International Journal of Research in Agricultural Sciences
Volume 5, Issue 4, ISSN (Online): 2348 – 3997

Effects of Various Weather Factors in Seasonal Variation of Insects Pest in Rice in Sundar Bazar, Lamjung

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Date of publication (dd/mm/yyyy): 01/08/2018

Abstract **– Rice (Oryza sativa L.) which is one of the major staple crops of world is affected by wide range of insect pest during its growing period. This research was conducted to study the effects of various weather factors in insect pest incidence on kharif season rice (US hybrid 312) in Lamjung Campus. A fixed plot survey was carried out during 22nd of July to 24th of October 2017 on which major insect pest were observed in 20 hills of rice in 332 m². The study revealed that Rice hispa, white spotted leaf beetle (Monolepta signata) and gundhy bug as a widely distributed insect-pest in rice. Rice hispa showed positive correlation with minimum temperature (r = 0.155) and average relative humidity (r = 0.285). Whereas, white spotted dotted leaf beetle got negative correlation with all weather parameters i.e. (temperature, rainfall and (RH) relative humidity). Similarly, it was found that gundhy bug has significant but negative correlation with minimum temperature (r = -0.600), maximum RH (r = -0.590), minimum RH (r = -0.612), average RH (r = -0.581). Pest forecasting, assessing efficacy of pest, regular monitoring and seemly pest management strategy could be the best option to cope incidence of pest under different weather factors.**

Keywords **– Fixed Plot Survey, Gundhi Bug, Monitoring, Pest Forecasting.**

I. INTRODUCTION

Rice (Oryza sativa L.) is one of the major staple food crops for more than half of the world's population and being grown worldwide (Aggarwal et.al. 2006). Warm and humid environment is essential for rice cultivation, also conducive to the survival and proliferation of insects. Rice is equally damaged by different types of insect pest right from the field to the storage. General surveillance and pest risk analysis of rice pests conducted in Nepal revealed 158 rice pests in pre and postharvest rice commodity (Joshi 2005 and Joshi 2013). Estimated average rice production losses in Nepal due to stem borers, leaffolder, brown plant hopper, green leaf hopper seed bug and rice hispa respectively, are 110,42,34,41,20 and 89 kg/ha (Ramasamy and Jatileksono 1996) and the extent of losses in India alone has been estimated to be 17.5% (Dhaliwal *et al.,* 2010).

Economic damage in the vegetative phase is caused by both lepidopterous and dipterous stemborers. The most important species are rice hispa (*Dicladispa armigera*), brown plant hopper (Nilaparvata *lugens*), armyworm (*Mythimna separate*), leaf folder (*Cnaphalocrocis medinalis*), yellow stem borer (*Scirpophaga incertula*) and in the reproductive phase; green stink bug *(Nezara viridula*), rice gundhy bug (*Leptocorisa oratorius*) are the most destructive insects which cause damage by sucking cell sap.

Increased temperatures can potentially affect insect survival, development, geographic range, and population size, population dynamics and species distribution. Temperature can impact insect physiology and development directly or indirectly through the physiology or existence of hosts. (Bale et al 2002). For developing weather based pest forecasting, the information on the relationship between the incidence of insect pests and weather factors is needed. Kisimoto and Dyck (1976) stated that climatic factors are responsible for causing certain biological events. Therefore, it is necessary to gain a thorough knowledge on relation of weather parameters to insects (Entomo-climatology) which will be very useful to farmers in all areas where major insect pests are appearing year after year and causing serious damage to crops. So, the aim of this work is to study, the seasonal abundance and to correlate the important weather factors viz, temperature, relative humidity and rainfall with the pest population so as to estimate the role of weather and to make an effort to assess abundance of rice insect-pest in western mid-hills of Nepal.

II. MATERIALS AND METHODS

The research was conducted in Sundar bazaar municipality of Lamjung district. Sundar bazaar lies longitude of 84°25'-84°42'E and latitude of 28°08'-28°13'N. Study area lies at an altitude of 720 meter average sea level with subtropical climate having annual mean minimum temperature of 7.3^{0}C in January and annual mean maximum 31.2^{0}C in June with annual mean precipitation of 2913.8 mm.

The experiment was conducted during the kharif, 2017, at Research Farm in Institute of Agricultural and Animal Science, Sundar Bazar, Lamjung. The variety 'US hybrid-312' under supervision was sown for the study. Later the seedlings of sufficient age were transplanted to main field with normal spacing followed at farmer condition and all the agronomical practices viz. irrigation, fertilizer application and intercultural operations were performed as per recommendation for rice crop in the area. Pesticides were not applied throughout the crop period to get a natural pest incidence on the crop.

