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## Prevalence and incidence of *Corynespora* leaf spot disease of cotton under South Gujarat of India

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### Abstract

Cotton is one of the most important economic products of the group of fibers due to volume and value of production. Its cultivation is also of great social importance, due to the number of jobs generated directly or indirectly. Cotton is an important fiber yielding crop of global importance, which is grown in tropical and subtropical regions of more than 80 countries of the world. In this experiment, prevalence and incidence was recorded in the cotton growing regions of Surat, Bharuch and Narmada districts of South Gujarat in the year 2021 to examine the presence of the *Corynespora cassiicola* pathogen on cotton plants and to record the observations on Percent Disease Incidence (PDI). The maximum percent disease intensity was found in the Surat district, while lowest disease intensity of *C. cassiicola* was found in the Bharuch district.

**Keywords:** Cotton, *Gossypium*, prevalence, incidence, *Corynespora*, village, district, intensity, diseases

### Introduction

Cotton (*Gossypium hirsutum* L.) is one of the most important fiber crops playing a key role in the economic and social scenario of the globe. It is the oldest among all the commercial crops of the world, providing fiber for the clothing of mankind. It is also known as "The white gold" or "The king of fibers". Cotton is a premier cash crop of our country and belongs to the family Malvaceae (Anonymous, 2017a) [1]. It is one of the most ancient and important commercial crops next only to food grains and is the principal raw material for flourishing the textile industry. It provides employment and sustenance to a population of nearly 42 million people, who are involved directly or indirectly in cotton production, processing, textiles and related activities (Manickam and Sankaranarayanan, 2013) [15].

Cotton is grown worldwide for its natural fiber and oil. Cotton seed contains 30 percent starch, 25 percent oil and 16.20 percent protein. It is also being used in the manufacture of medicinal supplies, tarpaulin, cordage and belting. The cotton hulls serve as roughage for livestock and the fuzz (short seed hair) is used in the manufacture of papers, plastics, carpets, rayon, explosives and cotton wools etc. (Prasad, 2015) [18].

India is one of the major cotton growing countries in the world. India ranks first in area and second in the total production of cotton in the world. Hence, India has a large domestic textile industry. It is chiefly grown in Maharashtra, Gujarat, Andhra Pradesh, Madhya Pradesh, Punjab, Tamil Nadu and Karnataka. India is the largest cotton growing country in the world with an area of around 134.77 lakh hectare with production of 360.65 lakh bales and productivity of 455 kg/ha, (Anonymous 2017b) [2]. In Gujarat, cotton is cultivated in an area of 26.55 lakh hectare and the production of 86.17 lakh bales with productivity 552 kg/ha (Anonymous (2017b) [2].

In India, the productivity of cotton is very low due to many constraints including diseases. Diseases are inherent compounds of the agro ecosystem that must be dealt with continuously and on a knowledge basis. Cotton is affected by various diseases caused by fungi, bacteria and viruses. The most common cotton diseases reported in India are Wilt (*F. oxysporum* f. sp. *vasinfectum* (G.F. Atk.) W.C. Snyder & H.N. Hansen), Root rot (*Rhizoctonia bataticola* (Taubenh.), *Verticillium wilt* (*Verticillium dahlia* Kleb.), Anthracnose (*Colletotrichum gossypii* Southworth. or *C. capsici* (Syd.) Butler & Bisby), Gray mildew (*Ramularia areola* G.F. Atk.), Blackarm (*Xanthomonas campestris* pv. *malvacearum* (Pammel) Dowson), *Corynespora* leaf blight (*Corynespora cassiicola* (Berk. & M. A. Curtis) C. T. Wei, Leaf blight (*Alternaria macrospora* Zimm) and Leaf curl (Cotton leaf curl virus), Boll rot (Sandipan *et al.*, 2022) [19] and Physiological disorders as Para wilt, Leaf reddening and sometimes Leaf elongation due to improper use of weedicides etc. Among them, *Corynespora*

