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MITE species composition from grain stores: a report from Kashmir, India

Mohd. Yousuf Paray* **and Parminder Singh Dehar**
Department of Zoology and Environmental Science, Punjabi University, Patiala-147002, India
usufparayzoo@gmail.com

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Abstract

In storage facilities, mites can be found either in stored food or food residues. In the present investigation, a total of 120 samples were collected and examined for exploring the mite fauna and sampling surveys lasted from March 2017 to February 2018. The samples were collected from the 10 Grain stores, one sample per month from each Grain store. The samples constituted the various materials like organic dust, debris and residues. Out of the 120 samples collected from the 10 Grain stores (12 samples from each Grain Store), 59 (49.17%) samples were infested with mites and 17 mite species were reported. The number of mite-infested samples and the mite populations they contained differed from one Grain store to another Grain store 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, grain stores, infested samples, *Acarus siro*, *Tyrophagus putrescentiae.*

Introduction

Storage mites are pests of stored products particularly of grains, grain flour and other cereal products[1]. Storage mites are particularly some astigmatic species from the families Acaridae, Chortoglyphidae and Glycyphagidae[2-4]. Mites of the genera *Acarus* and *Tyrophagus* of the family Acaridae, and *Lepidoglyphus* and *Glycyphagus* of the family Glycyphagidae are most frequently found in hay, straw and other plant products in farming environments[5-8]. The storage mites are commonly found in different stored foods and their products, in granaries or barns and other farming and occupational environments and in samples of house dust. The most frequent and abundant species reported are: *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[2,3,5,6]. In the fungi-infested samples and other stored foods *Tyrophagus putrescentiae* has been found to be more frequent and abundant than other stored food mites[9-11]. Tyroglyphid mites infest most stored food products such as grain, flour and other cereal products, Cheese and dried fruits[12].

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 Grain stores.

Materials and methods

The surveys were carried out from March 2017 to February 2018. A total of 120 samples were collected from the 10 Grain stores. The mites present in food samples were extracted by employing 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[5] 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 16 mite species were reported belonging to the 10 genera, 6 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 Grain stores was kept.

Results and discussion

Out of the 120 samples collected and examination, only 59 samples (49.17%) were mite-infested and rest 61 samples (50.83%) were mite-free. Samples were collected from the 10 Grain stores, one sample per Grain store per month from March 2017 to February 2018. The number and percentage of infestation contributed by the different Grain stores (GS1 to GS10) are presented in Figure-1 and 2. A total of 1016 mite

specimens were obtained. The number and percentage of mite populations contributed by the different Grain stores (GS1 to GS10) are presented in Figure-3 and 4. Both, the number of mite-infested samples as well as the number of mite specimens obtained from them varied dramatically between the Grain stores in the same month and within the same Grain store 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 (Figures-5,6,7 and 8). 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 (Figure-9).

The list of the 16 reported mite species are give as: *Acarus farris, Acarus immobilis, Acarus siro, Caloglyphus berlesei, Caloglyphus hughesi, Rhizoglyphus robini, Tyreophagus entomophagus, Tyrophagus putrescentiae, Glycyphagus destructor, Glycyphagus domesticus, Glycyphagus ovatus, Dermatophagoides farinae, Suidasia nesbitti, Cheyletus eruditus, Cheyletus malaccensis* and *Androlaelaps theseus.*

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 Figures-10 and 11. Similarly, the mite species with their level of population abundance (in number or %) are presented in the Figures-12 and 13. 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 6 mite families, 10 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 (Figure-14 and 15). At the family level, the Acaridae family members were 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 (Figures-16 and 17).

