DISEASES OF PERENNIALS

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The following discussion covers the gamut of diseases that might affect herbaceous perennials in gardens or production areas. Powdery mildew will be covered in the greatest depth, because of its relative importance.

Understanding the Powdery Mildew Disease Cycle

Powdery mildew is arguably the most notorious disease problem affecting herbaceous perennials. It is easy to identify, since the fungus forms powdery looking white colonies on the surface of leaves or stems. The powdery mildew is anchored into the epidermal cells of the leaf, where it steals nutrients through special absorptive structures. The powdery look of the mildews comes largely from the presence of many spores, produced by budding (asexual reproduction) at the end of upright conidiophores. Each individual spore is shaped like a transparent barrel. The various powdery mildew fungi are called *Oidium* species when they are producing these asexual spores, and they look alike.

Towards the end of the growing season, however, the powdery mildew fungi are triggered by the cool weather to form a second type of spore, sexually produced, that is packaged within a weather-resistant capsule called a cleistothecium. This year in the Northeast the weather was so unusually cool in early summer that young cleistothecia were seen on phlox in June. Mature cleistothecia look like a dotting of black pepper on the surface of mildew-covered leaves; a closer view with the microscope shows them to be round containers with projections like octopus tentacles. The characteristics of the cleistothecia are used by mycologists to tell one kind of powdery mildew apart from another. Although they may all look alike to the untrained eye, in reality powdery mildews may be very host-specific, and are quite often limited to the members of one plant family. The cleistothecia hold sacs of spores that will be released the following spring when new leaves and weather conditions make a new round of infections possible.

Powdery Mildew on Phlox: Cultivar Comparisons

Phlox and powdery mildew are nearly synonymous. Phlox powdery mildew is usually visible on the lower foliage of phlox by midseason in the Northeastern U.S. Either *Erysiphe cichoracearum* or *Sphaerotheca macularis* may cause powdery mildew on phlox. Following discussions of how little we knew about phlox cultivars should be recommended as the most powdery mildew resistant, Dr. Leonard Perry and Chris Darrow from the University of Vermont joined with me in a research project on this subject. This study was generously supported by the Perennial Plant Association. We set up 6 replications of 29 cultivars at the L.I. Horticultural Research Lab and also in two Vermont locations. Many growers contributed phlox to our study, including Bissett Nursery Corp., Country Gardens, Donvegan Nursery, Friars Head Farm, Kneuttel's Nursery, Pinewood Perennials, The Plantage, Sunny Border Nursery, Andre Viette Farm and Nursery, and Walter's Gardens.

The first thing we learned was that the yearly powdery mildew epidemic was not beginning in midsummer, as casual observation might suggest. We saw active powdery mildew colonies on the underside of the lower leaves of the phlox in production nurseries as early as Memorial Day. We also learned a lot about survivorship: many of the phlox succumbed to cultural and environmental stresses other than mildew when we attempted to establish them in field plots. We can offer reliable data only for those hardy cultivars that survived fairly well under our experimental conditions. Tables 1 and 2 give a comparison of powdery mildew ratings for just the Long Island grown plants on July 8 and August 12, 1991, and also for July 2, 1992. (see Table 1).

Several things can be seen from this data. First of all, there was a great deal of climate variation from year to year. 1992's unusually cool summer strongly encouraged powdery mildew development. Powdery mildew coverage in early June of 1992 was roughly comparable to that in August of the preceding year. Secondly, it is obvious that the *Phlox maculata* cultivar 'Alpha' shows far less susceptibility to powdery mildew than the *Phlox paniculata* cultivars. Results in Vermont indicate the *Phlox maculata* 'Alpha' was also superior to the *P. paniculata* cultivars, but the disease pressure was apparently greater during Vermont's 1992 summer, since 'Alpha' in Vermont had an

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average rating of 10% coverage, in contrast to Long Island's 0.2%. Most importantly, certain *P. paniculata* cultivars stand out from the rest as being much less susceptible to powdery mildew, as measured by percent upper leaf surface area infected. 'Prime Minister' showed only 10% leaf area infected, 'David ' 19% and 'Orange Perfection' 30% under conditions which caused most of the cultivars to be more than half covered by powdery mildew. Results in Burlington, Vermont, also showed 'Prime Minister' and 'David' to be less affected by the disease. This season on Long Island, 'Bright Eyes', 'Dorffreunde' and 'Eva Cullum' were attractive runners-up for powdery mildew resistance in early July, all having less than 40% leaf area infected, and all having showy flower displays that distracted the eye from the unaesthetic effect of the powdery mildew infection. This performance was in marked contrast to the cultivar 'Anja', which was already 90% covered with powdery mildew at the same date.

