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Influence of Abiotic Factors on Incidence of Major Insect Pests in Sesame (*Sesamum indicum* L.)

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ABSTRACT

Experimental trial was conducted during late *kharif* 2018 and 2019 to study the influence and their correlation of abiotic factors on incidence of major insect pests in sesame crop.The pooled seasonal incidence data pertaining to *Antigastra catalaunalis* larvae per plant during late *kharif* 2018 and 2019 revealed that, the initial incidence commenced from 2nd week of September (37th standard week) with 0.07 larvae per plant and its peak was observed (1.03 larvae per plant) during 3rd week of October (42nd standard week). The per cent flower infestation data pertaining to *Asphondylia sesami* revealed that, the infestation was started on 2nd week of October (41st standard week) with 5.43% flower infestation when the flowering was started on the crop. The peak infestation with a mean of 10.87% was observed on 3rd week October (42nd standard week) and recorded minimum infestation of 4.19% on 4th week of October (43rd standard week) coincided with capsule formation stage. The correlation between larval population of *A. catalaunalis* with preceding one week weather parameters (one week lag) showed a positive and significant correlation with morning relative humidity (0.542*). Multiple regression analysis shows all weather parameters collectively influenced the *A. catalaunalis* larval population to the extent of 70% and *A. sesami* flower infestation to the extent of 51% on sesame.

Keywords Abotic factors, Incidence, Correlation, *A. sesami*, *A. catalaunalis.*

INTRODUCTION

Sesame, *Sesamum indicum* (L.) is the oldest oilseed crop of the world cultivated throughout India and considered as 'Queen of oilseeds' because of its superior oil quality. In India, it is grown in the entire crop growing season's viz., *kharif*, late *kharif*, *rabi* and summer seasons. Seeds of sesame contain 38-54% oil content and 18-25% protein. It is grown in India with an area of 16.22 lakh ha, 6.57 lakh tonnes production and 405 kg ha^{-1} productivity. In Telangana sesame occupies an area of 21,000 ha with production and productivity of 0.14 lakh tonnes and 636 kg ha^{-1}, respectively (INDIASTAT 2020). Sesame yield is

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relatively low in India, and it is partly due to insect pests and diseases. In India, it is grown in many states (Sheeba and Indiragandhi 2020), and its oil has medicinal value (Gnanasekaran *et al.* 2010). This crop is attacked by 67 insect pests at different stages of its plant growth. Out of these, *A. catalaunalis* and *A. sesami* are regularly causing damage to sesame crop (Biswas and Das 2011, Thangjam and Vastrad 2015). Leaf webber and capsule borer (*A. catalaunalis*) is an important pest because and this pest is active in the sesame field from the seedling stages up to the harvest of the crop (Thakur and Ghorpade 2006). It feeds on tender foliage by webbing the top leaves, feeds on flowers and bores into the pods (Narayanan and Nadarajan 2005). This insect pest causes 10-70% infestation on leaves, 34-62% on flowers and 10-44% infestation on pods resulting about 72% loss in yield (Ahirwar *et al.* 2010). Another serious pest of sesame is *A. sesami* Felt, commonly known as sesame gall fly and is widely distributed in South part of country. Maggots cause damage and feed inside the floral bud leading to formation of gall like structure and the damaged flower does not produce capsule. The infestation by *A. sesami* was recorded as 99.23% of the plants from the plains of West Bengal and estimated loss in the yield was 31.28% (Sengupta *et al.* 2002). As the sesame cultivation area increases in Telangana, it was exposed to varied environmental conditions. Information on the seasonal incidence of insect pests and its relation to weather parameters on sesame crop, particularly in this agro-climatic situation is scanty. Keeping these facts in view, present study on incidence of major insect pests was undertaken.

