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# Incidence of *Tetranychus urticae* Koch on tomato (*Lycopersicon esculentum* Mill.) under screen house conditions

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**Abstract**
*Tetranychus urticae* Koch, the two spotted spider mite populations initially show low acceptance for tomato as a host, but they can rapidly became adapted, causing crop losses worldwide. The present study revealed damage potential of *T. urticae* on tomato. The proposed study was carried out at Department of Zoology in collaboration with Department of Vegetable science, CCS Haryana Agricultural University, Hisar. The crop was planted two times from July, 2017 to June, 2018. A comparison of *T. urticae* population on tomato leaves of different ages revealed that the distribution of *T. urticae* was statistically more on grown up leaves (11.34 mites/sq. cm leaflets) as compared to tender (9.98 mites/sq. cm leaflets) and older leaves (9.55 mites/sq. cm leaflets), during 2017. During year 2018, *T. urticae* population on tomato leaves of different ages *viz.* tender, grown up and older, revealed that statistically more number of mite observed on grown up leaves (12.30 mites/sq. cm leaflets) as compared to tender (11.93 mites/sq. cm leaflets) and older leaves (11.44 mites/sq. cm leaflets).

**Keywords:** *Tetranychus urticae*, tomato, two-spotted spider mite

## Introduction
Mites of the family Tetranychidae are among the destructive pests of agrihorticultural crops in many parts of the world. *Tetranychus urticae* Koch, two-spotted mite is phytophagous species of spider mites, and probably the most important agricultural mite pest (Khalighi *et al*., 2016) [12]. *T. urticae* is one of the cosmopolitan spider mite pest reported as serious pest on many plants like tomato, okra, brinjal, cotton, french bean, cucurbits, alfalfa, flowers, etc. (Manjulata *et al.*, 2002) [14]. Tomato, (*Lycopersicon esculentum* Mill) is grown in protected houses and in open fields for direct consumption and processing. In India, it is cultivated on 0.52 million hectares with production of 7.42 million tons (productivity 14269 kg/ha) (Anonymous, 2004) [4]. All parts of the tomato plant offer food, shelter and reproductive sites for many kinds of arthropods. There are a number of other pests that cause damage to tomatoes and reduce yields. On protected as well as field grown tomato, one of the predominant pest species is the two spotted spider mite, *T. urticae* Koch (Acari: Tetranychidae) (Lange and Bronson, 1981) [13]. This pest has become one of the most severe pests of Solanaceae in Africa with estimated, crop losses of up to 90% in South East Africa (Sibanda *et al.*, 2000) [19]. These phytophagus mites attack mainly the mature and old leaves of the tomato plant by sucking cell sap and damaging the chlorophyll-producing organs, thus reducing photosynthesis (Biswas *et al*., 2004) [5]. In tomato, high populations of the mite can cause webbing as well as spotty yellowing and curling of the leaves and thus reduce the quality and quantity of tomato yields (Boom *et al*., 2003; Erdogan, 2006; Acharjee and Mandal 2008) [6, 8, 1]. Moderate population may greatly affect crop production and heavy infestation results in death of the plant. A single factor cannot be considered to affect *T. urticae* outburst. In view of this, it becomes important to monitor the population build up of mite, so that suitable management strategy is formulated.

## Materials and Methods
The tomato (Variety -Hisar Arun) crop was raised from mid June, 2017 to November 2017 and January, 2018 to May, 2018 in the Research Farm Area, Department of Zoology in collaboration with Department of Vegetable science, CCS Haryana Agricultural University, Hisar following recommended cultural and agronomical practices. The observations were taken from ten randomly selected plants per sampling.

Two leaflets per plant at each stage (tender, grown up and old leaves) were collected in separate labelled polybags, one bag for each plant in the morning of each sampling day. Altogether, six leaflets were collected from each plant. The collected leaflets were brought to the Acarology laboratory for counting the number of mites. Examination of mite infested leaflets was done with the aid of stereo zoom binocular microscope. From both the surface (dorsal and ventral), the mite number was counted from three different places and the average of these spots was considered as final observation per replicate. While counting the mite population, the surface of the leaflets was observed to know the exact pattern of the mite distribution on leaflets and symptoms of their damage. Critical differences (CD) were calculated to compare the leaf ages and leaf surfaces by using two factorial CRD to know the effect of leaf ages and distribution on leaf surfaces on population dynamics of *T. urticae* in tomato plants. The Software 'OPSTAT', developed at the Computer Centre, College of Basic Sciences and Humanities, CCS Haryana Agricultural University, Hisar, was used for the analysis.

