Biological Forum – An International Journal **15(10): 1032-1036(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Seasonal Incidence of Sucking Pests of the Sunflower

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(Received: 16 August 2023; Revised: 25 September 2023; Accepted: 01 October 2023; Published: 15 October 2023)
(Published by Research Trend)

ABSTRACT: Sunflower is one of the important oil-seed crop of farmers community in India and its production is affected by insect pests. In order to determine the seasonal incidence of sucking insect pest of sunflower and its correlation with weather parameters the studies were carried out in College of Agriculture Parbhani, VNMKV, Maharashtra during *rabi,* 2022. In seasonal incidence study, it was observed that jassids, *Amrasca bigutulla bigutulla* and whitefly *Bemisia tabaci* were sucking pests in sunflower ecosystem. Jassids incidence was noticed during 4th week of September and reached peak at 5th week of October. Whitefly incidence had started during 4th week of September and reached a peak of 1.60 whiteflies/leaf/plant in 1st week of November. The population of jassid showed negative significant correlation with evening relative humidity (r = -0.601*) and wind speed (r = -0.595). The population of whitefly showed positive significant correlation with morning relative humidity (r=0.134*).

Keywords: Correlation, sunflower, jassids, whiteflies, regression.

INTRODUCTION

Sunflower (*Helianthus annuus* L.) belongs to the family Asteraceae. *Helianthus* genus contains 65 different species (Andrew *et al*., 2013). The name *Helianthus*, being derived from *helios* (the sun) and *anthos* (a flower), has the same meaning as the English name Sunflower, which has been given to it as it follows the sun by day, always turning towards its direct rays. The sunflower that most people refer to is *H. annuus*, an annual sunflower. In general, it is an annual plant which possesses a large inflorescence (flowering head), and its name is derived from the flower's shape and image, which is often used to depict the sun. The plant has a rough, hairy stem, broad, coarsely toothed, rough leaves and circular heads of flowers (Khaleghizadeh, 2011). The heads consist of many individual flowers which mature into seeds on a receptacle base (Seghatoleslami *et al*., 2012). Sunflower is the world's fourth largest oil-seed crop and its seeds are used as food and its dried stalk as fuel. It is already been used as an ornamental plant and was used in ancient ceremonies (Harter *et al*., 2004; Muller *et al*., 2011). Additionally, medical uses for pulmonary afflictions have been reported. In addition, parts of this plant are used in making dyes for the textile industry, body painting, and other decorations. Sunflower oil is used in salad dressings, for cooking and in the manufacturing of margarine and shortening (Kunduraci *et al*., 2010).

Sunflower oil contains principally oleic (19.81%) and linoleic (64.35%) acids, which cannot be synthetized by humans and need to be assimilated through a diet. Sunflower seeds are very nutritive (33.85% proteins and 65.42% lipids and 18 mineral elements). Due to the rich content of lipids, they are principally used as a source of vegetable oil. Compared to seeds, sunflower oilcakes are richer in fibers (31.88% and 12.64% for samples in form of pellets and cake, respectively) and proteins (20.15% and 21.60%), with a balanced amino acids profile. The remaining oil (15.77% and 14.16%) is abundant in unsaturated fatty acids (95.59% and 92.12%).

Globally, the sunflower is ranked as the fourth most important oilseed crop after soybeans, rapeseed, and safflower, as the most profitable and economic oilseed crop (Enebe & Babalola 2018). Among the four major oilseed crops in the world *viz*., soybean, brassicas, sunflower and groundnut, sunflower ranks third in the total area cultivated and fourth in total production. In world, during 2021-22, sunflower was cultivated on an area of 29.5 million ha with 58.18 million tonnes of production and 1970.30 kg per ha of productivity (FAOSTAT, 2022a). In India, during 2021-22 sunflower was cultivated on an area of 2.56 lakh ha with 2.3 lakh tonnes of production and 891 kg per ha of productivity (FAOSTAT, 2022b). The major sunflower growing states in the country are Karnataka, Andhra Pradesh, Maharashtra, Orissa, Bihar, Haryana, Punjab, Tamil Nadu and West Bengal. Among these, Karnataka state is the major producer of sunflower in the country. Maharashtra ranked third in area and production of sunflower. In Maharashtra during 2021-2022 sunflower was grown on an area of 26,050 ha with 12,150 tonnes of production and productivity (indiastatagri 2022).

Insect pests and diseases are the major production constraints in sunflower. In India, the major sucking insect pests include jassids, *Amrasca biguttula biguttula* Ishida and whitefly, *Bemisia tabaci* are of major economic importance (Basappa, 2004).

The incidence of sucking pest on sunflower crop varied due to several factors like planting time, variety, and most important abiotic factors. Different abiotic factors like temperature, humidity and rainfall plays an important role on the incidence and population dynamics of sucking pest. So, determining the link between the population of pests and various abiotic environmental factors proves to be helpful in formulating an effective strategy for pest management.

