INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 9 | ISSUE 2 | OCTOBER, 2016 | 578-582

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/9.2/578-582

Incidence and population builds up of *P. lotus* infesting *Capsicum chinense* Jacq. in relation to weather factors

■ M. BATHARI[1], S. RAHMAN[1] AND D. SHARMAH*

Krishi Vigyan Kendra, SOUTH TRIPURA (TRIPURA) INDIA
[1]Department of Entomology, Assam Agricultural University, JORHAT (ASSAM) INDIA

ARITCLE INFO

Received : 17.08.2016
Revised : 10.09.2016
Accepted : 24.09.2016

KEY WORDS :
Capsicum chinense, Yellow mite, Population, Weather parameters, Correlation

ABSTRACT

An Experiment was conducted in the experimental plot, Department of Entomology, Assam Agricultural University, Jorhat during 2014 and 2015 to study the population build up of *P. lotus* infesting *Capsicum chinense* with respect to weather factors. In the present investigation, the highest population (no/leaf) of yellow mite, *P. latus* was observed in the month of March with maximum 45 and 28 number of yellow mite per leaf in 2014 and 2015, respectively. The highest overall per cent incidence recorded was 80.61 in the last week of March whereas lowest overall incidence was found in May with 20.12 per cent mite incidence The correlation studies between *P. latus* and weather parameters revealed that population build up of *P. latus* found to be significant negative correlation with morning relative humidity (r=-0.787 and r=-721) and rainfall (r=-0.526) in both the years, respectively. Maximum temperature, minimum temperature and evening relative humidity showed a negative and non- significant correlation with mite population. Bright sunshine hour was found to be positively correlated. This present findings will certainly be a helpful for yellow mite forecasting as well as management point of view and to have profitable cultivation of *Capsicum chinense* by way of mite free crop production.

How to view point the article : Bathari, M., Rahman, S. and Sharmah, D. (2016). Incidence and population builds up of *P. lotus* infesting *Capsicum chinense* Jacq. in relation to weather factors. *Internat. J. Plant Protec.*, **9**(2) : 578-582, **DOI : 10.15740/HAS/IJPP/9.2/578-582**.

***Corresponding author:**
Email : dasharmah@gmail.com

INTRODUCTION

Among 400 different varieties of chillies, *Capsicum chinense* Jacq. is considered to be one of the hottest chilli species belonging to genus capsicum under the family solanaceae. Popularly known as "*Bhut Jolokia*" (Vernacular meaning Bhut= "ghost", Jolokia= "chilli"), "*Bih Jalakia*" (meaning poisonous chilli) in Assamese and "Naga Jalakia" named after the ferocious "Naga" warrior. Guinness Book of World Records, 2006 has recorded it hottest chilli with 1001304 SHU (Scoville Heat Unit). This extreme character of chilli is due to a volatile phenolic amine "Capsaicin", a molecule which

is responsible for the pungency of chilli peppers and found mainly in the placenta as well as fleshy tissue of the fruit (Thomas, 2013). *Capsicum* spp. are not only cultivated as vegetable and condiment crop but also have recognizable pharmacological properties (Reyes *et al*., 2011). This cultivar is being grown and consumed in different states of the region like Assam, Nagaland, Manipur and Mizoram from time immemorial. "Hot chilli" generally handle and consumed by local people with respect. Nevertheless, because of its refreshing aroma, palatability and medicinal properties, people have been using it for pickle preparation, flavouring curries and for home remedies of ailments like gastritis, arthritis and chronic indigestion problems. It contains large amount of vitamin C and β-carotene, it regulates blood circulation, strengthens the heart, the arteries and the nerve. It is an excellent remedy against alcoholism, lowers cholesterol levels, reduces high blood pressure etc. It is popular in developed countries and is also used for quick relief from heart pain, neuropathic pain and it also kills cancer cells.

Cultivation of this variety of chilli has increased because of its high export value. "*Bhut Jolokia"* is most ideal chilli variety and gaining momentum in the international market for extraction of "Capsaicin" (3%). Currently, *Bhut Jolokia* is being exported to many countries at the rate of 1400-1500 tonnes annually from Assam and neighbouring states of North Eastern region (Talukdar *et al.,* 2012).

The yellow mite, *Polyphagotarsonemus latus* (Banks) also known as broad mite, is an important pests of chilli belonging to the family *Tarsonemidae*. This polyphagous natured broad mite, *P. latus* usually seen in the newly emerged leaves and fruits causing malformation of terminal leaves and fruits, rat tailing of leaf petiole, buds drops immaturely and plants become stunted in growth, thus reduction in yield (Rai *et al*., 2007). Considering the importance and demand of hot chilli as well as reduction in yield due to infestation by *P. lotus*, the present investigation was carried out to find out the influence of weather factor in population build up of this mite pests in chili.