## Results and Discussion

### Seasonal Incidence of Tetranychus urticae on Tomato

The results on the seasonal incidence of *T. urticae* on tomato during Sep, 2017 to Feb, 2018 are presented in Tables and illustrated in Figs.

A comparison of *T. urticae* population on tomato leaves of different ages *viz.* tender, grown up and older, revealed that the distribution of *T. urticae* was statistically more (CD =0.79; p = 0.05) (Table 1) on grown up leaves (11.34 mites/sq. cm leaflets) as compared to tender (9.98 mites/sq. cm leaflets) and older leaves (9.55 mites/sq. cm leaflets). On tender leaves, number of mites was statistically comparable with mite number on older leaves. Statistical analysis showed a significant effect of the observation period on *T. urticae* incidence (CD = 1.58; p = 0.05) and irrespective of leaf age, statistically higher number of mites were recorded in the third week of October (20.71 mites/sq. cm leaflets) than the mites recorded on other observation periods. Statistically comparable data were recorded in the first week of September and third week of November. The non significant interaction between observation periods and leaf stage of plants. Ali *et al.* (2015) [3] reported that mite populations reached its peak in the 1st week of October in the first season, while during the second season in the 2nd week of September and the 1st week of October. Dhooria (2003) [7] recorded maximum mite population on September to November on tomato and other vegetables crop. Afzal and Bashir (2007) [2] recorded maximum mite population from brinjal (2.77) followed by tomato (2.55), pumpkin (1.1) and cucumber (0.91), respectively. The result reveled that lowest mite count of 0.17 adult /sq cm leaflets was recorded on third week of November, 2017(18.11.17). Sonika *et al.* (2017) [20] reported that *T. urticae* population gradual decline in month of November. Low to negligible mite population was encountered during December, January and February months (Gulati, 2004) [10].

During year 2018, *T. urticae* population on tomato leaves of different ages *viz.* tender, grown up and older, revealed that statistically more number of mite observed (CD =0.47; p = 0.05) (Table 2) on grown up leaves (12.30 mites/sq. cm leaflets) as compared to tender (11.93 mites/sq. cm leaflets) and older leaves (11.44 mites/sq. cm leaflets). On tender leaves, number of mites was statistically comparable with mite number on grown up leaves. Statistical analysis showed a significant effect of the observation period on *T. urticae* incidence (CD = 1.11; p = 0.05). Statistically higher number of mites was recorded in the last week of March (24.67 mites/sq. cm leaflets) than the mites recorded on other observation periods. Statistically comparable data were recorded in first week (2.42 mites/sq cm leaflets) of February and third week of May (2.66 mites/sq cm leaflets), third week of March (21.73mites/sq cm leaflets) and first week of April (21.35 mites/sq cm leaflets), 2018(Table 2). Likewise, *T. urticae* population was at par during last week of March (24.67 mites/sq cm leaflets) and first week of April (21.35 mites/sq cm leaflets). The interaction between observation periods and leaf stage was also found to be significant (CD= 1.92; p= 0.05).

A cursory analysis through graphical representation also showed the similar trend with maximum population build up grown up leaves, followed by tender and older leaves was shown by *T. urticae*. Grown up leaves harboured 37 percent mites followed by 32 percent on the tender leaves and 31 percent on the older leaves of tomato crop during 2017 (Fig. 1a). Similar results were obtained for occurrence of *T. urticae* on tomato crop for crop season 2018 which showed 35 percent mites on grown up leaves. This was higher than mite density on both the tender (33 %) and the older (32 %) leaves (Fig. 1b). Maximum mite density was thus recorded on grown up leaves of tomato during the study period. Likewise, preference for mature leaves over young leaves by *T. urticae* was reported by Sunita (1996) and Sharmila *et al*. (1999) [21, 18]. Sonika *et al*. (2017) [20] showed a preference for grown-up leaves of brinjal as compared to tender and older leaves under field and screen house conditions. Pokle and Shukla (2015) [16] reported that both the egg and mobile stages of *T. urticae* prefers top leaf canopy of tomato plant. Maximum population of mites was recorded from the middle strata followed by top and bottom strata on okra (Gulati, 2004; Geroh, 2007) [10, 9] and brinjal (Gupta, 1991) [11]. Shah and Shukla (2014) [17] reported that the spider mite, *T. urticae*, lays maximum eggs on top canopy of gerbera with maximum mobile stages. Mondal and Ara (2006) [15] observed the abundance of mite population on bottom strata than on middle and top strata on open cultivated rose. This may be due to different crop and the crop growing situations.