Seasonal incidence of insect pests on rice was studied on a farmer's plot of 332 m². The pest population was recorded on the basis of fixed plot survey format from the plot at 7 days interval from 21 DAT, then the occurrence of pest infestation was observed and was continued up to maturity. The incidence of pests was recorded on 20 randomly selected hills based on in-situ counts, in case of each plot. Weather data was also recorded simultaneously from the

meteorological observatory available at the Agricultural Research farm, Lamjung campus, Lamjung, to work out relationship between the occurrence of insect pests and weather parameters. Temperature and humidity was recorded by the thermo-hygro digital instruments and rainfall was recorded by the rain gauze installed in the periphery of Research Farm. The influence of weather factors on population density of Dicladispa armigera, Monolepta signata and Leptocorisa oratorius was performed using statistical software version SPSS 16.

III. Result and Discussion

Population Dynamics of Insect Pest of Rice :

The results indicated that the incidence of insect pest gradually increases from the tillering stage to late vegetative stage and found to be highest during second week of August and then gradually decreases to ripening stage which is shown in Fig. 1. Observation revealed that early growth stage of the plant rather than the late growth stage were adversely affected by the pest. The incidence of rice hispa (*Dicladispa armigera*) was observed from last week of July to mid of August and was found to be absent in September. This findings were found contrary to Rawat and Singh (1980) who reported the incidence of rice hispa till September and Choudhary et al. (2001) have reported that rice hispa remain active in paddy till to the second week of November. Similarly contradict result was found in the observation of Deka et al. (1999) and Raman et al. (2001) which have found maximum population abundance of rice hispa in the month of September. Incidence of rice hispa in the present findings corroborates to the observation of that of Sontakke et al. (1998) from the Eastern part of Orrisa have reported that population reaches maximum at about 33 SMW i.e. July to August. No population of gundhi bugs were noted up to July then detectable population of gundhi bugs were gradually increased and attains the maximum mid of October as shown in Fig 2. Bhattacharjee and Ray (2009) who reported maximum population levels and heavy infestation of gundhi bug in September-October in rice in Barak valley of Assam. Similar results were found with Girish et al. (2012) observed gundhi bug population appeared during reproductive phase of the crop. Shitiri et al. (2014) reported the incidence of ear head bug was observed from 60 days after transplanting till harvest. Sulagitti et al. (2017) reported gundhi bug was first observed during 2nd week of September and its activity gained peak during the third week of September and reached highest level during 4th week of October. Similar pattern of incidence was observed by Kalita et al. (2015) and Pathak (1977) had observed gundhi bug population was found maximum when the crop attained the milky stage.

Relationship of Insect Population with Cardinal Temperature

Increase in minimum temperature was seen to decrease incidence of gundhi bug (*Leptocorisa oratorius)* (r = -0.600) while gundhy bug incidence was found to be insignificant with maximum temperature. The correlation study revealed that the maximum temperature had positive correlation with appearance and population build up of rice hispa and gundhy bug. While minimum temperature showed negative correlation with white spotted leaf beetle (*Monolepta signata*) (r = -0.580), rice hispa (r = -0.638). Similarly significant but negative correlation was found in case of gundhi bug (-0.600) the result is in accordance to report of Bhatnager and Saxena (1999) who reported that minimum temperature played an important role in the population buildup of green leafhopper and rice gundhi bug, besides evening relative humidity and rainfall. Present result of effect of weather parameters on rice hispa was also supported by the findings of Dutta et al. (2003) and Dhahwal et al. (1978) from Punjab have reported that minimum temperature and rain fall had insignificant effect of rice hispa population which partly matches with present observation. As in our study none of the weather parameters found to have significant effect in rice hispa population.

