Lethal Decline of Phoenix Palms in Texas Associated with Mycoplasmalike Organisms

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ABSTRACT

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A rapid lethal decline of *Phoenix canariensis* and *P. dactylifera* palms was recently observed in the lower Rio Grande Valley, Texas. Symptoms were identical to those of declines associated with lethal yellowing of Phoenix palms in Florida. Electron microscopic examination of tissue samples from dying palms in Texas showed mycoplasmalike organisms within phloem sieve elements. We conclude that the geographical range of lethal yellowing has extended from Florida and the Caribbean to Texas.

A disease of unknown etiology affecting Canary Island date palms (*Phoenix canariensis*) (Figs. 1–3) and true date palms (*P. dactylifera*) was observed in mid-1978 in Brownsville, TX. These palms are widely planted in southern Texas for their aesthetic appeal in urban areas and along roadsides and in hedgerows in rural areas. When first observed, several plantings of these palms were severely affected, with approximately 50% of the palms dead. In the ensuing 18 mo, the disease spread rapidly, moving inland about 70 km. The disease kills palms in about 4 mo and affects all mature susceptible trees in a planting.

The pattern is the jump-spread typical of diseases carried by an airborne vector. Disease foci are discrete but diffuse; the disease does not necessarily spread from tree to adjacent tree and may skip several trees before affecting another in a focus. Given time, all mature palms in a focus are eliminated. The disease may affect immature palms, but many of these remain alive after all the tall mature palms in a focus are dead.

SYMPTOMATOLOGY

The earliest detectable symptoms of the disease are necrosis of the central whorl of young leaves in the crown and death of adventitious roots at the base of the trunk. Necrosis of developing inflorescences within the spathe may also occur. Off-coloration consisting of a lighter, duller shade of green becomes noticeable in the foliage, and leaves begin to turn brown and desiccate, beginning with the oldest at the base of the crown and advancing upward.

During the early stages of foliar discoloration, burrowing maggots follow a putrid soft rot down the youngest leaves and into the meristematic area. Once the apical meristem is dead, growth ceases and the palm dies. Eventually the crown topples from the palm. This entire process takes about 4 mo from initial symptom expression.

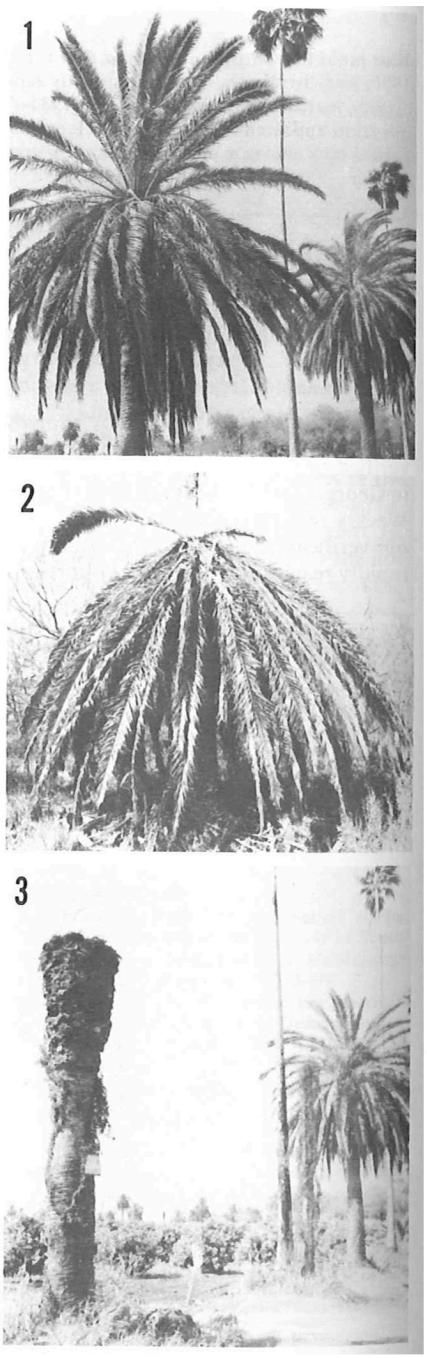
In the earliest detectable stage, the disease is impossible to diagnose visually from the ground. From a lift truck, the death of the central whorl of young fronds can be detected from above. Cutting into the base of the trunk at this stage will show necrotic adventitious roots.

