Research Journal of Microbiology

ISSN 1816-4935

Academic Journals Inc.

www.academicjournals.com

Research Journal of Microbiology, 4 (5): 208-213, 2009
ISSN 1816-4935

Date-Palm Fruit Spoilage and Seed-Borne Fungi of Saudi Arabia

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Abstract: The seeds and fruits of different date palm varieties were collected from local market and brought to the laboratory of the Department of Biology, College of Science, King Faisal University, in Al-Hassa, Saudi Arabia, where further experiments for isolation of fruit spoilage and seed-borne fungi were conducted by using common technique of wet blotter method. A total number of 100 seeds and 100 cubes (1 cm^3) obtained from the fruits (10 pieces per plate) were put on wet filter paper and incubated at 25°C to allow the growth of fungi for a period of 1 week. Fungal species developed on seeds and fruit pieces were isolated on potato dextrose agar for identification. This study was carried out during year from May 2007 to April 2008. Twenty species from 14 genera of fungi have been isolated from 13 different varieties of date-palm as seed-borne fungi while 39 species of 16 genera of fungi were isolated as fruit spoilage fungi. *Alternaria alternata*, *Aspergillus flavus*, *A. niger*, *Fusarium oxysporum* and *F. solani* were the predominant species in both seed-borne and fruit spoilage fungi.

Key words: Seed-borne, fruit spoilage fungi, date-palm varieties

INTRODUCTION

Saudi Arabia ranked number one among the date producers and exporting countries in the world where it produces 7170 tones of date annually (Al-Showiman and BaOsman, 1992). Saudi Arabia is also a genetic centre of date-palm trees and there are more than 400 different cultivars of fruiting date palm of economic value (Fayadh and Al-Showiman, 1990). Historically, date-palm tree had been crucial for the survival of nomadic tribes in Saudi Arabia (Hoop, 2003). The biochemical studies regarding the nutritional values of Saudi dates varieties have shown that these dates are rich in amino acids, vitamins, carbohydrates and minerals thus having great nutritional value (Al-Showiman, 1990).

Date seeds are used as animal feed. Their oil is suitable for use in soap and cosmetics. They are a good source for commercial production of oxalic acid and burned to make charcoal for silversmiths. They are also used as an additive to coffee. There are 16 imported commercial varieties of indigenously date-palm tree grown in USA. Among them, the most prominent are Barhee. Deglet Noor, Halawi, Khadrawy, Medjool, Thoory and Zahidi (Johnson and Hodel, 2007).

Fruit spoilage fungi of date palm have been reported from Saudi Arabia (Aba-Alkhail *et al*., 2004) and from other countries like Egypt (El-Deeb *et al*., 2007) and Iran (Karampour and Pejman, 2007; Omamor and Hamza, 2007).

There are several fungal diseases of date palm that reported to cause severe damages like beyoud caused by *Fusarium oxysporum* (El-Hassni *et al*., 2007). Belaat and bending head caused by *Phytophthora* and *Ceratocystis paradoxa* or *Lasiodiplodia theobromae*, respectively. Other diseases like black leaf spot, diplodia, fruit rots of date-palm, Graphiola leaf spot, inflorescence rot, Khamedji, Omphalia root rot, Pestalotia leaf spot, Taches brune and terminal bud rot have been reported from Saudi Arabia (Abdalla, 1995; Lhudaib *et al*., 2007; El-Hassni *et al*., 2004; Mansoori and Kord, 2006; Al-Rokeibah, 1991). Diseases of unknown casual organisms also reported from Saudi Arabia like

Al-Hijm, Berhee disorder, Faround, internal browning and rapid decline including diseases caused by nematodes and mycoplasma like organisms (Al-Rokeibah, 1991; Abbas and Abdullah, 2003; Al-Swaidi, 2003; Mansoori and Kord, 2006). These diseases causes major loss of date palm yield (Elliot *et al*., 2004; www.wikipedia.com).

Although, some studies have been done on fruit spoilage fungi (Aba-Alkhail *et al*., 2004) but as far as researchers knowledge is concerned no study has been reported on seed-borne fungi of date-palm of Saudi Arabia. Therefore, this study was conducted to know the seed-borne fungi and fruit spoilage fungi of date-palm of local varieties of Saudi Arabia.

