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POPULATION DYNAMICS OF *TETRANYCHUS NEOCALEDONICUS* ANDRE AND ITS CORELATION WITH WEATHER FACTORS IN BRINJAL ECOSYSTEM

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ABSTRACT

Population dynamics of *Tetranychus neocaledonicus* Andre (Acarina: Tetranychidae), the vegetable spider mite was studied in brinjal ecosystem (*Solanum melongena* L.) under field conditions during crop seasons of 2013-15.*T. neocaledonicus* was significantly negatively correlated with RH and rainfall, negative correlation with temperature was observed. The vegetable mite had positive correlation r=0.161 with maximum temperature which was not significant, the correlation with minimum temperature (r =-0.247) and average temperature (r = - 0.066) were both significantly negatively correlated whereas, significant negative correlation was found with morning RH (r =-0.581), evening RH (r = - 0.717) mean RH (r = -0.534) as well as with rainfall (r = - 0.576).In the second year of study showed non- significant negative correlation with maximum temperature (r = - 0.076), minimum temperature (r= - 0.440), average temperature (r = - 0.277) and morning RH (r = -0.347) whereas, evening RH (r = - 0.571), mean RH (r = - 0.555) and rainfall (r =- 0.505) were all significantly negatively correlated. A peak of 9.2 mite per 2.5 sq./cm. leaf was noted during august 2nd fortnight when rainfall was low and temperature high similarly heavy rainfall of 166.2 mm, 120.9 mm and 117.7 mm resulted in low population of mite.

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INTRODUCTION

The vegetable mite *Tetranychus neocaledonicus* Andre is one of the important mite pest of vegetables and is distributed throughout the tropical and sub tropical areas of world. Besides vegetables it is found to attacks fruits, field crops, flowers and crops of economic importance. It sucks the sap from the plant cells there by producing white spots which with time coalesce gradually leading to premature falling of leaves. *Tetranychus neocaledonicus* Andre the vegetable mite is now recognized as widely distributed causing economic injury to many important plants like vegetables, fruit crops, oilseeds, spices, tuber crops and weeds (Goldsmid, 1962; Rahman and Sapra, 1946; Jeppson *et al*., 1975; Manjunatha and Puttaswamy, 1989) making it a serious pest in tropical and subtropical countries of the world. *T. neocaledonicus* has tendency to colonies the lower surface of mature leaves, gathering along the midrib and veins of the leaves. They are also known to produce large amount of webbing. It sucks the sap from plant sap due to which there is loss of photosynthetic activity causing leaf discolouration as chloroplast disappears due to sap sucking and ultimately loss of plant vitality (Tanigoshi*et al*., 2004). The growth and yield of crop is severely affected by high population density.Positive correlation was shown by *T. neocaledonicus* population with maximum temperature (r = +0.161), negative correlation with minimum temperature (r = -0.247), significant negative correlation was found with morning RH (r=-.581) and evening RH (r = -0.717). Mite population was significantly negatively correlated with rainfall (r= -0.576) (Singh and Singh, 2014). Study of population dynamics of the vegetable mite in context to the changing climate becomes important as it influences its damage potential and management strategy. Since very less information was available about the population dynamics of the vegetable mite on brinjal it was thought desirable to conduct the experiment so that farmers can easily adopt proper time of control to protect the crop.

This paper deals with study regarding impact the abiotic factors was making on the population dynamics of the vegetable mite.

MATERIALS AND METHODS

The study on the population dynamics ofthe vegetable mite *T.neocaledonicus*with weather parameters was studied throughout the year for two years 2013-15 on variety Punjab Sadabahar at Vegetable Research Farm of Institute of Agricultural Sciences, Banaras Hindu University,Varanasi. The population of *T. neocaledonicus* was recorded from second fortnight of June to first fortnight of March in both the years at fortnightly interval. To record the mite population, five plants were randomly selected, tagged from each plot and six leaves (2 upper, 2 middle, 2 bottom) were plucked randomly from each of these five plants, twice a month. All the collected leaves were placed in individual polythene bags, labeled and were brought to laboratory for counting of mites. Care was taken not to disturb the natural population of mites on the leaves. The population of *T. neocaledonicus* was counted under the stereoscopic binocular microscope 2.5cm^2 at four spots per leaf.

