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A STUDY ON THE MITE SPECIES COMPOSITION REPORTED FROM THE FLOUR MILLS IN KASHMIR (INDIA)

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ABSTRACT: In storage services, one can find mites either in stored grain mass or in grain residues. During the present investigation, a total of 120 samples were collected and examined for the presence/absence of mite fauna from March 2017 to February 2018. The samples were collected from the 10 Flour mills, one sample per month from each flour mill. The samples constituted the various materials like organic dust, debris and residues. Out of the 120 samples collected from the 10 flour mills (12 samples from the each mill), 80 (66.67%) samples were infested with mites and 21 mite species were reported. The number of mite-infested samples and the mite populations they contained differed from one Flour mill to another Flour mill as well as varied dramatically between the hotter and cooler months. The most predominant species reported in terms of the number of samples found infested with and the number of specimens obtained was *Acarus siro* followed by *Tyrophagus putrescentiae.*

Keywords: Mites, Flour mills, infested samples, *Acarus siro*, *Tyrophagus putrescentiae.*

INTRODUCTION: Storage mites are important pests of stored products particularly of grains, grain flour and other cereal products (Solomon, 1946). Storage mites are especially certain astigmatic species from the families Acaridae, Glycyphagidae and Chortoglyphidae (Arlian, 1991; Arlian *et al*., 1993; Hughes, 1976). Mites of the genera *Acarus* and *Tyrophagus* of the family Acaridae and *Lepidoglyphus* and *Glycyphagus* of the family Glycyphagidae are most often found in the ecological studies of hay, straw and other vegetable products in farming environments (Arlian, 1991; Fain *et al.*, 1990; Hallas, 1985; Hallas and Gudmundsson, 1985; Hallas and Iversen, 1996; Hughes, 1976). The storage mites are commonly found in different stored food products, in granaries, barns and other farming and occupational environments and also in samples of house dust. The most abundant and most often reported are species *Acarus siro, Acarus farris* and *Tyrophagus putrescentiae* from the family Acardiae, *Lepidoglyphus destructor, Glycyphagus demesticus and Gohieria fusca* from the family Glycyphagidae, and *Chortoglyphus arcuatus* from the family Chortoglyphidae (Arlian, 1991; Arlian *et al*.,

1993; Fain, 1990, Hallas, 1981; Hughes, 1976). In the fungi-infested samples and other stored foods *Tyrophagus putrescentiae* has been found to be more frequent and abundant than other mites (Gill *et al*., 2018; Gill and Paray, 2018). Tyroglyphid mites commonly known as 'Cheese mites' or 'Flour mites' infest most stored products particularly grains, flour and other cereal products, Cheese and dried fruits (Solomon, 1945).

The storage mites are a source of clinically important allergens and cause occupational allergy among farmers, grain storage workers and other agricultural workers. They are also considered as an important occupational hazard for backers, pastry cooks, shopkeepers and some other occupational categories (Arlian *et al*., 1993; Dutkiewicz *et al*., 1988; Hage and Johansson, 1992; Hallas and Gudmundsson, 1985; Hallas *et al*., 1991; Tee, 1994).

Storages mites have their natural habitats in the open field (Fain *et al*., 1990; Hallas and Iversen, 1996; Hughes 1976). This field population is brought with the crops into stores or barns (Hallas and Iversen, 1991). It was found that stored products as grain seeds, flour, straw and hay are a secondary source of exposure of the agricultural workers to allergenic storage mites because there is exposure in the open field and in dwelling (Arlian *et al*., 1993; Hallas and Iversen, 1996).

Considering the fact that mite-infested food has the decreased quality of being nutritious and also serves as a source of multiple allergens that adversely affect the lives of their eaters whether man or livestock. Since mite-infested food can potentially be the persistent source of allergens if food infestation is not prevented and potentially can cost on the health of a person and loss of economy due to seeking a long duration medical treatment, farmers fail to sell such mite-infested food stocks. Therefore, the present study has been undertaken to explore the possible mite taxa found in the Flour mills and therefore being in your food on the dining table.

MATERIALS AND METHODS

The surveys were carried out from March 2017 to February 2018. A total of 120 samples were collected from the 10 Flour mills. The mites were extracted by using the Modified Berlese Funnel method, preserved in 70% ethanol and cleared in 60% lactic acid and were observed under stereomicroscope or light microscope or under both for grouping them into their apparent similar taxonomic entities. For making the permanent slides, the cleared specimens were mounted in Hoyer's Medium (Fain *et al*., 1990) and then observed properly under the microscope for their species-level identification. During the investigation, the mite specimens were observed under the microscope and were identified by using the available taxonomic keys. Only 21 mite species were reported belonging to the 12 genera, 8 families and 3 orders. The monthly based infested samples and mite specimens were identified and grouped into their taxonomic categories. This way a complete record of the infestation and the mite species reported with their specimen count from the Flour mills was kept.

RESULTS AND DISCUSSION

Out of the 120 samples collected and examination, only 80 samples (66.67%) were mite-infested and rest 40 samples (33.33%) were mite-free. Samples were collected from the 10 Flour Mills, one sample per Flour Mill per month from March 2017 to February 2018. The number and percentage of infestation contributed by the different Flour mills (FM1 to FM10) are presented in Column chart 1 and Pie chart 1. A total of 1990 mite specimens were obtained. The number and percentage of mite populations contributed by the different Flour mills (FM1 to FM10) are presented in Column chart 2 and Pie chart 2. Both the number of mite-infested samples as well as the number of mite specimens obtained from them varied dramatically between the Flour mills in the same month and within the same Flour mill in the different months.

