**	**15**	**15**	**16**	**13**	**16**	**18**	**21**	**21**	

*They could not be identified to species level as they were immature or fragmented condition.

H: House

Table 2. Number and % of positive house along with average densities of house dust mites per gram dust.

Species name	No. (% of positive house)	No. of mites/g. dust per house (Avg. ± S.D.)
Suidaseiidae		
Suidasia nesbitti Hughes	8 (40)	5.15 ± 6.54
Suidasia medanensis Oudemans	8 (40)	4.15 ± 4.34
Acaridae		
Tyrophagus putrescentiae (Schrank)	11 (55)	13.3 ± 12.46
Tyrophagus longior (Geravis)	12 (60)	15.15 ± 12.93
Tyroborus lini Oudemans	3 (15)	2.5 ± 6.11
Acarus gracilis Hughes	12 (60)	25.1 ± 21.39
Acarus siro Linnaeus	9 (45)	8.35 ± 10.21
Neoacotyledon rhizoglyphoides (Zachvatkin)	12 (60)	20.2 ± 17.65
Lardoglyphidae		
Lardoglyphus zacheri Oudemans	7 (35)	4.35 ± 6.34
Pyroglyphidae		
Hirstia domicola Fain	11 (55)	10.85 ± 10.19
Euroglyphus maynei Cooreman	14 (70)	14.05 ± 10.11
Dermatophagoides farina Hughes	14 (70)	157.15 ± 118.06
D. pteronyssinus Trouessart	20 (100)	673.35 ± 63.95
Sturnophagoides sp.*	2 (10)	0.7 ± 2.17
Pyroglyphus sp.*	3 (15)	0.8 ± 2.01
Glycyphagidae		
Glycyphagus ornatus Kramer	5 (25)	4.7 ± 8.43
Glycyphagus sp.*	4 (20)	1.5 ± 3.15
Lepidoglyphus destructor (Schrank)	10 (50)	19.05 ± 20.40
Echimyopodidae		
Blomia tropicalis (Bronswijk, Cock and Oshima)	20 (100)	415.05 ± 162.73
B. kulagini Zachvatkin	5 (25)	6.05 ± 11.03
B. tijiboda Oudemans	4 (20)	2.8 ± 5.86
B. freemani Hughes	2 (10)	1.35 ± 4.18
Aeroglyphidae		
Glycycometus geniculatus Vitzthum	12 (60)	117.9 ± 101.71
Ascidae		
Proctolaelaps sp.*	3 (15)	1.3 ± 3.21
Lasioseius americanus Chant	3 (15)	2.2 ± 5.46
L. mcgregori Chant	2 (10)	1.95 ± 6.01
Phytoseiidae		
Amblyseius longispinosus Evans*	2 (10)	1.4 ± 4.35
A. indicus Kaur	1 (5)	0.85 ± 3.80
Ameroseiidae		
Kleemannia plumosus Oudemans	5 (25)	4.8 ± 9.35
Typhlodromus sp.*	1 (5)	0.35 ± 1.56
Tydeidae		
Pronematus mcgregori Baker	4 (20)	2.65 ± 5.66
Tydeus sp.*	3 (15)	1.1±2.73
Stigmaeidae		
Cheylostigmaeus sp.*	2 (10)	1.15 ± 3.54
Mediolata serrata Podder, Saha and Gupta	1 (5)	0.25 ± 1.12
M. simplex Wood	8 (40)	3.6 ± 4.66
Cheyletidae		
Cheyletus malaccensis Oudemans	20 (100)	55.1 ± 48.53
C. trouessearti Oudemans	8 (40)	16.75 ± 23.94
C. carnifex (Zachvatkin)	5 (25)	5.15 ± 9.32
C. eruditus Schrank	5 (25)	2.75 ± 5.14
Chelacaropsis moorei Baker	8 (40)	5.7 ± 7.45

Table 2. Continued...