MATERIAL AND METHODS

The present experiment was conducted in the experimental plot of Department of Entomology, Assam Agricultural University, Jorhat to study the influence of weather factors on *P. lotus* population infesting *Capsicum chinense*. The experimental location is situated at 94°12´E Longitude and 24°47´N-Latitude and at an altitude of 86.8 meters above mean sea level. The land having homogeneous fertility and uniform textural makeup was selected for conducting the experiment.

Being situated in the monsoon sub-tropical zone, the climatic condition during the experimental period of Jorhat was characterized by hot humid summer, dry and cool winter, high rainfall (more than 2000mm per annum) and high average humidity (around 85%). Monsoon normally sets in from the first forth night of June and extends upto September with pre monsoon showers from February to May. The intensity of rainfall decreases from October, reaching the minimum during December/January. The maximum temperature rises above 37°C during the month of July-August and the minimum temperature falls below 10°C during 1st week of January.

Layout of the experimental plot :

A gross area of 136 sqm was considered for the experiment with three replication. Hot chilli seedlings (one month old) were transplanted in a spacing 1m (R-R) x 0.75m (P-P). All post planting agronomic operations were carried out to raise the crop expect plant protection measures. Gap filling was performed to maintain uniform plant population in each plot.

Sampling and method of observation :

For population study, randomly selected 10 plants per plot were considered and tagged accordingly. Three randomly selected leaves from the upper, middle and lower canopy from each tagged plants were plucked and collected in properly labeled polythene bags and mite population were counted under the binocular stereo zoom microscope. The yellow mite densities were recorded and the counts were made in every week interval and statistically analyzed.

Meteorological observation :

During the experimental period all data on meteorological factors *viz*., temperature (maximum and minimum), relative humidity (morning and evening), total rainfall and bright sunshine hours were collected from the Department of Agrometeorology, Assam Agricultural University, Jorhat (Assam).

Statistical analysis :

All the collected data was statistically analyzed by following SPSS-16 computer based software.

Simple correlation :

A simple correlation analysis was made between the mean mite population and weather factors like temperature (maximum and minimum), relative humidity (morning and evening), total rainfall and bright sunshine hours. To calculate correlation co-efficient (r), the following standard statistical formula by Pearson (1978) was adopted

$$r = \frac{\Sigma xy - \frac{\Sigma x \cdot \Sigma y}{N}}{\sqrt{\left(\Sigma x^2 - \frac{(\Sigma x)^2}{N}\right)\left(\Sigma y^2 - \frac{(\Sigma y)^2}{N}\right)}}$$

where,

r = Co-efficient of correlation

N = Number of observation

X=Mean population

Y=Independent variables

Then the correlation co-efficient (r) was tested for significance or non-significance by Fisher't' which is defined as follows:

$$t = \frac{r}{\sqrt{(1-r^2)}} x \sqrt{n-2} \text{ with (n-2) d.f.}$$

For correlation studies, weekly average values of the environmental factors were taken into consideration to know their influence on the pest population.

Simple regression analysis :

Simple regression line was fitted to know the impact of independent variables (weather factors) on the dependent variable (pest population).

The regression line was given by the equation:

$$Y = a + bx$$

where,

Y = Dependent variable

x = Independent variables

a = Intercept

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Population of yellow mite, *P. latus* on hot chilli, *Capsicum chinense* :

The population of yellow mite was recorded on hot chilli from February to May during 2014 and 2015 at weekly interval by plant inspection method. The population was recorded on the basis of number of mites per leaf and the results are presented in Table 1.

Activity of yellow mite was observed from third week of February for both the years. The lowest mean number 0.3 and 0.2 mite/leaf in 2014 and 2015 respectively was recorded during February, there after the population increased gradually. The highest population of the yellow mite was recorded during last week of March with a mean population of 28 and 45 mites/leaf both in 2014 and 2015, respectively. The activity of yellow mite was observed to fluctuate at various time intervals with maximum number per leaf in March and minimum in the month of May. Population of mite recorded to be zero in later weeks of observation when the crop was ageing towards maturity. The highest per cent incidence recorded was 80.61 per cent in the last week of March whereas lowest mite incidence was found in May with 20.12 per cent incidence. The recorded population fluctuation data of yellow mite is presented in Table 1.

Correlation studies of yellow mite, *P. latus* population with weather factors :

Simple correlation studies were carried out between the population of the yellow mite and different weather parameters *viz*., maximum temperature, minimum temperature, relative humidity, rainfall and bright sunshine hours (BSSH) (Table 2).

