



Epidemiological Study of Myrothecium Leaf Blight Disease of Cotton

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Cotton is one of the most important commercial crops which is mostly valued for its natural fiber. The diseases of cotton of common occurrence in Odisha have been identified as Angular leaf spot or Black arm, grey mildew, Alternaria leaf spot, Root rot and Myrothecium leaf blight. The incidence of Myrothecium leaf blight is growing consistently throughout the country among all the foliar diseases. In a survey conducted, across different locations of Odisha, Myrothecium leaf blight had the highest incidence in Bhawanipatna at 16.0%, surpassing Anthracnose and Bacterial blight. In contrast, Rayagada recorded the lowest Myrothecium leaf blight incidence at 6.5%. The diseases caused by *Myrothecium roridum* are generally thought to be associated most frequently with warmer environments during wet conditions. The disease increased progressively from 35th

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meteorological week and reached its peak during 41st Standard Meteorological Week with a maximum Percent disease Incidence of 46%. The meteorological parameters such as Temperature(maximum), relative humidity(morning), number of rainy days and bright sun shine hours showed highly significant positive correlation with PDI.

Keywords: *Myrothecium*; cotton; leaf blight; epidemiology.

1. INTRODUCTION

Cotton is one of the most important commercial crops which is mostly valued for its natural fiber. India grows cotton across 130.49 lakh hectares, yielding 337.23 lakh bales, with an average productivity of 439 kg/ha, as per the AICRP on Cotton Annual Report for 2022-23 [1]. India has the unique distinction of being the only country in the world to cultivate all four cultivable *Gossypium* species, *Gossypium arboreum* and *G. herbaceum* (Asian cotton), *G. barbadense* (Egyptian cotton) and *G. hirsutum* (American upland cotton) besides hybrid cotton. In the present situation, *G. hirsutum* occupies 90 per cent of area. On the other, *G. arboreum* and *G. herbaceum* account for 4 per cent and 5 per cent of the area, respectively. The area under *G. barbadense* is negligible and is only a few thousand hectares.

Cotton is a *kharif* crop which requires uniformly high temperature varying between 21°C and 30°C. The annual requirement of water can be met by an average of 50- 100 cm. The major planting season is however, April - July in the North and Central Zones and August - October in south zone. Some tracts growing cotton during summer, plant the crop in the month of February - March. The harvesting period also varies depending on the planting period and the duration of the variety. The maximum cotton is however picked during October - January and in some tracts the period extends up to April- May. Summer planted cotton is picked during June - September.

The Cotton growing tracts of Odisha are Bolangir, Kalahandi, Rayagada, Nawarangpur, Sonapur and Bargarh. The crop is affected by many fungal diseases, among which foliar diseases cause severe loss of yield estimated up to 30% Vairavan et al. [2]. The diseases of cotton of common occurrence in Odisha have been identified as Angular leaf spot or Black arm (*Xanthomonas axonopodis* pv. *malvacearum*), Anthracnose (*Colletotrichum capsici*), grey mildew (*Ramularia areola*), Alternaria leaf spot (*Alternaria macrospora*), Root rot (*Rhizoctonia*

solani and *R. bataticola*) and *Myrothecium* leaf blight (*Myrothecium roridum*). The incidence of *Myrothecium* leaf blight is growing consistently throughout the country among all the foliar diseases. The disease appears on the leaves in the form of irregular spots which later gets enlarged and develops concentric rings on the lesions. In high humidity the typical zonations are covered by white tuft like growth of sporodochia. The disease spreads through the spores dispersed through irrigation water and rainfall.

Sandipan et al., [3] reported that Indian cotton fields are severely affected by different fungal leaf spot diseases, such as, *Cercospora* leaf spot, *Helminthosporium* leaf spot, *Corynespora* leaf spot, *Alternaria* leaf spot, *Myrothecium* leaf spot. The diseases caused by *M. roridum* are generally thought to be associated most frequently with warmer environments during wet conditions [4]. Srivastava and Singh [5] reported the survival of *Myrothecium roridum* on infected mung leaves for 7 to 9 months on the residues left in the soil. Singh and Shukla [6] have studied the effect of temperature and RH on incidence of *Myrothecium* leaf spot disease of cowpea caused by *M. roridum*. They have observed that older plants (50 days) were more susceptible than young ones (21days) and they have found that no disease was occurred during drought conditions. Murakami et al. [7] observed that the density of *Myrothecium roridum* increased in field soil from June to October and decreased from February to April in 1996 - 1998.

