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## Survey and identification of fungal plant diseases in important fruits and vegetables of Tamil Nadu

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A field investigation was conducted in Coimbatore district of Tamil Nadu in the year 2020 to 2021 in order to identify the fungal plant diseases of some important crops (tomato, brinjal, sugarcane, mango and banana). The diseases were identified based on the development of characteristic disease symptoms on the plant and morphological studies of the associated micro-organisms under the microscope as- Early blight of Tomato (*Alternaria solani*), Septoria leaf spot of Tomato (*Septoria lycopersici*), Cercospora leaf spot of Brinjal (*Cercospora melongenae*), Red rot of Sugarcane (*Colletotrichum falcatum*), Grey blight of Mango (*Pestalotia anacardii*), Anthracnose of Mango (*Colletotrichum gloeosporioides*) and Yellow sigatoka leaf spot of Banana (*Cercospora musae*). The per cent disease incidence was assessed by recording the number of plants showing disease symptoms and the number of plants examined. Grey Blight of Mango was found to have the highest disease incidence in Udumalaipettai block, whereas Pollachi (North) recorded highest disease incidence for all other important crop diseases. It was also observed that Pollachi (North) block had the highest PDI (Per cent Disease Index) values for all diseases when compared to Udumalaipettai block.

**Keywords:** Disease incidence, disease severity, fungal diseases, Percent disease index Survey

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### INTRODUCTION

An estimated 10 to 30% of crop productivity is lost to crop losses caused by pests, diseases and weeds. Therefore, any disease that affects agriculture will have an impact on our economy and the population that depends on it (Lakshimikanth, 2008). A form of plant pathogen symptom known as a fungal disease symptom is what causes significant plant diseases (Bhawan, 2009).

To gather complete data on the disease distribution, severity and to recognise hotspots for genotype diagnostics in the disease resistance screening programme, a survey of the disease is required. Plant disease survey involves field survey of farmers' field, collection of samples and confirmation of the sample in the laboratory. Plant disease survey aims at identifying the causal organism from the symptoms observed and by

laboratory confirmation. The survey area that was chosen was Coimbatore which is one of the 38 districts that make up the state of Tamil Nadu. After Chennai and Tiruvallur district, it is the third most populous district in the state as of the 2020 census (Kumar and Elangovan, 2009). There are two Rural Development blocks in Coimbatore District viz. Udumalaipettai RD Block and Pollachi (North) RD Block. All of these blocks were surveyed and studied. Among the villages of Coimbatore District, three villages from each RD block were selected: Gollapatti, Ramapattinam, Rasakap-alayam, Alampalayam, Reddipalayam and Gandhi Nagar.

### MATERIALS AND METHODS

A survey on fungal diseases of vegetables (Tomato and Brinjal), cash crop (Sugarcane) and fruit crops (Banana and Mango) in Coimbatore district, Tamil Nadu was undertaken in farmer's field during *Kharif* and *Rabi* season of 2020-21. To identify the association of crop host and pathogen in the crop field in villages, three fields were chosen and for

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each crop, four trips were made to the field at different times, to coincide with the onset and progression of disease. The evaluation was made, based on plant components exhibiting characteristic symptoms and identification of pathogen was made based on their cultural and morphological characters.

The extent of damage caused by the pathogen to the crop was also assessed. Disease severity rating was recorded periodically for each field at different crop growth stages. The visual rating for disease damage was made according to the values given in a scale (Phytopathometry) for different crops. Survey sites were categorised into no/low (0-3 predominant), moderate (4-6 predominant) and high (7-9 predominant) based on disease incidence and severity. The per cent disease incidence was assessed by recording the number of plants showing disease symptoms and the number of plants examined. In each village, three fields were selected and in each field plants were examined randomly and scored for disease incidence by using the following formula.

$$\text{Disease incidence (\%)} = \frac{\text{No. disease plant}}{\text{Total No. of plant assessed}} \times 100$$

The disease scoring scales as given by Mayee and Datar (1986) and Sangeetha and Siddaramaiah (2007) were adopted for scoring pathogenicity.

Disease severity value was converted to (PDI) percent disease index. The disease incidence was assessed by recording severity of disease in a locality by adopting 0-9 scale (Mayee and Datar, 1986) and 0-5 scales (Sangeetha and Siddaramaiah, 2007).

$$\text{PDI (\%)} = \frac{\text{Sum of individual Rating}}{\text{Total No. of plant observed} \times \text{max disease grade}} \times 100$$

## RESULTS AND DISCUSSION

### **Association of crop host and pathogen** **Early blight of tomato**

Following careful examination of the tomato field, tiny black dots with a dark centre and scattered borders, size of 1.0-1.5 mm in diameter were observed on leaves and fruits of Tomato. The fungus produced dark mycelium, conidiophores

and conidia. Conidia that were produced had between 7 and 8 septa and measured 153- 288 × 18 -20 μm size ( Fig.1A & B).

