



## First record of *Fusarium solani* (Mart.) sacc. associated with sudden decline disease of date palm (*Phoenix dactylifera* L.) in Khairpur, Sindh, Pakistan

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### Abstract

Date palm is widely cultivated in Khairpur region of Sindh province, Pakistan. Since last few years the date palm plantation suffered from sudden decline disease of unknown etiology. During a survey of date palm plantation in Sindh for investigating the association of fungi with six fungal species viz. *Fusarium solani*, *Phoma ucladium*, *Helminthosporium sativum*, *Alternaria alternata*, *Aspergillus niger* and *Penicillium chrysogenum* were isolated from plant parts of affected date palm tree and identified on the basis of their colony characteristics and conidial morphology *Fusarium solani*. Among them *Fusarium solani* was the predominant from infected roots of date palm. Among the fungi isolated, *F. solani* appeared as predominant fungus isolated in very high frequency from all locations followed by *P. ucladium* and *H. sativum*. It produced white to creamy colour with sparse to dense and grayish mycelium. The microscopic observation revealed that the production of both micro and macro conidia were well developed. This is the first report of *Fusarium solani* on date palm in Sindh, Pakistan.

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## Introduction

Date palm (*Phoenix dactylifera* L.) is one of the most important fruit crop of the tropical and subtropical regions of the world and grown on large area in Pakistan, Egypt, Iran, Saudi Arabia, UAE, Oman and Libya (Khan *et al.*, 2008). In Pakistan, date palm is grown over an area of 98.7 thousands hectares with total production. 7, 35,276 (FAO, 2009). The date fruit is nutritionally a good source of potassium, iron and vitamins carpenter and Elmer (1978). Dates are mostly eaten fresh as well as are processed into a lot of by-products. Dates are exported to several countries and are a good source of foreign exchange earning which adds to national income of the country. Date palm at all stages of its growth is vulnerable to the attack of number of plant pathogens which cause destructive diseases. These infectious plant diseases are responsible for considerable loss in stands as well as yield (Djerbi, 1983). Several fungal pathogens attack date palm and causing root rot, wilt and decline disease (El-Arosi *et al.*, 1982).

The *Fusarium solani* has been found to cause wilt, there are controversial reports regarding the causal agent of dieback (Bajwa *et al.*, 2003). Mansoori and Kord (2006) isolated *Fusarium solani* from the crown and xylem tissues of the disease samples and found pathogenic when fungus inoculated on 1year old date palm seedlings. The predominant fungi associated with date palm decline were *Fusarium oxysporium*, *Fusarium solani*, *Diplodia phoenicum*, *Ceratocystis radicola* and *Phomopsis phoenicola* (Ellis, 1971; Rattan and Al- Dboon, 1980; Mousiri *et al.*, 2000). Sudden Decline Disease is a serious disease of unknown etiology at district Khairpur. Nowadays sudden decline has become a real threat for current date palm cultivation in Sindh particularly at Khairpur. Moreover, it restricts the extension of new cultivations of date palm. In Pakistan there is no systematic work on etiology of Sudden Decline Disease is reported to have been done in Sindh province of Pakistan. The present studies were therefore, carried out to investigate and ascertain the actual cause of disease of date palm in Khairpur region, Sindh province.

## Material and methods

### Isolation of disease causing pathogen(s)

The Infected roots, leaves, leaflets and rachis were washed thoroughly with tap water to remove the attached soil particles and blotted dry. The pathogens were isolated by the method described by Petrini (1986). The samples were cut into small pieces of 5 mm, rinsed with 5% commercial bleach (sodium hypochlorite) for 1-2 minutes and then five pieces were placed in sterilized petri dishes containing freshly prepared 2% potato dextrose agar (PDA) medium. The petri plates were incubated at 25°C for five days. Most of the fungal growth was initiated within 10 days of inoculation. The fungi that grew out from the segments were purified by transferring the hyphal tips to fresh PDA medium plates.

