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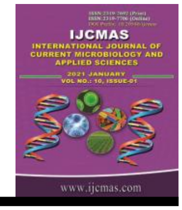

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Succession of Major Pests and Predators in Okra (*Abelmoschus esculentus* (L.) Moench) Ecosystem

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In present study, six insect species *viz*., *Aphis gossypii* (Glover), *Amrascabiguttula biguttula* (Ishida), *Bemisia tabaci* (Gennadius) and *Sylepta derogata* (Fabricius), *Dysdercus cingulatus* (Fabricius) and *Earias vittella* (Fabricius) were recorded as major pests of okra during *rabi* and *kharif* seasons, 2017. It was noticed that, Aphid, jassid, white fly and leaf roller remained fromvegetative to harvesting stage while red cotton bug and shoot and fruit borer appeared from reproductive to harvesting stage of the crop. The coccinellids, *viz*., *Coccinella transversalis* (Fabricius) and *Menochiluss exmaculatus* (Fabricius) were present in field with the population of sucking pests. In *rabi* season, minimum temperature showed positive significant correlation with *D. cingulatus* and *E. vittella* (r = 561[*], 740[*]). All weather parameters showed non significant relationship with pests and predators except morning relative humidity which had significant negative impact on *D. cingulatus* (r = -0.578*) and *E. vittella* (r = -0.616*) during *kharif*, 2017.

Introduction

Okra (*Abelmoschus esculentus* L. Moench) is an important commercial crop in India which plays a key role in national economy. India is the biggest producer of okra ranked first in the world (72.9% of the total world production) with 0.53 million ha area, 6.35 million tones production and a productivity of 11.96 t/ha (Anonymous, 2017a). In Assam, the crop is grown in an area of 12.11 thousand ha with an annual production of 191.70 thousand metric tonnes (Anonymous, 2017b). The state is contributing approximately 3.15 per cent of the total production of okra in the country, which is very low compare to other leading states. Despite large area and quite a good number of cultivars, the supply of okra in Indian market is not matching to its demand. The productivity of okra is low due to many factors and one of the most important constraint in production is the attack of insect pests. Okra is attacked by a number of insect pests, which are the major problems in getting higher yields (Kumar *et al.*, 2002). In India, as high as 72 species of insect pests have been recorded on okrawhich cause 48.97% reduction in pod yield (Pal *et al.*, 2013). Hence, if we go for total control of pests, it is very essential to know their time of occurrence and peak period of infestation in relation to weather parameters in that ecosystem. Considering these facts, the present investigation was undertaken to generate the information on succession of major pests and predators in okra ecosystem.

Materials and Methods

The field studies pertaining to the present investigation were carried out at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during *kharif* and *rabi* seasons, 2017, respectively. Okra cultivars namely, Prabhanikranti was sown in 600 sq. m area and the agronomic practices were carried out as per the crop production guide of AAU, Jorhat. Monitoring of insect fauna was initiated at the seedling emergence of the crop and continued until the last picking. Observations on insect pests and natural enemies were recorded at weekly interval starting from 10- 12 days after the sowing of crop. The collections were made by visual searching method and sweeping net methods. The population of sucking pests were visually recorded on 3 leaves (top, middle and bottom leaves). Insects such ascoccinellids, leaf roller, borer *etc* were recorded by counting their number on five plants selected randomly and expressed in number per plant. The collected insects were sorted, counted and observed the morphological characters in the laboratory under the binocular sterieoscope microscope Carl Zeiss 426126, model no. Stemi 2000 - C and identified by consulting the published taxonomic keys and related literature.

The meteorological data and incidence of major pests and predators obtained during the study period were subjected to simple correlation and regression analysis using SPSS software 20 version.

Results and Discussion

During *rabi* season, 2017, all the sucking pests were initially observed from 14 days after sowing *i.e.* at the early vegetative stage of the crop and remained available in the field up to harvesting stage when crop was 98 days old. Similarly in *kharif* season, these sucking pests were first observed in field at 12 days after sowing and continued to remain till 89 days of the crop (up to harvesting stage). The leaf roller (*S. derogata*) was first observed in the crop at 28 days after sowing in *rabi* season and persisted till the harvesting stage (98 DAS) while in *kharif* season it appeared at 26 days after sowing and remained up to the last week of harvesting (89 DAS). In case of *D. cingulatua* and *E. vittella*, their infestation started in field at reproductive stage when crop was at 42 days old and continued up to the end of crop stage (98 DAS) where as in *kharif* season they appeared in field at 33 days after sowing and present up to 89 days of crop. In the cases of Coccinellids, viz., *C.transversalis* and *M. sexmaculatus*, their presence was first observed in the field one week after appearance of aphid (28 DAS) in *rabi* season and persisted along with sucking pests population up to the end of season. In *kharif* season also these predators were first observed in field at 19 days after sowing and were present on the crop up to the harvesting stage *i.e*. 90 DAS.