The monthly based data pertaining to the level of samples with the mite occurrence/infestation including the mite density revealed that both were the highest during the months from June to September, moderate during the months from March to May and October to November, and the least in December, January and February (Column chart 3 & 4; Pie chart 3 & 4). Mite infestation and population size started to decrease from October past to November and almost dwindled during December, January and February. However, it appears to show a gradual build up past the February until it shows a sharp peak past the May to September. The monthly variation of infestation cum abundance of food samples with mite fauna is clearly in a positive correlation with the ambient surrounding atmospheric temperature variations. The monthly average temperature readings represented as significant values and worked well to decipher the role of temperature in regulating the mite population/multiplication and level of samples infestation (Line chart 1).

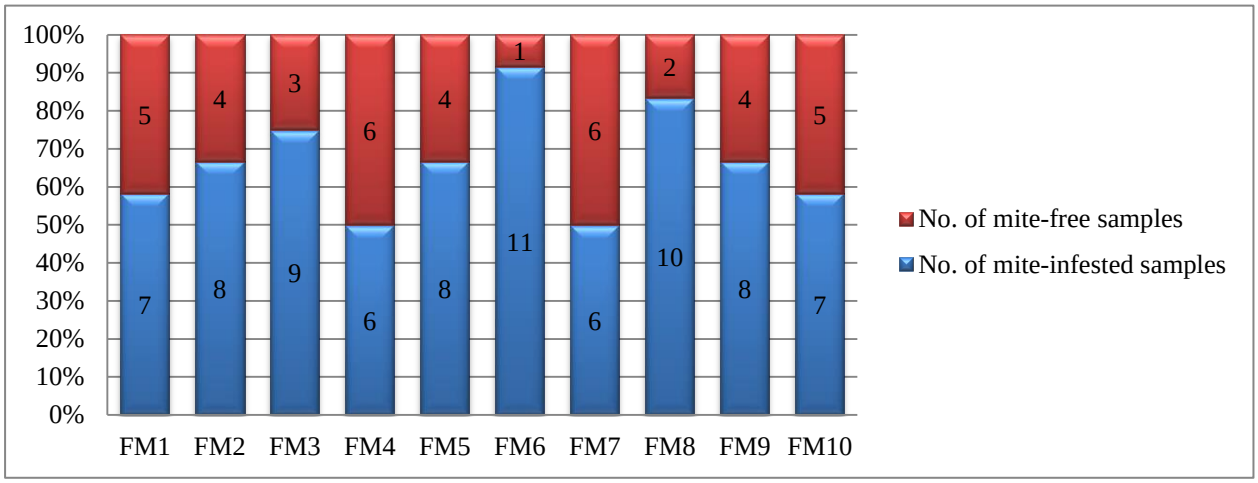
The list of the 21 reported mite species are give as: *Acarus farris, Acarus immobilis, Acarus siro, Caloglyphus berlesei, Caloglyphus hughesi, Caloglyphus mycophagus, Rhizoglyphus robini, Tyreophagus entomophagus, Tyrophagus putrescentiae, Carpoglyphus lactis, Glycyphagus destructor, Glycyphagus domesticus, Glycyphagus ovatus, Dermatophagoides farinae, Suidasia nesbitti, Cheyletus eruditus, Cheyletus malaccensis, Cheyletus aversor, Cheyletus praedabundus, Androlaelaps theseus and Dermanyssus gallinae.*

Most of the mite-infested samples contained specimens of more than one species. The mite species with their level of infestation (in number or %) are presented in Column chart 5 & 6. Similarly, the mite species with their level of population abundance (in number or %) are presented in the Column chart 7 and Pie chart 5. The frequency (%) of the relative occurrence and abundance showed that *Acarus siro* mite to be the most abundant species followed by *Tyrophagus putrescentiae* and then others.

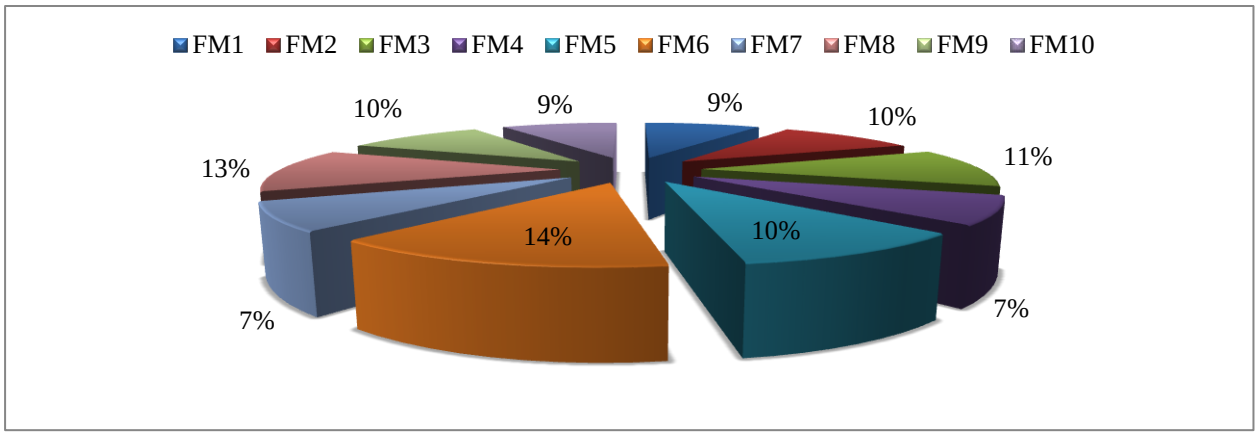
During the present study, the reported species belonged to the 8 mite families, 12 genera and 3 orders. At the taxonomic level of Order, Sarcoptiformes made up the highest portion of the population as well as the infestation, followed by the Trombidiformes and then Mesostigmata members (Column chart 8 and Pie chart 6).

At the family level, the Acaridae family was found to be the most frequent and abundant. The frequency (number & %) of the population of the family Acaridae was the highest followed by the Glycyphagidae, then Cheyletidae and others (Column chart 9 and Pie chart 7).

