

“Seasonal dynamics of major insect pests and their natural enemies in rice ecosystem of Mahasamund, Chhattisgarh.”

ABSTRACT

In the course of research studies under paddy cultivation three insect pests of rice viz. rice yellow stem borer (*Scirpophaga incertulus*), rice leaffolder (*Cnaphalocrocis medinalis*) and rice butterfly (*Melanitis leda*) and their natural enemies lady bird beetle (*Novius cardinalis*) and spider (*Paradosa pseudoannulata*) recorded. The maximum incidence of both dead heart (12.73%) and white ear head (16.77%) by yellow stem borer was observed during 37th SMW and 45th SMW, respectively. The maximum activity of rice leaffolder (12.87% leaf damaged) and rice butterfly (10.60% larva per hill) were observed during 38th SMW, and 39th SMW, respectively. While` natural enemies lady bird beetle of species *Novius cardinalis* having maximum population (1.40 per plant) and spider of species *Paradosa pseudoannulata* with maximum population (2.87 per plant) were recorded during 40th SMW and 39th SMW, respectively.

KEY WORDS: *Scirpophaga incertulus*, *Cnaphalocrocis medinalis*, *Melanitis leda*, *Novius cardinalis*, *Paradosa pseudoannulata*

INTRODUCTION

According to the Ministry of Agriculture and Farmers Welfare, total rice production during 2023-24 is estimated at record 1378.25 LMT. It is higher by 20.70 LMT than previous year's rice production of 1357.55 LMT. While in Chhattisgarh, rice occupies average of 3.6 million ha with the production of 14.7 million metric tons and productivity of the state was about 1106 kg/ha depending upon the rainfall.

More than 100 species of insects are known to attack rice crop, of which the yellow stem borer (YSB), *Scirpophaga incertulus* (Walker) (Lepidoptera: Pyralidae) is one of the most

destructive monophagous pest of this crop and is widely distributed in the Indian subcontinent. The pest attacks all stages of the crop. Larval damage to tillers during the vegetative stage results in 'dead heart' symptoms (drying up of central shoot) and damage during the panicle Initiation stage results in 'white ear head' (chaffy, unfilled grains). Yield loss estimate across India varied from 11.2 to 40.1% due to dead heart and 27.6 to 71.7% due to white ear heads respectively.

Other than yellow stem borer other pest like brown planthopper (*Nilaparvata lugens*), Gundhi bug (*Leptocorisa acuta*), leaf folder (*Cnaphalocrocis medianalis*), case worm (*Nymphula depunctalis*) is important pest of rice ecosystem. There is a rich complex of natural enemies in paddy. These arthropod natural enemies have existed in this environment for thousands of years and have contributed to keep pest species below damaging levels. Natural enemies such as spider, dragonfly, damselflies, lady bird, play important role in rice ecosystem.

MATERIAL AND METHODS

Seasonal incidence of insect pests and natural enemies on rice was studied on a separate plot of **100 m²**. The insect pests and natural enemies population was recorded in this unprotected plot at 7 days interval from the occurrence or initiation of pest infestation and were continued up to maturity. The incidence of insect pests and natural enemies was recorded on 10 randomly selected hills.

For the current study, weather data such as maximum and minimum temperature, relative humidity, rainfall and sunshine hours were collected from Department of Agrometeorology, Raipur (C.G.) to correlate between the occurrence of insect pests and weather parameters. The graphical representation was applied to depict the seasonal dynamics of major pests.

Percent incidence of major pests was computed as per the formulae:

- In case of plant hoppers and leaf hoppers (nymphs and adults) and caterpillars (larva's and adults) the number of hoppers and caterpillars on 10 randomly selected hills was recorded. The total count was averaged and expressed on per plant basis.
- In case of yellow stem borer counts was taken on a number of dead hearts/white ears and the total number of tillers/panicles from 10 randomly selected hills. The incidence % (dead heart/white ears) was calculated.

