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Dharmendra Kumar
Department of Entomology and Agricultural Zoology, Faculty of Agriculture RGSC, BHU, Barkachha, Mirapur, Utter Pradesh, India

M Raghuraman
Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, BHU, Varanasi, Utter Pradesh, India

Ramesh Singh Yadav
Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, BHU, Varanasi, Utter Pradesh, India

Mukesh Kumar Singh
Department of Genetics & Plant breeding, Faculty of Agriculture RGSC, BHU, Barkachha, Mirapur, Utter Pradesh, India

Correspondence
Dharmendra Kumar
Department of Entomology and Agricultural Zoology, Faculty of Agriculture RGSC, BHU, Barkachha, Mirapur, Utter Pradesh, India

Population dynamics of phytophagous mite, *Tetranychus ludeni* Zacher on cowpea in relation to abiotic conditions of Varanasi region

Dharmendra Kumar, M Raghuraman, Ramesh Singh Yadav, and Mukesh Kumar Singh

Abstract
The field experiment was conducted with a view to study the fluctuation of phytophagous mite's (*Tetranychus ludeni* Zacher) population and their relation to prevailing weather variables during 2010 and 2011 at the farmer Salik Ram field, Village Raipur, Varanasi, the cowpea variety Kashi kanchan was sown on 15 February 2010 and 20 February 2011 respectively. The result reveals that the mite population commenced on 10th standard week in both the year. The population of mite was counted per leaf basis. The highest population buildup of mites was recorded on 18th standard week (51.80) in 2010 while in 2011 the maximum buildup of mite's population was recorded in a 20th standard week (52.64). On an average the maximum mite's population buildup was recorded in the May in both the year. Positive correlation were shown by mite (*Tetranychus ludeni* Zacher) with average temperature, sunshine hours and wind velocity, where as negative correlation was found with relative humidity and rainfall in mites population.

Keywords: cowpea, abiotic factors, population, *Tetranychus ludeni* Zacher

1. Introduction
Cowpea (*Vigna unguiculata* L.), is a warm-season, annual, herbaceous legume crop. Cowpea also known as southern pea, black eye pea or lobia. Cowpea plant physically appeared as erect, semi-erect, prostrate (trailing) or climbing. Africa is the largest producer of cowpea in world. Area under cowpea in India is 3.9 million hectares with a production of 2.21 million tonnes with the national productivity of 683 kg per ha [1]. The cowpea are rich in protein, fat, fiber carbohydrate and the protein cowpea seed are rich in the amino acids, lysine and tryptophan, except methionine and cystine when compared to animal proteins. The Cowpea (*Vigna unguiculata* L.) is a poor men protein source. It is crop of low and high rainfall regions, an important component of cropping system grown as a catch crop, mulch crop, intercrop, mixed crop and green crop. It has ability to fix atmospheric nitrogen in soil at the rate of 56 kg per ha in association with symbiotic bacteria under favourable conditions [2].
The crops are attacked by several pest species and the proximity of plots probably favors dispersal of pests from one crop species to the other. Generally, the herbivore encounters plants of variable quality and departs from the poor quality plants more rapidly [3]. Mites (Order Acarina) of agricultural importance are generally classified either as phytophagous or predators. The most important super families of exclusively phytophagous mites are Eriophyoidea and Tetranychoidea. The family Tarsonamidae also has many phytophagous species [4]. The family Tetranychidae is among the most important crop pests worldwide. The subfamily Tetranychinae includes a number of economically significant species of which *Tetranychus urticae* Koch and *T. ludeni* Zacher is the most important for many vegetable crops [5]. *Tetranychus ludeni* is widespread in the tropics and has been recorded from more than 300 plant species worldwide [6]. In India, *T. ludeni* commonly occurs in many cultivated crops, especially on vegetable crops, causing substantial losses, with the highest damage on an eggplant and okra [7]. Infestations of cowpea which is an important vegetable crop in India, the *Tetranychus ludeni* Zacher was first observed by farmers of eastern Uttar Pradesh in the early 1980´s, after [8] first reported about that emerging pest problem. However, information about mites was available in the peninsular part of the country [9-10].

The abundance of *T. ludeni* started to increase around the same time in other parts of North India and draw the attention of the Indian Council of Agricultural Research (ICAR). 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. However, the present investigations on seasonal variation in the *Tetranychus ludeni* Zacher populations have studied to know field status of this mite. Further the co-relation of mite incidence with environmental factors also has been elucidated to understand the factors responsible for buildup of mite pest. This will help in knowing the when and why the pest would be serious in cowpea field.