Aphid *A. gossypii*

The population of aphid varied from 3.60 to 20.00 per three leaves during *rabi* season. The peak population reached after one month of initial observation at 26.3^{0}C maximum, 14.6^{0}C minimum temperature 19.2 mm rainfall, 91.0 and 62.0 per cent morning and evening relative humidity and there after the population started declining towards the end of harvesting stage due to high rainfall (Table

1). It was observed that aphid population had non significant positive correlation with maximum and minimum temperature and bright sunshine (r = 0.014, 0.096 and 0.259 respectively) whereas other weather parameters *viz*., rainfall, morning and evening humidity showed negative and non significant impact on aphid population (r = - 0.143, - 0.457, - 0.018 respectively) during that period (Table 2). In *kharif* season, aphid was first appeared on third week of July with a mean population 3.13 aphids per three leaves. The population increased it's highest density in the first week of August (1st August) with a mean population of 30.13 aphids/ 3 leaves. Thereafter, the population declined gradually and low population (3.53/ 3leaves) was observed in first week of October when crop was at harvesting stage (Table 3). Result presented in table 4 revealed that maximum and minimum temperatures, bright sunshine and evening relative humidity showed non significant positive correlation (r = 0.026, 0.221, 0.118 and 0.175, respectively) with aphid population whereas negative correlation was observed with rainfall (r = - 0.165) and morning relative humidity (r = - 0.361). The present findings were in agreement with those of Berwa (2016); Jatav (2013) and Veeravel and Baskaran (1995) who reported that the maximum aphid population was observed at the vegetative stage of the crop. Similarly, in another studies from Assam, Begam *et al.*, (2016), Thangjam (2017) reported that aphids started appearing from second week of February in *rabi* season and continued to stay up to May. Chouhan *et al.*, (2016) reported the initiation of *A. gossypii*on okra in the third week of February and peak in the third week of March. This findings were in conformity with Singh *et al.*, (2013), Selvaraj *et al.*, (2010), Aarwe *et al.*, (2016) and Biswas *et al.*, (2016) who reported that aphid population had a positive correlation with maximum and minimum temperatures but it was negatively correlated with rainfall and relative humidity. Jadhav *et al.*, (2017) reported that bright sunshine hours had positive impact on aphid population and it was negatively associated with rain fall.

Jassid, *A.biguttulabiguttula*

In *rabi* season, jassid population initially noticed on first week of February with a mean population of 2.20 jassid per three leaves which gradually increased and reached to peak (10.0/ 3 leaves) in the first week of March. Later on population remained in moderate density and lowest numbers (4.40/ 3 leaves) was observed on first week of May (Table 1). Correlation analysis (Table 2) revealed that maximum and minimum temperature and bright sunshine hours had non significant positive (r = 0.021, 0.354, 0.053 respectively) impact on jassid population while it was negatively associated with morning relative humidity (r = - 0.114). During *kharif* season, first appearance of jassid was recorded on 18th July with a mean population 3.40 per three leaves. The highest population (20.06/ 3 leaves) was recorded in the first week of August. In successive weeks, pest persisted in moderate level and and there after the population started declining (Table 3).It was observed that rainfall and bright sunshine hours had non- significant negative effect on (r =-0.229, -0.077) jassid population while other parameters were positively associated with it (Table 4).The present findings are in conformity with those of Pandey and Koshta (2017) who reported that a combination of maximum and minimum temperature with morning and evening relative humidity favoured the multiplication of jassid on okra. Present findings are in agreement with the findings of Berwa (2016); Prasad and Logiswaran (1997); Varma *et al.*, (2010) and Roy *et al.*, (2018), who observed the peak period of jassid was at vegetative stage of okra.

