



## Indian Journal of Hill Farming

June 2015, Volume 28, Issue 1, Page 69-72

# Effect of Weather Parameters on Population Buildup of Different Insect Pests of Rice and Their Natural Enemies

H. Kalita • R. K. Avasthe • K. Ramesh

ICAR Research Complex for NEH Region, Sikkim Centre, Tadong 737102.

### ARTICLE INFO

#### Article history:

Received 14 February 2015

Received Revised 16 May 2015

Accepted 20 June 2015

#### Key words:

Rice  
Insect Pests  
Population  
Weather

### ABSTRACT

The effect of weather parameters on population buildup of some major rice pests viz., stem borer, whorl maggot, leaf folder, and gundhi bug and their natural enemies viz., spiders, dragonfly/damselfly, lady bird beetle and Apanteles was studied by taking observations at fortnightly interval starting from second fortnight of July to first fortnight of November through fixed plot survey during kharif, 2007 and 2008 at ICAR Research Complex for NEH Region, Sikkim Centre, Tadong. It was observed from the study that the whorl maggot started the infestation at the initial stage of the crop and damaged maximum (22.25 -24.25 damaged leaves/10 hills) in the second fortnight of July. Stem borer infestation was found maximum during August-September (6.82-7.62% dead heart). They also attacked the rice crop at reproductive stage which resulted in white ear head. The maximum white ear head% was recorded in the second fortnight of October (7.56 % in 2007 and 8.14% in 2008). The leaf folder population was found maximum in the last part of August and first part of September (14.50 -16.75 damaged leaves/10 hills). Gundhi bug population was found maximum when the crop attained the milky stage in the first fortnight of October (14.80-16.40 gundhi bug/10 hills). Among the natural enemies the population of spiders, Apanteles and dragon flies was recorded during August and September but the lady bird beetle population was found maximum during the last fortnight of September. The correlation study revealed that the population build-up of different pests and their natural enemies was influenced by the weather parameters in both the years.

## 1. Introduction

The rice crop in Sikkim is prone to stress throughout the crop growth period due to onslaught from different insect pests such as stem borer, *Scirpophaga incertulas*; whorl maggot, *Hydrellia philippina*; leaf folder, *Cnephalocrocis medinalis*; and Gundhi bug, *Leptocoris orientalis*. On an average, the yield losses in the country due to insect pests in every year are around 30% (Prakash & Rao, 1998). In this context, the development of a suitable management strategy is utmost necessity for combating the menace of the rising insect pest populations.

Study on the population buildup of insect pests and their natural enemies and their relationship with weather parameters is an essential component of pest management as it generates information which can be utilized to improve cultural, mechanical, behavioural and chemical methods of insect control. With this knowledge even the time of crop sowing/planting can also be adjusted so as to avoid the coincidence of the peak insect population with the most susceptible stage(s) of the crop.

Besides, the weather parameters are known to have profound influence on the occurrence, growth and development and population build-up of insect pests in crop ecosystem and ultimately on the extent of damage to the crop and yield loss thereof. Information on the relationship of the prevalence and build-up of different insect pests and their natural enemies with the weather parameters is a prerequisite before formulating a location specific IPM module for management of these pests. Therefore, the present investigation was undertaken to study the population build-up of some major rice pests and their natural enemies and relationship with weather parameters.

## 2. Materials and methods

Around 600 sq m area was taken to study the population build-up of major insect pests of rice and their natural enemies. The total area was divided into four equal plots. The observations were taken at fortnightly interval. In case of stem borer 20 plants were selected randomly for recording of dead hearts along with total tillers from each plot. For leaf feeders like whorl maggot and leaf folder 10 plants were taken for counting of damaged leaves by these insects. The gundhi bug damaged grain was recorded from randomly collected 10 panicles from each plot.

Forty hills were observed randomly by walking diagonally to record the number of adult insects and predators' visually. The larval and pupal parasitoids were recorded by rearing larvae and pupae in the laboratory collecting from field (50 nos.). In case of stem borer 20 plants were selected randomly for recording of white ear head along with total panicles from each plot before harvesting.

## 3. Results and Discussion

The data on infestation of different insects, population of insects and natural enemies and their relationship with weather parameters are presented in Table 1 and 2. It was observed from the study that the whorl maggot started the infestation at the initial stage of the crop and damaged maximum (22.25 -24.25 damaged leaves/10 hills) in the second fortnight of July. The data showed that the stem borers a key group of insect pests damaging rice crop were abundant from July to November and they cause maximum damage to rice crop starting from August to October resulting in dead heart (6.82 – 7.62% in August-September) and white ear head (7.56 – 8.14 % in October) in both the years. It might be due to the favourable weather parameters (Table 2) and availability of rice plants in their preferred stages. This result corroborates the findings of Bora et al. (1995).