The weather parameters *viz*.; temperature (°C), relative humidity (%) and rainfall (mm) in the corresponding fortnightly interval was collected from the Meteorological Section, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh. To study the effect of abiotic factors on the populations dynamics of the vegetable mite on Brinjal, the observations of abiotic factors recorded at fortnightly interval were used to compute the simple correlation coefficients (r) values of dependent (mite population) and various independent variables (abiotic factors, *i.e.*, temperature, relative humidity and rainfall).

RESULTS

The population of *T .neocaledonicus* in first year of observation showed an increasing trend twice during the observation period once from 2nd fortnight of October with 8.33 mites per 2.5sq cm leaf area to 1st fortnight of December with 11.17mites per 2.5sq cm leaf area and again 5.60 mites in 1st fortnight of February to 13.40 mites per 2.5sq cm leaf area in 1st fortnight of March. A notably high population 8.97 mites per 2.5sq cm leaf area was observed in 1st fortnight of September when the corresponding maximum temperature was 33.1°C, 25.4°C minimum temp., morning RH 82.5%, evening RH 66.0 % and rainfall 3.20 mm. Similarly, in August 1st fortnight count was 8.47 mites per 2.5sq cm leaf area when the maximum temperature was 32.1°C, minimum temperature 25.8 °C, morning RH 89.5%, evening RH 78.0% and rainfall during this period was 66.0 mm. The heavy rainfall of 166.2 mm, 120.9 mm, 117.7 mm, 66 mm and 182.6 mm resulted in very low mite population in corresponding period which may be attributed to washing out of nymph and adults by the downpour. As the average temperature declined from 2nd fortnight of December the phytophagous mite population started declining till 1stFeburary fortnight.

In second year *T. neocaledonicus* population on brinjal was comparatively low as very heavy showers 55.7 mm, 327.4 mm, 50.6 mm, 185.1 mm were experienced from 2nd fortnight of June to August 1st fortnight, thereby slow build up of population was noticed. A peak of 9.2mites per 2.5sq cm leaf area in population was noticed in 2nd fortnight of August when the corresponding rainfall was 20.5 mm, 34.0°C maximum temperature, 27.3°C minimum temperature, 80.5% morning RH and 65.5% evening RH. An increasing trend in population was observed with rising temperature no rainfall from 8.1 mites in 2nd fortnight of January to 15.1 mites per 2.5sq cm leaf area in first fortnight of March. Rest of the period the mite populations build up was low to moderate as frequent rainfall prevented it.

The correlation coefficient of *T. neocaledonicus* with weather parameters were worked out and the result showed that the vegetable mite had positive correlation r = 0.161 with maximum temperature which was not significant, the correlation with minimum temperature (r = - 0.247) and average temperature (r = - 0.066) were both significantly negatively correlated whereas, significant negative correlation was found with morning RH (r = - 0.581), evening RH (r = - 0.717) mean RH (r = - 0.534) as well as with rainfall (r = - 0.576).The regression co-efficient (b) and constant (a) were worked to set regression equation. The regression equation of average temperature with mite population was Y= 9.952 – 0.071x, thereby indicating for every increase in one unit of temperature the mite population decreasing by 0.071x. For RH the regression equation worked out as Y = 32.622 – 0.342x, showing decrease in population of mite by 0.342x with every unit increase in RH. Equation for rainfall is Y = 10.881 – 0.061x, so every unit increase in rainfall will lead to decrease of mite population by 0.061x.

