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Population fluctuation of sucking insect pest of brinjal and its relation with weather parameters

NK Berani and JJ Patel

Abstract

The present investigations on population fluctuation of sucking insect pest of brinjal were carried out at College Farm, N.M. College of Agriculture, Navsari Agricultural University, Navsari during *Kharif* 2018-19 and 2019-20. The activity of sucking pests (aphid, jassid, whitefly and mite) was higher during 2nd week of October to 2nd week of December *i.e.*, 41st SMW to 50th SMW. The highest peak activity of aphid, jassid and mite was exhibited during 1st week of November (45th SMW) while, peak population of whitefly was recorded higher during 5th week of October (44th SMW). Maximum temperature, bright sunshine hours and evaporation were significantly positively correlated with all the sucking pests population while, minimum temperature, relative humidity (morning, evening and mean), vapour pressure (morning, evening and mean), wind speed and rainfall were negatively correlated with all the sucking pests population.

Keywords: Aphid, jassid, whitefly, mite and brinjal

Introduction

Brinjal *Solanum melongena* L. is known as a “King of Vegetables” originated in India, where a wide range of wild types and land races occurs. Brinjal is also known as egg plant, aubergine, guinea squash, brinjaul and bringella ^[1]. In India, the major brinjal growing states are Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat, Orissa, West Bengal, Madhya Pradesh, Bihar, Jharkhand, Uttar Pradesh, *etc.* ^[2, 3]. Brinjal is being cultivated in an area of about 133.48 thousand hectares in India with a production of 2413.86 thousand MT and productivity of 17.53MT per hectare as per final advance estimates during 2019-20. In Gujarat, brinjal is cultivated in almost all the districts occupying an area of about 71 thousand hectares with a production of 1437 thousand MT and productivity of 20.15MT per hectare during 2019-20 ^[4]. The brinjal crop is attacked by about 140 species of insect pests ^[5]. Insect pests identified in brinjal as sucking pest is aphids, *Aphis gossypii* Glover (Hemiptera: Aphididae), jassids, *Amrasca biguttula biguttula* Ishida (Homoptera: Cicadellidae), whitefly, *Bemisia tabaci* Genn. (Hemiptera: Aleyrodidae) and spider mites, *Tetranychus* spp. The population dynamics of the pests is required for deciding the IPM strategy of any pests in crops.

Materials and Methods

An investigation was carried out at College Farm, N. M. College of Agriculture, NAU, Navsari, Gujarat during *Kharif* season 2018-19 and 2019-20. Brinjal variety GNRB-1 was sown in 400 square meter area at a distance of 90cm × 60cm. All recommended agronomical practices were followed to raise the brinjal crop. The experimental plot was kept free from insecticidal spray during both the years. The brinjal plot was divided into 5 sectors to record the incidence of sucking insect pests and natural enemies. From each sectors, 10 plants were selected randomly to count sucking insect pests population. The population of aphid, jassid and whitefly was recorded from three leaves whereas, mite population were recorded from 4cm² leaf area by using magnifying lens (10X). The data was recorded at weekly interval starting from one week after transplanting till the crop maturity.

In order to study the effect of weather parameters *viz.*, minimum temperature (MinT), maximum temperature (MaxT), mean temperature (MeT), morning relative humidity (MoRH), evening relative humidity (EvRH), mean relative humidity (MeRH), morning vapour pressure (MoVP), evening vapour pressure (EvVP), mean vapour pressure (MeVP), bright sunshine hours (BSS), wind speed (WS) and evaporation (EP) on population fluctuation of insect pests, the data recorded for population was correlated with above weather parameters recorded at

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Agricultural Meteorological Observatory, NAU, Navsari using standard statistical procedure [6].

Results and Discussion

The results of population fluctuation of sucking insect pest in brinjal are presented in Table 1 and Table 2 and depicted in Fig. 1, Fig 2 and Fig. 3 and the results of mean of two years data discussed hereunder.

Aphid, *A. gossypii*

The means data of two years on aphid population (Table 1 and Fig. 1) ranged from 0.82 to 15.87 per leaf/plant with an average population of 7.95 per leaf/plant. The aphid population reached to the first and highest peak (15.87 per leaf/plant) during during 45th SMW *i.e.* 1st week of November. The second peak (12.90 per leaf/plant) was exhibited during 50th SMW *i.e.* 2nd week of December.

