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Effect of abiotic factors on seasonal incidence of mites on pear trees in Amritsar region

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Abstract
A survey of mites was conducted on pear trees in Amritsar region from February 2018 – November 2019 at three different locations. Three species of phytophagous mites belonging to the family Tetranychidae and Tenuipalpidae and five species of predatory mites of Phytoseiidae, Stigmaeidae and Cunaxidae were recorded from Khalsa College Amritsar, Guru Nanak Dev University and Government garden/nursery (Attari) locations. Among the three locations, maximum mite population was observed at Attari with dominant incidence of Tetranychidae and least of Cunaxidae. The incidence of the mites increases with increase in temperature and was highest during hot dry summer season. Population started decreasing due to rains in monsoon season. However, the mite population was completely absent during cold winter season. The highest peak of mite population was recorded at maximum temperature of 42°C and minimum of 25°C with no rainfall. There was significant positive correlation of mite abundance with temperature and negative correlation with rainfall at all the three locations. The coefficient of determination of all the mites with abiotic factors had significant contribution in regulating the mite population.

Keywords: Abiotic factors, correlation, pear mite, population dynamics, regression

Introduction
Pear is a typical important pome fruit crop of temperate regions and is the fifth most widely produced fruit in the world [29]. India ranks seventh among the major pear producing countries of the world with total area harvested being 44,000 ha and total production of 3,18,000 tonnes of fresh fruit [11]. In Punjab, pear occupies an area of 2,910 hectares with an annual production of 66,811 tonnes of fresh fruit. Its fruits are rich source of protein, vitamins and minerals like calcium, phosphorus and iron [1]. According to [31], the adaptation of different agro-eco systems in agriculture and advance agricultural practices has aggravated the problem of mites. A total of 660 mite species are known to occur on various plants of India, out of which 319 are phytophagous and remaining are predatory in nature [30] and [37, 7]. reported 62 species of phytophagous mites and 56 species of predaceous mites associated with various agricultural and horticultural crops from Punjab. In India, 189 species of Phytoseiidae have been reported so far from different agri horticulture ecosystem [21]. In Himachal Pradesh, twenty-six species of phytoseiid mites associated with phytophagous mites in subtropical and temperate fruits were reported by different workers [34, 24] and [3, 23]. revealed presence of 4 phytophagous, 6 predatory and one phoretic species on pear.
The incidence and development of mites is dependent upon the prevailing physical and biological environmental factors. Therefore, various studies regarding role of various biotic and abiotic factors on population dynamics of mites have been conducted [28], [20] and [10]. Abiotic factors, like temperature, rainfall, humidity, photo-period and wind direction have a great effect on the population density of the pest species [35]. These factors either increase or decrease the developmental time, survival rate and fecundity rate of these species. These climatic factors also play a major role on the biology of mites. In order to evolve effective pest management strategies, the population dynamic studies of pear mites under prevailing agro-climatic conditions of Punjab are essential in view of changing pest scenario of insect and mite pest incidence on improved varieties and hybrids. Regardless of its increasing importance, very little information is available about the influence of weather factors on the seasonal incidence of mites on pear.

Therefore, the present studies on the seasonal incidence of mites and effect of abiotic factors on their incidence was taken up which will help in formulating effective management strategies against mites in pear crop.

Materials and methods

A survey was conducted for two years, i.e. 2018 and 2019 on pear trees in the region of Amritsar district of Punjab Province in the North Indian plains at each location namely Khalsa College Amritsar (KCA), Guru Nanak Dev University (GNDU) and Government garden/nursery (Attari). These areas were selected based on different climatic conditions and were not treated with insecticide and miticides during the period of survey.

For population studies, five trees of pear were selected at random in each orchard and from each tree, twenty-five leaves were sampled at ten days interval from the initiation of foliage from February onwards till defoliation in November during both years. The leaves were cut and placed directly into transparent polythene bags (8"x10" size) and brought to the laboratory for microscopic studies. Samples were observed under stereo zoom microscope (Olympus SZ 70) and mites observed were picked and preserved in mixture of 70% ethanol and glycerine (9:1 v/v). Specimens were mounted in a drop of Hoyer's medium [15]. Slides were dried in hot air oven at 35-40°C. Identification was done under phase contrast microscope (Olympus CX41) up to genus and species level by following the standard keys [14] and [5].

Statistical analysis: Mean and LSD as well as correlation and regression between the population of mites and different abiotic factors was computed by using computer programme Statistix-10.

Results and Discussion

In the Amritsar District of Punjab which is major pear producing district, mites were found on aerial apical parts of pear trees during the period of investigation from February 2018 - November 2019. Three species of phytophagous mites i.e. *Tetranychus urticae* (Koch) and *Eutetranychus orientalis* (Klein) belonging to the family Tetranychidae; *Brevipalpus phoenicis* (Geijskes) of Tenuipalpidae and five species of predatory mites i.e. *Euseius alstoniae* (Gupta), *Euseius finlandicus* (Oudeman) and *Amblyseius largoensis* (Muma) of Phytoseiidae; *Agistemus fleschneri* (Summers) of Stigmaeidae, *Cunaxa setirostris* (Hermann) of Cunaxidae were also recorded along with phytophagous mites at KCA, GNDU and Attari locations.

Effect of abiotic factors on population fluctuation of mites on Pear

Phytophagous mites

Family Tetranychidae

Within this family two species (*Tetranychus urticae* and *Eutetranychus orientalis*) have been observed to cause damage on pear leaves.

Tetranychus urticae

Infestation of *T. urticae* was reported throughout the period of observation. Activity of *T. urticae* started in March 11, 2018 (0.08 mites/leaf) and abruptly increased due to increase in maximum and minimum temperature. The mite population at KCA attained peak activity on June 1, 2018 (1.99 mites/leaf) when maximum and minimum temperature was 42.72°C and 25.03°C respectively and with no rainfall (Figure 1). Maximum population at GNDU was recorded on June 3, 2018 (2.07 mites/leaf) when maximum and minimum temperature was 42.52°C and 25.03°C respectively with no rainfall (Figure 2). The peak in population at Attari was recorded on June 15, 2019 (7.90 mites/leaf) when maximum and minimum temperature was 43.10°C and 25.20°C with no rainfall (Figure 3). The population declined after June 21, 2018 and August 1, 2019 due to rains. Later on, mite population showed decreasing trend and population was not observed after November 21, 2018 as there were no leaves till February 2019. The present study revealed the peak population of *T. urticae* during hot dry summer season on pear at all the three different locations but maximum population was recorded at Attari followed by GNDU and KCA. The correlation coefficients between the incidence of *T. urticae* and the abiotic factors i.e. maximum, minimum and mean temperature and rainfall were worked out. It was observed that temperature had positive correlation with mite population with maximum temperature having highly significant correlation. Similarly, minimum and mean temperature had significant positive correlation whereas rainfall had negative nonsignificant correlation with the mite population (Table 1). In support of our findings, [4] reported the presence of *T. urticae* throughout the year with maximum population from April to June and minimum or negligible during winter and rainy season. They reported the positive correlation between temperature and mite population while rainfall and relative humidity had

Table 1: Correlation coefficients of mites on pear with different abiotic factors during 2018-19 (Pooled)