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

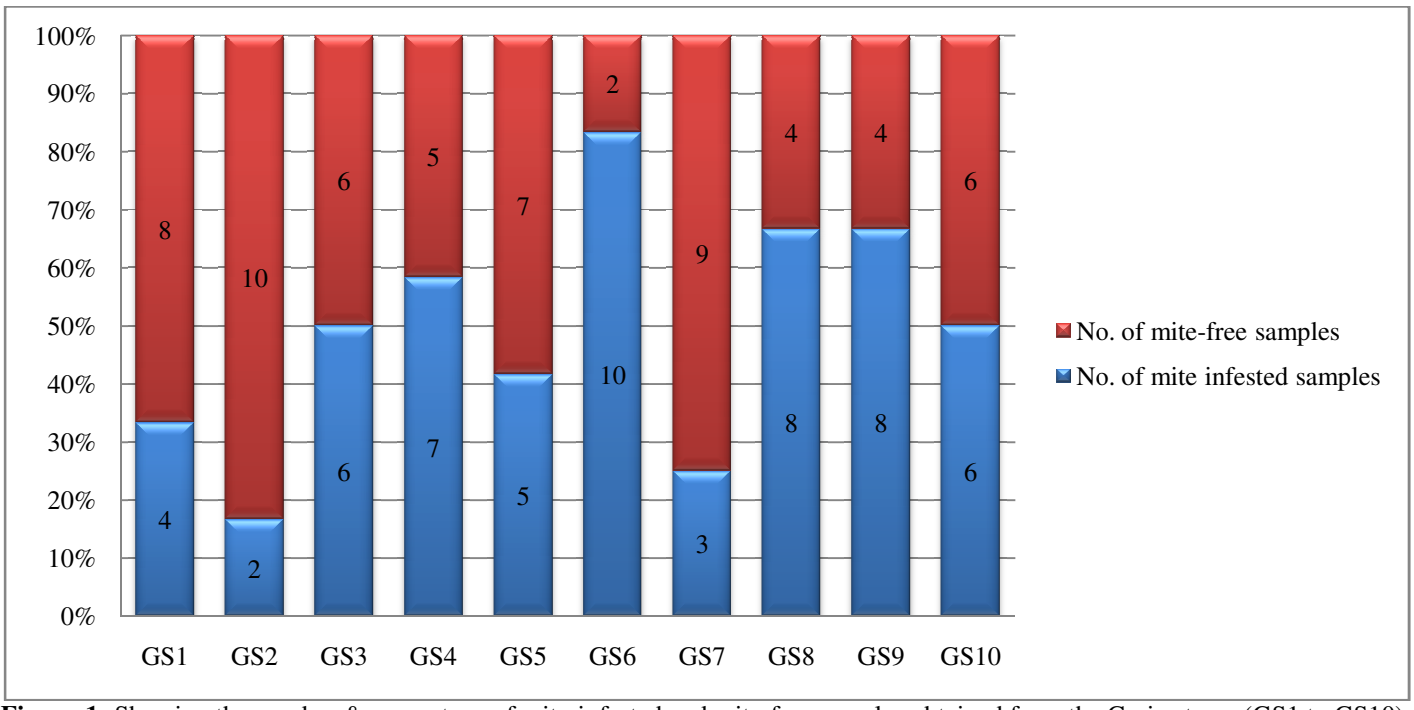

Figure-1: Showing the number & percentage of mite-infested and mite-free samples obtained from the Grain stores (GS1 to GS10).

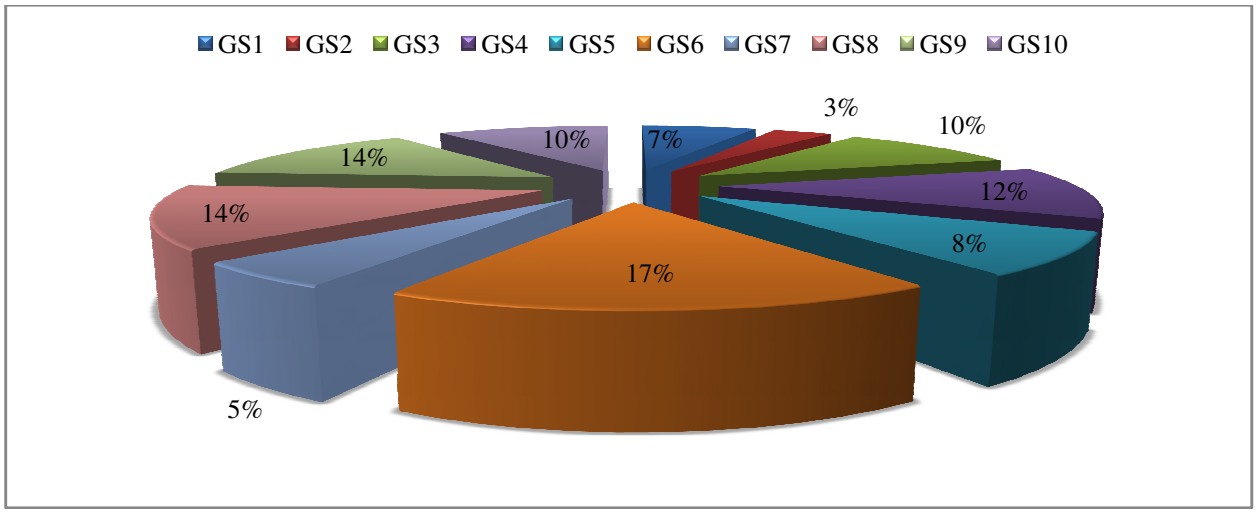

Figure-2: Showing the percentage of infestation contributed by the Grain stores (GS1 to GS10).

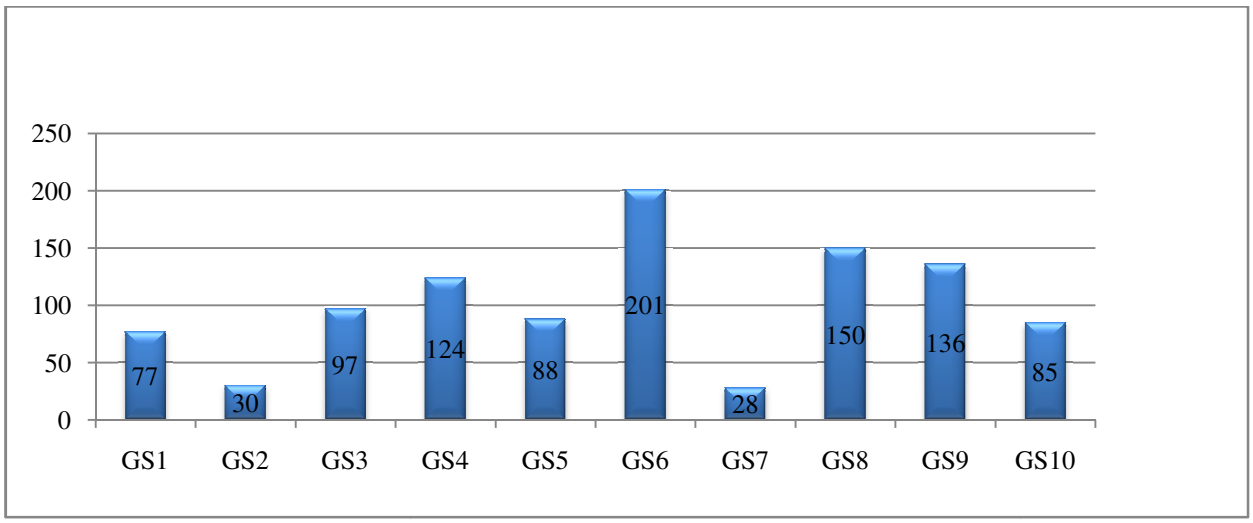

Figure-3: Showing the number of mite specimens obtained from the Grain stores (GS1 to GS10).