Jassid, *A. biguttula biguttula*

The means data of two years presented in Table 1 and Fig. 1 revealed that jassid population ranged from 0.73 to 15.23 per

leaf/plant with an average population of 7.42 per leaf/plant. The jassid population reached to the first and highest peak (15.23 per leaf/plant) during 43rd SMW *i.e.* 4th week of October. The second peak (14.43 per leaf/plant) was exhibited during 45th SMW *i.e.* 1st week of November.

Whitefly, *B. tabaci*

The means data of two years on whitefly population (Table 1 and Fig. 2) ranged from 0.34 to 11.79 per leaf/plant with an average population of 5.75 per leaf/plant. Whitefly population reached to the first and highest peak (11.79 per leaf/plant) during 44th SMW *i.e.* 5th week of October. The second peak (10.85 per leaf/plant) was observed during 48th SMW *i.e.* 4th week of November.

Mite, *Tetranychus spp*

The means data of two years presented in Table 1 and Fig. 2 indicated that population of mite ranged from 0.40 to 35.00 per 4cm² leaf/plant with an average 15.26 per 4cm² leaf/plant. The mite population reached to the highest peak (35.00 per 4cm² leaf/plant) during 45th SMW *i.e.* 1st week of November.

Table 1: Population of sucking insect pest on brinjal

Month and week	SMW	Aphid/leaf			Jassid/leaf			Whitefly/leaf			Mite per 4cm ² leaf			
		2018-19	2019-20	Average	2018-19	2019-20	Average	2018-19	2019-20	Average	2018-19	2019-20	Average	
August	I	32	0.00	0.00	0.00	0.90	0.56	0.73	0.42	0.26	0.34	0.00	0.00	0.00
	II	33	1.64	0.00	0.82	2.28	2.64	2.46	1.26	1.00	1.13	0.00	0.00	0.00
	III	34	1.12	2.40	1.76	1.80	3.00	2.40	1.00	2.24	1.62	0.00	0.00	0.00
	IV	35	1.00	2.00	1.50	1.20	2.86	2.03	0.74	1.64	1.19	0.80	0.00	0.40
September	I	36	3.40	1.54	2.47	3.86	2.28	3.07	2.14	1.12	1.63	1.80	0.00	0.90
	II	37	5.12	1.38	3.25	4.08	1.02	2.55	3.90	0.64	2.27	9.94	0.00	4.97
	III	38	3.40	2.88	3.14	1.00	2.80	1.90	2.34	1.40	1.87	4.80	0.94	2.87
	IV	39	4.24	5.44	4.84	2.20	3.40	2.80	4.48	1.80	3.14	14.44	1.42	7.93
October	I	40	6.34	8.44	7.39	5.40	5.92	5.66	3.04	2.34	2.69	26.88	2.80	14.84
	II	41	8.62	10.94	9.78	7.44	8.80	8.12	4.04	5.12	4.58	22.02	8.62	15.32
	III	42	10.26	13.40	11.83	10.62	12.26	11.44	7.84	8.84	8.34	27.22	22.54	24.88
	IV	43	13.26	17.64	15.45	14.44	16.02	15.23	10.26	12.62	11.44	30.44	25.20	27.82
November	V	44	14.44	16.02	15.23	11.42	14.46	12.94	13.04	10.54	11.79	35.42	25.94	30.68
	I	45	15.84	15.90	15.87	13.22	15.64	14.43	11.44	10.08	10.76	42.22	27.78	35.00
	II	46	12.56	14.42	13.49	12.38	14.78	13.58	8.56	9.38	8.97	38.54	26.18	32.36
	III	47	8.62	11.26	9.94	11.46	12.56	12.01	7.70	8.42	8.06	32.28	24.80	28.54
December	IV	48	9.82	11.06	10.44	10.92	12.20	11.56	10.48	11.22	10.85	28.22	21.42	24.82
	I	49	10.40	12.22	11.31	8.82	11.34	10.08	9.42	8.80	9.11	25.14	18.38	21.76
	II	50	12.24	13.56	12.90	7.64	8.82	8.23	7.44	8.00	7.72	22.80	16.24	19.52
	III	51	10.06	9.94	10.00	7.48	8.14	7.81	6.86	7.90	7.38	19.64	15.82	17.73
	IV	52	6.24	5.02	5.63	6.78	6.62	6.70	5.54	6.12	5.83	10.42	9.78	10.10
Mean			7.55	8.36	7.95	6.92	7.91	7.42	5.81	5.69	5.75	18.72	11.80	15.26

