

Cheyletid mites (Acari: trombidiformes: cheyletidae) from stored food products in Punjab: Ecological study

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ABSTRACT

Mites are cosmopolitan in distribution and are reportedly present almost in all the habitats. An enormous number of stored dried fruits, grains and various other stored foods are often infested with various types of mites. 3240 samples from 12 stored food products from 10 districts of Punjab were collected and examined for the mite fauna exploration. A total of 14812 mite specimens were obtained. In this paper, the emphasis is on the data pertaining to the presently reported mite species of the family Cheyletidae. Cheyletids were reported in samples of 12 (100 %) food types. A total of 171 samples (14.01 %) out of the 1220 mite positive samples, were positive for Cheyletid mite specimens. A total of 1499 (10.12%) specimens out of 14812 total specimens, obtained were Cheyletids. Both occurrence and abundance were highest during the rainy season. Similarly, occurrence and abundance were highest during the time period March 2014-February 2015. Cheyletid family was the second most frequent and abundant mite family found in stored food samples after the family Acaridae. Among the Cheyletids, Cheyletus eruditus was the most frequent and abundant species reported.

Keywords: Mite fauna, Cheyletids, Cheyletidae, Cheyletus eruditus, Occurrence, Abundance

1. INTRODUCTION

The mite family Cheyletidae, includes quite 360 predacious and parasitic species in seventy-three genera (Bochkov & Fain, 2001)¹. Predacious species occur on plants, soil and hold on the product, likewise as in vertebrate nests wherever they go after mites or little insects (Volgin, 1988²; Gerson *et al.*, 1999³; Gerson *et al.*, 2003⁴). Cheyletidae are found on fruit trees feeding on herbivorous mites and scale insects, wherever they hide below their armours; in flour mills, granaries and store homes. They sometimes related to hold on product pests; in soil and trash and feeding on insect, *Musca domestica* eggs and larvae and different little soil arthropods (Yousef *et al.* 1982⁵; Zaher, 1986⁶; Hagen *et al.* 1999⁷ and Fouly and Airehiyani, 2011⁸). Some species of Cheyletidae are thought-about parasites inhabiting nests of birds and wasps or in burrows of little mammals (Zaher *et al.*, 1986)⁹. Completely different biological aspects of cheyletid mites are studied by many authors (Wafa *et al.*, 1970¹⁰, 1971¹¹; Cebolla *et al.*, 2009)¹². Due to feeding behaviour, cheyletid mite are used for biological integrated pest management of stored food and while other species are parasitic both men and domestic animals. They all suck up liquid food after piercing tissues with their mouthparts showing peculiar adaptations to this feeding behavior. The main identification characteristics are- In most cheyletid species the gnathosomal apex bears a few short median protuberances, gnathosomal base has not any protrusions, palpal tarsi are small but well visible. In most predaceous cheyletid mites the dorsal setae of the palpal tarsus are comb-like and well developed, solenidion of the genu I is rod-like or globular.

2. MATERIALS AND METHODS

During the present study, stored food and their products samples from different fields/localities, homes, grocery shops and stores, from the 10 districts of Punjab viz. Barnala, Bathinda, Fatehgarh Sahib, Jalandhar, Ludhiana, Mansa, Muktsar, Patiala, Ropar and Sangrur were collected. From March 2014 to February 2017 research was carried out. Total of 3240 samples were collected. The samples were brought to laboratory in ziplocked polythene bags for the examination of mite fauna. A complete record of the date, time and locality of sampling was noted down including the temperature and relative humidity. Stored mites were extracted from the food samples with "Modified Berlese Funnel" (Macfadyen, 1953¹³, 1955¹⁴, 1961¹⁵). The mites were kept in 70% alcohol. For further identification mites were mounted in Hoyer's Medium (Fain *et al.*, 1990)¹⁶.