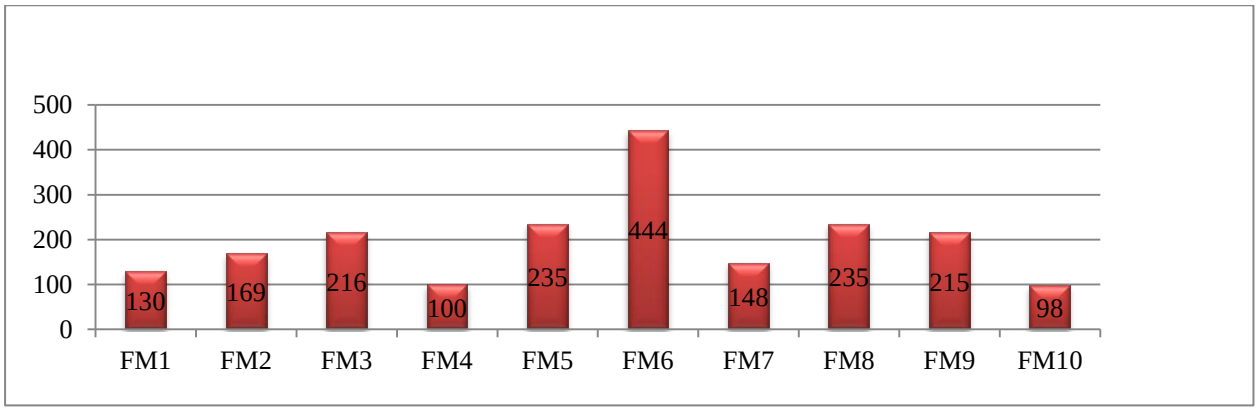
The proportion of occurrence of mite fauna in samples and the degree of their density in them varied from month to month, flour mill to flour mill, species to species, family to mite family, genus to genus and order to order**.**



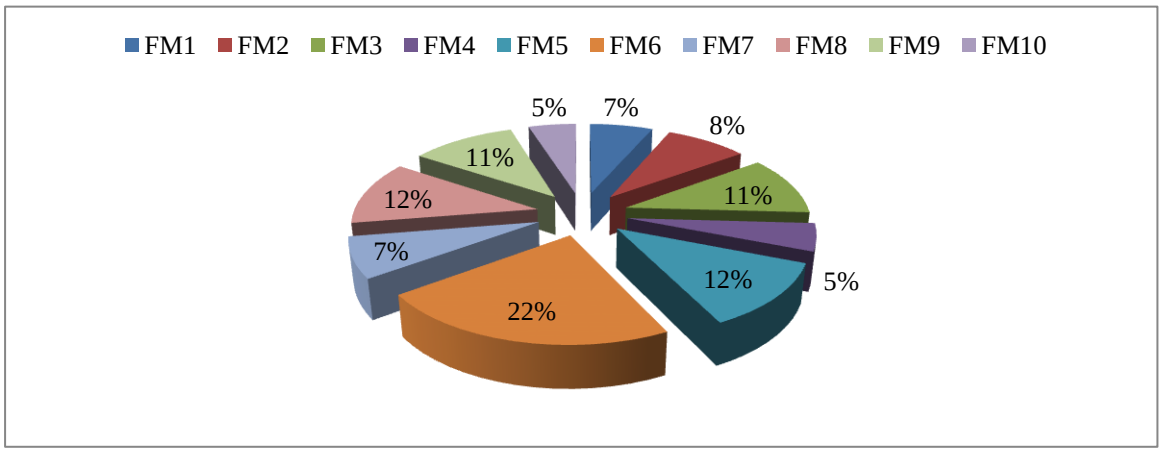
Column chart 1: Showing the number & percentage of mite-infested and mite-free samples obtained from the Flour mills (FM1 to FM10)



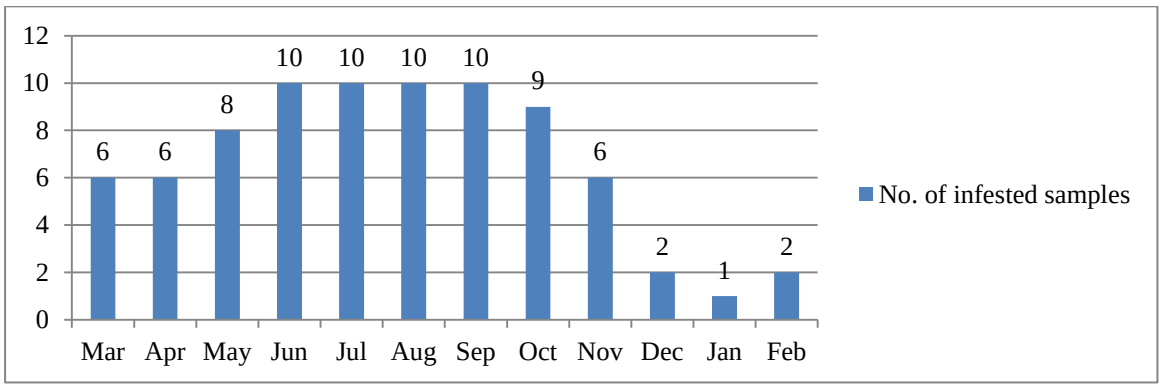
Pie chart 1: **Showing the percentage of infestation contributed by the Flour mills (FM1 to FM10)**



