

RESEARCH ARTICLE

MORPHOLOGY AND CULTURAL CHARACTERISTICS OF *CURVULARIA LUNATA* (WAKKER) BOEDIJN OF COTTON

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Abstract: Cotton (*Gossypium hirsutum* L.) is one of the most important fiber crop playing a key role in the economic and social scenario of the globe. Curvularia leaf spot appear initially as small circular brown to brownish black spot surrounding with yellow, later it become dark yellow to brown hallow surrounding to brownish black spots and in severe cases, the leaves turned yellow colour and detached easily from the branch resulting in the defoliation. There was a good deal of variation in cultural and morphological characters of the pathogen under the different temperature. In morphological characteristics, the maximum dry mycelium weight (194.70mg) with abundant (16.43 millions/ml) sporulation on potato dextrose broth medium was observed at 25°C and at 15°C there was no growth and sporulation observed after 15days of inoculation. In cultural characteristics, the maximum colony diameter (87.76mm) and abundant (++++) sporulation was recorded at 25°C on potato dextrose agar medium after 10 days of incubation.

Keywords: Cotton, Morphology, Cultural, Sporulation, *Curvularia*

INTRODUCTION

Cotton is the world's most widely grown fibre crop, which belongs to the genus *Gossypium* in the family *Malvaceae* (Anonymous, 2017). It has delicate, white, soft and fluffy fibre that is made of about 87 to 90 per cent of cellulose. Cotton has been cultivated as over thousands of years for both the food and fibre. It is versatile crop, its fibre is used as raw material in textile, pulp and paper industries and oil extracted from the cotton seed is used in food, cosmetics, chemicals and pharmaceuticals (Proto *et al.*, 2000).

The symptoms of Curvularia leaf spot appear initially as small circular brown to brownish black spot surrounding with yellow hallow, later it become dark yellow to brown hallow surrounding to brownish black spots (Joshi *et al.*, 2023).

Curvularia is a wide spread air borne facultative weak pathogen, which mostly survives as a saprophyte in tropical and sub-tropical areas. It is a dematiaceous, filamentous fungus. *Curvularia* spp. are darkly pigmented fungi with spores (conidia) efficiently adapted for most aerial dissemination. *Curvularia* is characterized by septate mycelium,

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dark brown hypha 1.5-4.5 μ in diameter, conidiophores are erect, swollen at the base, lower part straight, upper part flexuous, geniculate, septate, smooth, brown in colour, 30-268 μ long, 3-6 μ thick bearing conidia in clusters of 3-8. Conidia are straight or slightly curved 3 septate, 18-30 \times 7-15 μ in size (Bhatt and Kumar, 2018). The Curvularia leaf spot injures or kills the leaf tissues and thereby reduces the area of chlorophyll which involved in photosynthesis. If considerable leaf area is killed, then vigour and yields are reduced drastically. The genus *Curvularia* belongs to *Pleosporaceae*, *Pleosporales*, *Ascomycota* (Nelson and Haasis, 1964). *Curvularia* contains about 133 species including saprobes, endophytes and pathogens (Manamgoda *et al.*, 2015). Thus, the present study has been taken up with the specific objective.

MATERIALS AND METHODS

Morphological Variation

Design: Completely Randomized Design

Treatments: 7 (Different temperature)

Repetitions: 3

Location: Department of Plant Pathology, Post Graduate Laboratory, N. M. C. A., N. A. U., Navsari,

Gujarat

In this method, the isolate was cultured in liquid media in 100ml flask containing 20ml potato dextrose broth in different temperature as 15, 20, 25, 30, 35, 40 and 45°C for fifteen days. After incubation, average measurements were taken by the micrometry method.

The morphological characters like dry mycelium weight, sporulation, size (length and width) of conidia and conidiophore were recorded. The observations were recorded in three repetitions of isolate in different temperature. The study was carried out using ocular and stage micrometer after mounting them on the slides containing sterile distilled water at magnification of 40X.

Data was analyzed statistically using complete randomized design.

The following morphological characters were recorded under different temperatures on PDB medium after 15 days of incubation.

