International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 01-01-2022, Accepted: 16-01-2022, Published: 01-02-2022
Volume 7, Issue 2, 2022, Page No. 12-16

Seasonal incidence of mite and its natural enemies in bhendi

R Poovizhi, M Ramanan, N Muthukumaran
Department of Entomology, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu, India

Abstract
Seasonal incidence of mite and its natural enemies were observed in summr, *kharif* and *rabi*seasons in bhendi ecosystem. The data on mite and its natural enemies count were subjected to simple correlation and multiple regression analysis with abiotic factors. In summer season peak mite incidence was noticed during 22nd SMW recorded the mite count of 18.53 mites/ 4 cm^2 leaf area. In Kharif, peak mite incidence was noticed during 24th SMW and 25th SMW recorded the mite count of 19.87 and 19.97 mites per 4 cm^2 leaf area. In rabi, mite population was minimum in 5th SMW of 10.37 mites/ 4 cm^2 leaf area.Weather parameters,showed highest temperature and lowest in relative humidity favoured for the multiplication of mite.

Keywords: bhendi, mite, weather parameters, correlation and regression

Introduction
Okra, *Abelmoschusesculentus* (L.) Moench, also known as Lady's finger, a fast growing annual warm season vegetable crop (Aladele *et al*., 2008) [1]. The origin of okra is Ethiopia (Tindall, 1983). It needs warm and humid conditions for better growth. Sandy to clay soils with good drainage are suitable for okra cultivation. Soil pH should range between 6.0 and 6.8 for best yield (Chittora and Singh, 2016) [2]. India is the largest producer of okra (67.1%), followed by Nigeria (15.4%) and Sudan (9.3%) (Singh *et al*., 2014) [10]. The area and production of okra in India during the year of 2017-2018 are 5,14,000 ha and 61,26,000 MT (Ministry of Horticulture and Farmers Welfare, 2018).
Among major pests causing considerable damage to the yield of okra crop, phytophagous mites, *Tetranychus urticae* Koch attack 1200 species of plants and causes several types of direct damage to crops like, loss of chlorophyll, stunting of growth and plant deformities resulting in reduction of yield (Zhang, 2003) [11]. In okra yield loss by mite was 46% (Rajeshwari *et al*., 2018) [6].

Materials and Methods
Field investigations were carried out to know the seasonal incidence of bhendi mite during 2019. Crops were maintained throughout the year at Sivapuri, Cuddalore District, Tamilnadu, India.Bhendi were raised in the year of 2019 during *kharif*, *rabi*and summer as per the recommended agronomic practices except plant protection measures. Crop were monitored regularly for the incidence of mites. Observations on number of phytophagous mites and natural enemies were recorded on 25 randomly selected plants from three leaves selected one from top, one from middle and one from bottom portion of the plants at 15 days interval. Weather parameters *viz*., maximum and minimum temperatures, relative humidity and total rainfall were recorded from the Meteorological Unit, Department of Agronomy, Faculty of Agriculture, Annamalai University. The data on mite and its natural enemies count were subjected to simple correlation and multiple regression analysis with weather parameters.

Result and Discussion
Mite count
During summer season crop incidence of bhendi mite was recorded from 9th SMW to 22nd SMW. Mite count ranged from 12.97 to 18.53 mites/ 4 cm^2 leaf area. Maximum mite incidence was noticed during 28 May- 03 June i.e., 22nd SMW recorded. The mite count was18.53 mites/ 4 cm^2 leaf area observed. Kapoor *et al*., (1997) [3] observed that peak population of spider mites was in the month of May- Jun which is similar to the present findings. Prasad and Singh (2003) [8] observed that the mite population on the crop building up from the second fortnight of March and continued until the first fortnight of July.
In *kharif* season, mite population was observed from the 23rd SMW to 43rd SMW, (Table. 2, Fig. 2). Peak mite incidence were noticed during 24th SMW and 25th SMW recorded the mite count of 19.87 and 19.97 mites per 4 cm^2 leaf area. Thereafter, a gradual decrease of mite population observed due to the onset of monsoon. Monica *et al*., (2014) [4] reported that peak activity of mite in the first week of June with maximum and minimum temperature of 38.30ºC and 27.10ºC respectively.
In *rabi* season, mite population recorded from 44th SMW to 8th SMW. Mite population were minimum due to the monsoon season and at the end of month of Jan i.e., 5th SMW mite population got slightly increased at the range

of 10.37 mites/ 4 cm^2 leaf area (Table. 3). Rita *et al*., (2000) [7] reported mite population increased during October and November months.