### Identification of isolated fungi

The isolated fungi were purified using the single spore isolation technique and hyphal tip method. Purified fungi were identified according to the keys developed by Booth (1971), Ellis (1971), Singh (1977), Domsech *et al.*, (1980) and Sutton (1980). The data on frequency of isolated fungi from roots, leaves, leaflets and rachis of different locations were calculated using the following formula as described by Suryanarayanan *et al.*, (2003), Iram *et al.*, (2011).

$$\text{Infection\%} = \frac{\text{Number of pieces colonized by the fungus}}{\text{Total number of pieces studied}} \cdot 100$$

### Morphological and cultural characteristics

The purified fungal cultures were maintained on PDA slants and stored in refrigerator at 5°C for further studies. Studying the morphological and cultural characteristics, the pathogen was identified as *Fusarium solani*. The colonies of *Fusarium solani* on PDA usually appear as white to creamy colour with sparse to dense and grayish mycelium. The *Fusarium solani* on potato dextrose agar put forth moderately rapid growth covering the petri plate in 4-5 days. The pure culture of *Fusarium solani* was prepared by single spore isolation technique (Fig. 1- A, B). The sexual fertilization resulted in the formation of perithecia containing asci (Leslie and Summerell, 2006).

## Result and discussion

### Isolation of fungi

Six fungi namely, *Fusarium solani*, *Phoma ucladium*, *Helminthosporium sativum*, *Alternaria alternata*, *Aspergillus niger* and *Penicillium chrysogenum* were isolated from different plant parts collected from

affected date palm trees of various orchards of Khairpur, Pakistan. Among the fungi isolated, *F. solani* appeared as predominant fungus isolated in very high frequency from all locations followed by *P. ucladium* and *H. sativum* (Table 1).

