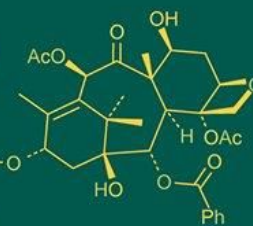
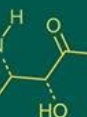
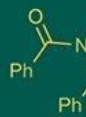


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Revendra Kushwaha
Department of Plant
Pathology, College of
Agriculture, JNKVV,
Jabalpur, Madhya Pradesh
India

Pramod Kumar Gupta
Directorate of Extension
Services, JNKVV, Jabalpur,
Madhya Pradesh India

Shraddha Karcho
Assistant Professor,
Department of Plant
Pathology, College of
Agriculture, JNKVV, Madhya
Pradesh India

Yogesh Kumar
Department of Plant
Pathology, College of
Agriculture, RVSKVV,
Gwalior, Madhya Pradesh
India

Harshit Sharma
Department of Plant
Pathology, College of
Agriculture, JNKVV, Jabalpur
Madhya Pradesh India

Kuldeep
Department of Plant
Pathology, College of
Agriculture, JNKVV, Jabalpur
Madhya Pradesh India

Sanjeet Ojha
Department of Plant
Pathology, College of
Agriculture, JNKVV,
Jabalpur, Madhya Pradesh
India

Corresponding Author:
Shraddha Karcho
Assistant Professor,
Department of Plant
Pathology, College of
Agriculture, JNKVV, Madhya
Pradesh India

Influence the weather parameters on sheath blight disease of rice

Revendra Kushwaha, Pramod Kumar Gupta, Shraddha Karcho, Yogesh Kumar, Harshit Sharma, Kuldeep and Sanjeet Ojha

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Abstract

The progress of sheath blight disease in rice in relation to different weather parameters was studied during two *Kharif* seasons (2023 and 2024) under field conditions using the susceptible rice variety 'Kranti'. Correlation analysis between weather variables and present disease incidence (PDI) revealed that minimum temperature and relative humidity were significantly negatively correlated with disease development, while all other weather parameters showed non-significant correlations. After the disease was established, high temperatures (25.50-29.62 °C) were found to favour disease progression and spread. A minimum temperature around 26 °C was also conducive to further development of the disease. Furthermore, high relative humidity (above 90%) was found to support rapid disease transmission. The disease incidence were positively correlated with morning relative humidity and sunshine hours, but negatively correlated with minimum temperature, evening relative humidity, and rainfall during both cropping seasons.

Keywords: Sheath blight, rice, *Kharif*, Kranti, present disease incidence, weather parameters

1. Introduction

Rice (*Oryza sativa* L.), a member of the family Poaceae, is one of the most important cereal crops grown in tropical regions. It can be successfully cultivated in both the wet and dry seasons, provided adequate water is available (Kawure *et al.*, 2022) ^[4]. On a global scale, rice is cultivated over an area of about 162 million hectares. In India, the crop covers nearly 47 million hectares, producing around 132 million tonnes annually with an average productivity of 4.2 tonnes per hectare. In the state of Madhya Pradesh, rice is grown on approximately 3.4 million hectares, yielding about 12.3 million tonnes with an average productivity of 3.6 tonnes per hectare. Rice is attacked by a number of fungal, bacterial and viral diseases. Among the fungal diseases rice sheath blight is regarded as an internationally important disease. Sheath blight is a soil borne disease caused by the fungus *Rhizoctonia solani* Kuhn AG1-IA. Favorable temperature and evaporation rate results in 23.0 and 61.1% of disease incidence under field conditions, respectively (Lenka *et al.* 2008) ^[5]. The maximum progression of the disease is observed at the temperature range of 25°-33 °C and relative humidity of 80-100% (Thind *et al.* 2008) ^[8]. The fungus affects the crop from tillering to heading stage. Initial symptoms are noticed on leaf sheaths near water level on the leaf sheath as oval or elliptical or irregular greenish grey spots are formed. As the spots enlarge, the center becomes greyish white with an irregular blackish brown or purple brown border. This disease causes significant yield losses of about 11.1-58.0 percent depending on variety and stage of the crop (Chahal *et al.* 2003) ^[2].

2. Methods and Materials

The *in vitro* experiments of present studies were carried out in the Department of Plant Pathology, JNKVV Jabalpur M.P.

