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SEASONAL INCIDENCE OF SUCKING PEST COMPLEX IN SESAME (*SESAMUM INDICUM* L.)

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ABSTRACT

The study recorded the incidence of thrips (*Thrips tabaci*), jassid (*Orosius albicinctus*), whitefly (*Bemisia tabaci*) and aphid (*Aphis gossypii*) at weekly intervals. Thrips appeared from the 10th Standard Meteorological Week (SMW), peaking at 6.82 per 3 leaves in the 13th SMW, showing a significant positive correlation with maximum temperature. Jassid incidence started in the 11th SMW, peaking at 6.10 per 3 leaves in the 15th SMW, with strong positive correlations to maximum and minimum temperatures. Whitefly incidence also started in the 10th SMW, peaking at 6.70 per 3 leaves in the 13th SMW, with a significant positive correlation to maximum temperature. Aphid population peaked at 2.44 per plant in the 15th SMW, showing a significant negative correlation with bright sunshine hours.

Keywords: Sesame, Seasonal incidence, Sucking pest, Thrips, Jassid, Whitefly, Aphid, Correlation, Temperature, Standard Meteorological Week

Introduction

Sesame (*Sesamum indicum* L.) is a significant and ancient oilseed crop widely grown in India, Burma, China, and Japan. It is also cultivated in the temperate and arid regions of Africa and the Mediterranean. Recently, sesame cultivation has gained increased attention in the U.S.A., Mexico, and several Latin American countries (Anon., 1995). India is a major producer of this crop, but its productivity (1182 kg/ha) is much lower compared to that of America (4118 kg/ha) and China (3674 kg/ha) (FAO, 2016). This productivity gap may be due to factors such as the unavailability of high-yielding varieties, cultivation on low-fertility soils, uneven rainfall distribution, monocropping without crop rotation, and other changing conditions. Among biotic stresses, sap-feeding insect pests play a crucial role in reducing yields (Dwivedi and Devi, 2018). Sesame is an important oilseed crop in India, following groundnut and rapeseed-mustard. It contains 46 to 54% oil and 12 to 20% protein. Approximately 78% of sesame seeds in India are used for oil extraction and 2.5% are reserved for seed purposes. The remaining seeds are utilized in confectionery and religious ceremonies. Around 73% of the extracted oil is used for edible purposes, 8.3% for hydrogenation and 4.2% for industrial applications, including the production of paints, pharmaceuticals, and insecticides (Joshi, 1961). Sesame is primarily grown in the states of Rajasthan, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka, Uttar Pradesh, West Bengal, Orissa and Punjab (Singhal, 2003). In India, Gujarat is the leading state contributing 22.3% of total production (Thangjam and Vastrad, 2018). The key sesame-producing districts include Amreli, Bhavnagar, Jamnagar, Rajkot, Kutch and Surendranagar in Gujarat. Due to its high profitability, sesame cultivation attracts farmers to expand its cultivation both within the state and across the country. Sesame production and productivity are significantly influenced by both biotic and abiotic factors. Among these, insect pests are a major constraint, impacting sesame production in terms of both quality and quantity (Ahirwar *et al.*, 2010). Pest infestations can lead to substantial seed yield losses, ranging from 25 to 90% (Ahuja and Kalyan, 2002). A significant constraint in sesame production is the damage caused by insect pests, especially sucking pests such as jassid (*Orosius albicinctus*), mirid bug (*Nesidiocoris tenuis*) and whitefly (*Bemisia tabaci*), which extract cell sap from leaves, flowers and pods (Ahirwar *et al*., 2010). Thrips and aphids also inflict severe damage on sesame during summer cultivation. The population of these sucking pests fluctuates considerably in natural environments, making the study of seasonal incidence crucial for understanding the relationship between weather factors and pest populations.