MATERIAL AND METHODS

The sunflower variety Ajeet - 531 was grown during *Rabi*, 2022 season on an area of 100 m^2 by adopting the spacing of 60 cm × 30 cm at the research farm of Department of Entomology, College of Agriculture, Parbhani by following the recommended package of practices except the plant protection measures against insect pests.

After one week of germination, observations on sucking insect pests were recorded on weekly basis till harvesting of the crop. Ten plants from plot were randomly selected and tagged. Sucking insect pests such as jassid and whitefly were recorded from three leaves per plant, one each from upper, middle and lower canopy of the plant. Mean of sucking pests was worked out as population per leaf.

RESULTS AND DISCUSSION

The data presented in table 1 revealed that insect pest species, *viz*., jassids and whitefly were recorded asper leaf per plant during *rabi*, 2022. The findings of the present study and the related discussion are explained here under.

A. Seasonal incidence of jassids

The data presented in Table 1 and graphically depicted by Fig. 1 revealed that infestation of Jassids *A. biguttula biguttula* commenced from about 20 days after sowing and recorded 0.33 jassids /leaf/ plant during 38th SMW. In next three weeks from 41st SMW jassids population increased rapidly and in next two weeks it reached to the highest of 3.71 jassids /leaf/ plant in 43rd SMW when the corresponding rainfall, maximum temperature, minimum temperature, before noon relative humidity, afternoon relative humidity and wind speed were 0.0 mm, 30.7°C, 14.2°C, 86 per cent, 26 per cent, and 3.1 km/hr., respectively. Thereafter the infestation decreased gradually up to the end of the crop. At harvest (50th SMW) jassids were recorded below ETL level i.e., 1.63 jassids/leaf/plant.

(i) Correlation studies between abiotic factors and jassid *A. biguttula biguttula*

The correlation coefficients were worked out between Jassid and abiotic factors (rainfall, temperature, relative humidity and wind speed) and presented in Table 2.

Table 1: The data on seasonal incidence of sucking insect pests of Sunflower during *rabi* 2022.

Sr. No.	Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity % (per cent)		Wind speed (km/h)	No. of Jassids/ leaf/pl	No. of Whitefly/ leaf/pl
				Max.	Min.	AM	PM			
1.	38	17-23 Sep	9.3	30.7	21.4	90	67	4.5	0.33	1.33
2.	39	24-30 Sep	47.4	32.0	21.2	92	58	3.2	0.96	0.30
3.	40	01-07 Oct	11.0	31.8	21.4	88	56	4.3	1.26	0.60
4.	41	08-14 Oct	57.1	31.0	22.1	91	64	2.7	2.90	0.40
5.	42	15-21 Oct	0.0	30.3	21.6	91	62	3.5	3.46	1.20
6.	43	22-28 Oct	0.0	30.7	14.2	86	26	3.1	3.71	1.30
7.	44	29-04 Nov	0.0	30.7	12.9	86	28	3.0	3.5	1.60
8.	45	05-11 Nov	0.0	31.5	12.6	83	25	2.7	3.5	0.40
9.	46	12-18 Nov	0.0	30.4	12.2	86	28	2.8	3.08	0.90
10.	47	19-24 Nov	0.0	29.3	11.4	80	26	2.8	2.83	0.40
11.	48	26-02 Dec	0.0	30.1	11.4	86	32	2.1	2.53	0.60
12.	49	03-09 Dec	0.0	29.7	13.8	88	35	2.5	1.97	0.50
13.	50	10-16 Dec	1.2	29.9	17.4	85	47	3.9	1.63	0.50

Table 2: Correlation of abiotic factors with sucking pests of sunflower.

Weather parameter	Correlation coefficient ('r' values)	
	A. biguttulabiguttula	*B. tabacci*
Rainfall (mm)	-0.300	-0.397
Maximum Temperature (°C)	-0.218	-0.073
Minimum temperature (°C)	-0.522	-0.011
Morning relative humidity (%)	-0.394	0.134*
Evening relative humidity (%)	-0.601*	-0.033
Wind speed (km/ h)	-0.595*	0.295

N= 13; *Significant at 5%

The population of Jassid showed negative significant correlation with Evening relative humidity (r= -0.601*) and wind speed (r = -0.595). The other remaining factors showed negative and non-significant correlation with Jassid population include rainfall (r= -0.300), maximum temperature (r= -0.218), minimum temperature (r= -0.522) and morning relative humidity (r= -0.394).

(ii) Regression studies

Table 3: Multiple regressions of abiotic factors with jassids on sunflower.

