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

aWazir A. Metlo*, bGhulam S. Markhand, cZaheer A. Chandio, dQurat U. A. Shaikh, eLal Bux, fWajid A. Jatoi

a Department of Molecular Biology & Genetics, Shaheed Benazir Bhutto University, Shaheed Benazirabad, Sindh, Pakistan. b Department of Botany, Shah Abdul Latif University, Khairpur, Sindh, Pakistan. c Department of Chemistry, Shaheed Benazir Bhutto University, Shaheed Benazirabad, Sindh, Pakistan. d Department of Plant Breeding & Genetics, Sindh Agriculture University, Tando Jam, Pakistan.

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 chrysogenium 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 nutritious 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 D.I Khan in Khyberpakhtoon khuwa (Jatoi et al., 2009), having significant place in the socio-economic progress...
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 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.

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 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.
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. Il 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 farms163 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 alternate, Aspergilus niger, Fusarium solani and Penicillium chrysogenium 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 chrysogenium, Aspergilus niger and Alternaria alternata, (Thle-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 chrysogenium (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               | F. solani | P. ucladium | H. sativum | A. alternate | P. chrysogenium | A. niger |
|------------------------|-----------|-------------|------------|--------------|-----------------|---------|
| Noor Pur               | 64        | 29.3        | 23.3       | 16.6         | 10              | 8.6     |
| Baberlo               | 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     |
| Piryal                | 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.
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: Moniliaceae 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 LibyaThe 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, discoulourin 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 reptred 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.

REFERENCES

Abdalla, M., A. Al-Rokibah, A. Moretti and G. Mule. 2000. Pathogenicity of toxigenic *Fusarium proliferatum* from date palm in Saudi Arabia. Plant disease, 84: 321-324.

Abul-Soad, A. A., W. A. Maitlo, G. Markhand and S. M. Mahdi. 2011. Date palm wilt disease (sudden decline syndrome) in Pakistan, symptoms and remedy. Bless Tree, 3: 38-43.

Al-Akaidy, H. K. H. 1994. Science and Technology of Date Palm Cultivation. Ekal Press, Iraq.

Barakat, F., K. Sabet and S. Hussein. 1992. Pathological studies on the deterioration of date palm off-shoots caused by *Botryodiplodia theobromae*. Bulletin of Faculty of Agriculture, Cairo Univ.(Egypt), 43: 395-
Phoenix dactylifera

Booth, C. 1971. The Genus Fusarium. The Lavenham Press Ltd. Lavenham Suffolk, 1: 237-241.

Cohen, R., S. Pivonia, Y. Burger, M. Edelstein, A. Gamliel and J. Katan. 2000. Toward integrated management of Monosporascus wilt of melons in Israel. Plant Disease, 84: 496-505.

Djerbi, D. 1983. Diseases of date palm (Phoenix dactylifera L) Regional project for palm and Date research centre in the Near East and North Africa, Baghdad: 106-110.

Domsch, K. H., W. Gams and T. H. Anderson. 1980. Compendium of soil fungi. Volume 1. Academic Press (London) Ltd, 1: 859-864.

Edongli, A., B. Ghaira, J. Khalil and S. Nursery. 1985. Study on date palm disease and pests in Jamahiriyat. Third Report Ministry of Agriculture, Tripoli, Libya.

El-Arosi, H., H. El-Said, M.A. Najieb and N. Jabeen. 1983. Al-wijam decline date palm disease. Proceeding of the first symposium on date palm, Al-Hassa, Saudi Arabia: 388-403.

El-Arosi, H., H. El-Said, M. Najieb and N. Jabeen. 1982. Al-Wijam, decline date palm disease. Proceeding of the first symposium on date palm, Al-Hassa, Saudi Arabia: 388-403.

Ellis, M. 1971. Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, Surrey, England. pp. 608-612.

Fernandez, D., M. Quinten, A. Tantaoui, J. P. Geiger, M. J. Daboussi and T. Langin. 1998. Fot 1 insertions in the Fusarium oxysporum f. sp. albedinis genome provide diagnostic PCR targets for detection of the date palm pathogen. Applied and Environmental Microbiology, 644: 633-636.

Iram, S., I. Ahmad, K. Nasir and S. Akhtar. 2011. Study of fungi from the contaminated soils of peri-urban agricultural areas. Pakistan Journal of Botany, 43: 2225-2230.

