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Seasonal Incidence of Insect-pests Complex of Sesame (*Sesamum indicum* L.)

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A B S T R A C T

During the investigation sucking pest viz; white fly and jassid were appeared in 33 standard meteorological week and maximum population of whitefly (0.60 per plant) and jassid (0.40 per plant) was recorded in 37th SMW. Correlation with sucking pest (whitefly and jassid) population and meteorological parameters was found positive non significant association with evening relative humidity and minimum temperature but negative correlation with maximum temperature, morning relative humidity and rainfall. The highest capsule borer population (45.33 /plant) was noticed in 37th SMW and maximum damaged capsule (67.69%) was observed in the 40th standard week. Correlation of capsule borer population exhibited non-significant and positive with relative humidity evening and temperature minimum, while, it was found negative with maximum temperature, morning relative humidity and rainy days. Til Hawk moth appeared in the 34th standard week and continued till the harvesting. The maximum til hawk moth (0.38 larvae per plant) was recorded at 36th SMW. Til hawk moth population was positively associated with rainy days, relative evening humidity, morning relative humidity and temperature minimum. However, it exhibited negative association with temperature maximum. The Gall fly was appeared on sesame in the 37th standard week and remained active on the crop up to 45th standard week. Maximum population was found in 40th standard weeks. However, the highest damaged capsule (59.31%) was observed in the 43th standard week.

Introduction

Sesame (*Sesamum indicum* L.) popularly known as til is one of the important edible oil seed crop in India. India ranks first in the area and production of sesame. Sesame is an important oil crop because of great stability, resistance to drought and easiness of its extraction. With an estimated production of 1, 24,383 MT, Madhya Pradesh had a share of 29.7% in the national production which was followed by Gujarat (78,959 MT) with a share of 18.9%, Rajasthan (73,548 MT) with a share of 17.6% and Uttar Pradesh (56187 MT) with a share of 13.4%. These four states collectively shared 79.7% of the national production.

Madhya Pradesh ranks third in production as well as area. The average productivity of sesame in Madhya Pradesh is 319 kg/ ha. Nearly 78 percent of the sesame seed produced in India is used for oil extraction, 2.5 percent for planting purposes and the rest in used in confectionaries and in religious Hindu ceremonies. Nearly 73 percent of the oil is used for edible purpose, 8.3 percent of hydrogenation, and 4.2 percent for industrial purposes in the manufacture of paints, pharmaceuticals and insecticides. Its seeds contain 50 to 54% oil of high quality and protein 18 to 20% (Deshmukh and Raghuvanshi, 2008).

Although, it is a short duration crop but is known to suffer from severe insect pests infestation. Among 67 insect pests damaging sesame crop insect pest's *viz*. leaf roller/ capsule borer, *Antigastra catalaunalis* (Duponchel). Til hawk moth *Acherontia styx*, Jassid *Orocious albicinctus* (Distance), Bihar hairy caterpillar *Spilosoma oblique* (Walker), Whitefly *Bemisia tabaci* (Genadius) and Mirid bug *Crytopeltis tenuis* (Reuter), are considered to be key pests of regular occurrence (Ahirwar *et al.*, 2009). Among these, Til capsule borer (*Antigastra catalaunalis* Dup.) is the most serious pest causing yield losses up to 90% (Ahuja and Bakhetia 1995). Til hawk moth, *Acherontia styx* Westwood is a sporadic pest but voracious feeder of sesame crop at larval stage.

The larvae feed voraciously on leaves and defoliate the plants and is capable of inflicting heavy damage at times. Only one larvae is enough to denude the whole plant. Leaf roller/ capsule borer, *Antigastra catalaunalis* Dup. is a major and serious pest of sesame crop damaging the crop from seedling to flower and capsule stages causing 20 to 50 percent yield losses. Information on the pattern of insect pest complex and their succession on crop is of immense importance for evolving pest management practices which are ecologically sound and economically feasible. Besides, it is also important to understand the existing relationship between the incidence of pest population and abiotic factors of environment. These would permit an ecological manoeuvring, by bringing about changes in the cropping system having relevant intact on pest damage.