Species name	No. (% of positive house)	No. of mites/g. dust per house (Avg. ± S.D.)
Cheyletidae		
Chelacaropsis neomoorei Podder, Saha and Gupta	1 (5)	0.35 ± 1.56
Acaropsis sollers Kuzin	2 (10)	0.95 ± 2.96
Eucheyletia sp.*	3 (15)	0.7 ± 1.78
Grallacheles indicus Podder, Gupta and Saha	2 (10)	0.5 ± 1.67
Grallacheles bakeri De Leon	4 (20)	1.5 ± 3.17
Tormbiculidae		
Trombicula sp.*	4 (20)	0.6 ± 1.35
Tarosonemidae		
Fungitarsonemus sp.*	3 (15)	0.45 ± 1.23
Tarsonemus kolkataensis Podder, Gupta and Saha	3 (15)	0.35 ± 0.87
Tarsonemus granarius Lindquist	4 (20)	1.25 ± 3.11
Alycidae		
Pachygnathus sp.*	5 (25)	0.35 ± 1.18
Raphignathidae		
Raphignathus broomicus Podder, Gupta and Saha *sp. inq.*	1 (5)	0.2 ± 0.89

*They could not be identified to species level as they were immature or fragmented condition.

The cheyletid mite, *Cheyletus malaccensis*, was the most common and abundant species and had a comparatively higher density (55.1 mites / gm of dust) than other species in this group (Table 2).

Suidasia nesbitti and *S. medanensis* were the only two species of suidasiids that were found in house dust. The average density of both the species was 5.15 ± 6.54 and 4.15 ± 4.34, respectively.

Other mites identified from this study were from Ascidae, Phytoseiidae, Ameroseiidae, Tydeidae, Stigmaeidae, Trombiculidae, Tarsonemidae, Alycidae and Raphignathidae. Among these, the lardoglyphid, aeroglyphid, alycid, trombiculid and raphignathid contain only one mite species each (Table 2).

Among these 51 species, the mites marked with asterix, could not be identified to species level as they were immature or fragmented condition (Table 1).

Also two plant mite species identified in the current study; *Amblyseius indicus* and *A. longispinosus*. The occurrence of these species in house dust was probably accidental.

The species diversity, evenness and richness of house dust mites in twelve months were expressed by values of Shannon H', Shannon Hmax, and Shannon J indices (Table 2). The results indicated that the trends of maximum diversity and richness were found in November, while minimum was in April. In case of evenness, the maximum was in May and minimum in February. This may be due to the possibly changes in the temperature and the humidity (Table 3).

DISCUSSION

The allergen producing mites *Dermatophagoides pteronyssinus, D. farinae, Glycycometus geniculatus, Blomia tropicalis, Acarus siro, Glycyphagus domesticus, Euroglyphus mayenei, Tyrophagus putrescentiae* are found in dwellings around the world (Kronqrist et al., 2000; Arlian, 2002; Solarz et al., 2004; Szilman et al., 2006; Yadav et al., 2006). These mite species have also been found in the different houses of the present study.

Several studies on the house dust mite fauna have been conducted in different parts of the country upto now and reported varying number of different species of dust mites in the country. Gupta and Datta (1975) isolated 12 species of mites from 6 districts of West Bengal. Dixit and Mehta (1973) observed 7 species of mites from Madhya Pradesh. ChannaBasavanna et al. (1984) recorded 26 species of mites belonging to 6 families and 2 orders from Bangalore. Kumar et al. (1988) identified 27 species under 21 genera from Punjab. Valandiker and ChannaBasavanna (1992) made faunistic studies of house dust mites in Karnataka and reported 11 species under 8 genera and 6 families. Lakshmi and Haq (1999) reported 17 species under 13 genera from Calicut. In a recent study, Chaudhury et al. (2005) reported 25 mite species from West Bengal. Podder et al. (2005, 2006, 2009) described some new species and new records from house dust of Kolkata, West Bengal. Kumar et al. (2013) described 26 species of house dust mites belonging to 19 genera under 12 families. Gill and Kaur (2014) reported 14 species belonging to 11 genera under 7 families from Punjab.

