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Abiotic influences on the seasonal incidence of green leafhopper *Nephotettix virescens* distant in rice *Oryza sativa* L.

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Abstract
The study was conducted in Field No. 42 of the Students' Instructional Farm (SIF) under the Department of Agronomy, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, during the kharif season of 2019.The farm is situated at left side of the Grant truck road about one kilo meter away from the campus in gangetic plain of Utter Pradesh. The experiment was laid out in a Randomized Block Design (RBD) with six treatments and three replications. Each plot measured 4 × 4 meters, with a 1-meter spacing maintained between plots and between replications.Six insecticides were taken during trail, like are Chlorpyriphose 20EC, imidaclopride 17.8SC, Fipronil 5% SC, Dipel Bt, Quinalphose 25 EC and *neem oil*. Their common name, chemical name and sources from which they were obtained are given in table-1. The GLH population was observed during fourth week of July i.e. 24 day after transplanting and its reached peak level during first week of (20 t0 26) August at 34 standered week. The correlation (table 2) revealed that GLH population showed non significant positive correlation with morning RH (r 0.3172) and evening RH (r 0.3073), non significant negative correlation with maximum temperature (r-0.1302), and non significant positive correlation with minimum temperature (r 0.3888), evaporation (r-0.4361) further a non significant negative correlation was observed. The BSS (r-0.1708) show non significant negative correlation and positive non significant correlation with rainfall (0.1611) was observed with studied insect population.

Keywords: Insect pests, seasonal incidence, abiotic factors, Kanpur, temperature, correlation

Introduction

Rice (*Oryza sativa*L.), a member of the family *Gramineae* (Poaceae), is believed to have evolved around 130 million years ago. It is one of the most important staple foods, sustaining billions of people worldwide. Among cereals, rice is considered the oldest domesticated crop, cultivated for nearly 10,000 years, and has evolved alongside human civilization under diverse and often harsh environmental conditions. Archaeological excavations at Hastinapur, India, have revealed paddy grains dating back to around 1000-750 B.C., which are regarded as some of the oldest known rice samples in the world. Although *Oryza sativa* is not strictly a tropical species, it thrives best in warm and humid climates (Ganesh *et al.*, 2007) [5]. Rice (*Oryza sativa* L.) is regarded as a first cultivated crop of Asia. Preserved rice grains were found in China around 3000 B.C. Paddy grains found during excavation at Hastinapur (India) around 1000-750 B.C. considered as an oldest sample in the world. (Anonymous 2009) [2]. Rice (*Oryza sativa* L.) is the central to the lives of billions of people around the world. Rice (2n = 24) belonging to the family, *Poaceae* and subfamily, *Oryzoidea* is the world's most important cereal crop and serves as the primary source of staple food. It has one of the largest germplasm collections in the world. Human selection and adaptation to diverse environments have created a large number of cultivars and it is estimated that about 1,20,000 varieties of rice exist in the world. (Khush, 1997) [3] Rice serves as the staple diet for over 65% of India's population and contributes nearly 46.6% to the nation's total food grain output, making it crucial for ensuring food and nutritional security (Pathak *et al.*, 2018) [6]. India has the world's largest rice-cultivated area, covering around 44.6 million hectares — about 28% of the global rice-growing area — and stands second only to China in total production. India contributes approximately 22.1% of the total global production (Anonymous, 2018) [1] in

2019, rice in India was cultivated on around 44 million hectares of land. The country's rice output during 2018-19 reached about 116.48 million tones, which was 3.72 million tonnes more than the previous record of 112.75 million tones achieved in 2017-18 (as reported in 2018-19). Uttar Pradesh is the second largest rice producing state with almost 5.86 million hectare land under rice cultivation producing about 12.5 million tonnes of rice during 2018. (Anonymous 2018) [1]

Rice crop is highly sensitive for several insect pests Rice gundhi bug, *Leptocorisa acuta* (Thunb) is an important pest of rice. The rice bugs both nymphs and adults causes damage by feeding on the sap of milky grain and turns them chaffy. The rice gundhi bug is recognized as a major pest affecting rice crops across India. Adult insects are slim, with a brownish-green coloration, and range from about 16 to 19 mm in length. Young nymphs appear pale with noticeably long antennae, while mature nymphs, measuring between 1.8 and 6.2 mm, exhibit a yellowish-green hue. The pest lays oval, shiny, reddish-brown eggs in clusters of 10-20, typically arranged in one to three rows along the midrib on the upper side of rice leaves. Severe infestations by this pest can cause yield losses of up to 30%. (Tiwari *et al.*, 2014) [4].

Material and Methods

The experiment was laid out in a Randomized Block Design (RBD) consisting of six treatments with three replications. Each plot measured 4 × 4 meters, with a spacing of 1 meter maintained between individual plots and replications.