leaf spot of cotton is one of the important and serious disease of cotton. Looking to the history target leaf spot caused by *C. cassiicola* was reported in Alabama for the first time in 1959 on upland cotton (*Gossypium hirsutum* L.), the most widely planted species of cotton in the world (Jones, 1961 [13]; Onesirosan *et al.*, 1975) [17]. In 1995, target spot was reported on upland cotton in Brazil but under the name of *Corynespora* leaf spot (Mehta *et al.*, 2005) [16]. The first occurrence and re-emergence of the disease on upland cotton appeared from China (Wei *et al.*, 2014) [25], Brazil (Galbieri *et al.*, 2014) [12] and several states in the United States including Georgia (Flumer *et al.*, 2012) [11], Alabama (Campbell *et al.*, 2012 [8]; Conner *et al.*, 2013) [9], China (Wei *et al.*, 2014) [25], Brazil (Galbieri *et al.*, 2014 [12]; Dias *et al.*, 2016) [10]. Louisiana (Price *et al.*, 2015) [20], Tennessee (Butler *et al.*, 2016) [7], Central India (Salunkhe *et al.*, 2019) [21] and South India (Bandi *et al.*, 2022) [6]. Target spot has been a concern for farmers and researchers due to its increasing occurrence especially on cotton (Sumabat *et al.*, 2018) [23] owing to the monoculture farming, adoption of conservation tillage systems, susceptibility of current cultivars, lack of crop

rotation and optimal weather patterns for disease development (Koenning *et al.*, 2006 [14]; Avozani *et al.*, 2014) [5]. The initial symptoms of target spot in cotton are characterized by small spots on the leaves located in the lower stratum of the plant (Conner *et al.*, 2013) [9]. The symptoms were observed in the lower canopy, which progressed upward to cover the entire plant. Initially, leaves exhibited circular to irregular, dark red, small and numerous lesions, which over the time became brown (5-10mm) surrounded by a dark border. As lesions matured, alternating rings of light and dark brown bands developed. The most mature lesions presented like a target type appearance. Lesions may present as concentric rings (Fulmer *et al.*, 2012) [11] and in case of great severity, the leaves acquire a yellowish colour and easily detach from the branches resulting in defoliation (Corner *et al.*, 2013) [9]. Looking to the recurrent occurrence in one or other region and inflicting intensity or damage under South Gujarat region. Hence, the present investigation was undertaken to illuminate deeply and meticulously this disease in these districts of South Gujarat.



Word cloud prepared from the Introduction part

**Material and Methods**

In South Gujarat region, survey of the major diseases of cotton crop was carried out in different fields in various districts. Bt cotton fields from different areas were selected randomly on the survey route. In each field, plants were selected at random and the severity for different diseases was recorded. The range of severity of disease intensity was calculated for foliar disease as the incidence of particular disease in their respective areas.

Five leaves from lower part and 5 leaves from middle/ plant

were selected by using 0-4 scale as given by (Sheoraj, 1989) [22] and then these grades were converted into percent disease intensity (PDI) by using the formula given by Wheeler (1969) [26].

$$\text{Disease incidence (\%)} = \frac{\text{No. of infected plants}}{\text{No. of leaves observed} \times \text{Max. Grade}} \times 100$$

Disease Rating Scale for Alternaria (ALS), *Corynespora* (CoLS), Myrothecium (MLS) and Rust disease

Scale	PDI	Grade	Symptoms
0	0.0	Immune	No Infection
1	1-25%	R	A few small spots, less than 2mm, scattered, which over less than 5% leaf area
2	26-50%	MR	Spots bigger in size up to 3mm and cover 6-20% leaf area covered
3	51-75%	MS	Spots increasing in size 3-5mm, irregular in shape, coalescing and 21-40% leaf area cover
4	>75%	S	Many spots coalesce to make bigger lesion, irregular in shape and size and covering more than 40% leaf area

For foliar diseases, it is the standard methodology of AICRP, Cotton.