The co-efficient of simple correlation presented in Table 2 showed that yellow mite had a significantly negative correlation with morning relative humidity (r=-0.787) and rainfall (r=-0.526). However, a negative non-significant correlation was observed with maximum temperature (r=-0.052), minimum temperature (r=-0.093) and evening relative humidity (r=-0.486) while BSSH (r=0.443) had a positive non-significant correlation with mite population in 2014.

The data presented in Table 2 indicated that maximum temperature, minimum temperature, evening relative humidity and rainfall had a negative non-significant relationship with yellow mite, r=0.014, r=-0.120, r=-0.388 and r=-0.280, respectively during 2015.

The relationship between morning relative humidity and yellow mite was found to be negatively significant (r=-0.721) and BSSH was found to be positive but none significant (r=0.089) with the yellow mite population in 2015.

Regression studies on yellow mite, *P. latus* population with existing weather factors :

The regression analysis of the significant relationship between the yellow mites population and weather factors were performed by taking the mean values of mite population and weekly average of various weather factors *viz*., temperature (maximum and minimum), relative humidity (morning and evening), rainfall and bright sunshine hours to draw the simple linear regression line (Table 2). The yellow mite population found to be significant negative and linear (r=-0.787 and r=-0.721) relationship with the morning relative humidity in 2014 and 2015, respectively. The regression equation Y=-2.416x + 227.22 and Y=-4.227x +401.87 thus, gives the magnitude of the association of mite population with morning relative humidity during 2014 and 2015, respectively. The relationship between rainfall and yellow mite population was found to be significant, negative and linear (r=-0.526). The regression of mite population with rainfall could be expressed by the equation Y=-0.181x + 12.18, which gives the magnitude of their association in 2014 whereas it was non-significant but negative in 2015.

The correlation studies between the *P. latus* and weather parameters during 2014 and 2015 revealed that population build up of *P. latus* had a significant negative

Table 1 : Population of yellow mite, *Polyphagotarsonemus latus* in hot chilli, *Capsicum chinense* with corresponding weather factors

Std. meteorological week	Yellow mites population (No. /leaf)		Yellow mite incidence (%)	
	2014	2015	2014	2015
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0.3	0	0	0
5	6.4	0	0	0
6	20	0.2	20.40	20.50
7	18.2	0.6	20.31	40.22
8	4.4	16.6	40.20	40.30
9	28	20	80.03	60.44
10	10.2	22.8	60.92	80.61
11	20	45	60.11	60.44
12	12	24	60.21	60.34
13	4.6	2.6	40.23	40.31
14	0.4	1.2	40.14	20.43
15	0	16	20.12	20.23
16	0	0	0	0
17	0	8	0	0

Data are the mean of three replication

Table 2 : Correlation and regression study of yellow mite population with different weather factors

Weather factors	Year			
	2014		2015	
	r	Regression equation	r	Regression equation
Max. temp (°C)	-0.052	-	-0.014	-
Min. temp (°C)	-0.093	-	-0. 120	-
Mor. RH (%)	-0.787*	Y= -2.416x + 227.22	-0.721*	Y= -4.227x +401.87
Eve. RH (%)	-0.486		-0.388	-
Av. rainfall (mm)	-0.526*	Y= -0.181x +12.189	-0.280	-
BSSH	0.443		0.089	-

* indicates significance of value at P =0.05

correlation with rainfall and morning relative humidity. Maximum temperature, minimum temperature and evening relative humidity had negative and non significant correlation with the mite population. Bright sunshine hour was found to be positively correlated. Similar results were also obtained by Bhede *et al.* (2008) who reported that the correlation of minimum temperature, morning and evening relative humidity with the mite population was negative and non-significant. Similarly, Patil and Nandihalli (2009) reported significant negative correlation of *P. latus* with rainfall, morning and evening relative humidity. Such significant negative correlation was reported by Singh and Singh (2012) that confirm the present findings. Meena *et al*. (2013) reported a negative correlation with maximum temperature. This established the conformity of the present findings with some of the earlier works.

Conclusion:

From the experimental findings it can be concluded that the correlation studies between weather parameters and population of yellow mite infesting *Capsicum chinense* has varying degree of relationship and these parameters found to be a great influence on population build up of this pests. The regression study indicated the strength of relationship between certain insect pest and weather factors. The present findings could be tools for yellow mite pests forecasting well in advance and management option against this mite.

Acknowledgement :

The authors would like to sincerely thank to Dr. L.K. Hazarika, Professor and Head, Department of Entomology, AAU, Jorhat, Assam for providing the necessary facilities along with valuable suggestion during the entire period of the experiment.

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