Ishtiaq, M., A. Alizai and K. Abdullah. 1988. Physical properties of the fruit of some indigenous date palm cultivars grown at DI Khan [Pakistan]. Sarhad Journal of Agriculture, 4: 271-274.

Jatoi MA, M. Z., Solangi N. 2009. Dates in Sindh: facts and figures. Proceedings of the “International Dates Seminar” organized by Date Palm Research Institute, Shah Abdul Latif University, Khairpur, Sindh, Pakistan.

Khalil, J., E. Edongali and S. MN. 1986. Decline Disease of Date-palm Trees (Phoenix dactylifera L.) in Libya. The Second Symposium on the Date Palm in Saudi Arabia. pp. 487-490.

Maitlo, W. A., G. S. Markhand, A. A. Abul-Soad, A. M. Lodhi and M. A. Jatoi. 2014. Fungi associated with sudden decline disease of date palm (Phoenix dactylifera L.) and its incidence at Khairpur, Pakistan. Pakistan Journal of Phytopathology, 26: 67-73.

Maitlo, W. A., G. S. Markhand, A. A. Abul-Soad, A. M. Lodhi and M. A. Jatoi. 2015. Evaluation of various fungicides against Fusarium solani (mart.) Sacc causing sudden decline disease of Date Palm (Phoenix dactylifera L. ). Proceeding of the first International Dates Seminar, Date Palm Research Institute, Shah Abdul Latif University Khairpur. pp. 71-76.

Mansoori, B. 2003. Fusarium solani, the cause of root rot of date palms (Phoenix dactylifera L.). Iran Journal of Plant Pathology, 39: 77.

Masood, A., S. Saeed, S. Silveira, C. N. Akem, N. Hussain and M. Farooq. 2011. Quick decline of mango in Pakistan: survey and pathogenicity of fungi isolated from mango tree and bark beetle. Pakistan Journal of Botany, 43: 1793-1798.

Molan, Y., R. Al-Obeed, M. Harhash and S. El-Husseini. 2004. Decline of date-palm offshoots with Chalara paradoxa in Riyadh region. Journal of King Saud University, 16: 79-86.

Pathak, V. 1987. Laboratory manual of plant pathology. Oxford & IBH Publishing Company. PP. 23-50.

Priest, M. and D. Letham. 1996. Vascular wilt of Phoenix canariensis in New South Wales caused by Fusarium oxysporum. Australasian Plant Pathology, 25: 110-113.

Rashed, M. 1998. Pathological studies on black scorch disease of date palm. Ph.D dissertation Faculty of Agriculture, Cairo University.

Rashed, M. and N. Abdel Hafeez. 2001. Decline of date palm trees in Egypt. 2nd International Conference on Date Palm. pp. 25-27.

Sarhan, A. 2001. A study on the fungi causing decline of date palm trees in middle of Iraq. Second International Conference on Date Palm. pp. 25-27.
Shar, M. U., M. Rustmani and S. M. Nizamani. 2012. Evaluation of different date palm varieties and pheromone traps against red palm weevil (*Rhynchophorus ferrugineus*) in Sindh. Journal of Basic and Applied Science, 8: 1-5.

Singh, S., P. Pandey and B. Misra. 1977. Twig blight and pod blackening of cacao (*Theobroma cacao* Linn.). Indian Forester, 103: 483-485.

Suryanarayanan, T., G. Venkatesan and T. Murali. 2003. Endophytic fungal communities in leaves of tropical forest trees: diversity and distribution patterns. Current Science, 489-493.

Sutton, B. C. 1980. The Coelomycetes. Common. Mycology. Inst., Kew, Surrey, England: 696-702.

Waller, F., K. Mukherjee, S. D. Deshmukh, B. Achatz, M. Sharma, P. Schäfer and K.-H. Kogel. 2008. Systemic and local modulation of plant responses by *Piriformospora indica* and related Sebacinales species. Journal of plant physiology, 165: 60-70.

Zohary, D. a. M. H. 2000. Domestication of plants in the old world: The origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley. Oxford University Press, Oxon, UK.

### Contribution of Authors:

| Name               | Contribution                                           |
|--------------------|--------------------------------------------------------|
| 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.                                     |