Materials and Methods

Thrips, leaf hopper /jassid and whitefly

The study on seasonal incidence was conducted during the summer of 2018, beginning on 21st February, at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. Sesame variety Gujarat Til - 3 was sown in a 20 m x 20 m plot with spacing of 30 cm × 10 cm to assess the population of thrips, jassid and whitefly. Recommended agronomical practices were followed for crop cultivation. The experimental plot was divided into twenty equal quadrants and the number of thrips, jassid, and whitefly was recorded from five randomly selected plants in each 1.5 × 1.5 m² quadrate. No insecticides were applied throughout the season. Observations were taken weekly, examining the upper, middle and lower leaves of each plant early in the morning, starting from the first week after germination and continuing until the crop was harvested.

Aphid

The seasonal incidence of aphid was observed during the summer of 2018, starting on February 21st, at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. Sesame variety Gujarat Til - 3 was cultivated in a plot measuring 20 m x 20 m, with a spacing of 30 cm x 10 cm, to assess the aphid population. All recommended agronomic practices were followed for crop cultivation. The experimental plot was divided into twenty equal quadrants and the aphid index was recorded from five randomly chosen plants in each 1.5 × 1.5 m² quadrate. No insecticides were applied throughout the season. Aphid population observations were based on the aphid index from five randomly selected plants, and the mean population was calculated accordingly.

Sampling technique for aphid index

Patel (1980) noted that aphids typically sit in an overlapping fashion, making it challenging to count them numerically. Therefore, the aphid index was visually determined using the following scoring system.

Aphid Index

0 Plant free from aphid.

1 Aphid present but colonies not built up. No injury due to pest appearance on the plant.

2 Small colonies of aphid are present on the leaves of the plant. Such leaves exhibit slight curling due to aphid feeding.

3 Large colonies of aphid present on leaves and other parts, damage symptoms visible due to aphid feeding.

4 Most of the leaves are covered with aphid colonies. Counts are not possible and the plant shows more damage symptoms due to aphid feeding.

5 The plant is completely covered with aphid colonies; plant growth is hindered due to pest feeding.

The average aphid index was worked out by using the following formula.

$$\text{Average Aphid Index} = \frac{0N + 1N + 2N + 3N + 4N + 5N}{\text{Total Numbers of Plant Observed}}$$

Where,

0, 1, 2, 3, 4 and 5 are the aphid index

N = Number plants showing respective aphid index

The observations began one week after germination and were conducted weekly until the crop was removed.

The data on the sucking pest population were correlated with various meteorological parameters recorded at the meteorological observatory of Agronomy, Instructional Farm, COA, JAU, Junagadh, following the standard procedure described by Steel and Torrie (1980).

Results and Discussion

Thrips (*Thrips tabaci*)

The data in Table 1 on thrips abundance indicated a variation ranging from 0.80 to 6.82 per three leaves between the 10th and 18th SMW. The peak thrips population (6.82 per three leaves) occurred during the 13th SMW, followed by 5.86 thrips per three leaves in the 14th SMW. Afterward, the population steadily declined until the 18th SMW. The lowest population

(0.80 per three leaves) was recorded during the 10th SMW. Syed *et al.* (2016) observed that the highest thrips population was also recorded during the 13th SMW. Kansagra (2018) noted that thrips incidence began in the 8th SMW and persisted until the 15th SMW, with a single peak of 4.99 thrips per leaf in the 12th SMW. In the current study, the highest thrips population (6.82 per three leaves) observed during the 13th SMW aligns closely with the findings of these researchers.

The study on the effect of various weather parameters on the fluctuation of thrips population in sesame during summer 2018 (Table 2) revealed a significant positive correlation between the pest population and maximum temperature (r = 0.681) and a non-significant positive correlation with minimum temperature (r = 0.219). Conversely, the pest population showed a non-significant negative correlation with bright sunshine hours (r = -0.448), evening relative humidity (r = -0.366), wind velocity (r = -0.290) and morning relative humidity (r = -0.253). Kalasariya (2010) observed a significant positive association between maximum temperature (r = 0.597*) and the thrips population, while Kansagra (2018) found that wind velocity, relative humidity and bright sunshine hours had a non-significant negative correlation with thrips.

