

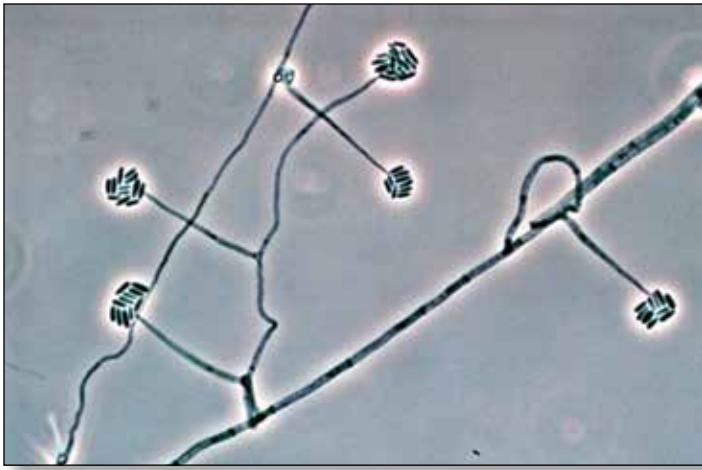


HOW *FUSARIUM* *OXYSPORUM* CHANGED THE COURSE OF THE DATE INDUSTRY

Mohamad Ismail

Many fungi have changed the course of history, changed lives, and altered the landscape. Most all of us know about *Phytophthora infestans*, the causal agent of late blight disease of potato, and the Irish potato famine. Between 1845–46 more than a million starved to death in Ireland, another two million Irish emigrated to North America, and the rest is history. The American chestnut was decimated by the fungus *Cryphonectria parasitica*. Starting in New York in 1905, an estimated five billion (some estimates are as high as 25 billion) chestnut trees were destroyed throughout the Appalachian range and the eastern seaboard. The devastation took three decades, and today many are still trying to reintroduce the mighty American chestnut to its once great and pre-eminent forest stature.

Possibly the most infamous—and destructive—of all plant pathogenic fungi belong to the *Fusarium* group. *Fusarium oxysporum* is a pernicious fungus affecting a wide variety of plants. It is the casual agent of Panama disease resulting in the eradication of the beautiful Gros Michel banana variety and is now wreaking havoc on its replacement, the Cavendish, with many expecting its extinction only a matter of time. *Fusarium* wilt is one of the many plagues of plants affecting tomato, potato, peppers, tobacco, sweet potato, rice, wheat,



ascospores can all be produced depending on the species and other parameters.

Date palms and disease

Of the more than 3,000 known varieties of dates, the Medjool is considered one of the most beautiful, highly esteemed and desirable varieties. The Medjool date palm, *Phoenix dactylifera*, is endemic to North Africa and the Middle East and plantations, or “Medjool oases,” are found primarily in Morocco and Algeria. The Medjool, دمجول, is a hardy palm and can grow up to 100 feet tall in 80 to 100 years.

The Bayoud disease of the date palm was first noted in Zagorra, Morocco in 1870 with the causal agent being *Fusarium oxysporum* f. sp. *albedinis*. The definitive description of the fungus was determined by G. Malençon in 1950. Bayoud comes from the Arabic word “abiadh” meaning white and refers to the whitening of the fronds in diseased palms. Being a monocot, *P. dactylifera* has the phloem and xylem in bundles instead of a circle around the circumference of the palm trunk. The fungus enters roots through the soil and infects the xylem preventing water flow, causing the whitening in the fronds and eventually killing the point of growth.

So far as is known, the disease is limited to Morocco and Algeria, where more than 20 million palms have died as of 2010. It affects Medjool, Deglet Nour, and other date varieties as well. Today there are over 100 million date palms in over 30 countries that produce over six million tons of dates per year. Egypt is the largest producer, with the USA not even in the top 20 producers. All USA date production is centered in California and Arizona, with Deglet Nour the number one variety. The Medjool is primarily produced in the Coachella and Bard Valleys of California.

