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National Academy of Agricultural Science (NAAS) Rating : 3.03

Prevalence of Tomato wilt Disease Incited by Soil Borne Pathogen *Fusarium oxysporum* f. sp. *lycopersic*i (Sacc.) in Tami Nadu

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ABSTRACT: *Tomato cultivation in Tamil Nadu is severely limited by soil borne Fusarium wilt disease caused by Fusarium oxysporum f. sp. lycopersici. A survey investigated the incidence and severity of these disease in ten districts of Tamil Nadu namely Dindugal, Karur, Tirupur, Coimbatore, Erode, Namakkal, Salem, Dharmapuri, Krishnagiri and Vellore districts at different growth stages in 2012. The occurrence of wilt disease incidence ranged from 19 % to 45% was noticed. Plant showing typical symptoms were taken from 20 fields and identified based on symptom appearance as well as morphological characteristics. The result of the survey revealed that wide range of infection and severity of wilt disease were occurred in the major tomato growing areas. Wilt disease caused more damage to root system by blocking the xylem vessels which adversely affected the yield of tomato. Hence these surveys provides information regarding the severity of Fusarium wilt disease and might useful for adopting appropriate management practices.*

Keywords: *Survey, Soil borne pathogen, Fusarium wilt, Disease severity, Tomato*

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is considered as one of the most important and remunerative vegetable crop cultivated throughout the world owing to its high nutritive values as well as its antioxidant and curative properties. In tropical Asia it is an important cash crop for small farmers (Villareal, 1979). In India, the total production of tomato in the year 2012-13 was 11.149 million tonnes from 0.599 million hectare of land which is low as compared to other country. In Tamil Nadu, tomato is grown in an area of 22,433 ha, with a production of 2, 82,912 tonnes and a productivity of 12,611 kg/ha. It is affected by several diseases, reflecting negatively on plant growth and the produced yield. Out of these, pathogenic fungi especially, *Fusarium* wilt is one of the most serious disease in tomato throughout the world, especially in upland.

This disease is caused by *Fusarium oxysporum* f. sp. *lycopersic*i (Sacc.) leading to serious economic losses. The fungus is highly destructive both in greenhouses and field grown tomatoes causing 10 – 50 % yield loss in many tomato production areas (Kallo, 1991; Mao *et al*., 1998). The wilt incidence was reported to an extent of 25 percent in Tamil Nadu remains to be a challenging task in terms of management (Chellemi *et al*., 1997). The yield loss up to 45 per cent was recorded in northern and southern states of India (Kalaivani, 2005). Kirankumar *et al.* (2008) reported that 30-40 % yield loss in tomato due to *Fusarium* wilt.

In Sirmour district of Himachal Pradesh the incidence ranged from 20-90% and it was reported to be caused by both *Fusarium oxysporum* and *Fusarium solani* (Singh and Singh, 2004) and in Andhra Pradesh by Madhavi *et al*., (2006).The major tomato production districts in Tamilnadu are Dharmapuri, Coimbatore, Salem, Krishnagiri, Theni, Dindigul and Vellore. Tomato is taken up in two seasons, *viz*., May - June and November - December. Tomatoes are normally produced in mountain regions or in the lowlands during the cool season (Villareae, 1978). Three physiological races of this pathogen have been reported. Race 1 is the most widely distributed and has been reported from most geographical areas (Reis *et al*., 2004). Race 2 was rapidly reported in several of the states and in several other countries, including Australia, Brazil, Great Britain, Israel, Mexico,

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Morocco, the Netherlands, and Iraq. Race 3 was reported in 1966 in Brazil (Jones, J.P. and Woltz, S.S. 1981, Valenzuela *et al.,* 1996).

This is a warm weather disease caused by the fungus *Fusarium oxysporum*. *Fusarium oxysporum* f. sp. *lycopersici* is a phytopathogenic fungus causing vascular wilt disease on tomato, known as fusariosis (Di Pietro *et al*., 2003). The first indication of disease in small plants is a drooping and wilting of lower leaves with a loss of green color followed by wilting and death of the plant (Arjunan, 2005). Woltz and Jones (1981) reported that the wilt appeared when plants were around 45 days old and wilted leaves were mildly chlorotic and later turned brown.

Tomato plants exhibited symptoms of swelling at the crown with some orange and brown lesions, root rot and interior decay of the lower stem. The lesions progressed towards for 10 – 15 cm and where the lower parts of the stem withered and fungal sporulation was visible. Such plants were wilted within 2 – 3 weeks. These symptoms were typical of *F. oxysporum* f. sp. *radicis lycopersici* and different from the vascular wilt caused by *F. oxysporum* f. sp. l*ycopersici* (Can *et al*., 2004).

