HORTSCIENCE 38(1):75–76. 2003.

Screening for Resistance to Myrothecium Leaf Spot Among *Syngonium* Species and Cultivars

D.J. Norman[1], R.J. Henny[2], J.M.F. Yuen[1], and T.A. Mellich[2]

University of Florida, Institute of Food and Agricultural Sciences, Mid-Florida Research and Education Center, 2725 Binion Road, Apopka, FL 32703-8504

Additional index words. Araceae, arrowhead vine, foliage plant, fungus, disease resistance, nephthytis, plant breeding

Abstract. **Commercially grown cultivars of *Syngonium* (Araceae) are very susceptible to Myrothecium leaf spot (incited by *Myrothecium roridum* Tode ex Fr.). Therefore, cultivation of *Syngonium* requires rigorous sanitation and frequent applications of fungicides for disease control. The goal of this research was to identify species and noncultivated accessions of *Syngonium* resistant to Myrothecium leaf spot. Five commercial cultivars and 30 accessions, comprising 16 different *Syngonium* species, were screened for resistance to *M. roridum*. All five commercial cultivars were susceptible to *M. roridum*. However, seven species (*S. neglectum, S. wendlandii, S. dodsonianum, S. erythrophyllum, S. chiapense, S. dodsonianum,* and *S. angustatum*) showed the highest resistance, as did two noncultivated accessions of *S. podophyllum.* The information on disease resistance for these species and accessions will be useful in future breeding work.**

The genetic diversity of commercially-grown cultivars of *Syngonium* is very narrow, with most cultivars originating from a single clone of *Syngonium podophyllum* Schott. ('White Butterfly'). While many phenotypic differences (e.g., foliage color, plant size, growth rate, growth habit) exist between cultivars and have been characterized (Henley and Robinson, 1993), no information exists on potential genetic sources for disease resistance.

All ornamental Araceae taxa grown as tropical foliage plants are susceptible to Myrothecium leaf spot, especially *Dieffenbachia, Spathiphyllum,* and *Syngonium* (Alfieri et al., 1994). Of all the ornamental tropical foliage plants, *Syngonium* is considered to be one of the most susceptible taxa to Myrothecium leaf spot (Chase, 1987).

The causal agent of leaf spot, *M. roridum*, is an opportunistic fungal pathogen usually infecting tissue-cultured plantlets or young plants during propagation and establishment. Plants are especially susceptible if damaged by mishandling, improper fertilization, or pesticide applications. *Myrothecium roridum* infections may also occur at petiole junctions, causing lateral petiole and shoot death. When leaves become infected, circular lesions develop on leaves and dark black spores (sporodochia) form in concentric rings on infected tissue. Thousands of spores are contained within each sporodochium. These spore structures readily dissolve in water and spores are spread by splashing irrigation, worker activity, and air movement. Spread of this pathogen in a nursery can be very rapid, often resulting in extensive losses. In some instances, disposal of entire crops of young plants may be required.

There is no published information on the presence of genetic resistance to Myrothecium leaf spot in *Syngonium* cultivars or species. Such information could greatly aid in improving this important ornamental foliage plant genus. Therefore the following study was conducted to screen *Syngonium* species and cultivars for resistance to *M. roridum*.

Materials and Methods

Five commercially grown *Syngonium* cultivars were selected for this study as well as 30 other accessions that included 16 species (Table 1). Stock plants were grown in a shaded greenhouse with a maximum irradiance of 125 μmol·m^{-2}·s^{-1} under natural photoperiod and a temperature range of 15 to 34 °C. Plants were grown 1.6-L plastic pots containing a substrate of Vergro Container Mix A (Verlite Co., Tampa, Fla.) amended with Osmocote 17N–2.6P–10K plus minors (The Scotts Co., Marysville, Ohio) at a rate of 700 kg/100 m^2 per year N. Plants were rooted under intermittent mist in 0.5-L pots in the same medium. Cuttings were rooted within 4 weeks, after which they were grown under the same environmental and nutritional conditions described previously for stock plants.

Experiments were conducted on 3-month-old plants using a randomized complete-block design (10 blocks) with one replicate of each cultivar or accession per block. An eleventh block containing noninoculated control plants of each cultivar and accession was isolated at one end of the bench to minimize the possibility of disease spread from inoculated plants. The experiment was conducted three times from July through Sept. 1999 using *M. roridum* isolate 96-27. Two more *Myrothecium* isolates (98-125, 00-7) were tested on selected *Syngonium* accessions (Table 1). This was done to confirm that resistance observed in the first three tests with isolate 96-27 were related to horizontal resistance in the cultivars and species of *Syngonium* tested rather than a reaction to a specific race or isolate of *M. roridum*. The three isolates (96-27, 98-125, and 00-7) were collected from *Syngonium* plants at different geographically located farms in Florida and were obtained in 1996, 1998, and 2000, respectively.

