Abundance of major insect pests in rice and their relation to weather parameters

ABSTRACT

The present investigation has been conducted in rice crop during *Kharif* 2021-22at Students' Instructional Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India. The population of six major insect pests was recorded *viz.* Rice Yellow stem borer (*Scirpophaga incertulus*), Rice Leaf folder (*Cnapholocrocis medinalis*), Rice ear head bug (*Leptocorisa acuta*), Brown plant hopper (*Nilaparvata lugens*), White backed plant hopper (*Sogatella furcifera*)and Green leaf hopper (*Nephotettix nigropictus*) that cause most damage at different crop growth stages initiated after sowing till harvesting. The maximum population of yellow stemborer was observed on rice crop at 36th SMW (12.20 per cent dead heart). The infestation of dead heart was non-significant positively correlated with minimum, maximum temperature and RH% (0.433, 0.010 & 0.253 respectively) and negatively correlated with rain fall (0.081) whereas, significant negatively correlated with sunshine (0.552*). The maximum population white ear in 40th SMW (16.80 per cent). The infestation of white ear was non-significant negative correlation with minimum, maximum temperature (-0.062, -0.167) and positive correlation with RH & rain fall (0.244 & 0.173) whereas, significant positive correlation with sunshine (0.703*). Maximum leaf folder population was observed during 35th SMW (16.35 per cent). and infestation of leaf folder was non-significant positive correlation with minimum temperature & RH (0.427 & 0.505) and negative correlation with maximum temperature, rainfall and sunshine (-0.079, -0.030 & -0.291). The maximum population was recorded of ear head bug in 38th SMW i.e., (10.90 ear head bug/hill respectively.). The infestation of ear head bug was non-significant positive correlation with minimum temperature, RH, rainfall & sunshine (0.061, 0.176, 0.155 & 0.210) and negative correlation with maximum temperature (-0.407). The peak mean population of BPH was recorded in 37th SMW i.e., (11.25 brown plant hopper/hill respectively.) Itwas non-significant positive correlation with minimum temperature & RH (0.463 & 0.357) and negative correlation with maximum temperature & rainfall (-0.066 & -0.088) whereas, significant negative correlation with sunshine (-0.597*), The peak mean population of WBPH was recorded in 38th SMW i.e., (12.80 white backed plant hopper/hill respectively.) It

was non-significant positive correlation with minimum temperature, RH & rainfall (0.300, 0.337 & 0.185) and negative correlation with maximum temperature (-0.300) whereas, significant negative correlation with sunshine (-0.094*) and the maximum population of green leaf hopper was recorded in 37th SMW i.e., (10.80 green leaf hopper/hill respectively.) with the infestation of green leaf hopperwas non-significant positive correlation with minimum temperature & RH (0.479 & 0.369) and negative correlation with maximum temperature & rainfall (-0.077 & -0.120) whereas, significant negative correlation with sunshine (-0.633*).

Keywords: Rice, Major, Insect pests, Weather parameters

INTRODUCTION

"Rice (*Oryza sativa*), is the most important crop of the world which occupies foremost status in human food requirement. It is the staple food of more than 60 per cent of the world's population because of the major source of calories. About 90 per cent of all rice grown in the world is produce and consumed in the Asian region. Rice crop is grown worldwide over acreage of around 167.25 million hectares" (Shahbandeh, 2019). "It is cultivated in almost all tropical, subtropical and temperate countries of the world. Almost 90% of rice is produced and consumed in Asian countries like China, India, Japan, Korea Republic, Sri Lanka, Pakistan, Bangladesh, *etc"*. (Nadaf *et al*., 2016). "The major rice growing countries are India, China, Japan, Indonesia, Thailand, Burma, Philippines and Bangladesh. India is amongst the top most rice producers in the world, second only to China. Rice contributes more than 40 per cent of the country's total food grain production" (Anonymous, 2018). "According to the data released by the Government of India, the annual production of rice in India is 115.63 million ton during 2018-19 (Anonymous, 2019). "The protein content of milled rice is usually 6 to 7 per cent. Rice however", compares favorably with other cereals in amino acids content. The biological value of its protein is high. The fat content of rice is low (2.0 to 2.5 per cent) and much of the fat is lost during milling. Rice contains a low percentage of calcium. The byproducts of rice milling are used for various purposes. Rice bran is used as cattle and poultry feed. Rice husk can be used in manufacture of insulation materials, cement, card board and as a litter in poultry keeping. Rice straw can be used as cattle feed as well as litter during winter.Rice yield is affected by many factors in which, climatic conditions and pest epidemics are most important. Reduction in the rice yield is due to many biotic and abiotic stresses such as, pests, diseases, soil fertility, rainfall,

