

Date Palm Wilt Disease (Sudden Decline Syndrome) in Pakistan, Symptoms and Remedy¹

Adel Ahmed Abul-Soad*, Wazir A. Maitlo*, G.S. Markhand* and Shaimaa M. Mahdi**

*Date Palm Res. Institute, Shah Abdul Latif University, Khairpur, Sindh, Pakistan.

**Horticulture Res. Institute, Agricultural Res. Center, Cairo, Egypt.

Corresponding author: adelaboelsoaud@gmail.com

1. Introduction

Date palm (*Phoenix dactylifera* L.) is one of the most important fruit crops of the tropical and subtropical regions of the world and grown in large area in Pakistan. Date palm cultivated area is 93.3 thousands hectares with total production 6, 80,107 tons². Dates production is distributed in Sindh (45.4%), Balochistan (44.8%), and a limited production in Punjab (7.9%) and Khyber Pakhtunkhwa (1.9%)³. Approximately 85% of Sindh dates are produced in Khairpur district.

Date palm trees in Sindh province particularly Khairpur are suffering from a serious disease which is the sudden decline syndrome (Fig. 1). This disease destroyed many orchards and dispersed trees at this area. The number of infected trees is increasing day after day but, some areas are considered as infection spots. Nowadays sudden decline became a real threat for current date palm cultivation in Sindh particularly at Khairpur rather than entire Pakistan. In addition it restricts the extension of new cultivations.

The date palm sudden decline disease could resemble some similar symptoms of wilt diseases in the world such as Palm Lethal Yellowing caused by *Phytoplasma* which is a fatal disease of Coconut and also infectious to date palm [1, 2, 3]. The drying manner of fronds displayed similar symptoms of Bayoud disease (Fusarium wilt) caused by *Fusarium oxysporum* Schlechtendahl f.sp.*albedinis* in Morocco and Algeria [4, 5].

¹**The Blessed Tree**; Khalifa International Date Palm Award, UAE, www.kidpa.ae. Volume No.3, Issue No.4, 2011.

² FAO, 2008.

³ The Year Book of Pakistan, 2008, Statistics Division, Government of Pakistan, Agricultural Department.

Figure 1: Normal and Infected (Referred by Arrows) Date Palm Trees with Sudden Decline in Pakistan.



2. Symptoms

The symptoms are starting with orange yellowish coloring for the fronds' midrib (rachis) then the leaflets (pinnae). Such symptom starts from outer-lower frond whorls toward central younger fronds (Fig. 2). Within a single frond drying begins from the terminal part to cover the whole frond. Eventually, the entire frond turns to pale brown color and the tree dies within few months.

Figure 2: Frond Symptoms of Date Palm Decline Disease.



Infection can be occurred at any time of the year. Infection at early stage of fruit development caused fruit drop and failure to reach maturity stage (Fig. 3). Overall drying affects fronds and fruit together. Fruit bunches dried when the disease attacked a date palm tree at late Khalal and Rutab stages. A tree fruiting is completely ceased when trees are infected before spathes emergence time.

Date palm at different ages showed the common symptoms of decline disease. However, males were found less infected than the productive females. Within the female trees, unhealthy and those are living in adverse conditions particularly water logging were more susceptible.

The most elusive thing is the selective behavior of the disease to infect individual palms among many trees in an orchard, i.e. synchronization (Fig. 1). Rarely all palms found infected in an orchard at same time (Fig. 3).

Figure 3: Infection during Fruit Development in Summer Caused Immature and Unripe Fruit.



Infected trees are dramatically broken-down (complete drying) within 3-6 months. But, sometimes, it takes 1-2 years during which trees stopped fruiting (Fig. 4).

Figure 4: The Late Stage of Infection of a Date Palm Tree.