Note: SMW= Standard Meteorological Week

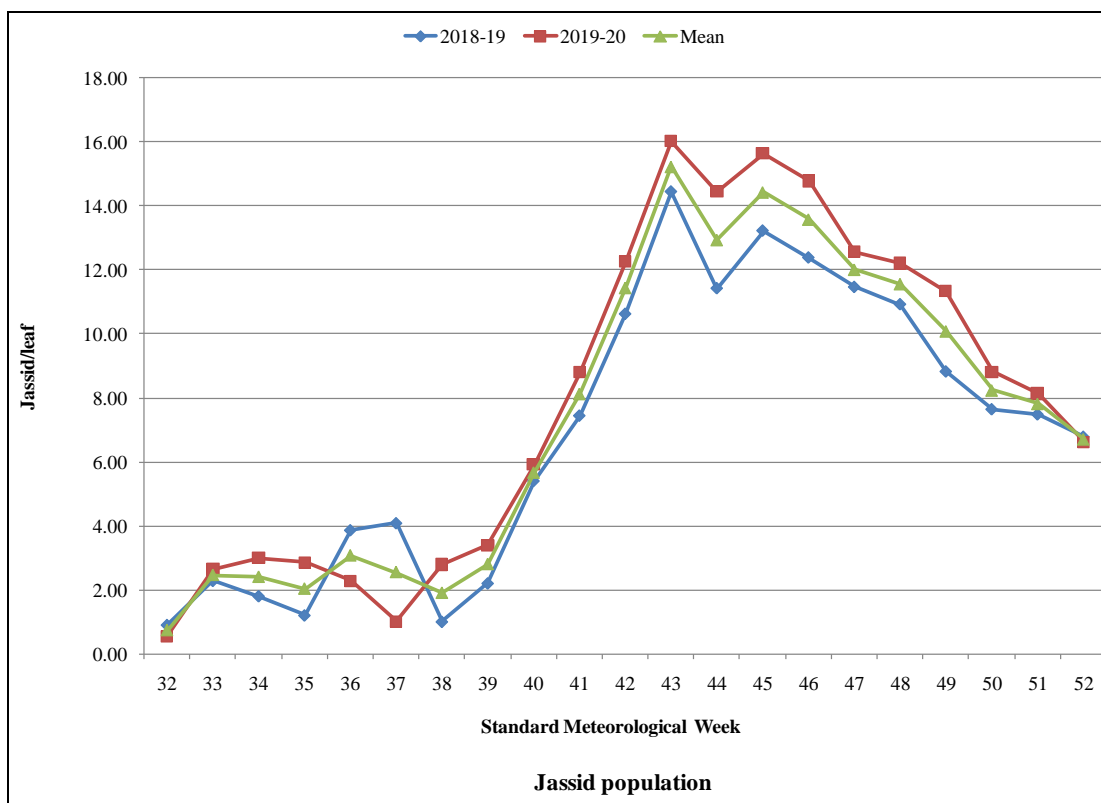