Percent dead heart and white ear percent was assessed by the standard formulae viz;

$$\text{Percent Incidence} = \frac{\text{Number of dead hearts / white ears}}{\text{Total number of tillers/ panicles}} \times 100$$

- For leaf folder and case worm the damaged leaves and total leaves from 10 randomly selected hills was observed in each plot.

$$\text{Percent leaf damage} = \frac{\text{Number of damage leaves}}{\text{Total number of leaves}} \times 100$$

- In case of rice butterfly (caterpillars), the number of caterpillars on the 10 randomly selected hills was recorded. The total count will be averaged and expressed on per plant basis.

Seasonal occurrence of natural enemies in rice under field conditions.

Seasonal occurrence of natural enemies was recorded throughout the cropping period at seven days interval. During the cropping period the natural enemies appeared on the crop was observed on 10 randomly selected hills and was recorded as per their activities shown during the different growth stages of the crop during *Kharif*, 2024.

RESULTS

Seasonal incidence of major insect pests of rice crop

During the period of study, insect pests were observed at different growth stages of the crop. Insect pests belonging to different insect orders comprised of three lepidopteron, (Table 1). Different insect pests that were observed include, yellow stem borer, Leaf folder, and Rice butterfly from vegetative to maturity stage of the crop.

Table 1: Incidence of insect pests recorded in rice crop at Mahasamund during *Kharif*, 2024

S.No	Name	Scientific name	Stage of crop
1.	Yellow stem borer	<i>Scirpophaga incertulas</i>	Vegetative stage to maturity
2.	Rice leaf folder	<i>Cnaphalocrocis medinalis</i>	Vegetative
3.	Rice Butterfly	<i>Melanitis leda</i>	Vegetative stage to maturity

Seasonal incidence of yellow stem borer, *Scirpophaga incertulas* during *kharif*, 2024

Dead hearts incidence appeared during 32nd SMW *i.e.*, 1st week of August with a mean percent incidence of 2.47% per hill. The incidence build up gradually and reached to its peak in the 2nd week of September 37th SMW with a mean percent incidence of 12.73 % per hill, when the maximum temperature, minimum temperature, rainfall, morning relative humidity, evening relative humidity and sunshine hours were 31.24 °C, 25.3 °C, 226.8 mm, 91 per cent, 72 per cent and 1.5 hrs, respectively. Then, the percent dead hearts incidence declined and, completely disappeared after 42nd SMW and peak incidence period was third week of August to September last week.

The percent white ear heads incidence appeared during 41st SMW *i.e.*, 2nd week of October with a mean percent incidence of 4.8 % per hill. The incidence builds up gradually and reached to its peak in the 1st week of November 45th SMW, with a mean percent incidence of 16.77 % per hill, when the maximum temperature, minimum temperature, rainfall, morning relative humidity, evening relative humidity and sunshine hours were 32.4°C, 18.3°C, 0.0 mm, 87 per cent, 35 per cent and 7.11 hrs, respectively. Then, the percent white ear heads incidence declined. Present findings are in line with Sulagitti *et al.*, (2017) who revealed that yellow stem borer outbreaks begin in late July (31st SMW) with per cent dead hearts incidence. Patil *et al.*, (2020) reported that per cent incidence of dead hearts of yellow stem borer was reached to its peak in second week of September (37th SMW) and Chavan *et al.*, (2013) reported that maximum white ear heads damage was recorded during third week of October.