But how the Medjool came to the USA is an incredible story owing to one man, Walter Swingle. The story is recounted well by Donald Hodel in *Dates of the United States*:

“Walter Swingle [a biologist with the USDA] was invited to Morocco in 1927 to take part in a study of Bayoud disease. During a visit to Bou Denib oasis where Medjool originated, Swingle was able to purchase 11 Medjool offshoots, all removed from a single palm growing in a Bayoud-free garden. Shipment of the offshoots to Washington D.C. took five weeks. Upon their arrival the USDA fumigated them and, to ensure they were disease free, required that they be grown in strict quarantine conditions for several years in a state where no date palms were grown. The southernmost point in Nevada, then with no date palms and having a suitable climate, met those conditions. A local Native American farmer near the Colorado River agreed to grow the 11 offshoots which were planted on July 4, 1927. Three years later the nine palms that survived were producing offshoots and a few fruit bunches. By 1935 the nine surviving original offshoots had produced 64 additional offshoots for a total of 73 palms. Having successfully passed all periodic inspections for Bayoud or other pests or diseases, the palms were released from USDA quarantine in the summer of 1936 and transplanted, without any losses, to the USDA Date Garden in Indio.”

So there you have it: how *Fusarium oxysporum* f. sp. *albedinis* changed the course of the date industry, resulting in the introduction of the beautiful Medjool to California.



Asexual spores of *Fusarium*: macroconidia and microconidia. Scanning electron micrograph images courtesy G. Barron.

and a plethora of other crops. It also occurs as crown rot, head blight, ear blight, and canker to name just a few other *Fusarium* diseases.

The biology of this fungus is fascinating. *Fusarium* produces no less than four different spore types in its many growth strategies: macroconidia, microconidia, chlamydospores and

There are now over 100,000 Medjool palms in California and Israel, all from one palm in Morocco, all owing to the efforts of one man, Walter Swingle, as a consequence of one fungus, *Fusarium oxysporum*.

References and further reading

- Benzohra, I.E., and M.M.R. Berdja. 2015. Bayoud disease of date palm in Algeria: history, epidemiology and integrated disease management. *African Journal of Biotechnology* 14(7): 542–550.
- Carpenter, J.B., and H.S. Elmer. 1978. *Pests and Diseases of the Date Palm*. U.S. Department of Agriculture, Agriculture Handbook No. 527.
- Chao, C.C.T., and R.R. Krueger. 2007. The date palm (*Phoenix dactylifera* L.): overview of biology, uses, and cultivation. *HortScience* 42(5): 1077–1082.
- Freeman, S., and M. Maymon. 2000. Reliable detection of

- the fungal pathogen *Fusarium oxysporum* f. sp. *albedinis*, causal agent of Bayoud disease of date palm, using molecular techniques. *Phytoparasitica* 28(4): 341–348.
- Hodel, D.R., and D.V. Johnson. 2007. *Imported and American Varieties of Dates (Phoenix dactylifera) in the United States*. UC ANR Publication 3498, Oakland, CA; University of California.
- Ma, L.-J., D.M. Geiser, R.H. Proctor, A.P. Rooney, K. O'Donnell, F. Trail, D.M. Gardiner, J.M. Manners, and K. Kazan. 2013. *Fusarium* pathogenomics. *Annual Review of Microbiology* 67: 399–416.
- Zaid, A. 2002. *Date Palm Cultivation*. FAO Plant Production and Protection Paper, number 156. Food and Agricultural Organization of the United Nations, Rome.
- This report was previously published, in part, in the newsletter of the Los Angeles Mycological Society.* 🍄



Looking for Mushrooms at Sunrise

When it is not yet day
I am walking on centuries of dead chestnut leaves
In a place without grief
Though the oriole
Out of another life warns me
That I am awake
In the dark while the rain fell
The gold chanterelles pushed through a sleep that was not mine
Waking me
So that I came up the mountain to find them
Where they appear it seems I have been before
I recognize their haunts as though remembering
Another life
Where else am I walking even now
Looking for me

W. S. Merwin, "Looking for Mushrooms at Sunrise" from *Migration: New & Selected Poems*. Copyright ©1956, 1960, 1963, 1967, 2005 by W. S. Merwin. All reprinted with the permission of The Permissions Company, LLC on behalf of Copper Canyon Press, coppercanyonpress.org.