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## Seasonal incidence of sucking insect pests of maize and their natural enemies

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### Abstract

The present investigation was carried out in randomized block design (RBD) during *Kharif* 2019 at research farm, College of Agriculture, Gwalior (M.P.). The population of leafhoppers increased gradually from the 31<sup>st</sup> to the 38<sup>th</sup> SMW, reaching its peak during the 38<sup>th</sup> SMW. Afterward, the population declined and eventually disappeared after the 43<sup>rd</sup> SMW in both years. The occurrence of aphids was first observed during the 35<sup>th</sup> SMW for both years. The population of this pest began to increase and reached its peak during the 39<sup>th</sup> SMW. However, minimum population was recorded during the 44<sup>th</sup> SMW in both the years. Sting bugs were first observed during the 33<sup>rd</sup> SMW when the crops were 30 days old and reached its peak during the 38<sup>th</sup> SMW in both years. However, starting from the 39<sup>th</sup> SMW, the population began to decline and reached its lowest point during the 40<sup>th</sup> SMW and 41<sup>st</sup> SMW respectively during both *Kharif* 2021 and 2022, after which this pest disappeared. First appearance of spiders in field was recorded during 34<sup>th</sup> SMW and reached to its peak during 38<sup>th</sup> SMW during both *Kharif* 2021 and *Kharif* 2022. Afterwards population gradually decreases and reached to its minimum during 44<sup>th</sup> SMW in both successive years Ladybird beetle first appeared during 35<sup>th</sup> SMW and the population of ladybird beetle and reached to its peaked during 39<sup>th</sup> SMW thereafter it started declining gradually. Minimum population recorded during 44<sup>th</sup> SMW in both *Kharif* 2021 and *Kharif* 2022.

**Keywords:** Leaf hopper, aphid, stink bug, natural enemies, pest, population, meteorological

### 1. Introduction

Maize is the third most important cereal crop in India after rice and wheat. It has dual importance as food and fodder in addition to industrial uses. In India, maize is cultivated to serve various purposes like human consumption, cattle and poultry feed, food processing and in the extraction of starch, dextrose, corn syrup, and corn oil. The leafy stem gives rise to ears that hold the grain, which are seeds known as kernels. In India, the average annual production of maize is 316.46 million tonnes and cultivated in 98.91 million ha of land, with average productivity of 3199 kg/ha (Anonymous, 2021) [2]. Among the maize growing states, Karnataka is the leading producer followed by Madhya Pradesh, Maharashtra, Tamil Nadu and West Bengal. In Madhya Pradesh, 14.05 million ha of the land area is under maize cultivation, which produces 38.81 million tonnes, and has a productivity of 2763 kg/ha (Anonymous, 2021) [2]. Insect pests are one of the key causes that affect maize yield, but there are many other ones as well. The insect pest complex of a specific crop varies from region to region and is dependent on the agro-climatic conditions of that location. Additionally, the status of insect pests of a specific crop has been changing as a result of climate change. Understanding the seasonal incidence of insect pests in maize crops is essential for implementing timely and targeted pest control measures. Monitoring pest populations throughout the growing season helps identify key periods of pest activity, enabling farmers to take preventive or curative actions at the most appropriate times. Studies on the ecology and dynamics of pest populations in maize are limited to the three main insect pests: *C. partellus*, *S. inferens*, and *Atherigona soccata*. Because of this, nothing is known about the seasonal occurrence and population dynamics of maize sucking insect pests such as leafhopper, *Cicadulina* sp., maize aphid, *R. maidis*, and stink bug, *Halyomorpha halys*. These insect pests may result in significant damage and yield losses as a result of the spread of maize cultivation into newer locations and changing climate situations. Studies of insect pests and their natural enemies of the maize crop provide a basic understanding of the seasonal prevalence of insect pests and their predators. The current analysis was conducted because it may be helpful to periodically examine insect pests and their natural enemies to understand the relative economic relevance of various pests to the crop. These factors were taken into consideration while the current study was conducted

with the goal of "Seasonal incidence of sucking insect pests of maize and their natural enemies".

## 2. Materials and Methods

A research experiment was conducted at the Research Farm, College of Agriculture, Gwalior (Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior) during two consecutive years i.e., *Kharif*, 2021-22 and *Kharif* 2022-23. To conduct comprehensive research on the major insect pests affecting Maize crops in the Gird region of Madhya Pradesh, a detailed investigation was carried out. In the experiment, variety "RHM 1899 Super" was sowed on 17<sup>th</sup> July 2021 and 17<sup>th</sup> July 2022 during both the consecutive years respectively, maintaining 60 cm plant to plant and 20 cm row to row distance. The size of each replicated plot was maintained as 10.0m x 9.0m. After sowing light irrigation was done for the setting of seed. Fertilizers were applied at the rate of 120 kg N, 60 kg P and 30 kg K per hectare. Observations were recorded on the incidence of all the insect pests on randomly selected 10 plants at weekly intervals starting from germination till harvest of the crop. The population of sucking pests *viz.*, aphid, leaf hopper and stink bug were recorded by visual observing at weekly intervals on per plant basis. The population of natural enemies and their period of activity were also recorded at weekly interval on randomly selected ten plants in each plot. The relative abundance of different species of coccinellids and spiders present in the field were also recorded.