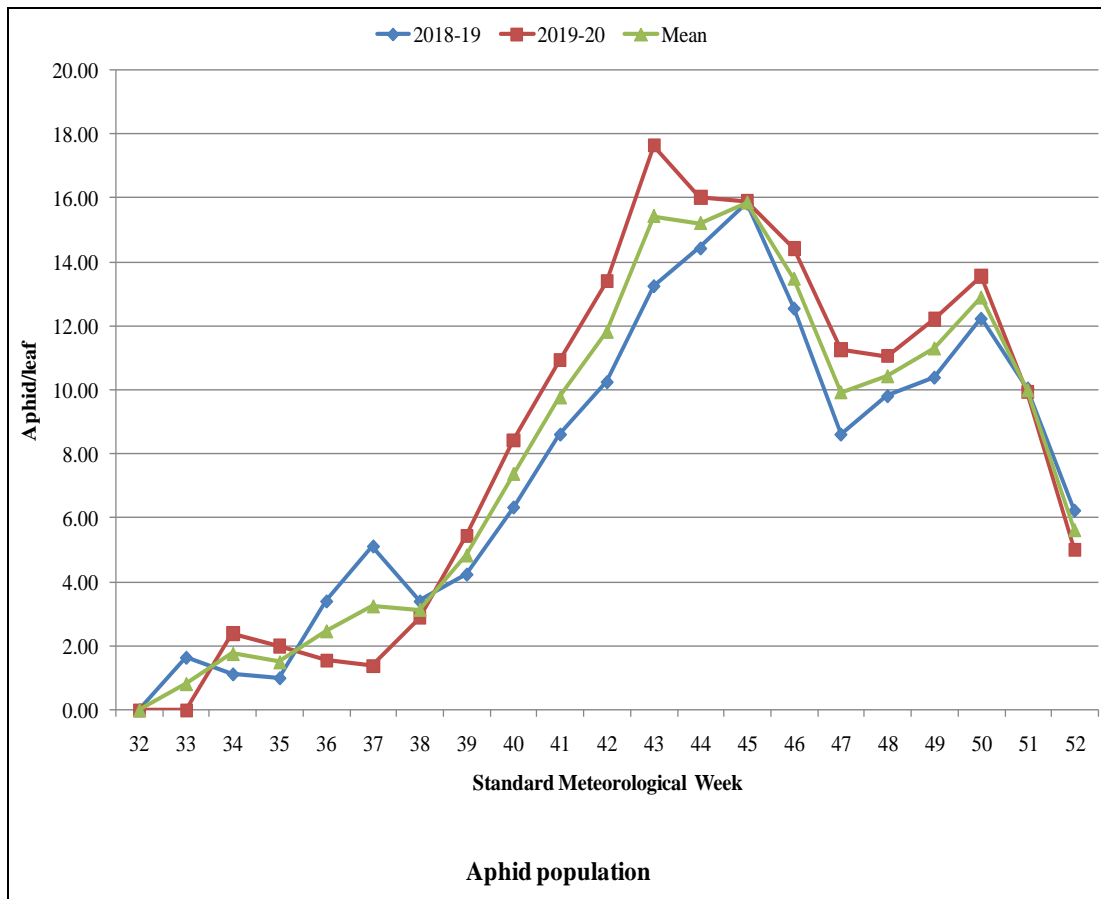


