Indian Journal of Entomology 84(2): 445-448 (2022) DoI No.: 10.55446/IJE.2021.266

SEASONAL INCIDENCE OF PHYTOPHAGOUS AND PREDATORY MITES ON CAPSICUM UNDER NETHOUSE

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ABSTRACT

Capsicum is a popular vegetable crop grown under protected cultivation, but it provides congenial microclimate for insects and mites. The present study evaluates the seasonal incidence of mites on capsicum under nethouse conditions (2017, 2018). Simple, partial, and multiple correlation/ regression coefficients of the incidence of mites with weather parameters revealed that the yellow mite *Polyphagotarsonemus latus* (Banks) exhibits significant negative correlation with minimum temperature and significant positive correlation with morning relative humidity (RH). With two spotted spider mite *Tetranychus urticae* Koch and predatory phytoseiid and stigmaeid mites, it was observed that there exists a significantly positive correlation with maximum, minimum and mean temperature but a negative one with morning RH. The weather parameters individually do not have much effect on mite incidence when other weather parameters were kept constant (partial correlation); however, all weather parameters had significant effect on mite incidence (multiple correlation). Preference of two spotted spider mite and yellow mite for different plant canopy level was also worked out; it was found that *T. urticae* preferred middle canopy followed by top and bottom ones, while *P. latus* preferred top canopy followed by others.

Key words: Capsicum, nethouse, *Tetranychus urticae, Polyphagotarsonemus latus,* phytoseiids, stigmaeids, temperature, relative humidity, plant canopy, multiple correlation, regression coefficients

Capsicum (*Capsicum annuum* var. *frutescens*) (Solanaceae) is a highly nutritious and remunerative vegetable crop grown in field as well as protected cultivation, but this crop is often affected by sucking pests (Sreedhara et al. 2013). In India, under poly-net and nethouses, two-spotted spider mite *Tetranychus urticae* Koch and broad or yellow mite, *Polyphagotarsonemus latus* (Banks) are serious affecting quality and yield (Gupta, 2012; Bhullar and Kaur, 2014; Zhang, 2003; Dhooria, 2016). Damage by *P. latus* leads to bronzing hence called '*murda*' disease which causes significant reduction in yield (Jeppson et al., 1975; Gupta, 2012). The microclimate/ weather factors play a great role in the incidence of these mites during the different crop stages, which in turn affect the quality and quantity of yield. Less than five mites on a young pepper plant can cause severe damage resulting in significantly fewer fruits/ plant and lower fruit weight (Cho et al. 1996). Keeping this in view, the present study analysed the population dynamics of mites on capsicum under nethouse conditions so as to provide required data for appropriate IPM strategies.

MATERIALS AND METHODS

The study was taken up at the Entomological Research Farm, Department of Entomology, Punjab Agricultural University, Ludhiana (l30°56'N,75° 52'E, 247 msal). For observing seasonal incidence, variety Indra hybrid was raised under nethouse (1 x 5 m), with 30 days old seedlings transplanted on November 19, 2016 and on November 8, 2017. These were spaced 45 cm apart with row to row spacing of 45 cm and 20 plants were transplanted in each bed. Observations were made at weekly intervals from 30 days after transplanting till June in 2017 and 2018; counts of different stages of mites i.e. eggs, immature stages and adult mites/ leaf were made from three leaves each of top, middle and bottom canopy of randomly selected three plants/ row. These leaves collected were taken in separate polythene bags, brought to laboratory, and mites/ leaf counted under stereozoom microscope (Carl Zeiss Discovery V 8). These counts of mites were plotted against dates to obtain a seasonal trend, and correlated with maximum and minimum temperature, and relative humidity (RH) recorded. Simple, partial, multiple correlations/ regressions were computed using the SPSS software (p=0.05, 0.01).

RESULTS AND DISCUSSION

The study analysed the population dynamics of phytophagous mites belonging to family Tarsonemidae - yellow mite, *Polyphagotarsonemus latus* (Banks),

family Tetranychidae, two-spotted spider mite, *Tetranychus urticae* Koch*;* and predatory mites belonging to family Phytoseiidae- *Euseius alstoniae* Gupta, *E. finlandicus* Oudeman and family Stigmaeidae, *Agistemus fleschneri* Summers.

***Polyphagotarsonemus latus*:** The data obtained reveal that its incidence was less during 2018 as compared to 2017, it commenced from February-March, and increased gradually and attained peak in April; its incidence exhibited significant negative correlation with minimum temperature (-0.273) and significant positive correlation with morning RH (0.271); non significant correlation was observed with average RH (0.143), evening RH (-0.062), average (-0.236) and maximum temperature (-0.182). The multiple correlation of incidence with maximum and minimum temperature, morning and evening RH was 0.537, suggesting the degree of relationship, while average RH was found to be 0.245 (Table 1). Patil and Nandihalli (2009) observed peak incidence of *P. latus* in April, and in the present study too, incidence was more in March and April. Meena et al. (2013) observed a negative correlation of maximum temperature and this corroborates with the present results; in contrast, Chakrabarti and Sarkar (2014) observed a significant positive correlation of temperature (maximum and minimum) and negative correlation of RH (maximum) in chilli under field conditions. Roopa and Kumar (2014) observed a negative relationship with maximum and minimum temperature and morning RH, and a positive one with evening RH and rainfall.