Table 1: Seasonal incidence of *Tetranychus* spp and its natural enemies in summer season (2019)

SMW	Period	Mite population	Natural enemies of mite	Temperature (°c)		Relative humidity (%)	Rainfall (mm)
				Max	Min		
9	26 Feb- 04 Mar	12.97	0.80	33.20	22.80	88.00%	0.00
10	05 Mar- 11 Mar	13.53	1.20	35.40	24.20	86.00%	0.00
11	12 Mar- 18 Mar	13.77	1.80	33.60	22.10	85.00%	0.00
12	19 Mar- 25 Mar	14.10	2.20	34.10	23.20	91.00%	0.00
13	26Mar- 01 Apr	14.97	2.90	34.70	22.50	89.00%	0.00
14	02 Apr- 08 Apr	15.83	3.60	35.20	24.10	87.00%	0.00
15	09 Apr- 15 Apr	15.97	3.90	35.80	24.40	87.00%	0.00
16	16 Apr- 22 Apr	16.87	4.00	36.40	26.10	82.00%	0.00
17	23 Apr- 29 Apr	16.97	4.20	36.20	25.80	85.00%	0.00
18	30 Apr- 06 May	15.63	4.40	38.20	26.00	80.00%	6.50
19	07 May- 13 May	17.10	4.60	39.20	26.50	82.00%	0.00
20	14 May- 20 May	17.43	4.90	39.40	27.40	79.00%	0.00
21	21 May- 27 May	18.20	4.90	38.30	27.50	83.00%	0.00
22	28 May- 03 Jun	18.53	4.93	38.60	27.80	82.00%	0.00

Table 2: Seasonal incidence of *Tetranychus* spp. and its natural enemies in *kharif* Season (2019)

SMW	Period	Mite population	Natural enemies of mite	Temperature (°c)		Relative humidity (%)	Rainfall (mm)
				Max	Min		
23	04 Jun-10 Jun	18.67	5.33	38.40	27.90	77.00%	0.00
24	11 Jun-17 Jun	19.87	5.67	39.00	27.60	76.00%	0.00
25	18 Jun-24 Jun	19.97	6.93	39.30	27.40	76.00%	0.00
26	25 Jun-01 Jul	16.80	4.66	32.20	27.30	83.00%	3.60
27	02 Jul-08 Jul	16.93	4.20	37.60	26.20	80.00%	0.00
28	09 Jul- 15 Jul	14.20	2.63	35.40	25.20	84.00%	18.20
29	16 Jul- 22 Jul	15.70	2.33	36.20	26.20	82.00%	2.80
30	23 Jul- 29 Jul	15.20	3.20	34.60	25.40	83.00%	5.20
31	30 Jul- 05 Aug	8.93	1.33	35.80	25.70	82.00%	54.20
32	06 Aug- 12 Aug	10.10	1.66	34.00	26.50	66.00%	5.40
33	13 Aug- 19 Aug	9.67	2.00	35.80	25.20	69.00%	22.80
34	20 Aug- 26 Aug	8.77	2.67	34.10	24.20	73.00%	79.50
35	27 Aug- 02 Sep	9.20	2.97	34.70	25.40	65.00%	18.00
36	03 Sep- 09 Sep	8.93	2.63	34.40	25.60	81.00%	27.60
37	10 Sep- 16 Sep	8.83	2.50	35.40	24.40	9.00%	70.80
38	17 Sep- 23 Sep	8.50	2.44	33.80	25.10	91.00%	55.60
39	24 Sep- 30 Sep	8.97	2.70	33.20	24.10	92.00%	18.30
40	01 Oct – 07 Oct	6.63	2.03	30.50	24.70	97.00%	157.80
41	08 Oct – 14 Oct	7.10	2.33	33.60	25.20	87.00%	3.80
42	15 Oct – 21 Oct	6.97	1.97	31.40	24.60	91.00%	52.80
43	22 Oct – 28 Oct	5.53	1.66	29.80	23.90	89.00%	86.20

Table 3: Seasonal incidence of *Tetranychus* spp. and its natural enemies in *rabi* Season (2019)