For inoculum production, *M. roridum* isolates were grown on potato dextrose agar medium (PDA) at 25 ± 1 °C under cool-white fluorescent lights (9.4 μmol·m^{-2}·s^{-1}) on a 12-h day/night cycle. Fungal cultures were incubated for 2 to 3 weeks and spores were harvested from PDA plates by flooding the plates with sterile distilled water (SDW) and scraping with a rubber spatula. Before inoculations, spore concentrations were adjusted in SDW with the aid of a hemacytometer to 1 × 10^6 conidia/mL. For inoculations, the two newest expanded leaves of each plant were wounded using a wood slat imbedded with three insect pins 2 cm apart, making a total of six wounds per plant. Spore suspensions were applied to leaves surfaces until runoff using a hand sprayer. High relative humidity ≈100% (conducive to infection) was provided by placing plants inside clear polyethylene bags for 24 h. Noninoculated control plants were wounded, sprayed with SDW, and also placed in plastic bags for 24 h. Re-isolations from representative symptomatic plants in each experiment were made to verify presence of the causal disease agent.

After 7 d of incubation, a slight water-soaking was observed surrounding wounds on leaves of susceptible plants. During the next 7 d, these water-soaked lesions increased to a diameter of ≈15 mm. By day 18, infected lesions had begun to dry and sporodochia were forming. Resistance was documented on the 18th day, by counting the total number of wounds on each plant exhibiting symptoms of *M. roridum* infection. Data were log transformed (1 + log$_{10}$), analyzed using analysis of variance (ANOVA), and means were separated by Tukey's least significant difference (LSD). In addition the following rating scale was used to help categorize levels of resistance: 0 to <2 for resistant, 2 to 3 for moderately resistant, and >3 susceptible. Each inoculation point (wound) was rated separately.

Results and Discussion

Among the 35 accessions that were tested with isolate 96-27, 10 averaged <2 infected spots and were categorized as resistant. Of these 10, three accessions were highly resistant and developed <1 infected spot per plant (Table 1). The three accessions with the lowest disease rating scores were *S. neglectum, S. wendlandii,* and *S. dodsonianum,* while *S. erythrophyllum, S. chiapense, S. angustatum,* and *S. macrophyllum* as well as two accessions of *S. podophyllum* were moderately resistant.

Received for publication 23 July 2001. Accepted for publication 10 June 2002. Florida Agricultural Experiment Station Journal Series No. R-08612.

[1]Dept. of Plant Pathology.

[2]Dept. of Environmental Horticulture.

Table 1. Resistance levels of 35 cultivars and accessions of *Syngonium* to Myrothecium leaf spot.

Cultivar	Source[y]	Country of origin	Disease rating for isolate[z] 96–27	98–125	00–7
S. macrophyllum Engl. (S36339)	MO	Costa Rica	5.4 q	---	---
S. podophyllum Schott 'Holly M'	AS	Unknown	4.7 p–q	4.5 e	3.4 f
S. podophyllum Schott 'White Butterfly'	AS	Unknown	4.5 o–q	3.6 e	2.7 d–f
S. podophyllum Schott 'Pink Allusion'	AS	Unknown	4.2 n–q	4.0 c	3.0 e–f
S. sp. (unknown) (S71736)	MO	Unknown	4.03 m–q	---	---
S. sp. (unknown) (S71734)	MO	Unknown	3.8 l–q	---	---
S. sp. (unknown)	MO	Unknown	3.7 k–q	---	---
S. sp. (unknown) (S78727)	MO	Costa Rica	3.6 j–q	---	---
S. neglectum Schott (S45243)	MO	Mexico	3.6 i–q	2.8 d	---
S. sp. (unknown) (S69814)	MO	Unknown	3.3 h–p	---	---
S. podophyllum Schott 'Cream Supreme'	AS	Unknown	3.2 h–p	3.7 e	3.2 f
S. yurimaguense Engl.	MS	Peru	2.9 g–p	---	---
S. podophyllum Schott (S49759)	MO	Panama	2.7 g–p	---	---
S. sp. (unknown) (S78727#2)	MO	Costa Rica	2.7 g–o	---	---
S. podophyllum Schott 'Regina Red'	AS	Unknown	2.7 f–o	3.0 e–d	2.6 d–f
S. hastiferum Croat (S79195)	MO	Costa Rica	2.6 e–n	0.9 c	---
S. rayii Croat & Grayum	MS	Unknown	2.6 e–m	2.3 a–c	1.1 a–b
S. armigerum Standley & L.O. Williams	MS	Unknown	2.5 e–m	---	---
S. podophyllum Schott (S53892)	MO	Unknown	2.4 e–m	---	---
S. podophyllum Schott (S18189)	MO	Honduras	2.3 e–m	0.5 a–c	1.7 b–d
S. wendlandii Schott (S59163)	MO	Costa Rica	2.2 d–l	---	---
S. hoffmannii Schott (S69809)	MO	Costa Rica	2.1 d–k	---	---
S. auritum (L.) Schott (S5676)	MO	Puerto Rico	2.0 d–j	0.9 b–c	---
S. sagittatum G.S. Bunting (S48080)	MO	Mexico	2.0 d–j	---	---
S. steyermarkii Croat	MS	Guatemala	2.0 d–i	---	---
S. macrophyllum Engl. (S47867)	MO	Mexico	1.9 d–h	0.1 a	---
S. podophyllum Schott (S60666)	MO	Unknown	1.7 d–h	0.1 a–b	0.9 a–b
S. angustatum Schott (S69812)	MO	Nicaragua	1.6 d–g	---	---
S. dodsonianum Croat	MO	Ecuador	1.2 d–f	---	---
S. chiapense Matuda	MS	Mexico	1.2 d–e	---	---
S. erythrophyllum Birdsey ex Bunting	MS	Unknown	1.1 c–d	---	---
S. podophyllum Schott (S81483)	MO	Ecuador	1.0 b–d	0.9 b–c	1.3 b–c
S. dodsonianum Croat (Orange)	MS	Ecuador	0.2 a–c	0.03 a	---
S. wendlandii Schott	OG	Costa Rica	0.2 a–c	---	---
S. neglectum Schott (S45336)	MO	Mexico	0.03 a–b	---	---
Control (SDW)			0 a	0 a	0 a