Table.1 Population build up of major insect pests of okra in relation to weather parameters during *rabi*, 2017

Different stages of okra	**Date of observation**	**Temperature (◦C)**		**Rainfall (mm)**	**RH (%)**		**Total BSSH**	**Aphid/ 3 leaves**	**Jassid/ 3 leaves**	**White fly/ 3 leaves**	**Leaf roller/ plant**	**Red cotton bug/ plant**	**Shoot &fruit borer/ plant**	***C.transversalis/ plant***	***M. sexmaculatus/ plant***
		Max.	Min.		I	II									
Vegetative stage	06.02.17	27.4	12.6	0.0	93	55	30.1	3.60	2.20	2.20	0.00	0.00	0.00	0.00	0.00
	13.02.17	27.9	11.0	0.0	94	44	49.8	6.40	4.00	4.06	0.00	0.00	0.00	0.00	0.00
	20.02.17	25.6	15.0	37.4	96	66	31.3	10.13	4.07	3.92	0.40	0.00	0.00	0.35	0.25
	27.02.17	25.9	15.0	0.0	94	60	22.3	10.00	6.86	7.00	2.50	0.80	0.00	1.25	1.00
	06.03.17	26.3	14.6	19.2	91	62	35.2	20.00	10.00	9.00	4.50	1.58	1.80	1.75	1.25
Flowering stage	13.03.17	26.8	14.3	10.6	91	53	46.7	15.46	8.06	8.06	3.00	2.00	4.00	2.40	1.75
	20.03.17	26.3	15.2	26	95	61	34.4	18.13	8.26	8.26	3.20	5.80	2.60	1.70	1.05
Harvesting stage	27.03.17	26.6	19.3	115.9	97	77	13.3	10.06	7.13	7.13	3.00	12.00	3.00	1.35	0.90
	03.04.17	25.9	19.4	99.9	96	79	17.9	8.27	5.00	5.00	2.80	12.18	12.37	1.25	0.50
	10.04.17	31.1	19.7	4.3	90	59	52.1	16.06	6.26	6.26	3.60	6.18	11.00	0.70	0.30
	17.04.17	28.1	20.3	36.8	94	75	20.7	14.13	10.00	9.00	2.20	7.20	10.00	0.25	0.20
	24.04.17	28.8	21.2	33.6	97	77	32.4	12.40	9.00	10.00	3.00	2.00	7.60	0.00	0.00
	01.05.17	28.6	20.4	46.3	96	73	30.0	5.00	4.40	3.40	2.00	0.50	3.00	0.00	0.00

Data represents mean of 5 plant , I = morning & II = evening relative humidity

Table.2 Correlation coefficient between population of insect pests, predators and abiotic factors during *rabi*, 2017

Particulars	**Correlation coefficient**							
	Insect pests Predators							
	Aphid	Jassid	White fly	Leaf roller	Red cotton bug	Shoot and fruit borer	*C.transversalis*	*M. sexmaculatus*
Maximum temperature	r = 0.014	r = 0 .021	r = 0.016	r = 0 .085	r = 0.277	r = 0 .451	r = - 0.470	r = - 0.489
Minimum temperature	r = 0.096	r = 0.354	r = 0.334	r = 0 .468	r = 0 .561*	r = 0 .740**	r = - 0.168	r = - 0.244
Rainfall	r = - 0.143	r = 0.044	r = 0.038	r = 0.218	r = 0.451	r = 0 .356	r = 0.127	r = 0 .015
Morning relative humidity	r = - 0.457	r = - 0.114	r = - 0.100	r = - 0.254	r = - 0.086	r = - 0.038	r = - 0.348	r = - 0.374
Evening relative humidity	r = - 0.018	r = 0.291	r = 0 .265	r = 0.343	r = 0.405	r = 0.534	r = - 0.106	r = 0.179
Bright sunshine hour	r = 0 .259	r = 0 .053	r = 0.054	r = 0.0	r = - 0.139	r = - 0.086	r = 0 .233	r = 0.026
Aphid							r = 0.871**	r = 0.816*
Jassid							r = 0.645*	r = 0.625*
Whitefly							r = 0.775*	r = 0.746*

Significant at 0.01 level of probability
Significant at 0.05 level of probability

Table.3 Population build up of major insect pests of okra in relation to weather parameters during *kharif*, 2017