Table 1. Showing correlation coefficient of *Monolepta signata, Dicladispa armigera and Letptocorisa oratorius.*

Insects	*Monolepta signata*	*Dicladispa armigera*	*Leptocorisa oratorius*
Weather factors(x)	Correlation coefficient (r)	Correlation coefficient (r)	Correlation coefficient (r)
Max. Temp.	-0.132 NS	0.155 NS	0.146 NS
Min. Temp.	-0.580 NS	-0.638 NS	-0.600 *
Av. Temp.	-0.671 NS	-0.300 NS	-0.217 NS
Max. R.H	-0.250 NS	0.274 NS	-0590 *
Min. R.H	-0.289 NS	0.299 NS	-0.612*
Av. R.H	-0.268 NS	0.285 NS	-0.581*
Av. Rainfall (mm)	-0.201 NS	-0.818 NS	0.056 NS

* Significant at 5 % level, NS = Non – significant

Relationship with Relative Humidity

One of the major pest of rice, gundhi bug showed significant but negatively correlated with max. relative humidity (r = -0.590), min relative humidity (r = -0.612) and av. mean humidity (r = -0.581) and rice hispa showed positive non-significant effect in population build up. Upadhyay and Sharma (2004) reported that rainfall and relative humidity played a significant role in the population buildup of yellow stem borer but in case of gundhi bug, no meteorological variables were found to be significant which was contrast with our finding. The incidence of rice hispa on crop was positively correlated with maximum temperature, relative humidity and rainfall and negatively related with sunshine hours reported by Devendra *et al.,* (2018), Islam et al (2004) and Karim (1986) have commented that high humidity imparts positive impact on

population development which was not supported by our finding as rice hispa found to be insignificant with all weather parameters.

Relationship with Average Rainfall (mm)

Among the different insects found in rice field during research, gundhy bug, rice hispa and white spotted leaf beetle (*Monolepta singnata*) showed positive non-significant correlation relationship with av. rainfall. Sharma *et al.* (2004) reported that no other factor except rainfall had positive correlation in the population buildup of rice gundhi bug which doesn't correlates with our research findings. Upadhyay and Sharma (2004) used principal component analysis and reported that rainfall and relative humidity played a significant role in the population buildup of yellow stem borer but in case of rice gundhi bug, no weather variables were found to be significant. But in our study except humidity none of the weather parameters found to be shown significant effect.

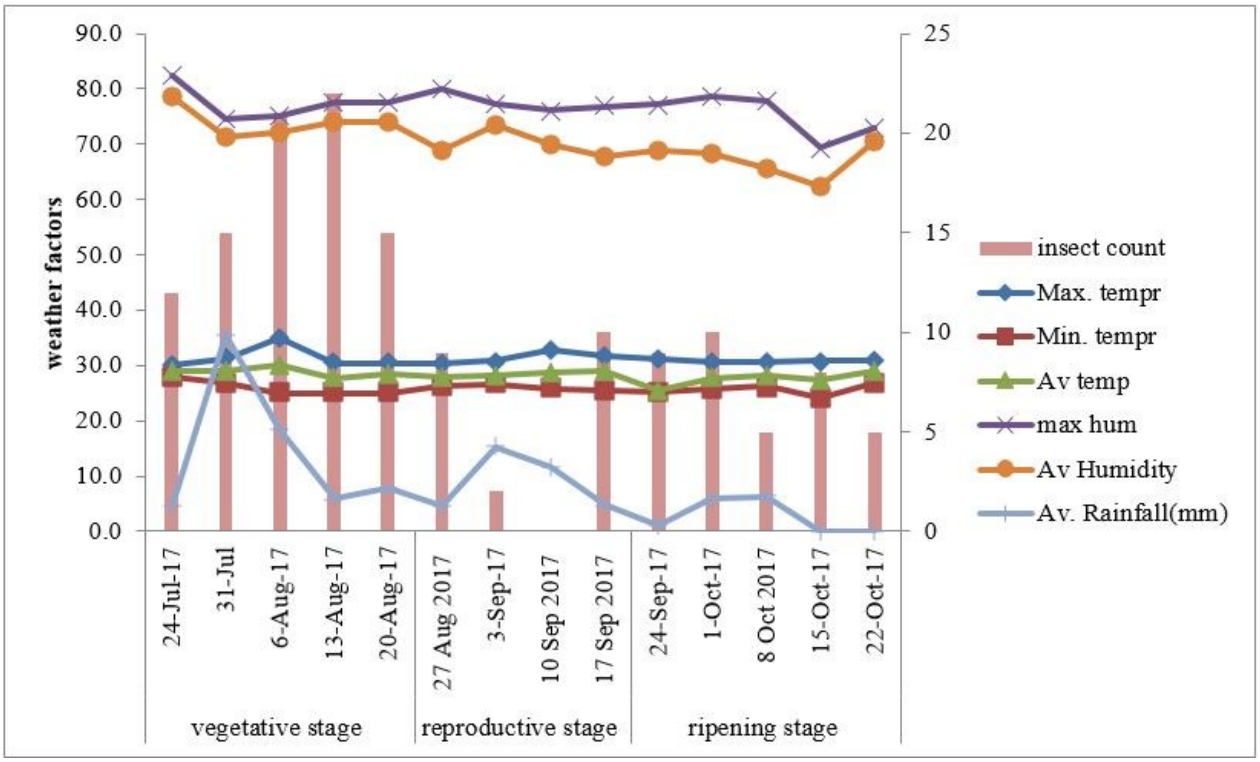

Fig. 1. Weather variables during crop growth stages and insect pest count, 2017.