Powdery Mildew Control Studies on Ornamentals

In a 1990 trial, we compared treatments of lilac with VaporGard (2%) and Safer's Ultrafine Spray Oil (2%) to Bayleton 25 TOF at 4 oz/100 gal, using 2 and 4 week spray intervals. This study (and subsequent control trials) was done in cooperation with Scott Clark, Nursery Specialist at Cornell Cooperative Extension of Suffolk County, with funding from the Long Island Nurserymen Association. All of the treated plants developed significantly less powdery mildew than the untreated season, we also set up a non-replicated demonstration plot using a range of herbaceous and woody perennials susceptible to one of the powdery mildew fungi. This included 4 phlox, 'Fujigama', 'Carolina Vandenberg', 'White Admiral' and *Phlox maculata* 'Miss Lingard'. 'Miss Lingard' developed no powdery mildew during the 1990 trial. 'Carolina Vandenberg' showed less powdery mildew coverage than the other *P. paniculata* cultivars. Encouragingly, the horticultural spray oil treatments gave powdery mildew control that was as good as or better than the standard systemic fungicide, Bayleton. The antitranspirant (VaporGard) showed some benefit also, but the results with hort oil were seen as having the most likelihood of eventually becoming legally registered for use as a fungicide on ornamentals.

In 1991, we conducted a replicated trial using phlox, bee balm, lilac and a deciduous azalea. We tested horticultural spray oil at 2% and 3% rates, at both a 14-day and a 21-day interval, in contrast to Bayleton and Funginex treatments at a 14-day interval. Rating the upper surface of leaves throughout the season, we observed significant control of powdery mildew on all plants by all of the oil treatments, with the Funginex often appearing to be the weakest of the treatments. This year we are repeating this study, as well as investigating the control of powdery mildew on roses with different oil and baking soda treatments.

Other Stem and Foliage Diseases of Perennials

There are many different foliage diseases on herbaceous perennials, which present a bewildering array to the gardener and grower. Some of the more common problems are listed below, with some comments relevant to their control. Unfortunately, many of the chemical pesticides which are available today list only a few perennials on their labels, so that legal chemical treatments are not available for many of the diseases that occur on perennials.

Controlling foliar diseases of perennials other than powdery mildew is largely a matter of water management. Powdery mildew is fairly unique in being a fungus disease that is not encouraged by an abundance of free water. High humidity and temperature fluctuations assist with the powdery mildew disease cycle, whereas most of the leaf spotting fungi and bacteria need free moisture to start new infections. Splashing by rain or irrigation is a common means by which fungi spores or bacteria spread. (see Table 2).

Another category of leaf diseases is that caused by the rust fungi. These are very highly-evolved parasites which are specialized to infect one host, or sometimes only two hosts, in alternation. The most familiar rust fungus to the gardener is the one affecting hollyhock. It has a closely related weed host called "Cheeses," which is *Malva neglecta*. Some of the other rusts that are encountered in the perennial garden include those affecting *Iris versicolor*, Viola, Jack-in-the-Pulpit, and Potentilla. All of these may be recognized by their common pattern of pale spotting on the upper surface of the leaf, and spore pustules filled with orange to brown spores on the undersurface opposite the pale spots.

Bacterial Diseases/Aster Yellows

Bacteria may also affect perennials, although this is less common than fungus infection. A *Pseudomonas* species causes black spots with yellow haloes on Delphinium leaves. It is fairly common to see a *Xanthomonas* causing

large brown wet lesions on Iris, or a different species of the same bacterial genus causing spotting on *Geranium* species. We have recently become concerned that the bacteria causing a minor problem on *Geranium* may be the source of infections for the highly susceptible greenhouse *Pelargonium* crops (zonal and ivy geraniums). Keeping hardy geranium crops separate from greenhouse geranium production is an important precaution that has not been stressed in the past.