### **Septoria leaf spot of tomato**

The symptoms of septorial infections appeared on leaves as tiny darkish brown dots approximately the size of head of a pin. The patches gradually grow in size and turn brown to greyish in colour. The boundaries of old spots are black, and the cores are light. The pycnidia were described as being black, globose to subglobose, ostiolate and 100–150 μm in diameter ( Fig. C & D)

### **Cercospora leaf spot of Brinjal**

Following careful examination of the brinjal field, the symptoms appear as circular spots which are typically large and brown to grey brown in colour, subsequently spots consolidate and damaged leaves usually fall down, although lesions on fruits were deep brown increased primarily on ripening fruits. *Cercospora melongenae* conidiophores were 25–115 × 4 μm in size, pale brown in colour, not branching, septate and geniculate ( Fig.1 E & F).

### **Red rot of Sugarcane**

A thorough inspection of the sugarcane field revealed discoloration of the young leaves is the first sign of red rot in a field. The tissues are uniformly reddish in the basal region, but the vascular bundles are notably strongly red. The symptoms on the leaves of infected plants are dark red

lesions in the midrib that lengthen and turn blood-red. Conidia are hyaline, unicellular, falcate or sickle-shaped and sometimes fusoid measuring 16-48 × 4-8 μm with oil globule ( Fig. G & H).

### **Grey blight of Mango**

The majority of the leaf surfaces gradually became infected on both leaf margins. Later, the leaves colour changed from green or brown to silvery grey and black pinhead-like specks on them, which caused drying and a loss of connection to the twig before the leaves completely defoliated. Mycelium was fluffy white, Conidia were borne on little conidiophores that were 3 to 5 septate, but mainly 4 septate, with dark-colored core cells and hyaline

terminal cells. Plate 13 shows conidia measurements of 15-25 × 3.3-5µm. At the terminal portion, three cilia were found ( Fig.1 I & J).

### **Anthraxnose of Mango**

After carefully examining the mango field, sunken dark brown to black markings with round to irregular edges were seen on the younger leaves. Individual leaf patches that were consolidated with or without shot holes symptoms were present. Additionally, deformed, irregularly blighted necrotic leaves were seen. The acervuli were normally setose or glabrous in appearance, spherical to elongate or irregular in shape, and up to 500 µm in diameter ( Fig.1 K & L).

### **Yellow sigatoka leaf spot of Banana**

Symptoms originally emerged as yellow streaks on the lower surface of the leaves, which progressively turned into brown streaks and, eventually, brown dots with grey centres. Conidiophores are upright, hyaline, and lack septation, geniculation, or branching, as well as spore scars. Conidia were terminal produced and usually cylindrical to obclavate cylindrical in shape. Usually having 2 to 5 septa, measuring about 10-80 µm × 2-6 µm with no distinct basal hilum ( Fig.1 M, N & O).

### **Association of crop host and pathogen in the crop field**

A detailed survey was undertaken during *Kharif and Rabi* 2020-21 in parts of Coimbatore district to gather information on the association of host and pathogen, incidence, distribution and spread of fungal diseases of vegetables, cash crop and fruit crops. From the survey it was revealed that the incidence of the diseases varied from one locality to another depending on the type of crop variety cultivated. The severity of disease was also dependent on inoculum load, agro-climatological situations prevailing in different localities. Assessment of the extent of damage caused by the pathogen to the crop under study is discussed below.

Among Tomato diseases, highest disease incidence of all the two diseases i.e. Early blight (*Alternaria solani*) and Septoria leaf spot of Tomato (*Septoria lycopersici*) was recorded in Pollachi

(North) block with 7.80% and 11.00% respectively (Table 1). In case of Brinjal, *Cercospora* leafspot of Brinjal (*Cercospora melongenae*), Red rot of Sugarcane (*Colletotrichum falcatum*) highest disease incidence was again recorded in Pollachi (North) block with 23.00% and 15.75% respectively (Table 1). Mango Grey blight caused by *Pestalotia anacardii* was found to be highest in Udumalaipettai block with the incidence of 15.94%. In case of Mango Anthracnose (*Colletotrichum gloeosporioides*) disease incidence was highest in Pollachi (North) block (20.88%). With respect to Banana, Yellow sigatoka leaf spot (*Cercospora musae*) was found to be highest in Pollachi (North) block with the incidence of 16.54% (Table 1).