3. RESULTS AND DISCUSSION

In this research work, specimens of 30 mite species belonging to the 21 genera, 12 families and 3 orders were obtained from the samples of 12 stored foods in Punjab (India) collected from the 10 districts. Out of the 3240 samples collected and examined, 1220 (37.65 %) samples contained 14812 mite specimens

out of which 171 (14.01%) samples of 12 (100%) food types contained 1499 specimens of *Cheyletid mites*. Only 4 mite species belonging to two genera viz. *Cheyletus* (*Cheyletus aversor*, *Cheyletus eruditus* and *Cheyletus malaccensis*) and *Acaropsis* (*Acaropsis docta*) of the family Cheyletidae were reported. The frequency of occurrence and abundance of *Cheyletus aversor*, *Cheyletus eruditus*, *Cheyletus malaccensis* and *Acaropsis docta* was 38 and 324, 89 and 848, 28 and 172 and 16 and 155, respectively. Within the family Cheyletidae, the frequency (%) of occurrence and abundance for the *Acaropsis docta*, *Cheyletus aversor*, *Cheyletus eruditus* and *Cheyletus malaccensis* was 1.31 %, 3.11 %, 7.29%, 2.30 % and 1.04%, 2.19 %, 5.73 %, 1.16 % respectively. The seasonal based distribution of cheyletid mite infested samples showed that 56 samples were infested during the summer season, 92 samples during the rainy season and only 23 samples were cheyletid positive during the winter season.

The seasonal distribution of the frequency of abundance of the cheyletid mites was highest during the rainy season (974 specimens), medium in summer (425 specimens), lowest in winter (100 specimens). The yearly distribution of the frequency of occurrence of the cheyletid mites was highest during the survey period from March 2014-February 2015 (61 infested samples), medium during March 2016-February 2017 (56 infested samples) and lowest during March 2015-February 2016 (54 infested samples). Similarly, the yearly distribution of the frequency of abundance of the cheyletid mites was highest during the survey period from March 2016-February 2017 (577 specimens), medium during March 2014-February 2015 (462 specimens) and lowest during March 2015-February 2016 (460 specimens). The frequencies (Number & %) of seasonal and yearly distribution of occurrence and abundance of Cheyletids are presented in tables- 1 and 2.

The reported members of the Cheyletid mites were obtained from the samples of Almond (9 samples), Black gram (16 samples), Cheese (13 samples), Dal Moong (3 samples), Dalia (24 samples), Maida (10 samples), Maize flour (12 samples), Rice (18 samples), Suji (13 samples), Walnut (6 samples), Wheat (25 samples) and White gram (22 samples). All 12(100 %) food types were found positive for one or other species of cheyletid mites reported.

The number of cheyletid specimens obtained from the Almond, Black gram, Cheese, Dal Moong, Dalia, Maida, Maize flour, Rice, Suji, Walnut, Wheat and White gram were 69, 113, 111, 21, 120, 102, 106, 241, 159, 24, 289 and 144 specimens, respectively. The food-wise seasonal distribution of obtained cheyletid mite positive food samples and their populations are given in Fig. 1 and 3, respectively. Similarly, the food-wise yearly distribution of obtained cheyletid mite positive food samples and their populations are given in Fig. 2 and 4, respectively.

The seasonal and yearly based distribution of the frequency of the number of food samples infested with the Cheyletid mites including the obtained respective mite specimen distribution was recorded during the study. The Cheyletids were most frequent and abundant during the Rainy season followed by Summer and least during the Winter season. Similarly, the Cheyletids were most frequent and abundant during the period March 2016 to February 2017 than they were during the period March 2014- February 2015 or March 2015- February 2016.

Among the cheyletids, *Cheyletus eruditus* was the most frequent and abundant and was reported in 89 samples of 9 (75 %) food types with a total count of 848 specimens. *Cheyletus malaccensis* was present in 28 samples of 4 (33.33 %) food types with a count of 172 specimens and *Cheyletus aversor* was reported in 38 samples of 5 (41.66 %) food types with 324 specimens. *Acaropsis docta* was present in 16 samples of 3 (25 %) food types with a count of 155 specimens. Within the Cheyletids, the relative frequency (%) of infestation/occurrence and abundance of *Acaropsis docta*, *Cheyletus eruditus*, *Cheyletus malaccensis* and *Cheyletus aversor* were 9.36 and 52.05, 16.37 and 22.22, and 10.34 and 56.57 and 11.48 and 21.61, respectively.

