



Official publication of Pakistan Phytopathological Society
Pakistan Journal of Phytopathology

ISSN: 1019-763X (Print), 2305-0284 (Online)

<http://www.pakps.com>



OCCURRENCE OF SUDDEN DECLINE DISEASE OF DATE PALM (*PHOENIX DACTYLIFERA* L.) IN KHAIRPUR, PAKISTAN

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ABSTRACT

Date Palm tree is one of the most important fruit crop in Pakistan after mango and citrus, Date Palm crop is almost found in all regions of Pakistan. Since last two decades the plantation of date palm was extremely suffered from unknown etiology. Therefore, a study of seventeen date palm farms of district Khairpur, Pakistan was performed to find out the mortality of sudden decline of date palm disease and to isolate pathogen associated with the decline problem. On different growing areas of date palm, the death of plant assorted from 1 to 33%. different were isolated from different locations such as *Fusarium solani*, *Helminthosporium sativum*, *Phoma ucladium* *Alternaria alternata* highly frequent whereas *Penicillium chrysogenum* and *Aspergillus niger* were isolated from plant parts of infected date palm plants. Among them *Fusarium solani* was the major fungus occurred in very high level followed by *Helminthosporium sativum* and *Phoma ucladium*.

Keywords: Decline disease, Date palm, Fungal pathogens, *Fusarium solani*.

INTRODUCTION

Date palm generally belongs to *Arecaceae* family usually cultivated in subtropical and tropical regions, where it is considered as very important source of income for dates industries and also for local farmers (Zohary and Hopf, 2000). Date palm has very deep impact on the socio-economic life of local people of the district Khairpur (Shar, 2012). The fruit of date palm which is considered as highly nutritive and providing high amount of energy Ishtiaq *et al.*, (1988). Dates are usually found in all over Pakistan but they are highly concentrated in Turbat and Panjgoor in Baluchistan, Khairpur and Sukkur in Sindh, Jhang, Muzaffargarh, D.G Khan and Multan in Punjab and DI Khan in Khyberpakhtoon khuwa (Jatoi *et al.*, 2009), having significant place in the socio-economic progress

Submitted: November 2, 2020

Revised: December 03, 2020

Accepted for Publication: December 07, 2020

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where more than l thousand workers of different class people are connected with date palm farming, buy and sell and market. The dates business nowadays is extremely infected by drying out disease problem which are caused by fungus mainly soil borne *Fusarium solani* which have extremely damaging the large number of trees in the entire area (Maitlo *et al.*, 2009 and Abul-Soad *et al.*, 2011; Maitlo *et al.*, 2015). Infection of such type of date palm disease problem is closely related to the whitening date palm fronds incited by *Albedinis* and *Fusarium oxysporium* f. sp. which has destroyed very large number of date palm trees various regions especially in North African regions (Al-Akaidy, 1994 and Djerbi, 1983). In same way the drying out or simulated bayoud is highly harmful date palm plants and becoming outbreak in other area of the county (Abul-Soad *et al.*, 2011 and Maitlo *et al.*, 2015). Bayoud caused by *Fusarium oxysporium* which is one of the most important issue of date palm in North Africa particularly in Morocco where twelve millions of date palm plants have been

declined and three million in Algeria were destroyed (Fernandez *et al.*, 1998). The date palm decline disease is one of the important diseases of *Phoenix dactylifera* L. and damaged bundles of date palm farms and spread trees in district Khairpur,, Pakistan. The *Fusarium solani* is infected date palm plants and increasing infection which is day by day increasing but some regions of Khairpur region are measured as disease spot. Currently significant decline of date palm develops as a genuine warning for present date palm trees farming in particularly Sindh at Khairpur district rather than all over the Pakistan. Additionally, it limits the expansion of fresh cultivations. The drastic sudden decline disease of date palm can also resemble some similar types symptoms of wilt disease in most of the world i.e. Palm streak usually caused by Phytoplasma which is considered as fatal disease. The decline disease has also furthermore reported by many scientists since different farming of date palm trees growing regions of world. On the other hand, they reported different fungal pathogens were intended for this disease such as *Fusarium proliferatum*, *Fusarium solani*, *Fusarium oxysporum* f. sp. *albedinis* and *Fusarium moniliforme*, (Abdalla *et al.*, 2000 and Sarhan, 2001; Rashed & Hafeez, 2001; Masood *et al.*, 2011). There is no any work have been carried out on this dangerous disease of date palm plants in district Khairpur Sindh , Pakistan before. This study was conducted first time by Mitlo *et al.* (2009), designed experimental work on this problem was identified & purified the microorganism, among them the most major fungus was the soil born fungus *Fusarium solani*. The present research work is in sequence of

$$\text{Plant mortality \%} = \frac{\text{Number of infected plants due to disease}}{\text{Total number of plants studied}} \times 100$$