Name of species	Max. temp.	Min. temp.	Mean. temp.	RF (mm)
KCA				
Tetranychus urticae	0.7748**	0.4393**	0.6275**	-0.2481
Eutetranychus orientalis	0.7430**	0.5570**	0.6757**	-0.0855
Brevipalpus phoenicis	0.5929*	0.5346**	0.5881**	-0.2058
Phytoseiids	0.8372**	0.6439**	0.7702**	-0.1786
Agistemus fleschneri	0.7479**	0.5826**	0.6921**	-0.1122
Cunaxa setirostris	0.4297**	0.5249**	0.5010**	-0.1672
GNDU				
Tetranychus urticae	0.8382**	0.5202**	0.7031**	-0.2035
Eutetranychus orientalis	0.7603**	0.6604**	0.7405**	-0.0732
Brevipalpus phoenicis	0.4958*	0.5747**	0.5613**	-0.1001
Phytoseiids	0.7890**	0.6571**	0.7531**	-0.2475
Agistemus fleschneri	0.7750**	0.5026**	0.6619**	-0.2580
Cunaxa setirostris	0.4565**	0.5671**	0.5375**	-0.2184
Attari				
Tetranychus urticae	0.8237**	0.6210**	0.7510**	-0.0814
Eutetranychus orientalis	0.7489**	0.4824**	0.6370**	-0.1125
Brevipalpus phoenicis	0.5407**	0.6748**	0.6404**	-0.0284
Phytoseiids	0.8165**	0.6474**	0.7624**	-0.0211
Agistemus fleschneri	0.6653**	0.5703**	0.6448**	-0.1578
Cunaxa setirostris	0.3878**	0.4120**	0.4197*	-0.2202

*Significant at p=0.05, **Significant at p=0.01.

negative correlation with mite population. The present results are also supported by various workers who also reported the similar trend of correlation between mite population and abiotic factors [25] and [16]. [19] revealed that maximum temperature had positive correlation with mite population and rainfall had negative correlation with mite population. The coefficient of determination was calculated to measure the contribution of independent variables i.e. maximum

temperature (X_1), minimum temperature (X_2), mean temperature (X_3) and rainfall (X_4) on dependent variables i.e. mite population. The coefficient of determination showed that abiotic factors had 43.75, 80.51, 66.69 percent contribution in regulating the mite population at KCA, GNDU and Attari respectively (Table 2).

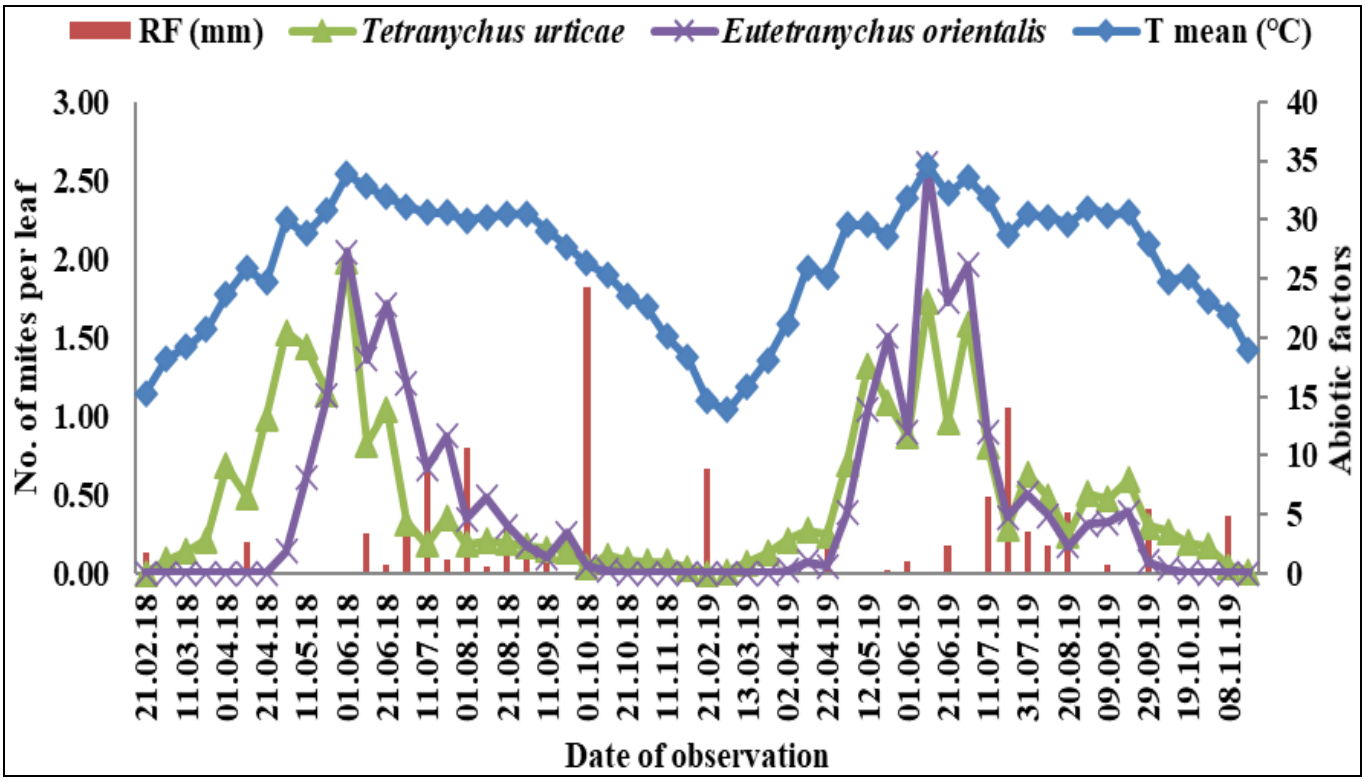

Fig 1: Effect of abiotic factors on mite population of Tetranychidae at KCA during 2018-2019. (T=Temperature, RF=Rainfall)

Eutetranychus orientalis

The study of population dynamics showed that *E. orientalis* mites started appearing on May 1, 2018 at KCA whereas April 3, 2018 onwards at GNDU and Attari. The population showed sudden increase in population with increase in temperature (maximum and minimum). The maximum population density was observed on upper surface leaves. The study of population dynamics showed that *E. orientalis* mites observed peak in population at KCA on June 11, 2018 (2.60 mites/leaf) when maximum, minimum and mean temperature was 43.42°C, 25.84°C and 34.63°C with no rainfall (Figure 1). The mite population at GNDU attain maximum population in the month of June 3 2018 with peak in population (2.74 mites/leaf) when maximum temperature was 42.52°C, minimum temperature 25.54°C and mean temperature 34.03°C with no rainfall (Figure 2). The studies on population fluctuation of this mite at Attari revealed that its population reached a peak on June 15 2019 (2.71 mites per leaf) when maximum (43.10°C), minimum temperature (43.10 °C) and mean temperature (25.20°C) with no rainfall was recorded (Figure 3). After that there was decline in population due to rainy season. The population was not observed during and after November 2018 and 2019. The study showed significant positive correlation of *E. orientalis* population with temperature (maximum, minimum and mean) while rainfall showed insignificant negative correlation with mite population (Table 1). The coefficient of determination (R^2) was 56.35, 61.82 and 60.39 per cent at KCA, GNDU and Attari respectively in contribution for regulating the mite population (Table 2). [9] and [4] reported the population of *E. orientalis* on citrus from March-June and September-October and negligible during rainy and winter months whereas [6] reported the occurrence of *E. orientalis* throughout the year with higher rate of multiplication during warmer months (March-October). They reported the positive correlation between temperature and mite population while rainfall and relative humidity had negative correlation with mite population [6], [9] and [22]. [18] revealed that *E. orientalis* had two peaks in a year and showed positive correlation between mite population and temperature (maximum and minimum) while rainfall and R.H. (maximum and minimum) showed negative correlation with mite population. Our results were also in accordance with [26] and [22], who found two peaks of *E. orientalis* population during summer months. The results were supported by various workers who also supported the similar trend of correlation between mite population and abiotic factors [8]; [12]; [32], [25] and [17]. Same results of correlation between abiotic factors and population of *E. orientalis* were also reported by [2] in Pakistan. In contrast of above findings [35] reported only one peak of *E. orientalis* which was observed during autumn.