The correlation of *T. neocaledonicus* population with weather parameters in the second year of study showed non- significant negative correlation with maximum temperature (r = - 0.076), minimum temperature (r= - 0.440), average temperature (r = - 0.277) and morning RH (r = -0.347) whereas, evening RH (r = - 0.571), mean RH (r = - 0.555) and rainfall (r = - 0.505)

Table 1: Population of *Tetranychus neocaledonicus* Andre on brinjal (2013 - 2014)

Month2013-14	Temperature^0 C			RH %			Rainfall	*T.*
	Maximum	Minimum	Average	Morning	Evening	Average	mm	*neocaledonicus*
June II	33.0	26.5	29.7	82.0	69.5	72.7	166.2	1.13
July I	32.8	26.6	29.7	84..0	71.0	77.7	120.9	1.75
July II	33.1	26.7	29.9	84.5	72.0	78.6	117.7	5.53
August I	32.1	25.8	28.9	89.5	78.0	83.7	66.0	8.47
August II	30.4	25.9	28.1	87.5	80.5	84.0	182.6	2.98
Sept. I	33.1	25.5	29.3	82.5	66.0	74.2	3.20	8.97
Sept. II	31.6	25.4	28.5	83.5	76.5	80.0	16.8	6.77
Oct. I	28.9	24.0	26.4	88.5	81.5	85.0	83.9	2.50
Oct. II	28.1	19.8	23.9	86.6	76.0	83.0	17.0	8.33
Nov. I	26.9	13.5	20.2	87.0	54.0	70.5	00.0	13.40
Nov. II	26.5	19.3	22.9	88.0	43.5	65.7	00.0	16.97
Dec. I	24.7	12.1	18.4	88.5	45.5	67.0	00.0	11.17
Dec. II	22.3	10.9	16.6	84.0	53.0	68.5	00.0	5.77
Jan. I	19.3	11.0	15.1	91.5	63.5	77.5	22.4	2.63
Jan. II	19.2	10.7	15.1	93.0	67.3	79.0	37.1	2.70
Feb. I	22.6	11.6	16.9	82.0	49.5	65.7	24.4	5.60
Feb. II	23.7	13.9	18.8	84.5	66.0	75.2	50.0	10.60
March I	27.7	14.4	21.0	82.5	46.5	66.2	00.5	13.40

Table 2: Population of *Tetranychus neocaledonicus* Andre on brinjal (2014 - 2015)

Month	Temperature⁰ C			RH %			Rainfall	*T.*
	Maximum	Minimum	Average	Morning	Evening	Average	mm	*neocaledonicus*
June II	38.2	28.1	33.2	72.5	43.0	57.7	55.7	1.6
July I	34.0	27.6	30.9	81.0	67.0	74.0	327.4	0.0
July II	33.0	27.2	30.2	87.0	74.5	80.7	50.6	0.6
August I	28.2	27.0	27.6	86.5	76.5	81.5	185.1	0.1
August II	34.0	27.3	30.7	80.5	65.5	73.0	20.5	9.2
Sept. I	32.3	26.1	29.2	88.0	74.5	81.2	45.9	0.4
Sept. II	33.3	25.1	29.3	86.0	64.0	75.0	15.8	4.6
Oct. I	30.7	22.0	26.4	83.5	66.0	74.7	50.7	0.7
Oct. II	30.1	18.6	24.4	84.0	63.5	73.7	6.2	3.9
Nov. I	29.4	14.9	22.2	84.5	38.0	61.2	0.0	5.7
Nov. II	27.3	11.4	19.4	86.5	42.5	64.5	0.0	8.2
Dec. I	22.8	10.4	16.7	87.0	51.5	69.2	2.8	3.0
Dec. II	18.6	7.1	12.9	93.5	59.5	76.5	0.0	7.7
Jan. I	17.3	10.8	14.1	93.0	75.5	84.2	33.1	3.4
Jan. II	21.0	11.0	16.0	92.5	71.5	82.0	14.1	8.1
Feb. I	24.0	12.0	18.1	87.0	59.5	73.2	0.0	12.4
Feb. II	29.3	14.0	21.7	85.5	50.0	67.7	0.0	14.3
March I	30.7	16.4	23.6	82.5	46.5	64.5	0.0	15.1