Different stages of okra	Date of observation	Temperature		Rainfall	Average RH		BSSH	Aphid/leaf	Jassid/leaf	White fly/ leaf	Leaf roller/ plant	Red cotton bug/ plant	Shoot &fruit Borer/ plant	*C. transversalis*	*M. sexmaculatus*
		Max.	Min.		I	II									
	18.07.17	34.4	26.1	58.3	93	72	45.8	3.13	3.40	2.20	0.00	0.00	0.00	0.00	0.00
Vegetative stage	25.07.17	34.2	24.9	84.8	96	77	37.1	4.00	15.13	6.80	0.00	0.00	0.00	0.30	0.20
	01.08.17	34	26	114.9	95	78	32.9	30.13	20.06	18.00	1.20	0.00	0.00	0.30	0.30
	08.08.17	31.4	25.5	94.7	96	86	6	13.93	16.66	13.67	2.30	0.40	0.60	1.00	0.50
	15.08.17	31.8	25.5	64.7	93	79	19.3	24.86	14.27	11.26	5.00	3.18	3.38	1.40	0.60
	22.08.17	35.1	26	8.2	93	74	40.7	20.66	12.13	16.6	4.18	9.18	9.40	2.53	2.35
Reproductive stage	29.08.17	33.3	25.2	67.9	93	78	24.5	18.00	10.26	15.00	3.00	11.78	7.77	1.54	1.45
	05.09.17	32.8	25.1	125.5	93	81	18.9	15.13	5.00	5.60	2.20	10.38	6.80	1.48	0.50
	12.09.17	32.4	25.1	36.9	93	74	30.4	11.86	9.19	8.13	2.20	9.40	10.40	1.35	1.50
	19.09.17	33.7	25.7	68.4	94	77	20.2	6.40	5.06	5.40	2.15	7.80	9.17	1.50	0.50
	26.09.17	32.2	25.5	62.3	96	81	24.1	4.00	3.13	3.26	1.15	5.60	4.16	0.70	0.30
Harvesting stage	03.10.17	32.4	25.5	63.4	96	76	25.5	3.53	3.00	2.00	0.80	1.20	0.80	0.00	0.00

Data represents mean of 5 plants, I = morning &II = evening relative humidity

Table.4 Correlation coefficient between population of insect pests, predators and abiotic factors during kharif, 2017

Particulars	Correlation coefficient							
	Insect pests & predators							
	Aphid	Jassid	White fly	Leaf roller	Red cotton bug	Fruit and shoot borer	*C.transversalis*	*M. sexmaculatus*
Maximum temperature	r = 0 .026	r = 0.052	r = 0.164	r = - 0.35	r = 0.047	r = 0.089	r = 0.001	r = 0.212
Minimum temperature	r = 0.221	r = 0.013	r = 0.193	r = 0.017	r = - 0.227	r = - 0.176	r = - 0.057	r = - 0.002
Rainfall	r = - 0.165	r = - 0.229	r = 0 .0(	r = - 0.229	r = - 0.414	r = - 0.459	r = - 0.465	r = - 0.474
Morning relative humidity	r = - 0.361	r = 0.133	r = -0.182	r = - 0.357	r = - 0.578*	r = -0.616*	r = - 0.507	r = - 0.511
Evening relative humidity	r = 0 .175	r = 0.2(	r = 0.193	r = 0.41	r = - 0.185	r = - 0.209	r = - 0.010	r = - 0.025
Bright sunshine hour	r = 0.118	r = -0 .077	r = 0.0(	r = - 0.53	r = 0 .089	r = - 0.062	r = - 0.226	r = - 0.090
Aphid							r = 0.731**	r = 0.672*
Jassid							r = 0.566*	r = 0.596*
Whitefly							r = 0.559*	r = 0.565*

Significant at 0.01 level of probability
Significant at 0.05 level of probability

The above results are in accordance with the report of Selvaraj *et al.*, (2010), Aarwe *et al.*, (2016). Biswas *et al.*, (2016) and Jadhav *et al.*, (2017) who reported that jassid population had a positive correlation with maximum, minimum temparature and negatively correlated with rainfall and relative humidity.