Materials and Methods

The present studies were conducted during the *Kharif* season 2018 in the experimental field of Department of Entomology, College of Agriculture, Gwalior. The experimental area is having uniform topography, gentle slope and adequate drainage (Table 1).

Details of the experiment

Crop	: Sesame
Variety	: SCS-551
Plot size	: 3 × 5 m^2
Row to Row distance	: 30 cm
Plant to plant distance	: 10 cm
Sowing date	: 08-08-2018

Observation to be recorded

To study the seasonal incidence of insect-pests, the crop was kept free from insecticide application. Weekly observations on different insect pests were recorded on 10 randomly selected plants starting from germination till their maturity of the crop.

For whitefly and jassid: The populations of Whitefly and Jassid was counted on upper, middle and lower leaves of the plant.

For til leaf roller/ capsule borer: Number of webbed leaf per ten plants was counted for leaf roller and 50 capsule randomly selected from each plot was observed and damaged

capsule was counted from there randomly selected plant.

For Til hawk moth: number of larvae was recorded by counting of larvae/plant on ten randomly selected plants.

For Gall fly: Number of webbed leaf per ten plant was counted for leaf roller and 50 capsule randomly selected from each plot was observed and damaged capsule was counted from there randomly selected plant.

For Mirid bug: observations was recorded on 10 plants randomly selected on shoot tip.

Statistical analysis

The data were subjected to statistical analysis after transformation. The count data were transformed to √x values, while percentages were transformed to √x whose values ranges from 0 to 30 and 70 to 100 and into angular whose values ranges from 0 to 100.

Analysis of correlation and regression studies

Correlation and regression of the abiotic factors on major insects were worked out by using the formula as suggested by Scnedecor and Cochran (1967).

$$\text{Correlation 'r'} = \frac{\sum xy - \frac{\sum x . \sum y}{n}}{\sqrt{\left\{\sum x^2 - \frac{\left((\sum x)^2\right)}{n}\right\}\left\{\sum y^2 - \frac{((\sum y)^2}{n}\right\}}}$$

Regression = a + bx (R2)

a = Intercept.
b = Regression coefficient.
R2 = Coefficient of multiple determination.
Test of significance 'r'

$$t = \frac{r}{\sqrt{1-r^2}}\sqrt{n-2}$$

Weather factors and the data collected on the succession & population dynamics of major insect pest of sesame was statistically analyzed to study the correlation and regression between meteorological data and insect pest population on sesame.

Results and Discussion

The results of present investigations were under taken in Kharif 2018-19 on the incidence of major insect-pests of sesame (*Sesamum indicum* L.). The results obtained are given below:

Whitefly (*Bemisia tabaci* Genn.)

Whitefly was observed to suck the cell-sap from the lower surface of leaves and spread leaf curl diseases virus. The activity of the whitefly was observed from 33rd standard week upto 45th standard week. During the activity period the population of whitefly ranged from 0.03 to 0.60 whitefly/ plant (Table 3).

Correlation coefficient among whitefly population and meteorological parameters revealed that the whitefly population was positively but not significantly associated with evening relative humidity (0.217) and minimum temperature (0.163). However, it exhibited negative correlation with maximum temperature (-0.076) and morning relative humidity (-0.225) and rainfall (-0.162) (Table 2). Present findings are in accordance with those of Laurentin *et al.,* (2003), Berlinger *et al.,* (1983) and Kumar *et al.,* (2010a)

Jassids (*Amrasca devastans* Ishida)

Jassid was another major pest of sesame crops and it appeared on 33rd August 2018. Jassid

population was highest in the 10th to 16th September 2018. During this period temperature maximum and minimum ranged from 28.9 to 36.7°C and 10.6 to 27.7°C, respectively. Relative humidity (morning and evening) was also high as it ranged from 37.1 to 92.9% and 27.5 to 81.4% and occasional rains was also observed in SMW 35 (Table 3). The damage was caused by both nymphs and adults that suck plant sap from the lower surface of leaves causing curling of leaves and leading to stunted growth of the plants. They excrete honey dew on the leaves on which the black sooty moulds grow which adversely affects photosynthesis.Present observations were more or less similar with the results of earlier workers Kumar et al, 2010c reported that the *A. devastans* appeared in the 1st week of January.