Isolation and identification of fungi: The fresh samples were stored in to laboratory for identification and isolation of related putative fungal pathogens. Dying date palm roots was washed thoroughly several times with tap water in order to get rid of any attached dust particles. Further, the collected samples were cut into small pieces, than those small pieces were rinsed with 5% Sodium hypochlorite for two minutes and then positioned in Petri dishes having potato dextrose agar (PDA) freshly prepared medium. Five pieces of plant which

experimental work and paying attention, this study was designed out to calculate the incidence and distribution of different fungal diseases usually occurred on date palm in most important growing locations of district Khairpur, Sindh Pakistan.

MATERIAL AND METHODS

Field survey of plant mortality: Widespread survey of date palm plant mortality in the growing regions of district Khairpur was carried out to record and identify the symptoms related to sudden decline disease and also occurrence of disease. About seventeen regions of Khairpur were visited and selected for study. Throughout the survey, the symptoms appeared on trees which were major cause of sudden decline disease were visualized and noted by using digital camera. The fresh samples for studies were collected and almost each part of infected date palm such as like roots, leaf and leaflet rachis in dirt free artificial uncontaminated plastic bag. Samples were collected from 5-10 cm depth from dying date palm root and were collected and moderately affected of date palm plant. Each sample was properly labeled and reserved at 4°C in a refrigerator in the laboratory until process. For each region, the plant mortality and disease incidence was examined with reported formulas by Abul Soad *et al.*, (2011), Maitlo *et al.*, (2014) and Cohen *et al.*, (2000), The leaflet and root samples were collected from disease affected trees in plastic bags separately and were labeled properly. The root samples were obtained from 5-10 cm deep in soil from infected plants of date palm.

The plant mortality and disease incidence was calculated by using formulas as previously explained and developed by Cohen *et al.*, 2000.

were infected were placed in separately Petri dish. Each petri dish was separately incubated at about 25°C for 120 hours to encourage sporulation of the fungi. Various fungal small colonies were emerged, which were purified using the single spore isolation technique and hyphal tip method. The fungal species were recognized on the basis of their morphological characteristics with the help of key developed by Booth. The data on frequency of isolated fungi were recorded using the following formula as described by Pathak 1987.

$$\text{Colonization \%} = \frac{\text{Number of plant pieces colonized by a fungus}}{\text{Total number of plant pieces studied}} \times 100$$

Fungi identification: The fungi were isolated and purified using the only single spore separation method and simple fungal part method. Purified fungi were recognized according to different the keys methods. The keys developed by different scientist such as Singh (1977), Domsech *et al.*, (1980) and

Sutton (1980) and Booth (1971), Ellis (1971). The frequency of isolated pathogens the data was recorded from leaves, roots, rachis and leaflets of diverse locations were considered using the formula as previously expressed by scientist two Iram *et al.*, (2011) and Suryanarayanan *et al.*, (2003).

$$\text{Colonization \%} = \frac{\text{Number of plant pieces colonized by a fungus}}{\text{Total number of plant pieces}} \times 100$$

Fungal culture maintenance: The fungal culture was prepared and purified Potato Dextrose Agar medium and cultures were stored in refrigerator at about 5°C for more experimental work.

Fungal suspension preparation: The fungal suspensions were prepared, and spore was ready for inoculation from 15 days mature cultures of separated fungi grown on freshly prepared PDA medium. It was added 10 ml distilled sterilized water in each Potato Dextrose Agar medium (PDA) plate which contain tested fungal cultures in sequence to take away conidia or spores the fungal culture was rub with pure hairbrush smoothly and the suspension of fungal spore was carefully collected in glass beaker which was sterilized. The amount of fungal spore in the sample suspension was adjusted by using hemocytometer (Waller *et al.*, 1998).

RESULT AND DISCUSSION

Symptomatology: Date palm sudden decline disease was frequently prevailed in almost all the areas of Khairpur visited during the present investigation. In affected trees, always infection occur initially one side of fronds of the tree. The affected fronds die in a one side manner from the lower leaf to the tip, pinnate or spines stunted on side of leaf were become white. After that the one side was affected and whitening also begins on other side of the rachis. All varieties grown in the study area of district khairpur was found to be suffering from this disease.