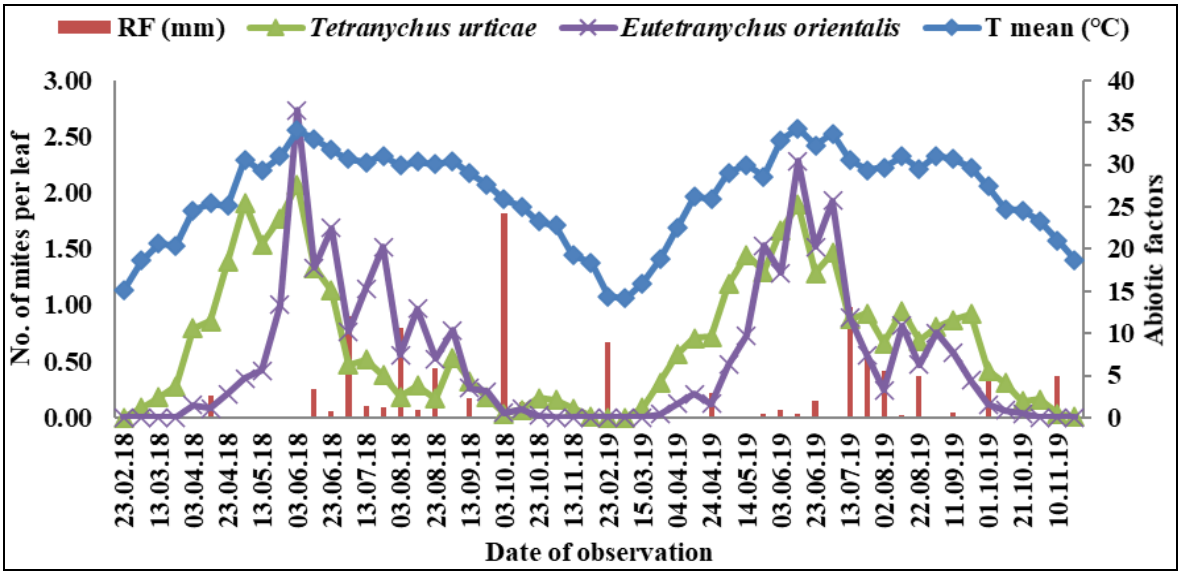

Fig 2: Effect of abiotic factors on mite population of Tetranychidae at GNDU during 2018-2019. (T=Temperature, RF=Rainfall)

Table 2: Regression equation of mites on pear during 2018-19 (Pooled)

Name of species	Regression equation	R^2
KCA		
Tetranychus urticae	$-2.2796+5.1088X_1+4.9431X_2-9.9859X_3-0.0102X_4$	0.7375
Eutetranychus orientalis	$-2.5465-1.9252X_1-2.0468X_2+4.0560X_3-0.0017X_4$	0.5635
Brevipalpus phoenicis	$-0.2684+6.8056X_1+6.8050X_2-13.592X_3-0.0140X_4$	0.4580
Phytoseiids	$-0.5517+0.0072X_1+0.0419X_2-0.0161X_3-0.0089X_4$	0.7229
Agistemus fleschneri	$-0.4416-0.0138X_1+0.0050X_2-0.0038X_3-0.0013X_4$	0.5819
Cunaxa setirostris	$0.1132-0.0093X_1+0.0116X_2-0.0036X_3-0.0033X_4$	0.3725
GNDU		
Tetranychus urticae	$-2.7719+2.0694X_1+1.8819X_2-3.8654X_3-0.0096X_4$	0.8051
Eutetranychus orientalis	$-2.1876-22.979X_1-22.923X_2-45.807X_3-0.0014X_4$	0.6182
Brevipalpus phoenicis	$-0.1164+4.5356X_1+4.5614X_2-9.0763X_3-0.0109X_4$	0.3912
Phytoseiids	$-0.9907+8.8567X_1+8.8301X_2-17.636X_3-0.0214X_4$	0.7005
Agistemus fleschneri	$-0.5598+2.9822X_1+2.9500X_2-5.9136X_3-0.0052X_4$	0.6801
Cunaxa setirostris	$-0.0089+0.8450X_1+0.8547X_2-1.6951X_3-0.0043X_4$	0.4628
Attari		
Tetranychus urticae	$-7.9250+0.1952X_1-0.1870X_2-0.2607X_3-0.0069X_4$	0.6669
Eutetranychus orientalis	$-3.0458+0.0902X_1-0.09239X_2+0.0878X_3+0.0101X_4$	0.6039
Brevipalpus phoenicis	$-0.0563-0.0090X_1+0.0127X_2+0.0082X_3-0.0140X_4$	0.4898
Phytoseiids	$-1.5024+0.0359X_1-0.0334X_2+0.0512X_3+0.0063X_4$	0.6413
Agistemus fleschneri	$-0.4105-0.0053X_1-0.0026X_2+0.0190X_3-0.0184X_4$	0.4493
Cunaxa setirostris	$-0.01804-0.0041X_1+0.0058X_2-0.0043X_3-0.0152X_4$	0.2708

X_1=Maximum temperature, X_2=Minimum temperature, X_3=Mean temperature, R^2=Coefficient of Determination

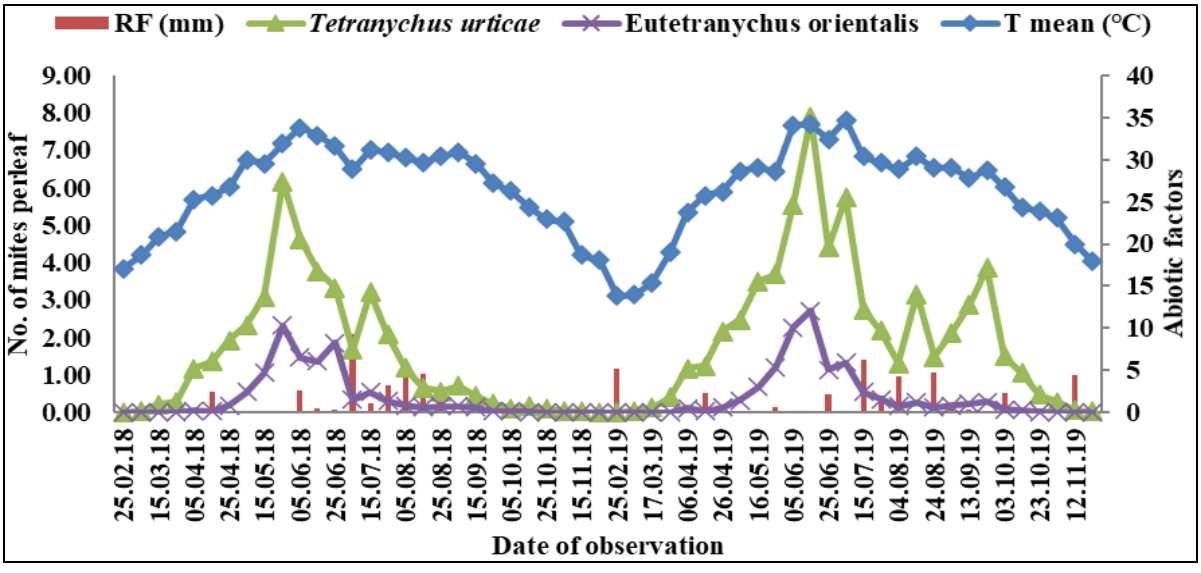

Fig 3: Effect of abiotic factors on mite population of Tetranychidae at Attari during 2018-2019. (T=Temperature, RF=Rainfall)

Family Tenuipalpidae

Within this family one species (*Brevipalpus phoenicis)* had been reported from Pear which was present throughout the period investigation at three different locations namely KCA, GNDU and Attari.

