J Krishi Vigyan 2022, 11 (1) : 229-232 DOI : 10.5958/2349-4433.2022.00133.7

Influence of Abiotic Factors on the Population Dynamics of *Scirtothrips dorsalis* and *Polyphagotarsonemus latus* in Chilli

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ABSTRACT

An experiment was conducted during 2018 and 2019 to find out the influence of abiotic factors (temperature, relative humidity and rainfall) on the population of two major insect pests in chilli crop; thrips, *Scirtothrips dorsalis* and mite, *Polyphagotarsonemus latus*. Results exhibited the peak activity of thrips during 21st to 25th SMW in 2018 and 40th to 42nd SMW in 2019. Highest population of mite was recorded during 44th to 45th SMW in 2018 and 38th to 39th SMW in 2019. Both thrips and mite populations exhibited negative correlation with rainfall (r = -0.349 and -0.357 in 2018; -0.571 and -0.292 in 2019). Thrips showed positive correlation with mean temperature (r = 0.622, 0.398), while negative with mean relative humidity (r = -0.5470, -0.5710) during both years. Chilli mite has showed opposite correlation to the thrips as negatively correlated with mean temperature (r = -0.804 and -0.4890) and positive with average humidity (r = 0.4920 and 0.3750) during 2018 and 2019.

Key Words: Chilli thrips, mite, population dynamics, abiotic factors.

INTRODUCTION

Chilli (*Capsicum annum* L.: Solanaceae) is an important cash crop, grown throughout the tropical and subtropical counties of the world for green and dry red fruits. It is famous for its pungency and has been used with vegetables, as spices in cousins, and to make sauces and pickles. Chilli fruits are rich in Vitamin A, B1, B2, B3, C, E and K as well as K, Mg, Cu and Fe (Alsebaeai *et al*., 2020). India is the largest producer, consumer and exporter of chilli and peppers (Anonymous, 2018). In 2017-18, India produced 3592 thousand tonnes of chilli on 309-thousand-hectare land. Andhra Pradesh, Telangana, Karnataka and West Bengal are the dominant in chilli production which collectively contributes more than 80 per cent of the total harvest (Kumar *et al*., 2011; Geetha and Selvarani, 2017). Both chilli mite and thrips are responsible for causing leaf curl disease in chilli plant.

Chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) and chilli mite, *Polyphagotarsonemus latus* (Banks) (Trombidiformes: Tarsonemidae) are polyphagous and sucking pests which are widely distributed in tropical and subtropical regions of the world. In India, these are widely distributed in chilli growing states and as major pests of chillies which can cause up to 50-90 per cent loss (Saini *et al,* 2017). Chilli thrips and mite, both are microscopic (< 2mm) pests, inhabiting leaves, flowers and green fruits. Both larvae and adults of thrips can produce the damage by drawing sap from plant, resulting upward curling of leaves and stunted growth. Mite infestation causes downward curling and crinkling of leaves giving an inverted boat shaped appearance, elongation of petiole i.e., rat-tail symptom, stunted growth, on fruit scaring is very common with reduced fruit size. Economic yield loss due to mite can be up to 60-80 per cent qualitatively in the event of serious infestation (Ghosh *et al*, 2009). These pests are cryptic, short lived, fast population build up and can develop resistance against insecticides. These pests are also able to transmit viruses in plant which can result up to 100 per cent crop loss.

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MATERIALS AND METHODS

Study was carried out at the experimental field of the Department of Plant Protection, Aligarh Muslim University, Aligarh for both summer and winter season chilli variety – Pusa Sadabahar. Chilli was grown in the plot size of 4x5 meter using 30x45cm plant spacing. Standard agronomical practises; weeding, irrigation and fertiliser application were followed and insecticides were not used throughout the cropping duration.

Sampling

Three trifoliate (3 leaves) were collected in plastic bags from the top, middle and bottom strata of five randomly selected plants of 5 different plots. Observations were taken on weekly interval in morning hours between 8:00-9:00 am, from 13th standard meteorological week (SMW) to 50th SMW in 2018 and 2019. Samples were brought to the laboratory and analysed under binocular microscope to record the thrips and mite populations.

Data analysis

Obtained data were analysed to find mean and trend of population, correlation with different abiotic factors (mean temperature, humidity and total rainfall) and test the significance of data using Microsoft Excel and 'R' software (version – 4.2.1, R Core Team). Weather data regarding temperature, humidity and rainfall was obtained from the Meteorological Station, Department of Physics, AMU, Aligarh.