water logging and climatic conditions.Amongst the various threats to rice productivity, damage by various types of insectpests is considered significant as it can cause large scale reduction both in quality and quantity of rice.Such cultivation pattern of rice accidentally or in advertently offers infestation of a large number of insect pests, which results in to severe loss in crop yields" (Neeta *et al.*, 2013). "Weather plays an important role for determining the geographical distribution and periodic abundance of major insect pests in rice" (Singh *et al.*, 2012). Among the weather factors; temperature, rainfall, relative humidity plays the crucial role in insect life.Hence, considering the importance of insectpests of rice an attempt has been made to study the influence of different abiotic factors on the incidence of major insect pests of rice.

MATERIALS AND METHODS

The present investigation was conducted under field conditions at students' Instructional Farm, Acharya Narendra DevaUniversity of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India during *Kharif*, 2021-2 on rice variety of NDR-2065. The quantification of the insect pests population was done under field conditions in the plot size kept 4×3 meter with border 1 meter and lineto line spacing kept 20 cm and plant to plant spacing kept 15 cm. The details ofexperiment are given in. The occurrence of the insect pests was recorded 20 days after transplanting (DAT).The pest population were recorded randomly selected 10 hills per plot at weekly intervals to pre-harvesting.The meteorological data of weather parameters were obtained from the Department of Agricultural Meteorology, College of Agriculture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, (U.P.). The correlation coefficient between insectpests population and weather parameters like maximum and minimum temperature (℃), relative humidity (%), rainfall (mm)and sunshine (hrs.) was worked out.

RESULTS AND DISCUSSION

Yellow stem borer (*Scirpophaga incertulas*)

Yellow stem borer was recorded at weekly intervals during crop period revealed that (*S. incertulas)*appeared at vegetative stage crop is called dead heart. During *Kharif* season, 2021, the initial infestation of (*S. incertulas)* was recorded in 29th SMW (0.50 per cent dead heart) and increase up to peak level of (12.20 per cent dead heart) in 36th SMW. Thereafter, yellow stem

borer of declined and it was not appeared 41th SMW. It was non-significant positively correlated with minimum, maximum temperature & RH (0.433, 0.010 & 0.253 respectively) and negatively correlated with rain fall (0.081) whereas, significant negatively correlated with sunshine (0.552*).Yellow stem borer was recorded at weekly intervals during crop period revealed that (*S. incertulas)*appeared at panicle initiation stage of crop is called white ear.During *Kharif* season, 2021, the initial infestation of (*S. incertulas)* was recorded in 36th SMW (0.70per cent white ear)and increase up to peak level of(16.80 per cent white ear) in 40th SMW. Thereafter, yellow stem borer of declined and it was not appeared 43th SMW. The infestation of white ear was non-significant negative correlation with minimum, maximum temperature (-0.062, -0.167) and positive correlation with RH & rain fall (0.244 & 0.173) whereas, significant positive correlation with sunshine (0.703*),(Table 2 and Fig.1).These findings are similar with the finding of Jasrotia *et al.* (2019) notice that maximum damage of 14.9% and 14.5% by yellow stem borer was recorded during 38thSMW in 2016 and during 39thSMW in 2017, respectively. These finding also similar to Patel and Singh (2017)reported that incidence of rice stem boreron different stage of crop. Dead heart started from 32th standard week and continued up to 38th standard week, while white ear head was recorded on 35th standard week and it reached peak in 45th standard week.