Brevipalpus phoenicis

Infestation of *B. phoenicis* was reported on April 1, 2018 at KCA and GNDU whereas on May 5, 2018 at Attari. Two peaks of this mite were reported in a year with higher peak during June 2018 and smaller peak during September 2018. Similar population trend of this mite was observed in the year 2019. Maximum population was observed on June 1, 2018 (0.69 mites/leaf) when maximum and minimum temperature was 42.72°C and 25.03°C with negligible rainfall (Figure 4). Peak in population of mite at GNDU was observed on June 3, 2018 (0.67 mites/leaf) when maximum temperature was 42.52°C, minimum temperature 25.54°C and mean temperature 34.03°C with no rainfall (Figure 5). At Attari peak population was reported on September 15, 2018 (0.38 mites/leaf) when maximum temperature and minimum temperature 34.2°C and 24.9°C with no rainfall were observed (Figure 6). The correlation coefficients between the incidence of *B. phoenicis* and the abiotic factors i.e. maximum, minimum and temperature and rainfall was worked out for the period of observation and showed a significant positive correlation with the maximum, minimum and mean temperature. Rainfall showed nonsignificant negative correlation with the mite population

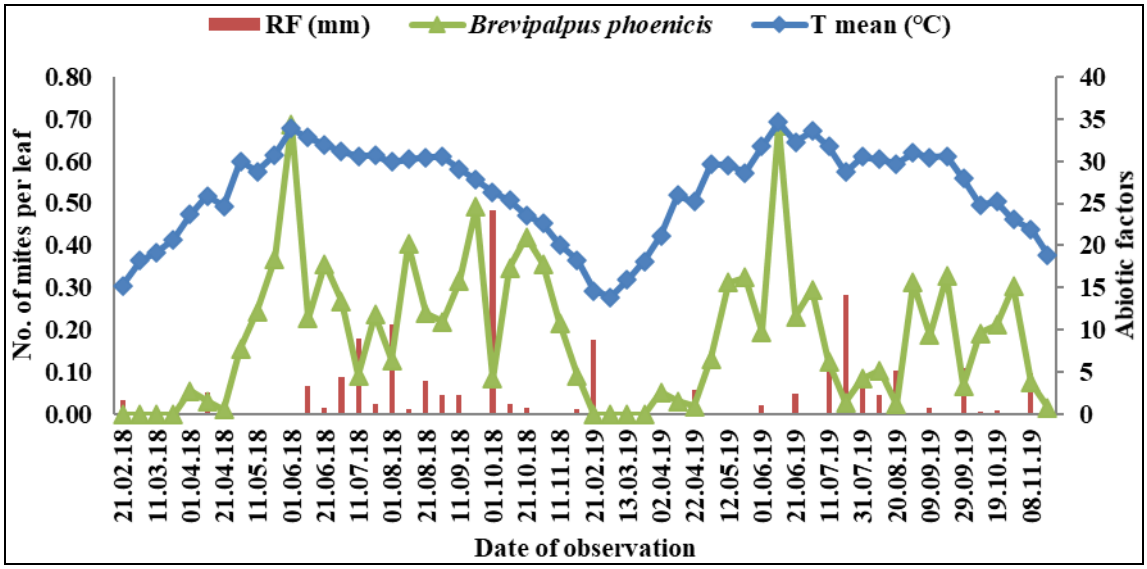

Fig 4: Effect of abiotic factors on mite population of Tenuipalpidae at KCA during 2018-2019. (T=Temperature, RF=Rainfall)

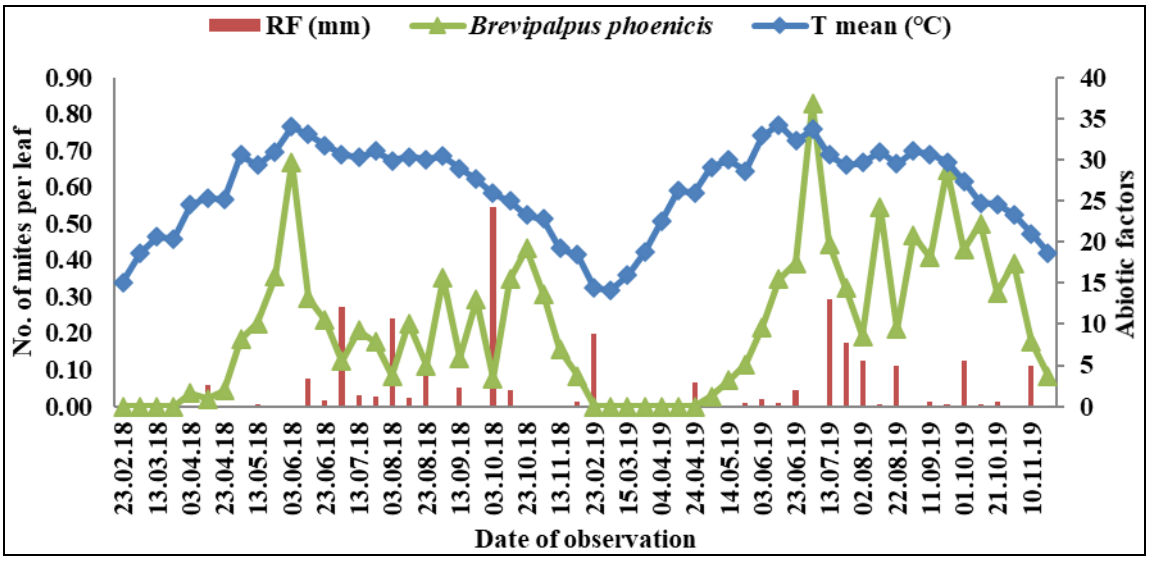

Fig 5: Effect of abiotic factors on mite population of Tenuipalpidae at GNDU during 2018-2019. (T=Temperature, RF=Rainfall)

(Table 1) having the coefficient of determination (R^2) at all the three locations as 45.80 (KCA), 39.12 (GNDU) and 48.98 (Attari) per cent (Table 2). The present study showed that population of mites was maximum at KCA followed by GNDU and then Attari. The results of present study are similar with those of [15] who reported the occurrence of *B. phoenicis* on Kinnow leaves in Punjab and reported the similar trend in population dynamics with effect of abiotic factors. [4] also reported the occurrence of tenuipalpids on Kinnow throughout the year with peak activity during October to January. In contrast to above findings, peak population of *B. phoenicis* was observed at high temperature (32.9), lower RH (32.5%) and no rainfall [13]. A positive correlation of tenuipalpid mite population with temperature

and negative correlation with humidity and rainfall as well as higher peak of *B. phoenicis* was reported during May and smaller peak during November on *Kaghzi lime* [33]. [18] observed that infestation of tenuipalpids was reported throughout the year and showed negative correlation with all the abiotic factors (maximum and minimum temperature, minimum R.H. and rainfall) except maximum relative humidity.

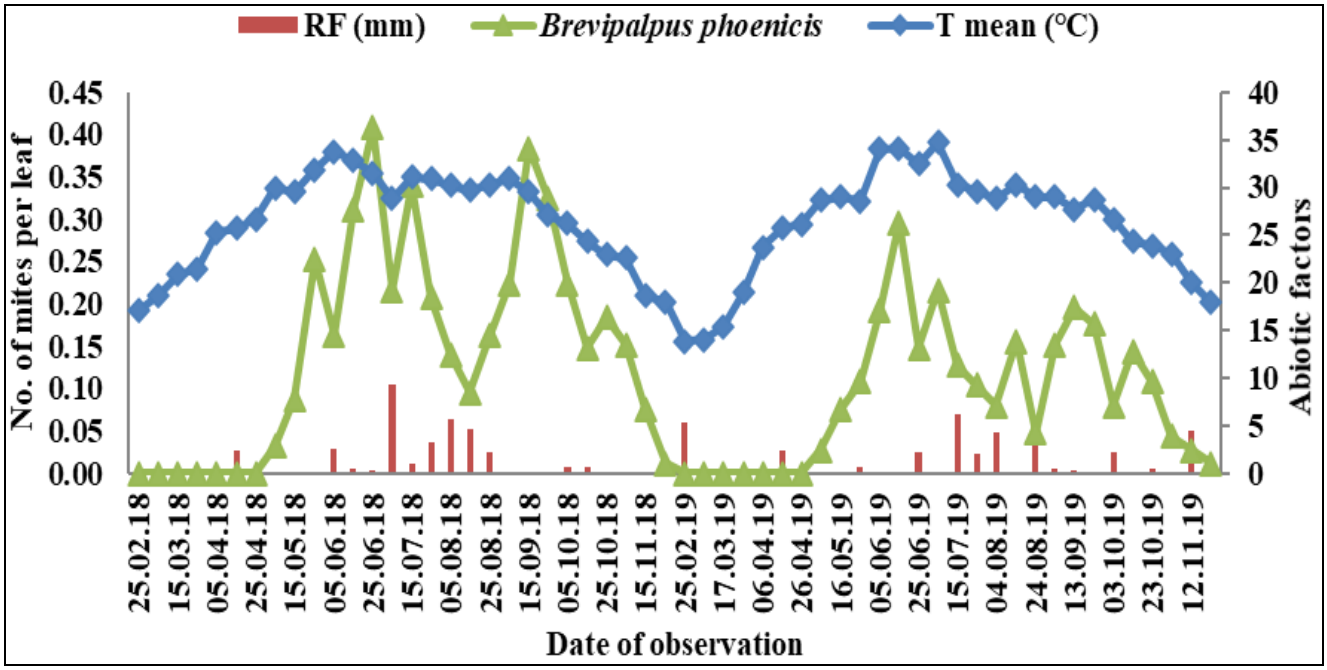

Fig 6: Effect of abiotic factors on mite population of Tenuipalpidae at Attari during 2018-2019. (T=Temperature, RF=Rainfall)