The present work investigated Cheyletid mite fauna from the samples of 12 stored foods on the seasonal basis for a period of 36 months (March 2014 to February 2017). The data revealed that only the 3 species of the genus *Cheyletus* and 1 species from *Acaropsis* were reported. The season-wise and year-wise monthly average temperature (maximum) and relative humidity values were used to show/estimate their effect on the frequency of mite infestation and population size. The Seasonal monthly average temperature appears to represent a significant figure/value related to the seasonal frequency changes of occurrence and abundance of the mite fauna. In addition, the seasonal and yearly based frequency changes in occurrence and abundance of the mites in food samples do not appear to be in a direct positive or negative relationship with the atmospheric averaged monthly recorded values of Relative humidity (%). The survey emphasizes the importance of mites in stored food products, and further studies like how to prevent their presence in our daily used stored foods and how to control their population build up once are in the stored foods, is highly desirable.

Table 1- Showing the food-wise total mite positive samples, Cheyletid mite positive samples, frequency (%) of total occurrence/infestation within the food type and frequency (%) of Cheyletid occurrence in the food.

S. No.	Food types examined	No. of mite positive samples	No. of samples with Cheyletids	Frequency (%) of mite-infested food samples	Frequency (%) of Cheyletid occurrence in the food type
1	Almond	55	9	20.4	16.36
2	Black gram	97	16	35.9	16.49
3	Cheese	53	13	19.6	24.53
4	Dal moong	92	3	34.1	3.26
5	Dalia	136	24	50.4	17.65
6	Maida	124	10	45.9	8.06
7	Maize flour	136	12	50.4	8.82
8	Rice	145	18	53.7	12.41
9	Suji	81	13	30.0	16.05
10	Walnut	39	6	14.4	15.38
11	Wheat	162	25	60.0	15.43
12	White Gram	100	22	37.0	22.00
Total	12	1220	171	37.7	14.02

Table 2- Showing the food-wise total of mite specimens obtained, Cheyletid mite specimens, frequency (%) of mite abundance within the food type and frequency (%) of Cheyletid abundance in the food

S.No.	Name of food type	Total mite specimens obtained	No. of Cheyletid mite specimens	Frequency (%) of mite abundance in the food type	Frequency (%) of Cheyletid abundance in the food type
1	Almond	594	69	4.01	11.62
2	Black gram	750	113	5.06	15.07
3	Cheese	688	111	4.64	16.13
4	Dal moong	1025	21	6.92	2.05
5	Dalia	1176	120	7.94	10.20
6	Maida	1540	102	10.40	6.62
7	Maize flour	1937	106	13.08	5.47
8	Rice	2187	241	14.77	11.02
9	Suji	1713	159	11.56	9.28
10	Walnut	368	24	2.48	6.52
11	Wheat	2022	289	13.65	14.29
12	White Gram	812	144	5.48	17.73
Total	12	14812	1499	100.00	10.12

Fig. 1- Showing the food-wise number of Cheyletid infested sampled obtained and seasonal distribution of Cheyletid infested samples

