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Population Dynamics of Rice Insect Pests in Yadagirigutta Mandal (Nalgonda District)- under Climate Change Perspective

Jhansi Lakshmi V[1*], Sunil V[1], Sampath Kumar M[2], Bentur JS[3], Katti GR[1] and Vennila S[4]

[1]ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad-500030, India.
[2]ICAR -National Bureau of Agricultural Insect Resources, Bangalore-560024, India
[3]Agribiotech Foundation, Rajendranagar, Hyderabad-500030, India.
[4]ICAR -National Centre for Integrated Pest Management, New Delhi-110012, India.
*Corresponding author (email: jhansidrr@yahoo.co.in)

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Abstract

Real time pest surveillance was conducted in Yadagirigutta mandal of Nalgonda District, Telangana state in 20 fixed fields of one acre each over 10 villages to analyze the impact of weather on the incidence of insect pests of rice during *kharif* 2012. Yellow stem borer (YSB), S. incertulas, incidence showed significant positive correlation with minimum and average temperatures, rain fall and wind velocity. Leaf folder (LF), C. medinalis, damage showed significant negative correlation with minimum and average temperatures, evening and average humidity and wind velocity. Rice hispa (RH) D. armigera damage was observed immediately after transplanting and showed positive correlation with rainfall and wind velocity. Brown planthopper (BPH), Nilaparvata lugens population had negative correlation with minimum temperature and average humidity whereas, whitebacked planthopper (WBPH), Sogatella furcifera incidence was negatively correlated with maximum temperature. The gundhi bug was significantly and negatively correlated with minimum temperature and wind velocity.

Key words: Insect pest incidence, Nalgonda district, Rice, Telangana, Weather parameters

Introduction

In India, rice (*Oryza sativa)* is the staple food crop and source of calories for 65 per cent of the population (Mathur *et al*., 1999) and the most favoured ecology of the rice plant is tropical and humid climate with a temperature range of 15-35^{0}C and RH of 85-100 per cent which is best suited for the survival and multiplication of many insects pests. Rice plant is attacked by more than 100 species of insects and 20 of these are major pests causing 30 per cent yield loss Pathak and Dhaliwal, 1981; Atwal and Dhaliwal, 2005). The climate change impacts on pests may include shifts in species distributions with species shifting their ranges to higher latitudes and elevations, changes in phenology and life cycles beginning earlier in spring and continuing later in autumn, increase in population growth rates and number of generations, change in migratory behaviour, alteration in crop-pest synchrony and natural enemy-pest interaction, and changes in interspecific interactions (Gian *et al*., 2002). In the selected study site, Yadagirigutta mandal of Nalgonda district, rice is grown continuously in both *kharif* and *rabi* seasons (Table 1). The climate in Yadagirigutta is semi arid with average annual temperature of 27.0 ^{0}C and precipitation of 748 mm (https://en.climate-data.org/location/441804/). Knowledge of the seasonal abundance and trends in population buildup, is essential to ensure timely tackling of impending pest problems and preventing crop losses. Diversity of rice pest complex is high in Yadagirigutta area and the present investigation was carried out to know the seasonal incidence of rice pests in relation to weather parameters.

Table 1. General cultivation practices in Yadagirigutta mandal of Nalgonda district

Date of sowing	June –July
Date of planting	July – August
Source of Irrigation	Open wells, bore wells and tanks
Method of planting	Transplanting manually
Weed control	Manual (*Cyperus, Echinocloa, Panicum)*
Fertilizer application	Recommended doses
Insecticide application	Phorate in the nurseries and early transplanted crop to control YSB and chlorpyriphos in the early transplanted crop to control hispa

Common insect pests and natural Enemies observed	YSB and hispa in nurseries, Severe incidence of hispa, YSB, gundhi bug, mites in the transplanted fields
	Low incidence of leaf folder, moderate incidence of stink bug, very low incidence of planthoppers
	Gundhi bug was seen feeding on *Echinocloa* seed
	Very high populations of spiders, hymenopterous and dipterous parasitoids, low to moderate numbers of mirid bugs, rove beetles and Staphylinids were seen

Materials and Methods

A case study was done under NICRA-Real Time Pest Surveillance Programme by ICAR-IIRR in collaboration with NCIPM, New Delhi during *kharif,* 2012 in Yadagirigutta Mandal of Nalgonda district of Telangana state. The fixed plot surveillance was done for 23 weeks in 20 fixed fields of one acre each in 10 villages (Fig. 1). Observations were recorded on the pest incidence on a major rice variety BPT-5204 (Table 2). Twenty plants were randomly selected for observations starting from 20 days after transplantation (DAT) until harvest of the crop. The incidence of major insect pests such as yellow stem borer, *Scirpophaga incertulas,* leaf folder, *Cnaphalocrocis medinalis*, hispa, *Dicladispa armigera,* gall midge, *Orseolia oryzae*, brown planthopper, *Nilaparvata lugens*, whitebacked planthopper, *Sogatella furcifera*, gundhi bug, *Leptocorisa acuta* and stink bug, *Menida histrio* were recorded. The weather parameters such as maximum and minimum temperatures, morning and evening relative humidity, rainfall, sunshine hours and wind velocity were sourced from Indian Meteorological Department.