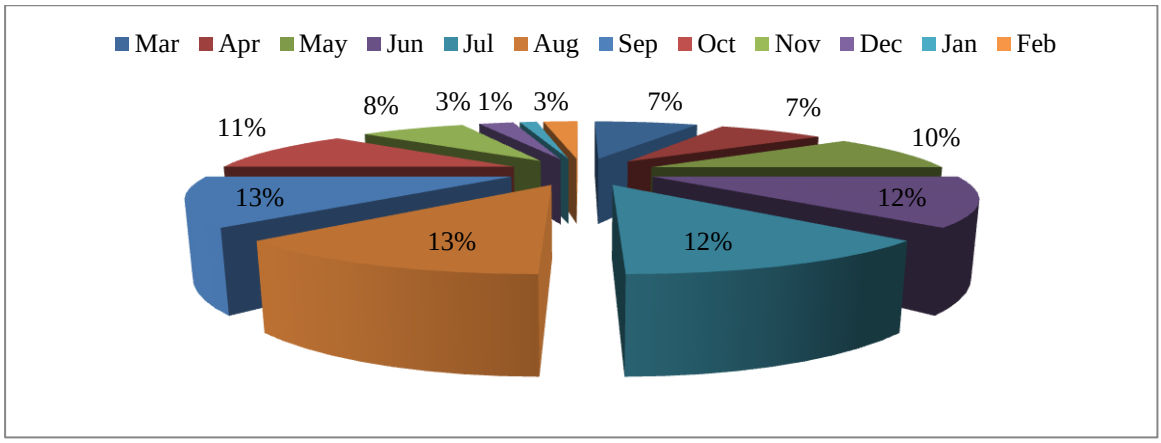
Column chart 2: Showing the number of mite specimens obtained from the Flour mills (FM1 to FM10)



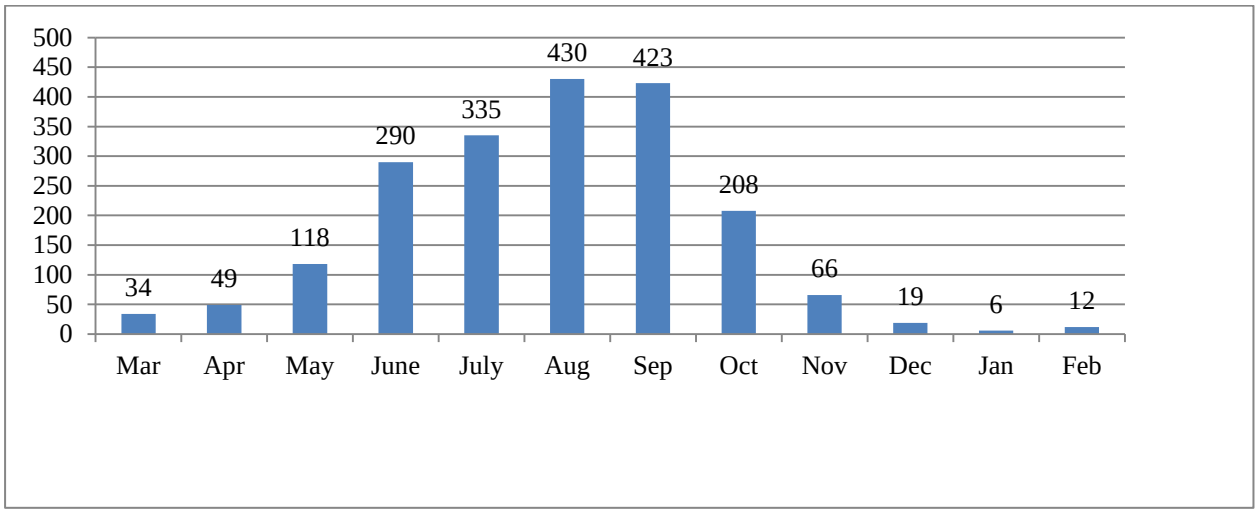
Pie chart 2: **Showing the percentage of mite population contributed by the Flour mills (FM1 to FM10)**



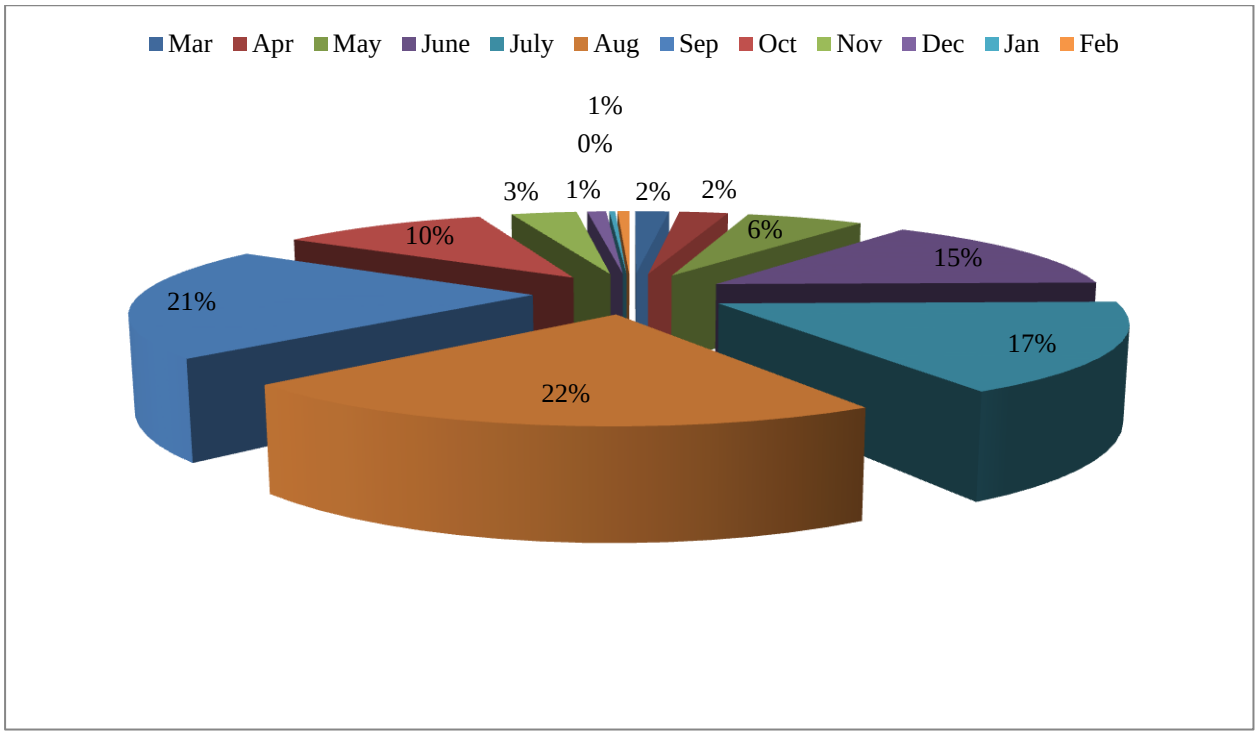
Column chart 3: Showing the monthly number of mite-infested sample obtained



