

Survey for the determination of dominant foliar pathogens of chilly in Tamil Nadu

<https://doi.org/10.56343/STET.116.010.004.010>
<http://stetjournals.com>

P. Ahila devi, R. Priyanga and V. Prakasam

* Plant Pathology unit, Tamil Nadu Rice Research Institute (TNAU, Coimbatore), Aduthurai, Tamil Nadu, India.

Abstract

Anthrachnose and powdery mildew are the two major foliar diseases of chilli crop and prevalent in Tamil Nadu. Field surveys were conducted in 12 districts of Tamil Nadu. They revealed that the Per cent Disease Index of chill anthracnose ranged from 8.80 - 78.89. Field surveys conducted in 7 districts of Tamil Nadu revealed that the disease incidence of chilli powdery mildew was ranged from 22.74 to 53.36 per cent. Seventeen isolates of *Colletotrichum capsici* were isolated from the samples and were named as Cc1 to Cc17 as continuous series. Three isolates were identified as *C. gloeosporioides* and were named as Cg1, Cg2 and Cg3. This indicated that *C. capsici* is a major pathogen involved in the anthracnose disease of chilli in Tamil Nadu. The pathogenicity tests conducted for *C. capsici* and *L. taurica* resulted in the development of typical symptoms of the anthracnose and powdery mildew.

Keywords: chilli- Anthracnose- powdery mildew -survey

Received :May 2016

Revised and Accepted :April 2017

INTRODUCTION

Chilli (*Capsicum annum*) is the fourth most important vegetable crop in the world and first in Asia, with world production approximately 122.34 million tonnes of fresh chilli and 2.8 tonnes of dry chilli in 2010 (Indian Horticultural Database). The most important producers and exporters of chilli include China, India, Mexico, Morocco, Pakistan, Thailand and Turkey. Demand for chilli in the world is increasing every year (FAO, 2004). Chilli is a very remunerative spice crop of the Indian subcontinent (Sharma *et al.*, 2005) and it is cultivated in occupies an area of about 0.81 million ha (Suthin Raj and Christopher, 2009) which accounts for 25% of the world production (Chandra Nayaka *et al.*, 2009). In Tamil Nadu, chilli is cultivated on 49.0 thousand hectares with 31.8 thousand tonnes of production. Chilli not only meets the domestic consumption but also helps in earning foreign exchange. One of the great challenges facing the world is to produce adequate food for the growing population. Under these circumstances, one third of the global food production is estimated to be destroyed annually by over 20,000 species of insects, diseases, weeds, mites, nematodes, rodents and other field storage fungi and pests (McEven, 1978). Besides insects

and weeds, plant diseases caused by fungi lead to yield loss to most the crops in the field as well as in storage. Unlike other chilli-producing countries, about 90 per cent of the production (estimated over 10 lakh tonnes of chilli) in India is absorbed by the huge domestic market. India exports only about 1.5 lakh tonnes of chilli out of the total production of 7.5 lakh tonnes (Anon, 2008).

Chilli is attacked by several fungal, bacterial and viral diseases. Among them, anthracnose and powdery mildew are found to be the major diseases incurring heavy losses, if not cared. Anthracnose (fruit rot and die back) caused by *Colletotrichum capsici* (Syd. Butler and Bisby) is prevalent throughout the chilli growing areas of India. (Jeyalakshmi, 1996).

The powdery mildew caused by *Leveillula taurica* (Lev.) Arn. is also one of the major constraint in chilli production in India causing heavy yield loss ranging from 14 to 20 per cent, due to severe defoliation and reduction in size and number of fruits per plant (Mathur *et al.*, 1972, Sivaprakasam *et al.*, 1976; Gohokar and Peshney, 1981). Thus the management of the crop to achieve good population and yield needs a through understanding of the constraints that affects the productivity. Crop yield loss due to disease is one of the major constraint, and hence an attempt has been made to survey the major pathogens that cause severe loss the crop and the confirmation of the pathogenic potentialities of the organisms were made by adoption the principles of Koch's postulates.

*Corresponding Author :
email: ahila.devi1@gmail.com

Survey for the incidence of anthracnose of chilli in Tamil Nadu

An intensive survey was conducted to assess the severity of the anthracnose disease and to collect different isolates of *Colletotrichum capsici* causing anthracnose in chilli. The diseased fruits were collected from the different districts of Tamil Nadu. Twenty five fruits were randomly selected and Per cent Disease Index was calculated as per the standard grade chart given by Ravinder Reddy (1982).