**Table 1.** Fungi isolated from affected date palm trees at different locations of Khairpur, Sindh.

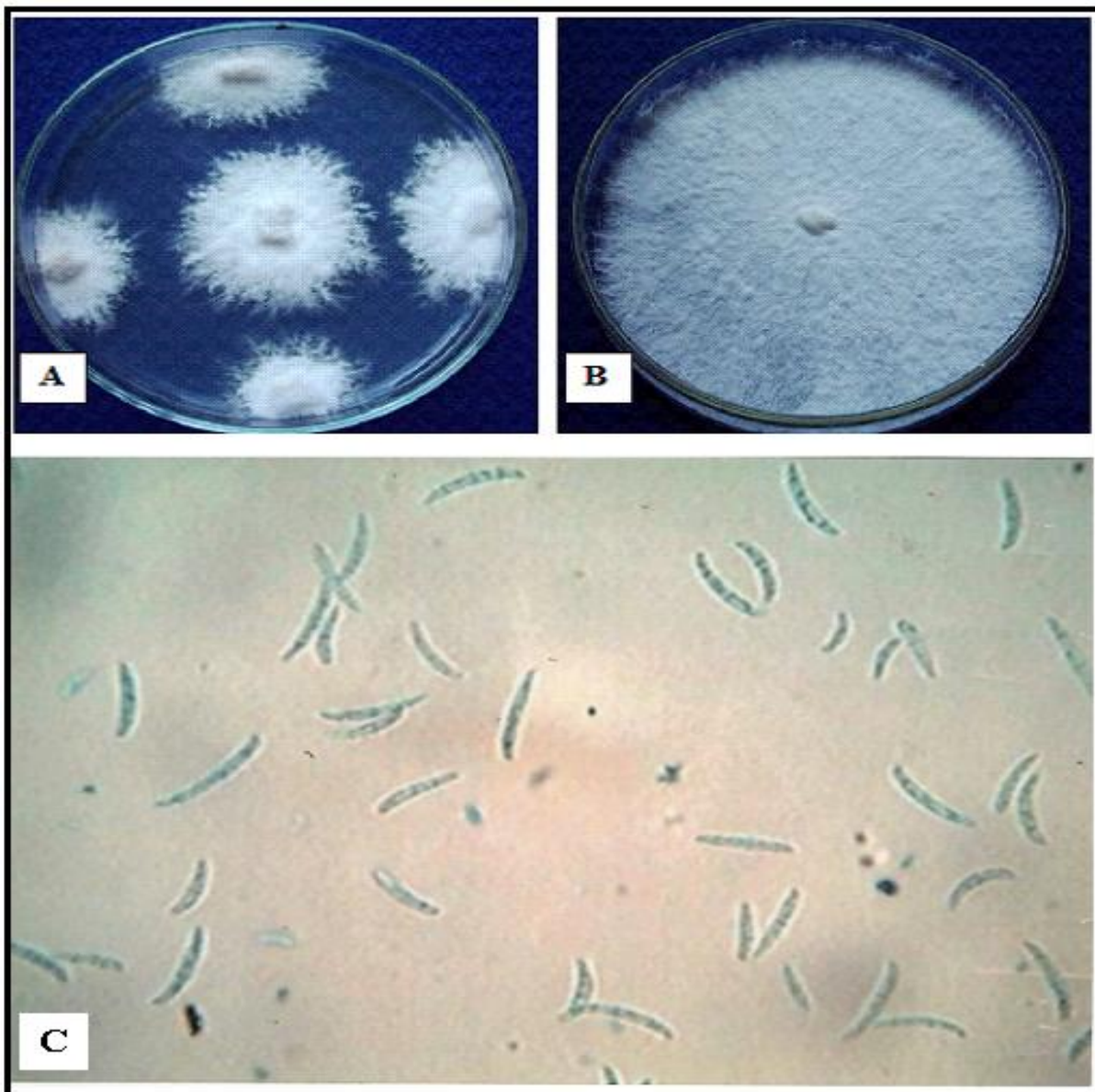
Location	Frequency of the fungi isolated (%)					
	<i>F. solani</i>	<i>P. ucladium</i>	<i>H. sativum</i>	<i>A. alternate</i>	<i>P. chrysogenum</i>	<i>A. niger</i>
Noor Pur	64	29.3	23.3	16.6	10	8.6
Baberloe	57.3	22.6	20	15.3	11.3	9.3
Ahmed pur	53.3	21.3	18.6	14	9.3	7.3
Kot Mir Mohammad	50.6	20	16.6	12	7.3	6
Machyoon	50	20	17.3	12.6	8.0	8.6
Garhi Mori	40	14.6	13.3	10	6	4.6
Piryalo	33.3	13.3	11.3	8.6	4.6	2.6
Drib Mahesar	30	12.6	10	8	5.3	4
Hadal shah	26.6	11.3	8.6	6.6	4.6	2.6
Munghan Wary	23.3	10	7.3	5.3	3.3	2
Khanpur	20	8.6	6	4	2	1.3
Maher Ali Shah	16.6	7.3	4.6	4	2	2
Rupri	13.3	6	4	3.3	2	1.3
Shadi Shaheed	10	6	4	2.6	2	2
Therhi	6.6	4.6	2.6	1.3	0.6	0.6
Noonari	3.3	2	1.3	1.3	0.6	0.6
Nizamani	1.3	0.6	1.3	0.6	0.6	2.6

Among seventeen locations, the date palm orchards located at Noorpur followed by Baberloe and Ahmedpur appeared as severely infected with isolated fungi as maximum fungi were isolated from these places (Table 1). However, minimum fungal infections were recorded at Nizamani followed by Noonari (Table 1). *F. solani* was isolated from all locations in varying frequencies ranging from 1.3-64% with overall average frequency of 29.38% followed by *P. ucladium* 0.6-29.3% (av. 12.36%) and *H. sativum* 1.3-23.3 % (av. 10.0%) (Fig. 3). This is the first report of *Fusarium solani* on date palm in Pakistan. Declined disease is considered most severe problem in most of the date palm growing areas of the world. Present investigations also revealed that decline disease was well established in date palm growing areas of Sindh, Pakistan and caused significant damage to date palm