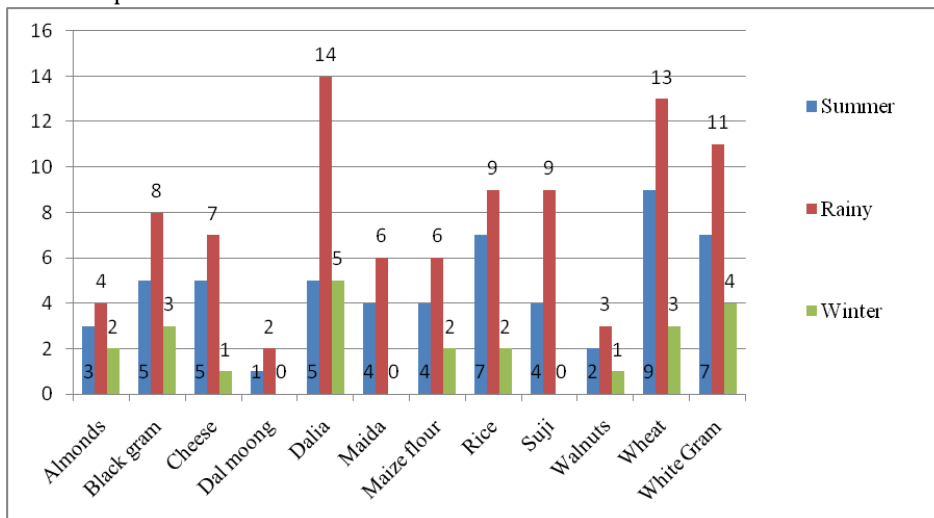


Fig. 2- Showing the food-wise number of Cheyletid infested sampled obtained and the yearly distribution of Cheyletid infested samples

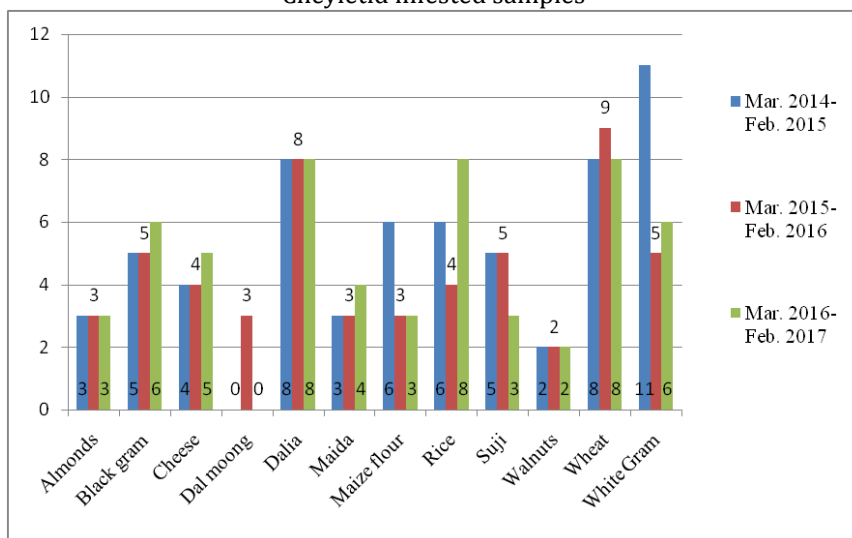


Fig. 3- Showing the food-wise number of Cheyletid specimens obtained and seasonal distribution of Cheyletid specimens

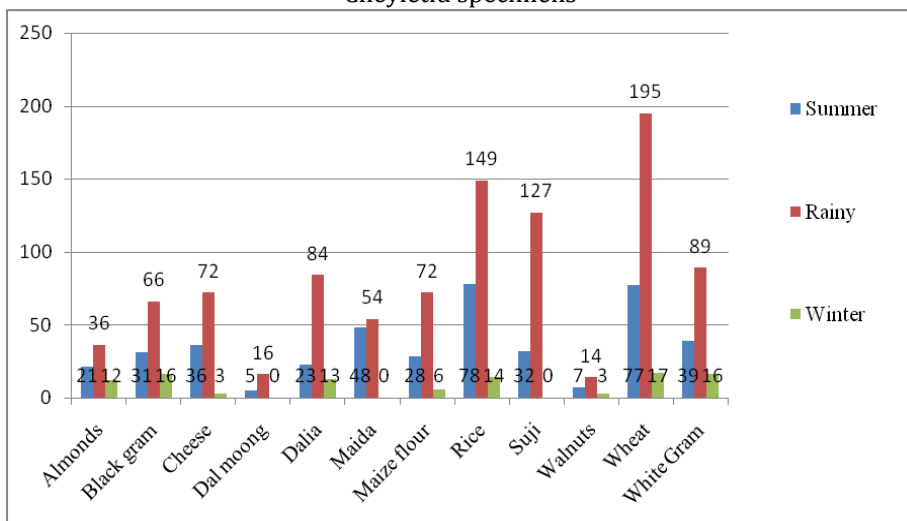


Fig. 4- Showing the food-wise number of Cheyletid specimens obtained and yearly distribution of Cheyletid specimens

