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Studies on Seasonal Occurrence of Pest Complex of Sunflower in Krishna-Guntur Zone of Andhra Pradesh

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ABSTRACT

A field experiment was conducted to study the seasonal occurrence of insect pests on sunflower at Agricultural College Farm, Bapatla during *rabi,* 2007-08. The peak occurrence of *Spodoptera. litura* (Fab.) was recorded during the second week of February while, sucking pests *viz., Amrasca biguttula biguttula* (Ishida) and *Bemisia tabaci* (Gannadius) were observed during third week of January and *Aphis craccivora* (Koch) during the first week of January.

Key words : Insect pests, Seasonal occurrence, Sunflower.

In India, oilseeds have been contributing significantly to the agricultural economy. India is the 3rd largest country in edible oil economy in the world; standing next to USA & China. In the global scenario of oil seed production, India holds a premier position accounting for 19% of the total area with 9% of total production. Sunflower (*Helianthus annus* L.) is a promising oil seed crop next to groundnut and soybean in India. It occupies an area of 2.13 m ha with a production of 1.12 mt (Ministry of Agriculture, Govt. of India, 2007). In Andhra Pradesh it is grown in 0.41 m ha with a production of 0.27 mt. (APEASB, 2003). As many as 251 insects and acarine species are known to attack sunflower crop throughout the world (Rajmohan *et al.,* 1974). Seasonal occurrence of different insect pests of sunflower provides information on the initiation and extent of damage at different growth stages of the crop and its relation to weather parameters is of great help to plan appropriate management.

MATERIAL AND METHODS

A sunflower variety APSH-11 was sown on 25.11.2007 in 100 m^2 area and the experiment was conducted in an observational non replicated plot (bulk plot) with normal agronomic practices except avoiding the plant protection measures. The pest population was recorded in the bulk plot at weekly intervals coinciding with the initiation of the pest and continued upto the maturity. A total of 50 plants from five different locations at ten plants per location were randomly selected and tagged for taking observations. The number of larvae of *Spodoptera litura* were counted at each observation on the selected plants. With respect to the population of sucking pests *i.e.,* leafhoppers, whiteflies and aphids the data were recorded by five leaf method (top two, middle one and bottom two) and at the same time the number of coccinellid predators and spiders were also recorded on the selected plants.

The meteorological data on weather parameters was recorded from meteorological observatory located at Agricultural College Farm, Bapatla. The influence of weather parameters *viz*., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rain fall and natural enemies on the incidence of pests was statistically analysed by multiple linear regression (MLR) method.

RESULTS AND DISCUSSION

The data recorded on the occurrence of *S. litura* revealed that its population was observed from second week of January to second week of March(Table 1). The initial incidence was observed in second week of January *i.e.,* at 49 days after sowing with a mean population of 0.12 larvae $plant^{-1}$. The pest population increased gradually from second week of January and reached to a peak by second week of February *i.e.,* at 77 days after sowing with a mean of 1.40 larvae $plant^{-1}$. There after the pest population has declined gradually and reached to a

minimum by second week of March with a mean of 0.22 larvae plant^{-1} *i.e.,* at 105 days after sowing.

Correlations were worked out to find out the relationship between larval population and the major weather parameters and natural enemies (Table 2). The results indicated negative but significant (r = -0.5278) association between the larval population and maximum temperature while the association between the larval population and the minimum temperature (r = 0.6554) and evening relative humidity (r = 0.6180) was positive and significant (Table 1). The relationship between the *S. litura* population and both the morning relative humidity (r = 0.2772) and the rainfall (r = 0.4884) was positive and non-significant.

The relationship between *S. litura* population with coccinellid predatory beetles (r = 0.3718) was positive and non- significant while the association between larval population of *S. litura* and spiders (r = 0.5223) was positive and significant.

The data on the incidence of *S. litura* when subjected to multiple linear regression analysis (Table 1) the following equation was arrived.

$Y = -2.9256 - 0.01245X_1 + 0.2963X_2^{**} - 0.0286X_3 - 0.0009X_4 - 0.0007X_5 - 0.1668X_6 + 2.1316X_7^{*}$.

The coefficient of determination (R^2) for *S. litura* population was 0.9524, which showed that abiotic and biotic factors together were able to explain the variation in the population of *S. litura* to the extent of 95.24 out of 100.

Sucking pests

The data recorded on the incidence of leafhopper, whitefly and aphid revealed that the population of leafhopper, whitefly and aphid were observed on third week of December *i.e.,* at 21 days after sowing with a mean population of 0.92, 2.66 and 2.86/five leaves/plant respectively (Table 1). The pest population of both leafhopper and whitefly increased gradually from third week of December and reached a peak by third week of January *i.e.,* at 56 days after sowing with a mean of 4.94 9.46/ five leaves/plant respectively. While, the peak occurrence of aphid was observed during first week of January *i.e.,* at 42 days after sowing with a mean of 16.12 aphids/five leaves/plant. There after the leafhopper population declined gradually and reached to a minimum by first week of March with a mean of 2.20 leafhoppers/five leaves/plant *i.e.,* at 98 days after sowing. While, the minimum pest population of both whitefly and aphid was observed during second week of March with a mean population of 1.82 and 2.12 /five leaves/plant *i.e.,* at 105 days after sowing respectively.