MATERIALS AND METHODS

The experiment was conducted for two consecutive late *kharif* seasons of 2018 and 2019 at Regional Agricultural Research Station, Polasa, Jagtial (18°15'15.8'' N, 78°58'51.6'' E) with swetha til variety. Sesame sowing was taken up in 500 m^2 plot during last week of August on 30.08.2018 and 28.08.2019 during respective years at a spacing of 30 X 15 cm and followed all agronomic practices for raising the sesame crop without any spraying of plant protection chemicals. The pest population was recorded in this unprotected plot of sesame at 7 days interval from the occurrence or initiation of the pest infestation and continued to maturity. A total of 10 plants from five random locations in the experimental plot were observed for incidence of leaf webber and capsule borer and gall fly. Data on leafwebber and capsule borer larval population was recorded and mean pest population per plant was computed. For gall fly, based on healthy and gall affected flowers the percent infestation was calculated.

$$\text{Per cent flower infestation} = \frac{\text{Number of infested flowers}}{\text{Total number of flowers}} \times 100$$

In addition, weather data were recorded simultaneously from the meteorological observatory available at Regional Agricultural Research Station, Polasa, Jagtial and correlated with the occurrence of the insect pests of sesame. Among weather parameters, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall of preceding one week were considered for correlating with the occurrence of the insect pests of sesame. To work out the relationship between the occurrence of the insect pests of sesame and the weather parameters, correlation and multiple linear regressions (MLR) methods were adopted.

$$r = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (\sum x)^2} \times N\sum y^2 - (\sum y)^2}$$

Where,
r = Simple correlation coefficient
x = Independent variables, i.e. abiotic components
y = Dependent variables, i.e. pests
N = Number of observations

RESULTS AND DISCUSSION

During late *kharif* 2018, the initial incidence of *A. catalaunalis* larvae was observed on second week after sowing (37th standard week) with mean population of 0.06 larvae per plant (Table1) and pest population reached to peak by 42nd standard week with a mean population of 1.10 larvae per plant (Fig. 1). Thereafter the pest population was declined gradually and reached to 0.10 larvae per plant on 46th standard week.

Table 1. Seasonal incidence of *A. catalaunalis* on sesame in relation to abiotic factors during late *kharif* 2018 and 2019.

2018 and 2019	Standard week	No. of leaf webber larvae/plant		
		Late *kharif* 2018	Late *kharif* 2019	Pooled (late *kharif* 2018 and 2019)
3-9 Sep	36	0.00	0.00	0.00
10-16 Sep	37	0.06	0.08	0.07
17-23 Sep	38	0.04	0.16	0.10
24-30 Sep	39	0.02	0.08	0.05
1-7 Oct	40	0.42	0.32	0.37
8-14 Oct	41	0.82	0.76	0.79
15-21 Oct	42	1.10	0.96	1.03
22-28 Oct	43	1.02	0.50	0.76
29 Oct-4 Nov	44	0.46	0.48	0.47
5-11 Nov	45	0.24	0.16	0.20
12- 18 Nov	46	0.10	0.08	0.09
19-25 Nov	47	0.00	0.00	0.00

During late *kharif* 2019, the incidence of *A. catalaunalis* was observed on 37th standard week with a mean population of 0.08 *A. catalaunalis* larvae per plant and population reached to peak by 42nd standard week with mean of 0.96 larvae per plant. Thereafter the pest population has declined gradually and reached to 0.08 larvae per plant on 46th standard week. The pooled data pertaining to *A. catalaunalis* seasonal incidence revealed that, the initial incidence commenced from 2nd week of September (37th standard week) with 0.07 larvae per plant (Table 1). Later, *A. catalaunalis* reached its peak (1.03 larvae per plant) during 3rd week of October (42nd standard week). Thereafter the pest population has declined gradually and reached to 0.09 per plant on 2nd week of November (46th standard week). The *A. catalaunali*s was active in the sesame field from the seedling stage to harvest of the crop (Thakur and Ghorpade 2006). The peak incidence of *A. catalaunalis* was observed on 3rd week of October (Chetan *et al.* 2016). The present findings were in accordance with Ramoliya Amith (2014) who opined that peak activity of *A. catalaunalis* was observed on 8th week after sowing of sesame crop where crop is at maximum flowering to capsule formation stage.