Singh et al. [8] have studied the effect of environmental factors, namely atmospheric temperature, relative humidity, and rain on incidence of *Myrothecium* leaf spot of pigeon pea cultivar T-21 (susceptible). Data on disease development was recorded for 10 fortnights from the first appearance of the disease symptoms to the harvesting of the crop. The maximum disease intensity was observed in the first fortnight of September (45.6%) when the average atmospheric temperature, relative humidity, and rain were 27°C, 84.7%, and 11.4 mm respectively.

Patidar [9] have conducted an experiment to study the effect of weather on development of myrothecium leaf blight of cotton and reported that during 25th Standard Meteorological Week (SMW) Myrothecium leaf blight was first observed in traces and the disease intensity gradually increased upto 35th SMW then decreased up to 43rd SMW.

Shivaji et al. [10] have conducted an experiment to study the correlation coefficient of PDI of Myrothecium leaf spot of bael with weather parameters viz., maximum and minimum temperature, relative humidity (morning and evening), bright sunshine hrs/day and rainfall. They have observed that Maximum PDI (30.21%) was recorded in 42nd meteorological week when weather parameters viz. maximum temperature (35.20°C) and minimum (19.20°C), relative humidity morning (70.40%) and evening (52.10%), bright sunshine hrs (5.80) and rainfall (0.0 mm).

2. MATERIALS AND METHODS

The study titled 'Epidemiological Study of Myrothecium Leaf Blight Disease of Cotton' was conducted at the Department of Plant Pathology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, in collaboration with AICRP on Cotton, Bhubaneswar. The aim was to investigate the impact of meteorological parameters on the natural occurrence and severity of Myrothecium leaf blight in cotton. Observations were made at the Experimental Farm in Bhubaneswar during the *Kharif* season of 2017. A comprehensive survey was undertaken to monitor the prevalent

diseases of cotton, including Anthracnose, Bacterial Blight, and Myrothecium leaf blight, throughout the *Kharif* season of 2017, spanning from June to December. This survey covered districts such as Bolangir, Umerkote, Rayagada, Bhawanipatna, and Bhubaneswar.

The roving survey was conducted utilizing a simple random sampling technique to select fields within each area. This involved randomly selecting ten plants from five quadrats, excluding border rows, and proceeding diagonally from the southwest corner of each field. These chosen plants were then tagged for continuous monitoring throughout the season. The incidence and severity of various foliar diseases were documented thrice during the crop period, employing a 0-4 scale (Sheoraj, 1988), with details presented in Table 1. The percent disease index was subsequently computed using the formula:

$$\text{PDI (\%)} = \left(\frac{\text{Sum of all numerical ratings}}{\text{Total number of leaves observed} \times \text{Maximum rating}} \right) \times 100$$

Standard meteorological parameters such as maximum and minimum temperatures, relative humidity (morning), relative humidity (evening), rainfall (mm), number of rainy days and bright sunshine hours were obtained from Meteorological Observatory, OUAT, Bhubaneswar. A correlation-regression analysis of the disease incidence with the weekly average meteorological parameters was studied to ascertain the contribution of weather parameters for perpetuation of the disease under natural conditions.

Table 1. Sheo Raj scale (0-4) for foliar diseases of cotton

Disease	Scale	Leaf area infected
Myrothecium leaf blight	0	No infection
	1	A few small spots less than 2mm, scattered, brown in colour, leaf area covered is less than 5%.
	2	Bigger spots upto 3 mm coalescing, brown in colour, 6-20% leaf area covered
	3	Spots increasing in size 3-5 mm and irregular in shape tending to coalesce, 21-40% leaf area covered
	4	Spots coalesce to form bigger lesions, irregular in shape and size more than 40% leaf area covered

3. RESULTS AND DISCUSSION

The symptoms of the disease first began to appear in the form of minute spots, brown in colour, with the typical zonation. Later the spots get enlarged and coalesce to form irregular spots. After few days the necrotic area dries and withers giving rise to shot holes. There was no incidence of the disease during 26th meteorological week (2 July-8 July). The disease symptoms were recorded during