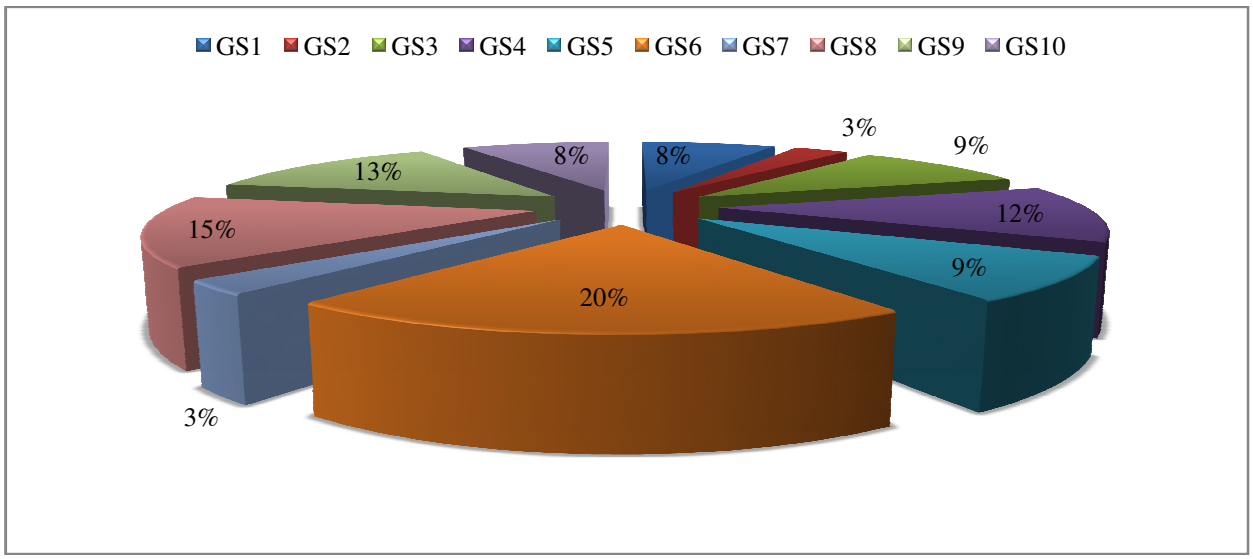

Figure-4: Showing the percentage of mite population contributed by the Grain stores (GS1 to GS10).

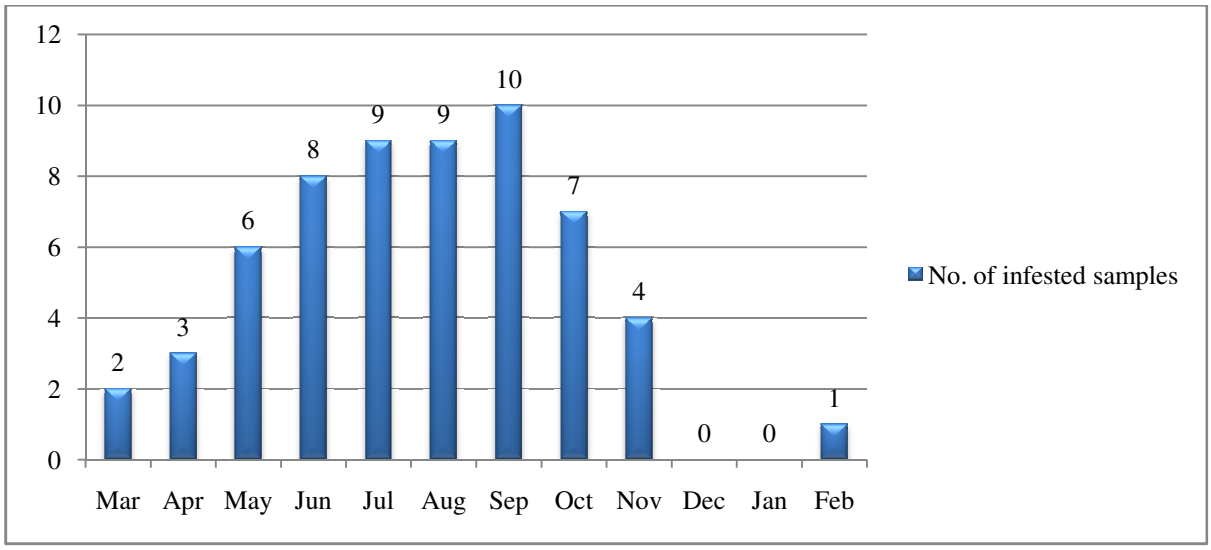

Figure-5: Showing the monthly number of mite-infested sample obtained.

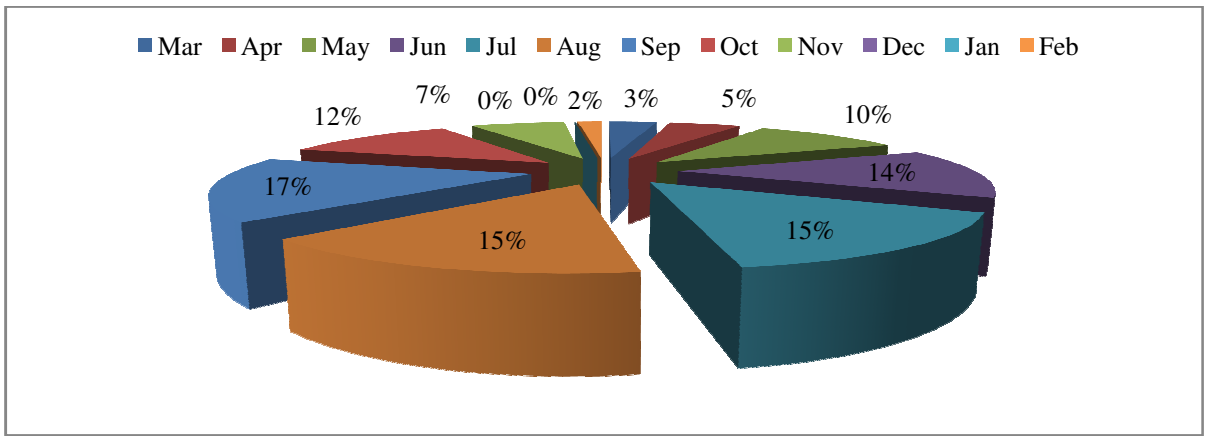

Figure-6: Showing the monthly percentage of mite-infested samples obtained.

