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Population Dynamics of Aphids Infesting Okra with different Sowing Dates

D.M. Pawar[1], Suresh Kumar[2]* and Gopal Golvankar[3]
[1]Dr. Balasaheb Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri (Maharashtra), India.
[2]Ph.D. Research Scholar, Department of Plant Pathology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture & Technology, Udaipur (Rajasthan), India.
[3]Department of Agril. Entomology, College of Agriculture, Dapoli (Maharashtra), India.

(Corresponding author: Suresh Kumar)*
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ABSTRACT: The field experiment was carried out on population dynamics of aphids infesting okra with different sowing dates during *rabi-summer* season of 2016-17 at Agronomy Farm, College of Agriculture, Dapoli. The results revealed that there were marked differences in infestation of aphid population. The initiation of aphids infestation was started from 4th week after sowing at each sowing dates. During cropping season at different sowing dates, the mean infestation varied from 0.80 to 4.66 per three leaves per plant. Minimum aphids infestation (0.80 ± 1.08) was recorded in S_1 (12th -18th Nov.,) sowing date in 5th SMW (29th Jan., – 4th Feb., *i.e.* 11 weeks after sowing), while maximum (4.66 ± 1.33) infestation was recorded during 19th SMW (7th – 13th May *i.e.* 7 weeks after sowing) in S_6 (26th Feb., –4th March) sowing date. In S_6 (26th Feb., – 4th March) sowing date correlation between various weather parameters with mean infestation of aphids were significantly relationship except minimum temperature and morning relative humidity.

Keywords: Seasonal incidence, aphids, weather parameters, correlation, sowing dates etc.

I. INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench) is an annual vegetable crop belongs to family Malvaceae. It occupies a place of prominence amongst summer vegetables in our country. Its medicinal value has also been reported in curing ulcers and relief from haemorrhoids. All over India, its immature tender fruits are used as vegetable. They are also used in soups and stews. It can also be sundried, pickled or canned for off season consumption. In India, okra is grown over an area of 0.529 M ha with a production of 61.51 lakh MT and productivity is 12.1 t ha^{-1} [1]. It contributes 5.8 per cent of the total vegetable area and 3.9 per cent of total countries vegetable production. In Maharashtra, area under this crop is 0.011 M ha with a production of 0.84 lakh MT and productivity is 8.01 t ha^{-1} [2].

Okra is very common and widely consumed vegetable in the Konkan region of Maharashtra. In this region, it is mainly grown in the summer and rainy season. It is highly susceptible to damage by insect-pests, which are a major constraint hampering the realization of the full yield potential in an otherwise lucrative crop.

As many as 72 insect pests are known to attack this crop [3] and among them, flea beetle generally categorized as a minor pest infests the crop heavily in this region.

Amongst them, aphids, jassids, whiteflies and mites are the major sucking pests of okra. The nymphs and adults suck the cell sap from the foliage and devitalize the plant [5]. There are several methods for management of sucking pests but among available control methods, cultural method is considered to be the safest and environment friendly. It included various practices out of that sowing method is one of them. Keeping the importance of this crop in view, the present experiment was undertaken to study the seasonality with different sowing dates as well as impact of weather parameters on aphids abundance.

II. MATERIALS AND METHODS

The field experiment was carried out at Agronomy Farm, College of Agriculture, Dapoli from 2016-17. The details of experiment are given in below.