Periodically, a grower or gardener may encounter crown gall, an impressive bacterial infection that results in large swollen areas on the roots or at the stem base. Since so many plants are susceptible to this disease, discarding affected stock along with the contaminated soil is the appropriate control measure. Another type of organism, similar to bacteria, is responsible for the dramatic-looking disease aster yellows, that occurs sporadically on many annual and perennial composites. The infection by the aster yellows mycoplasma like organism (MLO) causes yellowing of the foliage, and causes flowers to stay green rather than developing their appropriately colored petals. Control of the aster leaf hopper and the wild composite weeds it feeds on, is important for management of aster yellows.

Virus Diseases

Virus diseases occasionally are problematic on perennials. There are no direct controls other than destruction of infected stock. Control of insect vectors (aphids and thrips, especially) can halt virus spread in many cases. One of the most commonly seed viruses today is Tomato Spotted Wilt Virus (TSWV), spread by the Western flower thrips which is widespread in the greenhouse industry. Dahlias are often infected by TSWV. Many different symptoms are possible with this virus, including yellow ring spots and "oak leaf" shaped line patterns. It has a very broad host range, including many of the popular herbaceous perennials.

Root and Stem Infections Caused by Fungi

Root problems are often seen on plants such as lupines and poppies which prefer well-drained soils to frequently-irrigated highly organic mixes. Good drainage is critical to pot culture of perennials. Sometimes contagious diseases are also involved in the demise of a root system. *Rhizoctonia solani* is the most common problem, attacking the plant at the soil line to cause damping off or wilting and death of all or part of a mature plant. Avoid mulching directly around the stem of herbaceous perennials to decrease the chance of *Rhizoctonia* cankers. *Sclerotinia sclerotiorum* will act similarly to *Rhizoctonia*, but grow copious amounts of white fungal mycelium at the plant base. *Sclerotium rolfsii* may also attack stems, forming characteristic "mustard seed" shaped sclerotia on the killed tissue.

Remember that not all problems on herbaceous perennials are due to contagious disease organisms. Cultural problems can cause mimicking symptoms, and thrips, bud mites or nocturnal insects can also easily elude detection.

For Additional Information

Herbaceous Perennials: Diseases and Insect Pests (Information Bulletin 207) and the 1992-1993 Pest Management Recommendations for Production Herbaceous Perennials insert are available (for a fee) from Resource Center, 7 Business and Technology Park, Cornell University, Ithaca, NY 14850.

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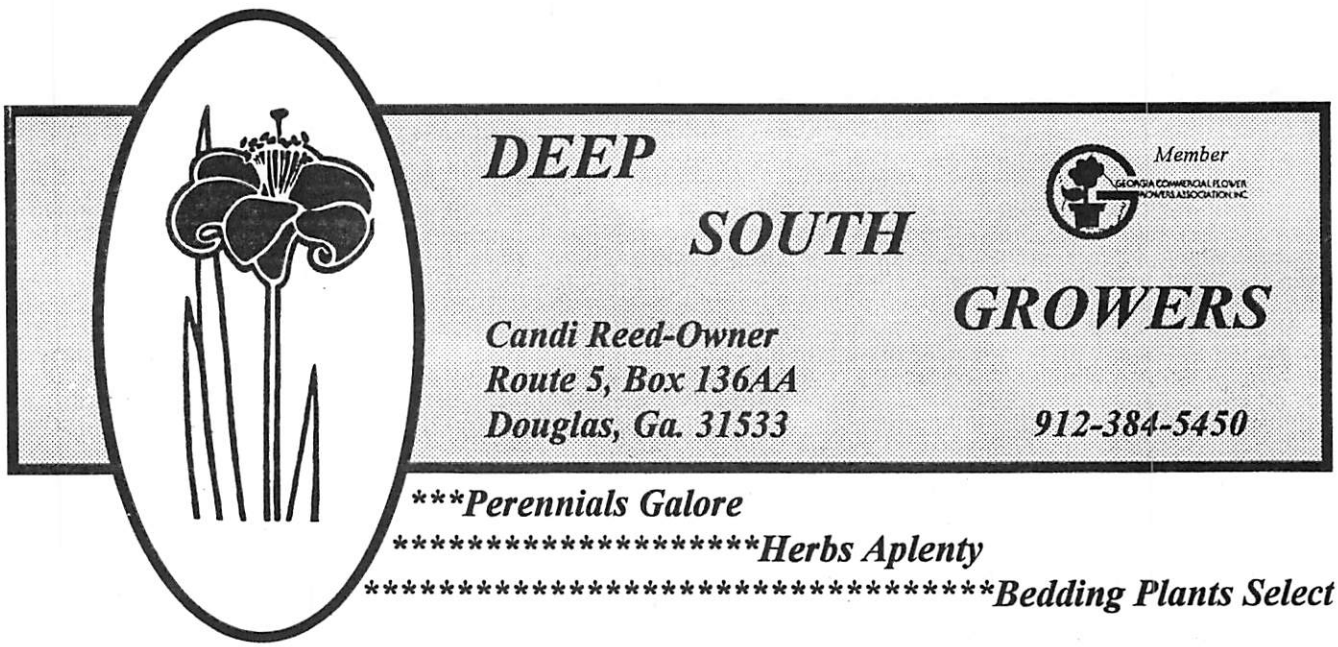
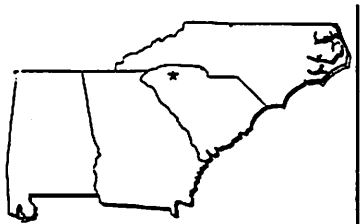
Table 1: Powdery Mildew on *Phlox paniculata* cultivars