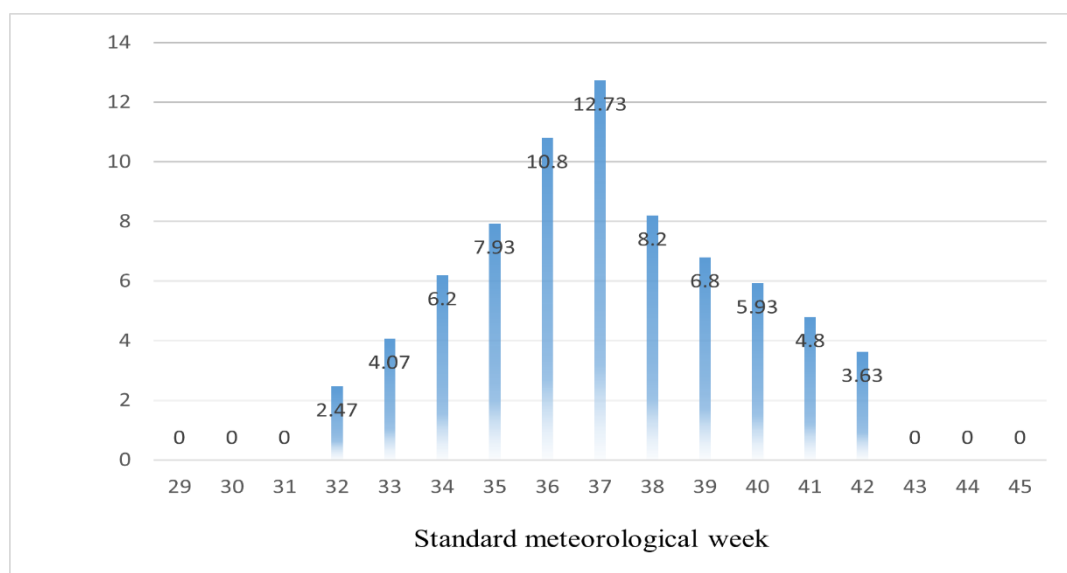


Fig 1: Dead heart caused by rice yellow stem borer during *Kharif*,2024.

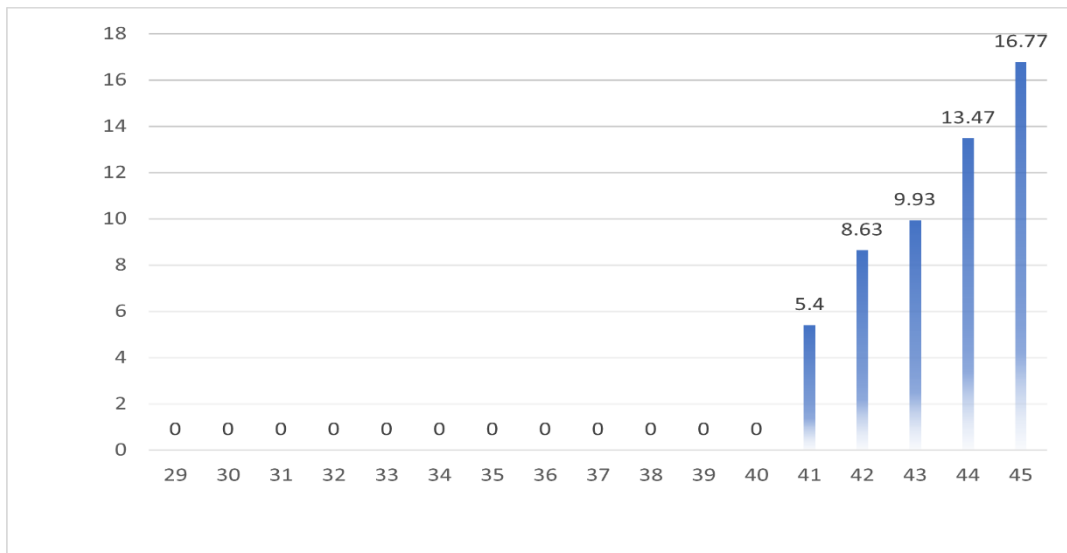


Fig 2: white ear head caused by rice yellow stem borer during *Kharif*,2024.

Seasonal incidence of rice leaffolder, *Cnaphalocrocis medinalis* during *kharif* 2024

The rice leaffolder appeared during 32nd SMW i.e., 2nd week of August with a mean percent leaf damage of 3.33 % per hill. The incidence builds up gradually and reached to its peak in the third week of September (38th SMW) with a mean percent leaf damage of 12.73 % per hill, when the maximum temperature, minimum temperature, rainfall, morning relative humidity, evening relative humidity and sunshine hours were 31.7 °C, 25.2 °C, 94.6 mm 90 per cent, 68 per cent and 4.2 hrs, respectively. Then, the percentage leaf damage declined. (Table 2) it completely disappeared after 43rd SMW and peak incidence period was last week of August to last week of September.