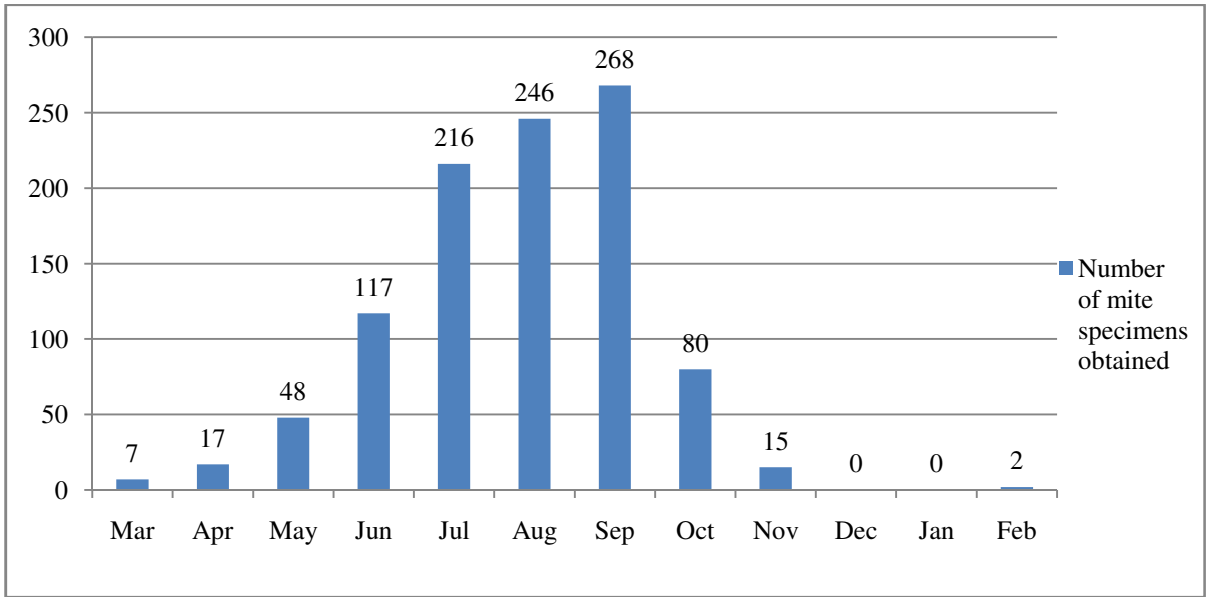

Figure-7: Showing the monthly number of mite specimens obtained.

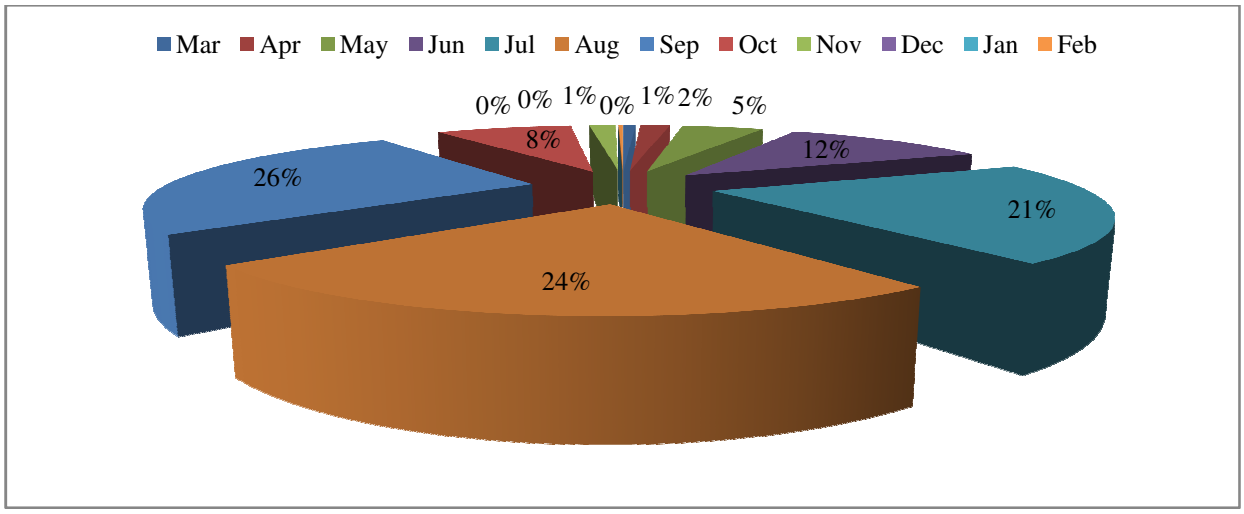

Figure-8: Showing the monthly percentage of mite specimens obtained.