Effect of weather parameters on the initiation and progression of sheath blight of rice *Kharif* 2023-2024. The weather parameters was observed like Maximum Temperature (°C), Minimum Temperature (°C), Maximum Relative Humidity (%), Minimum Relative Humidity (%), Rainfall (mm), Rainy Days.

3. Results

3.1 Progression of sheath blight disease incidence with weather Parameters

The progress of sheath blight of rice with different weather parameter variables was studied in two crop seasons *kharif* 2023 and *kharif* 2024 under field condition rice variety kranti (susceptible) was used in present investigation.

During *kharif* 2023 the first observation was taken from 34th standard metrological week till 45th standard metrological week. The sheath blight disease incidence progressively increased during the observation of percent disease incidence varies from 8.36 to 45.96 percent during 34th to 45th standard metrological week. The progress of disease was relatively faster from 38th to 39th standard metrological week and 40th to 41th standard metrological week. The maximum temperature varies from 29.9 °C to 33.9 °C and minimum temperature varies from 13.9 °C to 24.5 °C. The morning Relative Humidity (%) varies from 73.4% to 92.7%

and evening Relative Humidity (%) varies from 36.0% to 81.1% respectively. The rainfall varies from 9.2mm to 25.1mm and rainy days varies from 0 days to 5 days.

During *kharif* 2024 the first observation was taken from 34th standard metrological week till 45th standard metrological week. The sheath blight disease incidence progressively increased during the observation of percent disease incidence varies from 10.29 to 48.20 percent during 34th to 45th standard metrological week. The progress of disease was relatively faster from 35th to 36th standard metrological week and 40th to 41th standard metrological week. The maximum temperature varies from 30.0 °C to 33.5 °C and minimum temperature varies from 16.1 °C to 25.4 °C. The morning Relative Humidity (%) varies from 87.9% to 93.6% and evening Relative Humidity (%) varies from 46.2% to 76.0% respectively. The rainfall varies from 0 mm to 184.8 mm and rainy days varies from 0 days to 3 days.

Table 1: Weather parameters and disease incidence of sheath blight (*Kharif* 2023)

SMW	Maximum Temperature (°C)	Minimum Temperature (°C)	Morning Relative Humidity (%)	Evening Relative Humidity (%)	Rainfall (mm)	Rainy Days	*PDI
34	29.9	24.3	87	75	25.1	3	8.36
35	32.5	24.2	86.0	61.0	9.2	2	14.21
36	32	24.5	88.1	77.4	23.2	4	17.45
37	29.9	24.3	92.7	81.1	23.9	5	19.89
38	31.6	24	87.4	66.1	23.1	2	23.96
39	32.3	23.6	88.4	64.9	22.5	0	28.39
40	31.9	20.6	83	56.6	19	0	30.66
41	33.9	20.6	80.6	43.3	16.7	0	35.83
42	31.9	18.4	84.3	47.7	16.1	0	37.52
43	30	13.9	73.4	40.6	12.4	0	38.26
44	30.5	14	79	42	13.2	0	41.18
45	31.6	14.1	76.9	36	12.3	0	45.96

*Average of three replications; SMW-Standard meteorological week; PDI-Percent Disease Incidence; Source-(Meteorological observatory, JNKVV, Jabalpur Madhya Pradesh)

