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# ANTHRACNOSE OF PITAHAYA: A NEW DISEASE ON A NEW CROP IN SOUTH FLORIDA

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*Abstract*. **Vine-like, climbing cacti in the genera *Hylocereus* and *Selenicereus* produce fruit known variously as pitaya, pitahaya, dragonfruit or strawberry pear. *Hylocereus undatus*, a native of Mexico that produces red fruit, has recently become a commercial crop in South Florida. In December, 2004, a new disease was observed in a commercial planting in Miami-Dade County. Reddish-brown lesions with conspicuous chlorotic haloes developed on the ribs of vines, in particular where spines emerged from the rib edge. Eventually, lesions had white centers and coalesced to rot much of the vine column; in severe cases only the vascular column in the vine center remained unaffected. Salmon-colored spores and acervuli were observed in lesion centers. Disease samples were collected and tissue from lesion margins were surface disinfested and plated on one-half strength, acidified potato dextrose agar. The fungus *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc was isolated from all symptomatic plant tissues. Isolates produced abundant conidia in culture that were hyaline, straight, cylindrical, and averaged 14.7 µm (range 12.5 to 17.5 µm) by 5.0 µm (range 3.8 to 7.5 µm). Two isolates were shown, in repeated experiments, to cause the described disease, and Koch's postulates were completed with the re-isolation of isolates that were used to inoculate plants. To our knowledge this disease had not been reported previously on this crop.**

*Hylocereus undatus*, the red pitahaya, is the most popular and widely cultivated vine cactus worldwide. Vietnam is currently the largest commercial producer, and Mexico, where the crop is native, is developing an intensive industry (Nerd and Mizrahi, 2002). Pitahaya has recently become a commercial crop in south Florida, where present acreage is estimated around 50 acres (17 hectares).

In December 2004, a new disease was observed in a commercial planting in Miami-Dade County. Reddish-brown lesions with conspicuous chlorotic haloes developed on the ribs of vines, in particular where spines emerged from the rib edge. Eventually, lesions had white centers and coalesced to rot much of the vine column; in severe cases only the vascular column in the vine center remained unaffected.

As a new crop very little information exists on diseases of pitahaya, especially those that occur in Florida (Crane and Balerdi, 2005). The objectives for the present study were to: 1) identify the cause of the new disease, and 2) determine whether the age of branch segments affected disease development.

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## Materials and Methods

Symptomatic tissues were collected and sealed in plastic bags and stored on ice prior to examination at the Tropical Research and Education Center (TREC), Homestead, Fla. After storage for less than 24 h at 4°C samples were washed in tap water and then cut into 5-mm$^2$ sections from the margin of the lesion. Plant tissues were surface sterilized for 20 s in 70% ethanol followed by 60 s in 0.525% sodium hypochlorite (NaOCl). Surface sterilized tissues were plated on potato dextrose agar acidified with lactic acid (APDA) to a pH of 4.0. The plates were incubated in the dark at 25°C for 3-10 d. Fungal colonies emerging from tissues were identified to species based on reproductive morphology and single spore transfers were performed for all isolates.

The fungus *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc was isolated from all symptomatic plant tissues. Fungal colonies produced abundant masses of orange or salmon-colored conidia in cultures on potato dextrose agar (PDA). Conidia were hyaline, straight, cylindrical, and averaged 14.7 µm (range 12.5 to 17.5 µm) by 5.0 µm (range 3.8 to 7.5 µm). On the host, abundant acervuli were sub-epidermal, typically with setae, and simple, short, erect conidiophores. Appressoria were produced on glass cover slips in deionized water and varied from nonlobed to slightly lobed (Kuo and Hoch, 1996).

Koch's postulates were examined in greenhouse trials at the Tropical Research and Education Center. Treatments consisted of a non-inoculated control, four *C. gloeosporioides* isolates, and an *Alternaria* sp. (Table 1). All isolates came from symptomatic pitahaya tissue collected in Miami-Dade County. Fungi were grown on potato dextrose agar (PDA) for 7 d at 27°C. A sterile dissecting needle was used to gently pinprick the stem tissue and 2-mm-diameter plugs of either PDA cultures (treatment fungi) or PDA (noninoculated control) were placed over wounds. Plants were placed in a plastic tent in a greenhouse where temperature was held at 25°C, and free moisture was maintained on plant surfaces with a household humidifier for a week following inoculation. A completely random experimental design was utilized with five single plant replications per treatment. Pitahaya "vines" are actually sympodial branches (see Fig. 1). To determine whether the age of sympodial branch segments had an effect on disease development, each segment on a given plant was inoculated equidistant between nodes; a first level of sampling was segment age and the second level was branch repetition. Fitter's root hierarchy (Fitter, 1982) was used to assign relative segment age (Fig. 1).