cultivation (Abul Soad *et al.*, 2011 and Maitlo *et al.*, 2009; ; Masood, *et al.*, 2011 and Iqbal *et al.*, 2007). It also caused severe losses in Egypt (Rasheed and Abdel Hafeez, 2001, Barakat *et al.*, 1992 and Rasheed, 1998), Saudi Arabia (Molan *et al.*, 2004 and El-Arosi *et al.*, 1982), Libya (Khalil *et al.*, 1986 and Edongali *et al.*, 1985) and Sarhan, (2001) Iraq. Present studies also revealed that six fungi *viz.*, *Fusarium solani*, *Phoma ucladium*, *Helminthosporium sativum*, *Alternaria alternata*, *Aspergillus niger* and *Penicillium chrysogenum* were associated with affected date palm trees, among them *F. solani* was the predominant fungus. Our results are in agreement to those of Al-Yasiri *et al.*, (2010), (Besri 1982) and Mansoori *et al.*, (2003) who isolated *Fusarium oxysporium* and *Fusarium solani* from roots of declined date palm. Similarly, El-Arosi *et al.*, (1982)

and Rasheed and Abdel-Hafeez (2001) observed that *Fusarium moniliform* and *Fusarium solani* were frequently associated with date palm decline. Barakat *et al.*, (1992) isolated *Fusarium* species and *Botryodiplodia theobromae* from decline date palm offshoot. However, Molan *et al.*, (2004) isolated *Chalara paradoxa* from decline date palm Offshoots

in Saudi Arabia. Sarhan (2001) isolated *Alternaria alternata*, *Chalaropsis radicola*, *Diplodia phoenicum*, *Fusarium oxysporium* *F. solani*, *Gliocladium* sp., *Phomopsis phoenicola* and *Thielaviopsis paradoxa* and reported that species of *Fusarium* were the predominant fungi.



**Fig. 1.** A= Fig. A=Fungus isolated from infected roots of date plam, B=Pure culture plate and C=Micro and Macro conidia of *Fusarium solani*.

#### *Morphological and cultural characteristics*

The microscopic observation revealed that the production of both micro and macro conidia were well developed. Generally, the macro conidia and micro conidia of *Fusarium solani* appeared on PDA

cultures of growing fungus. Macroconidia were relatively wide, straight to slightly curved, 3 to 7 septate with rounded ends. The microconidia were formed abundantly on the aerial mycelium from elongated phialides (Fig. C.).

The *Fusarium solani* was the most abundant fungus that was isolated from all locations and appeared as predominant fungus as compared to other fungi. Our results are in agreement to those. Osama (2008) isolated twelve different fungal genera from affected parts of date palm in Egypt based on morphologic and the microscopic features (mycelium septation, conidiophores and pigmentations). The identified fungal genera were *Fusarium* sp., *Pythium* sp., *Rhizoctonia* sp., *Botryodiplodia theobromae*, *Phoma* sp., *Macrophomina* sp., *Alternaria* sp., *Helminthosporium* sp., *Nigrospora* sp., *Stymphyllium* sp., *Thielaviopsis* sp. and *Trichoderma* sp. The genus *Fusarium* included *Fusarium oxysporum*, *Fusarium solani* and *Fusarium culmorum*. The results of present study indicate that decline/drying of date palm is mostly a pathological problem, intensity of which is increasing day by day and became a alarming signal for Date's industry of Khairpur, Sindh, Pakistan.

### Conclusion

The date palm decline disease is alarming signal for Date's industry in Khairpur which occurs on date palm trees of all ages. The present studies suggest that the decline/drying of date palm is a pathological problem, which is increasing day by day in date palms of Khairpur... The evidences suggest that the predominant fungi *Fusarium solani* is mainly responsible for this disease. It produced white to creamy colour with sparse to dense and grayish mycelium. The microscopic observation revealed that the production of both micro and macro conidia were well developed. This is the first report of *Fusarium solani* on date palm in Sindh, Pakistan.

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