MATERIALS AND METHODS

Thirteen locally grown varieties of date palm were chosen to study the seed-borne and fruit spoilage fungi. These varieties are Al-Barakah, Al-Rashooda, A-lRotana, Al-Saki, Khadrawy, Khalasah (Al-Shaqheyah), Medjool (Majhoolah), Mishriq, Nabt Ali, Nabtat-Seyf, Sellaj, Sukhari and Umal Khasab. This study was carried out for one year during May 2007 to April 2008. The seeds and fruits of different date palm varieties were collected from local market and brought to the laboratory of the Department of Biology, College of Science, King Faisal University in Al-Hassa, Saudi Arabia, where further experiment for isolation of fruit spoilage and seed-borne fungi were conducted by using the common technique of wet blotter method.

Isolation of Seed-Borne Fungi

A total number of 100 seeds from each variety were plated in 13 cm diameter petri dishes (10 seeds per plate) over moist filter paper which kept moist throughout the experimental period by adding sterile water. These plates were kept into incubation chambers with light at 25±1°C temperature. After one week of incubation, the fungi emerging on the seeds were taken by sterile needles and cultured on potato dextrose agar (Oxoid, UK) for identification. The seeds were surface sterilized by dipping in 2% commercial chlorox (7% sodium hypochlorites) for 2 min prior to incubation (Agarwal *et al*., 2006; Agrawal, 2006; Mew and Gonzales, 2002).

Isolation of Fruit Spoilage Fungi

Approximately 1 cm^3 pieces were cut from fruit of date palm varieties. These pieces were put on wet sterilized filter paper in a 13 cm diameter petri dishes. A total number of 100 pieces of each variety (10 pieces per plate) were incubated for isolation of spoilage fungi. These plates were put into an incubator at 25±1°C. After a week of incubation, fungi which were appeared over the fruit pieces, were taken out with the help of sterilized needle and cultured on potato dextrose agar for growth and identification (Blackburn, 2006).

Identification of Fungi

Identification of the isolated fungi was done to the following study, Ellis (1971, 1976), Zycha *et al*. (1969), Raper and Fennell (1965), Pitt (1979), Ramirez (1982) and Nelson *et al*. (1983). Confirmation of the identification was done by Dr. Sarwat Parvez, Mycology Section, Department of Medical Microbiology, Riyadh Military Hospital, Riyadh, Saudi Arabia.

RESULTS AND DISCUSSION

Twenty species of fungi belonging to 14 genera have been isolated from seeds of 13 different varieties of date-palm (Table 1). Among these, the fungal species which were isolated from all the varieties of date palm are *A. alternata*, *A. flavus*, *A. niger*, *F. oxysporum*, *F. solani* and *Ulocladium atrum*. *Fusarium oxysporum* was the predominant species and it was isolated not only from all the

Table 1: Seed-borne fungi isolated from different varieties of date-palm

	No. of cases of a particular fungus (n = 100)/date-palm varieties												
Fungi	1	2	3	4	5	6	7	8	9	10	11	12	13
Alternaria alternate	6	8	11	7	9	5	12	5	7	4	8	5	6
A. chlamydospora	3	-	9	3	-	-	5	-	6	2	-	-	7
Aspergillus carbonarius	-	3	3	-	-	7	2	-	4	-	-	6	2
A. flavus	20	25	16	30	40	45	26	31	52	14	27	23	42
A. niger	16	18	25	20	15	17	16	21	31	18	23	18	12
Bipolaris hawaiiensis	10	8	5	6	4	9	-	-	4	-	3	-	-
B. spicifera	-	-	-	3	-	2	6	-	5	-	-	-	-
Chaetomium globosum	-	-	6	-	8	4	-	-	-	3	-	6	-
Chaetomium sp.	8	-	-	-	-	-	-	-	-	-	-	-	-
Curvularia lunata	-	7	-	-	-	4	-	-	-	3	-	-	-
Fusarium oxysporum	36	49	56	65	72	36	48	47	36	39	44	52	62
F. solani	10	12	3	10	16	20	13	19	7	11	13	22	30
Penicillium chrysogenum	-	-	-	4	-	-	-	8	-	5	-	-	7
P. sclerotiorum	-	-	-	-	-	-	-	-	4	-	-	-	2
Phialophora sp.	16	14	10	-	-	12	6	-	-	-	9	5	-
Rhizopus stolonifer	-	26	-	22	-	16	28	-	-	-	10	-	6
Scytalidium album	10	-	-	-	-	-	-	-	-	8	-	9	-
Thielavia albomyces	-	-	10	-	-	-	-	-	-	-	4	-	3
Trichoderma harzianum	21	16	-	-	-	-	13	12	-	-	-	-	-
T. viride	-	-	-	12	-	-	-	-	6	-	-	-	-
Ulocladium atrum	32	26	19	23	29	16	5	6	4	18	16	12	10
U. chlamydosporum	10	6	20	11	-	-	-	7	8	-	-	12	8
No. of species	13	13	12	13	8	13	12	9	13	11	10	11	13