Leaf folder (*Cnapholocrocis medinalis*)

The leaf folder infestation was noticed in different crop periods.During *Kharif* season, 2021, the initial infestation of (*C. medinalis)* was recorded in 29th SMW (1.10per cent)and increase up to peak level of (16.35 per cent) in 35th SMW. The infestation of leaf folder was non-significant positive correlation with minimum temperature & RH (0.427 & 0.505) and negative correlation with maximum temperature, rainfall and sunshine (-0.079, -0.030 & -0.291), (Table 2 and Fig.1).These findings are partial agreement with the finding of Jasrotia *et al.* (2019) notice that infestation of leaf folder attained peak during 3rd week of September (38th SMW) during 2016 and 2017 with 8.4% and 9.7% infestation levels, respectively.These finding are also similar to Priya and Prasad (2021) record the incidence of leaf folder started during 34th standard week with 13.0% leaf damage. Then, the infestation increased gradually and attained its peak in 40th standard week with 21.4% leaf damage.

Ear head bug (*Leptocorisa acuta*)

The ear head bug population was observed at panicle initiation & milking stage of crops. During *Kharif*, 2021, the initial population of (*L. acuta)* was recorded in 35th SMW (1.95bugs per hill)and increase up to peak level of (10.90 bugs per hill) in 38th SMW. The infestation of ear head bug was non-significant positive correlation with minimum temperature, RH, rainfall & sunshine (0.061, 0.176, 0.155 & 0.210) and negative correlation with maximum temperature (-0.407), (Table 2 and Fig.1). These finding are agreement with Girish *et al*. (2012) found that population gradually increased of earhead bug on 38th standard week as 4 nos./10 sweep nets. Later, the population suddenly increased with 9 nos./10 sweep nets when the panicle emerged and gradually reached to 17 nos./10 sweep nets during 44th standard week. These finding also similar to Sharma *et al*. (2019) reported that rice ear head bug population was first recorded on 36th standard week as 1 nos./10 sweep nets and peak population (17 nos./10 sweep nets) was observed during 44th standard week.

Brown plant hopper (*Nilaparvata lugens*)

The infestation of brown plant hopper was recorded at weekly intervals.During *Kharif*, 2021, the initial population of (*N. lugens)* was recorded in 29th SMW (0.20hopper per hill) and increase up to peak level of (11.25hopperper hill) in 37th SMW. Thereafter, yellow brown plant hopper of declined and it was not appeared 43th SMW. It was non-significant positive correlation with minimum temperature & RH (0.463 & 0.357) and negative correlation with maximum temperature & rainfall (-0.066 & -0.088) whereas, significant negative correlation with sunshine (-0.597*),(Table 2 and Fig.1). The present finding was closely associated with Patil *et al.* (2021)reported that incidence of brown plant hopper, (*Nirparvata lugens)* (Stal.) was started from 33rd SMW i.e., second week of August with its peak during 41st SMW i.e., second week of October. These results are also in closed associated with Patil *et al.* (2020)reported the incidence of brown plant hopper,*Nirparvata lugens* (Stal.) was started from 32nd SMW with its peak during 42nd SMW.

White backed plant hopper (*Sogatella furcifera*)

The infestation of white backed plant hopper was recorded at weekly intervals during *Kharif*, 2021, the initial population of (*S. furcifera*) was recorded in 30th SMW (0.50hopper per hill) and increase up to peak level of (12.80hopper per hill) in 38th SMW. Thereafter, white backed plant hopper of declined and it was not appeared 42th SMW. It was non-significant

positive correlation with minimum temperature, RH & rainfall (0.300, 0.337 & 0.185) and negative correlation with maximum temperature (-0.300) whereas, significant negative correlation with sunshine (-0.094*), (Table 2 and Fig.1). These finding were close association with to Sharma *et al.* (2018) reported the first appearance of WBPH Started from 30th standard metrological week and reached to its peak during 40th standard week. These results are also in closed association with Verma *et al.* (2021) incidence started from 33rd standard meteorological week and it attends its peak level during 38th standard meteorological week.

Green leaf hopper (*Nephotettix nigropictus*)

The infestation of green leaf hopper was recorded at weekly intervals during *Kharif*, 2021, the initial population of (*N. nigropictus)* was recorded in 41th SMW (0.20 hopper per hill) and increase up to peak level of (20.80 per cent per hill) in 37th SMW. Thereafter, green leaf hopper of declined and it was not appeared 42th SMW.It was non-significant positive correlation with minimum temperature & RH (0.479 & 0.369) and negative correlation with maximum temperature & rainfall (-0.077 & -0.120) whereas, significant negative correlation with sunshine (-0.633*), (Table 2 and Fig.1). These finding were close association with to Sharma *et al.* (2018) reported the first appearance of GLH Started from 30th standard metrological week and reached to its peak during 40th standard week. These results are also in closed association with Verma *et al.* (2021) incidence started from 33rd standard meteorological week and it attends its peak level during 38th standard meteorological week.