Predatory mites

Family Phytoseiidae

Within this family three species have been reported from Pear trees at three different location namely *E. finlandicus, E. alstoniae* and *A. largoensis.*

Phytoseiids

Population of phytoseiids at KCA appeared throughout the period of investigation starting from March 1, 2018 onwards at each location and were dominant in case of predatory mites. Population showed peak on June 11, 2019 (1.19 mites/leaf) at KCA when maximum temperature was 43.42°C and minimum temperature was 25.84°C with no rainfall (Figure 7). Later on, population decreased due to rainy season or may be due to decrease in population of tetranychids on which it predates from August 2018 and September 2019 onwards. The population of the mites was not observed after November 2018 and 2019 due to absence of leaves. At GNDU phytoseiids started appearing on March 3, 2018 and attained.

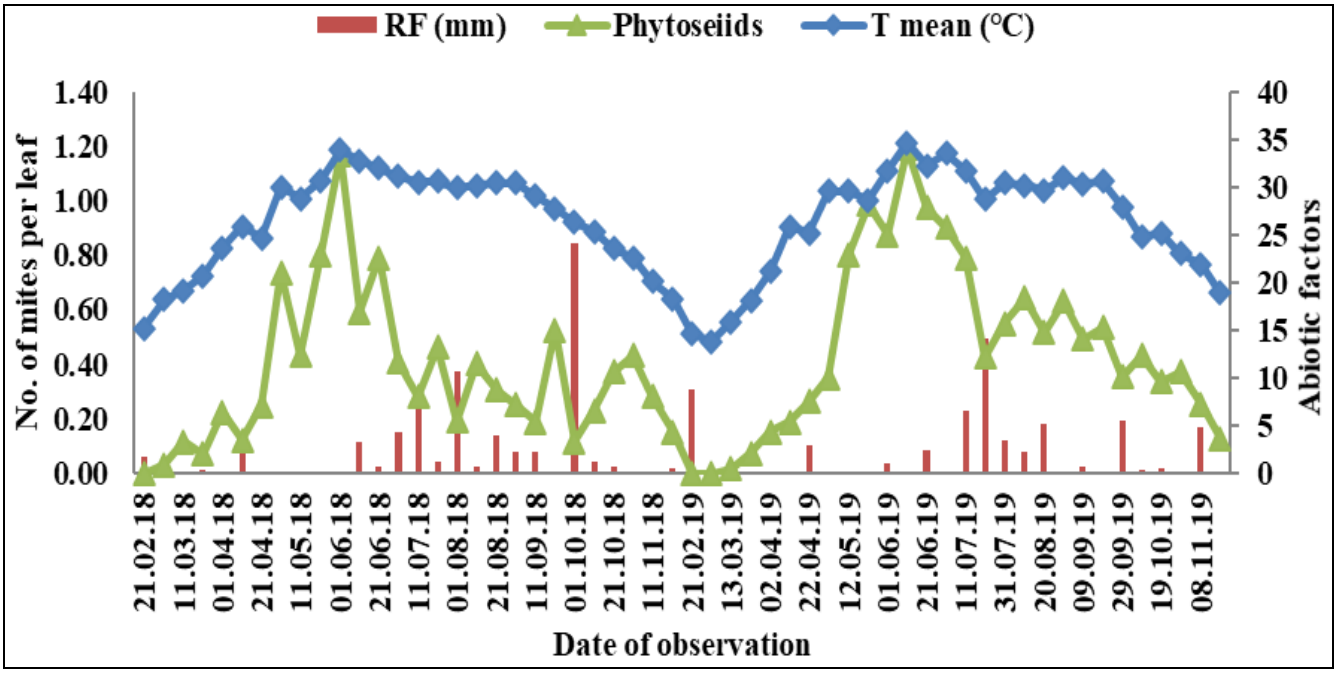

Fig 7: Effect of abiotic factors on mite population of Phytoseiidae at KCA during 2018-2019. (T=Temperature, RF=Rainfall)

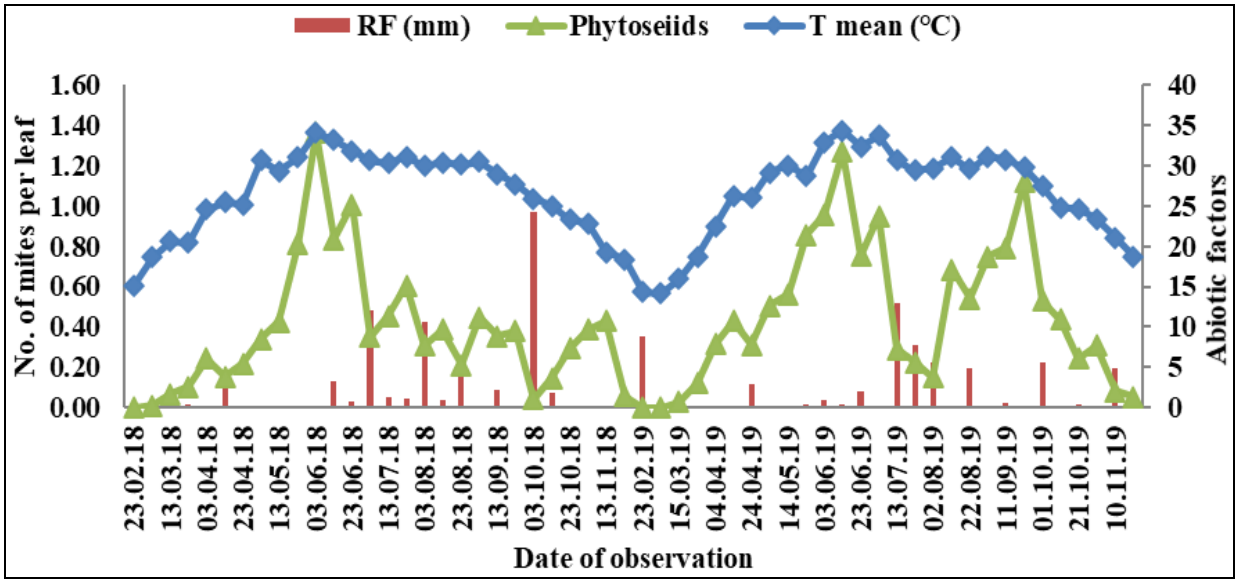

Fig 8: Effect of abiotic factors on mite population of Phytoseiidae at GNDU during 2018-2019. (T=Temperature, RF=Rainfall)

a first peak on June 3, 2018 (1.36 mites/leaf) when maximum temperature and minimum temperature were 42.52°C and 25.54°C respectively with no rainfall (Figure 8) after that population started declining due to rains and was absent in winters. Further a decreasing trend in population was observed during rainy months (July and August 2018). On March 5, 2018 population of mite was observed at Attari with a peak in population was recorded on June 5, 2019 (1.87 mites/leaf) when maximum and minimum temperature was 43.40°C and 24.70°C with no rainfall (Figure 9). During rainy season population showed declining trend due to rains. The population was not observed after the month of November of both years (during the winter months of December, January and February) due to absence of leaves. The correlation data revealed that Phytoseiidae showed highly positive significant correlation with maximum temperature and with minimum temperature. Rainfall had insignificant negative correlation at all the three locations. (Table 1). The coefficient of determination (R^2) at KCA, GNDU and Attari was (72.29), (70.05) and (64.13) per cent respectively (Table 2).