Jassid (*Orosius albicinctus*)

The data in Table 1 on jassid abundance shows that it ranged from 0.44 to 6.08 per three leaves between the 11th and 18th SMW. The highest population (6.08 per three leaves) occurred during the 15th SMW, followed by 5.80 per three leaves in the 16th SMW. Afterward, the population declined steadily until the 18th SMW. The lowest population (0.44 per three leaves) was recorded during the 11th SMW, with no population observed during the 10th SMW. Ramoliya (2014) reported that the jassid, *O. albicinctus*, appeared in the 7th SMW at a low level of 0.20 per leaf, gradually increasing to a peak of 5.18 per leaf in the 14th SMW. Similarly, Dhangde (2017) found the peak population at 15th SMW with 15.3 jassid per three leaves. In the current study, the highest population (6.10 per three leaves) was observed during the 15th SMW, closely aligning with these findings.

A study on the effect of various weather parameters on the fluctuation of the jassid population in sesame during the summer of 2018 (Table 2) revealed a highly significant positive correlation between the pest population and maximum temperature (r = 0.812**). Additionally, jassids exhibited a significant positive correlation with minimum temperature (r = 0.669*). Morning relative humidity (r = 0.156) and wind velocity (r = 0.057) showed a non-significant positive correlation with the jassid population, while bright sunshine hours (r = -0.278) and evening relative humidity (r = -0.118) demonstrated a non-significant negative correlation. Ramoliya (2014) observed a significant positive correlation between jassids and minimum temperature. Similarly, Bondre (2014) reported a significant positive correlation between maximum temperature and the jassid population in sesame crops. Prajapat (2018) also found that the population of jassid, *O. albicinctus*, in sesame had a significant positive correlation with minimum temperature.

Whitefly (*Bemisia tabaci*)

The data presented in Table 1 on whitefly abundance shows a variation ranging from 0.88 to 6.70 per three leaves between the 10th and 18th standard meteorological weeks (SMW). The highest whitefly population (6.70 per three leaves) was recorded during the 13th SMW, followed by 5.82 per three leaves in the 14th SMW. Subsequently, the population slightly decreased to 4.56 per three leaves in the 15th SMW, followed by a slight increase to 5.18 per three leaves in the 16th SMW, and then continued to decline during the 17th and 18th SMW. The lowest population (0.88 per three leaves) was observed in the 10th SMW. Syed *et al.* (2016) reported the highest whitefly population during the 12th SMW, while Sharma *et al.* (2017) noted its first appearance during the 13th SMW, with a peak in the 21st SMW. Jha and Kumar (2018) found that whitefly population density peaked in mid-February, with the highest infestation levels maintained from mid-February to mid-March. In the present study, the highest whitefly population (6.70 per three leaves) was recorded during the 13th SMW.

The study on the effect of various weather parameters on whitefly population fluctuations on sesame during the summer of 2018 (Table 2) revealed a significant positive correlation between the whitefly population and maximum temperature (r = 0.676*). However, there was a non-significant positive correlation with minimum temperature (r = 0.196). Among the studied parameters, evening relative humidity (r = -0.497), wind velocity (r = -0.334), morning relative humidity (r = -0.331) and bright sunshine hours (r = -0.330) showed negative correlations with the whitefly population. Dhangde (2017) reported a highly significant positive correlation with maximum temperature (r = 0.826), while evening relative humidity was negatively correlated with the pest population. Ahirwar *et al.* (2010) found that the whitefly *B. tabaci* in sesame had a significant positive correlation with maximum temperature. Mishra *et al.* (2015) also revealed a significant positive correlation between whitefly population incidence and maximum temperature in the sesame crop. Sharma *et al.* (2017) observed a positive correlation between whitefly population and both maximum and minimum temperatures, whereas both maximum and minimum humidity showed a negative correlation with the whitefly population.

Aphid (*Aphis gossypii*)

The data in Table 1 on aphid abundance indicate that the aphid index ranged from 0.76 to 2.44 between the 11th and 18th SMW, with the highest index (2.44) occurring during the 15th SMW, followed by 2.18 in the 14th SMW. Afterward, the population steadily decreased until the 17th SMW, when the lowest index (0.58) was recorded. Hath and Das (2004) observed aphid populations in the field from the third week of February to the last week of March, with a peak in the first week of March. Mandloi *et al.* (2013) reported a peak aphid population in the 11th SMW (11.66 aphids/6 leaves), while Dhangde (2017) recorded the highest population (17.8 aphids/3 leaves) in the 16th SMW. In the current study, the peak aphid index (2.44) was observed during the 15th SMW, possibly due to variations in agro-climatic conditions and crop varieties.

