Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 462-465

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

FULL LENGTH ARTICLE **OPEN ACCESS**

Correlation of Relative Incidence of Sorghum Aphid (*Melanaphis sacchari* Zehntner) and its Natural Enemies on Rabi Sorghum with Abiotic Factors

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ABSTRACT
The field experiment were conducted to study the correlation of relative incidence of aphid population and its natural enemies with respect to whether parameters on sorghum during rabi 2016-17. It is observed in present study that aphid incidence started from 2nd or 3rd week of December and reached a peak during 3rd or 4th week of January and disappeared by 2nd week of February. Chrysopa population attained their peaks during 4th week of January while the coccinellids attained peak during 1st week of February. The weather parameters (maximum and minimum temperature) showed negative and significant negative correlation (r= -0.4834 and r= -0.5750) with aphid population. Morning, evening humidity and sunshine hr. showed negative correlation (r= -0.2480, r= -0.0776 and r= -0.1492, respectively) with aphid population.

Received 30.07.2017 Revised 03.08.2017 Accepted 29.08. 2017

INTRODUCTION

Sorghum (*Sorghum bicolor* (L.) Moench) is the major source of food and fodder for millions of people in the tropics and semi-arid tropics. Grain sorghum is the fifth most important cereal crop in the world. India rank third in area representing the largest area (19 per cent) under sorghum cultivation in the world. In India, Maharashtra stands first with an area and annual production. Sweet sorghum is used for producing syrups, molasses and ethanol whereas grass sorghum is used for pasture and hay. Many constrains limit the production of sorghum like adverse climatic conditions, pests and diseases. Among these sorghum aphid (*Melanaphis sacchari* Zehntner) is becoming economically important constraint in *rabi* tract. *M. sacchari* injury includes purple leaf discoloration of seedlings followed by chlorosis, necrosis, stunting, delay in flowering and grain filling including quality and quantity yield losses. It can cause the overall loss of 16 and 15 per cent for grain and fodder yield, respectively (Balikai, 2001). Therefore, the present study had undertaken to evaluate the seasonal incidence of sorghum aphid so that farmers can adopt the need based protection measure at correct time according to ETL and EIL level by which their profit margin will improve. The outcome of present research will help research worker and cultivars to assess the aphid incidence and will help to formulate the different control strategies accordingly.

MATERIALS AND METHODS

A study on seasonal incidence of sorghum aphid (*Melanaphis sacchari* Zehntner) in sorghum ecosystem was conducted in field experiment during *Rabi* 2016-17 at All India Coordinated Sorghum Improvement Project (AICRP on Sorghum), MPKV, Rahuri, Maharashtra under irrigated condition. The experiment was conducted in a randomized block design with three replications on Phule Vasudha variety of sorghum sown on 20/10/2016 in a plot size of 10 X 10 m with a spacing of 45 X 15 cm. Field experiments were carried out on medium black soils. Recommended agronomic practices were followed in raising the crop. No plant protection measures were taken throughout crop season.

Meteorological data on temperature, relative humidity and rainfall were recorded during period of experimentation at weekly intervals. Aphid population present on 1 sq.cm leaf area was recorded. Observations on aphid incidence were recorded at weekly interval starting from the initial appearance to

final disappearance of the pest. The number of aphids per plant was counted and average was worked out. Initially, the whole plant was taken as a single unit and later on three leaves/plant (top, middle and bottom canopy of the plants) were selected. Five plants from each plot were selected at random (Rawat and Sahu, 1973). Similarly, the population of natural enemies present on each plant was recorded at weekly interval. The mean population of aphid and its natural enemies was then correlated with the weather parameters like temperature, relative humidity, rainfall and bright sunshine hours. Simple correlation was worked out between aphid population, natural enemy and weather parameters as per the procedure given by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Seasonal abundance of sorghum aphid and its natural enemies was studied on Phule Vasudha variety in *rabi* season at Rahuri condition. Data in respect of aphid population were recorded on 1 cm^2 leaf area at weekly interval, during the middle period of every standard meteorological week and presented in Table 1 and Fig. 1. The abundance of aphid was started from 48th standard meteorological week and increased gradually to reach its peak period in 3rd standard meteorological week. Thereafter, it declined gradually and started disappearing from 7th standard meteorological week.