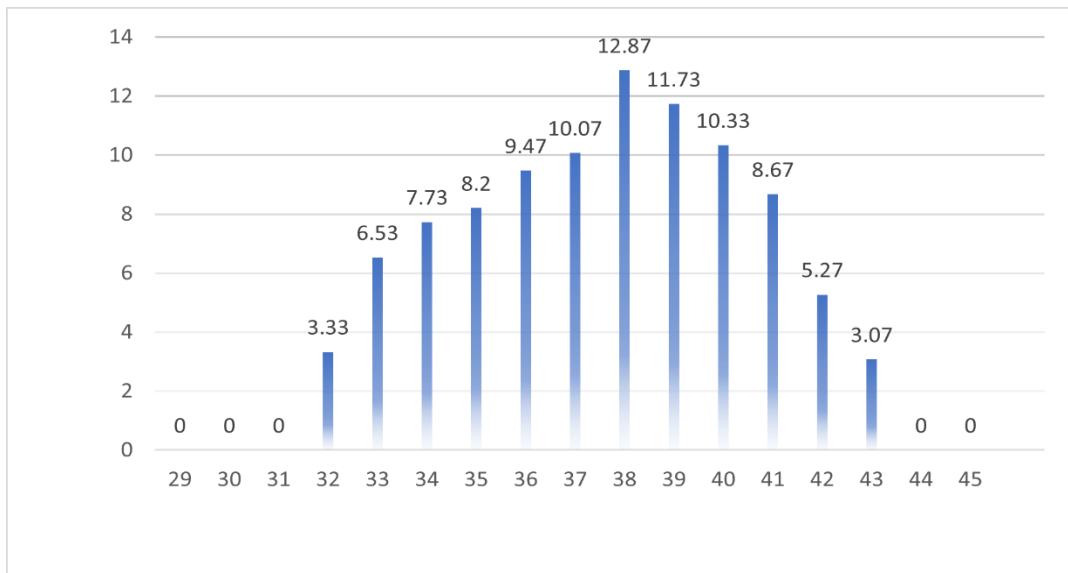


Fig 3: Seasonal incidence of rice leaffolder during *Kharif*, 2024

Seasonal incidence of rice butterfly *Melanitis leda* during *kharif* 2024

Rice butterfly appeared during 32nd SMW i.e., 1st week August of with a mean incidence of 2.27 % insects per hill. The incidence builds up gradually and reached to its peak in the last week of September (39th SMW) with a mean incidence of 10.6% insects per hill, when the maximum temperature, minimum temperature, rainfall, morning relative humidity, evening relative humidity and sunshine hours were 30.8 °C, 24.6 °C, 121 mm, 92 per cent, 79 percent and 2.3 hrs, respectively. Then, the incidence of rice butterfly declined, (Table 2)