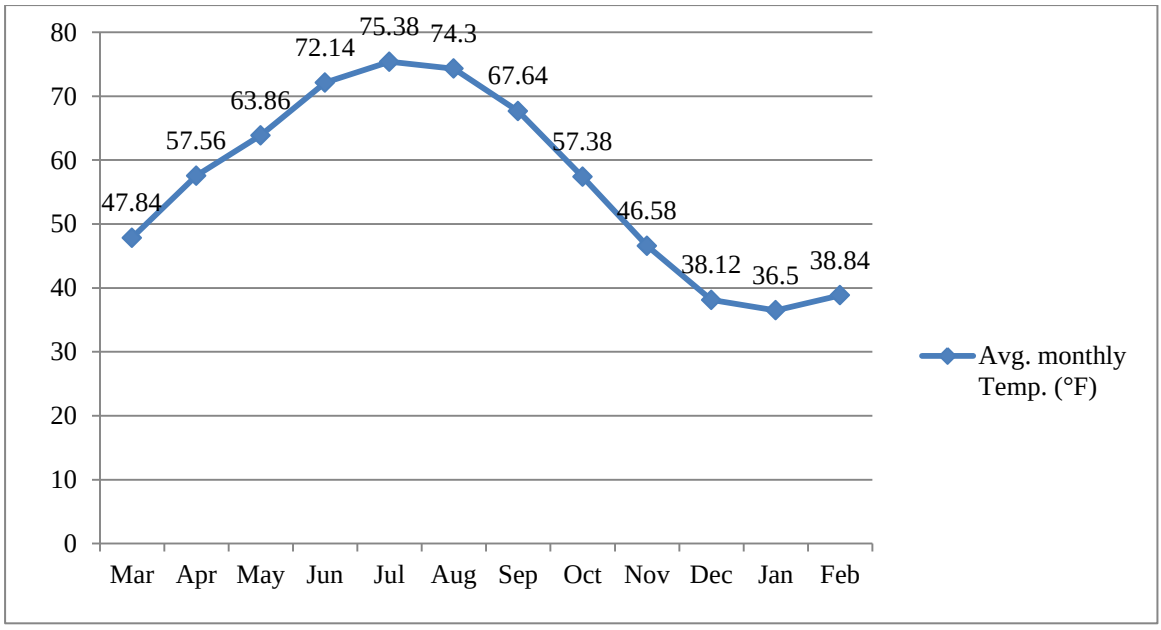
Pie chart 3: **Showing the monthly percentage of mite-infested samples obtained**



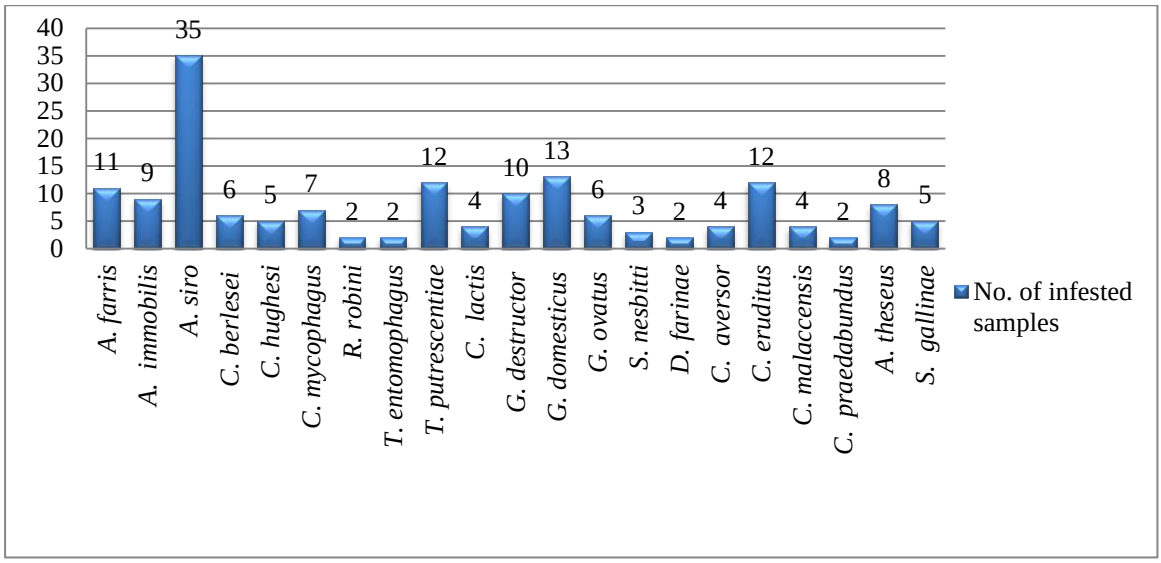
Column chart 4: Showing the monthly number of mite specimens obtained