Disease score chart for anthracnose

Grade	Description(Per cent fruit/ leaf area infected)
0	No sign or symptoms
1	0-10 Per cent infection
3	11-15 Per cent infection
5	16 - 25 Per cent infection
7	26-50 Per cent infection
9	>50 Per cent infection

Survey for the incidence of powdery mildew of chilli in Tamil Nadu

Surveys were conducted to assess the severity of powdery mildew and to collect different isolates of *Leveillula taurica* causing powdery mildew in chilli. The diseased leaves were collected from different districts of Tamil Nadu. Twenty five leaves were randomly selected in each replication and Per cent Disease Index was calculated as per the standard grade chart given by Jamadar and Desai (1997).

Disease score chart for powdery mildew

Grade	Description (Per cent leaf area infected)
0	No infection of powdery mildew or anthracnose
1	1-10 Per cent infection
2	11-15 Per cent infection
3	16-25 per cent infection
4	26-50 per cent infection
5	> 50 Per cent infection

The per cent disease index (PDI) was worked out using the following formula Mc Kinney's (1923).

$$PDI = \frac{\text{Total sum of numerical rating}}{\text{Total number of fruits/ leaves observed}} \times \frac{100}{\text{Maximum disease grade}}$$

Isolation of different isolates of *C.capsici*

The diseased chilli fruits showing the typical symptom of anthracnose were collected from different

districts of Tamil Nadu. The infected portions of the fruit were cut into small bits, surface sterilized in 0.1 per cent mercuric chloride solution for 30 sec., washed in repeated changes of sterile distilled water and placed on to sterilized PDA medium poured in sterilized Petri dishes. The plates were incubated at room temperature (28 ± 2 °C) for five days and observed for the fungal growth. The fungus was purified by single spore isolation technique and the purified isolates were maintained on PDA slants for further studies. The isolates from different districts were assigned numbers and maintained for further studies. (Anand, 2005)

Collection and maintenance of inoculum of *Leveillula taurica* in greenhouse

Chilli leaves showing typical powdery mildew symptoms were collected from different districts of Tamil Nadu. Conidial suspensions were prepared according to the methods of Vimala (2005). Conidia were harvested from diseased leaves by flooding the leaves with sterile distilled water. The process was repeated three times to obtain sufficient inoculum. The conidial suspension was strained through two layers of cheese cloth and centrifuged twice at 4000 rpm for 30 min. The conidial concentration was adjusted to 5×10^6 per ml with sterile distilled water (Souza and Cafe-Filho, 2003). Chilli hybrid - SIERRA was used for maintaining the powdery mildew isolates in glass house. To maintain the sufficient inoculum, 60 day old healthy chilli plants in the greenhouse were sprayed with spore suspension, after making slight pin pricks. They were then covered with polythene bags for 24 h to maintain high humidity for disease development. The different isolates were numbered and maintained for further studies.

Pathogenicity studies of different isolates of *C.capsici*

The pathogenicity of the purified isolates of *C.capsici* was proved by Koch's postulates. Chilli hybrid SIERRA was used for this study. The plants were raised in the glass house in earthen pots (30 cm) which contain three kg of uniform pot culture soil. Three plants were maintained in each pot. When the chilli plants were 45 days old, the plants were inoculated with conidial suspension (5×10^5 spores ml⁻¹) prepared in sterile distilled water from 10 days old culture of the different isolates. Water congestion was provided to the plants both 24 h prior to and after the inoculation by covering the plants with a moist polythene bag. The inoculation was done in the cool hours late in the evening. The plants were maintained inside the glass house. The symptom of the disease was observed on 7th and 15th day after inoculation and the disease severity was recorded. The plants sprayed with sterile distilled water served as control. The symptoms were recorded and compared with the original symptoms. The fungus was reisolated from artificially inoculated leaves and compared with the original isolate. (Anand, 2005)

Pathogenicity of *Leveillula taurica* in chilli leaves

Conidial suspension of powdery mildew was prepared by scrapping the conidia from the infected leaves of chilli. The conidial concentration was adjusted to 10⁶ conidia /ml using a haemocytometer. This suspension was sprayed on healthy leaves of 30 days old plants. The plants were covered by polythene bags for 24 hours to maintain high humidity for disease

Table 1. Survey for the incidence of chilli anthracnose disease in different districts of Tamil Nadu