Weather parameter	Reg. coefficients (b)	SE (b)	T test	T table (0.05)
Rainfall (mm) (B1)	-0.036	0.026	-1.366	2.447
Max. temperature (ºC) (B2)	-0.164	0.482	-0.341	2.447
Min. temperature (ºC) (B3)	0.695	0.305	2.277	2.447
Morning RH (%) (B4)	-0.091	0.155	-0.586	2.447
Evening RH (%) (B5)	-0.131	0.072	-1.831	2.447
Wind speed (B6)	-1.735	0.801	-2.166	2.447
Intercept (a) = 15.391				
Coefficient of determination (R Square) = 0.713				
Multiple Correlation Coefficient (R) = 0.844				
Standard Error = 0.835				

The regression equation worked out was as follow.

Y= 15.391 + (-0.036) × B1 + (-0.164) × B2 + (0.695) × B3 + (-0.091) × B4 + (-0.131) x B5 + (-1.735) × B6 + 0.835

The multiple regressions were worked out between abiotic factors and *Jassid* population on the sunflower during *rabi* 2022 and presented in Table 3.

The coefficient of determination (R^2) represents the proportion of common variation in the two variables. It was observed that the abiotic factors contributed for 71.3 per cent of total variation in the population of jassid on sunflower.

The results of the present finding are in accordance with the findings of Geetha and Hegde (2018) who reported that the incidence of jassids appeared from 37th SMW (2.00/6 leaves/ plant) and attained its peak of 22.30 per six leaves per plant at 43rd SMW. In the present study, *A. biguttulabiguttula* commenced from 38th SMW. In next five weeks it reached to the highest of 3.71 jassids/leaf/plant in 43rd SMW. She further analysed that there existed a significant and positive correlation between *A. biguttulabiguttula* population and maximum temperature (r=0.65*) in 2015. However, correlation between *A. biguttulabiguttula* and all the other weather parameters {minimum temperature (r= -0.81**), morning relative humidity (r=-0.77**), evening relative humidity (r=-0.74*) and wind velocity (- 0.68*)} except rainfall (r=-0.29) showed significant negative correlation. In this study the population of Jassid showed negative significant correlation with Evening relative humidity and wind speed where, the other remaining factors showed negative and non-significant correlation with Jassid population include rainfall, maximum temperature, minimum temperature and morning relative humidity, supporting the work.

Jadhao *et al*. (2015) found that in sunflower jassids showed negative non-significant correlation with maximum temperature (r= -0.772).

Ghante *et al.* (2022) observed that Negative and non-significant correlation was found between leafhopper population and all the abiotic factors and Collective influence of weather factors on population of leafhopper was to the tune of 41.60 per cent.

While, Basit *et al*. (2016) reported significant negative correlation between jassids and per cent relative humidity (r= -0.85*).

Above results support the present experimental findings.

B. Seasonal incidence of Whitefly

The data presented in Table 1 and graphically depicted by Fig. 2 revealed that the population of whitefly *Bemisia tabaci* ranged in between 0.30 to 1.60 whiteflies/leaf/plant. Their incidence first observed in fourth week of September by recording 1.33 whiteflies/leaf/plant in 38th SMW. Maximum population recorded was 1.60 whitefly/leaf/plant during 44th SMW when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed were 0.00 mm, 30.7°C, 12.9°C, 86 percent, 28 per cent and 3.0 km/hr, respectively. Minimum population was recorded in 39th SMW i.e., 0.30 whiteflies/leaf/plant.

(i) Correlation studies between abiotic factors and whitefly *Bemisia tabaci.* The correlation coefficients were worked out between *Bemisia tabaci* and abiotic factors (rainfall, temperature, relative humidity and wind speed) and presented in Table 2.

The population of *Bemisia tabaci* showed negative correlation with Rainfall (r= -0.397), Maximum temperature (r= -0.073), minimum temperature (r= -0.011) and evening relative humidity (r= -0.033). The population of whitefly showed positive significant correlation with morning relative humidity (r=0.134*) and positive correlation with wind speed (r= 0.295).

Table 4: Multiple regressions of abiotic factors with *Bemisia tabaci* on sunflower.

Weather parameter	Reg. coefficients (b)	SE (b)	T test	T table (0.05)
Rainfall (mm) (B1)	-0.006	0.013	-0.423	2.447
Max. temperature (ºC) (B2)	-0.132	0.245	-0.539	2.447
Min. temperature (ºC) (B3)	-0.018	0.155	-0.114	2.447
Morning RH (%) (B4)	0.147	0.079	1.872	2.447
Evening RH (%) (B5)	-0.027	0.036	-0.752	2.447
Wind speed (B6)	0.486	0.406	1.196	2.447
Intercept (a) = -8.017 **Coefficient of determination (R Square) = 0.537** Multiple Correlation Coefficient (R) = 0.733 Standard Error = 0.423				

(ii) Regression studies

The regression equation worked out was as follow

Y= -8.017 + (0.006) × B1 + (-0.132) × B2 + (-0.018) × B3 + (0.147) × B4 + (-0.027) × B5 + (1.486) × B6 + 0.423

The multiple regressions were worked out between abiotic factors and *Bemisia tabaci* population on the sunflower during *rabi* 2022 and presented in Table 4.