3. Cause(s) of the Problem

The problem has started approximately since 10 years in Pakistan, still it is not epidemic problem. The problem was recorded only in Khairpur district and other areas of Sindh province. Since that time and a controversial about the real cause was started. In the beginning some opinions attributed this problem to Termites infestation where it is a problem for the date palm trees in Khairpur. Most of infected trees were in fact infested with the Termites. The support to this opinion came through a local recipe made from a mixture contained the extract of Neem tree (*Azadirachta indica*) followed by relative recovery after the foliar application. However, recently and in the past so many trees are suffering from Termites with no such new symptoms. Termites may reduce the tree health to be less resistant to the infection.

A haphazard estimate was delivered by some agricultural officers who have visited the affected areas and mentioned that this is a viral disease! But with no evidence or feedback remedy of the problem which is inflaming day after day.

Furadan is the trade name of Carbofuran which is insecticide-nematicide suggested by National Nematology Research Center. Their findings for the infected trees were "heavy infection of Plant Parasitic and Root Knot Nematodes in the root zone". Application of Nematicide was applied for nematodes control. Unfortunately, field application with Furadan was frustrating trial when applied at HEJ Research Institute of Chemistry, Karachi University, backyard garden where some date palm trees showed same symptoms and are falling one after another (Fig. 5).

Figure 5: The Decline Disease Selectivity to Date Palm Trees in the Backyard Garden of HEJ, Karachi University in 2010.



Other findings of the Crop Disease Research Institute (CDRI), Pakistan Agriculture Research Council, Karachi University Campus indicated that the examined plant samples showed Pathogenic Fungi associated with the bark disease. Furthermore, visual examination revealed that all samples were severely infested with insect pests. Root-knot nematode and other Tylenchida⁴ were observed. The recommended application was Topsin-M or Carbendazim which used as bud drenching and soil drenching. Three to Four grams of Carbofuran have been used. Unfortunately, such treatment had no effect. Eventually, the treated trees died and symptoms started to appear on the adjacent trees associated with the common symptoms of the disease.

Date Palm Research Institute, Khairpur, Sindh, Pakistan (DPRI) is the leading Institute in whole Pakistan now, although it was established five years back by a technical help of a Foreign Professor & Consultant from Egypt. DPRI way to treat such problem started from the isolation and identification of the available pathogens. This made the institute able to apply few experiments for urgent remedy by which a briefed method will be discussed later in the remedy section.

4. Isolation and Identification of Actual Pathogen

The isolation and identification of the pathogens from infected different parts of date palm trees (roots, fronds and trunks) was started through a Ph.D study of a DPRI member (Mr. Wazir Ali Miatlo) under the supervision of Dr. Adel A. Abul-Soad and Dr G.S. Markhand in collaboration with Dr. Mumtaz Ali Pathan and Abdul Mubeen

⁴ An order of nematodes is consisting of many species which are plant parasites. Female worms lay eggs that hatch either in soil or in the host plant.

Lodhi from Pathology Dept., Tando Jam Agricultural Univ., Hyderabad in 2007. The preliminary results showed that the pathogen was the soil born fungus *Fusarium Solani*. This may be the first report of *Fusarium solani* on date palm in Pakistan. There were other 5 fungi species but, *Fusarium solani* was the predominant fungus isolated in very high frequency followed by *Phoma ucladium* and *Helminthosporium sativum*.

Healthy seedlings and offshoots which were artificially inoculated with *Fusarium solani* showed same symptoms and caused seedlings mortality in compared to control seedlings.

In date palm world, several reports on the isolation of *Fusarium* species from roots, fronds and trunks of date palm trees showed wilt and decline. *Fusarium oxysporum* and *F.solani* were the most frequent and most abundant in the roots of date palm trees showing decline in middle of Iraq [6]. *Fusarium monliforme* and *F. solani* were found associated with declined date palm trees in Egypt [7]. In Iraq, a similar disease symptoms caused by *F. solani* have been reported [8]. Recently, a serious disease of date palm was reported caused by *F. solani* associated with yellowing and death of the fronds. The disease occurred in date palm groves in Kazeron district, west of Fars province in Iran [9]. An investigation was reported on the incidence of date palm disease in Saudi Arabia and in particular in Al Qassim and Al-Medina Al-Monawara regions, several trees showed symptoms of wilt and dieback very similar to those caused by *Fusarium oxysporum* albedinis. Three *Fusarium* species were isolated from the infected fronds and roots of the date palm trees. These identified as *F. proliferatum*, *F. solani* and *F. oxysporum* [10]. All previously mentioned reports are in agreement with the findings of current study, however, more work has to be done on the side of remedy.