**Table 1.** Population buildup of insect pests of rice and their natural enemies during 2007 and 2008

Fortnights	Dead heart/WE (%)		Damaged leaves/10 hills			No. of insects/parasitized insects/predators/ 10 hills													
	2007	2008	Leaf folder	Whorl maggot		Stem borers		Gundhi bug		Spiders		Coccinellids		Apanteles			Dragon fly		
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	
<b>July-II</b>	2.08	2.48	5.5	3.5	24.3	22.3	0.80	0.60	0.00	0.00	1.0	1.2	0.0	0.0	0.0	0.0	0.4	0.6	
<b>Aug-I</b>	4.54	4.16	12.8	12.3	20.5	17.75	1.80	1.60	0.00	0.00	1.6	2.0	0.0	0.0	0.2	0.4	0.6	0.8	
<b>Aug-II</b>	7.62	6.56	14.5	16.8	14.8	12.50	1.60	1.40	0.00	0.00	2.0	2.6	2.0	2.2	1.0	1.2	1.0	1.4	
<b>Sept-I</b>	7.14	6.82	11.3	14.5	8.3	6.50	1.20	1.20	4.20	3.60	2.2	2.8	5.4	6.6	0.8	0.8	1.4	1.2	
<b>Sept-II</b>	5.86	6.12	8.0	8.0	3.8	2.75	0.80	0.80	13.60	10.40	1.6	1.8	10.6	12.4	0.4	0.6	1.2	.80	
<b>Oct-I</b>	5.24	5.36	4.3	4.3	0.0	0.00	0.40	0.60	16.40	14.80	0.6	0.8	7.4	8.6	0.2	0.4	0.4	0.6	
<b>Oct-II</b>	7.56	8.14	2.0	2.0	0.0	0.00	0.00	0.00	10.50	8.20	0.0	0.0	2.2	2.8	0.0	0.0	0.0	0.2	
<b>Nov-I</b>	6.32	6.74	0.0	0.0	0.0	0.00	0.00	0.00	2.00	2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

- Damaged leaves from 4 plots; No. of insects from 40 hills.

**Table 2.** Correlation between population of insect pests and natural enemies with weather parameters

Weather parameters/ Insect population and natural enemies	Temperature°C				Relative humidity (%)				Total rainfall(mm)		BSSH	
	Maximum		Minimum		Maximum		Minimum		2007	2008	2007	2008
	2007	2008	2007	2008	2007	2008	2007	2008				
<b>Stem borers</b>	0.742* R <sup>2</sup> =0.55	0.664* R <sup>2</sup> =0.44	0.049 R <sup>2</sup> =0.00	0.015 R <sup>2</sup> =0.00	0.023 R <sup>2</sup> =0.00	0.007 R <sup>2</sup> =0.00	0.012 R <sup>2</sup> =0.00	0.013 R <sup>2</sup> =0.00	0.131 R <sup>2</sup> =0.017	0.296 R <sup>2</sup> =0.087	-0.104 R <sup>2</sup> =0.01	-0.028 R <sup>2</sup> =0.00
<b>Whorl maggot</b>	0.642* R <sup>2</sup> =0.41	0.688* R <sup>2</sup> =0.47	0.671* R <sup>2</sup> =0.45	0.768** R <sup>2</sup> =0.59	0.561 R <sup>2</sup> =0.31	0.328 R <sup>2</sup> =0.11	0.601 R <sup>2</sup> =0.36	0.521 R <sup>2</sup> =0.27	0.649* R <sup>2</sup> =0.42	0.696* R <sup>2</sup> =0.48	-0.601 R <sup>2</sup> =0.36	-0.561 R <sup>2</sup> =0.31
<b>Leaf folder</b>	0.268 R <sup>2</sup> =0.07	0.237 R <sup>2</sup> =0.06	0.744* R <sup>2</sup> =0.55	0.753* R <sup>2</sup> =0.57	0.659* R <sup>2</sup> =0.43	0.744* R <sup>2</sup> =0.55	0.723* R <sup>2</sup> =0.52	0.793** R <sup>2</sup> =0.63	0.651* R <sup>2</sup> =0.42	0.685* R <sup>2</sup> =0.47	-0.460 R <sup>2</sup> =0.21	-0.569 R <sup>2</sup> =0.32
<b>Gundhi bug</b>	0.069 R <sup>2</sup> =0.00	-0.133 R <sup>2</sup> =0.017	-0.149 R <sup>2</sup> =0.02	-0.421 R <sup>2</sup> =0.177	-0.381 R <sup>2</sup> =0.145	0.117 R <sup>2</sup> =0.01	-0.348 R <sup>2</sup> =0.12	-0.115 R <sup>2</sup> =0.01	-0.018 R <sup>2</sup> =0.00	-0.308 R <sup>2</sup> =0.094	0.353 R <sup>2</sup> =0.12	-0.007 R <sup>2</sup> =0.00
<b>Spiders</b>	0.287 R <sup>2</sup> =0.087	0.257 R <sup>2</sup> =0.07	0.725* R <sup>2</sup> =0.53	0.825** R <sup>2</sup> =0.68	0.634* R <sup>2</sup> =0.40	0.799** R <sup>2</sup> =0.64	0.690* R <sup>2</sup> =0.48	0.873** R <sup>2</sup> =0.76	0.658* R <sup>2</sup> =0.43	0.854** R <sup>2</sup> =0.729	-0.637* R <sup>2</sup> =0.405	-0.763** R <sup>2</sup> =0.582
<b>Dragonfly/damselfly</b>	0.278 R <sup>2</sup> =0.08	0.326 R <sup>2</sup> =0.11	0.641* R <sup>2</sup> =0.41	0.790** R <sup>2</sup> =0.62	0.331 R <sup>2</sup> =0.11	0.766** R <sup>2</sup> =0.59	0.532 R <sup>2</sup> =0.28	0.571 R <sup>2</sup> =0.33	0.671* R <sup>2</sup> =0.45	0.790** R <sup>2</sup> =0.63	-0.290 R <sup>2</sup> =0.09	-0.595 R <sup>2</sup> =0.35
<b>Lady bird beetle</b>	0.138 R <sup>2</sup> =0.02	-0.101 R <sup>2</sup> =0.01	0.139 R <sup>2</sup> =0.02	0.000 R <sup>2</sup> =0.00	-0.117 R <sup>2</sup> =0.01	0.473 R <sup>2</sup> =0.22	0.013 R <sup>2</sup> =0.000	0.273 R <sup>2</sup> =0.07	0.414 R <sup>2</sup> =0.17	0.163 R <sup>2</sup> =0.03	0.083 R <sup>2</sup> =0.006	-0.320 R <sup>2</sup> =0.10
<b>Apanteles</b>	0.503 R <sup>2</sup> =0.03	0.566 R <sup>2</sup> =0.31	0.114 R <sup>2</sup> =0.01	0.185 R <sup>2</sup> =0.03	0.562 R <sup>2</sup> =0.31	0.087 R <sup>2</sup> =0.01	0.573 R <sup>2</sup> =0.32	0.086 R <sup>2</sup> =0.01	0.557 R <sup>2</sup> =0.31	0.190 R <sup>2</sup> =0.04	0.586 R <sup>2</sup> =0.34	0.555 R <sup>2</sup> =0.31

