House dust mites are microscopic organisms, belonging to the largest phylum Arthropoda, class Arachnida and subclass Acari and studied under Acarology. There is a strong association between human beings and dust mites. Dust mites are potential allergens and cause several allergy-related diseases like rhinitis, hay fever, skin rash, and in extreme cases bronchial asthma (Platts-Mills and Weck 1988; Thomas et al. 2010; Calderón et al. 2015). These allergies are mainly caused by inhalation of dead or live mites, their fecal matter or other byproducts (Nadchatram, 2005). During cleaning process or dusting, dust mites and their byproduct together with dust become airborne and inhaled, causing several allergic diseases (Colloff, 2009). Dust mites are cosmopolitan and can survive in several types of habitats and microhabitats (Arlian 2002; Modak et al., 2004; Podder et al., 2010; Sharma et al., 2011). Worldwide several research has been focused on house dust mites which are commonly present in human dwelling places or habitats (Arlian et al. 2002; Modak et al. 2004; Sharma et al. 2011; Jogdand 2012; Gill et al. 2014; Calderón et al. 2015; Damle et al. 2016). However, limited study has been reported from other habitats.

Among different species and genus, *Dermatophagoides pteronyssinus* has been reported foremost potential allergen in house dust (Kern, 1921). Approximately, 1-2% (65-130 million people) of the world population is being affected by house dust allergens (Colloff, 2009; Calderon et al. 2015). However, house dust mites are perennial source of allergen, storage dust mites and flour dust mites are also a potent source of allergen. Der f 1 and Der p 1 dust mite allergens have been reported in flour dust with severe cases of allergic diseases (Barber 1996; Yan, 2008; Suesirisawad, 2015). Species composition and species dominance vary with different habitats, microhabitats, climate, and geographical areas. Therefore study on abundance and species composition of flour or flour dust mite become important to control their harmful effects especially in different geographical location. Several species of dust mites have been reported in wheat flours and wheat dust worldwide (Al-Nasser, 2011; Yan, 2008; Dave et al., 2014; Suesirisawad, 2015). Wheat flour mite is a potential cause of Anaphylaxis, from Singapore two cases of allergy by wheat flour mite has been reported (Yan, 2008). However, very limited work has been reported from flour mill in India (Bansod et al., 2015).

In India there is abundance of flour mills and it is an important business or occupation, flour mill workers spend their more time here, and continuously come in contact with flour dust.
Dhanbad district is known as coal capital of India, there is no work reported on flour mill dust mites or flour mites, so it become important to study prevalence and species composition of dust mites in flour mill dust in Dhanbad district. This research provides an important or preliminary knowledge about population density, species diversity and species dominance of flour dust mites in Dhanbad district which may prove helpful to take prevention and treatment against flour dust mite allergy.

MATERIALS AND METHODS

Site selection and collection of the house dust samples.

Five widely located locations were chosen for sampling in Dhanbad district of Jharkhand, India. It is located at 23°48'0" N and 86°27'0" E on average elevation of 232 m above sea level. From each location, flour mills were randomly selected and marked. The selected flour mill were mainly wheat grain grinding.

Dust samples were collected weekly throughout the year from July 2015 to June 2016 following the method described by Jogdand and Tilak (1987). About 240 samples (5000 mg/sample) were collected manually from the floor of the selected flour mills in autoclaved plastic container. Large particles and fibrous material in the dust were separated by sieving through 300 mesh special brass sieve and examined under stereo microscope and Nikon trinocular research microscope for identification.

Identification of dust mites: Sieved house dust samples were examined same day of collection using stereo microscope as discussed by Tilak and Jogdand (1987). Sample was spread evenly over a Petridis (5.5cm diameter) as a thin layer and examined under stereo microscope. Mites were isolated from the dust sample manually with the help of needle and mounted by using glycerin jelly over a glass slide after clearing by 50% lactic acid. For further identification prepared slide examined under Nikon trinocular research microscope. The isolated mites were identified with the help of reference slides and available literature (Fain 1957; Hughes 1961; Tilak and Jogdand 1987; Colloff, 2009) and were categorized according to their genus during the study.