Plant Disease severity of all the diseases were also studied in Pollachi (North) and Udumalaipettai blocks. In case of diseases of Tomato, the highest PDI of Early blight (*Alternaria solani*) and Septoria leaf spot of Tomato (*Septoria lycopersici*) were observed in Pollachi (North) block with 6.18% and 7.39% respectively (Table 2). The PDI for all the diseases was also recorded to be highest for the rest of the diseases as well in the Pollachi (North) block as shown in Table 2.

In the present investigation, the high incidence of early blight in Pollachi (North) block may perhaps be described to the lower temperature and high humidity in the region. Early blight is more common and grows luxuriantly in dry and cool climate (Pawar and Chavan, 2010). In humid environments, especially during rainy seasons, frequent dew or over irrigation conditions exist (Andrus *et al.* 2005; Delahaut and Stevenson, 2014). Under favourable disease development conditions, it may cause full defoliation, resulting in severe crop loss. *Cercospora* leaf spot of brinjal due to environmental factors like temperature, moisture etc, which promotes the growth of fungus. The observations are supported by the findings of Srivastava *et al.* (2011). Red rot of sugarcane due to breakout of high disease incidence in this block could be due to farmers continuing to harvest sugarcane in their fields year after year without using a crop rotation strategy. As a result, infected material left in the field acts as a key source of infection, triggering disease outbreaks throughout the season. This could be attributable to cultivar differences or favourable climatic conditions such as temperature and steady rainfall during the study period. The conclusions were confirmed by

**Table 1a** : Percent Disease Incidence in tomato and brinjal in different villages and blocks under Coimbatore district,2020-21

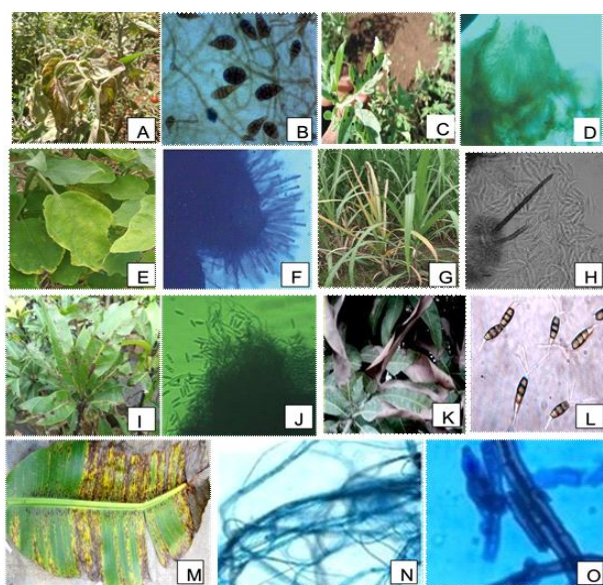
Block	Village	Fields	Tomato			Brinjal					
			DI (%)	Mean incidence of early blight disease of tomato	DI (%)	Mean incidence of septoria leaf spot disease of tomato	DI (%)	Mean incidence of cercospora leaf spot disease of brinjal			
			Village	Block	Village	Block	Village	Block			
Pollachi (North)	Gollapatti	F1	7.50	7.16	7.80	17.50	16.30	11.00	22.22	26.64	23.00
		F2	9.00			26.66			38.10		
		F3	5.00			4.72			19.60		
	Ramapattinam	F1	7.50	9.27		12.50	9.70		35.71	33.00	
		F2	8.09			7.14			33.75		
		F3	12.22			9.44			29.33		
	Rasakapalayam	F1	6.50	7.00		11.00	7.00		11.50	9.20	
		F2	3.66			4.33			10.00		
		F3	10.76			5.64			6.11		
Udumalai Pettai	Alampalayam	F1	10.47	7.05	5.79	10.00	6.76	6.10	6.00	5.21	6.10
		F2	3.32			6.09			4.00		
		F3	7.36			4.21			5.64		
	Reddipalayam	F1	9.13	5.58		9.13	6.54		10.00	7.61	
		F2	2.61			5.00			5.81		
		F3	5.00			5.50			7.01		
	Gandhinagar	F1	5.65	4.75		4.34	5.02		5.75	5.46	
		F2	4.52			3.09			8.26		
		F3	4.00			7.60			2.39		

**Table 1b** :Per cent Disease Incidence in sugarcane, mango different villages and blocks under Coimbatore district, Tamil Nadu, 2020-21