[z]Mean (n =10) number of infected wounds per plant (six was the maximum possible number). Numbers in the same column followed by the same letter are not significantly different using Tukey's least significant difference procedure at $P \leq 0.5$.
[y]AS = Agri–Starts, Apopka, Fla.; MO = Missouri Botanical Garden, St. Louis; MS = Marie–Selby Botanical Garden, Sarasota, Fla; OG = Oglesby Plant International, Altha, Fla.

No infected wounds developed on control plants within this study.

An average of 2.7 to 4.7 infected wounds per plant were observed on the five commercial *S. podophyllum* cultivars. Only one *S. podophyllum* cultivar ('Regina Red') was moderately resistant. Among five noncommercial accessions of *S. podophyllum* (S49759, S53892, S18189, S60666, and S81483), the average level of disease resistance ranged from 1.0 to 2.7 infected wounds per plant. One *S. podophyllum* accession (S81483) displayed resistance that was not significantly different from the three most resistant species. S81483 was also significantly more resistant than the most resistant commercial cultivar (*S. podophyllum* 'Regina Red') to all three *M. roridum* isolates tested. These results indicate that there is a high degree of variation in disease response within accessions of a single species. *Syngonium podophyllum* S81483 could be especially valuable in breeding since there is less chance that interspecific crossing barriers will be encountered. In addition, induction of flowering with gibberellic acid has already been documented with this species (Henny et al., 1999).

Results from this study indicate that sufficient genetic diversity exists among *Syngonium* accessions to produce hybrids resistant to *M. roridum*. It is important when testing for resistance to incorporate pathogen isolates from different geographical locations. This pathosystem approach increases the likelihood that genetic variation in pathogen isolates differing in virulence and race are incorporated into the study. If this is not done one may be testing for vertical resistance (oligogenic) to a specific isolate or race of the pathogen. Varieties with vertical resistance are more likely to succumb to epidemics of new virulent races introduced from different geographic sources. Horizontal resistance (polygenic) to multiple races is more stable and long-term allowing for multiple cropping before resistance is overcome. Development of *Syngonium* cultivars resistant to *M. roridum* would be of major benefit to ornamental tropical foliage plant producers, particularly in Florida because it is one of the top ten foliage plants in wholesale dollar value (U.S. Dept. of Agriculture, 2001).

Literature Cited

Alfieri, S.A., K.R. Langdon., J.W. Kimbrough, N.E. El-Gholl, and C. Wehlburg. 1994. Bul. 14. Diseases and disorders of plants in Florida. Div. of Plant Indus., Gainesville, Fla.

Chase, A.R. 1987. Compendium of ornamental diseases. APS Press, St. Paul, Minn.

Henley, R.W., and C.A. Robinson. 1993. Nephthytis cultivars to know and grow. Proc. Fla. State Hort. Soc. 106:343–347.

Henny R.J., D.J. Norman, and M.E. Kane. 1999. Gibberellic acid-induced flowering of *Syngonium podophyllum* Schott 'White Butterfly.' HortScience 34:676–677.

U.S. Dept. of Agriculture. 2001. Foliage, floriculture and cut greens. U.S. Dept. Agr., Stat. Serv., Agr.. Stat. Board., U.S. Govt. Printing Office, Wash., D.C.