Plant mortality: In sequence the tree mortality of date palm sudden decline disease, was to determine the total date palm farms 163 at 17 seventeen diverse regions were visited throughout the present investigation. The death of plant was diverse from 1 to 33% at different date palm growing regions (Fig. 2). The severe sudden decline disease incidence was recorded significantly at Noorpur where maximum

tree mortality was recorded about (33%) after that Ahmedpur (31%) followed by Machyoon (30%). Furthermore, at some areas where orchards were not properly organized as a result very minimum impact of disease was seen. The least plant mortality was reported at Shadi Shaheed (3%) Therhi (2%) followed by Noonari (1%) (Fig. 2).

Isolation: The total diverse fungi i.e *Helminthosporium sativum*, *Phoma ucladium*, *Alternaria alternata*, *Aspergillus niger*, *Fusarium solani* and *Penicillium chrysogenum* were isolated from various infected plant parts, which were incited by sudden decline disease. The samples were collected from infected date palm trees of various date palm farms of district Khairpur. The different fungi were isolated among them, such as *Fusarium solani* was isolated and appeared as most frequent fungus which was isolated in especially in high frequency from all regions followed by *Helminthosporium sativum* and *Phoma ucladium* as compare to other species like fungi *Penicillium chrysogenum*, *Aspergillus niger* and *Alternaria alternata*, (Table-1) amongst diverse studied 17 regions of district Khairpur, the date palm farms was situated at Ahmedpur Baberloe and Noorpur appeared as highly infected, the highest fungi was isolated from these spaces with isolated fungi, as on the other hand, smallest frequency of fungal infectivity was calculated at Noonari and Nizamani. The *Fusarium solani* specie was isolated from every one of regions in different frequencies range from about 1.3 - 64% with in general mean frequency of 29.3% which was followed by *Phoma ucladium* 0.6-29% (Fig. 8), *Helminthosporium sativum* 1.3 - 23.3% *Alternaria alternata*, *Penicillium chrysogenum* (average.12.36%) and *Apergillus niger* (average. 10.0%); (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. chrysogenium</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

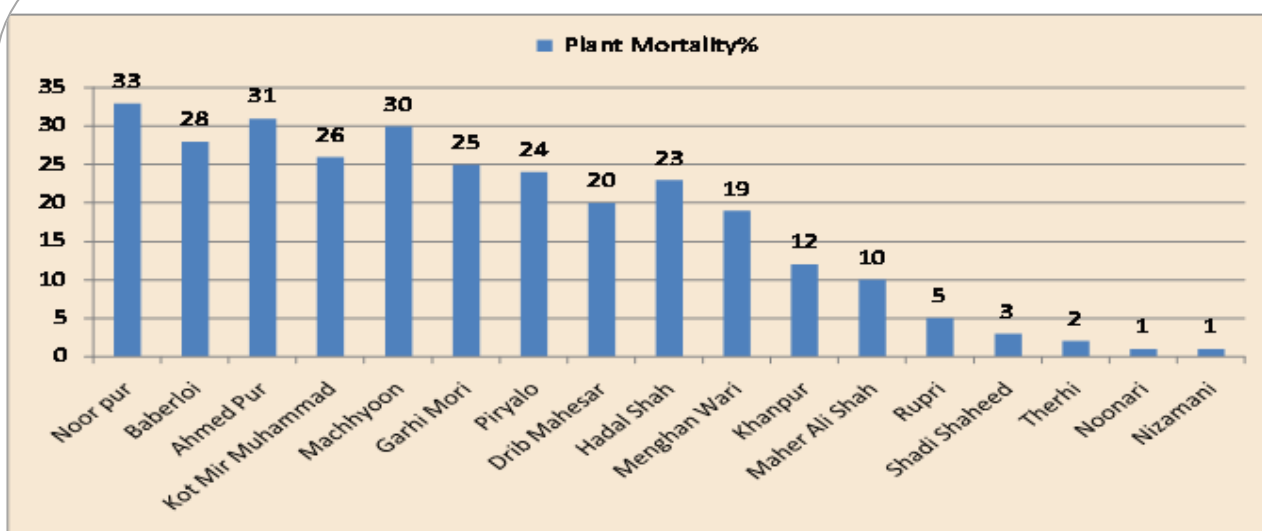


Figure 1 Plant mortality due to date palm decline disease at different orchards of Khairpur, Sindh.