- Dry mycelium weight (mg)
- Sporulation (million/ml)
- Size (μm) of conidia and conidiophore

Cultural Variation

Design: Completely Randomized Design

Treatments: 7 (Different temperature)

Repetitions: 3

Location: Department of Plant Pathology, Post Graduate Laboratory, N. M. C. A., N. A. U., Navsari, Gujarat

The isolate was separately cultured on potato dextrose agar medium in different temperature as 15, 20, 25, 30, 35, 40 and 45°C for ten days. The 5mm disc of *Curvularia lunata* isolate was inoculated on PDA Petri plate and incubates at different temperature.

After ten days of incubation period, colony diameter, sporulation, cultural characteristics including colony character, colour of mycelium and substrate was recorded. The results were tabulated and three repetitions were made for the isolate. Data was analyzed statistically using complete randomized design.

The following cultural characters were recorded under different temperatures on PDA medium after 10 days of incubation.

- Colony diameter (mm)
- Colony characters
- Sporulation category: - Absent, + Scanty, ++ Moderate, +++ Good, ++++ Abundant

RESULTS AND DISCUSSION

Morphological characteristics

Morphological studies were carried out under different temperature on potato dextrose broth medium revealed variation in growth and sporulation, size of conidia and conidiophore of *Curvularia lunata*. The results are presented in Table: 1, Photo 4.5.

Growth and sporulation

The maximum dry mycelium weight (194.70mg) with sporulation (16.43 million/ml) was observed at 25°C, while at 15°C there was no growth and sporulation observed (Table: 1).

Conidia

Conidia were obovoidal to broadly clavate, curved at the sub terminal cell and have 0-3 septa. The size of conidia was maximum at 25°C (27.14 \times 9.10 μm) followed by 30°C (26.94 \times 9.00 μm), 40°C (26.35 \times 7.57 μm), 20°C (26.30 \times 7.10 μm), 45°C (25.50 \times 9.40 μm) and 35°C (25.35 \times 8.10 μm). At 15°C temperature no conidia were produced (Table: 1, Photo 4.4).

Conidiophore

Conidiophore was straight to flexuous, slightly geniculate towards apex, uniformly sub hyaline to pale brown, smooth and septate. The size of conidiophore was maximum at 30°C (150.80 \times 5.10 μm) and minimum at 45°C (107.90 \times 4.020 μm). At 15°C conidiophore were not produced (Table: 1).

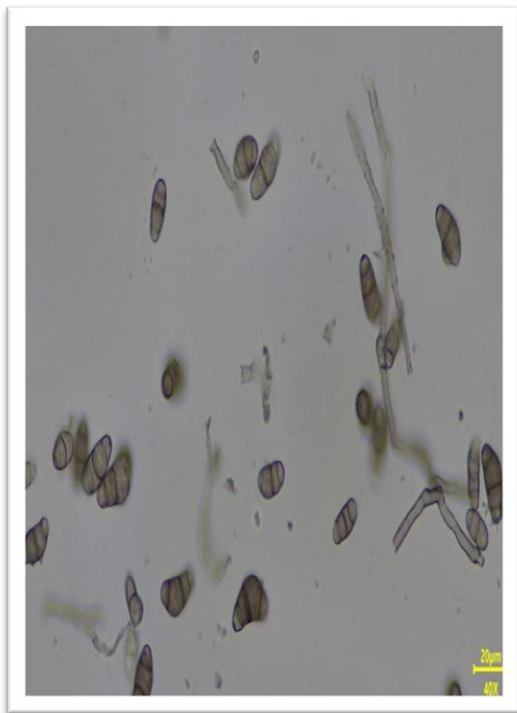
These results are in agreement with the results obtained by various research workers. Ming *et al.* (2005) studied the leaf blight of *Cynodon* hybrid caused by *Curvularia lunata* based on morphological characteristics. The pathogen grew well at a temperature ranged from 20 to 35°C in which the optimal temperature is 25°C. Yashwant *et al.* (2010) studied the effect of temperature on the growth and sporulation of *Cochliobolus lunata* caused leaf spot of okra crop. The effect of nine different temperatures (between 10 to 40°C) was studied to determine their effect on fungal growth. Maximum mycelial dry weight of the pathogen (830.00mg) was obtained at 28°C. The minimum fungal dry weight (144.66mg) was recorded at 15°C. Excellent sporulation of the pathogen was observed at 28 and 30°C, good at 25°C, fair at 20 and 32°C and poor growth at 15 and 40°C.