The study on the impact of various weather parameters on the fluctuation of aphid populations on sesame during the summer of 2018 (Table 2) revealed a significant negative correlation between aphid numbers and bright sunshine hours (r = -0.714*). In contrast, aphids showed a non-significant positive correlation with maximum temperature (r = 0.399) and minimum temperature (r = 0.060). Wind velocity (r = -0.377), evening relative humidity (r = -0.325) and morning relative humidity (r = -0.131) exhibited non-significant negative correlations with the aphid population. Butani and Kapadia (2000) also found a significant negative correlation between bright sunshine hours and aphid populations. Kumar *et al.* (2000) reported that aphid populations had a positive correlation with temperature, while relative humidity and wind velocity had negative effects. Similarly, Jadhav *et al.* (2017) observed a non-significant positive correlation between maximum and minimum temperatures and aphid populations.

Conclusion

The populations of thrips, jassids, whiteflies and aphids were present throughout the crop season, with distinct peaks and declines in their numbers. Thrips peaked during the 13th SMW, jassids during the 15th SMW, whiteflies during the 13th SMW and aphids during the 15th SMW. Maximum temperature was a key factor influencing pest populations, showing a significant positive correlation with all four pests, particularly with jassids (r = 0.812**) and thrips (r = 0.681). Minimum temperature had a significant positive correlation with jassids and a non-significant positive correlation with the other sucking pests. Bright sunshine hours, evening and morning relative humidity and wind velocity generally exhibited non-significant negative correlations with all pests, suggesting a limited impact on their populations. Notably, aphids showed a significant negative correlation with bright sunshine hours (r = -0.714*), indicating that increased sunshine may help suppress their population. Overall, maximum temperature emerged as the most consistent factor of pest population dynamics, while other weather factors had varying and often non-significant effects.

Table 1: Population of sucking pest on sesame during summer 2018

Week after sowing	SMW	Month	Mean no. of insect /3 leaves			Aphid Index /Plant	Temp.		Relative Humidity		Wind Speed (km /hr)	Mean bright sunshine Hours
			Thrips	Jassid	Whitefly		Max.	Min.	RH_1	RH_2		
3	10	March	0.80	0.00	0.88	0.00	36.3	18.4	78	21	4.5	10.3
4	11		1.90	0.44	2.30	0.76	36.7	20.3	60	16	5.7	10.4
5	12		3.76	1.06	3.60	1.16	36.2	20.4	60	21	5.8	9.7
6	13		6.82	3.90	6.70	2.08	41.4	21.3	60	16	5.0	9.6
7	14	April	5.86	4.36	5.82	2.18	40.1	22.2	56	21	5.1	9.1
8	15		5.22	6.08	4.56	2.44	39.4	23.9	78	22	5.9	8.7
9	16		4.26	5.80	5.18	1.14	40.8	24.9	67	17	6.0	10.8
10	17		4.14	3.86	3.70	0.58	40.7	23.8	65	20	5.9	11.0
11	18	May	1.78	2.22	1.48	0.00	39.7	26.1	83	26	8.4	10.2

Table 2: Correlation between weather parameters and population of sucking pest on sesame during summer 2018.

Abiotic factors	Correlation co-efficient ('r')			
	Thrips	Jassid	Whitefly	Aphid
Maximum Temperature (°C)	0.681*	0.812**	0.676*	0.399
Minimum Temperature (°C)	0.219	0.669*	0.196	0.060
Morning Relative Humidity (%)	-0.253	0.156	-0.331	-0.131
Evening Relative Humidity (%)	-0.366	-0.118	-0.497	-0.325
Bright Sunshine Hours (hr /day)	-0.448	-0.278	-0.330	-0.714*
Wind Velocity (km /hr)	-0.290	0.057	-0.334	-0.377

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