**Table 1:** Information details for South Gujarat Farmers

1	Date of sowing	:	Farmer's field: With onset of monsoon Research Farm: 12 <sup>th</sup> -29 <sup>th</sup> June (Depending upon rain)
2	Normal or delayed sowing	:	-
3	If delayed, reasons there of	:	-
4	Number of entries sown	:	BG II hybrids on farmer's field/ others, if any
5	Details of additional entries sown, if any	:	-
6	Whether border rows sown	:	-
7	No. of rows/entry	:	-
8	Row length (in m)	:	-
9	Spacing (in cm)	:	120 x 45 (Irrigated) and 90 x 30 (Rainfed)
10	No. of replications	:	-
11	Irrigation No. with date	:	As per availability
12	No. of Weeding	:	Pre-emergence application of herbicide + 2-3 manual weeding + 2-3 interculturing
13	Fertilizer application	:	240-40-00 NPK kg/ha as per recommendation for hybrids, <i>G. hirsutum</i> 120-0-0 kg/ha and <i>G. herbaceum</i> & <i>G. arboreum</i> 80-0-0 kg/ha (Rainfed)
14	Insecticide/Pesticide application	:	Insecticides for sucking pest & Pink boll worm management and fungicides for foliar diseases

### Result & Discussions

In the years 2021, a roving survey was conducted to determine the presence of *C. cassiicola* pathogen on the cotton plants and to record the observations on Percent Disease Intensity (PDI) in the cotton growing regions of Surat, Bharuch and Narmada districts of South Gujarat. Five areas in each field were chosen to determine the severity of the disease. A total of 25 plants were evaluated from each farmers field. The severity of the disease condition was determined by using a 0-4 point disease assessment scale as mentioned. The survey was conducted for symptomatology, incidence, distribution and spread of the disease along with the results are provided in the Table 2.

Among all the districts of South Gujarat surveyed, the *C. cassiicola* was more prevalent in Surat district. Various locations had different soil and climatic conditions and crops were at different growth stages during the field visit. The cotton crops were surveyed for prevalence of *C. cassiicola* pathogen.

In Surat district, survey was carried out in three locations which, had medium to black soil type and the crop was in flowering to fruiting stage. Table 2 and Fig. 1 revealed that during the year 2021 the disease intensity of Surat district was ranged from 1.50 to 26.50 percent. Maximum disease intensity of 0.00-26.50 percent was observed in LRA 5166 followed by G. Cot. Hy. 12 BG II with 0.00-8.50 PDI, G. Cot. Hy. 8 BG II with 0.00-6.50 PDI and G. Cot. Hy. 10 BG II with 0.00-5.50 PDI at Main Cotton Research Station (MCRS) of Choryasi taluka of Surat. The average disease intensity of 17.00 percent was observed in Surat district. In Bharuch district, total three locations were surveyed. The location had black soil and cotton crop was in flowering to fruiting stage and the disease intensity was ranged from 1.50 to 3.50 percent with the maximum disease intensity of 0.00-3.50 percent was observed in Trinetra BGII at Chiklota village of Valia taluka and the average district disease intensity was 3.00 percent. In Narmada district, total three locations were surveyed. The location had medium to black soil and cotton crop was in flowering to fruiting stage and the disease intensity ranged from 1.00 to 6.50 percent. Maximum disease intensity of 0.00-6.50 percent was observed in Sadabhar BG II at Kukarada village of Dediapada taluka and the average district disease intensity was 3.16 percent. Overall, the survey results indicated that the MCRS location of Surat district,

which can be considered as the main region for the presence of *C. cassiicola* pathogen.

Similar research findings were reported by Suresh *et al.* (2017) [24], who carried out survey of the target leaf spot disease in chilli in major chilli growing areas at Basantpur, Mohanpur, Haringhata, Jajuli, Kalyani and Laupala in Nadia district of West Bengal during the year 2015-16. The disease incidence range varied from 11 to 35 percent in different chilli fields.

The survey was conducted in major cotton growing districts of Guntur, Krishna and Prakasam of Andhra Pradesh. The intensity of *Corynespora* leaf spot disease was observed 15 and 12 percent in Akira and RCH 659 in Krishna district. The average highest PDI 21.3 percent, 11.07 percent and 7.7 percent of *Corynespora* leaf spot was recorded in Krishna, Guntur and Prakasam districts (Anonymous, 2020b) [3].

The survey was conducted in major cotton growing districts of Bhavnagar, Rajkot and Junagadh of Gujarat, 2021. In mid season, the PDI of *Corynespora* leaf spot (CoLS) was observed in the range of 0.0-10.5 percent. Whereas, in the late season, PDI of the *Corynespora* leaf spot disease (CoLS) was recorded in the range of 15.0-55.2 percent (Anonymous, 2021a) [4]. Whereas, in the late season, PDI of the *Corynespora* leaf spot disease (CoLS) was recorded in the range of 15.0-55.2 percent (Anonymous, 2021a) [4].