A comparison of *T. urticae* population on tomato leaves of different surface *viz.* Dorsal and ventral surface is presented in Table 3, during the year, 2017 and 2018. The results showed that ventral surface were susceptible to mite infestation. The distribution of *T. urticae* was found to be more on ventral surface (36.68 mites/sq. cm leaflets) which was statistically higher (CD = 2.89; p = 0.05) than the mite density on dorsal surface (32.92 mites/ sq. cm leaflets). Statistical analysis of *T. urticae* incidence showed a significant effect of the observation period (CD = 3.93; p = 0.05). Irrespective of leaf age, statistically higher number of mites was recorded during second fortnight of October, 2017 (51.57 mites/ sq. cm leaflets) than the mites recorded at other observation periods during 2017 and statistically higher number of mites was recorded during second fortnight of March, 2018 (69.60 mites/ sq. cm leaflets) during 2018Likewise, preference of *T. urticae* for ventral leaf surface over dorsal leaf surface by was reported by Sonika *et al*. (2017) [20].

**Table 1:** Effect of leaf age on *Tetranycus urticae* during September, 2017 – November, 2017

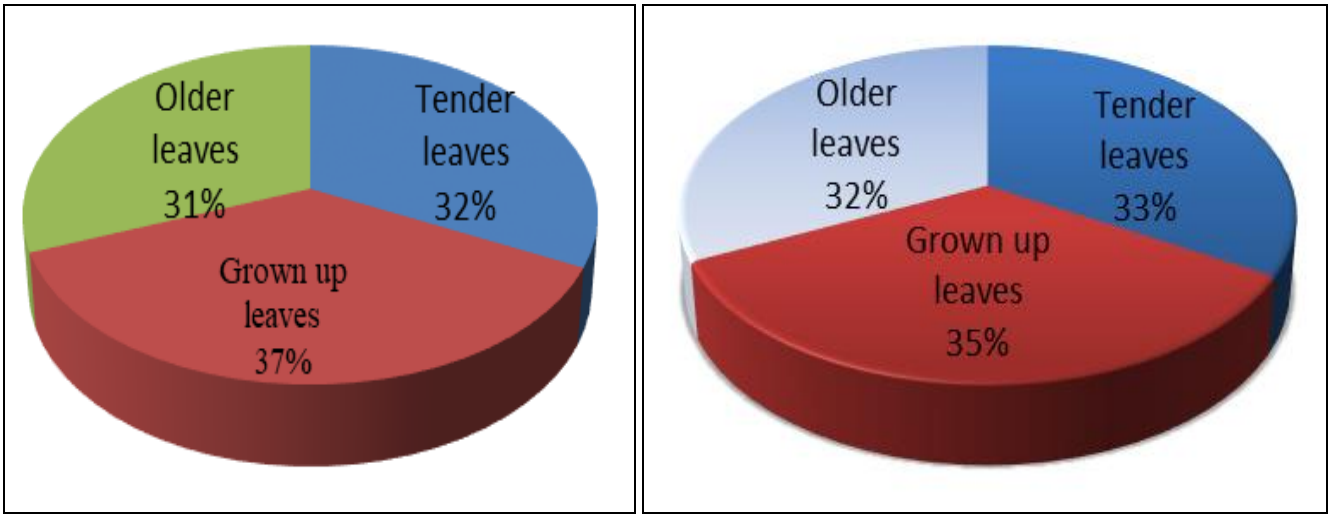
| Observation period | Average number of *Tetranychus urticae* / sq.cm leaflet | | | |
|---|---|---|---|---|
| | Tender leaves | Grown up leaves | Older leaves | Mean |
| 2.09.017 | 3.05 | 2.76 | 2.87 | 2.90[a] |
| 9.09.017 | 5.33 | 6.19 | 5.56 | 5.69[b] |
| 16.09.017 | 7.17 | 8.42 | 8.58 | 8.06[c] |
| 23.09.017 | 9.76 | 11.11 | 11.07 | 10.65[d] |
| 30.09.017 | 12.33 | 13.47 | 13.16 | 12.99[d] |
| 7.10.017 | 14.27 | 16.05 | 14.98 | 15.10[e] |
| 14.10.017 | 17.14 | 18.12 | 15.45 | 16.90[e] |
| 21.10.017 | 20.17 | 24.70 | 17.25 | 20.71 |
| 28.10.017 | 13.97 | 16.19 | 11.88 | 14.01[d] |
| 4.11.017 | 8.35 | 9.61 | 7.33 | 8.43[c] |
| 11.11.017 | 5.51 | 6.15 | 4.42 | 5.36[b] |
| 18.11.017 | 2.66 | 3.32 | 2.06 | 2.68[a] |
| Mean | 9.98[a] | 11.34 | 9.55[a] | |