Whitefly, *B. tabaci*

The mean number of whitefly recorded was 2.20 per three leaves in first appearance, which steadily increased (Table 1). The highest population (9.0/ 3 leaves) was recorded on 6th March in *rabi* season. Thereafter activity of the pest was observed to fluctuate at various time intervals. The effect of weather parameters on whitefly population (Table 2) revealed that maximum temperature, minimum temperature and rainfall, morning and evening relative humidity showed non significant positive correlation (r = 0.016, 0.334, 0.038, 0.265 respectively) while morning relative humidity had negative but no- significant (r = - 0.100 respectively) effect on it. In *kharif* season, incidence of whitefly commenced in the third week of July and reached to maximum level (18.00/ 3 leaves) on 8th August, 2017. Afterwards, the activity of the pest was observed to fluctuate at various time intervals and gradually declined. The result (Table 4) revealed that morning relative humidity showed non-significant correlation with whitefly population whereas, maximum temperature, minimum temperature, rainfall, evening and bright sunshine were positively and non significantly related to whilefly populations. The present findings were in partially in agreement with Thangjam (2017) according to whom *B. tabaci* appeared on the *Bhutjolokia* from last week of February to second week of May with maximum population during fourth week of March in Assam. Meena *et al.*, (2013) also indicated that *B. tabaci* appeared in chilli crop within 15 days after transplanting. The result were more or less similar with Selvaraj *et al.*, (2010), Aarwe *et al.*, (2016). Nagar *et al.*, (2017) and Biswas *et al.*, (2016), who reported that whitefly population had positive correlation with maximum and minimum temparatures but the population was negatively correlated with rainfall and relative humidity.

Leaf roller, *S.derogata*

In *rabi* season, leaf roller was first recorded from 3rd week of vegetative stage(0.40/ plant) and highest population (4.50/ plant) was recorded on third week of March, thereafter the pest persisted in moderate level (Table 1). During *kharif* season, it was first observed on 1st August, 2017 at 3rd week of vegetative stage with a mean population of 1.20 leaf roller per plant. Peak population (5.00 /plant) was recorded on 15th August, 2017 in the last week of vegetative stage (Table 3). Subsequently, the population declined towards the harvesting stage of okra. Correlation study (Table 2) revealed that, maximum and minimum temperature, rainfall, evening relative humidity and bright sunshine showed non significant positive correlation (r = 0.085, 0.468, 0.218, 0.343, 0.048, respectively) with leaf roller population while morning relative humidity had negative effect (r = - 0.254) on it. In *kharif* season, only minimum temperature showed positive correlation with leaf roller whereas maximum temperature, rainfall, bright sunshine, morning and evening relative humidity were negatively correlated with leaf roller population (Table 4).Roy *et al.*, (2018) reported that maximum and minimum temperature, rainfall and evening relative humidity had positive effect on leaf roller incidence whereas morning relative humidity was negatively correlated with it. In Palampur, Badiyala (2007) reported that larval population of *S. derogate* was significantly and positively correlated with relative humidity but bright sunshine hours had negative significant effect on it. Butani and Verma (1976) who have mentioned that cloudy weather and rainy days congenial for the activity of this pest. In West Bengal, Ghosh *et al.*, (1999) found a negative and non significant correlation of leaf roller larval population with maximum temperature and positive signifcant correlation with minimum temperature and relative humidity in okra crop.

Red cotton bug, *Dysdercuscingulatus*

The incidence of *D. cingulatus* commenced in the last week of February and reached to its maximum (12.18 / plant) at reproductive stage (3rd April) (Table 1). Thereafter, activity of the pest was observed to fluctuate at various time intervals and declined towards the last week of harvesting stage. The data pertaining to correlation (Table 2) indicated that red cotton bug had significant positive correlation with minimum temperature (r =0.561*). However, maximum temperature (r = 0.277), rainfall (r = 0.451) and evening relative humidity (r = 0.405) had positive correlation and bright sunshine hour (r = - 0.139) and morning relative humidity (r = - 0.086) were negatively correlated with it. In *kharif* season, the population of red cotton bug was started from fourth week of vegetative stage(0.40/plant) and highest population (11.78/ plant) was recorded in the second week of September when the crop was at reproductive stage. Afterwards, population was seen to be decreased and low population was observed (1.20/ plant) when crop was at last week of harvesting. It was observed that maximum temperature and bright sunshine hours (r = 0.047and 0.089) showed non significant positive relationship with red cotton bug while rainfall, minimum temperature and evening relative humidity, had negative correlation with it (r = - 0.414, - 0.227, -0.185, respectively). However morning relative humidity had a significant negative impact on red cotton population (Table 4). Similar findings was also reported by Chouhan *et al.*, (2016) and Pandey and Koshta (2017) who observed a positive correlation between incidence of red cotton bug with maximum and minimum temperature and negative relationship with rainfall, morning and evening relative humidity.