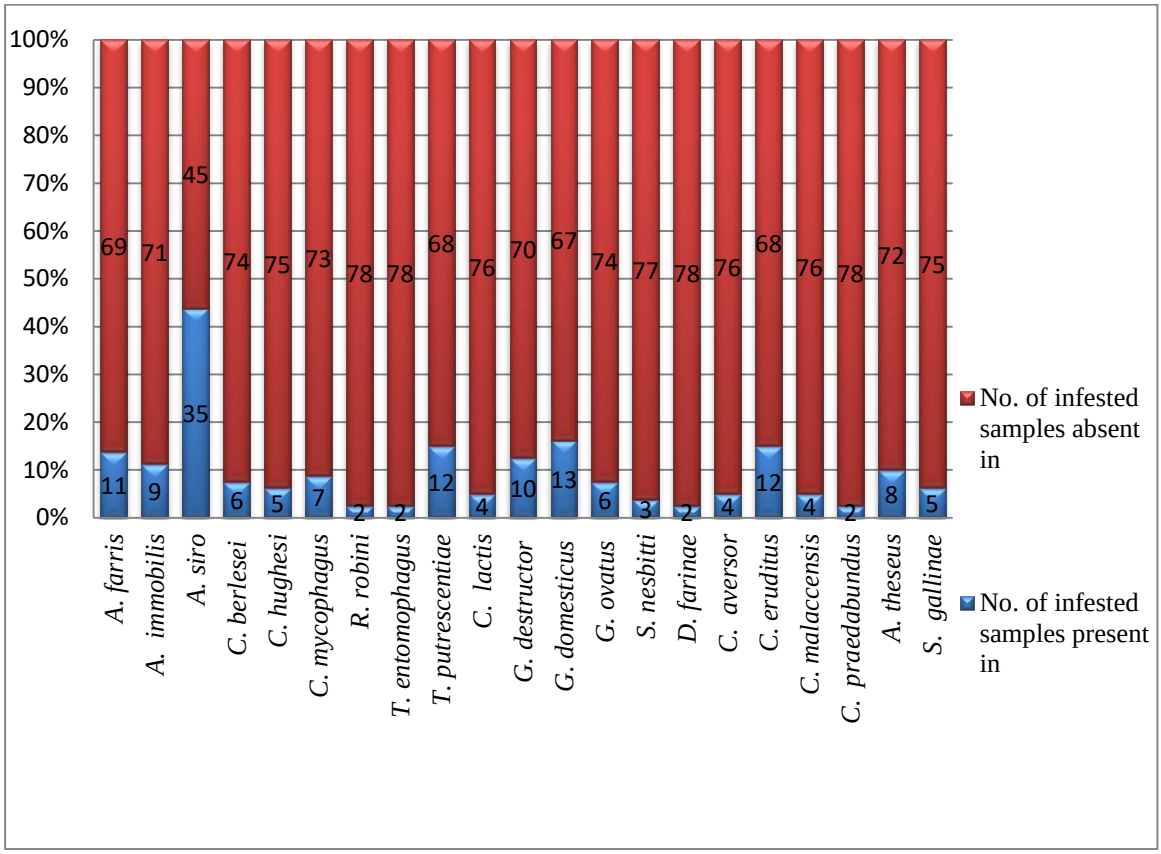
Pie chart 4: **Showing the monthly percentage of mite specimens obtained**



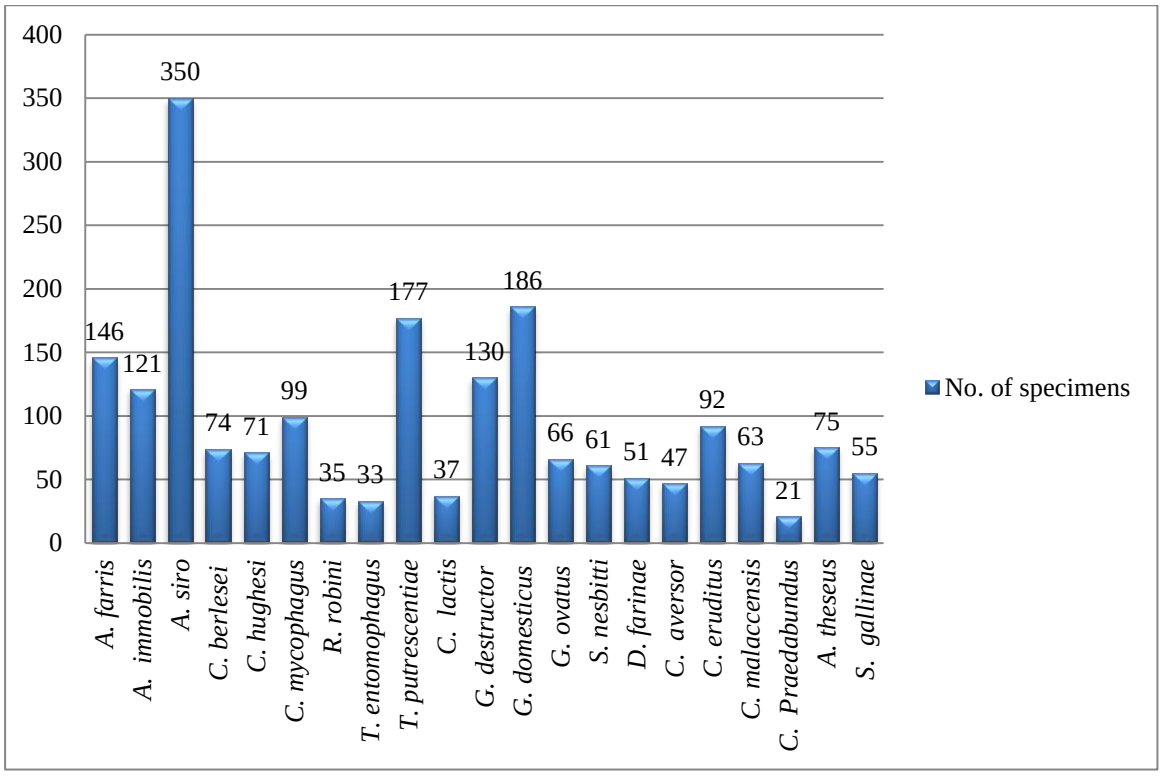
Line chart 1: Showing the monthly Average temperature (°F) from March 2017 to February 2018