Table.1 Meteorological data during the crop season of 2018

Standard Week no.	Week	Temperature °C		Relative Humidity (%)		Rainfall (mm)
		Max	Min	Morning	Evening	
32	Aug. 6-12	33.5	26.5	87.1	62.3	013.0
33	Aug. 13-19	33.8	26.3	91.0	65.4	064.8
34	Aug. 20-26	31.6	25.7	90.7	78.6	082.0
35	Aug.-Sep. 27-2	30.5	25.0	92.9	73.7	084.4
36	Sep. 3-9	28.9	23.8	91.4	81.4	050.0
37	Sep. 10-16	31.8	24.6	79.9	67.4	000.0
38	Sep. 17-23	33.3	23.8	83.0	66.8	032.0
39	Sep. 24-30	33.8	27.7	80.1	56.8	000.0
40	Oct. 1-7	36.7	18.5	63.6	44.1	000.0
41	Oct. 8-14	35.4	18.7	81.5	38.5	000.0
42	Oct. 15-21	36.5	17.4	76.8	27.5	000.0
43	Oct. 22-28	34.5	14.9	80.7	28.7	000.0
44	Oct.-Nov.29-4	33.3	14.4	82.1	28.2	000.0
45	Nov. 5-11	29.6	10.6	83.6	33.6	000.0
Average		**33.1**	**21.3**	**83.2**	**53.8**	**23.3**

Source: Meteorological observatory, College of Agriculture, Gwalior (M.P.)

Table.2 Correlation of insect population with meteorological parameter

Meteorological parameter	Whitefly	Jassid	Leaf roller/ capsule borer	Til Hawk moth	Gall fly	Mirid bug
Temp.(Max.)	-0.076^{NS}	-0.207^{NS}	-0.200^{NS}	-0.525*	-0.123^{NS}	**-0.185^{NS}**
Temp. (min.)	0.163^{NS}	0.277^{NS}	0.133^{NS}	0.351^{NS}	-0.031^{NS}	**0.264^{NS}**
RH (morn.)	-0.225^{NS}	-0.171^{NS}	-0.300^{NS}	0.212^{NS}	-0.348^{NS}	**-0.190^{NS}**
RH (even.)	0.217^{NS}	0.381^{NS}	0.202^{NS}	0.587*	0.089^{NS}	**0.355^{NS}**
Rainfall (mm)	**-0.162^{NS}**	**-0.085^{NS}**	**-0.276^{NS}**	**0.340^{NS}**	**-0.288^{NS}**	**-0.144^{NS}**

* Significant at 5% and 1%, NS – Non Significant

Table.3 Seasonal Incidence of Insect pest complex of sesame (Variety SCS-551) during the year 2018