The total number of coccinellids and chrysopa (grubs) recorded at weekly interval. Their occurrence with respect to whether parameters and aphid host were presented in Table 1. Coccinellids started appearing along with aphid and attained their peak during 3rd standard meteorological week and declined gradually and disappeared by 7th standard meteorological week.

The correlation coefficient (r) of aphid abundance and weather parameters of the two week prior to the date of observation indicated that the weather parameters of two week prior to the date of observation had significant correlation with the abundance of sorghum aphid and there was negative correlation with maximum (r= -0.4834) and significant negative correlation with minimum temperature (r= -0.5750). Minimum temperature had significant role in increase of aphid population. There was negative correlation with morning humidity (r= -0.2480) and evening humidity (r= -0.0776) also there was negative correlation with sunshine hrs. (r= -0.1492) found. The r value of lady bird beetle and green lace wing were significant and positive (r= 0.9779 and r= 0.9816 respectively). It indicated that there was increase in population of these natural predators with increase in aphid population.

The present study was corroborated with the study of Balikai and Lingappa (2002) who revealed that the sorghum aphid appeared on the 48th or 49th standard week (1st or 2nd week of December) and reached a peak in the 3rd or 4th standard week (3rd or 4th of January) and declined thereafter before disappearing in the 7th standard week and he also studied the population of natural enemies, which was peak during 3rd or 4th standard week.

The temperature during period of sorghum aphid incidence and abundance in the present study ranged from 7.9 to 32.4^{o}C which was very close to the ranges which were (11.4 to 34.7^{o}C) recorded by Waghmare *et al*. (1995), Mote and Kadam (1984) and Narayana *et al*. (1982). Our findings are in accordance

Table 1. Seasonal abundance of sorghum aphid and its natural enemies and their correlation with weather parameters

MW	Dt. of obs.	Aphid/sq.cm	Correlation coefficient of aphid population with weather parameters and natural enemies							
			T. Max	T. Min	Morn. H	Eve. H	RF	S. Shine	LBB/pl.	Chrysopa/pl.
46	15.11.16	0	30.0#	14.9#	51.0#	42.0#	0.00#	9.20#	0	0
47	22.11.16	0	29.8	12.4	52.0	26.0	0.00	9.70	0	0
48	29.11.16	0	30.0	14.9	78.0	47.0	0.00	8.30	0	0
49	06.12.16	2	29.0	9.9	55.0	29.0	0.00	10.40	0	0
50	13.12.16	11.7	32.4	10.4	63.0	27.0	0.00	9.40	1.33	0.56
51	20.12.16	15.23	29.6	11.4	64.0	30.0	0.00	8.50	3.2	1.4
52	27.12.16	20.36	29.8	9.9	56.0	25.0	0.00	9.70	7.24	2.5
1	03.01.17	27.2	28.4	9.5	52.0	33.0	0.00	9.30	8.56	3.6
2	10.01.17	35.55	27.6	7.9	51.0	29.0	0.00	9.50	10.66	3.9
3	17.01.17	47.25	29.0	8.9	47.0	41.0	0.00	9.80	11.66	4.6
4	24.01.17	44.25	28.4	9.4	52.0	22.0	0.00	9.70	11.26	4.9
5	31.01.17	33.56	29.6	14.9	77.0	37.0	0.00	5.60	9.66	3.4
6	06.02.17	19.23	32.4	13.9	61.0	32.0	0.00	9.10	6	2.6
7	13.02.17	11.36	32.4	12.4	57.0	22.0	0.00	10.20	2	1.2
8	20.02.17	3.45	32.0	13.5	70.0	34.0	0.00	9.10	0	0
9	27.02.17	0	30.6	13.5	54.0	28.0	0.00	9.50	0	0
'r' values			**-0.483**	**-0.575***	**-0.248**	**-0.078**	**-**	**-0.149**	**0.979****	**0.982****

Data of two weeks prior to the date of observation. * Significant at 0.05 % & 0.01 % = 0.497 & 0.623, respectively