SMW	Period	Mite population	Natural enemies of mite	Temperature (°c)		Relative humidity (%)	Rainfall (mm)
				Max	Min		
44	29 Oct- 04 Nov	5.93	1.79	29.80	24.00	88.00%	84.40
45	05 Nov- 11 Nov	6.87	1.66	29.30	24.40	89.00%	38.60
46	12 Nov- 18 Nov	5.10	1.53	29.60	23.90	83.00%	62.00
47	19 Nov- 25 Nov	4.93	1.45	30.80	24.10	94.00%	117.20
48	26 Nov- 02 Dec	6.20	1.36	29.00	22.20	88.00%	14.50
49	03 Dec- 09 Dec	3.43	0.80	29.40	22.60	92.00%	643.40
50	10 Dec- 16 Dec	5.67	0.97	29.60	22.50	89.00%	0.00
51	17 Dec- 23 Dec	5.43	1.22	29.50	21.80	87.00%	31.40
52	24 Dec- 31 Dec	5.77	1.29	28.80	25.00	88.00%	7.80
1	01 Jan- 07 Jan	10.20	1.43	30.10	23.20	94.00%	19.80
2	08 Jan- 14 Jan	11.10	1.53	29.10	21.80	90.00%	0.00

3	15 Jan- 21 Jan	9.93	1.37	29.20	21.70	89.00%	28.20
4	22Jan- 28 Jan	9.97	1.29	29.60	20.60	90.00%	0.00
5	29 Jan- 04 Feb	10.37	2.30	31.20	21.30	92.00%	0.00
6	05 Feb- 11 Feb	11.63	2.44	31.60	22.40	89.00%	0.00
7	12 Feb- 18 Feb	11.87	2.53	31.20	22.50	86.00%	0.00
8	19 Feb- 25 Feb	12.80	2.67	31.70	21.70	89.00%	0.00

Natural enemies

Seasonal incidence of natural enemies of bhendi mite recorded from 9th SMW to 22nd SMW of 2019 in summer season crop. Population of natural enemies started increasing from 9th SMW to 22nd SMW ranges from the count of 0.8 to 4.93. In *kharif* crop peak population at 25th SMW of 6.93. Natural enemies in *rabi* crop ranges from 0.8 to 2.67 (Tables. 1, 2 & 3) and (Fig 1, 2 & 3). Rachana *et al*., (2009) [5] reported that high natural enemies population was observed from March first fortnight and continued upto second fortnight of April.

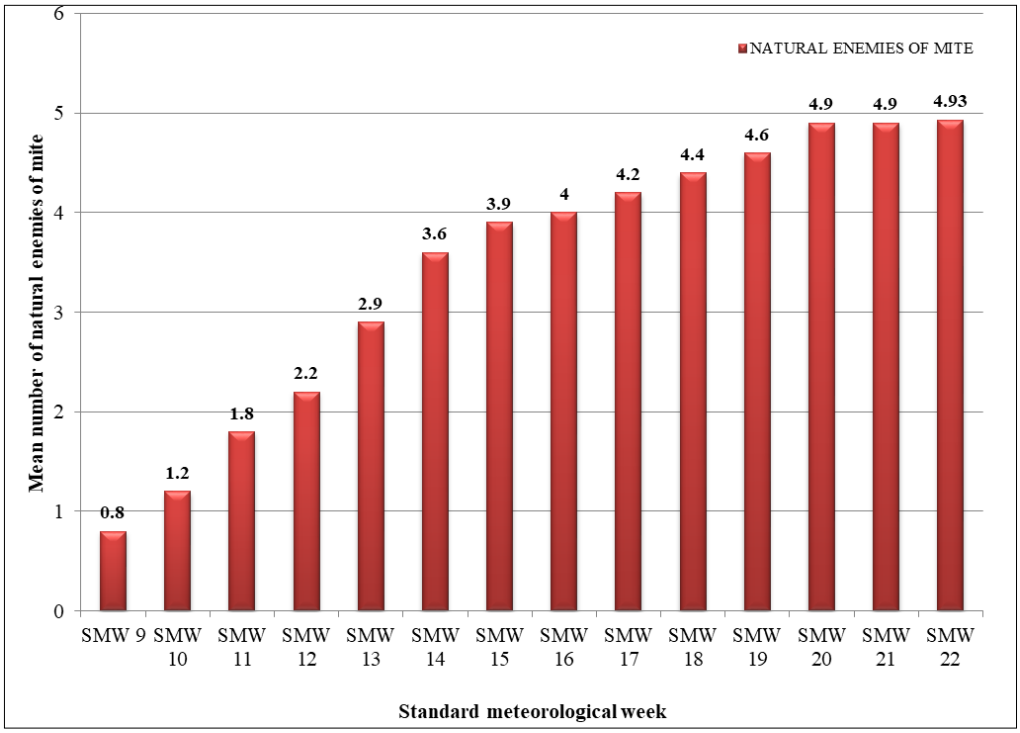

Fig 1: Seasonal incidence of natural enemies of mite during summer season (2019)