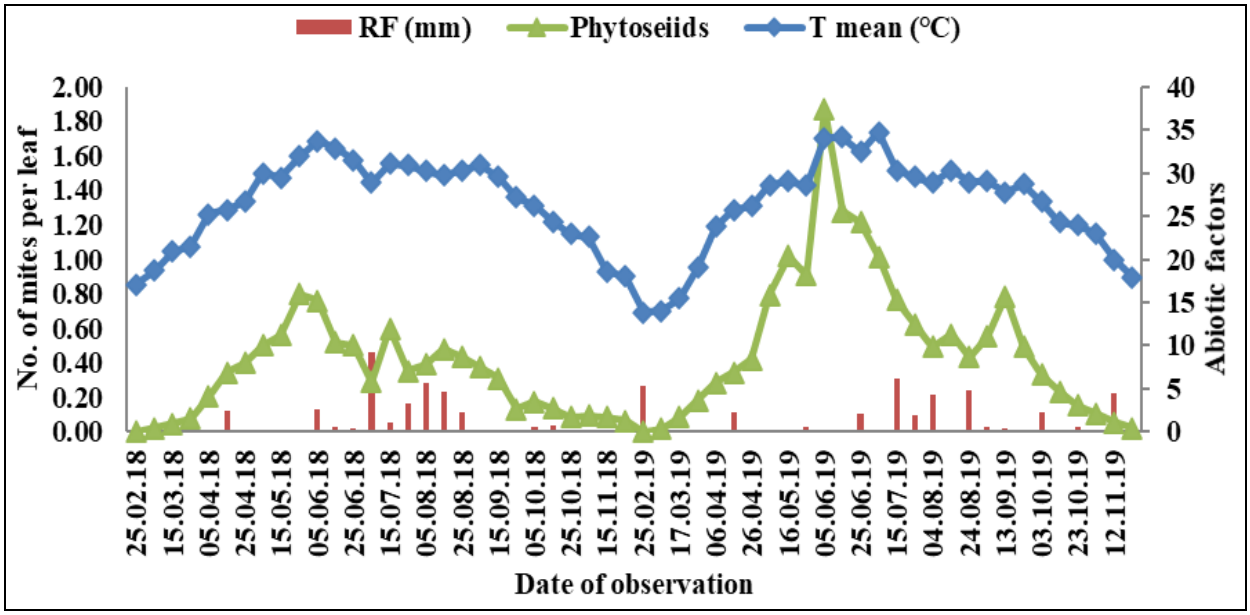

Fig 9: Effect of abiotic factors on mite population of Phytoseiidae at Attari during 2018-2019. (T=Temperature, RF=Rainfall)

In contrast to present findings, [32] supported the results and reported that the population of predatory mites had a positive correlation with abiotic temperature (maximum and minimum). The study of [16] also supported the results and reported positive correlation between abiotic temperature (maximum and minimum) and phytoseiids population whereas negative correlation with rainfall. The study of [18] study showed positive correlation between maximum temperature and phytoseiids population except rainfall which showed negative correlation.

Family Stigmaeidae

Agistemus fleschneri

The studies of population dynamics showed that *A. fleschneri* was present from May 11, 2018 at KCA, April 13, 2018 at GNDU and April 5, 2018. The studies of population dynamics showed that *A. fleschneri* peak population at KCA was present on June 11, 2019 (0.48 mites/leaf) when maximum, minimum and mean temperature was 43.42°C, 25.84°C and 34.63°C with no rainfall (Figure 10). Infestation of this mite at GNDU with peak in population was observed on June 13,

2019 with 0.57 mites per leaf when maximum temperature was 43.05°C, minimum temperature was 25.47°C and mean temperature 34.26°C with 0.41mm rainfall (Figure 11). Later on, with decrease in temperature there was decrease in mite population and there was no population after September 2019. A

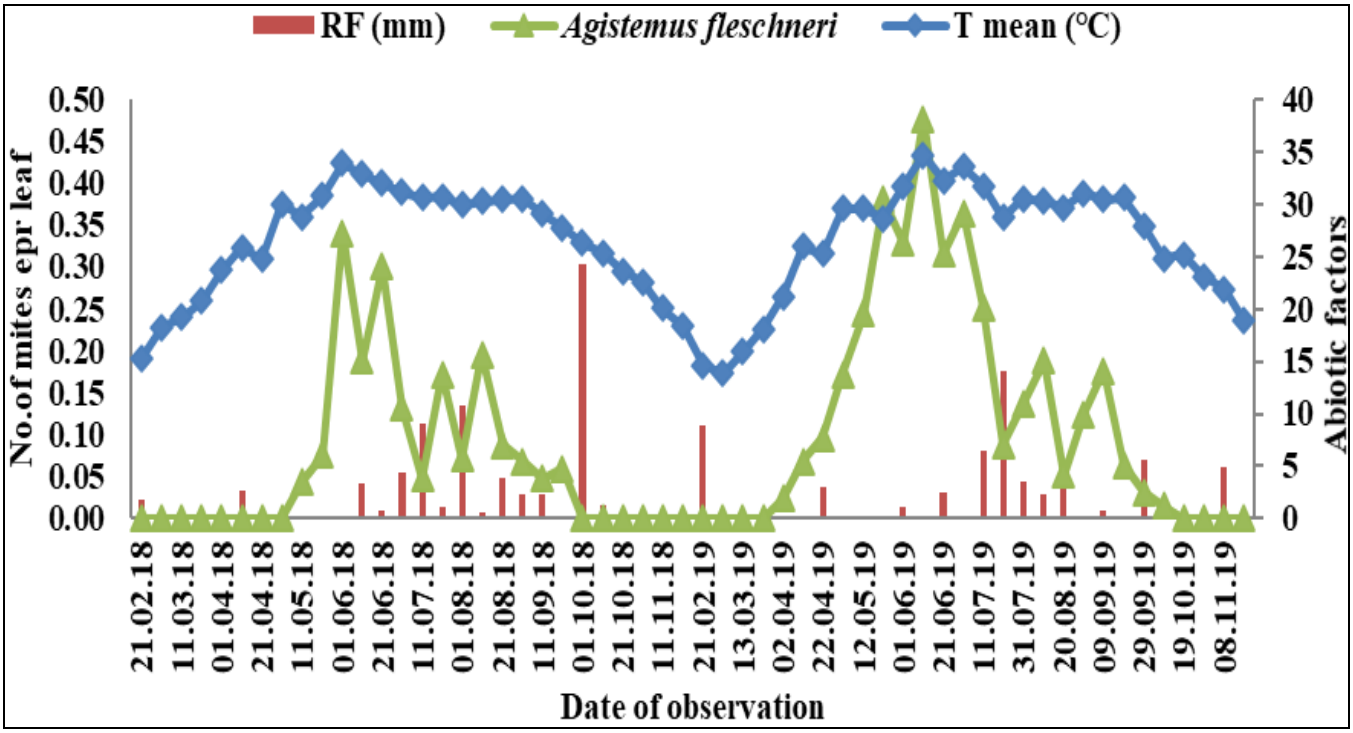

Fig 10: Effect of abiotic factors on mite population of Stigmaeidae at KCA during 2018-2019. (T=Temperature, RF=Rainfall)