5. Remedy

All previously mentioned trails pressurized DPRI, SAL Univ., to conduct a comprehensive study in which all pesticides and fungicides which are available in the market have been applied to the infected trees with hope for a quick remedy. Two fungicides applications which were Bavistin (a broad-spectrum systemic fungicide of the benzimidazole group) and Topsin M (Thiophanate Methyl) gave good results and trees up to high extent recovered, i.e. fronds drying out stopped, started to produce spathes and its fruiting was normal but, yellowish of the outer fronds midrib remained.

It is a prime importance to mention that any remedy method must include a change in the adverse conditions particularly soil drainage which believed is the main reason led to the infection with *Fusarium solani* at Khairpur.

The following four-tiered approach has been developed to control the diseased trees:

5.1.Cultural Practices

The infected fronds that showing such symptoms must cut and burn but, there is no need for cut if they are at the initial stage of the infection showing the yellowish midrib (sometimes the central younger fronds acquired pale green yellowish color particularly the 5-7 years-old trees).

As water logging as concerned to the infection, soil drainage and irrigation water percolation should be optimized. The majority of the infected trees were found planted on the terraces of irrigation canals or at areas with low level land. For garden palms, daily irrigation for surrounded grass must be suspended and replaced by periodical irrigation with enough quantity of water according to climatic conditions, soil, etc. Rice cultivation intercropped among shade of tall date palm trees made stagnant water created adverse condition.

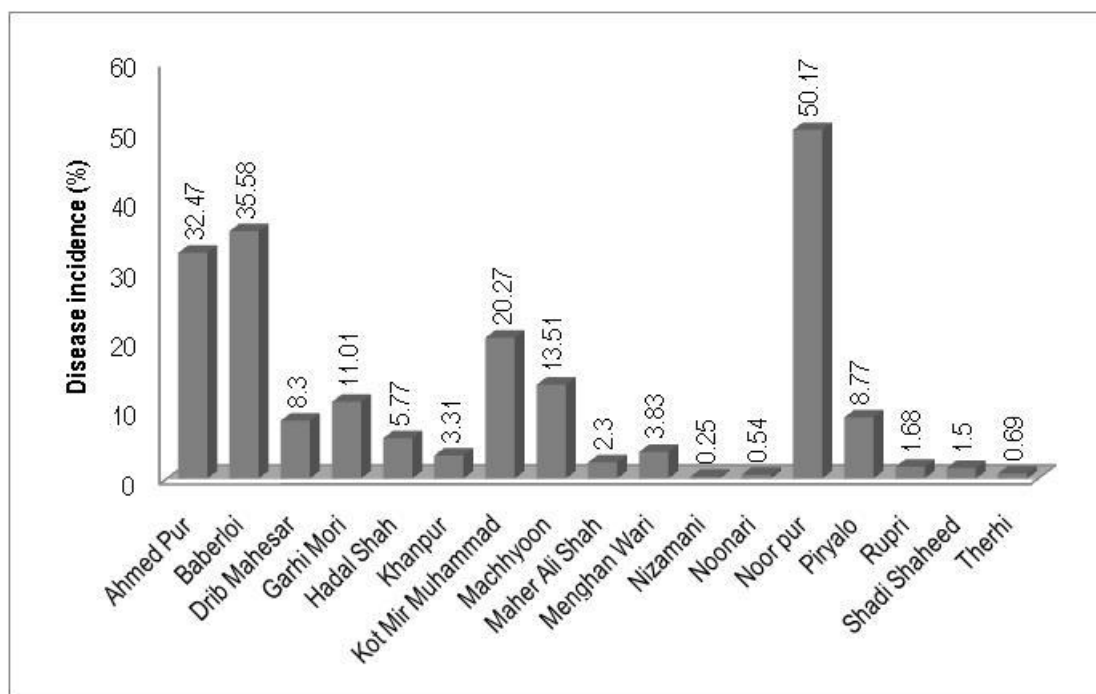
DPRI has made a survey of seventeen locations at Khairpur are presented in Fig. 6 to estimate the incidence and mortality of date palm decline disease according to the following equations:

