Phytophthora Blight of Pothos[1]

Robert M. Leahy[2]

INTRODUCTION: *Epipremnum pinnatum* (L.) Engl., a member of the Araceae family and native to Asia, has been a staple item in the ornamental foliage industry for nearly 50 years. *E. pinnatum*, commonly known as goldenpothos, is cultivated as hanging baskets, grown on totems or in landscapes as a tree trunk cover (Everett 1981). The vertical climbing habit of pothos encourages the production of much larger foliage than the downward growth habit of popular hanging basket specimens. This is especially evident in tropical South Florida landscapes.

The popularity of *E. pinnatum* has increased steadily over the years. This demand, as well as increased labor costs in the United States, has led to a booming offshore industry specializing in the propagation and production of pothos eyecuttings destined to a great extent for the U.S. market. Guatemala and Costa Rica are the largest producers of these cuttings. In these countries, pothos stock is generally cultivated in ground beds. Some operations are developing raised stock beds which can help reduce disease incidence.

PATHOGEN(S): *E. pinnatum* is a relatively easy plant to grow, and has few disease problems. Of the diseases impacting pothos production, Phytophthora blight is one of the most destructive. Historically, *Phytophthora nicotianae* Breda de Haan has been the species most commonly associated with blighted pothos and root rot (Fig.1). This held true until the mid-1990s when, as imported eye-cuttings became more abundant in the Florida foliage industry, the emergence of a Phytophthora species identified as *Phythophora capsici* Leonian was isolated routinely from rotted, imported pothos cuttings (Erwin and Ribeiro 1996). From 1999-2001, plant pathologists from the University of Massachusetts reported that *P. capsici* was infecting offshore pothos cuttings (Wick and Dicklow 2002).

Fig. 1. Characteristic globose, non-deciduous (persistant) sporongia.

In early 2001, the accuracy of the Florida identifications were questioned after learning of the existence of a *P. capsici*-like species isolated from rotted cyclamens in the Netherlands, which was also capable of infecting *Epipremnum aureum* (Gerlach and Schubert 2001). This fungus was referred to as *Phytophthora tropicalis* (Aragaki and. Uchida 2001). *P. tropicalis* had been formally described in 2000 (Aragaki and Uchida 2001). Florida isolates of the *P. capsici*-like species recovered from both imported and domestic pothos cuttings were sent to Dr. Janice Y. Uchida, University of Hawaii, where their identity as *P. tropicalis* was confirmed. Both *P. capsici* and *P. tropicalis* produce deciduous sporangia with long pedicels. The sporangial length to diameter ratio of *P. capsici* is less than 1.8. This ratio for *P. tropicalis* is more than

[1] Contribution No. 736, Bureau of Entomology, Nematology, Plant Pathology - Plant Pathology Section.
[2] Biological Scientist IV, FDACS, Division of Plant Industry, P. O. Box 147100, Gainesville, FL 32614-7100.

1.8. Sporangial bases of *P. tropicalis* are tapered compared to more rounded sporangial bases produced by *P. capsici* (Figs. 2 A-B). *P. capsici* grows well in-vitro at 35EC, and is pathogenic on *Capsicum*. *P. tropicalis* grows poorly at 35EC and is either non-virulent or weakly pathogenic on *Capsicum.* Unlike *P. tropicalis*, *P. capsici* does not produce chlamydospores (Aragaki and Uchida 2001).

In August 2002, symptomatic pothos foliage was collected from several locations in Guatemala and Costa Rica. *P. tropicalis* was isolated exclusively from Costa Rican samples and *P. nicotianae* was isolated exclusively from the Guatemalan pothos. However, mixed populations of these species are likely to exist on pothos in both countries.