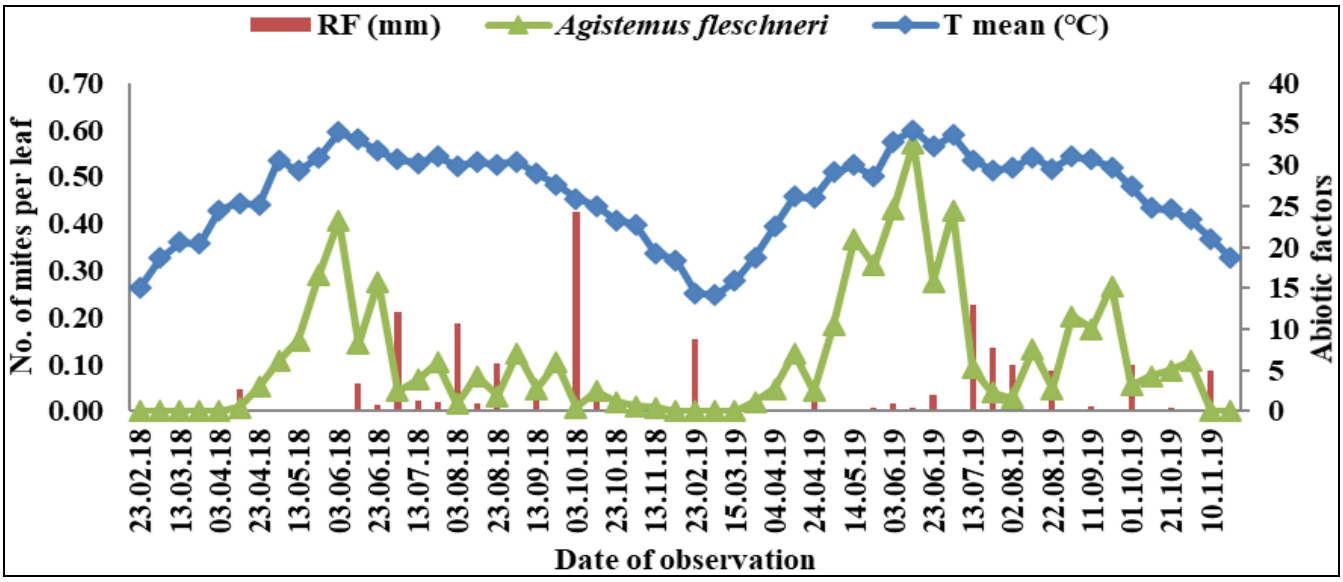

Fig 11: Effect of abiotic factors on mite population of Stigmaeidae at GNDU during 2018-2019. (T=Temperature, RF=Rainfall)

peak in population of this mite at Attari was reported on June 15, 2019 (0.78 mites/leaf) when maximum temperature was 43.10°C, minimum temperature was 25.20°C and 34.25°C as mean temperature with rainfall negligible (Figure 12). The rainfall had negative insignificant correlation with population of this mite whereas temperature (maximum, minimum and mean) had positive correlation and (Table 1). The coefficient of determination (R^2) was 58.19 (KCA), 68.01 (GNDU) and 44.93 (Attari) per cent (Table 2).

In contrast to our findings, [27] observed that population of *A. fleschneri* attained its peak in 2nd week of June with maximum temperature 40.5ºC, minimum temperature 27.9ºC, morning RH 55 per cent and evening RH 32 per cent. Stigmatid mites exhibited significant positive correlation with maximum temperature (0.466), minimum temperature (0.646), average temperature (0.601) and nonsignificant correlation with morning RH (-0.375), evening RH (0.133), average RH (-0.204)

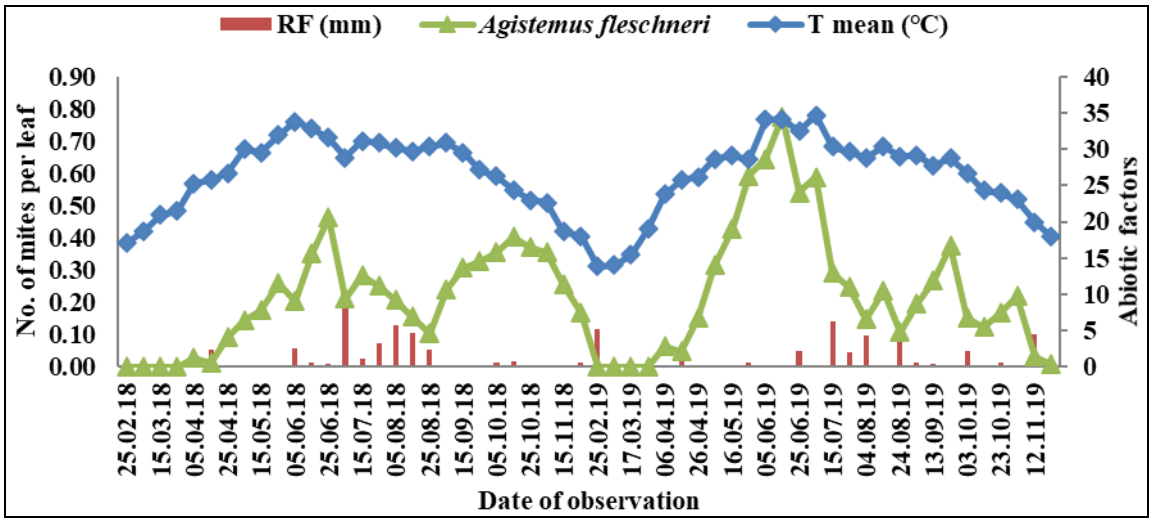

Fig 12: Effect of abiotic factors on mite population of Stigmaeidae at Attari during 2018-2019. (T=Temperature, RF=Rainfall)

Family Cunaxidae

Cunaxa setirostris

Maximum population was observed at KCA on September 19, 2019 (0.19 mites/leaf) during which maximum temperature, minimum temperature and mean temperature being 35.71°C, 25.47°C and 30.49°C respectively with no rainfall (Figure 13). At GNDU peak in population was recorded on September 21, 2019 (0.16 mites/leaf) when maximum, minimum and mean temperature was 34.82°C, 24.55°C and 29.69°C respectively with 0.20mm rainfall (Figure 14). Population of cunaxids showed peak at Attari on June 15, 2019 (0.31 mites/leaf) when maximum temperature, minimum temperature and mean temperature was 43.10°C, 25.20°C and 34.25°C respectively with negligible rainfall (Figure 15). The data of correlation coefficients revealed all the abiotic factors (maximum, minimum and mean) temperature except rainfall showed positive correlation. [16] reported that cunaxids population had positive correlation with all the abiotic factors (maximum and minimum temperature) except rainfall (Figure 14). The study of [18] showed negative correlation between the abiotic factor, rainfall and cunaxids. The coefficient of determination (R^2) was 37.25, 46.28 and 27.08 at KCA, GNDU and Attari per cent respectively (Table 2). In contrast of our findings, [18] reported Cunaxidae (*C. setirostris*) on Kinnow leaves which were maximum from September to December at Ludhiana and Abohar and during November at Hoshiarpur in Punjab. All the abiotic factors (maximum and minimum temperature, minimum R.H. and rainfall) except maximum R.H. showed negative correlation with population of Cunaxidae mites. [16] reported that cunaxids population had positive correlation with all abiotic factors (maximum and minimum temperature and maximum and minimum R.H.) except rainfall.