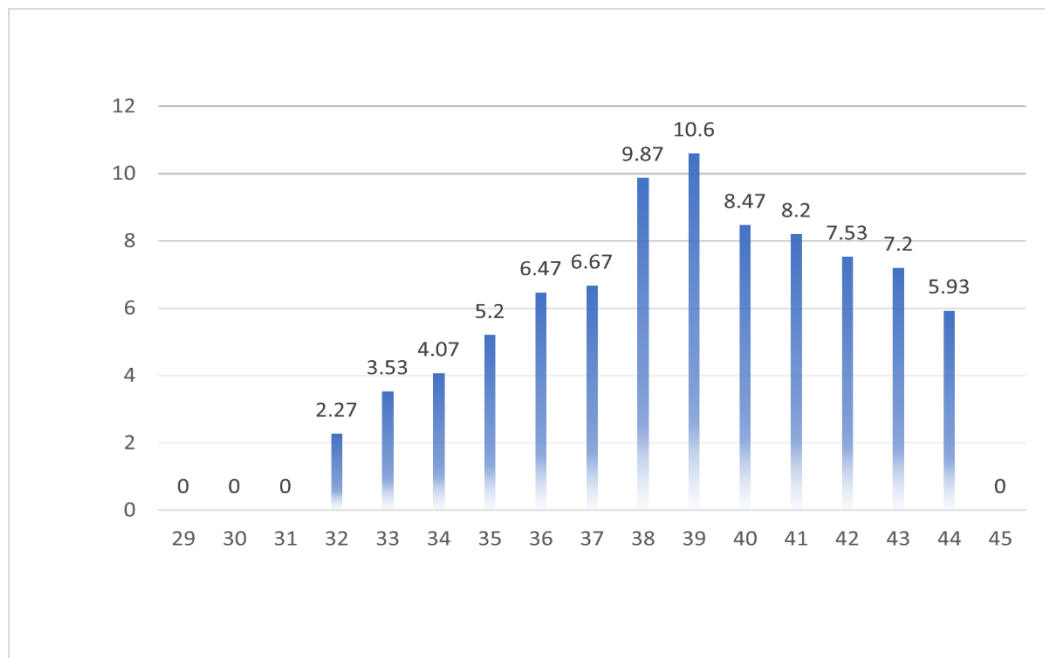


Fig 4: Seasonal incidence of rice Butterfly during *Kharif*, 2024

Incidence /damage average population of insect and larvae /hill						
S.N.	SMW	Duration	DH	WEH	LEAFFOLDER	RICE BUTERFLY
1	29	July 16-22	0	0	0	0
2	30	23-29	0	0	0	0
3	31	30-05	0	0	0	0
4	32	Aug 06-12	2.47	0	3.33	2.27
5	33	13-19	4.07	0	6.53	3.53
6	34	20-26	6.20	0	7.73	4.07
7	35	27-02	7.93	0	8.20	5.20
8	36	Sep 03-09	10.80	0	9.47	6.47
9	37	10-16	12.73	0	10.07	6.67
10	38	17-23	8.20	0	12.87	9.87
11	39	24-30	6.80	0	11.73	10.6
12	40	Oct 01-07	5.93	0	10.33	8.47
13	41	O8-14	4.80	5.40	8.67	8.20
14	42	15-21	3.63	8.63	5.27	7.53
15	43	22-28	0	9.93	3.07	7.20
16	44	29-04	0	13.47	0	5.93
17	45	Nov 05-11	0	16.77	0	0

Table 2: Seasonal incidence of insect in rice crop during *Kharif*, 2024.

Table 3: Seasonal incidence range of major insect's pest of rice during *kharif*, 2024

Major insect pests					
S.No.	Name of insect	Scientific name	Range (%)	Active period	Peak activity period
1	Yellow stem borer	<i>Scirpophaga incertulas</i>	2.47-12.73	Early tillering to maturity stage	September first week to 3 rd week of September
2	yellow stem borer white ear head	<i>Scirpophaga incertulas</i>	5.41-16.77	Panicle initiation to maturity stage	October 3 rd week to 4 th week of October
3	Rice leaffolder	<i>Cnaphalocrocis medinalis</i>	3.33-12.87	Late tillering to maturity stage of crop	Last week of august to first week of October
4	Rice Butterfly	<i>Melanitis leda</i>	2.27-10.60	Late tillering to maturity stage of crop	Last week of august to first week of October

Seasonal incidence of natural enemies

In the experimental field, active period of natural enemies was recorded during the vegetative period to the crop maturity stage. Natural enemies associated with crop included the lady bird beetle and spiders. (Table 4)

Seasonal incidence of lady bird beetle in rice crop during *Kharif*, 2024.

Lady bird beetles of species mainly *Novius cardinalis* appeared during 2nd week of September (37th SMW) with initial average incidence of 0.63 adults/hill. The highest incidence was seen in the 1st week of October (40th SMW) with average incidence of 1.4 adults per hill. Later, the incidence declined to 0.5 adults/hill in the 3rd week of October (42nd SMW).