Details of the field experiment

1	Location	:	Agronomy Farm, College of Agriculture, Dapoli
2	Crop	:	Okra
3	Variety	:	Varsha Uphar
4	Season	:	*Rabi-Summer* 2016-17
5	Size of plot	:	4.50 m × 3.60 m (16.20 m^2) each sowing dates plot
6	Method of planting	:	Flat bed
7	Spacing	:	45 cm × 30 cm

Sowing Dates Details:		
No.	**Standard Meteorological Week**	**Sowing Dates**
S_1	46^{th} SMW	12^{th} -18^{th} November
S_2	49^{th} SMW	3^{rd} - 9^{th} December
S_3	52^{nd} SMW	24^{th} – 31^{st} December
S_4	3^{rd} SMW	15^{th} – 21^{st} January
S_5	6^{th} SMW	5^{th} – 11^{th} February
S_6	9^{th} SMW	26^{th} February – 4^{th} March

Method of recording observations. The experimental plot was kept unsprayed throughout the crop season. The observations were recorded as soon as the incidence is noticed. Observations on sucking pests like aphids were recorded at weekly interval. The fifteen plants per plot were selected randomly from each treatment plot. The observations of aphids infesting okra were recorded at weekly interval as per standard meteorological week till the harvesting of crop. The numbers of aphids were recorded from three leaves *i.e.* top, middle and bottom per plant. The data recorded was mean infestation as per three leaves per plant and standard deviation was worked out. Data on incidence of aphids infesting okra and different weather parameters were correlated.

III. RESULTS AND DISCUSSION

Population dynamics of aphids infesting okra at different sowing dates. The data on meteorological weather parameters during experimental study is presented in Table 1 and data pertaining to the mean infestation of aphids on okra at different sowing dates are presented in Table 2. The initiation of aphids infestation was started from 4^{th} week after sowing at each sowing dates. During cropping season at different sowing dates, the mean infestation varied from 0.80 to 4.66 per three leaves per plant. Minimum aphids infestation (0.80 ± 1.08) was recorded in S_1 (12^{th} -18^{th} Nov.,) sowing date in 5^{th} SMW (29^{th} Jan., – 4^{th} Feb., *i.e.* 11 weeks after sowing), while maximum (4.66 ± 1.33) infestation was recorded during 19^{th} SMW (7^{th} – 13^{th} May *i.e.* 7^{th} weeks after sowing) in S_6 (26^{th} Feb., – 4^{th} March) sowing date. In each sowing dates plots the peak activity of aphids at different sowing dates *viz.*, S_1, S_2, S_3, S_4, S_5 and S_6 were recorded with (3.89 ± 1.08, 4.51 ± 1.28, 4.23 ± 1.16, 4.34 ± 1.19, 4.51 ± 1.26 and 4.66 ± 1.33 mean infestation per three leaves per plant, respectively; in 1^{st}, 3^{rd}, 7^{th}, 11^{th}, 13^{th} and 19^{th} SMW, respectively) *i.e.* 7^{th} weeks after each sowing dates except in S_2 (3^{rd} - 9^{th} Dec.) sowing date peak activity noticed in 3^{rd} SMW *i.e.* 6^{th} weeks after sowing and further slowly declined the infestation till the harvest.

The present findings more or less accordance with the results of Sumathi (1998) [8] conducted studies on seasonal incidence of sucking pests during April 1998 to January 1999 in Coimbatore, Tamil Nadu. Among the different dates of sowing of *bhendi* sowings taken on 28^{th} May 1998, 23^{rd} July 1998 and 14^{th} January 1999 recorded minimum (2.81, per plant) population of the aphids, *Aphis gossypii*.

Boopati *et al.* [4] revealed that the incidence of *A. gossypii* commenced from first week of June *i.e.*, seventh week after sowing of okra. The aphid population reached at its peak in the third week of June *i.e.*, ninth week after sowing (8.90) followed by last week of June *i.e.*, eleventh week after sowing (6.68).

Correlation between mean infestation of aphids infesting okra at different sowing dates and weather parameters. The data on meteorological weather parameters and mean infestation of aphids at different sowing dates are presented in Table 1 and 2. Data on correlation coefficient of mean infestation of aphids at different sowing dates of okra in relation to different weather parameters are given in Table 3.