Table 2. Observations on different pests

Insect pest	Observation	Per cent Incidence
Yellow stem borer	Number of dead hearts/white ears and total number of tillers/panicles	Number of dead hearts or white ears X 100 Total number of tillers/panicles
Leaf folder and hispa	Number of damaged and total leaves	Number of damaged leaves X 100 Total number of leaves
Gall Midge	Number of silver shoots and total number of tillers	Number of Silver shoots X 100 Total number of tillers
Brown planthopper and whitebacked planthopper	Number of nymphs and adults	Number of nymphs and adults per hill
Gundhi bug and stink bug	Number of nymphs and adults	Number of nymphs and adults per hill

Statistical Analysis

Weekly totals of pest population were correlated with the prevailing weather factors such as maximum, minimum and average temperatures; morning, evening and average relative humidity; rainfall; sunshine hours and wind velocity.

Results and Discussion

The results are presented in tables 3 and 4. Yellow stem borer appeared during third week of July and peak dead heart incidence was found in second week of August and it showed a significant positive correlation with minimum and average temperatures (r=0.67*, 0.64*), rainfall (r=0.53*) and wind velocity (r=0.68*) while, white ear incidence showed a significant negative correlation with wind velocity (r=-0.51*). YSB occurred in September with peak incidence in October – November (Kumar and Patil, 2004) and low temperature, high humidity and high rainfall resulted in YSB outbreaks (Rahman *et al*., 2002).

Leaf folder incidence was low with a peak infestation during November second week. The incidence showed a significant negative correlation with minimum and average temperatures (r=-0.80**, -0.75**) and wind velocity (r=-0.60*). Similar results were observed by Vidyawati Garg, (2012) in contrary to Khan and Ramamurthy, (2004) who observed that leaf folder population density had a significantly positive correlation with maximum and average temperature, maximum and average relative humidity and rain fall and damage was low in the first three months of crop season, attaining the highest activity in the last week of October.

Hispa incidence was observed from July third week up to crop harvesting with peak infestation during August first week. The incidence showed a positive correlation with rainfall (r=0.50*) and wind velocity (r=0.67*). The present findings are corroborated by the findings of Rao, (1977) and Prakasa Rao *et al*. (1971) who reported an incursion of hispa at high humidity following heavy rainfall and intermittent bright sunshine.

Table 3: Weather parameters and seasonal incidence of major insect pests in rice during *Kharif* 2012