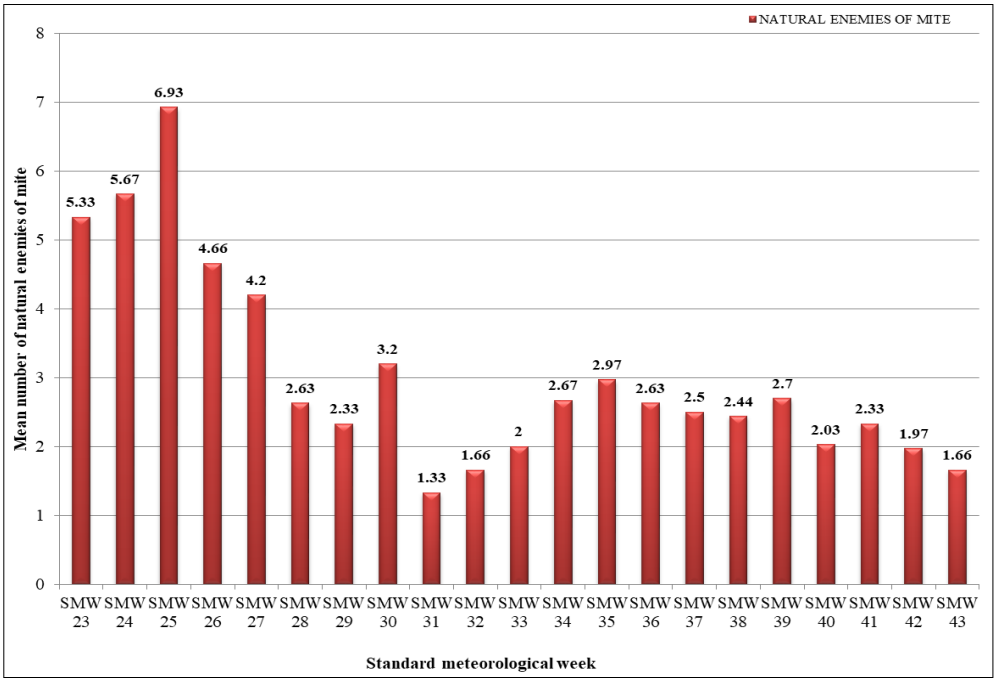

Fig 2: Seasonal incidence of natural enemies of mite during *kharif* season (2019)

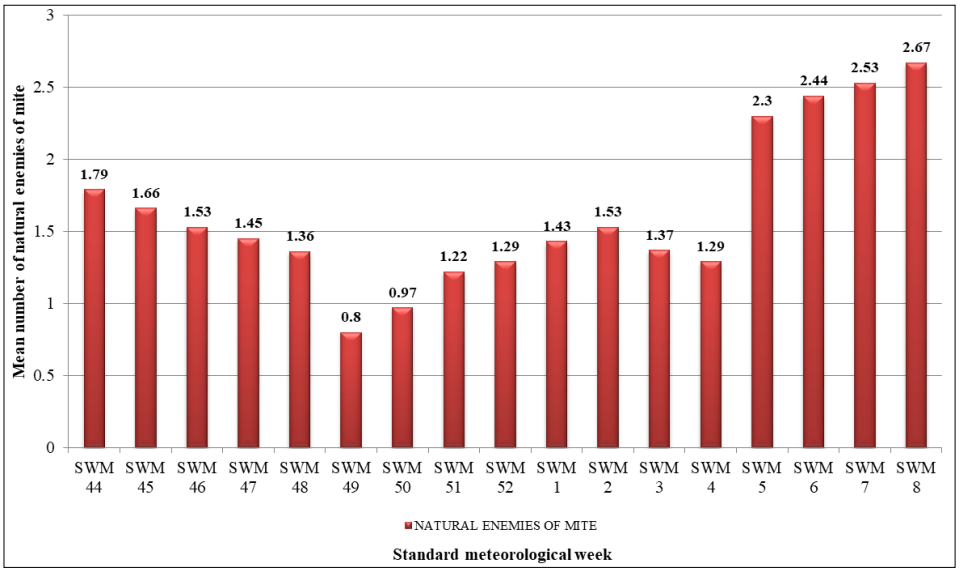

Fig 3: Seasonal incidence of natural enemies of mite during *rabi* season (2019)