The correlation studies between the seasonal incidence of *A. catalaunalis* larval population with the preceding one week weather parameters (one week lag) during late *kharif* 2018 revealed that, maximum temperature (0.466), minimum temperature (0.083) and evening relative humidity (0.230) showed positive and non significant correlation and morning relative humidity (0.536*) showed positive and significant correlation (Table 2). Whereas, sunshine hours (-0.033) and rainfall (-0.352) were negatively non significant correlation. During late *kharif* 2019, maximum temperature (0.438), minimum temperature (0.001), morning relative humidity (0.474) and rainfall (0.011) shown positive and non significant correlation. Whereas the evening relative humidity (-0.151) and sunshine hours (-0.015) showed negative and non significant correlation. The correlation coefficients between pooled larval population of *A. catalaunalis* with preceding one week weather parameters (one week lag), results revealed that, a positive and significant correlation was recorded with morning relative humidity (0.542*). A positive and non significant correlation with maximum temperature (0.393), minimum temperature (0.155) and evening relative humidity (0.256) and non significant negative correlation with sunshine hours (-0.062) and rainfall (-0.039). The results of the present study were in agreement with Yalwar *et al.* (2020) who reported that *A. catalaunalis* larval population showed non-significant positive correlation with morning and evening relative humidity and non significant negative correlation with rainfall. The present results were also in conformity with Kumar *et al.* (2010) who

Table 2. Correlation coefficients between *A. catalaunalis* larval population and weather parameters (one week lag) in sesame during late *kharif* 2018 and 2019.

Weather parameters	Correlation coefficients (r)		
	Late *kharif* 2018	Late *kharif* 2019	Pooled (late *kharif* 2018 and 2019)
Maximum temperature (°C)	0.466	0.438	0.393
Minimum temperature (°C)	0.083	0.001	0.155
Moring relative humidity (RH I)	0.536*	0.474	0.542*
Evening relative humidity (RH II)	0.23	-0.151	0.256
Sunshine hours (h)	-0.033	-0.015	-0.062
Rainfall (mm)	-0.352	0.011	-0.039

*Significant at 5% level.

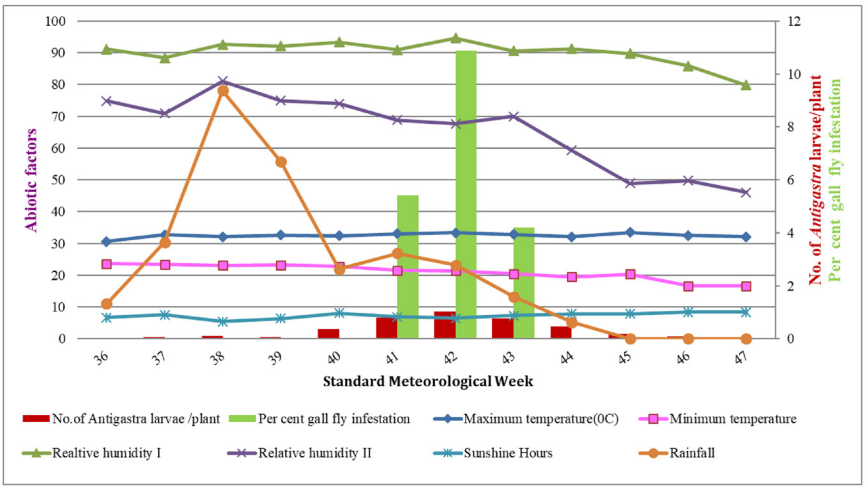

Fig. 1. Pooled seasonal incidence of major insect pests on sesame in relation to abiotic factors during late *kharif* 2018 and 2019.

reported that *A. catalaunalis* larval population shows a non significant positive correlation with maximum and minimum temperatures.

Regression analysis revealed that, all weather parameters collectively influenced the *A. catalaunalis* larval population to the extent of 70% (R_2 =0.70%). Multiple regression equation was developed for *A. catalaunalis* larval population with preceding one week weather parameters (one week lag) indicated that increase in one unit of maximum temperature, morning relative, evening relative humidity and sunshine hours resulted in the increase of *A. catalaunalis* larval population by 0.321, 0.056, 0.043 and 0.056 units respectively. Further, with one unit increase in, minimum temperature and rainfall the *A. catalaunalis* larval population was decreased by 0.069 and 0.010 units, respectively.

$$Y = - 16.780 + 0.321\ X1 - 0.069\ X2 + 0.056\ X3 + 0.043\ X4 + 0.056X5 - 0.010\ X6\ (R^2 = 0.70)$$

Table 3. Seasonal incidence of *A. sesami* on sesame in relation to abiotic factors during late *kharif* 2018 and 2019.