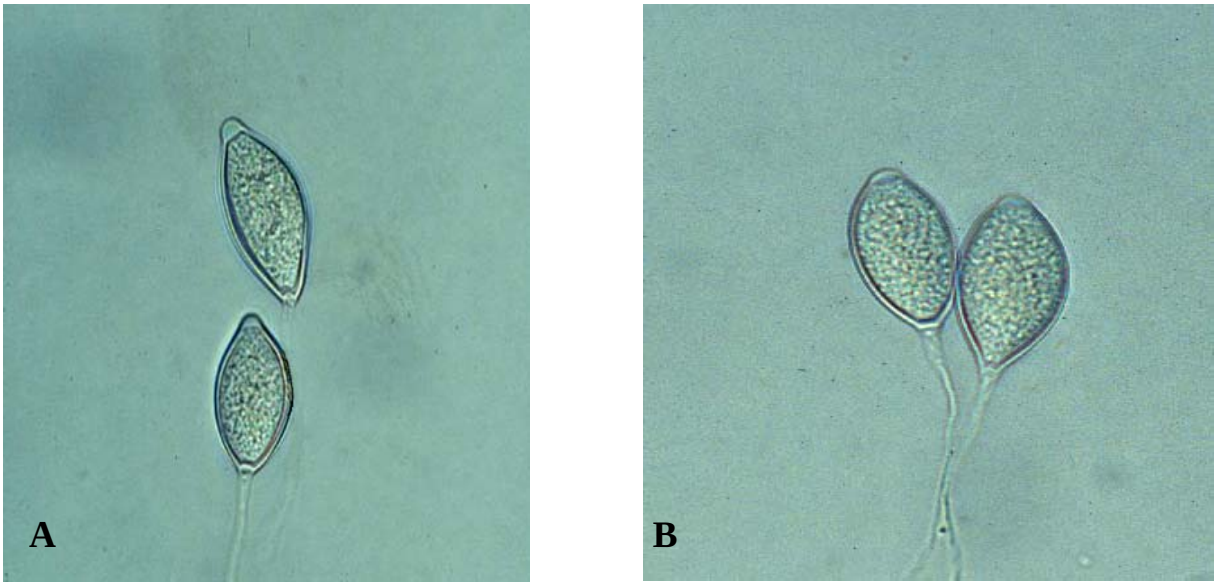

Fig. 2. Sporangia of A) *Phytophthora tropicalis* are more narrow and elongated than B) *P. capsici*. Typical deciduous *Phytophthora capsici* sporangia with long pedicels.

Fig. 3. Petiole and basal leaf necrosis caused by *Phytophthora tropicalis* (Photography credit: Robert Leahy).

SYMPTOMS: Phytophthora blight of leaf eye-cuttings is manifested by the development of dark brown petiole and basal leaf necrosis (Fig. 3). Disease development is rapid and leaf blight symptoms are followed quickly by stem necrosis (Fig. 4). Variations of these classic symptoms are likely to be observed among a population of pothos cuttings. Rooted cuttings and containerized pothos usually develop root rot as well as foliar blight symptoms as the disease progresses. Phytophthora blight can be easily confused with *Rhizoctonia* spp. blight and *Erwinia* spp. soft rot. The rotted appearance of pothos foliage infected with *Phytophthora* and *Rhizoctonia* is similar. However, close examination of symptomic leaves infected with *Rhizoctonia* usually reveals an expanding weft of mycelium associated with the advancing foliar necrosis.

Fig. 4. Progressive Phytophthora blight killing stem and entire leaves. (Photogtraphy credit: Robert Leahy)

Phytophthora-infected pothos will have no weft.

Erwinia spp. bacterial soft rot causes the blighted pothos foliage to separate easily when handled. The production of pectolytic enzymes produced by the bacterium digests key components of the middle lamella which serves as the "glue" that holds plant cells together. Leaf tissue rotted by *Erwinia* spp. also produces a pungent, fishy odor. Pothos foliage infected by *Phytophthora* spp. retains its integrity and does not smell fishy, unless Erwinia is acting as a secondary pathogen or saprophyte on severely rotted cuttings.