Block	Village	Fields	Sugarcane				Mango				Banana			
			DI (%)	Mean incidence of red rot disease of sugarcane	DI (%)	Mean incidence of grey blight disease of mango	DI (%)	Mean incidence of anthracnose disease of mango	DI (%)	Mean incidence of Yellow sigatoka leaf spot disease of cotton				
			Village	Block	Village	Block	Village	Block	Village	Block				
Pollachi (North)	Gollapatti	F1	22.22	26.64	15.75	17.85	16.29	14.88	35.71	29.29	20.88	17.50	16.29	16.54
		F2	38.09			12.69			23.81			26.66		
		F3	19.60			18.33			28.33			4.72		
	Ramapattinam	F1	12.50	12.52		7.50	10.63		17.50	14.74		25.00	19.81	
		F2	12.86			8.10			11.90			16.67		
		F3	12.22			16.29			14.81			17.77		
	Rasakapalayam	F1	11.50	8.04		12.38	17.72		9.53	18.60		17.50	13.50	
		F2	7.00			10.78			20.58			11.90		
		F3	5.64			30.00			25.71			11.11		
Udumalai Pettai	Alampalayam	F1	5.71	4.29	5.71	27.50	16.45	15.94*	46.25	25.55	19.54	5.00	7.07	7.68
		F2	3.32			6.31			12.63			7.00		
		F3	3.86			15.55			17.77			9.23		
	Reddipalayam	F1	9.13	7.37		20.00	15.02		10.47	16.28		17.61	10.89	
		F2	5.00			10.78			9.80			6.64		
		F3	8.00			14.28			28.57			8.42		
	Gandhinagar	F1	5.75	5.46		16.25	16.33		13.75	16.78		4.78	5.05	
		F2	8.26			25.33			24.00			2.38		
		F3	2.39			7.40			12.59			8.00		

**Table 2:** Per cent Disease Index of the diseases in different blocks under Coimbatore district during 2020-21

Block	Village	Early blight of tomato	Septoria leaf spot of tomato	Cercospora leaf spot of brinjal	Mean PDI Red rot of sugarcane	Grey blight of Mango	Anthrachnose of Mango	Yellow sigatoka leaf spot of banana
Pollachi (North)	Gollapatti	6.18	7.39	17.73	17.29	19.43	12.32	14.49
UdumalaiPettai	Ramapattinam Rasakapalayam Alampalayam	4.51	4.37	5.76	3.76	13.82	9.00	4.19
	Reddipalayam Gandhinagar							



**Fig.1( A-O ) :** Symptoms of crop and vegetable diseases along with microscopic observations of pathogens. Symptoms of Early Blight of tomato (A), Septoria leaf spot of tomato (C) Cercospora leaf spot of brinjal (E), Red rot of sugarcane (G), Grey blight of mango (I), Anthracnose of mango (K) and Yellow sigatoka leaf spot of banana (M). B- Conidia with mycelium of *A. solani* (40x); D- Pycnidium of *S. lycopersici* (100x); F- Conidiophores of *Cercospora melongenae* (40x); H- Conidia and setae of *Colletotrichum falcatum* (40x); J- Conidium having three celled appendages of *Pestalotia anacardiae* (100x); L- Acervuli of *Colletotrichum gloeosporioides* (40x); N & O- Mycelia and conidia, respectively of *Cercospora musae* (100x).

the results of (Chattopadhyay *et al.* 2011), who also observed that the severity of red rot disease on leaves was favoured by relative humidity (RH) and temperature. The highest disease incidence of anthracnose of mango and disease severity was recorded in Pollachi (North) block. It is known that the cultivation method of the farmers can also influence higher disease incidence like fields being surrounded by bushes or grasses. These favour

longer retention of water droplets from rain order, which are required for fungal spore germination and subsequent incursions (Jones *et al.* 2008). In the present investigation, the high incidence of anthracnose in Pollachi (North) block may perhaps be described to the incidence of the disease caused by high rainfall and favourable environmental circumstances, such as optimal temperature and humidity, moisture conditions that may have favoured the build-up of inoculum and, as a result, increased disease severity (Kumar, 2013). This could be attributed to farmers not using proper management measures, such as fungicidal spray against sigatoka leaf spot. Also, because of the persistent rains throughout the season, fungicidal spraying was not possible, at least for those farmers who typically used it. The high disease incidence may also be attributed to the influence of weather. The influences of weather on the pathogen resulting in high disease incidence have also been reported by (Meena *et al.*, 2010). Similarly, severity of sigatoka leaf spot disease on leaves was positively correlated to environmental factors which were favourable to disease development (Chattopadhyay *et al.* 2005).

## CONCLUSION

With the exception of the Grey Blight of Mango where the disease incidence was found highest in Udumalaipettai block, the highest disease incidence was found in the Coimbatore district's Pollachi (North) block for all other diseases. The Pollachi (North) block had the highest PDI (Percent Disease Index) reading for all the diseases when compared to Udumalaipettai block.

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