Crop: Rice
Variety: Saket 4
Design: Randomized Block Design (RBD)
Replication: 3
Treatment: 7
Transplanting: 11 June 2019
Spacing: 20 x 15 cm
Plot size: 4 x 4 cm

3.2 Selection of insecticidal material:

Six insecticides—Chlorpyriphos 20EC, Imidacloprid 17.8SC, Fipronil 5% SC, Dipel Bt, Quinalphos 25EC, and Neem oil—were used in the experiment. The details regarding their common names, chemical compositions, and respective sources are presented in Table 1.

Green Leaf hopper, *Nephotettix virescens* Distant

The nymph and adult population of green leafhoppers were observed by net sweeping @ ten times per plot as per suggested by (Dyck and Pathak, 1974) one day before spray and 5,15 and 25 days after spray at a particular time of interval.

Observations of insect-pests of rice from transplanting to harvesting

The observations on rice gundhi bug and green leaf hopper were made in standing crop per 10 hills. Data was recorded on the hills by counting the adult and larvae population of gundhi bug and green leaf hopper.

Green leaf hopper

The number of motile (adult and nymph) stage on all the 10 hill was recorded. The total count average and expressed in per 10 hills basis.

Collection of data

First spray

5 days after spray: 22 July 2019
15 days after spray: 1 August 2019
25 days after spray: 11 August 2019

Second spray

5 days after spray: 23 August 2019
15 days after spray: 2 September 2019
25 days after spray: 12 September 2019

Statistical analysis

All the data, except yield were transformed into X + 0.5, subjected to the statistical analysis and critical difference between the mortality of different intervals was calculated. The mean of original data was calculated as percentage reduction over control with the following formula.

$$\text{Percentage reduction} = \frac{C\text{-}T}{C} \times 100$$

Where,
C = population of control
T = population of treated plots.

Results and Discussion

The incidence of *Nephotetettix virescens* Distant on rice crop was recorded as number of insect (adult and nymphs) per 10 hills. The insect population was recorded during the 27th standard week, corresponding to the tillering stage of the crop, with an average of 1.5 insects per 10 hills. The maximum and minimum temperature was 33.7 °C and 26.1 °C, respectively while morning and evening RH was 85.8 and 69 per cent, respectively, and BSS/hr was 4.6`. The population was gradually increased at 29th standard week as 7.45 insects per 10 hills and the temperature (maximum and minimum) prevailed at that time was 35.3 °C and 26.3 °C, respectively, while morning and evening RH was recorded to the tune of 80 and 59 per cent, respectively. However, when the panicle emerged the population gradually reached as 13.7 insects per 10 hills during 32nd standard week, the corresponding maximum and minimum temperatures were 37.7 °C and 26.1 °C, respectively, while morning and evening RH was 84 and 66 per cent, respectively. The green leaf hopper population reached maximum at 34th standard week i.e. 16.05per 10 hills and the weather phenomenon like maximum and minimum temperature were recorded i.e. 31.5 °C and 24.8 °C, respectively, the morning and evening RH were 93 and 75 per cent, respectively and rainfall during the period was recorded in terms of 148.9mm. The insect population began to decrease from the 35th standard week, with 11.33 insects per 10 hills, eventually reaching zero insects per 10 hills by the 40th standard week (Table 2, Fig. 1). These findings are consistent with the observations of Madhukar *et al.* (2014) [7], who reported that leafhopper populations appeared from the first week of September (36th SMW) and gradually increased, peaking in the first week of October (40th SMW). Similar trends were also noted by Nirala *et al.* (2015) [7]

Table 1: Influence of abiotic factors on seasonal incidence of various insect pest on paddy (Kharif 2019)

Week	Periods (2019)	Green Leaf hopper	Temperature (°C)		Total Rainfall (ml)	R.H. (%)		Evaporation (mm/day)	B.S.S.(hr)
			Max	Min		Mor	Eve		
24	11-17 Jun	0	39.9	27.8	0.6	58.4	35	7.6	7.9
25	18-24 Jun	0	36.1	25	2	74.7	50	7.6	4.7
26	25Jun—O1July	0	40.7	27.3	32.6	70	43	7.6	6.4
27	02-08 July	1.5	33.7	26.1	134.4	85.8	69	7.5	4.6
28	09-15 July	3.4	33.7	26.1	93.2	84	68	4.4	6.6
29	16-22July	7.45	35.3	26.3	12.4	80	59	4.3	6.4
30	23-29July	11.35	32.1	26	101.4	90	77	4.3	2
31	30July-05 August	12.45	34.1	26.9	28.8	86	67	4.2	6.1
32	06-12August	13.7	37.7	26.1	15.4	84	66	4.2	4.2
33	13-19 August	14.25	33.2	25.9	38.8	85	75	4	4.2
34	20-26 August	16.05	31.5	24.8	148.9	93	75	4	0.2
35	27 Agust-02 Sep	11.33	34.4	26.4	40	85	69	4	7.3
36	03-09 Sep	5.1	34	27.1	3.2	86	64	3.9	6.5
37	10-16 Sep	1.33	32.2	26.2	35.3	89	78	3.8	4.2
38	17-23 Sep	0	29.3	24.1	20.4	89	86	3.8	1.3
39	24-30Sep	0	27.7	23.1	136.2	95	85	3.7	0.4
40	01-oct-07oct	0	31.1	22.3	23.6	89	63	3.6	6.5