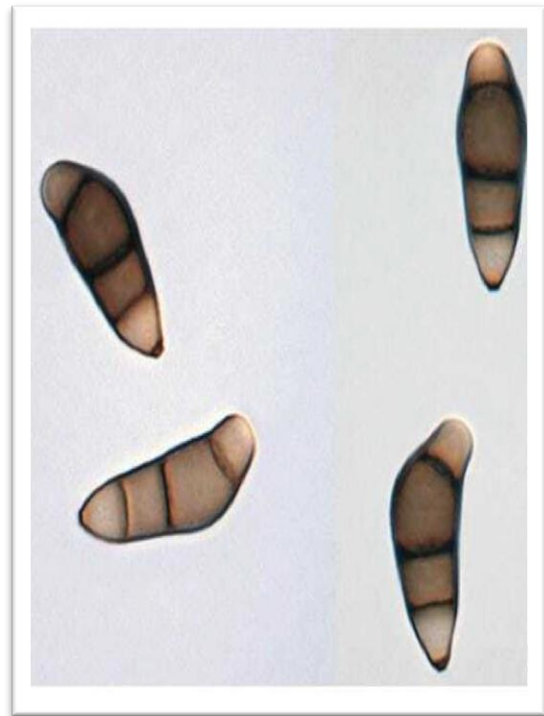
Mycelium (10 X)



Conidiophore (40 X)



Conidia (20 X)



Conidia (40 X)

Photo 4.4. Microphotographs showing Mycelium, Conidiophore, Conidia (20 X) & Conidia (40 X) of *Curvularia lunata*

Table 1. Dry mycelium weight, sporulation and size of conidia and conidiophores of *Curvularia lunata* in different temperature

Temp°C	#Dry mycelium weight (mg)	#Sporulation (million/ml)	Conidia		Conidiophore
			Size (µm)	No. of septa	Size (µm)
15	00.00	00.00	-	-	-

20	150.70	15.70	26.30×7.10	1-2	128.67 × 4.15
25	194.70	16.43	27.14 × 9.10	2-3	140.98 × 4.00
30	173.37	13.53	26.94 × 9.00	1-2	150.80 × 5.10
35	90.43	12.20	25.35 × 8.10	0-1	145.12 × 4.19
40	41.47	10.63	26.35 × 7.57	0-1	129.55 × 5.00
45	10.02	07.81	25.50 × 9.40	0	107.90 × 4.02
SEm ±	1.25	0.07			-
CD at 5%	3.83	0.24			-
CV %	2.29	1.26			-

On PDB (Average of three repetitions)



Photo 4.5. Mycelial growth of *Curvularia lunata* under different temperature on PDB

Mehi *et al.* (2014) studied to know the effect of different temperatures (8, 15, 20, 25, 28, 30, 35 and 37°C) on *Curvularia lunata* causing Curvularia leaf spot on black gram crop. They observed that the fungus can grow up to the temperature ranged of 15°C to 37°C. Whereas, 28°C (830.00mg) was the optimum for the growth of fungus followed by 30°C (734.66mg). Abdel *et al.* (2015) observed *Curvularia lunata* causing disease in rice crop and found that conidia were smooth-walled, olivaceous brown, end cells somewhat paler, conidia obovoidal to broadly clavate, curved at the subterminal cell, 25-30×10-14µm. Conidiophores were erect, septate, unbranched and leuouse in the apical part with lat, dark brown scars, 3 septate. Joshi *et al.* (2023) studied the morphological characters of *C. lunata* in cotton crop by using the microscope. They found that the spores were slightly curved or straight, mycelium was septate with brown to black in colour and conidia

was found 25-27×8-10µm in size.

Cultural characteristics

The cultural studies of *Curvularia lunata* was made by growing single spore culture on potato dextrose agar medium under the different temperature and colony diameter (mm), sporulation, cultural characteristics as colony characters and colony colour as mycelium and substrate were recorded (Table: 2, Photo: 4.5).

The maximum colony diameter (87.76mm) was recorded at 25°C after ten days of incubation followed by 78.69mm at 30°C, 59.42mm at 20°C, 45.36mm at 35°C, 28.00mm at 40°C, 9.00mm at 45°C and no colony growth was recorded at 15°C temperature.

