

Epidemiological study of *Helminthosporium* blight in maize under Odisha condition

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The incidence of Maydis leaf blight caused by *Helminthosporium maydis* Nishik & Miyk, largely depends on meteorological factors, location, cultivars susceptibility and cultural practices. Correlation of meteorological parameters on the natural occurrence of Maydis leaf blight was studied from 10/6/13 to 13/10/13 in eighteen meteorological weeks. The weather factors such as maximum and minimum temperature (°C), maximum and minimum relative humidity (%), rainfall (mm), number of rainy days (days), wind velocity (km/h), bright sunshine hour (h) and evaporation (mm) contributed about 76.8% towards the disease incidence. However, the parameters like maximum relative humidity, rainfall and bright sunshine hour were found statistically significant with respect to disease development. The maximum infection was recorded in October at maximum relative humidity of 97%, rainfall as high as 298.4 mm and bright sunshine hour of 2.6 hrs (7/10/13 to 13/10/13).

Key words: *Helminthosporium* blight, maize, epidemiological parameters

INTRODUCTION

Maize (*Zea mays* L.) globally known as 'queen of cereals' due to its highest genetic potentiality among the cereals. It is one of the most important cereals in India. Maize ranks first in world production representing 38% of total grain production (868 million tonnes from 168 million hectare) followed by wheat (691 million tonnes) and rice (461 million tonnes). In India, it contributes nearly 9% towards the national food basket and generating employment over 100 million man days at the farm, downstream agriculture and industrial sectors. In Odisha, it is grown in an area of 0.26 million hectares with production of 0.6 million tonnes at the productivity level of 2.6 t/ha (2011-2012). Maize suffers from

about 110 diseases on a global basis caused by fungi, bacteria and viruses. Among the fungal diseases Maydis leaf blight is an important disease in warm humid tropical climate in the cropping period. Therefore, it is felt necessary to co-relate the Maydis leaf blight incidence with the meteorological factors under natural occurring condition.

MATERIALS AND METHODS

The study on the relationship of meteorological parameters with the natural occurrence of *Helminthosporium* blight disease in maize, observations were taken from 10/06/13 to 13/10/13 consisting of eighteen meteorological weeks (2013, *kharif*) under field condition at experimental plot

of Department of Plant Pathology, OUAT, Bhubaneswar. The weather parameters like maximum and minimum temperature ($^{\circ}\text{C}$), maximum and minimum RH (%), rainfall (mm), number of rainy days (days), wind velocity (km/h), bright sunshine hours (h) and evaporation (mm) were correlated with Helminthosporium disease incidence. The PDI was recorded following a standard scale of 0-5 point (Shekhar and Kumar, 2012) basing on the intensity of disease appeared on maize leaves through visual observation as indicated in Table 1.

The per cent disease incidence (PDI) was calculated by using the formula

$$\text{PDI} = \frac{\text{Sum of all numerical rating}}{\text{Total number of plants observations}} \times \frac{100}{\text{Maximum disease scale}}$$

The prediction equation $Y = 402.881 - 11.060X_1 - 2.217X_2 + 1.657X_3 - 1.243X_4 + 0.080X_5 - 3.384X_6 - 2.989X_7 + 3.410X_8 - 2.809X_9$

Co-efficient of determination $R^2 = 0.891$, adjusted $R^2 = 0.768$

where

- X_1 - Maximum temperature
- X_2 - Minimum temperature
- X_3 - Maximum RH
- X_4 - Minimum RH
- X_5 -Rainfall
- X_6 -No. of rainy days
- X_7 - Wind velocity
- X_8 -Bright sunshine hours
- X_9 -Evaporation
- Y- Per cent disease incidence (PDI)

RESULTS AND DISCUSSION

It may be seen from the Table 2 that, the Maydis leaf blight disease appeared more or less throughout the season in maize crop. The least infection was found during June and July when temperature and RH were in the range of 24.7 to 34.7 $^{\circ}\text{C}$ and 71 - 95% respectively. However maximum incidence (52.6%) was recorded at temperature range of 23.9 - 31.4 $^{\circ}\text{C}$ and RH of 81-97%. High rainfall (298.4 mm) accompanied by high wind velocity (7/10/2013 to 11/10/2013) contributed to the maximum disease incidence. It is revealed from the correlation studies that (Table 3) the weather

Table 1 : Recording of disease reaction of Helminthosporium leaf blight in maize

Sl. No.	Scale	Disease severity	Disease incidence
1	1.0	Very slight to slight	1 or 2 to few scattered lesion on lower leaves
2	2.0	Light	Moderate number of lesions on lower leaves
3	3.0	Moderate	Abundant lesions are on lower leaves and few on middle leaves
4	4.0	Heavy	Lesions are abundant on lower and middle leaves, extending to upper leaves
5	5.0	Very heavy	Lesions abundant on almost all leaves. Plants prematurely dry or killed by disease.