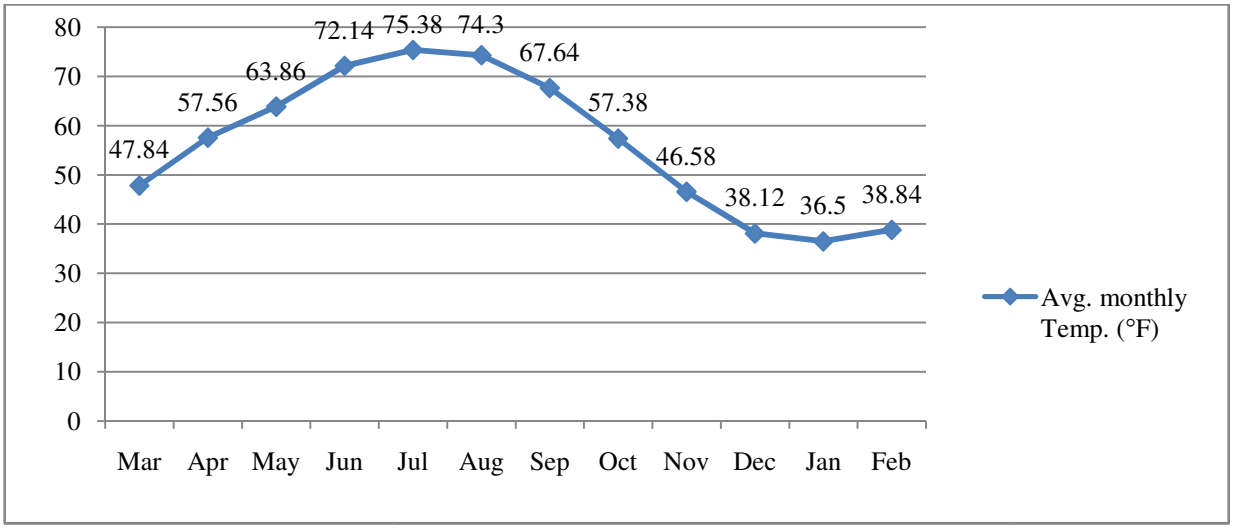

Figure-9: Showing the monthly Average temperature (°F) from March 2010 to February 2011.

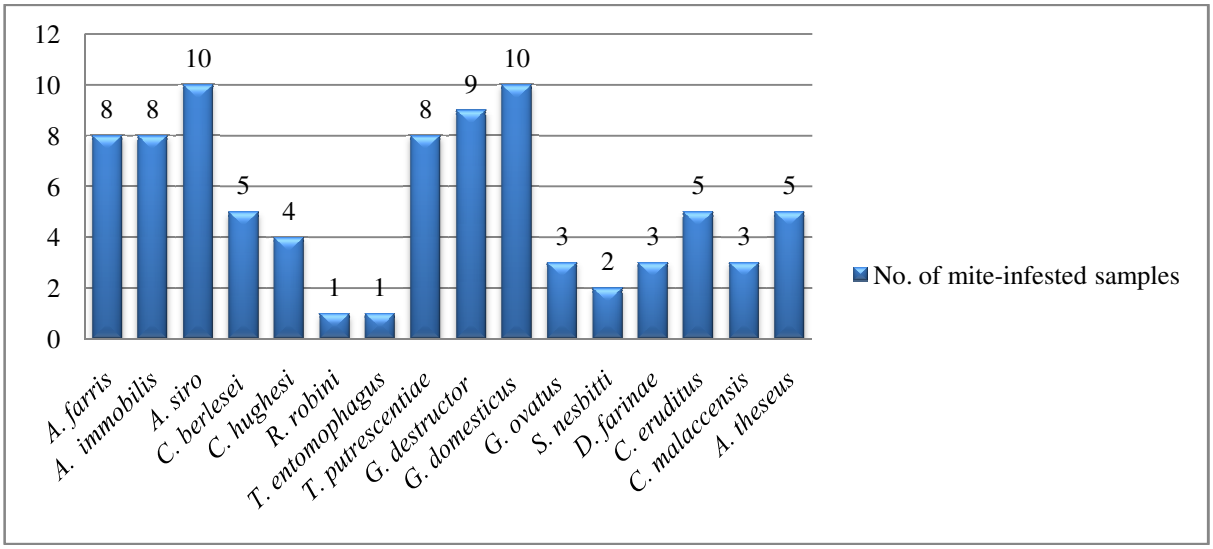

Figure-10: Showing the mite-wise occurrence in the number of samples.

