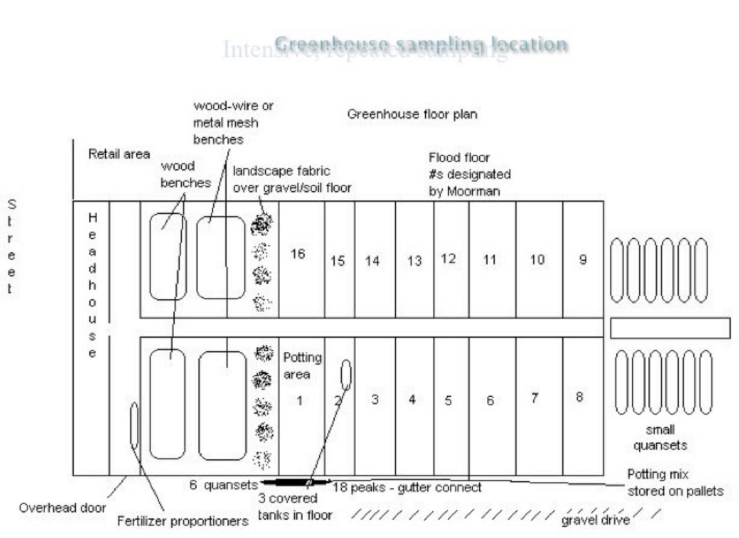
Reducing Root Rot, Bulb Rot and Vascular Wilt Disease Losses By Improvements in Pathogen Tracking and Management

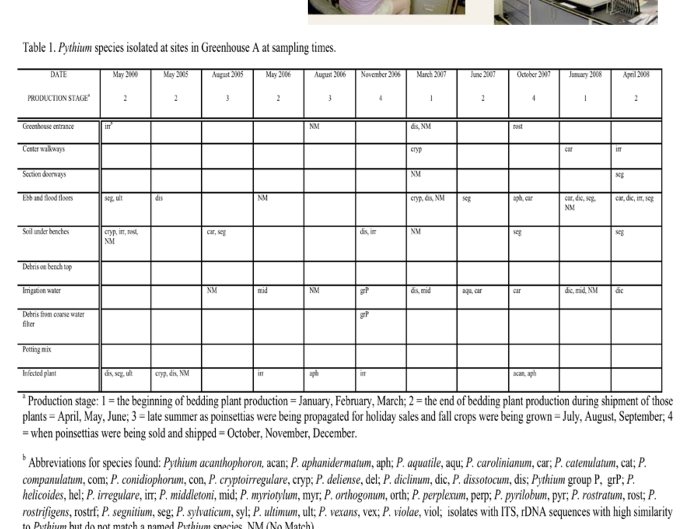
Margery Daughtrey, Cornell University, LIHREC, Riverhead, NY mld9@cornell.edu; Bill Miller, Cornell University, Ithaca, NY wbm8@cornell.edu; Gary Moorman, Pennsylvania State University, State College, PA gmoorman@psu.edu; Steve Jeffers, Clemson University, Clemson, SC sjffrs@clemson.edu; Gary Chastagner, Washington State University, Puyallup, WA chastag@wsu.edu; and Steve Wraight, USDA-ARS, Ithaca, NY spw4@cornell.edu

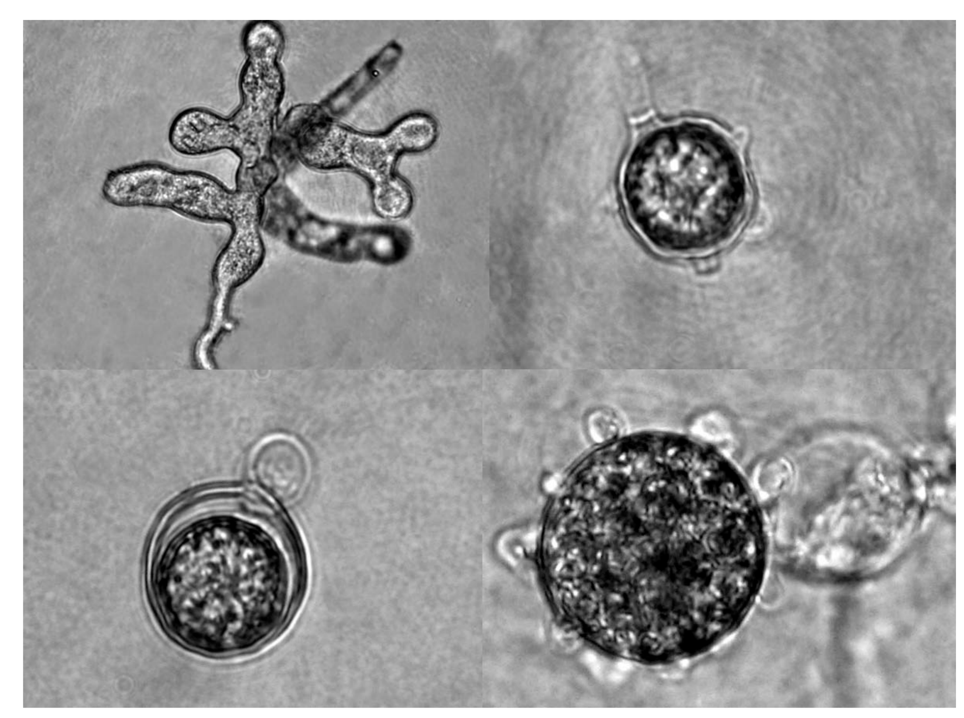
Diseases caused by pathogens of roots, stems and bulbs are rampant in floriculture. Some examples, from left: Phytophthora crown rot caused by *Phytophthora cryptogea* on gerbera, Fusarium basal rot caused by *Fusarium oxysporum* f. sp. *narcissicola* on daffodil, *Pythium irregulare* on New Guinea impatiens, *P. aphanidermatum* on poinsettia (both wilting and root rot images), Thielaviopsis and Rhizoctonia root rot on gaillardia, Phytophthora crown rot on osteospermum, and Pythium root rot on geranium.