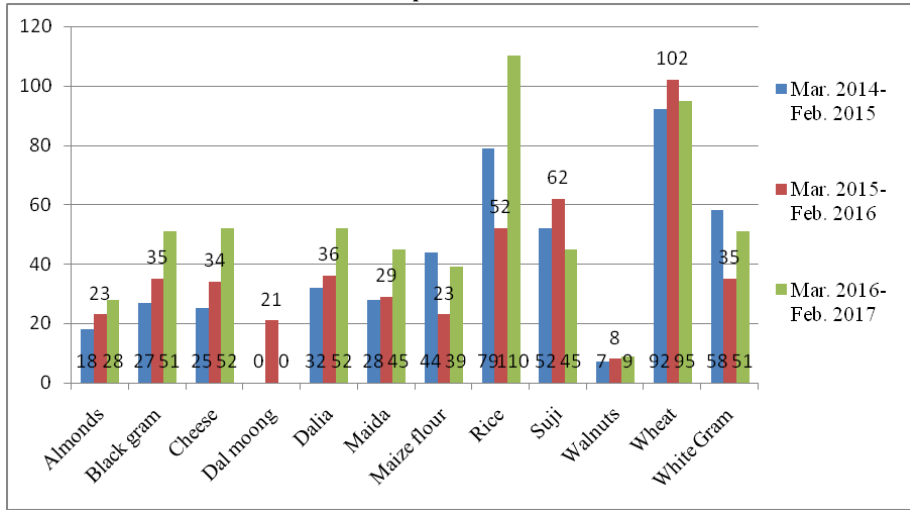


Fig. 5- Showing the Cheyletid mite species with number of samples found in, and frequency of the occurrence within the Cheyletid infested samples (171) and total infestation (1220).

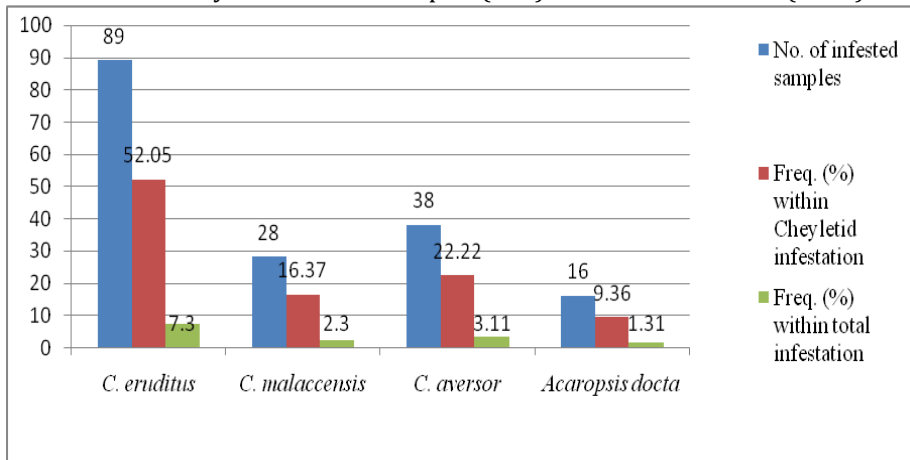


Fig. 6- Showing the Cheyletid mite species with number of specimens, and frequency of the abundance within the Cheyletid specimens (1499) and total mite specimens (14812)