RESULTS AND DISCUSSION

Results (Fig. 1) revealed that first occurrence of thrips in summer crop was recorded on 13th SMW and reached to its peak on 21st to 25th SMW in 2018 (3.23, 4.64, 2.13, 3.15 and 2.16 individuals/leaf). Thrips population was found positively correlated with mean temperature ($r = 0.662$; $R^2 = 0.3863$; $F = 13.22$; $p<0.05$), while negatively correlated with mean humidity and rainfall ($r = -0.547$; $R^2 = 0.2989$, $F = 15.35$, $p < 0.05$; $r = -0.349$; $R^2 = 0.1221$, $F = 5.01$, $p = 0.05$). Mite activity (Fig. 1) was prevalent during 41st to 50th SMW and highest on 44th and 45th SMW (9.05 and 10.45 individuals /leaf). Mite population was negatively correlated with mean temperature and rainfall ($r = -0.804$; $R^2 = 0.6464$; $F = 45$; $p < 0.05$, $r = 0.357$; $R^2 = 0.1275$; $F = 3.36$; $p>0.05$) and positively with humidity ($r = 0.492$; $R^2 = 0.2425$; $F = 8.0$; $p<0.05$). In 2019, thrips incidence (Fig. 2) was highest during 40th-42nd SMW (2.62, 3.87 and 2.33 individuals /leaf), while mite was highly occurred on 38th to 39th SMW (2.33 and 3.27 individuals /leaf). Thrips was positively correlated with temperature ($r = 0.398$; $R^2 = 0.1582$; $p>0.05$) and negatively with humidity and rainfall ($r = -0.571$; $R^2 = 0.3264$; $F = 16.96$; $p<005$, $r = -0.342$; $R^2 = 0.1167$; $F = 4.62$; $p<0.05$). Mite showed negative correlation with temperature and rainfall ($r = -0.489$; $R^2 = 0.2395$; $F = 11.02$; $p<0.05$, $r = -0.292$; $R^2 = 0.0853$; $F = 2.05$; $p>0.05$) while exhibited positive with humidity ($r = 0.375$; $R^2 = 0.1407$; $F = 4.58$; $p<0.05$). During both years, thrips and mite populations were found affected by weather factors. During 2019, both thrips and mite densities were less in 2018 that received 14 weeks of rainfall as compared to 2019, which received 18 weeks of rainfall (<1 mm).

Population studies of insect species in relation to biotic and abiotic factors have significance in investigation of their supporting or limiting factors of their natural growth and decision making for the management and forecasting of the pests (Macfadyen *et al*, 2018). Patel *et al* (2009) also observed the more or less similar trend with present finding; positive correlation ($r = 0.39$) with maximum temperature while negative with minimum temperature and rainfall ($r = -0.45$ and -0.57). The present findings corroborate the earlier findings of Aarwe *et al.* (2019) and Yadav *et al* (2017), who also reported peak activity of thrips and mites in April-May (16th SMW). Finding are also at par with Zainab *et al* (2016); Rajput *et al* (2017) and Meena *et al* (2012), who recorded highest incidence of thrips in the first week of October (40th SMW). Kumar *et al* (2019) also found the similar results on the occurrence of chilli mite in 38th to 42nd SMW. Results also comply with the findings of Kumar