Table 3: Correlation of *T. neocaledonicus* Andre population on brinjal with abiotic factors during 2013-14

Factors	Correlation coefficient (r)	Regression Model	Coefficient of determination (R^2)
Maximum temperature	0.161	Mite = 2.982 + 0.183 T_{max}	0.026
Minimum temperature	- 0.247	Mite = 12.774 - 0.233 T_{min}	0.061
Average temperature	- 0.066	Mite = 9.952 - 0.071 $T_{av.}$	0.004
Morning RH	- 0.581**	Mite = 36.133 - 0.338 RH_m	0.337
Evening RH	- 0.717**	Mite = 24.25 - 0.266 RH_e	0.514
Mean RH	- 0.534*	Mite = 32.622 - 0.342 $RH_{av.}$	0.485
Rainfall	- 0.576**	Mite = 10.881 - 0.061 RF	0.332

**Significant at 0.01 level (2-tailed) *Significant at 0.05 level (2-tailed).

Table 4: Correlation of *T. neocaledonicus* Andre population on brinjalwith abiotic factors during 2014-15

Factors	Correlation coefficient (r)	Regression Model	Coefficient of determination (R^2)
Maximum Temperature	0.076	Mite = 8.574 + 0.079 T_{max}	0.006
Minimum Temperature	- 0.440	Mite = 12.971- 0.357 T_{min}	0.194
Average Temperature	- 0.292	Mite = 12.896 - 0.277 T_{av}	0.085
Morning RH	- 0.347	Mite = 32.242 - 0.307 RH_m	0.121
Evening RH	- 0.571*	Mite = 21.541 - 0.257 RH_e	0.327
Mean RH	- 0.555*	Mite = 32.921- 0.370 RH_{av}	0.308
Rainfall	- 0.505*	Mite = 7.844 - 0.037RF	0.255

**Significant at 0.01 level (2-tailed) *Significant at 0.05 level (2-tailed).

were all significantly negatively correlated. The regression equation of average temperature with mite population was Y = 12.896 – 0.277x, thereby indicating for every increase in one unit of temperature the mite population decreasing by 0.277x. For RH the regression equation worked out as Y = 32.921 – 0.307x, showing decrease in population of mite by 0.307x with every unit increase in RH. Equation for rainfall is Y = 7.844 – 0.037x, so every unit increase in rainfall lead to decrease of mite population by 0.037x.

DISCUSSION

The present findings are in agreement with the findings of Patil and Nandihalli (2009) who had reported negative correlation of yellow mite with morning and evening humidity, rainfall and age of crop. The increase in mite population was reported with corresponding period of low rainfall, low humidity and high temperature by Puttaswamy and ChannaBasanna (1983).The present finding is also in agreement with Sarkar and Somachowdhary (1989) who reported mite population increase with increasing temperature and sharp decline in population with heavy rainfall. Mani *et al* (2007) reported the population of *T. urticae* to increase in December and reaching its peak in April on grapevine in Pune due high temperature and low RH. In concord with present study Sharma and Pandey (1981) reported similar population fluctuation with low population between October to January and rapid increase thereafter. Meena*et al* (2013) found the chilli mite population to have negative correlation with maximum temperature but positive with minimum and mean temperature. As in present study Kumar *et al* (2014) also reported *T. ludeni* population to have negative correlation with relative humidity and rainfall on cowpea in Varanasi, whereas, Bairwa and Singh (2013) reported non-significant negative correlation of sugarcane leaf mite population with temperature and rainfall and significant positive correlation with relative humidity at Varanasi on Sugarcane.

Such studies help in studying the influence of abiotic factors on population of the mite pest and make suitable management tactics.

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