Pythium tracking:



Greenhouses have been sampled in PA and NY over time. PA studies by G. Moorman in 3 collaborating greenhouses have shown that *Pythium* species recovery shows no spatial or temporal pattern and is not correlated with disease outbreaks, leading to the tentative conclusion that pathogens causing epidemic losses are most likely introduced with planting material or growing media.





Using morphological and molecular biological techniques, the *Pythium* species found to be most commonly damaging to greenhouse flower crops in the Moorman and Daughtrey labs have been found to be *P. irregulare*, *P. cryptoirregulare, P. aphanidermatum, P. ultimum* and *P. vexans*. Shown clockwise, from upper left are *P. aphanidermatum, P. irregulare* (indistinguishable morphologically from *P. cryptoirregulare*), *P. myriotylum* and *P. ultimum*.

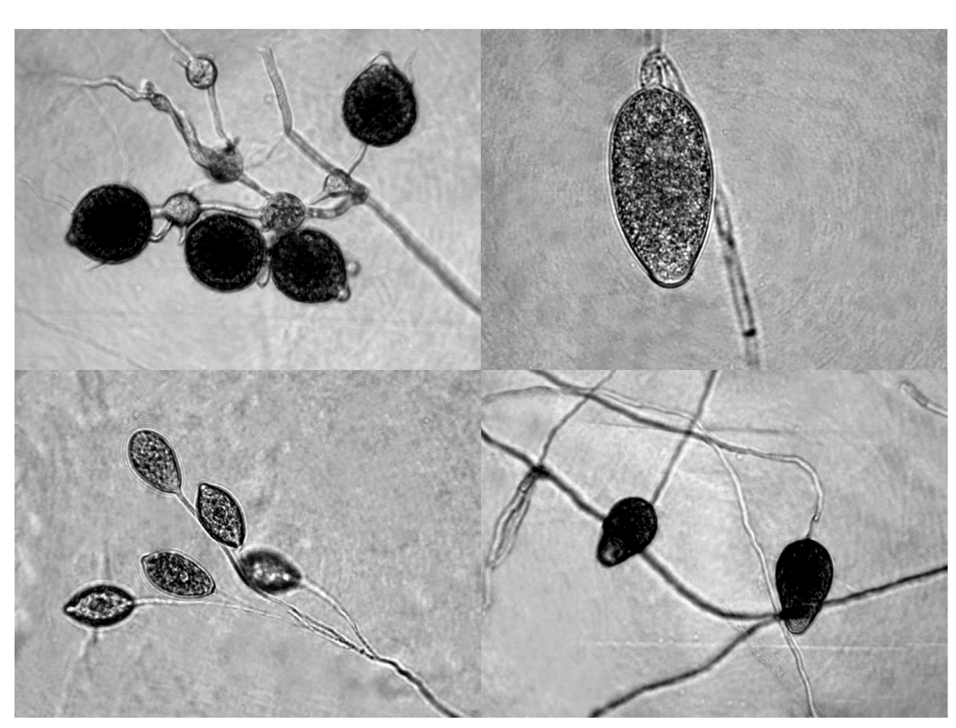
Phytophthora identification:

Table 2. Numbers of herbaceous and selected woody ornamental plant genera associated with species of *Phytophthora* based on research conducted at Clemson University using primarily samples submitted to the Clemson University Plant Problem Clinic over 14 years (1995-2008)

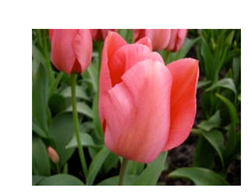
Phytophthora sp.	Associations	New associations[a]
P. nicotianae	50	29
P. palmivora	13	8
P. cinnamomi	12	12
P. drechsleri	8	7
P. cryptogea	8	7
P. citrophthora	4	4
P. citricola	2	1
P. tropicalis	1	0
P. capsici	1	1
P. megasperma	1	1
P. sp.-clemson1[b]	3	3
P. sp-clemson2[b]	1	1
Totals: 12	**104**	**74**

[a] Host-pathogen associations not reported previously.
[b] Unknowns—species not yet described.