CONCLUSION

The infestation of yellow stem borer (dead heart) was positive correlation with minimum temperature, maximum temperature, RH and negative correlation with rain fall, whereas significant negative correlation. The infestation of leaf folder was positive correlation with minimum temperature, RH and negative correlation with maximum temperature, rain fall and sunshine. The incidence of ear head bug was positive correlation with minimum temperature, RH, rainfall and sunshine whereas negative correlation with maximum temperature. The incidence of BPH was positive correlation with minimum temperature, RH, and negative correlation with maximum temperature & rainfall whereas significant negative correlation with sunshine. The incidence of WBPH was positive correlation with minimum temperature, RH, rainfall and negative correlation with maximum temperature & sunshine. The incidence of GLH was positive correlation with minimum temperature, RH, and negative correlation with maximum temperature & rainfall whereas significant negative correlation with sunshine.

Table1: Occurrence of major insect pests on Rice in relation to weather parameters during *Kharif* 2021-22

SMW	Incidence of Major Insect Pests							Weather Parameters				
	Yellow stem borer		Leaf folder (%)	Ear head bug/hill	BPH/hill	WBPH/ Hill	GLH/ hill	Temperature (℃)		Average RH (%)	Rainfall (mm)	Sunshine (hrs.)
	Dead heart (%)	White ear (%)						Min.	Max.			
29.	0.50	0.00	1.10	0.00	0.20	0.00	0.00	21.80	34.10	80.00	38.00	5.30
30.	0.80	0.00	1.30	0.00	0.80	0.50	1.20	27.20	34.40	79.60	37.40	5.60
31.	1.00	0.00	2.50	0.00	1.45	0.90	4.50	26.40	33.20	76.00	30.00	5.90
32.	2.15	0.00	5.80	0.00	3.70	1.50	8.60	26.20	32.20	85.90	12.50	3.40
33.	4.70	0.00	8.60	0.00	5.20	1.80	10.20	26.20	38.80	80.80	18.80	5.40
34.	6.25	0.00	13.05	0.00	8.75	2.35	17.60	25.50	32.20	87.80	24.60	2.60
35.	9.32	0.00	16.35	1.95	9.20	5.30	18.00	25.80	32.70	81.20	1.00	5.50
36.	12.20	0.70	11.20	5.20	10.60	6.70	19.20	26.20	33.70	79.40	24.20	3.90
37.	8.25	1.00	11.80	10.00	11.25	10.35	20.80	25.50	32.10	78.80	2.60	4.40
38.	6.50	3.80	9.90	10.90	7.45	12.80	16.30	25.20	31.20	85.80	41.40	6.10
39.	3.30	9.70	12.40	7.25	4.50	7.30	6.20	25.10	32.20	84.50	63.00	7.30
40.	0.50	16.80	8.40	4.50	1.80	3.70	2.25	24.40	32.70	82.80	18.00	8.10
41.	0.00	7.50	4.60	3.50	0.00	1.33	0.20	24.00	34.00	79.50	0.00	9.00
42.	0.00	4.20	2.20	2.80	0.00	0.00	0.00	23.60	31.80	81.30	24.00	6.90
43.	0.00	0.00	1.31	1.50	0.00	0.00	0.00	18.20	31.10	68.00	0.00	6.50