The correlation studies between the population of *A. biguttula biguttula*, *B. tabaci* as well as *A. craccivora* and weather parameters and natural enemies indicated negative but non-significant association with maximum temperature and minimum temperature and positive and non-significant association with evening relative humidity and rainfall while, the association between the pest population and morning relative humidity, coccinellids and spiders was positive and significant (Table 3 and 4).

The data on the occurrence of leafhoppers when subjected to multiple linear regression analysis (Table 2), the following equation was arrived.

$Y = -23.6040 + 0.1065X_1 + 0.1281X_2 + 0.1216X_3 + 0.1059X_4^{*} - 0.1713X_5 + 5.1528X_6^{**} - 0.7168X_7$.

The coefficient of determination (R^2) for leafhopper population was 0.9654, which showed that abiotic and biotic factors together were able to explain the variation in the population of *A. biguttula biguttula* to the extent of 96.54 per cent.

The data on the occurrence of whitefly when subjected to multiple linear regression analysis (Table 4), the following equation was arrived.

$Y = -0.9056 + 0.1413X_1 - 0.6136X_2 - 0.1083X_3 + 0.2652X_4 + 0.0308X_5 + 6.2982X_6 + 3.6507X_7$.

The coefficient of determination (R^2) for whitefly population was 0.9041, which showed that the abiotic and biotic factors together were able to explain the variation in the population of *B. tabaci* to the extent of 90.41 per cent.

The data on the occurrence of aphid when subjected to multiple linear regression analysis (Table 4), the following equation was arrived.

$Y = -19.1980 - 0.0137X_1 - 0.2987X_2 + 0.1268X_3 + 0.2177X_4^{*} - 0.2840X_5 + 16.6236X_6^{**} - 3.6494X_7$.

The coefficient of determination (R^2) for aphid population was 0.9889, which showed that the abiotic and biotic factors together were able to explain the variation in the population of *A. craccivora* to the extent of 98.89 out of 100.

The larval incidence of *S. litura* was noticed for the first time during the second week of January, 2008 (*i.e.,* at 49 days after sowing) and reached to a peak of - during the second week of February, 2008 (*i.e.,* at 77 days after sowing). The weather parameters like low temperature and high relative humidity favoured the incidence. The population gradually declined by the second week of March, 2008 (Table 1) due to increase in temperature and decrease in relative humidity. The present results are in accordance with the observations of Srinivas and Rao (1999) in groundnut. On contrast Chalapathi rao *et al.,* (2000) observed the peak larval population of *S. litura* during the first week of April on sunflower.

Table 1. Influence of abiotic and biotic factors on the seasonal occurrence of major pests on sunflower during *rabi*, 2007-08

Date of observation	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Natural Enemies		*S. litura*	*A. biguttula biguttula*	*B. tabaci*	*A. craccivora*
	Max	Min	Morning	Evening		Coccinellids plant^{-1}	Spiders plant^{-1}	Mean population plant^{-1}	Mean population 5 leaves^{-1} plant^{-1}	Mean population 5 leaves^{-1} plant^{-1}	Mean population 5 leaves^{-1} plant^{-1}
2nd Dec	31.13	19.66	86.57	67.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9th Dec	30.49	19.34	84.86	70.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16th Dec	29.86	20.31	89.00	72.71	0.01	0.08	0.10	0.00	0.92	2.66	2.86
23rd Dec	30.56	18.40	84.71	69.57	0.27	0.34	0.16	0.00	1.14	3.88	6.32
30th Dec	31.34	17.87	91.00	67.00	0.00	0.56	0.34	0.00	2.86	5.92	9.44
6th Jan	30.29	16.79	93.14	59.86	0.00	1.10	0.62	0.00	4.52	7.40	16.12
13th Jan	30.29	16.30	94.57	66.43	0.00	0.98	0.80	0.12	4.26	9.22	14.56
20th Jan	30.00	17.00	94.29	65.86	0.00	0.82	0.66	0.34	4.94	9.46	12.72
27th Jan	29.66	18.73	90.43	71.29	0.00	0.86	0.76	1.14	4.12	8.44	14.34
3rd Feb	29.95	20.13	91.14	73.29	0.00	0.78	0.62	1.26	4.86	8.76	13.12
10th Feb	30.21	21.57	88.29	77.71	2.97	0.66	0.58	1.40	4.18	8.72	9.10
17th Feb	27.89	21.56	93.57	81.86	9.37	0.70	0.50	1.36	3.72	7.54	11.12
24th Feb	28.49	20.59	90.71	70.71	0.00	0.64	0.54	1.30	3.30	4.32	9.36
2nd Mar	32.06	19.71	91.86	69.00	0.00	0.40	0.46	0.86	2.20	2.12	6.30
9th Mar	32.00	18.04	87.57	54.86	0.00	0.32	0.40	0.22	0.00	1.82	2.12