2. Materials and Methods

The field experiment was conducted during 2010 and 2011, at the farmer Salik Gram field, Village Raipur, Varanasi, the cowpea variety Kashi kanchan was sown on 15 February 2010 and 20 February 2011 respectively. For the cultivation of cowpea crop the normal agronomic practices were adopted. The plant geometry of cowpea was 50x75 cm and sown in three replications. Observations were taken of mites infestation was regularly to visit the crop in village at farmer field and infested materials were taken as well as brought to laboratory for the correct identification of the mites' species with the help of stereomicroscope and identified as *Tetranychus ludeni* Zacher. Observations were taken of mites infestation was regularly to visit the crop in village at the farmer field. The data were taken in each replication of ten randomly selected plants for weekly observations to population dynamics of *Tetranychus urticae* Zacher from each plant four leaves were taken. The mite population per area leaf (except petiole and stem) was observed in the field with help of 10X magnification hand lens. The meteorological data were collected from the department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, and the data were correlated with *Tetranychus ludeni* Zacher population and abiotic (weather variables) were worked out with the help of SPSS software.

3. Results and Discussion

3.1 Population dynamics of *Tetranychus ludeni* Zacher

The present investigation was carried out at the farmer field and crop was sown in field on the 15 February 2010 and 20 February 2011. The data were recorded from 10th standard week to 28th standard weeks during 2010 and from 10th standard week to 26 standard weeks during 2011. The results show that the population of *Tetranychus ludeni* Zacher was commenced during 10th Standard week of the both years. The average population of *Tetranychus ludeni* was highest in the month of May and June in during 2010 and 2011 (18th standard week) (Fig.1 and Fig.2 respectively). The population of *Tetranychus ludeni* Zacher was increased continuously with growing of crop vegetative growth stages. During present investigation, population of phytophagous mites was increased as Log phage manner. After mid May (19th standard week), the population *Tetranychus ludeni* Zacher was decreased slowly and after June (24th standard week) the drastic reduction of population during 2010 presented in Fig.1. Whereas, in 2011 the reduction of *Tetranychus ludeni* Zacher was started from June (20th Standard week) and after 22nd standard week population was suddenly fall down (Fig.2). Singh and Mukherjee [11] identified that the *Tetranychus urticae* mite has been very damaging to cowpea in the Varanasi region and major pest of vegetable in the summer (May to June). Aggregation of mites on tips of the pods is common during periods of the day when temperature is above 38°Cand reported that the high populations were recorded in April, May and June. The highest average population of *Tetranychus ludeni* Zacher 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), during 2010; Whereas, in 2011 The highest average population of *Tetranychus ludeni* Zacher 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). Singh [12] Studied on the seasonal incidence of *Tetranychus ludeni* on cowpeas were carried out in Varanasi, Uttar Pradesh, India, reported that the peak population of *T. ludeni* was observed in May and June, and the lowest population was observed in August. Whereas, Chandra *et al.* [13] was recorded similar trend on population dynamics of *Tetranychus ludeni* Koch in grape.

Increases in population density were associated with a period of high temperature and low humidity and the temperature appeared to be regulatory factor for population buildup of mite pest. Such, type of phenomenon are directly related to the environmental conditions and the availability of the food. The cowpea is short duration early mature crop. At the later stages the plants became hardy and their concentric food dried consequently such mite cannot able to suck the plant sap may also.

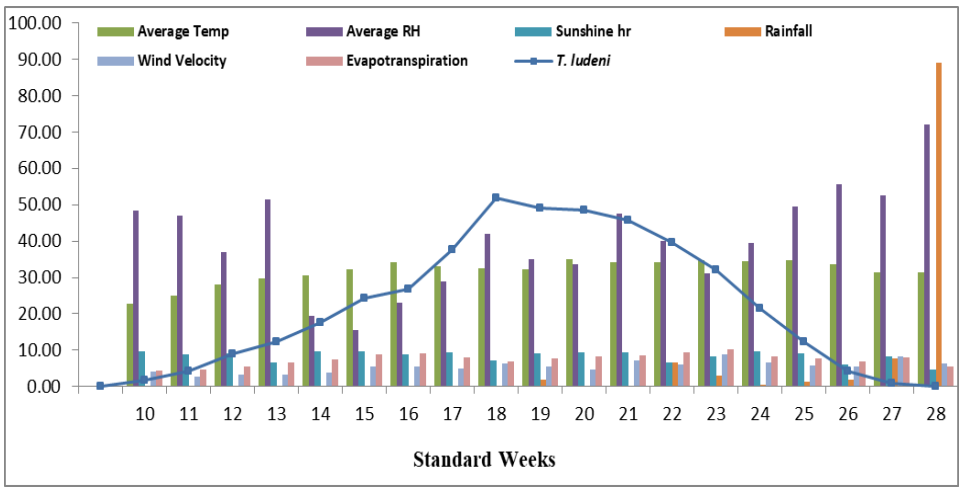

Fig 1: Population dynamics of phytophagous mite (*Tetranychus ludeni* Zacher) on cowpea influenced by abiotic factors during 2010