(A) MCRS, Surat





(B) Modaliya, Bharuch



(C) Dediypada, Narmada



(D) Sagbara, Narmada

**Table 2:** Survey for occurrence of Target spot disease in cotton crop of South Gujarat during the year 2021

Sr. No.	District	Taluka	Village / GPS Coordinates	Type of soil	Variety	Stage of crop	Percent Disease Intensity (PDI) Range
1.	Surat	Mangrol	Ambavadi 21.08'56" °N, 72.71'71" °E	Medium black	PandavBG II	Flowering	0.00-2.50%
		Choryasi	MCRS farm 21.17'00" °N, 72.80'10" °E	Black	G. Cot. Hy. 12 BG II G. Cot. Hy. 8 BG II G. Cot. Hy. 10 BG II LRA 5166	Fruiting	0.00-8.50% 0.00-6.50% 0.00-5.50% 0.00-26.50%
		Umarpada	Vakrant Amba 21.46'56" °N, 73.56'53" °E	Medium black	Rashi Neo 578 BG II	Flowering	0.00-1.50%
	District Mean						
2.	Bharuch	Valia	Chiklota 21.63'38" °N, 73.31'46" °E	Black	Trinetra BGII	Fruiting	0.00-3.50%
		Netrang	Modaliya 21.21'55" °N, 71.54'27" °E	Black	Pandav BG II	Flowering	0.00-2.00%
		Amod	Ranipura 22.01'53" °N, 72.87'81" °E	Black	Shanar BG II	Fruiting	0.00-1.50%
	District Mean						
3.	Narmada	Rajpipala	Mota Limbatwada 21.87'57" °N, 73.55'94" °E	Medium Black	Bhagya 999 BG II	Flowering	0.00-1.00%
		Dediypada	Kukarada 21.94'51" °N, 73.87'42" °E	Medium Black	Sadabahar BG II	Flowering	0.00-6.50%
		Sagbara	Simamli 21.52'00" °N, 73.76'58" °E	Black	Rashi 658 BG II	Flowering	0.00-2.00%
	District Mean						

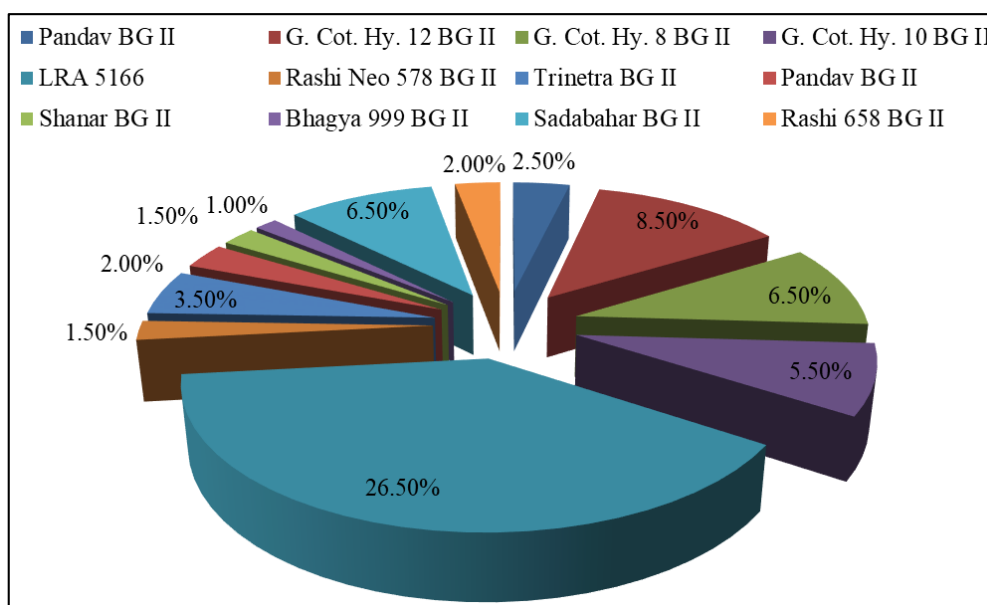


Fig 1: Survey for target leaf spot disease of cotton in South Gujarat during the year 2021

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