2018 and 2019	Stan-dard week	Per cent flower infestation of gall fly		
		Late *kharif* 2018	Late *kharif* 2019	Pooled (late *kharif* 2018 and 2019)
3-9 Sep	36	0.00	0.00	0.00
10-16 Sep	37	0.00	0.00	0.00
17-23 Sep	38	0.00	0.00	0.00
24-30 Sep	39	0.00	0.00	0.00
1-7 Oct	40	0.00	0.00	0.00
8-14 Oct	41	4.88	5.97	5.43
15-21 Oct	42	10.31	11.43	10.87
22-28 Oct	43	3.82	4.55	4.19
29Oct-4 Nov	44	0.00	0.00	0.00
5-11 Nov	45	0.00	0.00	0.00
12- 18 Nov	46	0.00	0.00	0.00
19-25 Nov	47	0.00	0.00	0.00

During late *kharif* 2018, the gall fly flower infestation on sesame was noticed from 2nd week of October (41st standard week) with 4.88% flower infestation and reached peak with 10.31% during 3rd week of October (42nd standard week) (Table 3). During 4th week of October (43rd standard week) the per cent flower infestation of *A. sesami* declined to a minimum of 3.82% (Fig. 1). During late *kharif* 2019 same trend was noticed as late *kharif* 2018. The flower infestation of gall fly on sesame was observed on sesame during flowering stage of the crop and initial infestation was observed on 2nd week of October (41st standard week) with 5.97%. The peak infestation was observed on 3rd week of October (42nd standard week) with per cent infestation of 11.43 and during 4th week of October (43rd standard week) the per cent flower infestation of *A. sesami* declined to minimum of 4.55%. The pooled data on infestation

Table 4. Correlation coefficients between gall fly *A. sesami* infestation and weather parameters (one week lag) in sesame during late *kharif* 2018 and 2019.

Weather parameters	Correlation coefficients (r)		
	Late *kharif* 2018	Late *kharif* 2019	Pooled (late *kharif* 2018 and 2019)
Maximum temperature (°C)	0.357	0.367	0.297
Minimum temperature (°C)	0.082	0.029	0.098
Moring relative humidity (RH I)	0.268	0.233	0.324
Evening relative humidity (RH II)	0.162	0.001	0.146
Sunshine hours (hr)	-0.171	-0.226	-0.029
Rainfall (mm)	0.224	0.082	0.016

of to *A. sesame* revealed that, the infestation has started on 2nd week of October (41st standard week) with 5.43% infestation when the flowering has started and the peak infestation with a mean of 10.87% has observed on 3rd week October (42nd standard week) and recorded minimum infestation of 4.19% on 4th week of October (43rd standard week) and it coincided with capsule formation stage. The results of present study were in accordance Kumar *et al.* (2010) who reported that sesame gall fly active from flowering to capsule formation stage.

The correlation studies between the per cent flower infestation of *A. sesami* with the preceding one week weather parameters (one week lag) during late *kharif* 2018 revealed that, maximum temperature (0.357), minimum temperature (0.082), morning relative humidity (0.268), evening relative humidity (0.162) and rainfall (0.224) had non significant positive correlation. The sunshine hours (-0.171) had negative and non significant correlation (Table 4). During late *kharif* 2019, the maximum temperature (0.367), minimum temperature (0.029), morning relative humidity (0.233), evening relative humidity (0.001) and rainfall (0.082) had non significant positive correlation, respectively with the per cent flower infestation of *A. sesami*. The only one weather parameter sunshine hours (-0.226) shows non significant negative correlation. The pooled results revealed that, a positive and non significant correlation with maximum temperature (0.297), minimum temperature (0.098), morning relative humidity (0.324), evening relative humidity (0.146) and rainfall (0.016) and non significant negative correlation with sunshine hours (-0.029). The results of present study were in agreement with Ramoliya Amit (2014) and Kumar *et al.* (2010) who reported that infestation of gall fly was positive correlation with minimum temperature.