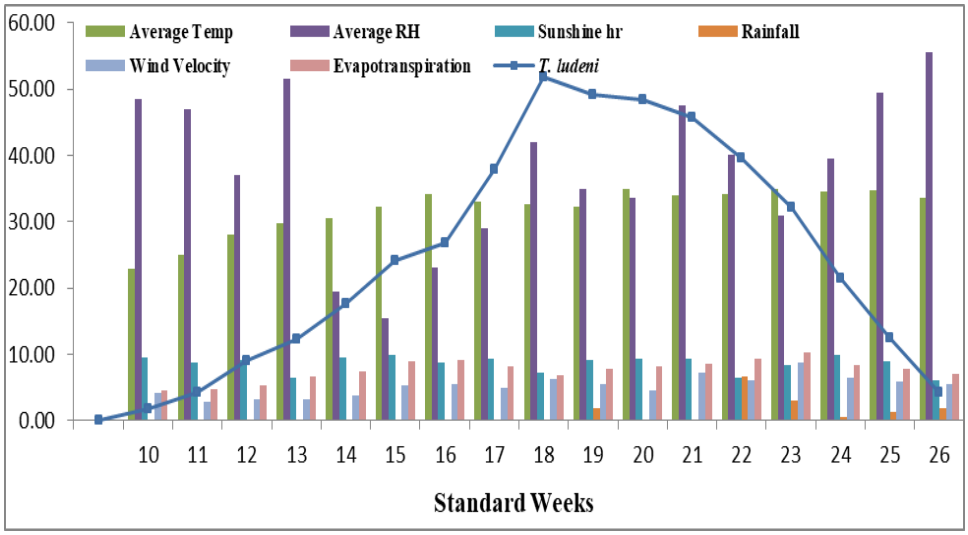

Fig 2: Population dynamics of phytophagous mite (*Tetranychus ludeni* Zacher) on cowpea influenced by abiotic factors during 2011

3.2 Correlation between *Tetranychus ludeni* Zacher population and abiotic factors

The correlation coefficient of *Tetranychus ludeni* Zacher with weather variables in 2010 and 2011 have made, are shown in Table.1 and 2, respectively. Result presented that there is positive significant Correlation with mean temperature, sunshine hours, wind velocity and evapotranspiration. The evapotranspiration was found at the 0.01 level in 2010 (0.580**) while in 2011 (0.525*) significant at 0.05 level. The temperature has shown positive correlation with phytophagous mites, *Tetranychus ludeni* Zacher is the (r=0.563* in 2010 and r=0.581* in 2011). Sunshine hours and wind velocity were shown as non significant (r= -0.244 in 2010 and 0.433 in 2011) and (r= 0.246 in 2010 and -0.120 in 2011) respectively. The relative humidity and rainfall shown as negative correlation as (r= -0.467* in 2010 and 0.491* in 2011) and (r= - 0.318 in 2010 and = - 0.395 in 2011) respectively. Veerendra *et al.* [14] have recorded on grape that there was significantly positive correlation was observed between *T. urticae* and maximum temperature (*r*= 0.804), whereas minimum temperature (*r*= 0.021) had nonsignificant effect. Further significantly negative correlation was found between *T. urticae* and morning relative humidity (r= -0.970) as well as evening relative humidity (*r* = - .952). A non-significant correlation was found between *T. urticae* and rainfall (*r*= 0.235).

Table 1: Coefficient correlation (r) of phytophagous mite (*Tetranychus ludeni* Zacher) with different abiotic factors during 2010 in Varanasi

S. No.	factors	Correlation coefficient (r)	Coefficient of determination $(r)^2$	Coefficient of variation (%)
2.	Mean population X mean temperature	0.553*	0.306	30.581
3.	Mean population X mean RH	-0.467*	0.218	21.809
4.	Mean population X sunshine hours	0.244	0.060	5.954
5.	Mean population X rain fall	-0.318	0.101	10.112
6.	Mean population X Wind	0.246	0.061	6.052
7.	Mean population X Evaporation	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 correlation (r) of phytophagous mite (*Tetranychus ludeni* Zacher) with different abiotic factors during 2011 in Varanasi

S. No.	factors	Correlation Coefficient (r)	Coefficient of Determination $(r)^2$	Coefficient of Variation (%)
2.	Mean population X mean temperature	0.581*	0.338	33.756
3.	Mean population X mean RH	-0.491*	0.241	24.108
4.	Mean population X sunshine hours	0.433	0.187	18.749
5.	Mean population X rain fall	-0.395	0.156	15.603
6.	Mean population X Wind	0.120	0.014	1.440
7.	Mean population X Evaporation	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)

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