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Seasonal incidence, correlation and regression among weather parameters against mites on summer okra

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ABSTRACT

On summer okra crop seasonal incidence as influenced by weather parameters on mites population reached its peak during last week of April with 8.40 mites in 6.25cm^2 leaf area/ 3 leaves. The correlation between mite population was positively significant against maximum temperature (r= 0.841**), minimum temperature (r= 0.805**), evaporation (r= 0.803**), wind velocity (r= 0.728**) and bright sunshine hours (r= 0.649*), while with morning R.H (r= - 0.717**) and evening R.H (r= - 0.643*) it was negatively significant. The equations of linear and multiple regression were set of mite population by working out regression co-efficient (b) and constant (a) alongwith co-efficient of determination (R^2).

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INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench] a *Malvaceae* flowering plant originated from Africa having good nutritional, medicinal and multipurpose crop value whose fruits are used as a fresh vegetable can be consumed as canned, dehydrated or frozen forms or in culinary preparations as sliced and dried pieces. Ripe seed are roasted and used as substitute for coffee.

Okra is cultivated in tropical, subtropical and warm temperate regions around the world. India ranks first in okra cultivation and production with an area of 532.64 thousand hectares and production of 6346.40 thousand tonnes alongwith productivity of 13.14 mt/ha (Anonymous, 2013). As high as 72 species of insects have been recorded on okra hence known as the house of pests due to its two distinct *i.e.* vegetative and fruiting growing stages. Important pests of okra reported by Jambhale and Nerkar (2005) are jassid (*Amrasca biguttula biguttula*), aphid (*Aphis gossypi*), spotted bollworm (*Earias* sp.), whitefly (*Bemisia tabaci*), mites (*Tetranychus* spps.) and root knot nematode.

Besides insect pests, several species of mites belonging to the genus *Tetranychus* causes a loss of 7 to 48 per cent in okra fruit yield (Kumaran *et al*., 2007).

Climatic conditions largely influence the pest numbers and their activity either directly or indirectly (Arif *et al.*, 2006). Hence, the present studies were focused on location specific seasonal occurrence of mites at different crop growth stages and its relation with weather factors which is of great significance in formulating efficient pest management tactics.

MATERIAL AND METHODS

A field trail was conducted at Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during summer 2013 and 2014 to know the summer season incidence, correlation and regression among weather parameters against okra mites. The observations regarding mites population were recorded on weekly basis by dividing experimental plot (10m x 10m) into four equal quadra from which 5 plants from each were randomly selected of each plant top, middle and bottom leaves were considered. The numbers of mites in 6.25 cm^2 (2.5 cm x 2.5 cm) leaf area per three (3) leaves were recorded. The different weather parameters recorded were collected from the meteorological unit and population of mites were correlated with them. The data obtained was averaged and subjected to simple correlation, linear and multiple regression analysis as per Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The pooled data regarding mites infestation versus weather factors during summer 2013 and 2014 were studied with an aim to know the trend in fluctuations of mites population with respect to the weather conditions.

Seasonal incidence of mite (*Tetranychus macfarlanei* Baker and Pritchard) :

The pooled mites population between the standard weeks of 10 to 21 showed an average mean of 3.64 mites in 6.25 cm^2 leaf area/ 3 leaves. There was no mites incidence seen in first two weeks of crop growth which later on appeared in a fluctuating mode till 18th standard week of April with highest incidence of 8.40 mites in 6.25 cm^2 leaf area/ 3 leaves when the corresponding average rainfall was 4.30 mm, maximum temperature of 41.87^{0}C, minimum temperature of 24.09^{0}C, morning-evening relative humidity of 52.51 per cent - 17.07 per cent, evaporation of 11.91 hrs, bright sunshine hours of 10.20 hrs and wind velocity of 4.87 kmph, respectively followed by 6.60, 4.10, 7.28 mites in 6.25 cm^2 leaf area/ 3 leaves incidence on 19th, 20th and 21st standard week of May. An average mean incidence observed during the total cropping tenure was 3.64 mites in 6.25 cm^2 leaf area/ 3 leaves (Table 1). The present results are in line with the findings of Kumar and Sharma (1991) reported that mite population appeared in the 1st week of April during summer with 27.0 mite/10 cm^2 leaf area on okra. Rai *et al.* (1991) reported the seasonal incidence of *Tetranychus macfarlanei* (Baker and Pritchard) on okra started in the month of April and reached its peak during middle of May. Gulati (2004) reported that in summer crop mites appeared in the month of April and showed an increasing trend in May. Anitha and Nandihalli (2008) observed that on summer okra, mite (*T. cinnabarinus*) incidence commenced from the 16th standard week (2.12 mites per 3 leaves). Peak mite incidence was noticed during the second week of May 2006 (14.61 mites per 3 leaves).

Correlation and regression among weather parameters against mite (*Tetranychus macfarlanei* Baker and Pritchard)

Simple correlation studies :

The pooled data indicated that the correlation between maximum temperature (r = 0.841**), minimum temperature (r = 0.805**), evaporation (r = 0.803**), bright sunshine (r = 0.649*), wind velocity (r = 0.728**) and mite population was positive and significant whereas, negatively significant correlation was observed between mite population on okra and morning RH (r = -0.717**), evening relative humidity (r = -0.643*). The correlation of rainfall and rainy days with mite population was found negatively non- significant.

Linear regression studies :

The regression equations were set by working out pooled regression co-efficient (b) and constant (a) (Table 2) showing that the impact of rainfall and rainy days was non-significant.