Regression analysis revealed that, all weather parameters collectively influenced the per cent flower infestation of *A. sesami* to the extent of 51% (R^2 =0.51) on sesame. The multiple regression equation was developed for per cent flower infestation of *A. sesami* with preceding one week weather parameters (one week lag) which indicated that increase in one unit of maximum temperature, morning relative humidity, evening relative humidity and sunshine hours resulted in the increase of per cent flower infestation of *A. sesami* by 2.360, 0.273, 0.280 and 0.239 units respectively. Further, with one unit increase in, minimum temperature and rainfall the per cent flower infestation of *A. sesami* was decreased by 0.357and 0.070 units, respectively in sesame.

$$Y = - 110.984 + 2.360\ X1 – 0.357\ X2 + 0.273\ X3 + 0.280\ X4 + 0.239X5 – 0.070\ X6\ (R^2 = 0.51)$$

REFERENCES

Ahirwar RM, Gupta MP, Smita B (2010) Bioecology of leaf roller/ capsule borer, *Antigastra catalaunalis* (Dupochel). *Advances of Bioresearch* 1 (2): 90-104.

Biswas GC, Das GP (2011) Insect and mite pests' diversity in the oilseed crops ecosystems in Bangladesh. *Bangladesh Journal of Zoology* 39 (2): 235-244.

Chetan MB, Pandey AK, Moni Thomas (2016) Studies on succession and population dynamics of major insect pests of sesame. *Progressive Research - An International Journal* 11 (8): 5249-5251.

Gnanasekaran M, Jebaraj S, Gunasekaran M, Muthuramu S (2010) Breeding for seed yield and shoot webber (*Antigastra catalaunalis* D.) resistance in sesame (*Sesamum indicum* L.). *Electronic Journal of Plant Breeding* 1 (4): 1270-1275. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=0ee599291aa64a52c7e39ccd3dacaed887748e1f

INIDIASTAT(2020) Crop Statistics. India´s comprehensive statistical analysis. http://www.indiastat.com/. Accessed on 19th December 2021.

Kumar R, Ali S, Chandra U (2010) Population dynamics of flower feeders in sesame and correlation with abiotic factors. *Annals of Plant Protection Sciences* 18 (1): 70-76. https://www.indianjournals.com/ijor.aspx?target=ijor:apps&vol

ume=18&issue=1&article=017

Narayanan US, Nadarajan L (2005) Evidence for a male- produced sex pheromone in sesame leaf webber, *Antigastra catalaunalis* (Duponchel) (Pyraustidae: Lepidoptera). *Journal of Current Science* 88(4): 631-634. https://www.currentscience.ac.in/Volumes/88/04/0631.pdf

Ramoliya Amit G (2014) Seasonal incidence, varietal screening and chemical control of pest complex of sesamum in summer season. MSC thesis. submitted to Junagadh Agricultural University, Gujarat.

Sengupta S, Datta AK, Chakrabarti S (2002) A report on *Asphondylia sesame* Felt. Induced galls in sesame (*Sesamum indicum* L.) from West Bengal plain. *Journal of Phytological Research* 15 (1): 101-102.

Sheeba JR, Indiragandhi P (2020) Diversified cropping system for managing major insect pests in sesame. *Journal of Pharmacognosy and Phytochemistry* 9 (2): 227-231. https://www.phytojournal.com/archives/2020/vol9issue2S/PartE/S-9-2-57-469.pdf

Thakur SG, Ghorpade SA (2006) Sesame leaf webber and capsule borer, *Antigastra catalaunalis* Dup. *Jornal of Maharashtra Agricultural University* 31 (3): 300-307.

Thangjam R, Vastrad AS (2015) Evaluation of insecticides for the management of sesame phyllody vector, *O. albicinctus* Distant. *Indian Journal of Entomology* 77(3): 230-234. https://www.researchgate.net/publication/283663333.pdf

Yalawar Rakesh, Acharya VS, Renuka Hiremath (2020) Bio efficacy of different insecticides against leaf webber and capsule borer, *Antigastra catalaunalis* (Dup.) on sesame. *Journal of Pharmacognosy and Phytochemistry* 9(5): 90-93. https://www.phytojournal.com/archives/2020/vol9issue5/PartB/9-4-349-359.pdf