factors e.g. maximum temperature, minimum temperature, maximum RH, minimum RH, rainfall, number of rainy days, wind velocity, bright sunshine hours and evaporation as a whole contributed 76.8% towards the diseases occurrence. However, the parameters like maximum RH, rainfall and bright sunshine hours were found to be statistically significant with respect to disease development. High rainfall coupled with maximum relative humidity in October 2013 was exceptional year for Odisha as cyclone Philin hit coastal Odisha in second week of October. This may be one of the reasons that the disease incidence was found to be maximum in October which supports the findings of Tolba *et al.* (2005) who reported that, disease severity varied from year to year due to variation in climatic conditions. He found high disease infection due to high temperature (27°C) and relative humidity (71%). Purohit and Purohit (2002) also opined that *Bipolaris maydis* incidence was observed to be more in the month of August and October which supports the present findings. The continuous wetness period in the month of October also another factor which favoured the disease development. As reported by Pei *et al.* (2009) wetness period and rate of appressorium formation were significantly correlated which is also in agreement with the present findings.

From the present investigation it is evident that unfavourable climatic conditions provided

Table 2 : Climatic parameters on the incidence of Maydis leaf blight

Week	Max Temp(°C)	Mini temp(°C)	Max. RH(%)	Min. RH(%)	Rainfall (mm)	No. of rainy days	Wind vel. (km/hr)	BSH (hr)	Evaporation (mm)	PDI
10/06/2013 - 16/06/2013	32.8	25.2	92	78	79.7	5	6.5	2.5	5.5	0.0 (0.00)*
17/06/2013 - 23/06/2013	34.7	25.2	90	71	95.8	3	4.9	4.5	5.0	0.0 (0.00)
24/06/2013 - 30/06/2013	33.2	25.9	90	76	48.8	4	7.2	3.7	5.3	1.4 (6.80)
01/07/2013 - 07/07/2013	33.5	25.9	92	80	41.9	3	3.5	1.5	3.1	2.8 (9.63)
08/07/2013 - 14/07/2013	33.7	25.4	94	76	28.2	4	4.7	5.9	3.6	5.0 (12.92)
15/07/2013 - 21/07/2013	31.8	25.4	92	87	96.3	5	3.5	1.8	3.1	6.8 (15.12)
22/07/2013 - 28/07/2013	30.7	25.2	95	88	72.4	6	5.7	1.1	3.3	10.0 (18.44)
29/07/2013 - 04/08/2013	31.5	24.7	93	81	27.4	4	5.2	2.6	3.4	13.6 (21.64)
05/08/2013 - 11/08/2013	31.5	25.3	96	83	43.5	5	3.0	1.2	3.4	18.4 (25.48)
12/08/2013 - 18/08/2013	33.2	25.2	93	73	55.1	5	3.0	3.7	3.4	20.5 (26.92)
19/08/2013 - 25/08/2013	32.5	25.5	90	72	2.6	2	4.4	3.1	3.6	28.0 (31.95)
26/08/2013 - 08/09/2013	32.0	24.9	95	77	51.6	4	2.9	3.4	3.3	32.4 (34.70)
02/09/2013 - 08/09/2013	32.1	24.4	95	76	73.0	3	3.0	2.4	2.9	36.8 (37.35)
09/09/2013 - 15/09/2013	33.7	24.8	94	77	44.9	3	2.4	4.9	3.4	39.6 (39.00)
16/09/2013 - 22/09/2013	31.6	23.8	98	80	133.9	6	3.7	1.7	3.0	45.2 (42.25)
23/09/2013 - 29/09/2013	32.5	24.3	96	75	93.8	4	2.8	3.1	2.8	48.0 (43.85)
30/09/2013 - 06/10/2013	31.7	23.9	96	76	50.5	6	2.8	3.5	3.3	50.4 (45.23)
07/10/2013 - 13/10/2013	31.4	23.9	97	81	298.4	5	9.2	2.6	2.5	52.6 (46.49)

Table 3 : Co-relation matrix of climatic parameters on disease incidence

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	Y
X ₁	1.000									
X ₂	0.447	1.000								
X ₃	-0.598	-0.782	1.000							
X ₄	-0.680	0.005	0.335	1.000						
X ₅	-0.272	-0.548	0.450	0.232	1.000					
X ₆	-0.600	-0.398	0.575	0.549	0.354	1.000				
X ₇	-0.106	0.054	-0.165	0.160	0.557	0.142	1.000			
X ₈	0.695	0.057	-0.263	-0.688	-0.200	-0.379	-0.046	1.000		
X ₉	0.550	0.494	-0.671	-0.334	-0.294	-0.171	0.306	0.342	1.000	
Y	-0.470	-0.786	0.738	-0.046	0.315	0.156	-0.293	-0.054	-0.719	1.000

favourable platform for multiplication and spread of *Helminthosporium maydis*.

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