CD (p=0.05) for Period = 1.58
CD (p=0.05) for Leaf stage = 0.79
CD (p=0.05) for Period × Leaf stage = N/A
Values with the same superscript do not differ significantly

**Table 2:** Effect of leaf age on *Tetranycus urticae* during February 2018 – May, 2018

| Observation Period | No. of mites/ sq.cm leaflet | | | Mean |
|---|---|---|---|---|
| | Tender leaves | Grown up leaves | Older leaves | |
| 06.02.018 | 2.41 | 2.43 | 2.41 | 2.42[a] |
| 13.02.018 | 4.67 | 5.43 | 5.58 | 5.23[bh] |
| 20.02.018 | 8.75 | 9.83 | 9.29 | 9.29[c] |
| 27.02.018 | 11.69 | 12.61 | 12.81 | 12.37[d] |
| 06.03.018 | 14.31 | 15.41 | 16.63 | 15.45[e] |
| 13.03.018 | 18.72 | 18.31 | 19.27 | 18.76 |
| 20.03.018 | 22.22 | 21.20 | 21.76 | 21.73[fg] |
| 27.03.018 | 25.20 | 26.59 | 22.21 | 24.67[g] |
| 03.04.018 | 22.32 | 22.32 | 19.40 | 21.35[f] |
| 10.04.018 | 18.45 | 18.36 | 15.71 | 17.51 |
| 17.04.018 | 15.10 | 16.35 | 12.60 | 14.68[e] |
| 24.04.018 | 12.98 | 13.49 | 11.32 | 12.60[d] |
| 01.05.018 | 9.64 | 11.36 | 9.39 | 10.13[c] |
| 08.05.018 | 7.50 | 7.66 | 7.30 | 7.49 |
| 15.05.018 | 4.82 | 4.40 | 4.71 | 4.64[bh] |
| 22.05.018 | 2.73 | 2.38 | 2.86 | 2.66[a] |
| 29.05.018 | 1.27 | 1.03 | 1.14 | 1.15 |
| Mean | 11.93[a] | 12.30[a] | 11.44 | |

CD (p=0.05) for Period = 1.11
CD (p=0.05) for Leaf stage = 0.47
CD (p=0.05) for Period × Leaf stage = 1.92
Values with the same superscript do not differ significantly




**(a)** **(b)**

**Fig 1:** Occurrence of *Tetranychus urticae* on tender, grown up and older leaves of tomato (a) September, 2017 – November, 2017 (b) February 2018 – May, 2018

**Table 3:** Seasonal incidence of *Tetranychus urticae* on tomato during September, 2017 – November, 2017 and February 2018 – May, 2018

| Observation Period | | No. of mites/ sq.cm leaflet | | Mean |
|---|---|---|---|---|
| Month | Fortnight | Dorsal Surface | Ventral Surface | |
| September | First | 11.96 | 13.75 | 12.86[b] |
| | Second | 40.76 | 52.94 | 46.85[d] |
| October | First | 44.27 | 51.74 | 48.00[ed] |
| | Second | 48.36 | 54.78 | 51.57[e] |
| November | First | 17.89 | 23.48 | 20.69 |
| | Second | 3.45 | 4.59 | 4.02[a] |
| 2018 | | | | |
| February | First | 10.71 | 12.22 | 11.47[b] |
| | Second | 31.48 | 33.51 | 32.49[c] |
| March | First | 48.66 | 53.99 | 51.32[e] |
| | Second | 66.42 | 72.77 | 69.60[f] |
| April | First | 57.89 | 58.68 | 58.28[f] |
| | Second | 40.08 | 41.76 | 40.92 |
| May | First | 33.05 | 33.72 | 33.39[c] |
| | Second | 5.86 | 5.55 | 5.71[a] |
| | Mean | 32.92[a] | 36.68[a] | |

CD (p=0.05) for Period = 3.93
CD (p=0.05) for Leaf stage = 1.50
CD (p=0.05) for Period × Leaf stage = N/A
Values with the same superscript do not differ significantly

## Conclusion

It was quite appealing from present study that *T. urticae* emerging pests on tomato. The distribution of *T.urticae* was found to be more on grown up leaves which were statistically higher than the mite recorded on tender and older leaves under screen house conditions. Mite population peaked in the second fortnight of October, 2017 and second fortnight of March, 2018 under screen house conditions. Higher number of mites observed in ventral surface of leaves of tomato. So it is important to manage two spotted spider mites on tomato.

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