Tetranychus urticae: Its incidence commenced in last week of April, reached its peak in May, and thereafter decreased gradually; in 2017, incidence was maximum during 21st standard meteorological week (SMW), while in 2018 it was found maximum in 18th SMW. There existed a significant positive correlation of incidence with maximum (0.281), minimum (0.364) and average temperature (0.332); and a significant negative one with morning RH (-0.288), and a non-significant one with evening (-0.044) and average RH (-0.206). The multiple correlation revealed that an r value of 0.416, but with average temperature, average RH, it was 0.343, suggesting that these weather parameters do not have much influence on its incidence (Table 1). Monica et al. (2014) reported that maximum and minimum temperatures had positive correlation while RH had a negative one, with incidence increasing from April to June, agreeing with the present observations. Prasanna (2007) with *T. macfarlanei* in brinjal observed a significant positive correlation with maximum temperature and negative correlation with morning and evening RH; and peak incidence was in the second fortnight of May, agreeing with present results. Earlier workers also had reported positive correlation of *T. urticae* with maximum and minimum temperature and negative correlation with RH (Tehri et al. 2014; Meena et al. 2013); Hanafy et al. (2014) reported positive correlation with maximum and minimum temperature and maximum RH, while the minimum RH exhibited a negative correlation. Chauhan and Shukla (2016) reported that maximum, minimum temperature, and evening RHrelative humidity had a significantly positive correlation, and morning RH with a a non-significant one.

Phytoseiids and stigmaeids: In 2017, occurrence of phytoseiid predators commenced in the last week of April (17th SMW- 0.02 mites/ leaf) and increased gradually (0.26 mites/ leaf in last week of May) by 22nd SMW. These exhibited significant positive correlation with maximum (0.295), minimum (0.421) and average temperature (0.367); and significant negative correlation with morning RH (-0.277); and multiple correlation revealed that the weather parameters had an influence on their multiplication; and their occurrence was not observed during 2018. Stigmaeid mites started appearing from 2nd fortnight of April (16th SMW in 2017 and 17th SMW in 2018) and remained till the end of crop season; their peak was during May and June; these mites exhibited significant positive correlation with maximum (0.360), minimum (0.490), and average temperature (0.453) and significant negative correlation with morning RH (-0.313); and it was non-significant with evening (0.023) and average RH (-0.199). The multiple correlation r value was 0.573; with average temperature and RH being 0.519, suggesting that all these weather parameters had an influence on the multiplication of mites (Table 1). Darbemamieh et al. (2011) also who found that predator *Zetzellia pourmirzai* (Acari: Stigmaeidae) exhibited significant positive correlation with temperature. Singh and Chauhan (2017) found that predatory mites *Euseius finlandicus*, *E. delhiensis*, *E. alstoniae*, *Neoseiulus paspalivorus*, *N. longispinosus* was more during May and June, similar to the present study.

Preference of mites to crop canopy levels: The results revealed that among different canopy levels of capsicum, *T. urticae* preferred middle one followed by top and bottom canopy; while *P. latus* preferred top one preferring the soft and succulent leaves (Fig. 1). Alagarmalai et al. (2009) found that both sexes of

yellow mite preferred young cucumber leaves; Girish et al. (2014) observed these more abundantly on leaves in the top canopy of the chilli plant; while Mann et al. (1920) observed these more damaging on top leaves of potato. Prasanna (2007) observed that middle canopy harboured maximum *T. macfarlanei* density in brinjal.

ACKNOWLEDGEMENTS

The authors thank the Professor and Head, Department of Entomology, Punjab Agricultural University, Ludhiana and Indian Council for Agricultural Research, New Delhi for the financial support. First author thanks the Bayer Crop Science for providing