The coefficient of determination (R^2) represents the proportion of common variation in the two variables. It was observed that the abiotic factors contributed for 53.7 per cent of total variation in the population of *Bemisia tabaci* on sunflower.

Geetha and Hegde (2018) observed the incidence of whitefly ranged from 0.00 to 2.60 per six leaves per plant and the incidence appeared from 37th SMW (0.50/6 leaves/plant) and attained peak on 43rd SMW (2.60/6 leaves/plant). In the present study their incidence first observed in 38th SMW. Maximum population recorded was during 44th SMW. The correlation of whiteflies population with weather parameters (Rainfall, morning and evening relative humidity) was non-significant and negative in pooled data of 2015 and 2016. However, in the year 2015 whitefly showed negative non-significant correlation with maximum temperature and non-significant positive with morning relative humidity and wind speed.

Jayewar *et al*. (2018) revealed that the whitefly population, has a significant and negative correlation of population with maximum temperature. Weather parameters as minimum temperature, rainfall, relative humidity morning and relative humidity evening exhibited positive correlation with whitefly population but was non-significant. Therefore, it can be concluded that increase in the maximum temperature is causing significant reduction in whitefly population.

Ghante *et al.* (2022) found that Whitefly population have negative significant relation with minimum temperature and positive non-significant relation with rainfall and evening relative humidity. Relation was negative and non-significant with maximum temperature and Collective influence of weather factors was to the tune of 59.10 per cent.

These findings are in line with the experimental findings that the population of *Bemisia tabaci* showed negative correlation with rainfall, maximum temperature, minimum temperature and evening relative humidity. The population of whitefly showed positive significant correlation with morning relative humidity and positive correlation with wind speed.

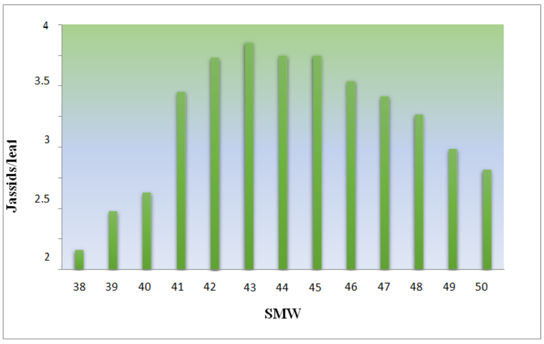

Fig. 1. Seasonal incidence of sunflower jassids *A.biguttulabiguttula*.

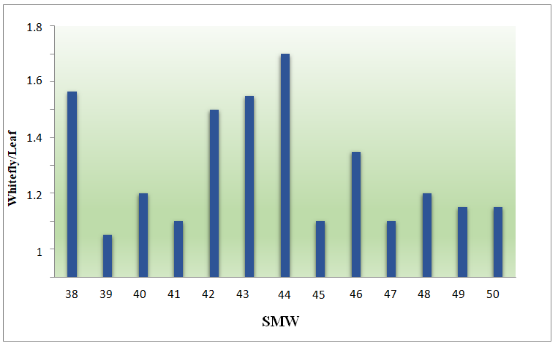

Fig. 2. Seasonal incidence of sunflower whitefly *Bemisia tabaci.*

Adult jassid *A. biguttulabiguttula*

Nymph A. biguttulabiguttula

Whitefly *Bemisia tabaci*

CONCLUSIONS

Jassids population had reached to the highest of 3.71 jassids/leaf/plant in 43rd SMW and it showed negative significant correlation with evening relative humidity (r= -0.601*) and wind speed (r = -0.595*). It is therefore concluded that abiotic factors contributed for 71.3 per cent of total variation in the population of jassid on sunflower. Maximum population of whitefly was recorded 1.60 whitefly/leaf/plant during 44th SMW and it showed positive significant correlation with morning relative humidity (r= 0.134*). Thus, it is concluded that the abiotic factors contributed for 53.7 per cent of total variation in the population of whitefly *Bemisia tabaci* on sunflower.

Acknowledgement. In the ecstasy of delight, I express my esteem and profound sense of gratitude to my revered major advisor, Associate Professor, Department of Entomology and committee members their valuable guidance, constructive criticism and sustained interest throughout the course of investigation.

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How to cite this article: Anjali Purushottam Sharma, Milind M. Sonkamble, Chirag B. Channe, Neha G. Matra and Dilip B. Randive (2023). Seasonal Incidence of Sucking Pests of the Sunflower. *Biological Forum – An International Journal, 15*(10): 1032-1036.