Table 1. Treatments for the Koch's postulates experiment.

| Treatment | Species | Isolate |
|---|---|---|
| 1 | Non-treated control | |
| 2 | *C. gloeosporioides* | April (2-2-1) |
| 3 | *C. gloeosporioides* | April (2-1-3) |
| 4 | *C. gloeosporioides* | December (011004-9) |
| 5 | *C. gloeosporioides* | December (011004-10) |
| 6 | *Alternaria* sp. | April (1-3-1) |

Table 2. Least squares means of Box Cox transformed (λ = 0.5) treatment responses and results from Dunnett's test comparing responses to the non-treated control.

| | | Treatment | | Dunnett's Test | | |
|---|---|---|---|---|---|---|
| Response | Trt | Estimate | StdErr | Estimate | StdErr | Probt |
| Lesion | 1 | 1.39 | 0.412 | | | |
| Lesion | 2 | 1.38 | 0.370 | -0.01 | 0.554 | 0.650 |
| Lesion | 3 | 1.97 | 0.370 | 0.57 | 0.554 | 0.167 |
| Lesion | 4 | 2.95 | 0.370 | 1.56 | 0.554 | 0.003 |
| Lesion | 5 | 2.29 | 0.348 | 0.89 | 0.540 | 0.054 |
| Lesion | 6 | 1.63 | 0.370 | 0.23 | 0.554 | 0.267 |

## Results and Discussion

Anthracnose symptoms, including reddish-brown and concentric lesions appeared 10 to 14 d after inoculation with isolates 011004-9 and 011004-10 (Table 1). Lesion length, width, and area were recorded (Table 2). Lesions produced by isolates 011004-9 and 011004-10 were significantly greater (λ = 0.5) than those produced by the other isolates or mock inoculation (Table 2). These virulent isolates produced typical anthracnose lesions and the age of branch segments was not a significant factor in disease development. Koch's postulates were completed with the re-isolation of the isolates that were used to inoculate plants.

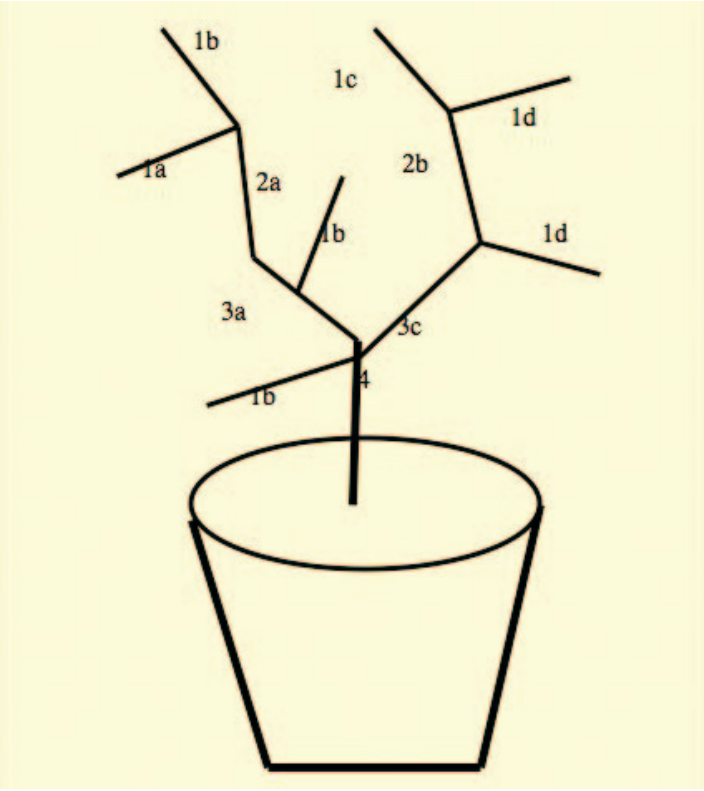


Fig. 1. Fitters root diagram.

This is apparently the first report of anthracnose on pitahaya. Work is needed to determine the environmental conditions that affect infection and subsequent disease development. Temperature will be examined, since there appears to be a seasonal effect on the fungi that are recovered from affected plants in South Florida. Since pitahaya is grown locally under full sun (as a natural epiphyte, the plant may be better adapted to shade), we will also examine the effect of light intensity on disease development.

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