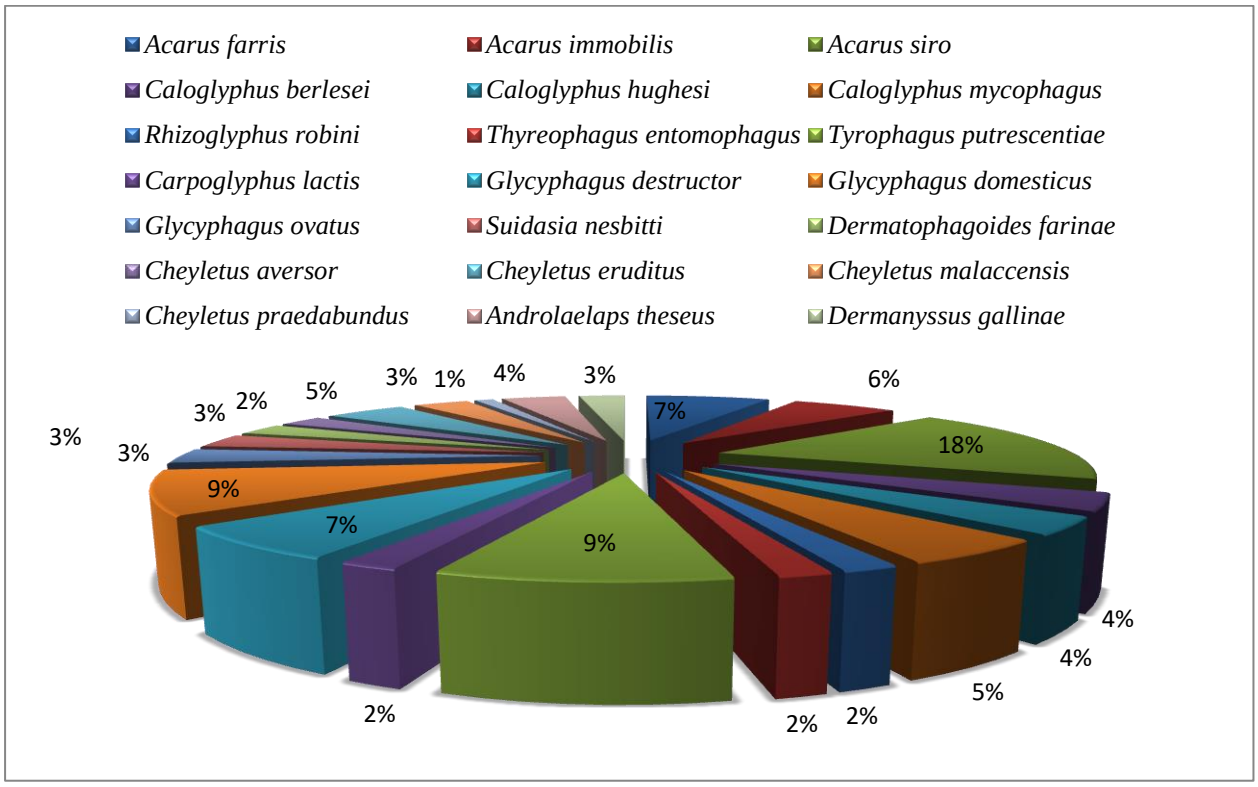
Column chart 5: Showing the mite-wise occurrence in the number of samples



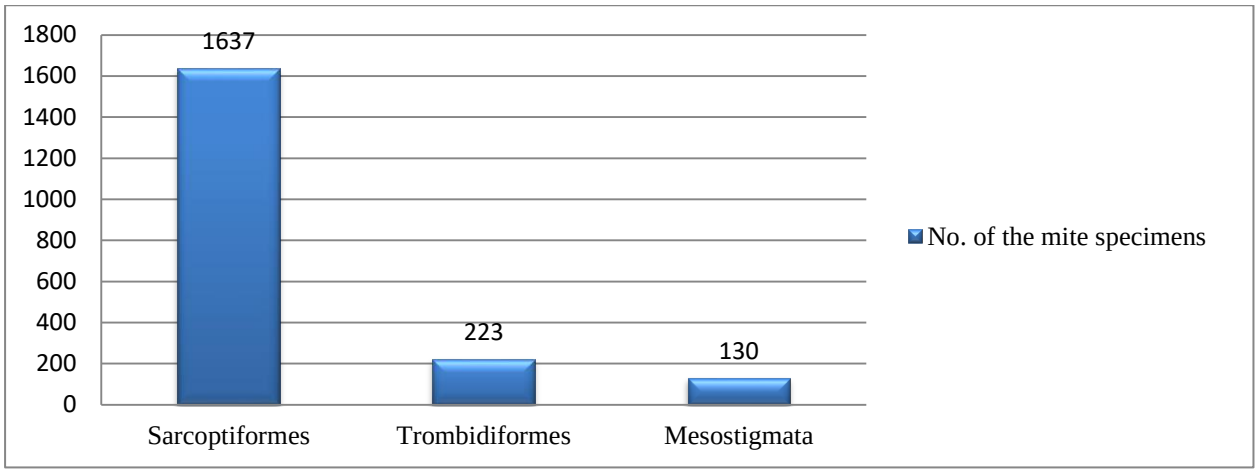
Column chart 6: Showing the number & percentage of the mite presence or absence in the total number of infested samples