The first symptom of Fusarium wilt in gardens and fields is usually the golden yellowing of a single leaflet or shoot, or a slight wilting and drooping of the lower leaves on a single stem. Leaves or whole branches will turn yellow, then brown and die still attached to the plant described as a yellow-flagging appearance. (Alexander and Tucker, 1945). Leaves on only one side of the stem turn golden yellow at first. Sometimes half of a leaf or branch will be affected, with the other half seemingly unaffected. The fungus can be observed as brown discoloration in the vascular tissue of affected branches (Agrios, 2005).

The stem of wilted plants shows no soft decay, but when cut lengthwise, the woody part shows a dark brown discoloration of the water-conducting vessels (Cai *et al*., 2003). As the fungus develops inside the stem, plants show progressive yellowing, wilting, and withering starting generally with the lowermost foliage. Yellowed and wilted leaflets drop early. Pernezny *et al.,* (2003) reported that the wilted plants shows darkening of stem base and fruits from infected plant, wrinkle and rot.

The pathogen is a soil inhabitant. Between crops it survives in infected plant debris in the soil as mycelium and in all its spore forms but, most commonly, especially in the cooler temperate regions, as chlamydospores (Agrios, 2005). The fungus grows into and multiplies in the water and food conducting tissues of the roots and stems. These tissues later become partly plugged or killed. Toxic substances are believed to be secreted by interaction of the fungus and tomato plant. These materials apparently cause the wilting and death of the plant.

The aim of this study was to determine the prevalence of yellow Sigatoka disease of *Fusarium* wilt disease through field survey in major tomato growing districts of Tamil Nadu.

MATERIALS AND METHODS

Survey in the Field Experiment

Survey was undertaken in major tomato growing districts of Dndugal, Karur, Tirupur, Coimbatore, Erode, Namakkal, Salem, Dharmapuri, Krishnagiri and Vellore districts in Tamil Nadu. In each district two villages were selected for a view to assess the *Fusarium* wilt incidence. The name of the villages surveyed along with districts was given in the table 1.

In each village three farmer's fields were selected and in each farmers field 0.1 ha area was selected at

Table 1
Survey for the Occurrence of *Fusarium* Wilt Disease Incidence of Tomato in Major Tomato growing Areas of Tamil Nadu

S.No	*District*	*Location*	*Percent disease incidence (PDI)* *
1.	Dindugal	Nilakottai	22.50
2.	Dindugal	Ottanchatram	19.35
3.	Karur	Parmathi	27.50
4.	Karur	Mailampatti	25.00
5.	Tirupur	Moolanur	28.15
6.	Tirupur	Udumalapet	31.20
7.	Coimbatore	Kinathukadavu	45.50
8.	Coimbatore	Thondamuthur	43.50
9.	Erode	Vellakovil	36.55
10.	Erode	Bhavani	39.55
11.	Namakkal	Rasipuram	31.15
12.	Namakkal	Tiruchengodu	33.50
13.	Salem	Aattayampatti	34.50
14.	Salem	Tarmangalam	36.75
15.	Dharmapuri	Kasiampatti	37.00
16.	Dharmapuri	Pudur	34.55
17.	Krishnagiri	Maharajakadai	43.67
18.	Krishnagiri	Kochampalli	41.75
19.	Vellore	Ambur	21.75
20.	Vellore	Pudupadi	23.50

*Mean of three replications

random. Total and infected plants were counted in all the selected areas and the wilt incidence was calculated by using the following formula.

$$\text{Per cent disease Incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Isolation and Identification of the Pathogen

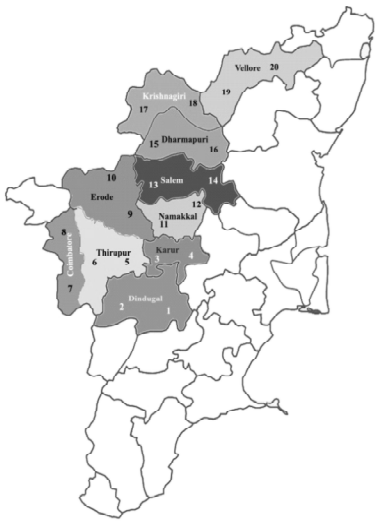
The tomato plant showing typical symptoms of wilt disease was collected from the farmer's field in each village as mentioned in the table 1. The pathogen was isolated from brown discoloured areas of split open infected root portion bits. The infected root bits were surface sterilized with 0.1% mercuric chloride for 30 seconds, and subsequently three washings were given with sterile distilled water. Then, they were placed in sterilized petridishes containing potato dextrose agar (PDA) medium and incubated at the laboratory conditions at 25 ± 2 °C for seven days. Pure culture of the pathogen was obtained by single hyphal tip method (Rangaswami, 2005).