SMW= Standard Meteorological Week

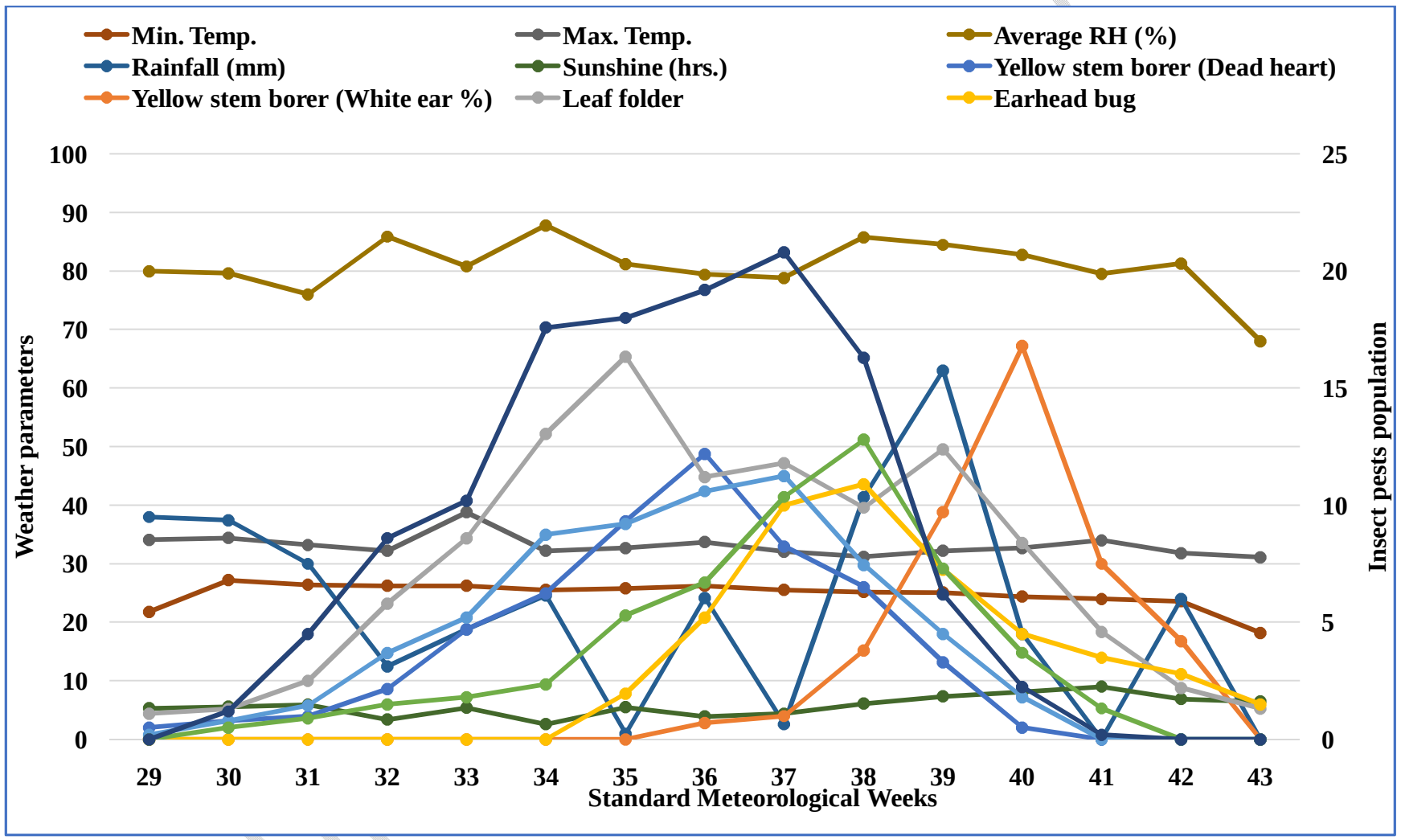

Fig.1: Occurrence of major insect pests on Rice in relation to weather parameters during *Kharif* 2021-22

Table 2: Relationship between insect pests of Rice and weather parameter during *Kharif* 2021-22

Insect Pests		Weather Parameters				
		Temperature(°C)		Relative Humidity (%)	Rainfall (mm)	Sunshine (hrs.)
		Min.	Max.			
Yellow stem borer	**%DH**	NS (0.433)	NS (0.010)	NS (0.253)	NS (-0.081)	-0.552*
	%WE	NS (-0.062)	NS (-0.167)	NS (0.244)	NS (0.173)	0.703*
Leaf folder		NS (0.427)	NS (-0.079)	NS (0.505)	NS (-0.030)	NS (-0.291)
Earhead Bug		NS (0.061)	NS (-0.407)	NS (0.176)	NS (0.155)	NS (0.210)
BPH		NS (0.463)	NS (-0.066)	NS (0.357)	NS (-0.088)	-0.597*
WBPH		NS (0.300)	NS (-0.300)	NS (0.337)	NS (0.185)	NS (-0.094)
GLH		NS (0.479)	NS (-0.077)	NS (0.369)	NS (-0.120)	-0.633*

***Significant at 5%**

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