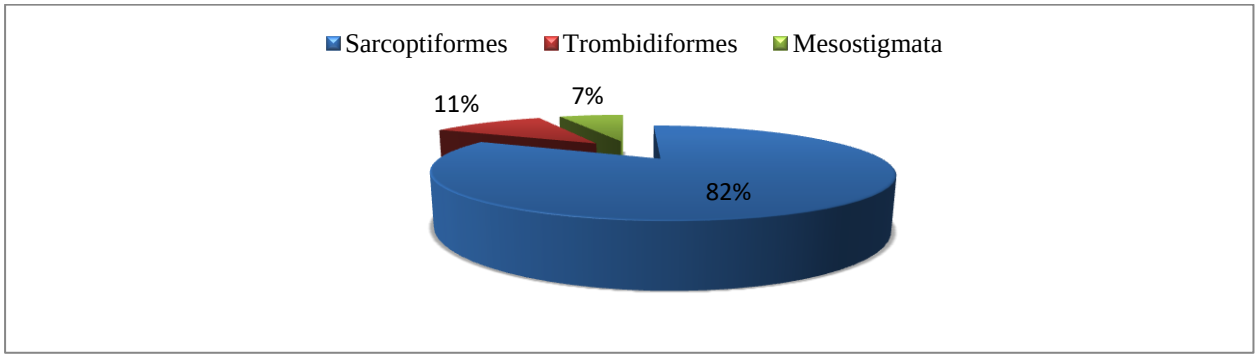
Column chart 7: Showing the mite-wise number of specimens



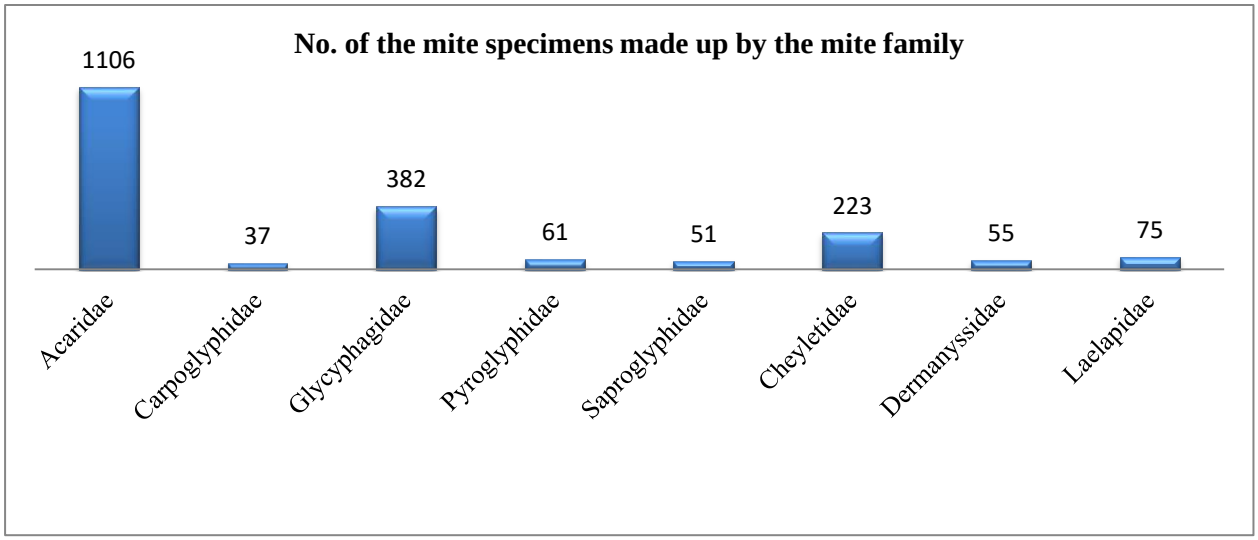
Pie chart 5: Showing the mite-wise population percentage obtained



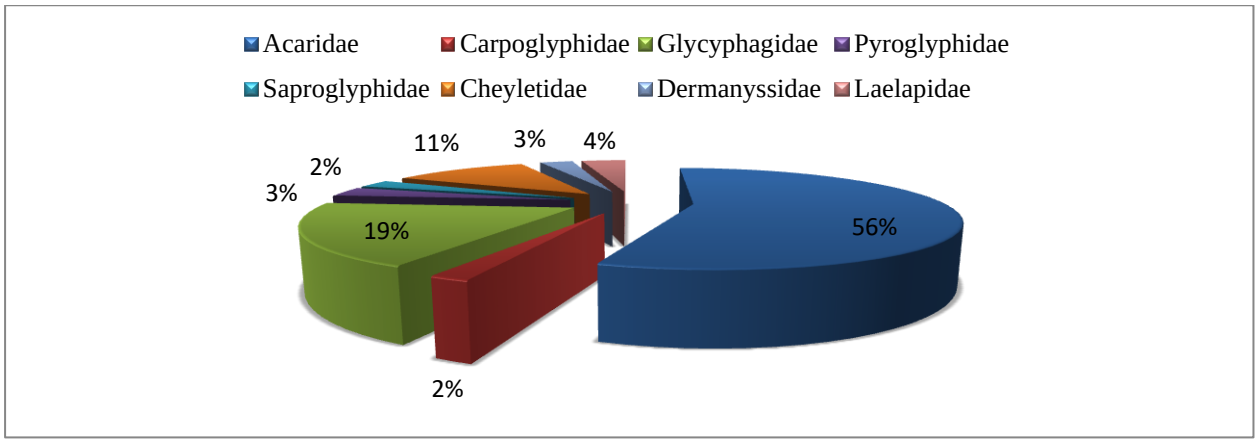
Column chart 8: Showing the number of specimens made up by the mite Orders



Pie chart 6: Showing the percentage of specimens contributed by the mite Orders



Column chart 9: Showing the number of specimens contributed by the mite families



Pie chart 7: Showing the percentage of specimens contributed by the mite families

CONCLUSION

The mite fauna of Kashmir (India) remain untouched so the aim of this study was to analyse the mite fauna of flour mills in Kashmir (India). Extensive surveys were done in 10 flour mills in the valley to explore the mite fauna from March 2017 to February 2018. 21 mite species were reported from three orders. 120 samples were collected from 10 mills (12 each), 66.67 % (80 out of 120) samples were infested with mites. The number of mites obtained from mills varies in different months due to variation in temperature. *Acarus siro* was the predominant species from the samples obtained from 10 flour mills.

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