## 3. Results and Discussion

### 3.1 Leaf hopper, *Cicadulina* sp.

The presence of nymphs and adult *Cicadulina* sp. was recorded throughout the study period in both years. The appearance of *Cicadulina* sp. was first observed during the 31<sup>st</sup> Standard Meteorological Week (SMW) with mean population of leafhoppers per plant was 0.2 in *Kharif* 2021 and 0.4 in *Kharif* 2022. The pest population started to increase gradually and reached to its peak in September, specifically during the 38<sup>th</sup> SMW when the crops were 60 days old. The mean population of leafhoppers per plant during this period was 3.4 in *Kharif* 2021 and 3.2 in *Kharif* 2022. After reaching the peak, the leafhopper population started to decline. The minimum population of leafhoppers per plant, 0.2 in *Kharif* 2021 and 0.4 in *Kharif* 2022, was observed during the 43<sup>rd</sup> SMW in both years. After the 43<sup>rd</sup> SMW, the population of leafhoppers disappeared in both years. The current results are completely supported by Kumari (2020) [3], who noted that leaf hoppers first appeared during first week of August (31<sup>st</sup> SMW) with a mean population of 0.08 adults/plant. The population increased progressively until the third week of September (38<sup>th</sup> SMW), when it peaked. The results of the present study are also consistent with those of Sidar *et al.* (2015) [6] who reported the greatest adult population (2.30 hopper/ plant) during the fourth week of September.

### 3.2 Aphid, *Raphalosiphum maidis*

Throughout the study period in both years, the number of nymphs and adult *R. maidis* was observed and recorded. The occurrence of aphids was first observed during the fourth week of August, with an average population of 8.10 and 10.00 aphids per plant during the 35<sup>th</sup> Standard Meteorological Week (SMW) respectively for both years. The population of this pest began to increase and reached its peak during the 39<sup>th</sup> SMW, with a mean population of 30.5 and 32.6 aphids per

plant respectively. After reaching the peak, the population started to decline in both consecutive years. The minimum population was recorded during the 44<sup>th</sup> SMW, with a mean population of 12.3 and 9.8 aphids per plant respectively in *Kharif* 2021 and *Kharif* 2022. The current findings correspond with the finding of Paul *et al.* (2020) [4] that the aphids first arrived in the fourth week of August (the 35<sup>th</sup> SMW) and reached their peak population in the fourth week of September. The results of the present study are partially consistent with those of Ahad (2012) [1], who found that black aphid population variations were the largest among hemipteran insects, ranging from 4.30 to 53.23 plants with frequent population fluctuations. But maximum infestation showed up in the fourth week of August. However, Sidar *et al.* (2015) [6], observed the peak of black aphid in the third week of September with population mean (30 aphids per plant).

### 3.3 Stink bug

The recorded data on the pest population indicated that stink bugs were first observed during the 33<sup>rd</sup> SMW when the crops were 30 days old, with an average of 0.3 bugs and 0.5 bugs per plant respectively during successive year. The numbers of stink bugs then started to increase during the 34<sup>th</sup> SMW, with an average population of 0.5 and 0.7 bugs per plant in August respectively. The population of stink bugs reached its peak during the 38<sup>th</sup> SMW in both years, with 1.2 bugs and 1.5 bugs per plant respectively. However, starting from the 39<sup>th</sup> SMW, the population began to decline and reached its lowest point during the 40<sup>th</sup> SMW, with a mean population of 0.1 bugs per plant in *Kharif* 2021, after which this pest disappeared. Meanwhile, during *Kharif* 2022, the population also declined and reached its minimum during the 41<sup>st</sup> SMW, with a mean population of 0.1 bugs per plant, and the pest disappeared after the 42<sup>nd</sup> SMW. The present results are in conformity with the findings of Sidar *et al.* (2015) [6] who conclude that the maximal population mean of the green stink bug (1.80/ plant) was reached in the second week of September.