ETIOLOGY

Bacteria or fungi have not consistently been isolated from the dying palms. Several Fusaria that were isolated from diseased tissue did not infect field-grown date palms in pathogenicity tests, and *Phytophthora* was not isolated. The crownshaft region of dying palms was examined for boring insects such as weevils or rhinoceros beetles, but no galleries or boreholes were found in the tender heart tissue.

The symptoms differ distinctly from those observed in the Fusarium or Gliocladium wilts of Phoenix palms in California (3). The symptoms are, however, remarkably similar to another date palm disease of unknown cause, rapid decline, which has occurred sporadically in California date groves (1). The difference between these two diseases is not in symptomatology but in rate and pattern of spread. The disease in Texas spreads rapidly and kills all palms in an affected planting within a few years. In contrast, rapid decline has been documented in no more than several hundred trees over the last 50 years (1).

Other palm diseases of similar symptomatology and pattern of spread are sudden wilt and hartrot, which affect African oil



Figs. 1–3. *Phoenix canariensis* with lethal decline in Texas. Note unaffected tall Washingtonia palms interplanted between Phoenix palms. **(1)** Foreground palm with early symptoms not detectable from ground level. **(2)** Late stage of decline with total foliar collapse. **(3)** After death of affected palm, the crown falls, leaving a bare trunk.

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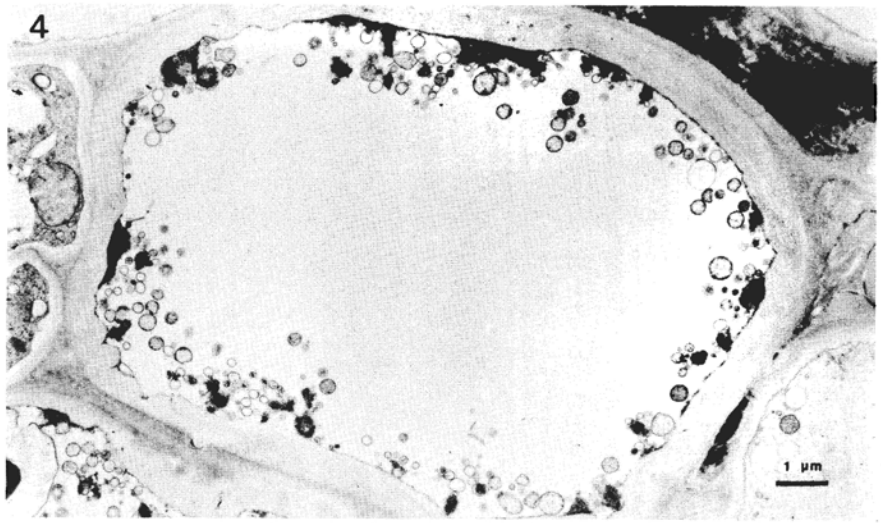
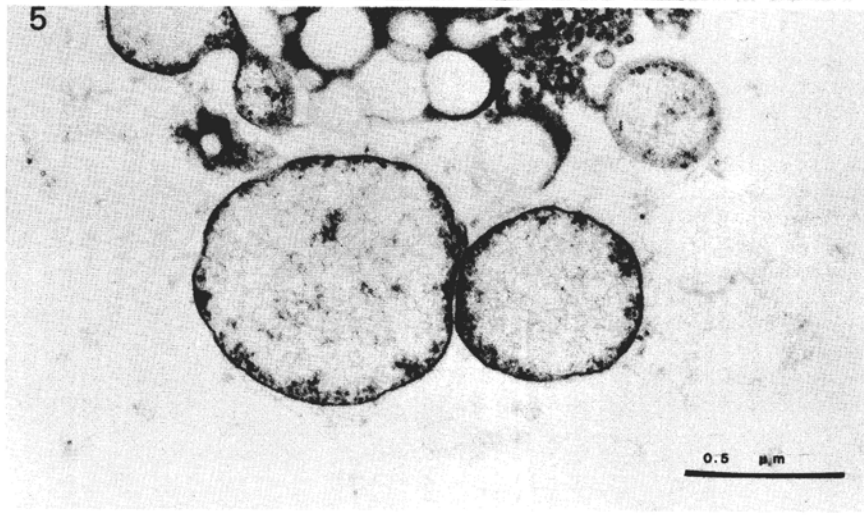
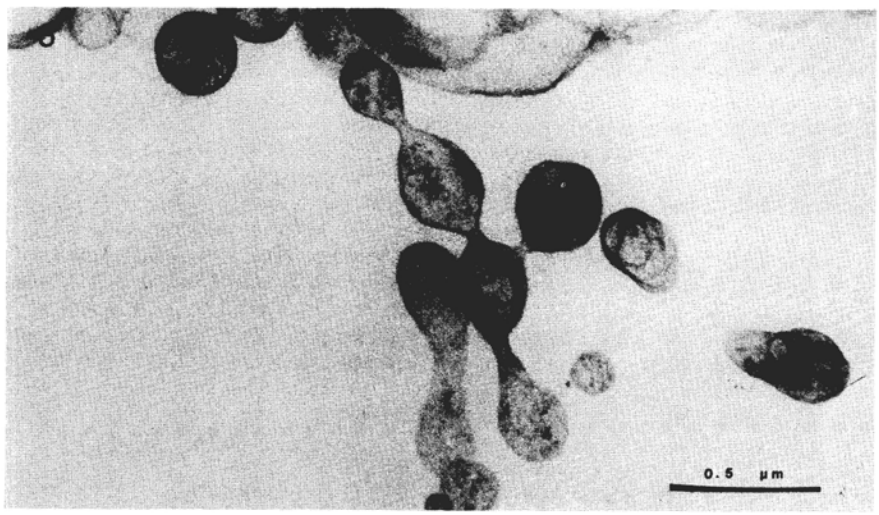
palm (*Elaeis guineensis*) and coconut palm (*Cocos nucifera*) in South America (2,7,9). Hartrot and sudden wilt are associated with uniflagellated protozoa of the genus *Phytomonas*. Juice expressed from heart tissues of the Texas palms and examined by phase contrast light microscopy was free of protozoa.