RESULTS AND DISCUSSION

Flour mill dust samples were rich in dust mites species composition and population. Total eight species belonging to seven genera, five family and three order were identified (Table 1). Identified species were *Dermatophagoïdes pteronyssinus*, *Dermatophagoïdes farinae*, *Austroglycyphagus orientalis*, *Cheyletus eruditus*, *Blomia tropicalis*, *Acarus siro*, *Glycyphagus domesticus*, and *Urodiaspis tecta*. Out of eight species, six species (*Dermatophagoïdes pteronyssinus*, *Dermatophagoïdes farinae*, *Austroglycyphagus orientalis*, *Blomia tropicalis*, *Acarus siro*, *Glycyphagus domesticus*) belongs to the order Astigmata, one species (*Cheyletus eruditus*) belongs to the order Prostigmata and another one species (*Urodiaspis tecta*) belongs to the order Mesostigmata (Table 1). *Dermatophagoïdes pteronyssinus* (49.03%) of family Pyroglyphidae was the most abundant species followed by *Blomia tropicalis* (21.27%) of the family Glycyphagidae, *Acarus siro* (15.51%) of the family Acaridae and *Cheyletus eruditus* (8.32%) species of the family Cheyletidae in collected flour dusts (Table 1 and Fig 1).

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Genus and species</th>
<th>Family</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Dermatophagoïdes pteronyssinus</em></td>
<td>Pyroglyphidae</td>
<td>Astigmata</td>
</tr>
<tr>
<td>2</td>
<td><em>Dermatophagoïdes farinae</em></td>
<td>(50.35%)</td>
<td>(91.66%)</td>
</tr>
<tr>
<td>3</td>
<td><em>Acarus siro</em></td>
<td>Acaridae</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><em>Blomia tropicalis</em></td>
<td>Glycyphagidae</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><em>Glycyphagus domesticus</em></td>
<td>(25.8%)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><em>Austroglycyphagus orientalis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><em>Cheyletus eruditus</em></td>
<td>Cheyletidae</td>
<td>Prostigmata</td>
</tr>
<tr>
<td>8</td>
<td><em>Urodiaspis tecta</em></td>
<td>Dinychidae</td>
<td>Mesostigmata</td>
</tr>
</tbody>
</table>

Table 1: Species diversity of dust mites in flour mill dust.

Fig 1: Percentage composition of in different species in total population.
Family Pyroglyphidae contributes higher in total population density, while family Glycyphagidae contributes higher in species diversity. Astigmata (91.66%) was the major mite order, while Prostigmata (8.32%) and Mesostigmata (0.02%) contributes very less. Family Pyroglyphidae (50.35%) contributes higher percentace of total population followed by Glycyphagidae (25.8%), Acaridae (15.51%), Cheyletidae (8.32%),Dinychidae (0.02%) (Table 1).

*Dermatophagoides pteronyssinus* is globally abundant in house dust (Arlian et al. 2002; Modak et al. 2004; Sharma et al. 2011; Jogdand 2012; Calderón et al. 2015), the present study shows that, *Dermatophagoides pteronyssinus* is also abundant species in flour mill dust of Dhanbad district. *Acarus siro* is known as flour/storage mite and found solely in flour mill dust from Pune (Bansod et al., 2015), while in this study eight species of mites were found in flour mill dust and shows species variation in flour mill dust. Worldwide only few research conducted on flour mill dust, some researcher work on cooking flour and wheat dust and reported *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae* as a most abundant species (Barber 1996; Yan, 2008; Suesirisawad 2015;), however this study also shows the dominance of *Dermatophagoides pteronyssinus* in flour mill dust of Dhanbad district but Dermatophagoides farinae was found in very less number (Fig. 1).

In this study we found that Population density of flour mill dust mites showed monthly variation, round the year, Mean population density ranges from 0.00 to 106.75 mites/g. Population density was higher from July to October, moderate from November to February and lowest from March to April, in May dust mites were not present in the sample and population density become zero. (Fig. 2).

**Fig 2:** Mean Population density of dust mites/g in different month from July 2015 to June 2016

### REFERENCES