Data revealed that in different sowing dates mean infestation of aphids relationship with all weather parameters found to be non significant except BSS had (r = -0.712*) negatively significant in S_1 (12^{th}-18^{th} Nov.) sowing date. The various meteorological parameters *viz.*, maximum temperature, minimum temperature, evening relative humidity, Bright Sunshine Hours (BSS) and rainfall were found to be non-significant while, morning relative humidity had (r= 0.837*) positively significant in S_2 (3^{rd} - 9^{th} Dec.) sowing date. While remaining sowing dates had relationship with mean infestation of aphids *viz.*, S_3 (24^{th} – 31^{st} Dec.) sowing date evening relative humidity (r= -0.782*) negatively significant, S_4 (15^{th} – 21^{st} Jan.) Bright Sunshine Hours (BSS) (r= 0.786*) positively significant and S_5 (5^{th} – 11^{th} Feb.) morning relative humidity (r = 0.782*) positively significant, respectively and showed that the various meteorological parameters were found to be non-significant. In S_6 (26^{th} Feb., – 4^{th} March) sowing date showed that the maximum temperature and BSS (r= 0.782* and r = 0.710*) positively significant while, evening relative humidity and rainfall (r = -0.713* and r = -0.739*) negatively significant; minimum temperature and

morning relative humidity were found to be non-significant.

The present finding more or less supported by Konar *et al*. (2013) [6]. They reported that aphid population was non significant negatively correlated with maximum and minimum temperature, minimum relative humidity, rainfall and total sunshine hours. Whereas, maximum relative humidity was positively correlated with the aphid population on okra.

The aphid population had negative correlation with minimum and mean temperature, rainfall and maximum and minimum relative humidity whereas, positive correlation with maximum temperature. Whitefly and leafhopper population showed negative correlation with maximum, minimum and mean temperature and maximum and minimum relative humidity whereas, positive correlation with rainfall [7].

Table 1: Meteorological data recorded at meteorological observatory, Agronomy Farm, College of Agriculture, Dapoli, during *rabi* - *summer* season 2016-2017.

SMW	Period (12.11.2016 to 10.06.2017)	Temperature (°C)		Mean relative humidity (%)		Rainfall (mm)	Rainy days	BSS (hrs^{-1})
		Max.	Min.	RH-I	RH-II			
46	12.11 –18.11	33.2	16.5	92	63	0.0	0	6.9
47	19.11 –25.11	33.1	13.1	91	72	0.0	0	8.1
48	26.11 –02.12	33.4	13.3	91.3	67.9	0.0	0	7.7
49	03.12 –09.12	32.7	15.3	93	50	0.0	0	7.2
50	10.12 –16.12	32.2	14.7	90	41	0.0	0	7.0
51	17.12 –23.12	32.1	14.2	94	38	0.0	0	7.6
52	24.12 –31.12	32.0	11.9	94	51	0.0	0	8.0
1	01.01 -07.01	31.6	11.2	93	60	0.0	0	7.7
2	08.01 -14.01	28.8	10.9	92	54	0.0	0	8.9
3	15.01 -21.01	31.0	14.4	94	51	0.0	0	8.8
4	22.01 -28.01	33.7	14.4	90	54	0.0	0	9.3
5	29.01 -04.02	33.8	14.4	92	56	0.0	0	8.9
6	05.02 -11.02	31.0	13.6	90	55	0.0	0	9.0
7	12.02 -18.02	33.8	13.9	88	55	0.0	0	8.3
8	19.02 -25.02	34.3	13.3	81	67	0.0	0	8.7
9	26.02 -04.03	36.1	13.6	86	56	0.0	0	8.3
10	05.03 -11.03	31.3	13.6	90	68	0.0	0	8.7
11	12.03 -18.03	31.1	14.7	90	73	0.0	0	9.1
12	19.03 -25.03	33.1	16.4	88	64	0.0	0	8.5
13	26.03 -01.04	33.6	22.1	93	65	0.0	0	7.0
14	02.04 -08.04	32.6	18.9	89	61	0.0	0	7.5
15	09.04 -15.04	33.8	20.6	90	64	0.0	0	5.8
16	16.04 -22.04	32.5	20.7	88	64	0.0	0	7.4
17	23.04 -29.04	32.7	20.8	86	59	0.0	0	8.7
18	30.04 -06.05	33.2	22.4	86	65	0.0	0	8.6
19	07.05 -13.05	34.0	23.0	87	65	6.2	1	7.7
20	14.05 -20.05	34.3	22.5	88	62	0.0	0	7.4
21	21.05 -27.05	33.7	23.0	84	66	0.0	0	9.1
22	28.05 -03.06	32.4	25.7	84	68	24.3	3	6.5
23	04.06 -10.06	31.8	24.1	93	73	293.8	6	5.4