### 3.4 Spiders spp. (*Oxyopidae* spp. and *Araneidae* spp.)

Data obtained on the natural enemy populations indicated that no spiders was found till 33<sup>rd</sup> SMW in both the year of study period. First appearance of spiders in field was recorded during 34<sup>th</sup> SMW with mean population 1.8 and 2.4 spiders per plant respectively during *Kharif* 2021 and *Kharif* 2022. The population of spiders started increasing from 35<sup>th</sup> SMW and reached to its peak during 38<sup>th</sup> SMW with 4.6 spiders per plant during *Kharif* 2021 and 4.8 spiders per plant during *Kharif* 2022. Afterwards population gradually decreases and reached to its minimum i.e., 0.2 and 0.3 spiders per plant respectively during both successive years. Spiders present throughout the harvesting of the crop in both the year of investigation. The results of the present study are supported by Kumari (2020) [3] who reported an increase in spider population from the middle of September to the last week of October. Similar to this, Sidar *et al.* (2017) [5] reported that the fourth week of September observed the most activity of spider species, including *Oxyopidae* spp. and *Araneidae* spp.

### 3.5 Ladybird beetle, *Coccinella septempunctata*

During *Kharif* 2021 and *Kharif* 2022, data obtained on the natural enemy populations indicated that no coccinellids was found till 34<sup>th</sup> SMW in both the year. Ladybird beetle first

appeared during 35<sup>th</sup> SMW with mean population 0.8 and 0.9 ladybird beetle per plant respectively. The population of ladybird beetle started increasing and reached to its peaked during 39<sup>th</sup> SMW with mean population (5.4 and 5.9 ladybird beetle per plant respectively) and thereafter it started declining gradually. Minimum population recorded during 44<sup>th</sup> SMW with mean population 1.6 ladybird beetle per plant

during *Kharif* 2021 and 1.5 ladybird beetle per plant during *Kharif* 2022. A study conducted by Kumari (2020) [3], revealed that number of coccinellid beetle were higher from the middle of September to the first week of October

#### 4. Tables

**Table 1:** Seasonal incidence of sucking insect pests infesting the maize crop during *Kharif* season

SMW	Sucking insect pests					
	<i>Kharif</i> 2021			<i>Kharif</i> 2022		
	Leaf hopper	Aphid	Stink bug	Leaf hopper	Aphid	Stink bug
31	0.2	0.0	0.0	0.4	0.0	0.0
32	0.9	0.0	0.0	1.2	0.0	0.0
33	1.7	0.0	0.3	1.9	0.0	0.5
34	1.7	0.0	0.5	2.2	0.0	0.7
35	1.9	8.1	0.6	2.4	10.0	0.8
36	2.2	11.0	0.6	2.6	12.2	0.9
37	2.4	21.5	0.7	2.8	22.6	1.0
38	3.4	24.2	1.2	3.2	26.5	1.5
39	2.8	30.5	0.3	1.7	32.6	0.3
40	1.9	28.2	0.1	1.4	30.4	0.2
41	0.6	20.1	0.0	0.6	25.6	0.1
42	0.3	18.9	0.0	0.5	20.1	0.0
43	0.2	12.3	0.0	0.4	14.4	0.0
44	0	10.8	0.0	0	9.8	0.0

**Table 2:** Seasonal incidence of natural enemies in maize during *Kharif* season

SMW	Natural enemies			
	<i>Kharif</i> 2021		<i>Kharif</i> 2022	
	Spider population/ plant	Coccinellids/Plant	Spider population/ plant	Coccinellids/Plant
34	1.8	0.0	2.1	0.0
35	2.5	0.8	2.8	0.9
36	3.8	2.3	3.6	2.8
37	4.2	3.3	4.2	3.6
38	4.6	4.4	4.8	4.8
39	2.8	5.4	2.9	5.9
40	2.4	4.8	2.6	4.7
41	1.7	4.6	1.9	3.5
42	0.8	2.4	1.2	2.6
43	0.3	1.7	0.6	1.9
44	0.2	1.6	0.3	1.5

#### 5. Conclusion

Leaf hopper was first observed during the 31<sup>st</sup> Standard Meteorological Week (SMW) in *Kharif* 2021 and 2022. The population increased gradually from the 31<sup>st</sup> to the 38<sup>th</sup> SMW, reaching its peak during the 38<sup>th</sup> SMW. The population declined and disappeared after the 43<sup>rd</sup> SMW. Aphids were first observed during the 35<sup>th</sup> SMW, reaching their peak during the 39<sup>th</sup> SMW. Sting bugs were first observed during the 33<sup>rd</sup> SMW, reaching its peak during the 38<sup>th</sup> SMW. The population declined from the 39<sup>th</sup> SMW to its lowest point during the 40<sup>th</sup> and 41<sup>st</sup> SMW in both *Kharif* 2021 and 2022. Natural enemies i.e., Spiders and ladybird beetles were first observed during the 34<sup>th</sup> SMW and 35<sup>th</sup> SMW respectively and reached at its peaked during 38<sup>th</sup> SMW and 39<sup>th</sup> SMW respectively during both the consecutive years. Spiders and ladybird beetles present throughout the harvesting of the crop in both the year of investigation.

#### 6. Acknowledgement

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