Sample No	District	Location	Per cent disease index (PDI)
C1	Madurai	Chittampatti	78.89
			(62.58) ^a
C2	Virudhunagar	Arupukottai	51.76
			(45.97) ^b
C3	Tirunelveli	Narnapuram	26.65
			(31.05) ^f
C4	Salem	Karupur	40
			(39.23) ^c
C5	Virudhunagar	Sankarankovil	38.86
			(38.53) ^d
C6	Virudunagar	Rajapalayam	53.12
			(46.78) ^b
C7	Tuticorin	Kovilpatti	28.84
			(32.46) ^f
C8	Salem	Omalur	64.41
			(53.37) ^b
C9	Erode	Sakthi	22.89
			(28.52) ^h
C10	Coimbatore	Perur	76.53
			(61.00) ^a
C11	Nagapattinam	Mayiladuthurai	45
			(42.13) ^c
C12	Pondicherry	Karaikal	39.42
			(38.88) ^d
C13	Coimbatore	Othakalmandabam	46.7
			(43.11) ^e
C14	Thirunelveli	Menachipuram	25.55
			(30.33) ^g
C15	Dindugal	Palani	50
			(45.00) ^b
C16	Coimbatore	Mathampatti	39.49
			(38.65) ^{bc}
C17	Coimbatore	TNAU	32.73
			(34.88) ^e
C18	Nagapattinam	Nagore	21.11
			(27.27) ^g
C19	Coimbatore	Lakshmiapuram	48.25 ^c
			-43.97
C20	Nagapattinam	Nagore	8.88 ⁱ
			-17.26



Fig. 1. Survey for the incidence of powdery mildew in chilli in different districts of Tamil Nadu

Table 3. The pathogens identified from chilli crop

S.No	Pathogens-	Acession No	Sequence similarity.
1	<i>Colletotrichum capsici</i>	JN717228.1	100
2	<i>Colletotrichum capsici</i>	JN717227.1	100
3	<i>Bipolaris</i> sp. AD-2012a	JX010685.1	100
4	<i>Bipolaris</i> sp. AD-2012b	JX010686.1	100
5	<i>Exserohilum</i> sp. AD-2012	JX010687.1	100
6	<i>Fusarium</i> sp. AD-2012a strain	JX010680.1	100
7	<i>Fusarium</i> sp. AD-2012a	JX010681.1	100
8	<i>Colletotrichum gloeosporioides</i> strain cg20	JX010682.1	100
9	<i>Colletotrichum capsici</i> strain cc3	JX010683.1	100
10	<i>Fusarium</i> sp. AD-2012b strain cbe2	JX010684.1	100

development. The development of the disease was observed at regular periodical intervals after inoculation (Vimala, 2005).

RESULTS AND DISCUSSION

Survey for the incidence of chilli anthracnose in different districts of Tamil Nadu

Field surveys in 12 districts of Tamil Nadu revealed that the Per cent Disease Index (PDI) was ranged from 8.80 - 78.89. The Chitampatti of Madurai district recorded highest disease incidence, followed by Perur of Coimbatore (76.53%) and Omalur of Salem district (64.41%). The minimum of 8.8 per cent was recorded in Nagore of Nagapattinam district. Angadi (1999) carried out a survey for the incidence of anthracnose of chilli caused by *C. capsici* in Raichur, Dharwad and Gadag districts. The disease was more prevalent in Raichur district than in Dharwad and Gadag districts. Sanathkumar (1999) during his survey in and around Bangalore district observed that the chilli varieties Chikkaballapur, Gauribidanur, Byadagi Kaddi and Pant C-2 showed anthracnose infection of 25, 35, 30 and 25 per cent, respectively. Madhusudhan (2002) surveyed the incidence of soybean anthracnose caused by *C. truncatum* and collected 24 soybean seed samples

of 15 genotypes from Bangalore, Dharwad, Nippani, Sankeshwar, Ugarkhurd, Coimbatore, Guntur and Indore. Further, he reported that seed infection by *C. truncatum* was of 2.0, 3.92, 6.75, 4.08, 4.25, 0.50, 5.17 and 3.25 per cent, respectively. Prakasam (1983) also surveyed for the occurrence of anthracnose in different districts of Tamil Nadu.