\* Significant at p=0.05, \*\* Significant at p=0.01

The leaf folder population was found maximum in the last part of August and first part of September (14.50 -16.75 damaged leaves/10 hills). This might be attributed to the influence of weather parameters and coincidence of late tillering/reproductive stage of the crop. The similar observation was reported by the earlier workers like Kushwaha (1998), Mishras et al., (1999) and Khan et al., (2004). Gundhi bug population was found maximum in the first fortnight of October (14.80-16.40 gundhi bug/10 hills).

The per cent of damaged grain of Gundhi bug was recorded maximum in the second fortnight of October (12.86%). This might be attributed to the coincidence of milky stage of the rice crop in this period.

Among the natural enemies the population of different species of spiders viz., wolf spiders (*Lycosa sp*), lynx spiders (*Oxyopes sp*), dwarf spiders (*Atypena sp*), orb spiders (*Argiope sp*) and long-jawed spider (*Tetragnatha sp*) (2.0 – 2.8 spiders/10 hills), dragonfly (*Anax sp*) and damselfly (1.0 – 1.4 /10 hills) are most common and potential natural enemies in the months August and September but the lady beetles (*Micraspis sp*) (7.4 – 12.4/ 10 hills) population is found maximum during the last fortnight of September. The natural parasitism of *Apanteles flavipes* was found very less. The correlation study revealed that the population build-up of different pests and their natural enemies was influenced by the weather parameters in both the years.

*Relationship of insect population with temperature (maximum & minimum)*

The correlation study revealed that the maximum temperature has significant effect on population of whorl maggot and stem borers but the minimum temperature showed significant effect on the population build-up of pests like whorl maggot and leaf folder and natural enemies like spiders and dragonfly/damselfly (Table 2).

*Relationship with relative humidity (maximum & minimum)*

Except gundhi bug and lady bird beetle the population of all insects and natural enemies was influenced positively by the relative humidity (maximum & minimum) in both the years but it has significant effect on the population of leaf folder and spiders (Table 2).

*Relationship with total rainfall*

The total rainfall also exhibited marked effect on the multiplication of insect populations and population of natural enemies. The results revealed that in both the years the population of insect pests' viz., whorl maggot and leaf folder and natural enemies like spiders and dragonfly/damselfly showed the significant positive relationship with total rainfall.

Over all, the Bright Sun Shine Hours has significant effect on the population buildup of spiders only.

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