Influence of weather parameters on bhendi mites, *Tetranychus* spp. and their natural enemies

The effect of weather parameters on the incidence of bhendi mite were studied using correlation and regression matrix. The correlation studies in summer crop showed that the bhendi mite was highly significant and positively correlated with maximum and minimum temperature i.e., r = 0.840** and r = 0.896**, significant and negatively correlated with relative humidity where r = - 0.649* and non correlated with rainfall. The multiple linear regression equations for mite was calculated to be $Y = -22.228 + 0.182\ X_1 + 0.819\ X_2 + 0.129\ X_3 + 0\ X_4$.The corresponding correlation co-efficient of multiple determination (R^2) values worked out to be 0.822. The overall impact of weather factors on population build-up of mite was 82.20 per cent. The correlation studies on natural enemies of mite showed highly significant and positively correlated with maximum and minimum temperature i.e., r = 0.869** and r = 0.851**, highly Significant and negatively correlated with relative humidity where r = -0.684** and non correlated with rainfall. The multiple linear regression equations for natural enemies of bhendi mite was calculated to be $Y = -27.431 + 0.465\ X_1 + 0.271\ X_2 + 0.084\ X_3 + 0.033\ X_4$. R^2 values worked out to be 0.778 (Table. 4).

Table 4: Correlation between weather parameters and the incidence of *Tetranychus* spp. with its natural enemies during summer season (2019)

Weather Parameters	Correlation Coefficient (r)	
	Mite	Natural enemies of mite
Maximum Temperature (ºC)	0.840854**	0.86911**
Minimum Temperature (ºC)	0.896523**	0.85136**
Relative Humidity (RH %)	-0.64946*	-0.68434**
Rainfall (mm)	0^{NS}	0.19150^{NS}

(** = Significant at 1 %; * = Significant at 5 %; NS = Non Significant)

In *kharif* crop, correlation studies showed that the bhendi mite were highly significant and positively correlated with maximum and minimum temperature where r = 0.765** and r = 0.845**, highly significant and negatively correlated with rainfall where r = - 0.655 ** and non correlated with relative humidity i.e., r = - 0.023. Multiple linear regression equations for okra mite were $Y = -67.826 + 0.690\ X_1 + 2.111\ X_2 + 0.023\ X_3 - 0.0105\ X_4$. The corresponding correlation co-efficient of multiple determination (R^2) values worked out to be 0.796. The overall impact of weather factors on population build-up of mite was 79.60 per cent. Natural enemies were highly significant and positively correlated with maximum and minimum temperature where r = 0.659** and r = 0.751**, non correlated with RH, significant and negatively correlate with rainfall. $Y = -22.350 + 0.196\ X_1 + 0.707\ X_2 + 0.004\ X_3 + 0.002\ X_4$ is the multiple linear regression equation. 0.612 is the worked out R^2 value (Table. 5).

Table 5: Correlation between weather parameters and the incidence of *Tetranychus* spp. with its natural enemies during *kharif* season (2019)

Weather Parameters	Correlation Coefficient (r)	
	Mite	Natural enemies of mite
Maximum Temperature (ºC)	0.76534**	0.65981**
Minimum Temperature (ºC)	0.845512**	0.75144**
Relative Humidity (RH %)	-0.02322^{NS}	-0.03552^{NS}
Rainfall (mm)	-0.65535**	-0.48984*

(** = Significant at 1 %; * = Significant at 5 %; NS = Non Significant)

Whereas in *rabi*crop mites population fluctuation were significant and positively correlated with maximum temperature where r = 0.569*, significant and negatively correlated with minimum temperature and rainfall where r = - 0.531* and r = - 0.516*, non correlated with relative humidity where r = 0.082. Multiple linear regression equations for bhendi mite found to be $Y = - 15.821 + 1.249 X_1 - 0.948 X_2 + 0.095 X_3 - 0.0084 X_4$. The corresponding correlation co-efficient of multiple determination (R^2) values worked out to be 0.6617. The overall impact of weather factors on population build-up of mite were66.17 per cent. Natural enemies of okra mite were highly significant and positively correlated with maximum temperature and non correlated with minimum temperature, RH and rainfall. Multiple linear regression equation calculated to be $Y = - 8.875 + 0.478 X_1 + 0.014 X_2 - 0.046 X_3 - 0.0008 X_4$. R^2 value found to be 0.812 (Table. 6). Singh *et al*., (2018) reported that increase in temperature with decrease in relative humidity favoured for the increase in development of mite.