Fig 1: Population fluctuation of aphid and jassid in brinjal

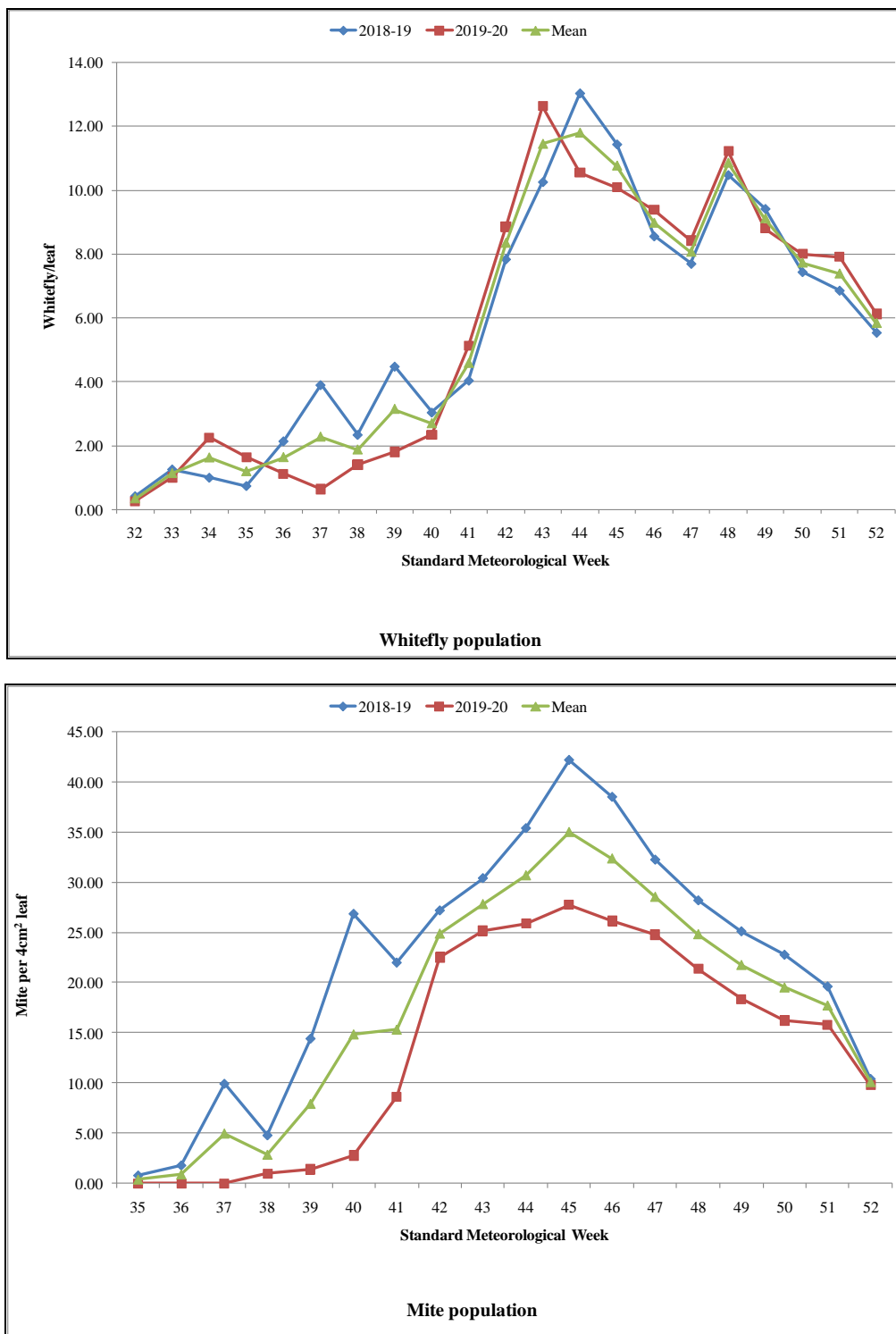


Fig 2: Population fluctuation of whitefly and mite in brinjal

Jassid, *A. biguttula biguttula*

The mean results of two years (Table 2) revealed that MaxT ($r = 0.689^{**}$), BSS ($r = 0.734^{**}$) and EP ($r = 0.559^{**}$) showed significant positive correlation whereas, MinT ($r = -0.591^{**}$), MoRH ($r = -0.655^{**}$), EvRH ($r = -0.78^{**}$), MeRH ($r = -0.769^{**}$), MoVP ($r = -0.642^{**}$), MeVP ($r = -0.546^{*}$), WS ($r = -0.690^{**}$) and RF ($r = -0.716^{**}$) showed significant negative correlation with jassid population.

Whitefly, *B. tabaci*

The mean results of two years (Table 2) revealed that MaxT ($r = -0.572^{**}$), BSS ($r = 0.706^{**}$) and EP ($r = 0.503^{*}$) showed significant positive correlation with whitefly population

whereas, MinT ($r = -0.682^{**}$), MoRH ($r = -0.709^{**}$), EvRH ($r = -0.806^{**}$), MeRH ($r = -0.803^{**}$), MoVP ($r = -0.729^{**}$), EvVP ($r = -0.495^{*}$), MeVP ($r = 0.656^{**}$), WS ($r = -0.667^{**}$) and RF ($r = -0.712^{**}$) were significantly negatively correlated with whitefly population.

Mite, *Tetranychus* spp.