CONTROL: Disease control of soil borne pathogens in ground bed production areas is difficult to achieve for a number of reasons. A reservoir of fungal inoculum exists in contaminated soil and infected plant tissue which can be moved throughout the production area on clothing, tools and skin. Susceptible pothos foliage can be easily infected by inoculum of *Phytophthora* spp. transported in splashing water droplets during irrigation or rain storms. Discarded pothos left in cull piles near production areas serve as another source of infective inoculum.

Strict sanitation in pothos production areas is the best cultural method for controlling Phytophthora blight. Nurseries growing pothos for the production of eye-cuttings should start with clean soil and disease-free cuttings to ensure the establishment and maintenance of healthy stock beds. Cuttings selected for establishment in ground beds should be graded for health and sprayed or drenched with an appropriate fungicide when they are stuck. Once cuttings are established, they may also be treated with fungicides (Simone 2003).

Nurseries producing containerized pothos and hanging baskets should adhere to the same sanitation and cultural controls suggested for cutting producers. Starting a production cycle with clean cuttings and soil is the best way to avoid disease and will likely reduce the amount of fungicide necessary during the growing season. Pothos produced in containers or pots should be grown on raised benches to minimize the risk of infection associated with splashing water and contaminated soil. Hanging baskets should be arranged in such a way as to avoid suspending rows of baskets directly over other baskets or over benches. If Phytophthora inoculum exists in hanging baskets, containers directly below may become infected from fungal propagules in the leachate of overhead pots. Routine scouting of the pothos crop for disease symptoms and prompt removal of suspect plant material will curtail the outbreak and rapid spread of Phytophthora blight. Hand-washing stations and disinfectant boot dips should be provided at the entry and exit doors of production houses to help contain the disease and reduce the chance of spreading inoculum to other areas. Any tools used in production houses should also be dipped and cleaned prior to use in other locations. A number of products are available commercially which will decontaminate skin, clothing, tools and other inanimate objects that may harbor infective inoculum. If Phytophthora blight is identified in a production house, postpone removal of diseased pothos until the end of the day to further reduce the possibility of contaminating other houses.

Along with implementing cultural controls, it is important to enlist the use of effective, registered fungicides to provide preventative control of Phytophthora blight during the pothos production cycle. Those fungicides, previously listed, should be applied as directed by the product label to maximize their efficacy (Simone 2003).

SURVEY AND DETECTION: Pothos cuttings infected with Phytophthora blight exhibit extensive, dark brown tissue necrosis usually starting with the petiole, extending into the leaf base and spreading rapidly towards the leaf tip. Other foliar manifestations of this disease include dark brown, variously shaped, leaf spots and stem necrosis. Containerized pothos may exhibit these symptoms as well as root rot, which is evidenced by dark, mushy, sloughing roots.

LITERATURE CITED

Aragaki, M. and J.Y. Uchida. 2001. Morphological distinctions between *Phytophthora capsici* and *P. tropicalis* sp. nov. Mycologia 93(1): 137-145.

Bledsoe, S.D., P.F. Harmon, and R.J. McGovern. 2006. Professional disease management guide for ornamental plants. http://edis.ifas.ufl.edu/PP123.

Erwin, D.C. and O.K. Ribeiro. 1996. *Phytophthora capsici.* pp. 262-268 *In* D. C. Erwin and O.K. Ribeiro (eds.). Phytophthora diseases worldwide. American Phytopathological Society Press. St. Paul, Minnesota.

Everett, T.H. 1981. The New York botanical garden illustrated encyclopedia of horticulture. Garland Publishing, Inc., New York and London. Volume 4: 1222-1223.

Gerlach, W.W.P. and R. Schubert. 2001. A new wilt of cyclamen caused by *Phytophthora tropicalis* in Germany and the Netherlands. Plant Disease 85: 334.

Wick, R.L. and M.B. Dicklow. 2002. *Epipremnum,* a new host for *Phytophthora capsici*. Plant Disease 86: 1050.