Std. Week	Respective Month and Dates	Temperature (^{0}C)			Relative Humidity (%)			Rain fall (mm)	Sun shine hours (h/day)	Wind velocity (km/h)	*S. incertulas*		*C. medinalis* LFDL (%)	*D. armigera* Damaged leaves (%)	*O. oryzae* Silver shoots (%)	*N. lugens* No./ hill	*S. furcifera* No./ hill	*L. acuta* No./ hill	*M. histrio* No./ hill
		Max.	Min.	Avg.	Morn.	Even.	Avg.				% DH	% WE							
29	July 20-22	33.6	25.2	29.4	80.7	59.3	70.0	56.0	9.3	5.0	7.8	0.0	0.4	7.9	0.0	0.0	0.0	0.0	0.0
30	July 27- Aug 1	32.8	25.9	29.4	91.0	89.0	90.0	48.0	8.0	3.0	8.1	0.0	0.6	8.2	0.0	0.0	0.0	0.0	0.0
31	Aug 2-7	32.7	26.3	29.5	76.0	66.0	71.0	0.0	10.0	5.0	5.2	0.0	0.4	12.8	0.0	0.0	0.0	0.0	0.0
32	Aug 8-11	33.7	26.4	30.1	70.3	61.3	65.8	8.0	10.5	4.0	14.4	0.0	0.0	7.3	0.0	0.0	0.0	0.0	0.0
33	Aug 16-18	33.0	24.4	28.7	90.3	66.0	78.2	190.8	7.7	2.3	10.2	0.0	0.3	8.5	0.0	0.0	0.0	0.0	0.0
34	Aug 22-25	31.5	24.8	28.2	94.5	79.0	86.8	105.5	8.0	1.8	6.4	0.0	0.0	9.7	0.0	0.0	0.0	0.0	0.0
35	Aug 29-31	31.4	25.1	28.3	86.7	73.3	80.0	18.2	9.7	4.0	7.9	0.7	0.8	6.3	0.0	0.0	0.0	5.0	0.0
36	Sept. 5-9	32.5	25.6	29.0	88.4	66.8	77.6	0.0	10.4	3.2	4.1	0.4	1.6	1.6	0.0	0.0	0.0	0.0	2.0
37	Sept.12-15	33.3	24.9	29.1	96.0	60.5	78.3	20.9	10.0	1.8	2.7	0.7	1.1	2.5	2.8	0.0	0.0	2.0	0.0
38	Sept.19-22	33.3	24.3	28.8	87.8	59.3	73.5	23.4	9.0	2.0	5.0	1.1	1.5	1.5	5.1	0.0	0.0	0.0	0.0
39	Sept. 25-29	34.4	24.2	29.3	87.8	59.2	73.5	10.7	9.4	2.0	1.9	2.2	1.1	1.0	10.3	0.0	0.0	0.0	0.0
40	Oct. 1-4	33.8	24.1	28.9	79.8	64.8	72.3	0.0	4.5	1.5	1.9	4.1	1.6	1.6	15.9	0.0	0.0	6.1	3.1
41	Oct. 10-15	33.3	24.3	28.8	94.5	77.2	85.8	1.5	9.0	1.2	1.3	2.0	1.3	1.2	11.4	0.0	0.0	6.2	3.9
42	Oct.17-20	32.3	21.7	27.0	73.0	62.0	67.5	0.0	9.0	1.3	0.6	1.7	2.7	2.3	11.6	16.4	6.5	8.9	3.8
43	Oct. 24-27	31.0	23.2	27.1	82.3	62.3	72.3	0.4	9.0	1.8	0.0	1.1	3.2	5.2	10.3	12.9	10.0	9.7	5.6
44	Oct. 31- Nov 4	30.7	22.1	26.4	95.0	69.4	82.2	0.0	8.8	2.0	1.4	0.0	1.5	3.0	6.9	16.8	10.3	8.8	6.6
45	Nov 11-17	32.5	17.5	25.0	68.0	41.0	54.5	0.0	9.0	1.0	0.0	5.4	5.0	2.0	8.7	23.0	7.0	10.2	7.8
46	Nov 18-23	30.8	16.8	23.8	86.0	50.0	68.0	1.4	9.0	1.0	0.0	0.4	2.7	2.6	2.1	0.0	0.0	0.0	4.5
47	Nov 24-28	31.4	19.0	25.2	86.0	52.0	69.0	0.0	9.0	2.0	0.0	0.5	2.3	1.3	1.6	0.0	0.0	0.0	0.0

Table 4: Correlation of insect populations with prevailing weather parameters

Insect Pest	Temperature (^{0}C)			Relative Humidity (%)			Rainfall (mm)	Sunshine (h/day)	Wind (km/h)
	Max.	Min.	Avg.	Morning	Evening	Avg.			
S. incertulas (DH)	0.34	0.67*	0.64*	-0.06	0.39	-0.22	0.53*	0.15	0.68*
S. incertulas (WE)	0.27	-0.4	-0.24	-0.42	-0.43	-0.48	-0.34	-0.40	-0.51*
C. medinalis	-0.34	-0.80**	-0.75**	-0.39	-0.64*	-0.60*	-0.48	-0.04	-0.60*
D. armigera	-0.05	0.49	0.38	-0.10	0.42	-0.22	0.50*	0.08	0.67*
O. oryzae	0.17	-0.26	-0.16	-0.18	-0.18	-0.20	-0.41	-0.47	-0.62*
N. lugens	-0.37	-0.51*	-0.42	-0.40	-0.35	-0.53*	-0.27	0.02	-0.39
S. furcifera	-0.50*	-0.38	-0.46	-0.22	-0.20	-0.24	-0.27	0.01	-0.34
L. acuta	-0.43	-0.62*	-0.38	-0.23	-0.33	-0.21	-0.41	-0.15	-0.56*
M. histrio	-0.31	-0.35	-0.64*	-0.26	-0.13	-0.33	-0.37	-0.20	-0.45

*Significant at p=0.05 **Significant at p=0.01.