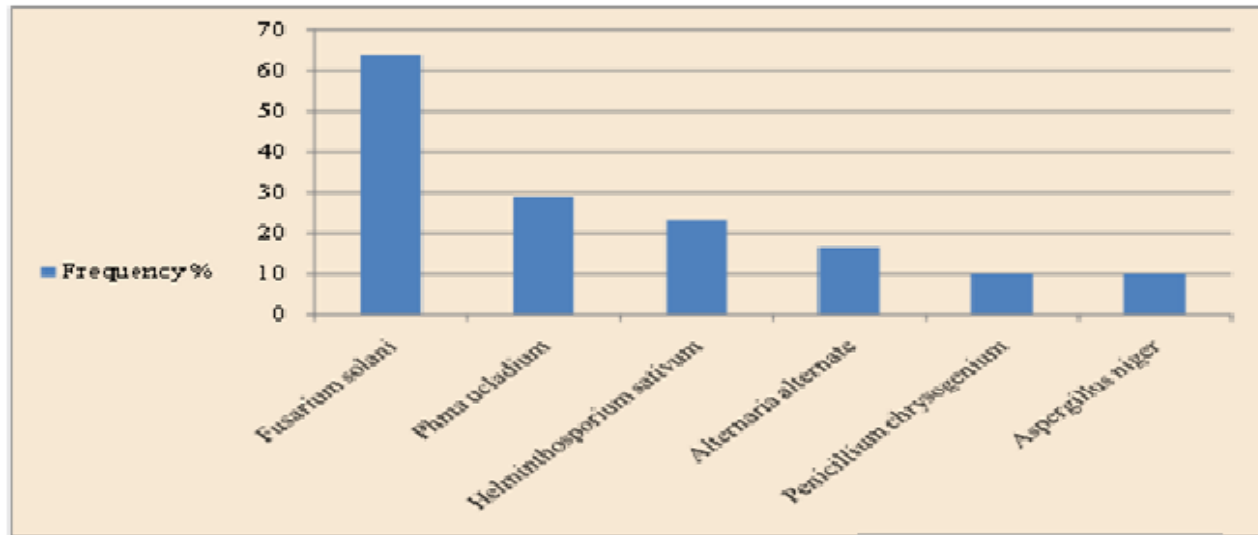


Figure 2 The overall frequency of different fungi isolated from affected date palm trees.

The Date palm plants are exposed to be attacked by very large number of diseases and insect pests. Near about 30 insect species which are reported, that usually infest different species of dates palm in various regions of the world. In Pakistan date palm is attacked by different Insect, pest and pathogen like red palm weevil (*Rhynchophorus ferrugineus*, Dubas bug (*Ommatissus lybicus*), fruit stalk borer (*Oryctes elegans*), lesser date moth, *Batrachedra amydraula* (Meyr), and pathogen *Fusarium solani*. Order: Moniliales family: Moniliaceae are a very important pest and pathogen of date palm. It attacks the date palm and causes heavy economic losses. The Sudden decline disease was reported particularly at Khairpur, Sindh, Pakistan. Same type of fungal disease on date palm has also caused severe sufferers in Egypt Barakat et al., 1992; Rasheed, 1998); (Rasheed and Abdel-Hafeez, 2001, In Saudi Arabia Edongali et al., 1985; Khalil et al., 1986) in Iraq (Sarhan, 2001). (ElArosi et al., 1982; Molan et al., 2004), In Libya The date palm trees were infected showed a significant number of typical symptoms counting streak of foliage upper leaves showed discoloration of leaflet, spine and midrib, discolourtin of leaflets & twigs, a little number of damaged roots showed reddish color also. The results of the present studies in close confirmation to that scientist who reported the fungi isolated from different infected roots of infected date palm belong to genera *Fusarium solani* and *Fusarium oxysporium* whereas Al-wijam

disease or dying of date palm leaves were also associated with *Fusarium moniliform* and *Fusarium solani* (El-Arosi et al., 1983). In, Barket et al., 1992 was also reprinted and isolated *Botryodiplodia theobromae* and *Fusarium* sp. Both fungi causing decline of date palm young plant, In 1996 (Priest and Letham) were isolated *Fusarium proliferatum* from infected date palm roots and foliage of declining date palm leaves and claimed to cause symptom associated to destruction of frond (Bayoud disease) in Saudi Arabia. The results of the present studies by Mansoori et al., (2003 who isolated *Fusarium solani* from infected date palm roots of decline date palm in Iran.

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Wazir A. Metlo	: Conceive idea of research and manuscript writeup.
Ghulam S. Markhand	: Collection of data.
Zaheer A. Chandio	: Collection of literature.
Qurat U. A. Shaikh	: Data analysis.
Lal Bux	: Data interpretation
Wajid A. Jatoi	: Edited manuscript.