Table 6: Correlation between weather parameters and the incidence of *Tetranychus* spp. with its natural enemies during *rabi* season (2019)

Weather Parameters	Correlation Coefficient (r)	
	Mite	Natural enemies of mite
Maximum Temperature (ºC)	0.569384*	0.82326**
Minimum Temperature (ºC)	-0.5311*	-0.15089^{NS}
Relative Humidity (RH %)	0.082509^{NS}	-0.15096^{NS}
Rainfall (mm)	-0.51602*	-0.42586^{NS}

(** = Significant at 1 %; * = Significant at 5 %; NS = Non Significant)

Conclusion

In *kharif* crop, the incidence of okra mites, *Tetranychus* spp. was peak during 25th SMW i.e., in the month of June with 19.97 mites per 4cm^2 leaf area. In summer okra, peak mite incidence was noticed during 22nd SMW i.e., at the end of May month with mite population of 18.53 per 4cm^2 leaf area. In *rabi* crop, peak mite incidence was noticed during 8th SMW i.e., in February month with 12.80 mites per 4cm^2 leaf area. On *kharif* crop, peak incidence of natural enemies of mite was noticed during 25th SMW with the population of 6.93. In summer and *rabi*crop, the incidence of natural enemies was peak during 22nd and 8th SMW with the mean population of 4.93 and 2.67.The population of mites showed highly significant positive correlation with maximum temperature. Rainfall showed negative correlation with mites.

References

1. Aladele SE, Ariyo OJ, Lapena R. Genetic relationship among West African okra (*Abelmoschuscaillei*) and Asian genotypes (*Abelmoschusesculentus*) using RAPD. African Journal of Biotechnology,2008:7(10):1426-1431.
2. Chittora A, Singh N. Production technology of okra. Marumegh, 2016, 1(1).
3. Kapoor VC, Paul M, Kapur J. Seasonal incidence of mite species infesting okra (*Hibiscus esculentus*) and brinjal (*Solanummelongena*) in Punjab. Indian Journal of Agriculture Sciences,1997:67(7):325-326.
4. Monica VL, Kumar A, Chand H, Paswan S, Sanjeev K. Population dynamics of *Tetranychusurticae* Koch on brinjal crop under north Bihar conditions. Department of Entomology, Sugarcane Research Institute, Rajendra Agricultural University,2014:20(1):47-49.
5. Rachana RR, Manjunatha M, Gayathri Devi S, Naik MI. Seasonal incidence of red spider mite *Tetranychusneocaledonicus* Andre, and its natural enemies. Karnataka Journal of Agricultural Science,2009:21(1):213–214.
6. Rajeshwari G, Bhanu KRM, Chakravarthy AK, Sridhar V, Mohan kumar S. Efficacy of biorational compounds against red spider mites on okra and brinjal. Journal of Entomology and Zoology Studies,2018:6(5):1030-1033.
7. Rita KVC, Bhullar MB, MB, Mahal MS. Population dynamics of mites associated with okra (*Hibiscus esculentus*) in Punjab. Indian Journal of Agricultural Science,2000:70(11):794-796.
8. Singh AK, Kumar M. Efficacy and economics of neem based products against cotton jassid, *Amrascabiguttulla* Ishida in okra. Crop Research Hisar,2003:26(2):271-274.
9. Singh AK, Koul K, Shankar U, Singh SK, Mondal A, Singh M. Seasonal incidence and management of red spider mite, *Tetranychus urticae* Koch on Okra, *Abelmoschusesculentus* L. Moench. Journal of Entomology and Zoology Studies,2018:6(2):650-656.
10. Singh P, Chauhan V, Tiwari BK, Shauhan SS, Simon S, Bilal S *et al*. An overview on okra (*Abelmoschusesculentus*) and its importance as a nutritive vegetable in the world. Biological Sciences,2014:4(2):227-233.
11. Zhang Z. Mites of Greenhouses. CABI Publishing Oxon, UK, 2003, 244.