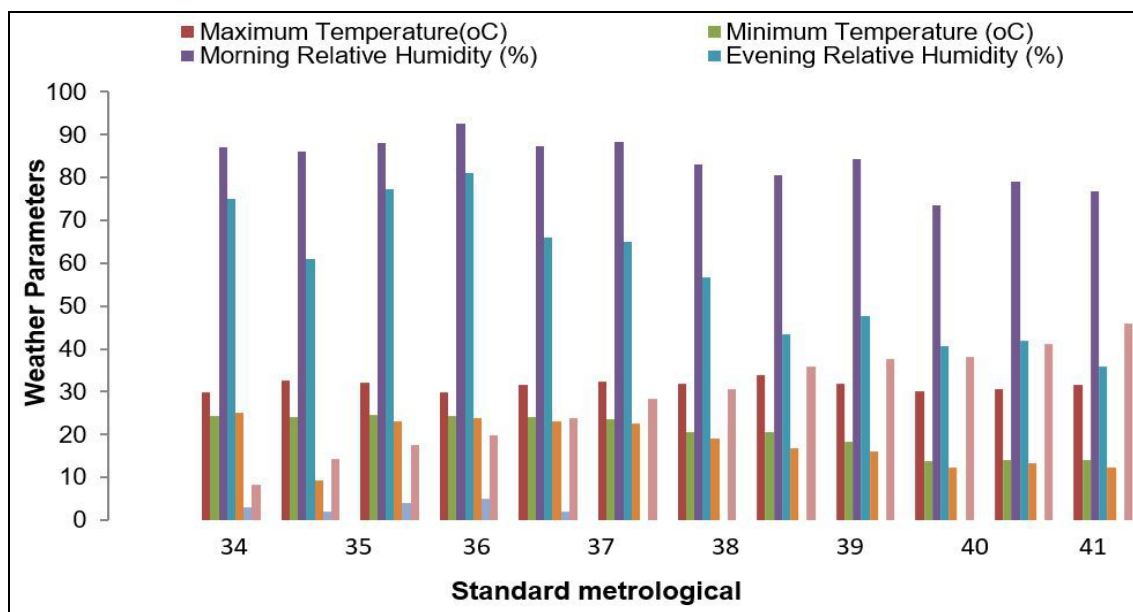


Fig 1: Correlation of different weather parameter with percent disease incidence (*Kharif* 2023)

Table 2: Weather parameters and disease incidence of sheath blight (*Kharif* 2024)

SMW	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Relative Humidity (%)	Minimum Relative Humidity (%)	Rainfall (mm)	Rainy Days	*PDI
34	31.1	24.6	91.6	67.9	17.6	1	10.29
35	31.9	25.4	91.3	68.7	17.8	1	14.26
36	32.7	25.4	91.1	67.7	17.2	2	19.41
37	30.0	24.2	91.7	76.0	184.8	3	21.26
38	30.6	24.2	93.6	67.7	93.8	2	23.15
39	31.6	25.2	91.1	71.1	10.8	2	26.99
40	33.5	24.2	87.9	58.9	0.0	0	28.29
41	32.5	23.1	88.6	59.6	0.0	0	34.59
42	31.5	21.0	90.4	56.6	14.4	1	36.66
43	31.2	18.3	90.0	50.0	0.0	0	39.18
44	32.8	17.5	86.6	48.0	0.0	0	42.26
45	30.9	16.1	88.8	46.2	0.0	0	46.20

*Average of three replications; SMW-Standard meteorological week; PDI-Percent Disease Incidence; Source-(Meteorological observatory, JNKVV, Jabalpur Madhya Pradesh)

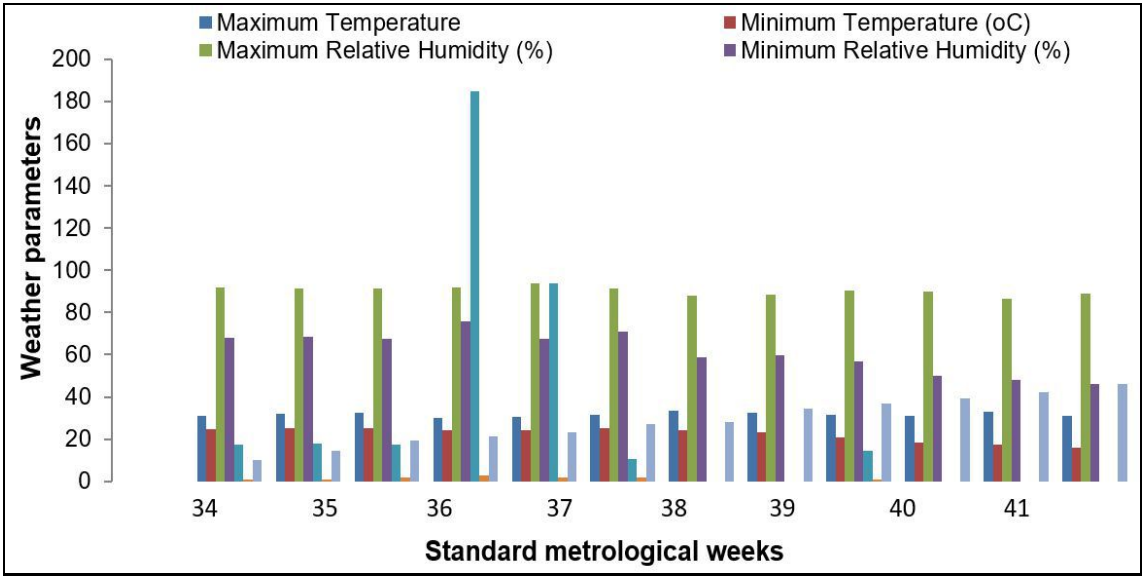


Fig 2: Correlation of different weather parameter with percent disease incidence (*Kharif* 2024)