1: Al Barakah, 2: Al-Roshooda, 3: Al Rotana, 4: Al Saki, 5: Khadrawy, 6: Khalash, 7: Medjool (Majhoolah), 8: Mishriq, 9: Nabt Ali, 10: Nabt-Seyf, 11: Sellaj, 12: Sukari, 13: Umel Khasab

Table 2: Fruit spoilage fungi isolated from different varieties of date-palm

	No. of cases of a particular fungus (n = 100)/date-palm varieties												
Fungi	1	2	3	4	5	6	7	8	9	10	11	12	13
Alternaria alternate	69	76	83	75	45	53	36	39	69	84	85	36	52
A. chlamydospora	36	42	32	22	29	31	49	22	16	19	14	22	26
Aspergillus candidus	12	-	-	-	10	-	-	-	-	-	-	4	-
A. carbonarius	19	29	12	8	11	17	29	21	16	19	10	32	15
A. carneus	40	-	-	-	-	-	10	-	-	-	3	-	-
A. ellipticus	-	-	19	12	16	-	-	-	-	6	-	-	6
A. flavus	82	79	59	62	48	44	63	72	18	16	36	49	8
A. fumigatus	16	29	30	18	12	23	12	16	62	45	30	21	32
A. nidulans	-	-	14	12	16	-	-	9	-	-	6	30	10
A. niger	83	85	76	92	88	87	76	75	69	86	83	89	91
A. terreus	32	39	26	21	13	19	29	24	32	16	18	12	22
A. versicolor	-	-	-	-	-	-	-	-	-	-	16	8	-
Bipolaris hawaiiensis	32	16	23	12	36	34	29	10	42	13	12	19	23
B. spicifera	49	52	59	43	33	39	46	29	18	42	12	18	36
Chaetomium globosum	12	10	5	5	6	5	7	-	12	22	12	10	19
C. robustum	-	-	10	-	9	-	-	8	-	-	-	19	4
Curvularia lunata	8	12	19	12	6	7	7	5	5	3	16	12	8
Diplodia sp.	-	-	-	-	-	10	-	-	-	-	6	-	-
Fusarium chlamydosporum	59	79	82	75	86	83	56	48	34	39	57	62	63
F. oxysporum	36	42	69	75	82	68	43	53	75	66	61	69	55
F. solani	63	65	61	64	59	42	49	51	57	46	34	62	64
Geotrichum candidum	-	-	12	-	-	-	-	12	-	-	8	-	-
Penicillium chrysogenum	76	69	59	63	73	85	81	79	65	45	52	69	72
P. expansum	10	4	9	12	16	13	12	10	12	9	16	12	19
P. sclerotiorum	8	-	-	-	-	-	-	-	-	-	-	-	-
P. thomii	-	-	16	-	-	6	-	-	-	-	4	-	-
Phialophora sp.	-	-	-	8	12	-	-	-	-	5	-	-	-
Rhizopus microporus	12	8	19	-	-	7	9	8	6	-	8	10	5
R. stolonifer	43	59	39	63	64	34	36	42	17	16	63	65	45
Scytalidium album	-	6	-	10	-	12	-	4	-	19	-	12	-

Table 2: Continued

Fungi	No. of cases of a particular fungus (n = 100)/date-palm varieties												
	1	2	3	4	5	6	7	8	9	10	11	12	13
S. lignicola	-	-	-	-	10	-	-	-	-	-	-	-	-
Stachybotrys atrum	4	18	21	-	-	5	-	4	5	-	-	6	-
S. micropora	-	-	6	-	2	-	-	-	3	-	4	-	-
Thielavia albomyces	-	-	-	16	-	-	-	-	-	-	-	-	-
Trichoderma harzianum	12	6	-	-	-	-	10	-	-	-	-	-	-
T. viride	-	-	4	-	-	4	-	-	-	-	3	-	-
Ulocadium atrum	16	12	30	29	34	21	18	14	12	7	12	23	26
U. chlanaydosporum	22	29	4	-	-	-	-	10	-	-	-	6	-
U. tuberculatum	-	-	8	7	6	5	7	-	-	-	-	-	-