The present study indicates that the fauna of house dust mites in West Bengal, India, is quite diverse and not only restricted by a few mite species in contrast to the reports available from other parts of the country. In this study, *Amblyseius longispinosus* which is predominantly a plant mite species and has been reported from the house dust on India or in Asia the first time. One possibility is that; this is the accidental appearance in house dust from ornamental plant which was placed in an earthen pot inside the houses. The presence of three mite families (Phytoseiidae, Stigmaeidae and Cheyletidae) that include a number of known predators of other mites is of particular

Table 3: The values of density indices of house dust mites in different months of Kolkata.

Index	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Shannon H' Log Base 10.	0.795	0.752	0.713	0.681	0.786	0.802	0.731	0.866	0.891	0.855	0.865	0.831
Shannon Hmax Log Base 10.	1.505	1.415	1.491	1.531	1.556	1.519	1.462	1.544	1.58	1.519	1.491	1.491
Shannon J'	0.528	0.532	0.478	0.445	0.505	0.528	0.5	0.561	0.564	0.563	0.58	0.557

interest. The result of the present study indicated that the presence of high percentage of predatory mite (*Cheyletus malaccensis*) in the all the houses surveyed may have role to maintain the ecological balance within the niche as they feed on other mites but their numbers are always lower than the other prey mites (Yoshikawa, 1985; Mariana et al*.,* 2000).

Observations on the house dust mite diversity provide information about the variations in the species richness and the evenness shaped by the temperature, humidity and the species interactions. Although the local determinants of the diversity such as competition, predation remained undetermined in the present study, grossly the different habitats influence the richness and the evenness of house dust mites in the different regions of West Bengal.

Dermatophagoides pteronyssinus was the most abundant mite recovered during the study and this species represented an average of 47% of total mites collected from house dust followed by *Blomia tropicalis* (16.6%) in West Bengal. The present study disagrees with the study of Mariana et al. (2000) from Malaysia, who opined that the *B. tropiocalis* is more abundant than *D. pteronyssinus*. This may be due to difference in local climatic factors which are responsible for their population growth (Colloff, 1992).

So, the allergenicity of *Acarus siro*, *Blomia tropicalis*, *Dermatophagoides pteronyssinus*, *D. farinae*, *Lepidoglyphus destructor* and *Tyrophagus putrescentiae* is well studied in West Bengal, India (Podder et al*.,* 2009, 2010a, 2018). However, the allergenicity of other mites is not well studied and characterised. Therefore, it is recommended that the allergenicity of other mites which are reported to be allergenic around the world, isolated from house dust, should be evaluated among the West Bengal population.

This study showed that West Bengal is extremely rich in house dust mite fauna because of ideal temperature and relative humidity are prevailing in this part of the country (Modak et al*.,* 2004; Podder et al., 2009, 2010b). Spieksma (1970), Wharton (1970), Bronswijk and Sinha (1971) and Aykut et al. (2016) also observed that a temperature varying between 18-30^{o}C and RH 75-80% are ideal for the multiplication and growth of house dust mite.

This study showed the occurrence of a very rich assemblage of house dust mite species and also established the prevalence of high populations of allergenic mites in the houses of West Bengal. Undoubtedly, these allergenic mites might play a significant role in the incidence of respiratory problems in West Bengal. However, to generate in-depth information in this regard, there is a need to carry out more studies in different corners of this country.

Authors' contribution

Sanjoy Podder: Conceptualization, project administration, formal analysis, writing - original draft. **Himani Biswas:** Data collection, investigation, formal analysis. **Goutam Kumar Saha:** Supervision, formal analysis, writing - review & editing.

Statement of ethics approval

The authors state that ethical permission is not required for investigation on diversity of the mites and collection of house dusts in India.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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