Research by S. Jeffers at Clemson has established that petunia isolates of *Phytophthora nicotianae* are, surprisingly, host-specialized: they are only able to cause disease on petunia.



Phytophthora species have been identified by morphological and molecular means. Clockwise, from upper left: *Phytophthora nicotianae*, *P. cryptogea*, *P. drechsleri*, and *P. capsici*. *P. nicotianae* is the species most often associated with crop losses in greenhouse flowers and herbaceous perennials in SC and NY (Jeffers and Daughtrey labs).



Understanding Fusarium-related ethylene generation in tulips:

B. Miller at Cornell is studying the physiology of *Fusarium*-induced ethylene generation from different cultivars of tulip. Data (not shown) suggest that sports arising from natural or radiation-induced mutation exhibit similar ethylene induction to that shown by the parent cultivar in the presence of *F. oxysporum* f. sp. *tulipae.*

Table 3. Ethylene Production From Tulips

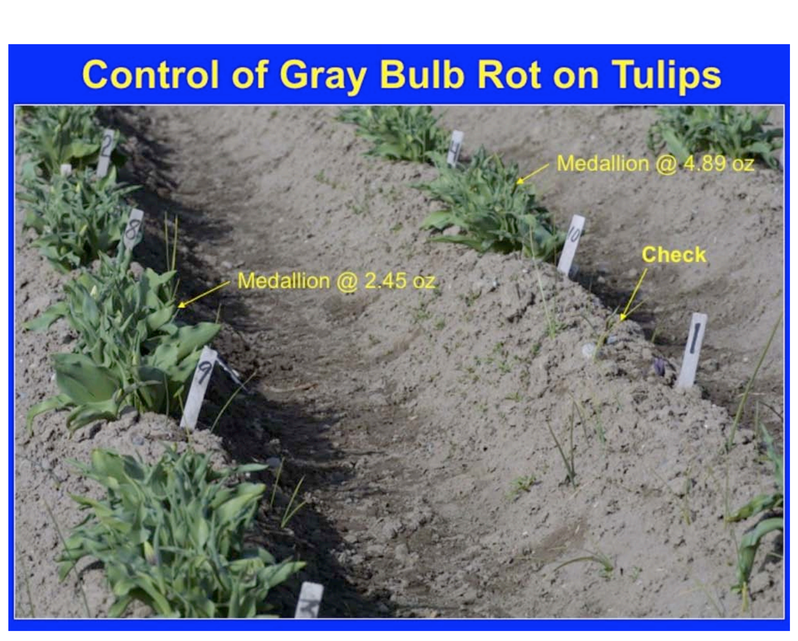
Cultivar		Ethylene (ul g^{-1} FW h^{-1})
T. turkestanica	A	2.73
Friso	B	1.58
Oscar	B C	1.31
Mondial	B C D	1.07
Purple Flag	C D E	0.94
Christmas Dream	C D E	0.91
Yokohama	C D E F	0.88
Passionale	C D E F	0.87
Kikomachi	C D E F G	0.74
Ile de France	D E F G H	0.54
Yellow Flight	D E F G H	0.51
Blue Ribbon	D E F G H	0.49
Calgary	D E F G H	0.48
World's Favorite	D E F G H	0.47
Sprying	E F G H	0.42
Cummins	E F G H	0.39
Flaming Parrot	F G H	0.29
Pink Impression	F G H	0.26
Judith Leyster	G H	0.21
T. tarda	G H	0.18
Negrita	G H	0.15
Parade	H	0.09
Strong Gold	H	0.08
Bright Parrot	H	0.06

Values are averages of two experiments with n=8. Values not followed by the same letter are significantly different (P=0.05) according to Student's multiple comparison test.

Treatments (from left) are 1. non-inoculated control, 2. inoculated control, 3-6 biocontrol formulations, 7. Banrot at 6 oz/100 gal, and 8. Banrot 10 oz/100 gal; note regularity of symptoms in inoculated controls vs. treatments 3-6.

Trials by M. Daughtrey showed the ability of an experimental biofungicide to reduce the effect of Pythium root rot on geranium. The effect was significant, but not uniform among the treated plants.

Root and bulb disease management:



Fungicide treatment is essential for combating bulb rots in the field. Here in one of G. Chastagner's field plots the reduced-risk fungicide Medallion is shown to be very effective against *Rhizoctonia tuliparum*, previously managed with Terraclor (PCNB).

In other studies, chlorine dioxide was shown to be an effective replacement for formaldehyde, to prevent the spread of basal rot in narcissus bulbs during hot water treatment.

Cultivars have shown different susceptibility to root rot pathogens. The pink poinsettia below shows dramatic stunting when inoculated (on left) with *Pythium aphanidermatum.*

(Please note: additional research on vectors of root rot pathogens is reported on the poster presented by J. Sanderson and S. Wraight)