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IMPACT OF ABIOTIC FACTORS ON POPULATION DYNAMICS OF PHYTOPHAGOUS MITE (*TETRANYCHUS LUDENI* ZACHER) ON COWPEA IN EASTERN UTTAR PRADESH

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ABSTRACT

A field experiment was carried out to investigate the population dynamics and impact of abiotic factors on population of spider mite (*Tetranychus ludeni* Zacher) under unprotected conditions of Varanasi region. The results revealed that the incidence of *T. ludeni* started from second week of March during both the years of study. The highest population buildup of mites was recorded on 18th and 20th standard week (51.80 and 52.64) in 2010 and 2011 respectively. The spider mites were active during the month of May in both the years. The predatory mites were also active during 17th and 18th standard week with a peak of 13.10 mites per leaf. Among the weather parameters, mean temperature, sunshine hours and wind velocity showed a positive correlation, while relative humidity and rainfall showed negative correlation on the population of the mite.

KEY WORDS
Tetranychus ludeni
Abiotic factors
Population dynamics

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INTRODUCTION

Before three decades, infestation by phytophagous mites was not a common feature in Eastern Uttar Pradesh and the farmers were totally unaware of the mites. Infestation of the spider mite *Tetranychus ludeni* on cowpea *Vigna unguiculata* (L.) Walp, which is an important vegetable crop in India, was first observed by farmers of eastern Uttar Pradesh in the early 1980´s, after Singh (1976) first reported about that emerging pest problem. The infestation of *T. ludeni* started to increase around the same time in other parts of north India, attracting the attention of the Indian Council of Agricultural Research (Singh and Raghuraman, 2011). *Tetranychus ludeni* is widespread in the tropics and has been recorded from over than 300 plant species worldwide (Bolland *et al*., 1998, Zhang, 2002). In India, *T. ludeni* commonly occurs on many cultivated crops, especially on vegetable crops, causing substantial losses, with the highest damage on eggplant and okra (Reddy, 2001). The outbreak of spider mites in many vegetable growing areas is assumed to be due to the indiscriminate and frequent use of synthetic pesticides, especially pyrethroid insecticides and acaricides (Dobson *et al*., 2002). Hence it is need of the hour for formulation of suitable management programme of this pest. However, one of the key conditions for establishing an efficient and sustainable IPM strategy is the detailed knowledge of the pest through its biology, ecological requirements and associated natural enemies. Very little information is available on impact of abiotic factors on the population dynamics of this mite pest under Eastern Uttar Pradesh conditions. Hence the present investigations were made to study the impact of weather parameters on the population dynamics of *T. ludeni* and its predatory mites occurring in cowpea.

MATERIALS AND METHODS

Field studies were carried out during 2010 and 2011, at the farmers field conditions in Raipur village, Varanasi. The cowpea variety Kashi kanchan which is recommended for farmers of this region was sown on second fortnight of February during both the years of study. For the cultivation of cowpea crop, the recommended agronomic practices were adopted. The plant geometry of cowpea was 50 × 75 cm and sowing in three replications.

Sampling was done as described by Poe (1980) for mites. Leaves were collected at weekly intervals from different parts of the canopy of cowpea. The presence of mites on plant structures was determined with the use of hand lenses (10 x), and by taking into consideration typical symptoms of infestation caused by mites. The infested structures were brought to the laboratory and the mites were observed under a stereomicroscope. Mites were handled with camel hair brushes and dissecting needles and mounted in Hoyer´s medium for identification (Singh and

Raghuraman, 2011). The meteorological data was obtained from the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, and the correlation between phytophagous mites population and biotic (predatory mites) and abiotic (weather variables) were worked out with SPSS software.

RESULTS AND DISCUSSION

Population dynamics of *T. ludeni* as well as predatory mites on cowpea are presented in Fig. 1 and 2 and their correlation with abiotic factors during two consecutive years, are presented in Table 1 and 2.

The present findings showed that the phytophagous mite and predatory mite population commenced from 10th Standard week of March. The population of phytophagous mite (*T. ludeni*) and predatory mite was at their peak in the month of May and June during 2010 and 2011 respectively. The mite's population increased gradually in crop growth period. The population buildup started from the 10th standard week (March) and during present investigation, the population buildup was constantly increasing from March to middle of May.

After mid May (19th standard week) the population started declining and in June (24th 22nd standard week) during 2010 and 2011 respectively, there was a drastic reduction of mite population. This may be attributed to the fact that cowpea is short duration and early maturing crop which becomes hardy at maturity.