	7/8/91	8/12/91	7/2/92
Windsor	0[a]	0.5[a]	70.0[a](1)[b]
David	0.2	0.8	19.0 (6)
Orange Perfection	2.0	0	30.0 (2)
Prime Minister	1.3	1	10.0 (1)
Fairest One	7.0	2.3	58.0 (2)
Starfire	4.8	6.0	(0)
H. B. May	7.5	4.5	47.0 (3)
Fujigama	27.6	17.2	55.8 (6)
Dodo Hanbury Forbes	12.3	5.8	38.7 (4)
White Admiral	14.2	10.8	59.0 (5)
Pinafore	16.7	11.0	65.8 (5)
New Bird	25.4	12.3	74.5 (6)
Adonis	17.5	11.0	53.8 (4)
Dresden China	39.8	19.0	69.0 (5)
Sandra	67.0	25.0	90.0 (1)
Anja	-	-	87.6 (5)
Bright Eyes	-	-	33.4 (5)
Dorffreunde	-	-	36.0 (5)
Eva	-	-	39.5 (4)
Fairy's Petticoat	-	-	45.0 (6)
Franz Schubert	-	-	42.2 (6)
Fuchsia	-	-	43.5 (2)
Mrs. R. P. Struthers	-	-	62.5 (4)
Pinafore	-	-	65.8 (5)
Stemhimmel	-	-	1.4 (5)

[a]values are the mean percent foliar coverage (on the upper leaf surface)
[b]number of plants (out of 6 replicates) from which data was collected 7/2/92.



Examples of Perennials Affected	Fungus Genus	Comments
Aquilegia, Dianthus	Alternaria	Purple rimmed leaf spots Benomyl and thiophanate-methyl ineffective
Cimicifuga, Clematis	Ascochyta	Brown leaf spots, roughly circular
Heuchera, Bergenia	Colletotrichum (Gloeosporium)	Purplish leaf spots; on Bergenia, the infection of young leaves results in severe distortion.
Phlox, Gaillardia, Lythrum	Septoria	Spots may develop gray centers as they age. Tiny dots on lesions are the spore cases.
Peony	Cladosporium	Purple to brown leaf blotches
Lily of the valley, Hemerocallis	Collecephalus	Tiny or coalescing reddish brown streaks
Iris, *Belamcanda	Didymellina (Heterosporium)	Oval tan spots affect foliage early in spring. Treat as foliage first emerges and repeat to cover the new growth.
Lythrum	Coniothyrium	Causes brown cankers (killed stem areas) anywhere along the stem, leading to branch wilt and death.
Hosta	Botrytis	Tiny tan leaf spots appearing in early spring: treat early to have any affect.
Peony	Botrytis	Large leaf spots with zonate pattern, blasting of young buds, premature browning of open flowers, blighting of young vegetative shoots in spring. Gathering plant debris in fall reduces overwintering; treating new foliage as it emerges is appropriate. Provide good air drainage around plants.
Gaillardia	Entyloma	The round, pale leaf spotting in this case is known as a "leaf smut" disease. The fungus produces brown spores inside the leaf (and this practice makes it tricky to identify).
Geum, Potentilla	Peronospora	This is a leaf infection known as "downy mildew," which is quite different from the similar-sounding powdery mildew diseases. Different chemicals are used for its control. Symptoms are pale angular spots on the upper leaf surface, and fuzzy growth of spores in a patch directly opposite on the leaf undersurface.



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