The mean results of two years (Table 2) stated that MaxT ($r = 0.722^{**}$), BSS ($r = 0.792^{**}$) and EP ($r = 0.622^{**}$) showed significant positive correlation with mite population whereas, MinT ($r = -0.596^{*}$), MoRH ($r = -0.626^{**}$), EvRH ($r = -0.810^{**}$), MeRH ($r = -0.779^{**}$), MoVP ($r = -0.644^{**}$), MeVP ($r = -0.548^{**}$), WS ($r = -0.719^{**}$) and RF ($r = -0.736^{**}$) was

significantly negative correlation with mite population. Mite population was positively correlated with mean temperature, while negative relationship was found between mean humidity and mite population [7]. Aphid, jassid and whitefly population significantly negatively correlated with rainfall, maximum temperature, minimum temperature, mean temperature, morning relative humidity, evening relative

humidity, mean relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure and wind speed [8]. Jassid and whitefly population significantly positively correlated with bright sunshine hours [9, 10]. Jassid, whitefly, aphid and mite population showed highly significant positive correlation with maximum temperature [11-13].

Table 2: Association between weather parameters and population of sucking insect pest infesting brinjal

Weather parameters	Aphid			Jassid			Whitefly			Mite		
	2018-19	2019-20	Average	2018-19	2019-20	Average	2018-19	2019-20	Average	2018-19	2019-20	Average
MinT (°C)	-0.703**	-0.447*	-0.606**	-0.665**	-0.431*	-0.591**	-0.724**	-0.560**	-0.682**	-0.583**	-0.513*	-0.596**
MaxT (°C)	0.591**	0.690**	0.687**	0.638**	0.683**	0.689**	0.533*	0.572**	0.572**	0.764**	0.616**	0.722**
MeT (°C)	-0.291	-0.070	-0.188	-0.233	-0.058	-0.173	-0.340	-0.231	-0.312	-0.096	-0.166	-0.160
MoRH (%)	-0.644**	-0.484*	-0.665**	-0.623**	-0.482*	-0.655**	-0.675**	-0.526*	-0.709**	-0.570**	-0.469*	-0.626**
EvRH (%)	-0.735**	-0.772**	-0.824**	-0.651**	-0.792**	-0.783**	-0.712**	-0.818**	-0.806**	-0.755**	-0.789**	-0.810**
MeRH (%)	-0.754**	-0.708**	-0.802**	-0.686**	-0.721**	-0.769**	-0.748**	-0.755**	-0.803**	-0.744**	-0.714**	-0.779**
MoVP (mm)	-0.746**	-0.539*	-0.652**	-0.713**	-0.533*	-0.642**	-0.763**	-0.658**	-0.729**	-0.634**	-0.604**	-0.644**
EvVP (mm)	-0.291	-0.461*	-0.401	-0.149	-0.489*	-0.351	-0.355	-0.611**	-0.495*	-0.147	-0.549**	-0.354
MeVP (mm)	-0.619**	-0.513*	-0.571**	-0.541*	-0.520*	-0.546*	-0.648**	-0.646**	-0.656**	-0.487*	-0.588**	-0.548**
BSS (hr)	0.801**	0.585**	0.804**	0.732**	0.552**	0.734**	0.742**	0.501*	0.706**	0.804**	0.514*	0.792**
WS (km/hr)	-0.737**	-0.542**	-0.714**	-0.727**	-0.548**	-0.690**	-0.701**	-0.545*	-0.667**	-0.809**	-0.527*	-0.719**
EP (mm/day)	0.699**	0.457*	0.670**	0.574**	0.388	0.559**	0.598**	0.318	0.503*	0.770**	0.274	0.622**
RF (mm)	-0.562**	-0.634**	-0.735**	-0.496*	-0.638**	-0.716**	-0.534*	-0.644**	-0.712**	-0.587**	-0.598**	-0.736**

Note: * Correlation is significant at the 0.05 level (2-tailed)

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

Conclusion

From the present investigation, it is concluded that sucking pests (aphid, jassid, whitefly and mite) population was higher during 2nd week of October to 2nd week of December. Maximum temperature, bright sunshine hours and evaporation were significantly positively correlated with all the sucking pests population while, minimum temperature, relative humidity (morning, evening and mean), vapour pressure (morning, evening and mean), wind speed and rainfall were negatively correlated with all the sucking pests population.

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