$$\text{Disease incidence \%} = \frac{\text{Number of infected plants with the disease}}{\text{Total number of plants studied}} \times 100$$

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

The disease intensity was greatly varied from location to location and range was from 1% to 50% (Fig. 6). The highest disease incidence of date palm decline was recorded at Noor pur (50.17%) followed by Baberlo (35.58%) and Ahmed Pur (32.47%). These are the spots of heavy infection [11]. Ahmed Pur village is low land area and stagnant water is predominant over there around the year.

Figure 6: The Disease Incidence of Date Palm Decline at Different Locations of Khairpur.



5.2.Foliar Application

Three foliar sprays with Cupper Oxychoride (A contact fungicide and fertilizer) solution 5 grams per liter of water through 10 days intervals alternatively with Bavistin solution 3 ml per liter of water.

5.3.Soil Application

Three soil applications of 3 grams Topsin M per liter of water (0.3%) dissolved with the irrigation water around the trunk. The infected and adjacent trees which showing no symptoms must be treated with three fortnightly soil applications.

5.4.Fertilizer Application

As the health of a palm tree as concerned to be more resistance, the infected palm tree needs special care regarding fertilization, while most of date palm farmers are not applying any chemical fertilizers for date palm. Two to three soil applications should be applied of 250 grams per palm from N-P-K fertilizer 17-17-17 on monthly bases, 2-3 feet away from the trunk.

It is worth to mention that the above procedure has applied for orchards and individual trees. In a remedy trial on an infected tree attacked during fruiting and all

fruit bunches dried out at Khalal stage and failed to reach Rutab stage. Once the tree was affected by the pathogen, the lower 2-4 frond whorls started drying and dangled down within 2 months. A tree with dangling dried fronds and yellowish color of the central young fronds is a general symptom of the latent infection. The above mentioned four-tired remedy procedure stopped the drying out of remained green fronds at the center (Fig. 7). Maintaining a good position needs soil elevation and enhance of soil drainage. The precipitate (silt) of Sindh river bed could play a role for enhancing the soil properties and reduce the infection of such disease by finding a fresh and nutritive bed for the roots.

Figure 7: Infection during Fruiting (Left Photo) and Remedy Treatment Application (Right Photo).



6. Summary

The common symptoms of sudden decline syndrome in Khairpur are the orange yellowish rachis followed by gradual drying of the pinnae. Drying started from old lower fronds toward younger central fronds to be ended with a complete death of the date palm tree within few months.

Infected adult trees during winter prevented spathes emergence whereas the infection during fruit development in summer caused immature and unripe fruit formation.

The age is not compulsory for a date palm tree to be infected with the disease in view of the fact that all ages showing the common symptoms. Males were found less infected than the productive females. Within the females, unhealthy trees and those are living in adverse conditions particularly water logging were more susceptible. A suspicion that the presence of the infection source (*Fusarium* Spp.) associated with an adverse condition(s) was found to be responsible for date palm wilt disease.

A remedy method was invented to treat a decline date palm tree consisted of four-tired procedure includes infected fronds cut, foliar application of Cupper

Oxychloride (0.5% solution), and soil application of Topsin M (0.3% solution) and chemical fertilizer. Keeping in consideration the adverse impact of water logging and actions have to be made to improve the soil drainage.

Real efforts with sanitary procedures should be taken to prevent the transmission of the disease to other production areas and finding cost-effective and innovative solutions to control such massive disease at Khairpur in Pakistan and similar areas in the world.

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