The Texas disease is identical symptomatically to the declines associated with lethal yellowing in Phoenix palms in Florida (6). The rate and pattern of spread are also similar to those of lethal yellowing in Florida and Jamaica (5).

Samples from four diseased *P. canariensis* from three sites in the lower Rio Grande Valley were collected from heart tissues and processed for electron microscopy as previously described (8). Mycoplasmalike organisms (MLO) of typical polymorphic morphology were seen in sieve elements of affected palms (Figs. 4–6). Ultrathin sections delineated the single unit membrane and fibrillar nucleic acid content of the MLO (Fig. 5). Examination of 0.3-μm sections indicated that the MLO tended to be filamentous (Fig. 6). No helical forms were seen.







Figs. 4–6. Sections of sieve elements of *Phoenix canariensis* with lethal decline. Ultrathin sections show **(4)** numerous peripherally located mycoplasmalike organisms (scale bar = 1 μm) and **(5)** peripherally located ribosomes, a fibrillar nucleic acid network, and a limiting membrane in one mycoplasmalike organism (scale bar = 0.5 μm). **(6)** Semithick (0.3 μm) section shows multilobed filamentous nature of the mycoplasmalike organisms and no helical forms (scale bar = 0.5 μm).

DISCUSSION

The symptomatology, pattern of spread, and presence of MLO suggest that the Phoenix disease in Texas and the declines associated with lethal yellowing of palms in Florida are coidentical. In Florida, MLO have been found in more than 20 species of palms including *P. canariensis* and *P. dactylifera*, in addition to coconut palm (8). Although all available evidence suggests that the same pathogen causes lethal yellowing of coconut palm and decline of other palms (8), these diseases have been termed lethal declines until reciprocal transmission or cultural evidence confirms coidentity.

Lethal decline has never been diagnosed in Washingtonia palms (*Washingtonia robusta*, *W. filifera*), Queen palm (*Arecastrum romanzoffianum*), or sabal palm (*Sabal palmetto*) (4). These latter palms, including *S. texana*, were not seen to be affected in Texas. Where Phoenix palms are interplanted with Washingtonia palms, the Phoenix are selectively eliminated and the tall Washingtonia palms were not affected (Figs. 1 and 3).

The fact that the lethal decline of Texas palms has a suscept list similar to that for lethal yellowing is further evidence that the two diseases are synonymous. The occurrence of lethal decline in Texas is a further demonstration of its potential for spread and the danger it poses to the production of palm crops. The immediate implication is that the destruction of susceptible palm species in the lower Rio Grande Valley is expected.

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