1: Al Barakah, 2: Al-Roshooda, 3: Al Rotana, 4: Al Saki, 5: Khadrawy, 6: Khalash, 7: Medjool (Majhoolah), 8: Mishriq, 9: Nabt Ali, 10: Nabt-Seyf, 11: Sellaj, 12: Sukari, 13: Umel Khasab

varieties but also yielded highest number of isolates from most of the varieties of date palm. It was isolated from 72 seeds out of 100 seeds incubated in case of variety Khadrawy. Fungi isolated here in this work belonging to *Alternaria*, *Aspergillus*, *Chaetomium*, *Bipolaris*, *Curvularia*, *Fusarium*, *Penicillium*, *Ulocladium* and others genus have either been reported to cause severe diseases of date-palm (El-Hassni *et al*., 2007; Al Rokeibah, 1991; Abbas and Abdullah, 2003; AlSwaidi, 2003) or to be seed-borne fungi (Gure, 2004; Agarwal *et al*., 2006; Embady and Abdel-Galil, 2006; Koo, *et al*., 2003).

Thirtynine species belonging to 16 genera of fungi were isolated as fruit spoilage fungi of date-palm. *Aspergillus* was the predominant genus with ten species followed by *Penicillium* with four species. Fungal species which were isolated from all the varieties are *Alternaria alternata*, *A. chlamydospora*, *Aspergillus carbonarius*, *A. flavus*, *A. fumigates*, *A. niger*, *A. terreus*, *Bipolaris hawaiiensis*, *B. spicifera*, *Curvularia lunata*, *Fusarium oxysporum*, *F. chlamydosporum*, *F. solani*, *Penicillium chrysogenum, P. expansum, Rhizopus stolonifer* and *Ulocladium atrum* (Table 2). These results are in accordance with those published in several articles from samples obtained from Saudi Arabia (Aba Al-Khail *et al*., 2004) and from neighbouring countries (El-Deeb *et al*., 2007; Omamor and Hamza, 2007).

CONCLUSION

Out of about 400 varieties of date palm cultivated in Saudi Arabia only 13 varieties have been studied in this study. Therefore, future studies could be carried out for investigation of seed borne fungi from other varieties too. Most of the fungi isolated are known to produce harmful chemicals including mycotoxins that could cause health risk for consumers. This point might also be experimentally investigated in future studies.

ACKNOWLEDGMENTS

The author would like to acknowledge the assistance provided by different laboratories of the Science College at King Faisal University for both, allowing to use some of their equipments and/or providing some basic materials for performing the experiments needed for the study.

REFERENCES

Aba-Alkhail, A.R.A., G.H. Ibrahim, S.M. Al-Rehiayani, A.I. Askar and K.A. Osman, 2004. Susceptibility of some varieties of date fruits to support the production of aflatoxins: Analysis by high performance liquid chromatography. Pak. J. Biol. Sci., 7: 1937-1941.

Abbas, E.H. and A.S. Abdullah, 2003. First report of neck bending disease on date palm in Qatar. Plant Pathol., 52: 790-790.

Abdalla, M.Y., 1995. Sudden decline of date palm trees caused by *Erwinia chrysanthemi*. Plant Dis., 85: 24-26.

Agarwal, P.C., U. Dev, B. Singh, R. Indra and R.K. Khetarpal, 2006. Seed-borne fungi detected in consignments of soybean seeds (*Glycine max*) imported into India. Bull. OEPP, 36: 53-58.

Agarwal, V.K., 2006. Seed Health. International Book Publisher, Lucknow.

Al-Rokeibah, A., 1991. Leaf blight of date palm caused by *Glomerella cingulata* in Al-Qassim Region. J. King. Saud. Univ., 3: 109-115.

Al-Showiman, S.S., 1990. Chemical composition of some date-palm seeds (*Phoenix dactylifera* L.) in Saudi Arabia. Arab. Gulf. J. Sci. Res., 8: 15-24.

Al-Showiman, S.S. and A.A. BaOsman, 1992. Review of vitamins with special reference to dates. Saudi Pharma. J., 7: 173-190.