3.2 Correlation analysis

The result indicated that percent disease incidence was considerably influenced by the prevailing weather condition. During *Kharif* 2023, correlation coefficient between percent disease incidence and weather parameter viz., temperature maximum (0.140^{NS}) shows non significant correlation, temperature minimum (-0.877^{*}) shows negative significant correlation, Relative Humidity Morning (-0.753^{NS}) shows negative non significant correlation, Relative Humidity Evening (-0.886^{*}) shows negative significant correlation, Rainfall (-0.848^{*}) shows negative significant correlation,

Rainy Days (0.781^{NS}) with percent disease incidence. During *Kharif* 2024, correlation coefficient between percent disease incidence and weather parameter viz., temperature maximum (0.123^{NS}) shows non significant correlation, temperature minimum (-0.901^{*}) shows negative significant correlation, Relative Humidity Morning (-0.695^{NS}) shows negative non significant correlation, Relative Humidity Evening (-0.864^{*}) shows negative significant correlation, Rainfall (-0.873^{*}) shows negative significant correlation, Rainy Days (0.620^{NS}) with percent disease incidence.

Table 3: Correlation coefficient between Weather Parameter with Percent disease incidence of sheath blight disease

Percent disease incidence	Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity Morning (%)	Relative Humidity Evening (%)	Rainfall (mm)	Rainy Days
<i>Kharif</i> 2023	0.140 ^{NS}	-0.877 [*]	-0.753 ^{NS}	-0.886 [*]	-0.848 [*]	0.781 ^{NS}
<i>Kharif</i> 2024	0.123 ^{NS}	-0.901 [*]	-0.695 ^{NS}	-0.864 [*]	-0.873 [*]	0.620 ^{NS}

*Significant value at level 0.05 = 0.811, ^{NS} Non Significant

4. Discussion

Environmental factors play a crucial role in the development of sheath blight. Among meteorological parameters, temperature and relative humidity are the most critical in influencing the growth of the pathogen and disease progression. Yield losses due to sheath blight are

significantly affected by factors such as host susceptibility, inoculum load, temperature, humidity, and rainfall. The progress of sheath blight disease in rice in relation to different weather parameters was studied during two *Kharif* seasons (2023 and 2024) under field conditions using the susceptible rice variety ‘*Kranti*’.

Correlation analysis between weather variables and present disease incidence (PDI) revealed that minimum temperature and relative humidity were significantly negatively correlated with disease development, while all other weather parameters showed non-significant correlations. Similar findings were reported by Sindhu *et al.* (2023) ^[7] and Biswas *et al.* (2011) ^[1], who observed that maximum air temperature was the most critical meteorological factor influencing sheath blight incidence under field conditions. After the disease was established, high temperatures (25.50-29.62 °C) were found to favor disease progression and spread. A minimum temperature around 26 °C was also conducive to further development of the disease. Furthermore, high relative humidity (above 90%) was found to support rapid disease transmission. Kaur *et al.* (2015) ^[3] reported that disease incidence and severity were positively correlated with morning relative humidity and sunshine hours, but negatively correlated with minimum temperature, evening relative humidity, and rainfall during both cropping seasons. Similar observations were made by Reddy *et al.* (2001) ^[6].

rice with crop age and weather factors. *Plant Dis Res.* 2008;23:34-40.

5. Conclusion

The correlation coefficient analysis between percent disease incidence and weather parameters revealed the following: maximum temperature showed a non-significant correlation; minimum temperature showed a significant negative correlation; morning relative humidity exhibited a non-significant negative correlation; evening relative humidity showed a significant negative correlation; rainfall and number of rainy days both exhibited significant negative correlations with percent disease incidence.

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