Survey for the incidence of chilli powdery mildew in different districts of Tamil Nadu

Field surveys were conducted in 7 districts of Tamil Nadu (Figure.1). Ten leaves were collected and the PDI was worked out and the results revealed that the disease incidence was ranged from 22.74 to 53.36 per cent. Omalur of Salem district recorded the least incidence of 22.74 per cent as compared to the highest incidence of 53.36 per cent in Satyamangalam of Erode district. This was followed by Rajapalayam of Virudhunagar district which recorded the PDI of 52.25 per cent. Practically no survey report was available on the incidence of powdery mildew in different districts of Tamil Nadu. The pathogenecity tests were conducted in glass house condition using chilli hybrid, SIEERA. The chilli plants were inoculated as per the method. The plants were observed for symptom development upto 15 days of inoculation. It was observed that all the isolates exhibited the typical symptoms of anthracnose. In the case of powdery mildew also the plants were sprayed with the standard density of conidial suspension (10^6 conidia/ml), and were observed for symptom development after 7 days. All the isolates produced typical symptoms of powdery mildew

REFERENCE

- Anand, T. 2005. Bioefficacy, Phytotoxicity and Residues of Azoxystrobin (Amistar 25 SC) against Major Fungal Diseases in Chilli (*Capsicum annuum* L.), Cucumber (*Cucumis sativus* L.) and Tomato (*Lycopersicon esculentum* L.). Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore, India. p. 190.
- Angadi, H. D. 1999. Studies on anthracnose of chilli (*Capsicum annuum*) and its management. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Bangalore, Karnataka, India.
- Anon, 2008. Spices export in 2007-08. http://www.Indianspices.com/admin/content_files/review_2007-08-R.pdf.
- Chandra Nayaka, S., Udaya, A.C., Shankar, Niranjana, S.R., Prakash, H.S. and Mortensen, C.N. 2009. Anthracnose disease of chilli pepper. *Asian Seed Health Centre Technical Bulletin*. P. 1-13
- Gohokar, R.T. and Peshney, N.L. 1981. Chemical control of powdery mildew of chilli. *Indian J. Agric. Sci.*, 51: 663-665.
- Indian Horticultural Database, 2011-2012.
- Jamadar, M.M. and Desai, S.A. 1997. Bioefficacy of dimethomorph against downy mildew of grapevine. *Adv. Agric., Res-India*, 4:81-85.
- Jeyalakshmi, C. 1996. Studies on fruit rot and die-back disease of chilli (*Capsicum annuum* L.) incited by *Colletotrichum capsici* (syd.) Butler and Bisby. M.Sc. (Ag.) Thesis. Tamil Nadu Agric. Univ., Madurai, India. 216p
- Madhusudhan, B. S. 2002. Studies on soybean anthracnose caused by *Colletotrichum truncatum* (Schw.) Andrus and Moore. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Bangalore, Karnataka, India.
- Mathur, R.I., Singh, G. and Gupta, R.B.L. 1972. Chemical control of powdery mildew of chilli (*Capsicum annuum*) caused by *Leveillula taurica*. *Indian J. Myco.Pl. Path.*, 2: 182-183.
- Mc Even, F.L. 1978. In: *Food Production-The challenges of pesticides*. *Bioscience*, 28: 773.
- Prakasam, V. 1983. Studies on Fruit rot diseases of Chilli (*Capsicum annuum* L.) in relation to disease resistance. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore, India. P. 150.
- Ravinder Reddy, M. 1982. Evaluation of fungicides against major diseases of chilli. M.Sc. (Ag.) Thesis. *Tamil Nadu Agric. Univ.*, Coimbatore, India, P. 90.
- Sanathkumar, V. B. 1999. Studies on anthracnose of chilli caused by *Colletotrichum capsici* (Sydow) Butler and Bisby with special reference to epidemiology and management. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Bangalore, Karnataka, India
- Sivaprakasam, K., Jaganathan, R., Pillayarsamy, K. and Anavaradham. 1976. Control of powdery mildew of chillies. *Madras Agric. J.*, 63: 52-54
- Souza, V.L. and Cafe-Filho, A.C. 2003. Resistance to *Leveillula taurica* in genus *Capsicum*. *Plant Pathol.*, P. 52
- Suthin Raj, T. and Christopher, D. 2009. Effect of Bio-control agents and Fungicides against *Colletotrichum capsici* causing Fruit Rot of Chilli. *Annu. Rev. Pl. Prot. Sci.*, 17: 143-145.
- Vimala, R. 2005. Studies on Powdery Mildew of Bendi Caused by *Erysiphe cichoracearum* DC) Ph.D. Thesis, Tamil Nadu Agric. Univ., Madurai, India. P. 120