Table 2. Correlation and multiple linear regression between abiotic and biotic factors and population of *S. litura* on sunflower during *rabi*, 2007-08

Abiotic and biotic factors (Weather parameters and natural enemies)	Correlation coefficient (r)	Partial regression coefficient	Standard error	t - value
X_1 – Maximum temperature (°C)	-0.5278*	-0.0124	0.0692	0.1798 NS
X_2 – Minimum temperature (°C)	0.6554**	0.2963	0.0622	4.7641**
X_3 – Morning relative humidity (%)	0.2772 NS	-0.0286	0.0270	1.0621 NS
X_4 – Evening relative humidity (%)	0.6180*	-0.0009	0.0147	0.0655 NS
X_5 – Rainfall (mm)	0.4884 NS	-0.0007	0.0293	0.0241 NS
X_6 - Coccinellids	0.3718 NS	-0.1668	0.5000	0.3337 NS
X_7 - Spiders	0.5233*	2.1316	0.6007	3.5481*

NS: Non-significant Intercept: -2.9256 R^2 value: 0.9524 ** Significant at 1% level
* Significant at 5% level

Table 3. Correlation and multiple linear regression between abiotic and biotic factors and population of *A. biguttula biguttula* on sunflower during *rabi*, 2007-08

Abiotic and biotic factors (Weather parameters and natural enemies)	Correlation coefficient (r)	Partial regression coefficient	Standard error	t - value
X_1 – Maximum temperature (°C)	-0.4661 NS	0.1065	0.1835	0.5806 NS
X_2 – Minimum temperature (°C)	-0.1238 NS	0.1281	0.1649	0.7768 NS
X_3 – Morning relative humidity (%)	0.7868**	0.1216	0.0716	1.6989 NS
X_4 – Evening relative humidity (%)	0.2462 NS	0.1059	0.0391	2.7056*
X_5 – Rainfall (mm)	0.2018 NS	-0.1713	0.0778	2.2013 NS
X_6 - Coccinellids	0.9250**	5.1528	1.3260	3.8859**
X_7 - Spiders	0.8799**	-0.7168	1.5929	0.4499 NS

NS: Non-significant Intercept: -23.6040 R^2 value: 0.9654 ** Significant at 1% level
* Significant at 5% level

This may be due to variation in time of sowing and cropping season. The results are also in accordance with observations of Chalapathi rao *et al.* (2000) and Ghorpade and Thakur (1995) who reported that the minimum temperature was positively correlated with the incidence of *S. litura*. The present results of sucking pests are in agreement with the findings of DOR (2002), DOR (2003) and DOR (2004).

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Table 4. Correlation and multiple linear regression between abiotic and biotic factors and population of *B. tabaci* on sunflower during *rabi*, 2007-08

Abiotic and biotic factors (Weather parameters and natural enemies)	Correlation coefficient (r)	Partial regression coefficient	Standard error	t - value
X_1 – Maximum temperature (°C)	-0.4429 NS	0.1413	0.5611	0.2518 NS
X_2 – Minimum temperature (°C)	-0.1898 NS	-0.6136	0.5042	1.2169 NS
X_3 – Morning relative humidity (%)	0.7001**	-0.1083	0.2188	0.4949 NS
X_4 – Evening relative humidity (%)	0.2348 NS	0.2652	0.1196	2.2162 NS
X_5 – Rainfall (mm)	0.2531 NS	0.0308	0.2379	0.1297 NS
X_6 - Coccinellids	0.8987**	6.2982	0.0538	1.5536 NS
X_7 - Spiders	0.8567**	3.6507	4.8698	0.7496 NS

NS: Non-significant Intercept: -0.9056 R^2 value: 0.9041 ** Significant at 1% level * Significant at 5% level

Table 5. Correlation and multiple linear regression between abiotic and biotic factors and population of *A. craccivora* on sunflower during *rabi*, 2007-08

Abiotic and biotic factors (Weather parameters and natural enemies)	Correlation coefficient (r)	Partial regression coefficient	Standard error	t - value
X_1 – Maximum temperature (°C)	-0.4155 NS	-0.0137	0.2981	0.0461 NS
X_2 – Minimum temperature (°C)	-0.3167 NS	-0.2987	0.2678	1.1153 NS
X_3 – Morning relative humidity (%)	0.7829**	0.1268	0.1162	1.0911 NS
X_4 – Evening relative humidity (%)	0.0822 NS	0.2177	0.0635	3.4247*
X_5 – Rainfall (mm)	0.1379 NS	-0.2840	0.1264	2.2468 NS
X_6 - Coccinellids	0.9786**	16.6236	2.1536	7.7189**
X_7 - Spiders	0.8907**	-3.6494	2.5871	1.4106 NS

NS: Non-significant Intercept: -19.1980 R^2 value: 0.9889 ** Significant at 1% level * Significant at 5% level

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