The highest mean population of phytophagous mite, *Tetranychus ludeni* per leaf was recorded in May (51.80, 49.12 and 48.43 from 18th, 19th and 20th standard week respectively), followed by June (45.70 in 21st standard week respectively), while predatory mite was highest in May (13.10, 10.21 and 12.40 average predatory mite in 18th, 19th and 20th standard week respectively) followed by April (12.56 average predatory mite in 18th, 19th and 17th standard week) during 2010;

Table 1: Coefficient of correlation (r) of *T. ludeni* with weather variables and predatory mites during 2010 in Varanasi

Factors	Correlation coefficient(r)	Coefficient of determination $(r)^2$	Coefficient of variation(%)
Mean population × population of predatory mite	0.857**	0.734	73.445
Mean population × mean temperature	0.553*	0.306	30.581
Mean population × mean RH	-0.467*	0.218	21.809
Mean population × sunshine hours	0.244	0.060	5.954
Mean population × rain fall	-0.318	0.101	10.112
Mean population × wind	0.246	0.061	6.052
Mean population × evapotranspiration	0.580**	0.336	33.640

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)

Table 2: Coefficient of correlation (r) of *T. ludeni* with weather variables and predatory mites during 2011 in Varanasi

Factors	Correlation coefficient(r)	Coefficient of determination $(r)^2$	Coefficient of variation(%)
Mean population × population of predatory mite	0.753**	0.567	56.701
Mean population × mean temperature	0.581*	0.338	33.756
Mean population × mean RH	-0.491*	0.241	24.108
Mean population × sunshine hours	0.433	0.187	18.749
Mean population × rain fall	-0.395	0.156	15.603
Mean population × wind	0.120	0.014	1.440
Mean population × evapotranspiration	0.525*	0.276	27.563

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)

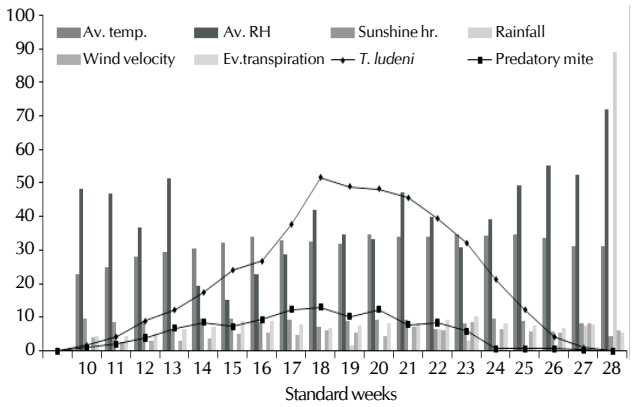

Figure 1: Seasonal population dynamics of phytophagous mite (*Tetranychus ludeni* Zacher) and predatory mite as influenced by weather variables during in cow pea during 2010

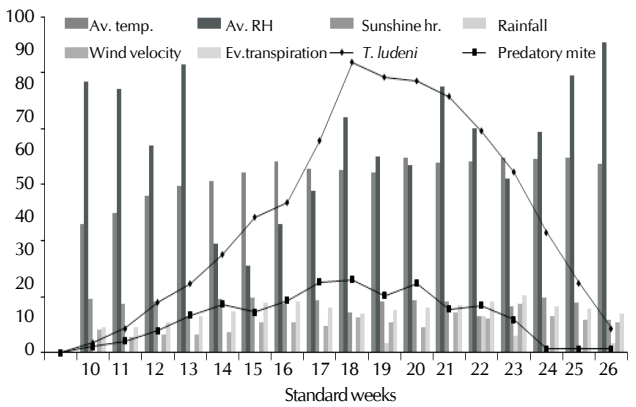

Figure 2: Seasonal population dynamics of phytophagous mite (*Tetranychus ludeni* Zacher) and predatory mite as influenced by weather variables during in cow pea during 2011

Whereas, in 2011 The highest average phytophagous mite, *Tetranychus ludeni* Zacher population per leaf was recorded in May (52.64, 47.90 and 45.78 from 20th, 19th and 18th standard week respectively), followed by June (39.50 in 21st standard week respectively), while predatory mite was highest in May (14.16 and 13.05 average predatory mite in 18th and 19th standard week respectively) followed by April (12.43 average predatory mite in 17th standard week).

The present findings confirmed the results obtained by Singh and Raghuraman (2011) who identified that *Tetranychus urticae* has been very damaging to cowpea in the Varanasi region and major pest of vegetable in the summer. In the present study, aggregation of mites on tips of the pods was a common feature during periods of the day when temperature is above 38°C. Similar reports were done by Singh (1995) who also suggested that increases in population density were associated with a period of high temperature and low humidity and temperature appeared to be regulatory factor for population buildup of mite pest.

Correlation between mite's population and weather variables

The correlation coefficient of *Tetranychus ludeni* Zacher with predatory mite and weather variables in 2010 and 2012, are shown in Table 1 and 2 respectively. A positive significant correlation was established at 0.01 level in 2010 (r = 0.857**) and in 2011 (r = 0.753**) in case of *T. ludeni* and predatory mite, and similar relation with evapotranspiration were found at the 0.01 level in 2010 (0.580**) while in 2011 (0.525*) significance was seen at 0.05 level. The temperature and relative humidity showed positive (r = 0.563* in 2010 and r = 0.581* in 2011) and negative correlation (r = - 0.467* in 2010 and r = 0.491* in 2011) respectively with phytophagous mite, *T. ludeni,* which were significant. Other variables such as sunshine hours and wind velocity showed positive non significant relation whereas the rainfall showed negative correlation with the mites population during 2010 (r = - 0.318 in 2010 and -0.395 in 2011). Meena *et al*. (2013) also reported a similar relation of abiotic factors with yellow mite. Results of the present investigations showed that in Eastern Uttar Pradesh region, the incidence of *T. ludeni* is high during the months of April and May, which indicates that appropriate plant protection measures should be applied during these months to prevent the crop loss.

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