The mite population on okra was positively significant showing regression equations which were worked out as Y = - 29.10 + 0.842 x, Y = -12.98 + 0.764 x, Y = -8.244 + 1.144x, Y = - 20.28 + 2.606x, Y = -0.379 + 0.018 x which indicated that for every unit increase in correlated with maximum temperature, minimum temperature, evaporation, bright sunshine, wind velocity the mite population on okra increased by 0.841, 0.805, 0.803, 0.649 and 0.728.

Whereas regression equations worked out were Y = 20.42 – 0.280x, Y = 10.74 – 0.071x which showed that for every unit increase in morning RH and evening RH the mite population on okra decreased by 0.717 and 0.643.

Table 1 : Seasonal incidence of mite on okra (pooled of summer 2013 and 2014)

Months	M.W.	Rain-fall (mm)	Rainy days	Temp. (^{0}C)		Humidity (%)		EVP (mm)	B.S.S. (Hrs.)	W.V (kmph)	No. / 3 leaves
				Max	Min.	Max	Min.				Mites in 6.25 cm^2 leaf area
March	10	35.35	2.00	32.14	15.54	76.43	34.50	6.89	7.95	3.88	0.00
	11	4.30	0.50	35.56	18.95	69.93	28.71	7.73	8.62	1.92	0.00
	12	0.00	0.00	37.34	19.37	63.79	21.43	8.93	8.96	1.62	0.75
	13	0.00	0.00	38.86	20.65	61.57	19.64	9.02	9.19	1.60	2.23
April	14	0.00	0.00	39.34	19.84	56.86	16.43	10.04	9.88	1.75	3.23
	15	0.25	0.00	39.47	22.01	53.79	18.57	10.15	9.13	3.38	1.48
	16	1.85	0.00	38.89	22.04	58.79	19.79	10.10	9.87	4.43	5.08
	17	0.00	0.00	39.96	23.64	59.79	19.86	10.69	9.41	4.34	4.53
	18	4.30	1.00	41.87	24.09	52.21	17.07	11.91	10.20	4.87	8.40
May	19	0.50	0.00	40.79	23.84	56.07	18.64	12.40	9.36	6.01	6.60
	20	2.10	0.50	39.79	25.71	52.50	26.07	12.31	7.99	6.10	4.10
	21	5.00	0.50	42.80	25.38	55.71	16.57	14.54	9.58	8.01	7.28
Mean											3.64

Table 2 : Correlation and linear regression co-efficients between weather parameters and mite pests on okra (pooled of summer 2013 and 2014)

Weather parameters	Mite population		
	r	b	a
Rainfall (mm)	-0.325	-0.094	4.059
Rainy days	-0.120	-0.564	3.851
Temp. ^{0}C Max.	0.841**	0.842	-29.10
Temp. ^{0}C Min.	0.805**	0.764	-12.98
R.H (%) AM	-0.717**	-0.280	20.42
R.H (%) PM	-0.643*	-0.071	10.74
EVP	0.803**	1.144	-8.244
BSS (hr./day)	0.649*	2.606	-20.28
W.V (kmph)	0.728**	0.018	-0.379
Number of observations	24	24	24

* and ** indicate significance of values at P=0.05 and 0.01, respecetively

Table 3 : Multiple regression co-efficients between weather parameters and mite population on okra (pooled of summer 2013 and 2014)

Sucking pests	Pooled correlation co-efficient values (r)								
	Rainfall (mm) (X_1)	Rainy days (X_2)	Temperature (^{0}C) Max. (X_3)	Temperature (^{0}C) Min. (X_4)	Relative humidity (%) Morning (X_5)	Relative humidity (%) Evening (X_6)	Evapor-ation (X_7)	BSS (Hrs.) (X_8)	Wind velocity (X_9)
Mite Bi	0.236	-1.589	0.211	0.688	-0.014	0.508	1.204	4.068	-0.777
S.E.±	0.379	5.102	3.334	1.798	2.227	1.130	2.015	2.396	1.725
‘t’ values	0.622	-0.312	0.063	0.382	-0.064	0.449	0.598	1.698	-0.450
Path co-efficient	0.819	-0.339	0.210	0.725	-0.036	0.986	0.909	1.013	-0.562
	B_o = -76.764		F-val = 5.341		R^2 = 0.960			SEY = 1.336	

where, X_1 = Rainfall, X_2 = Rainy days, X_3 = Max. Temp., X_4 = Min. Temp., X_5 = Morning RH, X_6 = Evening RH, X_7 = EVP, X_8 = B.S.S, X_9 = Wind velocity

Multiple correlation studies :

Multiple regression co-efficients for different weather parameters were worked out (Table 3). The pooled multiple regression equation with weather parameters in order to predict pest infestation of *T. macfarlanei* was as below,

$$Y = - 76.764 + 0.236 X_1 – 1.589 X_2 + 0.211 X_3 + 0.688 X_4 - 0.014 X_5 + 0.508 + X_6 +1.204 X_7 + 4.068 X_8 – 0.777 X_9.$$

The pooled co-efficient of determination (R^2) between weather parameters and population mite on okra was highly significant and was 96 per cent showing the importance of these parameters influencing the abundance of mite on okra.

The present findings are in conformity with those of Anitha (2007) conducted the correlation studies between mite population and various weather parameters and revealed a significant negative correlation with morning relative humidity. Rachana *et al.* (2009) in their correlation studies indicated that the incidence of *T. neocaledonicus* had significant positive correlation with mean temperature, a significant negative correlation with mean relative humidity and non-significant negative correlation with mean rainfall. Varadaraju (2010) studied correlation between mite population and different weather parameters which revealed significant positive correlation with maximum temperature whereas, it was negative with morning relative humidity, evening relative humidity and rainfall.

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