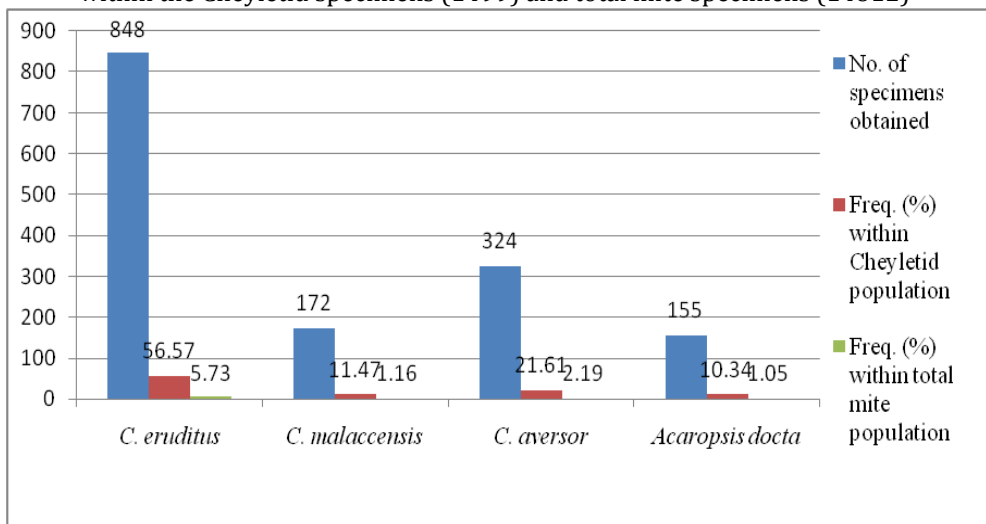


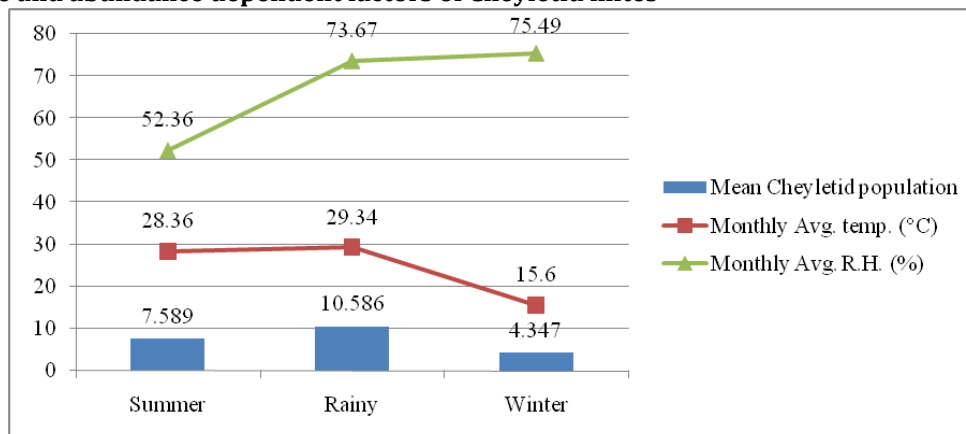
Table 3- Showing total and Cheyletid infested samples, their seasonal distribution, and seasonal frequency (%) of Cheyletid infested samples and their grouping as per Rajeski's proposal

Mite group	No. of infested samples	Seasonal frequency distribution of mite infested samples		
		Summer	Rainy	Winter
All mites	1220 (37.65 %)	395	653	172
Cheyletid	171 (5.27 %)	57	91	23
Cheyletid frequency (%)		14.43	13.93	13.37
Remarks		Eudominant	Eudominant	Eudominant

Table 4- Showing total and Cheyletid specimens obtained, their seasonal distribution, and seasonal frequency (%) of Cheyletid specimens and their grouping as per Rajeski's proposal

Mite group	No. of specimens found	Seasonal frequency distribution of specimens		
		Summer	Rainy	Winter
All mites	14812	4155	9515	1142
Cheyletid	1499	425	974	100
Cheyletid frequency (%)		10.22	10.24	8.75
Remarks		Constant species	Constant species	Accessory species

Fig. 7 Showing the seasonal based independent environmental factor values and frequency (%) of occurrence and abundance dependent factors of Cheyletid mites



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