Table 2. Effect of weather parameters on incidence of Myrothecium leaf blight disease in cotton (2017-2018)

Date of observation	Meteorological week	Temperature(°c)		Relative humidity(%)		Rainfall (mm)	No. of Rainy days	Evaporation (mm)	Sunshine hrs/day	PDI
		Maximum	Minimum	Morning	Evening					
2.7.17	26	31.8	26.2	93.4	71.1	30.2	3	4.4	1.2	0
9.7.17	27	31.3	25.9	91.1	73.6	72.9	4	3.5	0.8	2.5
16.7.17	28	31.9	25.2	93.6	78	135.3	7	3.1	0.8	8
23.7.17	29	31.7	25.7	91.9	83.6	200.1	7	3.1	2.8	12.5
30.7.17	30	31.5	26.5	93	79.3	280.1	3	3.4	2.4	20.8
6.8.17	31	34.3	26.3	90.4	69.9	56.8	3	3.5	4.7	25
13.8.17	32	33	25.5	90.9	76.7	91.4	5	3.4	5.3	25.5
20.8.17	33	32.7	25.9	93.7	85	71.6	5	3.4	2.7	28.3
27.8.17	34	33.3	26	87.1	71.1	66.7	5	3.5	7.5	30
3.9.17	35	32.1	25.6	93.9	78.7	104.6	4	3.2	3.5	35.2
10.9.17	36	33.3	25.7	93	75.4	83.5	2	3.4	5	36
17.9.17	37	34.6	25.8	90.1	64.4	70.1	2	3.5	7.1	32.5
24.9.17	38	32.7	25.7	92.7	71.4	52.7	4	3.2	2.8	40
1.10.17	39	34	25.6	91.3	67.3	29.5	4	3.4	4.3	36
8.10.17	40	31.3	25.3	93.7	77.5	49.5	4	3.1	2.3	42.2
15.10.17	41	32.3	25.2	95.3	68.7	57	2	3.3	4.7	46
22.10.17	42	32.5	25	92.1	67.6	83.2	2	3.4	6.6	40
29.10.17	43	32.8	23.5	91.9	67.3	19	1	3.5	7.7	36.8
5.11.17	44	31.2	21	92.1	62	0	0	3.4	7.8	38.6
12.11.17	45	31.6	19.5	86.1	54.3	0	0	3.5	9.5	32.5
19.11.17	46	28.1	20.2	84.7	62.4	49.1	3	3.1	4.8	30
26.11.17	47	28.9	19.8	91.1	61.6	6.1	1	3.2	5.3	35
3.12.17	48	29.5	14.1	93.7	39.3	0	0	3.5	8.5	38.4
10.12.17	49	27.5	13.3	86.1	40.1	0	1	3.4	6.8	34.5
17.12.17	50	28.8	18.5	93.7	65.9	36.3	1	3.3	5.1	38
24.12.17	51	28.3	13.7	92.7	43	0	0	3.5	7.9	36.5
31.12.17	52	28	12.8	93.6	43.4	0	0	3.5	7.7	37
7.1.18	1	26.5	12.7	89.8	38	0	0	3.6	6.4	32.5
14.1.18	2	27.6	11.1	92.7	35	0	0	3.6	7.2	36.5
21.1.18	3	28.7	11.3	93.7	34.4	0	0	3.6	7.7	38

Date of observation	Meteorological week	Temperature(°c)		Relative humidity(%)		Rainfall (mm)	No. of Rainy days	Evaporation (mm)	Sunshine hrs/day	PDI
		Maximum	Minimum	Morning	Evening					
28.1.18	4	28.3	13	92.3	34.7	0	0	3.7	7.7	38
4.2.18	5	30.4	12.1	91.9	25.4	0	0	3.9	8.3	36.5
11.2.18	6	33.7	16	92.7	28.4	0	0	4.1	8	38
18.2.18	7	31.2	15.7	89.3	33.9	0	0	4.1	7.4	34.5
25.2.18	8	34.7	16.4	94.3	30.1	0	0	4.4	8.8	42.5
4.3.18	9	37.3	18.9	92.9	27.1	0	0	4.6	8.7	40
11.3.18	10	36.5	20.2	88.6	29.9	0	0	5.1	7.3	38.5
18.3.18	11	36.6	21.3	91.6	27.1	0	1	5.3	5.6	39.5
25.3.18	12	37.5	22.5	92.7	31.9	0	0	5.5	6.6	40