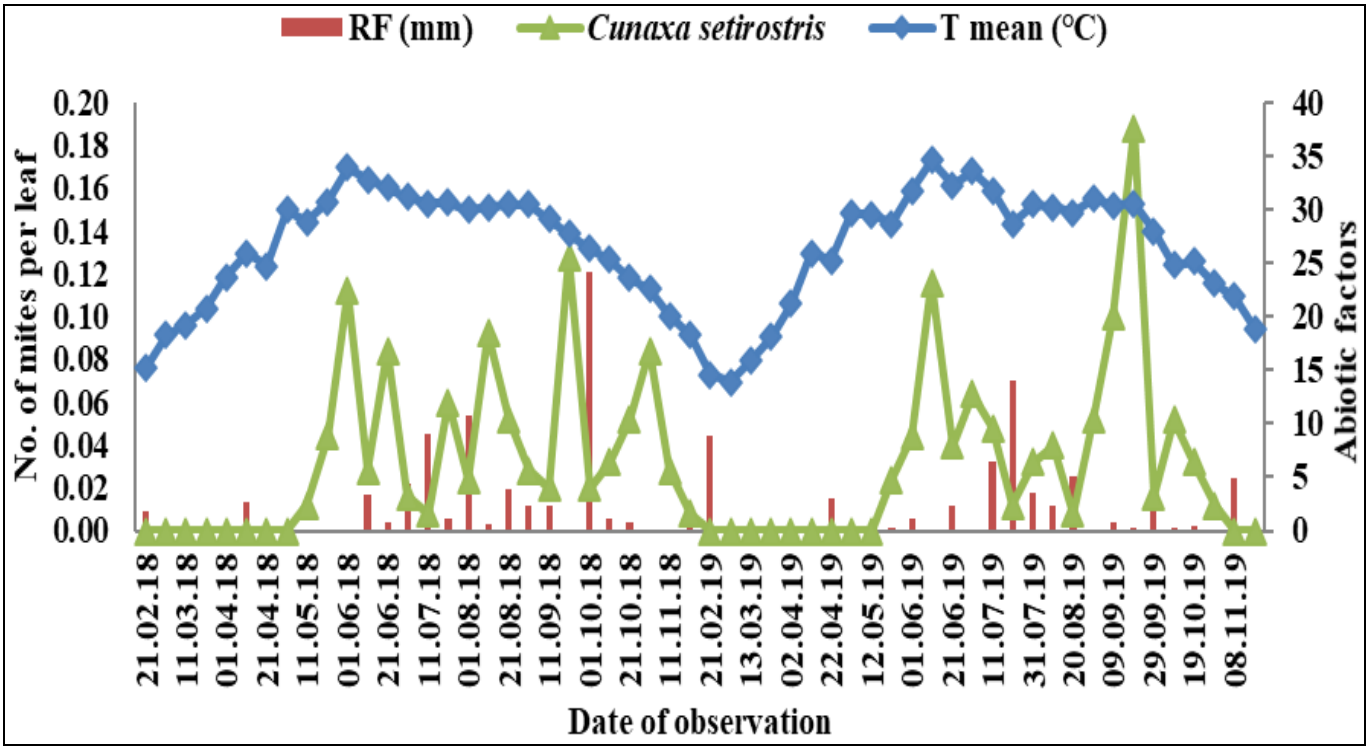

Fig 13: Effect of abiotic factors on mite population of Cunaxidae at KCA during 2018-2019. (T=Temperature, RF=Rainfall)

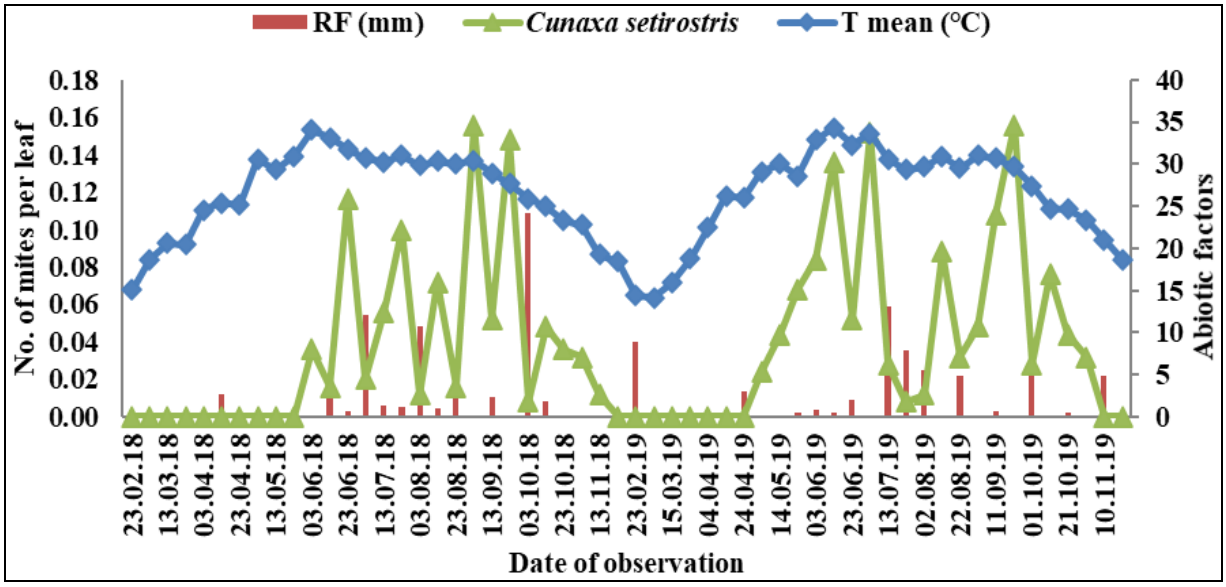

Fig 14: Effect of abiotic factors on mite population of Cunaxidae at GNDU during 2018-2019. (T=Temperature, RF=Rainfall)

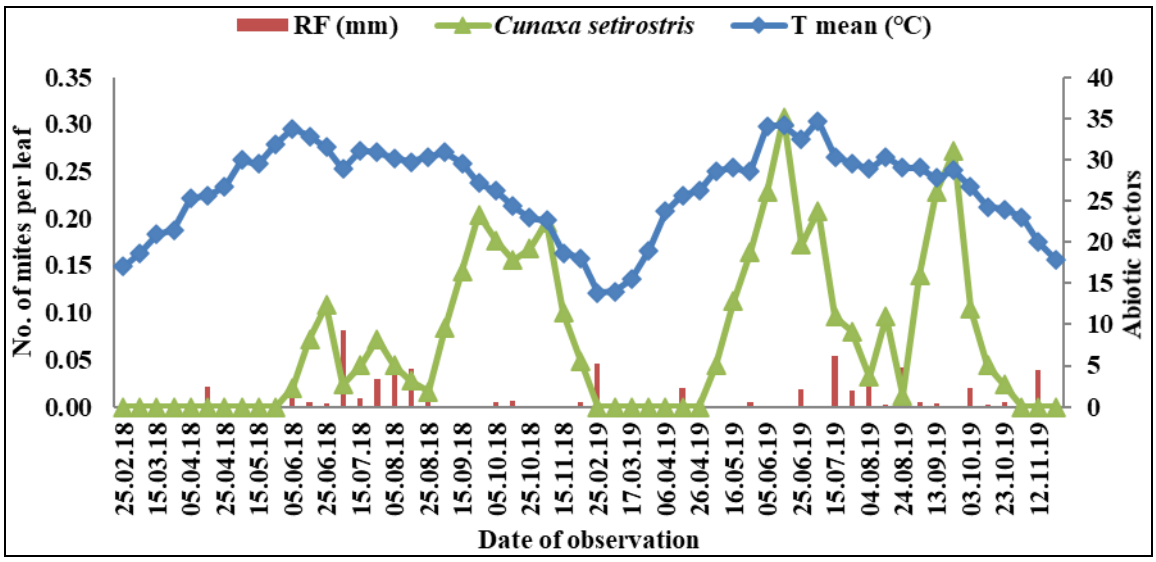

Fig 15: Effect of abiotic factors on mite population of Cunaxidae at Attari during 2018-2019. (T=Temperature, RF=Rainfall)

Conclusion

During the present study, the population of mites varied in different months with maximum incidence during summer season (May-July) when days are hot and dry and started declining during rainy season. Population was completely absent during winter season (December-February) due to absence of leaves. Incidence of mites was more in 2019 as compared to 2018. Results showed a significant positive correlation between mite abundance and temperature and negative correlation with the rainfall. The coefficient of determination of all the mites showed a significant contribution of abiotic factors in regulating the mite population at all the location. Based on the present studies, advisory can be given to pear farmers for the effective management of mites.

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