Periodical weeks	Standard week no.	White Fly adult /plant	Jassids adult /plant	Leaf roller/ capsule borer		Til Hawk moth Larva e /10 plant	Gall Fly		Mirid bug / shoot tip/10 plant	Temperature (^{0}C)			Relative Humidity (%)		Rainfall (mm)
				population /10 plant /plot	% damage /50 capsule/ plot		Population /10 plant /plot	% damage /50 capsule/ plot		Max.	Min.	Avg. Temp.	Morning	Evening	
Aug. 6-12	**32**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.5	26.5	30.0	87.1	62.3	013.0
Aug. 13-19	**33**	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	33.8	26.3	30.1	91.0	65.4	064.8
Aug. 20-26	**34**	0.07	0.04	0.66	40.59	0.14	0.00	0.00	0.05	31.6	25.7	28.7	90.7	78.6	082.0
Aug.-Sep. 27-2	**35**	0.28	0.16	18.00	61.33	0.33	0.00	0.00	0.11	30.5	25.0	27.8	92.9	73.7	084.4
Sep. 3-9	**36**	0.41	0.37	32.66	63.79	0.38	0.00	0.00	0.36	28.9	23.8	26.4	91.4	81.4	050.0
Sep. 10-16	**37**	0.60	0.40	45.33	63.61	0.30	2.66	38.15	0.41	31.8	24.6	28.2	79.9	67.4	000.0
Sep. 17-23	**38**	0.55	0.33	24.33	58.02	0.22	3.33	49.52	0.34	33.3	23.8	28.6	83.0	66.8	032.0
Sep. 24-30	**39**	0.32	0.24	33.66	64.75	0.18	10.33	53.50	0.25	33.8	27.7	30.8	80.1	56.8	000.0
Oct. 1-7	**40**	0.25	0.20	24.33	67.69	0.13	20.66	55.00	0.19	36.7	18.5	27.6	63.6	44.1	000.0
Oct. 8-14	**41**	0.26	0.15	18.00	63.83	0.11	13.66	49.79	0.16	35.4	18.7	27.1	81.5	38.5	000.0
Oct. 15-21	**42**	0.29	0.12	11.66	59.31	0.09	13.00	39.10	0.11	36.5	17.4	27.0	76.8	27.5	000.0
Oct. 22-28	**43**	0.22	0.08	13.66	49.79	0.10	11.66	59.31	0.09	34.5	14.9	24.7	80.7	28.7	000.0
Oct.-Nov.29-4	**44**	0.15	0.07	13.00	39.10	0.08	10.33	40.50	0.08	33.3	14.4	23.9	82.1	28.2	000.0
Nov. 5-11	**45**	0.09	0.05	15.00	38.46	0.06	11.00	35.20	0.06	29.6	10.6	20.1	83.6	33.6	000.0

Correlation coefficient of jassids population exhibited non significant and positive with relative humidity evening (0.381) and temperature minimum (0.277), while negative association of this character was observed with temperature maximum (-0.207) and relative humidity of morning (-0.171) and rainfall (-0.085) (Table 2).

Leaf roller/ capsule borer (*Antigastra catalaunalis* Duponchel)

The studies on the seasonal incidence of leaf roller revealed that the pest was first recorded on sesame in the 34th standard week (20-26 August) and remained active on the crop upto 45th standard week (5-11November). During the activity period of the pest the population of leaf roller ranged from 0.66 to 45.33 leaf roller per plant. During the pest activity period the range of minimum and maximum temperature, morning and evening relative humidity and rainfall ranged from 28.9^{o}C to 36.7^{o}C, 10.6^{o}C to 27.7^{o}C, 37.1 to 92.9%, 27.5 to 81.4% and 000.0 to 084.4 mm, respectively.

The pest population was found highest in 37th standard weeks (10-16 September) when the average minimum and maximum temperature, morning and evening relative humidity and rainfall were 24.6^{o}C, 31.8^{o}C, 79.9%, 67.4% and 082.0 mm, respectively. The pest population started declining from 45th standard week onwards (5-11November) (Table 3).

As far as the capsule damaged of the capsule borer is concerned, the symptom of the damage by the pest appeared in second week of August when 38.10% damaged capsule was recorded. However, the highest damaged capsule (67.69%) was observed in the 40th standard week. When the average minimum and maximum temperature, morning and evening relative humidity and rainfall (24.6^{o}C and 31.8^{o}C, 79.9% and 67.4% and 000.0 mm) were the damaged capsule started declining from 45th standard week. Thus damaged capsule was observed more serious from August-November. Present findings are in accordance with those of Chaudhuri *et al.*, (2001), Reddy and Kumar (2004), Umesh and Onukwu (2005) and Mandal (2012).

Correlation coefficient of leaf roller/ capsule borer population exhibited non significant and positive with relative humidity evening (0.202) and temperature minimum (0.133), while, it was found negative with temperature maximum (-0.200) relative humidity morning (0.300) and rainy days (-0.276) (Table 2).