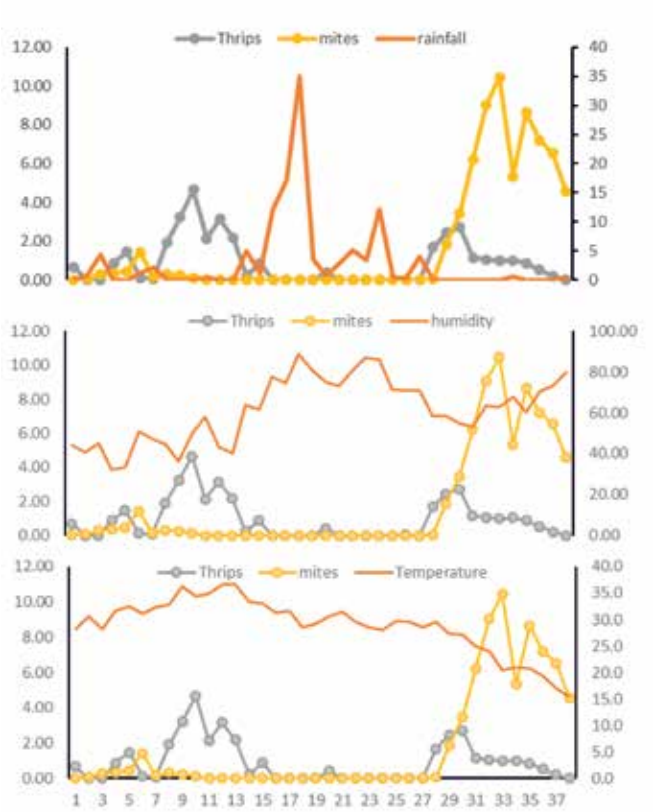

Figure 1. Population dynamics of chilli thrips and mite in 2018

Figure 2. Population dynamics of chilli thrips and mite in 2019

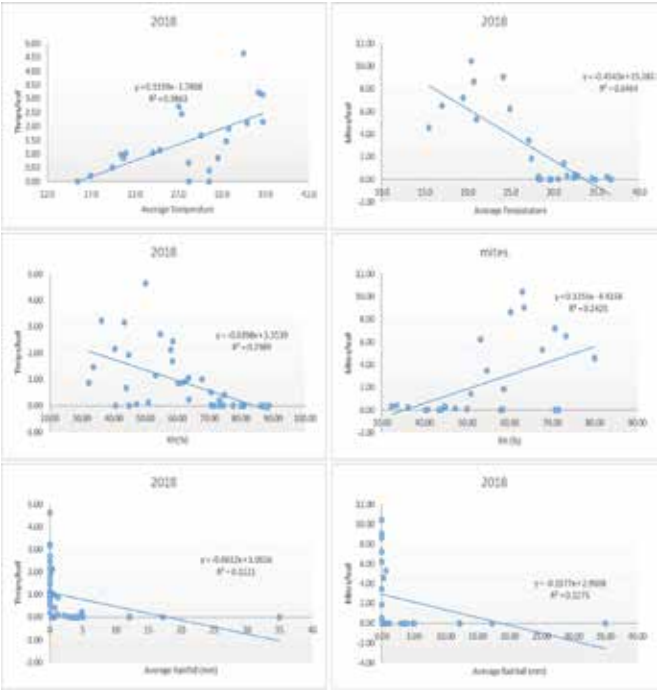

Plate 1. Scatter plot correlation of thrips and mite population with abiotic factors (2018)

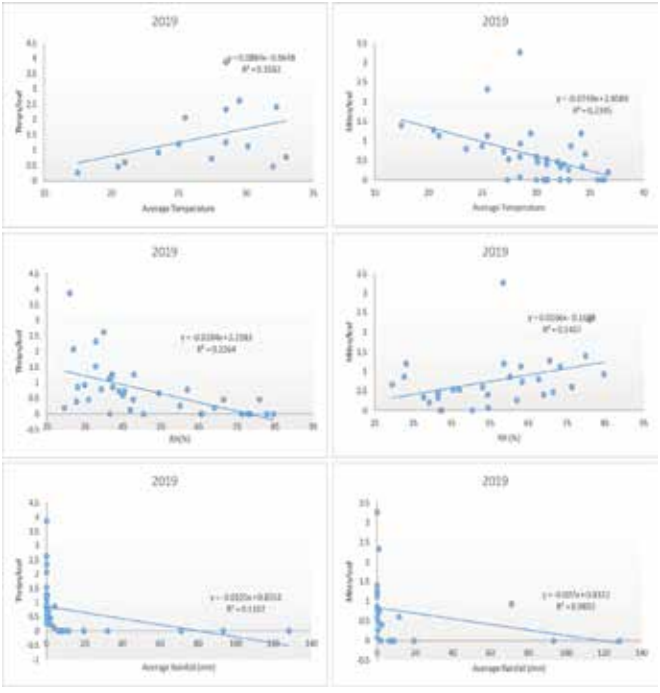

Plate 2. Scatter plot correlation of thrips and mite population with abiotic factors (2019)

et al. (2020) who reported the peak population of thrips in second week of April and significant positive correlation observed with maximum and minimum temperature (r = 0.689 and 0.690) while negative with relative humidity (r = -0.645).

ACKNOWLEDGEMENTS

We are thankful to Chairman, Department of Plant Protection for providing necessary facilities and Chairman, Department of Physics for providing meteorological data.

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Received on 20/2/2022 *Accepted on 18/8/2022*