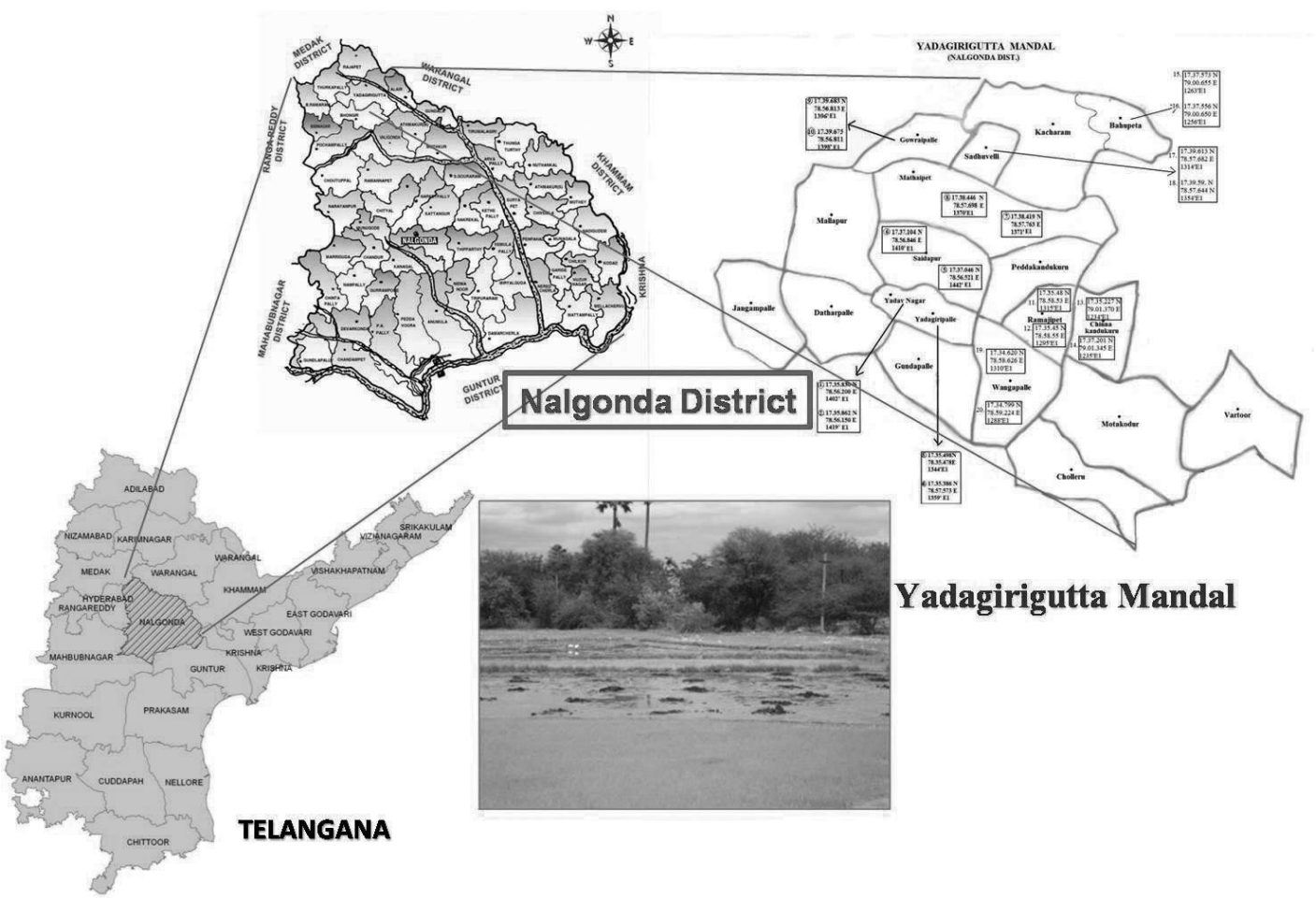

Figure 1: Overview of the fixed plots of Yadagirigutta mandal

Gall midge incidence was observed from September second week to November last week with peak incidence during the first week of October. Planthopper (BPH & WBPH) incidence was observed from October third week to November second week and the population decreased as the crop reached the harvesting stage. BPH showed a negative correlation with minimum temperature and average humidity (r=-0.51* & -0.53*) whereas, WBPH showed a negative correlation with maximum temperature (r=-0.50*). Similar results were observed by Vidyawati Garg, (2012). Varma *et al*. (2008) observed that among the weather parameters, rainfall in the preceding month had shown significant positive influence on BPH light trap catches.

The panicle pests, gundhi bug and stink bug initially appeared during August with peak incidence during November second week. Gundhi bug showed a significant negative correlation with minimum temperature (r=0.62*) and wind velocity (r=-0.56*) while stink bug showed a significant negative correlation with average temperature (r=-0.64*). Similar results were observed by Vidyawati Garg, (2012). Rao and Kulshreshtha, (1985) reported that high humidity, rainfall, diurnal fluctuations of temperatures during the milky stage of paddy encourage the infestation of gundhi bug.

YSB and hispa incidence is positively correlated with weather parameters while that of leaf folder, BPH, WBPH and panicle bug is negatively correlated with weather parameters.

ellow stem borer, Leaf folder, Hispa, ather parameteres ditions with no rain fall and sun shine hrs.infall 1.5 mm, sunshine hrs

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