Table 2: Correlation coefficient of insect pest population on rice with prevailing weather parameters during *kharif* 2019

	Weather Parameter						
Insect Pest	Temperature (°C)		Rainfall (mm)	RH (%)		Evaporation	BSS (hours)
	Max	Mini		Morning	Evening		
Green leaf hopper	-0.1302	0.3888	0.1611	0.3172	0.3073	-0.4361	-0.1708

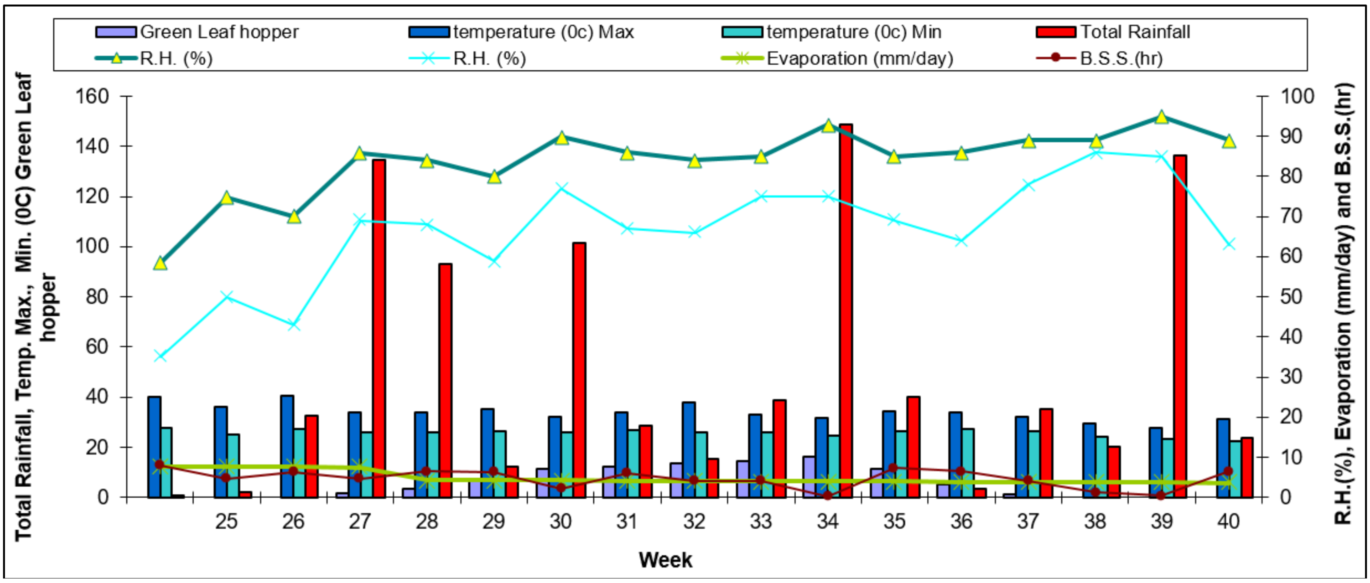

Fig 1: Influence of abiotic factors on seasonal incidence of Green leaf hopper on paddy (Kharif 2019)

The correlation (table 2) revealed that GLH population showed non significant positive correlation with morning RH (r 0.3172) and evening RH (r 0.3073)., non significant negative correlation with maximum temperature (r-0.1302), and non significant positive correlation with minimum temperature (r 0.3888), evaporation (r-0.4361) further a non significant negative correlation was observed. The BSS (r-0.1708) show non significant negative correlation and positive non significant correlation with rainfall (0.1611) was observed with studied insect population M. Shimim (2009) observed the activity of Green leaf hopper attained peak population during 43rd standard meteorological week.

The correlation analysis indicated that pest population had a significant positive association with minimum temperature and a significant negative association with evaporation. Other factors, including maximum temperature, rainfall, morning and evening relative humidity, and bright sunshine hours (BSS), did not show any significant correlation. These findings are largely consistent with the observations of Chaudhary *et al.* (2014), who reported a positive correlation with temperature, and Khan and Misra (2003), who found positive associations with relative humidity, temperature, and sunshine.

Conclusion

The GLH population was observed during fourth week of July i.e. 24 day after transplanting and its reached peak level during first week of (20 t0 26) August at 34 standered week.

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