Curvularia lunata was differed in colony characters at different temperature. At 20°C produced profuse fluffy aerial growth with irregular margin, brownish grey mycelium, at 25°C moderate fluffy aerial

growth with regular margin with dark blackish mycelium, at 30°C produced flat mycelial growth with regular margin, brownish black mycelium, at 35°C moderate fluffy aerial mycelial growth, cottony raised growth, grayish black mycelium, at 40°C flat growth with irregular cottony margin, light brown and white mycelium, at 45°C submerged mycelial growth with regular margin with whitish brown mycelium was observed.

Findings of the cultural variations such as mycelial growth, colour and sporulation are in conformity

with the findings obtained by Olufolaji (1983) conducted an experiment on the growth and sporulation of *Curvularia pallescens* of maize on different solid media at different temperatures. The maximum sporulation and growth were observed at 24°C on malt extract agar and potato dextrose agar. Sumangala and Patil (2010) conducted cultural and physiological studies on *Curvularia lunata*, a causal agent of grain discoloration in rice. The maximum growth of *Curvularia lunata* was observed at the temperature of 25°C.

Table 2. Colony diameter, sporulation and cultural characteristics of *Curvularia lunata* under different temperature on PDA

Temp (°C)	Colony diameter (mm) [#]	Sporulation category ^{##}	Cultural characteristics		
			Colony characters	Colour	
				Mycelium	Substrate
15	00.00	-	No growth	-	-
20	59.42	+++	Profuse fluffy aerial growth with irregular margin	Brownish grey	Slight brown
25	87.76	++++	Moderate fluffy aerial growth with regular margin	Dark blackish	Brown to light black
30	78.69	++++	Flat mycelial growth with regular margin	Brownish black	Dark brown
35	45.36	++	Moderate fluffy aerial mycelial growth, cottony raised	Greyish black	Grey
40	28.00	+	Flat growth with irregular cottony margin	Light brown and white	No color
45	9.00	+	Submerged mycelial growth with regular margin	Whitish brown	Light black
SEm±	0.911				
CD at 5%	2.790				
CV %	3.584				

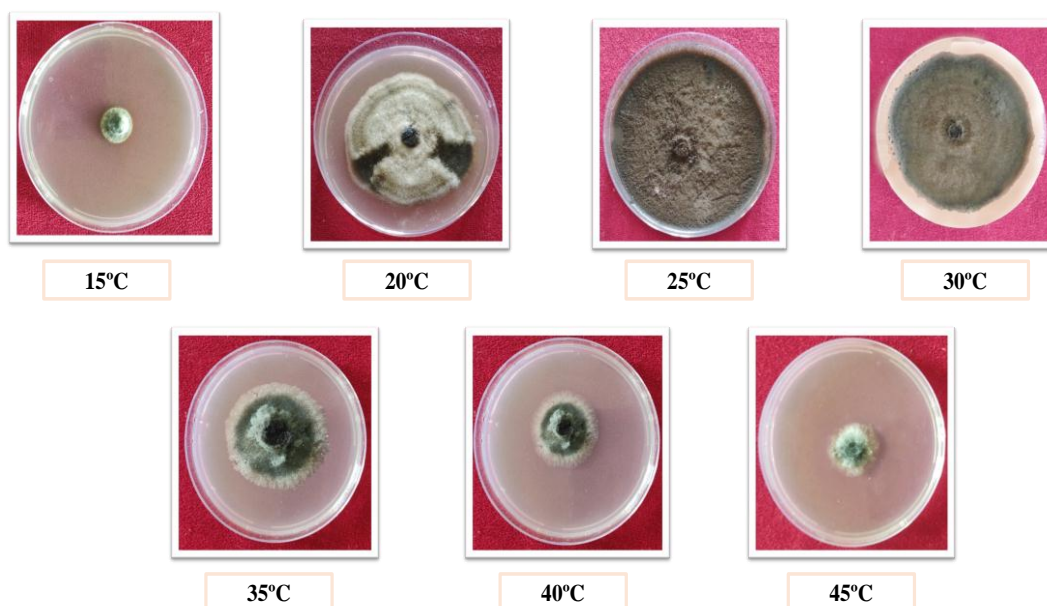


Photo 4.6. Mycelium growth of *Curvularia lunata* on different temperature on PDA

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