Til Hawk moth (*Acherontia styx* Westwood)

The Til Hawk moth appeared in the 37th standard week and continued till the harvesting. Increasing trend was observed in this case with crop growth stages. The maximum Til hawk moth larvae (0.38 larvae per plant) was recorded at 3-9 September 2018. When, the average maximum and minimum temperature was 28.9and 23.8^{0}C respectively with 91.4% and 81.4% morning and evening relative humidity and 050.0 rainfall (Table 3). Present findings are in accordance with those of Gravena (1999), Chaudhuri *et al.*, (2001), Asalatha (2002) and Reddy and Kumar (2004), Kharpuse (2005) revealed that the maximum (76.67 %) leaf infestation by *L. trifolii* was recorded at middle of the March.

Til hawk moth were positively associated with rainy days (0.340), relative humidity evening (0.587), relative humidity morning (0.212) and temperature minimum (0.351). However, it exhibited negative association with temperature maximum (-0.525) (Table 2).These findings are in agreement with that of Bagmare *et al.*, (1995), Asalatha (2002) and Kumar *et al.*, (2010c)

Gall fly (*Asphondylia sesame* Felt)

The studies on the seasonal incidence of gall fly revealed that the pest was first recorded on sesame in the 37th standard week (10-16 Sep.) and remained active on the crop upto 45th standard week (5-11November). During the activity period of the pest the population of gall fly ranged from 2.66 to 20.66 gall fly per plant. During the pest activity period the range of minimum and maximum temperature, morning and evening relative humidity and rainfall ranged from 10.6°C to 27.7°C, 28.9°C to 36.7°C, 37.1 to 92.9%, 27.5 to 81.4% and 000.0 to 084.4 mm, respectively. The pest population was found highest in 37th standard weeks (1-7 Oct.) when the average minimum and maximum temperature, morning and evening relative humidity and rainfall were 18.5°C, 36.7°C, 63.6%, 44.1% and 000.0 mm, respectively. The pest population started declining from 45th standard week onwards (5-11 November) (Table 3).

As far as the capsule damaged, by the gall fly is concerned, the symptom of the damage by the pest appeared in 37th standard week of August when 38.15% damaged capsule was recorded. However, the highest damaged capsule (59.31%) was observed in the 43rd standard week (22-28 October), when the average minimum and maximum temperature, morning and evening relative humidity and rainfall (14.9°C and 34.5°C, 80.7% and 28.7% and 000.0 mm) were the damaged capsule started declining from 45th standard weeks (5-11November). Thus damaged capsule was observed from August-October but more serious during August-November. Present findings are in accordance with those of Goncalves *et al.,* (2004).

Gall fly population had no significant and positive correlation with relative humidity evening (0.089) and it was negatively associated with temperature maximum (-0.123), temperature minimum (-0.031), rainy days (-0.288) and relative humidity morning (-0.348) (Table 2).

Mirid bug (*Nesidiocoris* sp.)

Mirid bug of this pest was observed, feeding on sesame fruits by making holes. The pest infestation commenced from 20 to 26 August 2018 and gradually increased till the crop maturity. Population peaked (0.36 bug/ plant) in the 3-9 September 2018, when the average maximum and minimum temperature was 28.9 and 23.8^{0}C,respectively with 91.4% and 81.4% morning and evening relative humidity and occasional rain was also observed (Table 3). Present findings are in accordance with those of Srinivasan (1993), Nair (1995), Gravena (1999), Rudednko *et al.,* (2001), Chaudhary *et al.,* (2001), Reddy and Kumar (2004) and Mandal (2012).

Mirid bug population expressed no significant and positive correlation with relative humidity evening (0.355) and other positive association *i.e*. temperature minimum (0.264). However, it was negative associated with and temperature maximum (-0.185), relative humidity morning (-0.190) and rainfall (-0.144) (Table 2). These findings are in agreement with that of Kakati *et al.,* (2005).

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