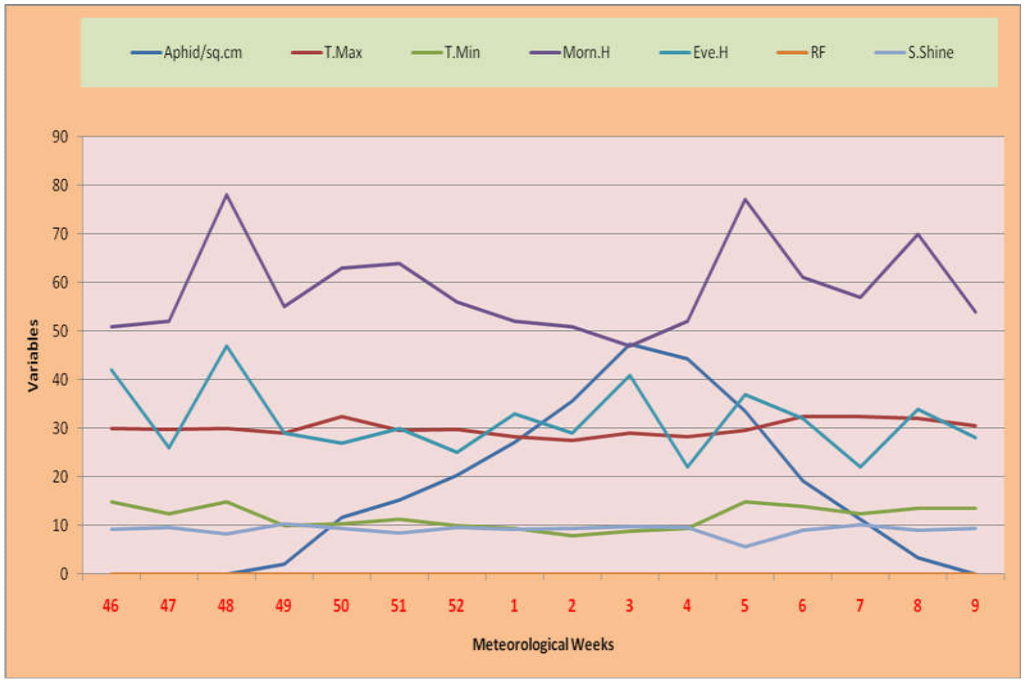

Fig 1. Relative incidence and abundance of sorghum aphid with respect to whether parameters

with Behura and Bohidar (1983) who found that at the temperature of 35^{0}C aphids dose not survive. The present investigation is also supported by Pawar *et al.* (2014) who reported that the abundance of sorghum aphid started from 1st week of December i.e. 90 days after sowing and further increased continuously up to last week of January and declined thereafter. The population was at its peak in the month of January i.e. 120 days after sowing. In correlation studies, they found that the weather parameters of two week prior to the date of observation had significant correlation with the abundance of aphid and there was negative correlation with maximum (r= -0.640 and r= -0.863) and minimum temperature (r= -0.703 and r= -0.695). The favorable range of maximum temperature and minimum temperature during the peak infestation of aphid was from 29 to 30^{o}C and 9 to 11^{o}C respectively.

In case of correlation data of predatory coccinellids with whether parameters, the present investigation were supported by Patil and Sathe (2001) who observed that *Menochilus sexmaculata* F. appeared from 2nd week of November and attained a peak in 2nd week of February in *rabi* season.

CONCLUSION

From present investigation it was confirmed that during cultivation of sorghum in *rabi* season particularly in Maharashtra region of India the sorghum aphid causes a great menaces and losses in production. Its population was regulated by many abiotic factors and its incidence occurred in the months of December to February. The peak population was noticed in mid to last week of January. Hence control measure or plant protection approaches should be taken on need basis i.e. when required so as to achieve a profit oriented, sustainable and healthy agriculture.

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CITATION OF THIS ARTICLE

V. K. Ghodekar, R. R. Dhole, D. B. Pawar and S. K. Patil. Correlation of Relative Incidence of Sorghum Aphid (*Melanaphis sacchari* Zehntner) and its Natural Enemies on Rabi Sorghum with Abiotic Factors. Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [3] 2017: 462-465