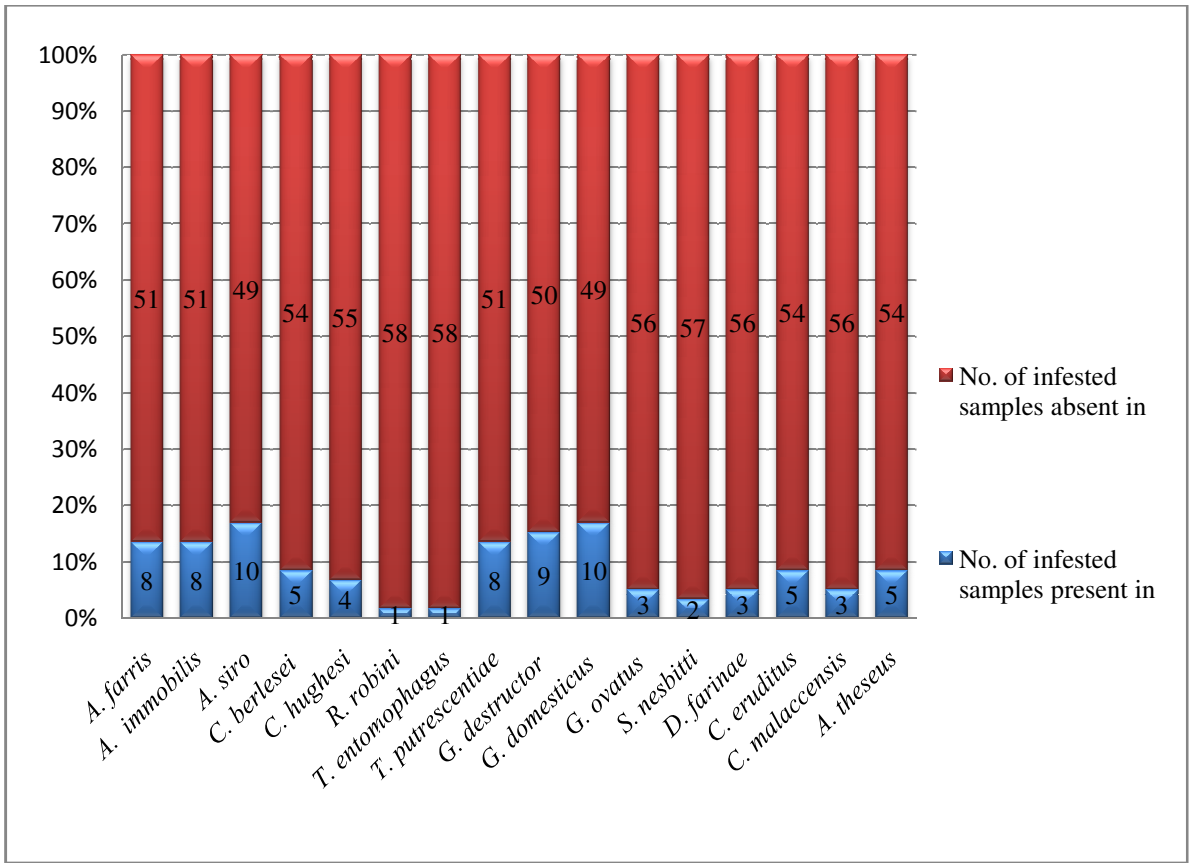

Figure-11: Showing the number & percentage of the mite presence or absence in the total number of infested samples.

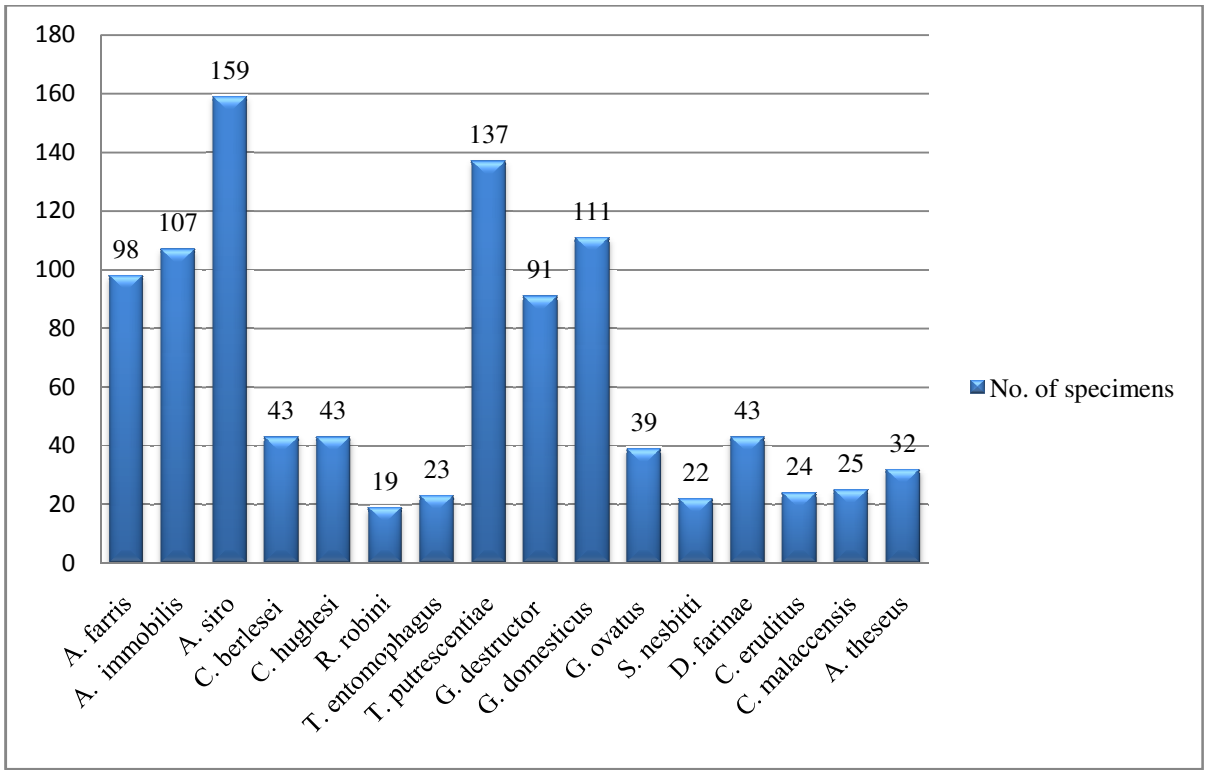

Figure-12: Showing the mite-wise number of specimens.