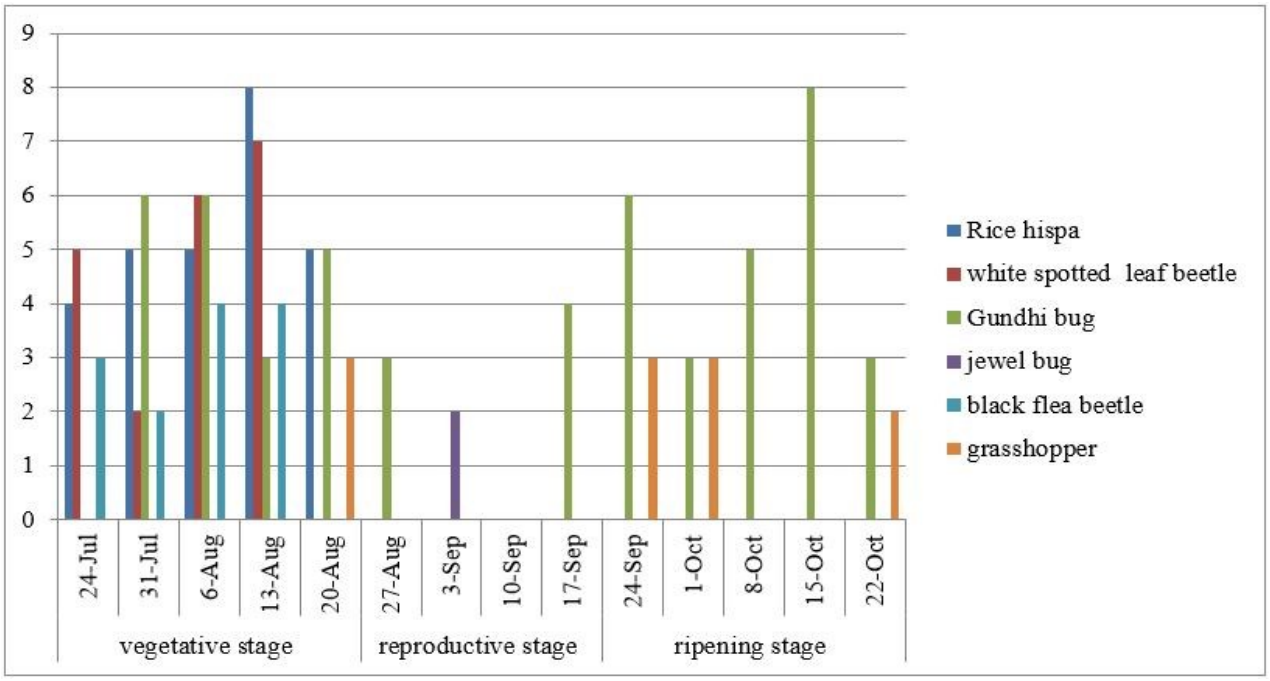

Fig. 2. Black flea beetle, jewel bug, grasshopper, gundhi bug, rice hispa and white spotted leaf beetle incidence in different growth stages of rice (US hybrid 312), 2017.

IV. Conclusion

The seasonal incidence of rice hispa, gundi bug and white spotted leaf beetle was studied for the year 2017, which revealed that the infestation of gundi bug started from the tillering stage till ripening stage and found to be significant but negative correlation with maximum relative humidity, minimum relative humidity and average relative humidity and minimum temperature. The result revealed that the not only weather parameters favors the incidence of insect pest but also crop growth stages have a significant effect in population build up of insect pest. Finally this research concludes that the gundhi bug as a major pest of western mid hill of Lamjung. These findings could be helpful for proper and timely management and pest forecasting in relation with weather parameter as these parameters have compound effect that govern the pest incidence.

Acknowledgement

I am highly thankful to Head, Department of Entomology, and the Chief of Lamjung campus and colleagues for the necessary facilities and encouragement during course of present investigation.

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