Seasonal incidence of spiders in rice crop during *Kharif*, 2024.

Spiders of species *Paradosa pseudoanulata* and *Neoscona theisi* appeared during 2nd week of August (33rd SMW) with initial average incidence of 0.53 adults/hill. The highest incidence was seen in the last week of September (39th SMW) with average incidence of 2.87 adults per hill. Later, the incidence declined to 0.73 adults/hill in the 3rd week of October (42nd SMW).

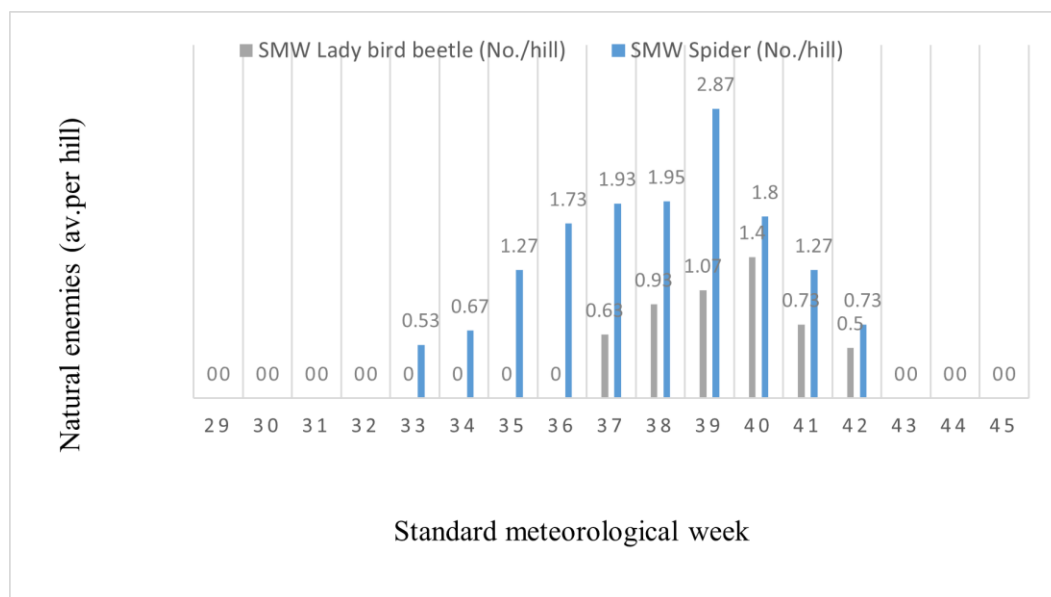


Fig 5: Seasonal incidence of natural enemies in rice crop during *Kharif*, 2024.

Table 4: Seasonal incidence of natural enemies in rice crop during *Kharif*, 2024.

SMW	Duration	Natural enemies	
		Lady bird beetle (No./hill)	Spider (No./hill)
29	July 16-22	0	0
30	23-29	0	0
31	30-05	0	0
32	Aug 06-12	0	0
33	13-19	0	0.53
34	20-26	0	0.67
35	27-02	0	1.27
36	Sep 03-09	0	1.73
37	10-16	0.63	1.93
38	17-23	0.93	1.95
39	24-30	1.07	2.87
40	Oct 01-07	1.40	1.80
41	08-14	0.73	1.27
42	15-21	0.50	0.73
43	22-28	0	0
44	Oct 29-04	0	0
45	Nov 05-11	0	0
	Mean	0.30	0.86

Table 5: Occurrence of Natural enemies in rice crop during *Kharif*, 2024

S.No	Natural enemies	Range in (%)	Period of activity	Peak period of activity
1.	Lady bird beetle	0.5-1.4	2 nd week of September to 3 rd week of October	last week of September
2.	Spiders	0.53-2.87	2 nd week of August to 3 rd week of October	last week of September

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