Table 1. Population dynamics of mites on capsicum under nethouse conditions

SMW	2017				2018			
	No. of mites/ leaf				No.of mites/ leaf			
	Tarsonemidae	Tetra-nychidae	Phyto-seiidae	Stigmaeidae	Tarsonemidae	Tetra-nychidae	Phyto-seiidae	Stigmaeidae
7	2.81	0	0	0	0	0	0	0
8	2.50	0	0	0	0.00	0.00	0	0.00
9	2.41	0	0	0	0.00	0.00	0	0.00
10	1.17	0	0	0	0.00	0.00	0	0.00
11	5.91	0	0	0	0.00	0.00	0	0.00
12	11.17	0	0	0	0.00	0.00	0	0.00
13	8.00	0	0	0	0.52	0.00	0	0.00
14	7.50	0	0	0	4.91	0.00	0	0.00
15	1.74	0	0	0	4.09	0.00	0	0.00
16	2.17	0	0	0.33	1.69	0.00	0	0.00
17	4.13	0	0.02	0.06	0.00	0.04	0	0.02
18	1.70	0	0.07	0.04	0.39	0.35	0	0.41
19	1.69	0	0.04	0.04	0.00	0.28	0	0.24
20	0.35	0.69	0.20	0.22	0.39	0.00	0	0.04
21	0.48	3.04	0.15	0.28	0.00	0.15	0	0.09
22	0.74	1.94	0.26	0.59	0.00	0.00	0	0.02
23	0.07	0.94	0.09	0.72	0.00	0.00	0	0.00
24	0	0.54	0.04	1.11	0.00	0.00	0	0.00
25	0	0.04	0.17	0.70	0.00	0.00	0	0.00

Correlation coefficients - incidence vs. weather parameters (2017 and 2018, pooled)

Weather parameters	Tarsonemidae	Tetranychidae	Phytoseiidae	Stigmaeidae
Max. Temp. (^{0}C)	-0.182	0.281*	0.295*	0.360*
Min. Temp. (^{0}C)	-0.273*	0.364*	0.421**	0.490**
Avg. Temp. (^{0}C)	-0.236	0.332*	0.367*	0.453**
Morning RH (%)	0.271*	-0.288*	-0.277*	-0.313*
Evening RH (%)	-0.062	-0.044	0.015	0.023
Avg. RH (%)	0.143	-0.206	-0.170	-0.199

Regression analyses- incidence of mites vs. weather parameters (2017, 2018)

Mite	Regression equation 2017	R^2	Multiple correlation
Tarsonemidae	Y=-3.38-0.140 (Max T)+ 0.243 (Min T)+0.192 (MRH)-0.240 (ERH)	0.288*	0.537*
Tetranychidae	Y=0.482-0.013 (Max T)+ 0.028 (Min T)-0.015 (MRH)+ 0.017 (ERH)	0.173	0.416
Phytoseiidae	Y=0.022-0.003 (Max T)+0.006 (Min T)-0.001 (MRH)+ 0.002 (ERH)	0.246*	0.496*
Stigmaeidae	Y=-0.536+0.007 (Max T)+ 0.014 (Min T)- 0.005 (MRH)+ 0.013 (ERH)	0.328**	0.573**
	2018		
Mite	Regression equation	R^2	Multiple correlation
Tarsonemidae	Y=6.817-0.137 (Avg T)- 0.022 (Avg RH)	0.060	0.245
Tetranychidae	Y=-1.349+ 0.043 (Avg T)+ 0.007 (Avg RH)	0.118	0.343
Phytoseiidae	Y=-0.226+ 0.006 (Avg T)+ 0.001 (Avg RH)	0.170*	0.413*
Stigmaeidae	Y=-1.207+0.032 (Avg T)+ 0.008 (Avg RH)	0.269**	0.519**

** Significant at p=0.01; * Significant at p=0.05**)**

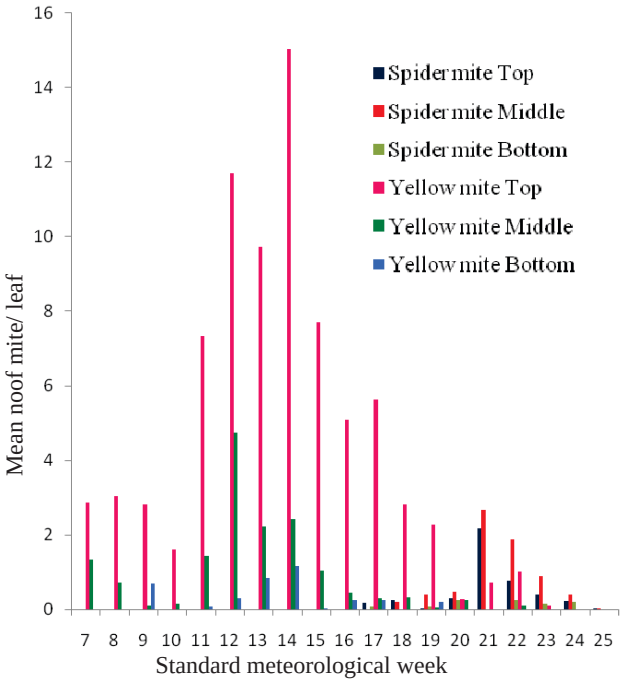

Fig. 1. Incidence of spider mite and yellow mite among canopy levels of capsicum 2017, 2018

fellowship. The authors also thank the Department of Science and Technology for the facilities under the DST-FIST programme [Project No SR/FST/LSI/636/2015(c)].

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(Manuscript Received: November, 2020; Revised: January, 2021;
Accepted: January, 2021; Online Published: May, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e20298