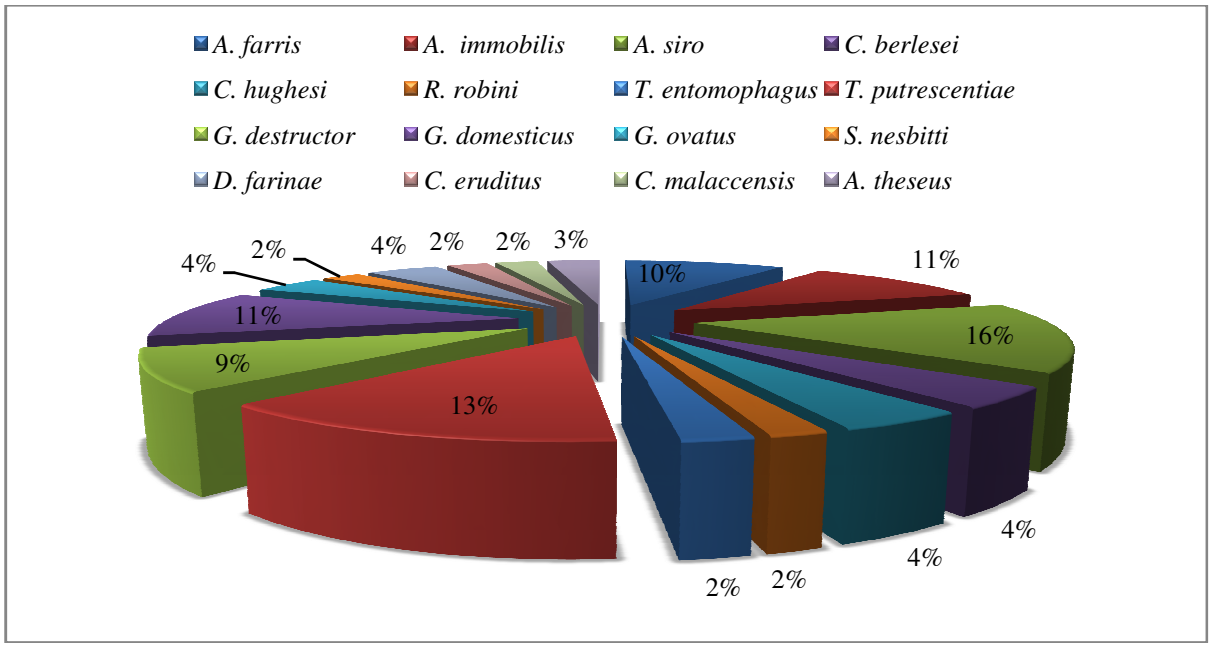

Figure-13: Showing the mite-wise population percentage obtained.

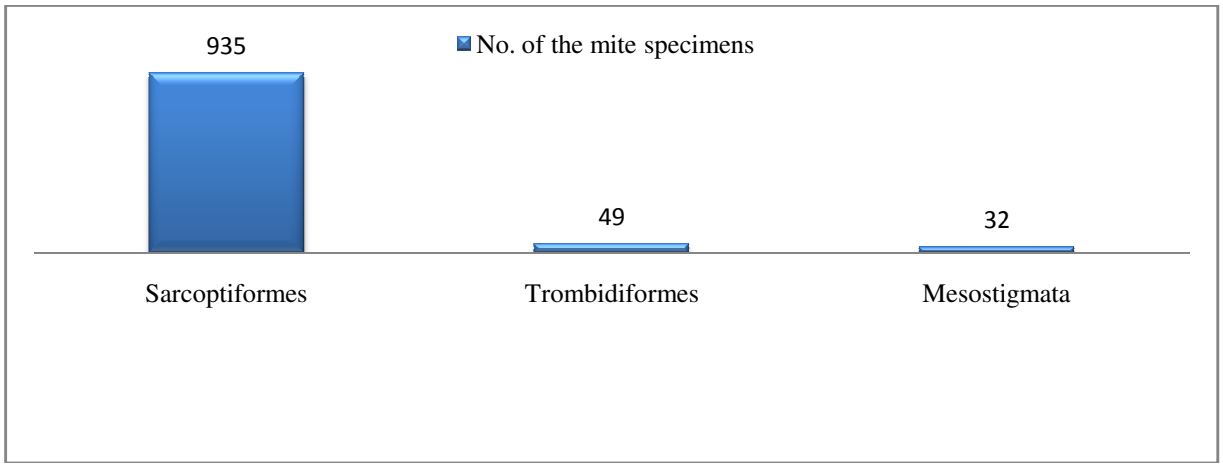

Figure-14: Showing the number of specimens made up by the mite Orders.

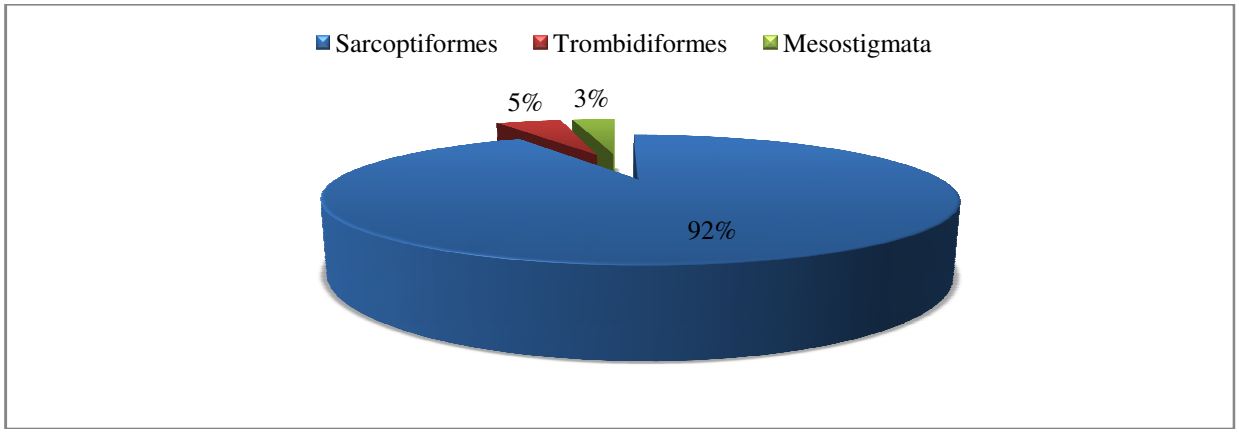

Figure-15: Showing the percentage of specimens contributed by the mite Orders.