SMW- Standard meteorological week,	T_{max}- Maximum temperature,
T_{min}- Minimum temperature,	RH-I- Morning relative humidity,
RH-II- Evening relative humidity,	BSS- Bright sunshine hours

Table 2: Population dynamics of aphids infesting okra at different sowing dates.

Weeks After Sowing (WAS)	Mean infestation of aphids/ 3 leaves/ plants					
	S_1: 46 SMW (12^{th} -18^{th} Nov.,)	**S_2: 49 SMW (3^{rd} - 9^{th} Dec.,)**	**S_3: 52 SMW (24^{th} - 31^{st} Dec.,)**	**S_4: 3 SMW (15^{th} - 31^{st} Jan.,)**	**S_5: 6 SMW (5^{th} - 11^{th} Feb.,)**	**S_6: 9 SMW (26^{th} Feb., - 4^{th} March)**
4 WAS	3.57	3.54	3.63	2.51	3.56	3.70
5 WAS	2.79	2.89	3.10	3.13	3.20	3.27
6 WAS	3.20	4.51	3.55	3.65	3.72	3.76
7 WAS	3.89	4.06	4.23	4.34	4.51	4.66
8 WAS	3.10	3.39	3.64	3.72	3.82	3.94
9 WAS	2.71	2.89	3.05	3.11	3.23	3.40
10 WAS	1.31	1.20	1.29	1.35	1.26	1.32
11 WAS	0.80	0.88	1.03	0.89	0.93	0.81
SD	± 1.08	± 1.28	± 1.16	± 1.19	± 1.26	± 1.33

SMW: Standard Meteorological Week

Table 3: Correlation coefficient of mean infestation of aphids infesting okra at different sowing dates in relation to different weather parameters.

Climatic parameters	Correlation coefficient (*r*)					
	S_1: 46 SMW (12^{th} -18^{th} Nov.,)	**S_2: 49 SMW (3^{rd} -9^{th} Dec.,)**	**S_3: 52 SMW (24^{th} -31^{st} Dec.,)**	**S_4: 3 SMW (15^{th} -31^{st} Jan.,)**	**S_5: 6 SMW (5^{th} -11^{th} Feb.,)**	**S_6: 9 SMW (26^{th} Feb.,-4^{th} March)**
Maximum temperature (T_{max})	-0.620	-0.383	0.546	-0.329	0.126	0.793*
Minimum temperature (T_{min})	-0.528	0.097	-0.306	-0.517	-0.262	-0.645
Morning relative humidity (RH I)	0.277	0.837*	-0.320	0.077	0.782*	-0.323
Evening relative humidity (RH II)	-0.208	-0.640	-0.782*	0.435	0.351	-0.713*
Rainfall	0.000	0.000	0.000	0.000	0.000	-0.739*
Bright Sun Shine Hours (BSS)	-0.712*	0.223	-0.238	0.786*	-0.185	0.710*

*Significant at 5 per cent level ; $r = 0.707$

IV. CONCLUSIONS

From the present investigation, it can be concluded that the sowing date play vital role in okra production. Early sowing of okra reduces aphids infestation. While, S_6 (26^{th} Feb., – 4^{th} March) sowing date correlation between various weather parameters with mean infestation of aphids were significantly relationship except minimum temperature and morning relative humidity.

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