Table 3. Correlation studies of weather parameters with incidence of Myrothecium leaf blight disease

S.No	Weather Parameters	Percent disease index of leaves
1	Maximum Temperature	0.64**
2	Minimum Temperature	-0.39*
3	Relative Humidity(Morning)	0.57**
4	Relative humidity(Evening)	-0.47*
5	Rainfall(mm)	0.51*
6	No. of rainy days	0.59**
7	Sun shine hrs/day	0.65**
8	Evaporation(mm)	0.31

**Highly significant, *Significant

27th meteorological week when environmental factors viz., maximum temperature (31.3), minimum temperature (25.9), Relative humidity morning (91.1%), Relative humidity evening (73.6%), rainfall (72.9 mm), number of rainy days (04), Evaporation (3.5 mm), sunshine hrs/day (0.8). The occurrence of the disease is the outcome of interaction between the host, pathogen and environment.

The disease increased progressively from 35th meteorological week and reached its peak during 41st Standard Meteorological Week (15 Oct-21 Oct), with a maximum PDI (46%) with mean maximum temperature 32.3°C, mean minimum temperature 25.2°C, morning relative humidity 95.3%, evening relative humidity 68.7%, rainfall 57 mm, 2 rainy days and bright sunshine hours 4.7 h/day. Correlation matrix studies indicated that temperature (minimum) and relative humidity (evening) showed significant negative correlation. Temperature (maximum), relative humidity(morning), number of rainy days and bright sun shine hours showed highly significant positive correlation with PDI. The quantity of rainfall also exhibited a positive correlation.

An investigation into major cotton diseases including Anthracnose, Bacterial blight, and

Myrothecium leaf blight across Bolangir, Umerkote, Rayagada, Bhawanipatna, and Bhubaneswar revealed that Anthracnose reached its peak PDI in Bhawanipatna at 8.0%, with the lowest incidence recorded in Bhubaneswar at 3.6%. Bacterial blight was most prevalent in Rayagada at 15%, while Bolangir and Bhubaneswar exhibited the lowest incidence at 10%. Myrothecium leaf blight showed its highest incidence in Bhawanipatna at 16.0%, with the lowest incidence in Rayagada at 6.5%.

Similar results have been reported by Patidar [9] who conducted an experiment to study the effect of environmental factors on development of myrothecium leaf blight of cotton and reported that the disease was increased gradually up to 35th SMW then decreased up to 43rd SMW. The findings of this experiment align with previous research, Shivaji et al. [10] who have conducted an experiment to study the effect of weather parameters on PDI of Myrothecium leaf spot of bael. They have observed that Maximum PDI (30.21%) was recorded in 42nd meteorological week when weather parameters viz. maximum temperature (35.20°C) and minimum (19.20°C), relative humidity morning (70.40%) and evening (52.10%), bright sunshine hrs. (5.80) and rainfall (0.0 mm).

Table 4. Survey for the incidence of foliar disease of cotton in different locations

S.No.	Location	Percentage of disease incidence		
		Anthracnose	Bacterial blight	Myrothecium leaf blight
1	Bolangir	6.5	10.0	8.0
2	Umerkote	7.2	12.5	10.0
3	Rayagada	6.0	15.0	6.5
4	Bhawanipatna	8.0	12.8	16.0
5	Bhubaneswar	3.6	10.0	12.5

4. CONCLUSION

Myrothecium leaf blight was prevalent at all the surveyed locations of the major cotton growing tracts of Odisha. The maximum average disease incidence was observed to be highest in Bhawanipatna. The disease progression began in the 35th meteorological week and reached its peak during 41st Standard Meteorological Week with a maximum Percent Disease Incidence of 46%. All the weather factors temperature (maximum), relative humidity (morning), number of rainy days and bright sun shine hours contributed positively to the development of the disease. These insights underscore the importance of monitoring and managing weather conditions in conjunction with disease control strategies to mitigate the impact of Myrothecium leaf blight on cotton crops in Odisha.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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