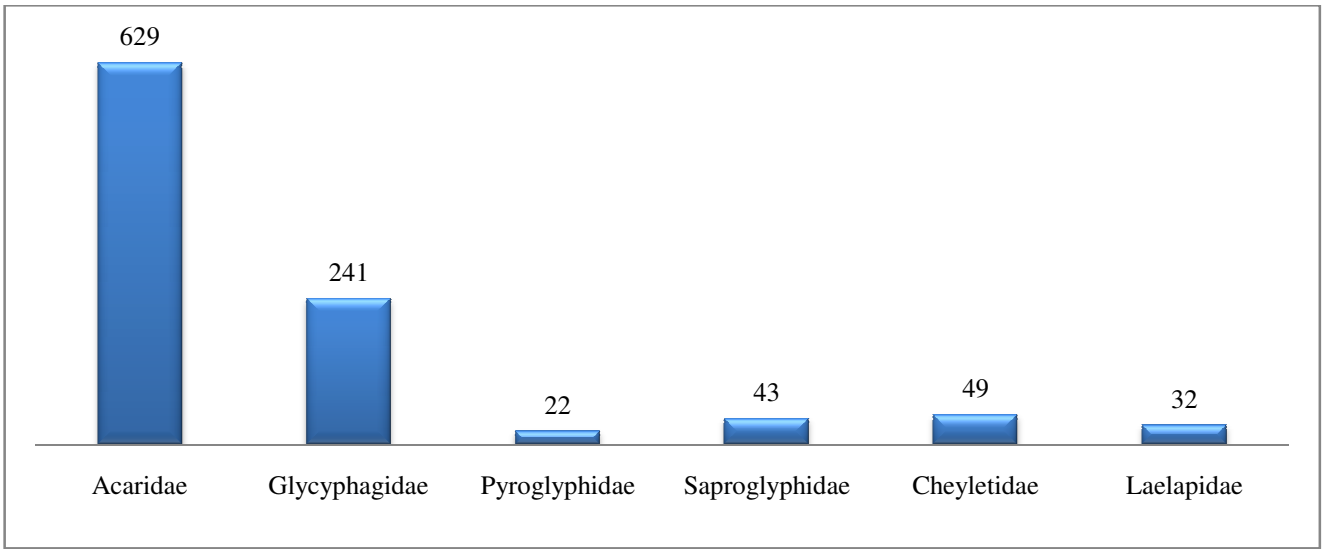

Figure-16: Showing the number of specimens contributed by the mite families.

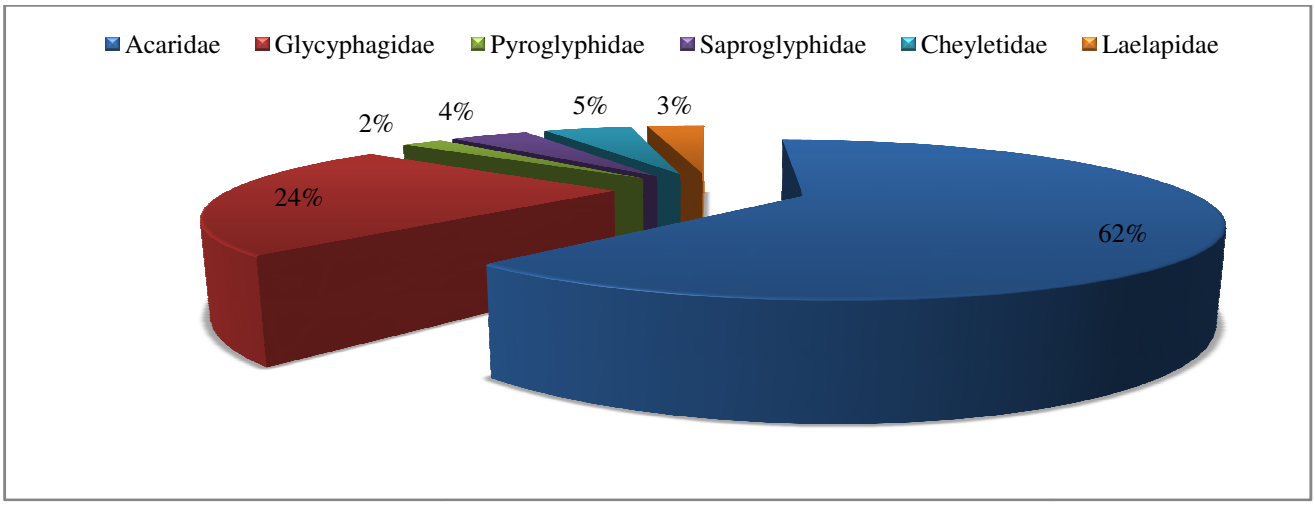

Figure-17: Showing the percentage of specimens contributed by the mite families.

Conclusion

During the 12 months survey of stored mites from the samples of 10 Grain Stores, only 16 mite species under the 6 Families and 3 Orders were reported. The frequency of mite-infested samples not only varied from store to store but also from month to month. Similarly, mite populations also showed the variation from store to store and from month to month. In general, frequency of infested samples and abundance of mite populations were highest during the summer season (May to August) and lowest during the winter (December to February). During the Autumn season (September to November), both infestation and abundance frequencies were lower than summer but higher than the Spring season (March to April). The most frequent and abundant mite species was *Acarus siro*. Similarly, Acaridae was the most frequent and abundant family. Sarcoptiformes made up the highest proportion of mite-infested samples and mite specimens obtained from them.

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