Microscopic Observation and Identification

Hyphae, conidia, chlamydospore, size, shape, colour were observed under the microscope at 40 X magnifications from the culture and microphotographs were taken.

RESULTS AND DISCUSSION

A survey was conducted to assess the intensity of *Fusarium* wilt disease incidence in different districts of Tamil Nadu (Fig. 1). The results of the survey revealed that disease incidence ranged from 19.35 to 45.50 was noticed in different districts. The maximum of 45.50 was recorded at Kinathukadavu in Coimbatore district where as Ottanchantram in Dingugal district recorded minimum of 19.35 percent. All the districts had significant incidence of *Fusarium* wilt disease. The symptoms were noticed from all the parts of the plants. The present study revealed that, the incidence of wilt disease showed its wide spread occurrence in almost all tomato growing area of Tamil Nadu. A similar occurrence of the disease to an extend of 20-90% in districts of Himachal Pradesh by Singh and Singh, 2004 and De Boer *et al*. (2003) in Andhra Pradesh. Madhavi *et al*. (2006) reported the wilt incidence up to 30% indicating the occurrence of the disease in almost all tomato growing areas. Anitha and Rebeeth (2009) reported that maximum wilt disease incidence of 75.0% was recorded in Nachipalayam village of Coimbatore District. Similarly, Vethavalli S and Sudha S. S. (2012) observed



Locations							
1.	Nilakottai	6.	Udumalapet	11.	Rasipuram	16.	Pudur
2.	Ottanchatram	7.	Kinathukadavu	12.	Tiruchengodu	17.	Maharajakadai
3.	Parmathi	8.	Thondamuthur	13.	Aattayampatti	18.	Kochampalli
4.	Mailampatti	9.	Vellakovil	14.	Tarmangalam	19.	Ambur
5.	Moolanur	10.	Bhavani	15.	Kasiampatti	20.	Pudupadi

Figure 1: Prevalence of Tomato wilt disease caused by soil borne pathogen *Fusarium oxysporum* f. sp. *lycopersici* in Tamil Nadu

the 30 % of tomato wilt disease incidence in Coimbatore district. The present study revealed that this disease is present in mild to severe form wherever the crop is grown.

The pathogen was isolated from the root bits of infected tomato plants using potato dextrose agar (PDA) medium by half plate technique. After seven days the pathogen produced a dense, creamish white with pink coloured fluffy mycelial growth on Petridish (Fig. 2). The pure culture was maintained in PDA slants in a refrigerator at 4° C for further studies. In the laboratory, the pathogen *F. o*. f. sp. l*ycopersici* was observed microscopically for their two types of conidia *viz*., micro and macro conidia. Micro conidia are small, oval shaped, hyaline and single or bicelled. Macroconidia were sickle shaped hyaline and multicelled with three to five septate. Abundant chlamydospores were observed terminally and intercalary (Fig. 2). This result was similar to the findings reported by Rekah *et al.,* 2000. They are spherical with 7 - 10µm in diameter. They are round thick walled spores produced within or terminally on older mycelium or in macroconidia. Chlamydospores can survive in the soil for a long period of time.

In conclusion, survey and characterization of the population structure of fungal pathogens is important for understanding biology of the organism and for

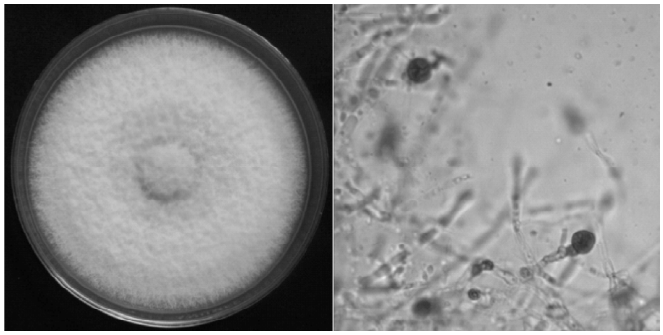


Figure 2: Mycelial growth of *Fusarium oxysporum* f. sp. *lycopersici* and microscopic view of Chlamydospore

development of disease control strategies. Morphological and other phenotypical observations are still essential for the valid description of a fungal species. Hence proper surveying the *Fusarium* wilt disease helps for adopting the proper management practices in Tamil Nadu.

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