Al-Swaidi, J.S., 2003. The Date palm: From Traditional Resource to Green Wealth. The Emirate Center for Strategic studies and Research, UAE.

Blackburn, C., 2006. Food Spoilage Microorganisms. Unilever Research Colworth, UK.

El-Deeb, H.M., S.M. Lashin and Y.A. Arab, 2007. Distribution and pathogenesis of date palm fungi in Egypt. Acta Hortic., 736: 421-429.

El-Hassni, M., F. Jaiti, A. Dihazi, E. Aitbarka, F. Dayaff and I. El-Hadrami, 2004. Enhancement of defence response against Bayoud disease treatment of date palm seedlings with an hypoaggressive *Fusarium oxysporum* isolate. J. Phytopathol., 152: 182-189.

El-Hassni, M., A. El-Hadrami, D. Fouad, C. Mohamad, E.A. Barka and I. El-Hadrami, 2007. Biological control of bayoud disease in date-palm. Selection of microorganism inhibiting the causal agent and inducing defence reaction. Environ. Exp. Bot., 59: 224-234.

Elliot, M.I., T.K. Broschat, J.Y. Uchida and G.H. Simone, 2004. Compendium of Ornamental Palm Diseases and Disorders. A.P.S. Press, UK., pp: 71.

Ellis, M.B., 1971. Dematiaceous Hyphomycetes. 1st Edn., Commonwealth Mycological Institute, Kew, Surrey, UK., pp: 608.

Ellis, M.B., 1976. More Dermatiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, UK.

Embady, E.M. and M.M. Abdel-Galil, 2006. Seed-borne fungi and mycotoxins associated with some legume seeds in Egypt. J. Applied Sci. Res., 2: 1064-1071.

Fayadh, J.M. and S.S. Al-Showiman, 1990. A review on chemical composition of date palm (*Phoenix dactylifera* L.). J. Chem. Soc. Pak., 12: 84-103.

Gure, A., 2004. Seed-borne fungi of the afromontane tree species *Podocarpus falcatus* and *Prunus africana* in Ethiopia. Acta Univ. Agric. Sueciae, 334: 1-31.

Hoop, B.M., 2003. Date palm micropropagation in Saudi Arabia and technology transfer. Int. J. Biotechnol., 2: 333-341.

Johnson, D.V. and D.R. Hodel, 2007. Past and present date varieties in the United States. Acta Hortic., 736: 39-45.

Karampour, F. and H. Pejman, 2007. Study on possible influence of pathogenic fungi on date bunch fading disorder in Iran. Acta Hortic., 736: 431-439.

Koo, H., S. Lee, I. Jung Min and S. Chun, 2003. A seed-borne fungus *Bipolaris spicifera* detected from imported grass seeds. Plant Pathol. J., 19: 133-137.

Lhudaib, K.A., Y.A. Rocha, M.W. Ilson and P.J. Ones, 2007. Al-Wijam, a new phytoplasma disease of date palm in Saudi Arabia. Bull. Insectol., 60: 285-286.

Mansoori, B. and M.H. Kord, 2006. Yellow death: A disease of date palm in Iran caused by *Fusarium solani*. J. Phytopathol., 154: 125-127.

Mew, T.W. and P. Gonzales, 2002. A Handbook of Rice Seedborne Fungi. International Rice Research Institute, USA.

Nelson, P.E., T.A. Toussoun and W.F.O. Marasas, 1983. *Fusarium* species: An Illustrated Manual for Identification. 1st Edn., Pennsylvania State University Press, University Park, New York, ISBN-10: 0271003499.

Omamor, I.B. and A. Hamza, 2007. The effect of relative humidity and temperature on disease development in stored date fruits. Acta. Hortic., 736: 457-460.

Pitt, J.I., 1979. The Genus *Penicillium* and Its Telomorphic State *Eupenicillium* and Talaromyces. Academic Press, London, UK.

Ramirez, C., 1982. Manual and Atlas of Penicillia. Elsevier Biomedical Press, Amsterdam, The Netherlands, pp: 874.

Raper, K.B. and D.I. Fennell, 1965. The Genus *Aspergillus*. 1st Edn., Williams and Wilkins Co., Baltimore, Maryland.

Zycha, H., R. Siepmann and G. Linnemann, 1969. Mucorales: Eine Beschreibung Aller Gattungen und Arten Dieser Pilzgruppe. Cramer Lehre, Germany.