Shoot and fruit borer, *Eariasvittella*

Initially, population of borer was first started in the first week of March with a mean population of 1.80 larvae per plant. The maximum population was recorded on first week of April (12.37 larvae /plant) when crop was at reproductive stage. Afterwards, it remained in moderate level and low population was recorded on 1st May, 2017 (Table 1). In *kharif* season, shoot and fruit borer was first observed from 4th week of vegetative stage (0.60/ plant) which gradually increased and reached to peak (10.40/plant) in the last week of reproductive stage. Thereafter, started declining(Table 3).Data presented in table 2 revealed that during *rabi* season, *E. vittella* had significant positive association with minimum temperature (r = 0. 740**) whereas maximum temperature (r =0.451), rainfall (r =0.356) and evening relative humidity (r = 0.534) had non significant positive impact on borer population. However, morning relative humidity (r = - 0.038) and bright sunshine hour (r = - 0.086) showed non significant negative effect on shoot and fruit borer population.In accordance with the present findings, Kadam (2003) and Harinkhere (2014) also reported that shoot and fruit borer was present from late vegetative stage to maturity stage in okra crop. Ahmad *et al.*, (2010) and Pal *et al.*, (2013) reported shoot and fruit borer as an important pest of okra in reproductive stage of the crop. Chouhan *et al.*, (2016) and Pandey and Koshta (2017) found that *E. vittella* had positive relationship with maximum and minimum temperature and negatively related with bright sunshine hours. In *kharif* season, the morning relative humidity showed negative significant correlation with borer population (r=- 0.616*), while maximum and minimum temperature, rainfall, evening relative humidity and sunshine hour showed a nonsignificant correlation (Table 4).

Coccinella transversalis

In *rabi*season, population of *C. transversalis* appeared in the third week of February (0.25/ plant) i.e. two weeks after appearance of their prey in the field and maximum population (1.75/ plant) was observed on 13th March (Table 1).While comparing the population of *C. transversalis* with weather parameters and its prey, result (Table 2) showed that it was positively related with rainfall and bright sunshine (r =0. 127 and 0.233) and negatively correlated with maximum and minimum temperature (r = - 0.470 and - 0.168) and morning and evening relative humidity (r = -0.348 and -0.106). However prey population like aphid (r = 871*), jassid (r = 0.645*) and whitefly (r = 0.775*) had significant with positive correlation with it. During *kharif* season, it was first observed on 25th July and maximum population (2.53/ plant) was observed on 22nd August when its prey like aphid, jassid and whiteflies were more in field. Later on population gradually declined in the subsequent weeks and no coccinellid was recorded in the last week of harvesting stage (Table 3).The correlation with weather parameters showed that *C. transversalis* had significant positive corelation with population of *A. gossypii*, *A. biguttulabiguttula* and *B. tabaci* (r = 0.731*, 0.566*, 0.559*) whereas different weather parameters had non significant impact on it (Table 4). The results were in conformity with Naik*et al.,* (2017) who reported that weather parameters had no significant effect on the natural enemies but significant positive correlation was observed with aphid population (Ingawale and Tambe 2007, Meena and Kanwat (2010), Begam *et al.*, (2016), Thangjam *et al.*, (2017) and Jadhav *et al.*, (2017) reported that the ladybird population showed positive correlation with maximum and minimum temperature and bright sunshine hours but negative correlation with relative humidity and rainfall.

Menochilussexmaculatus

In *rabi* season, first incidence of *M. sexmaculatus* was observed on 20th February and reached to peak (1.75/plant) on 13th March at reproductive stage of crop (Table 1). The correlation matrix indicated a non-significant positive correlation with maximum temperature (r =- 0.489), minimum temperature (r = -0.244), morning and evening relative humidity (r =- 0.374 and 0.179) while sunshine hours was positively related with the population of *M. sexmaculatus*.

The population of sucking insect pests had significant positive impact on it (r = 0.816*, 0.625*, 0.746* for aphid, jassid and white fly respectively). In *kharif* season, it started appearing on the crop on 25th July and remained till last harvest with a population density ranging from 0.20 to 2.35 per plant. The peak period of activity was noticed on 22nd August (2.35/plant) (Table 3). The data presented in the table 4depicted that *M. sexmaculatus* had significant positive correlation with population of *A. gossypii*, *A. biguttulabiguttula* and *B. tabaci* (r = 0.672*, 0.596*, 0.565*) whereas different weather parameters had non significant impact on it. The present findings were also comparable with Singh *et al.*, (2013) and Bhatt *et al.*, (2018), who found that the population of aphidophagouscoccinellid predators appeared simultaneously with the population of soft bodied insects mainly aphids population.

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