

# Plant Evaluation Notes

## *An Evaluation Report of Selected Phlox Species and Hybrids*

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Today many writers and gardeners are extolling the virtues of foliage, but still we treasure the flowers we grow. The brightly colored blossoms of phlox are among the most recognizable and desirable of all. Phlox is familiar in a variety of landscapes, from the miniature terrain of a rock garden to the dappled shade of a woodland to the high summer border of a cottage garden. Phlox is valued in both our native landscapes and our gardens.

There are over 60 species of *Phlox* native to North America and one species native to Siberia. The genus name is derived from the Greek word for *flame*, and so named because of its brilliantly colored flowers. Most species use phlox as the common name, although

some species are also called sweet William.

Flowers are the main ornamental attribute of phlox, although pleasing habits in a range of sizes are also valued. The colorful flowers – from pink and salmon to purple, lavender, scarlet, red, orange, white and shades of blue – can be seen on various species from spring to fall. Many phlox are blessed with a sweet fragrance too.

The diversity of plant habits and the variety of cultural conditions in which phlox will grow make it an important garden plant. Plants range from under 1 foot tall to over 3 feet tall, and are clump-forming to stoloniferous. There are phlox that grow in almost every light environment from shade to full sun. Culture varies depending upon the species, but

in general, most phlox grow well in full sun. The low-growing, early-blooming species tend to prefer light shade. Too much sun can cause these plants to grow poorly or die out. With few exceptions, phlox prefer moist, well-drained soils.

Powdery mildew is a serious and debilitating disease of certain phlox. White spots or patches on the upper leaf surface characterize this disease. Symptoms are observed in summer and autumn when the development of the fungus is promoted by high humidity. Choosing mildew-resistant cultivars should be a gardener's primary consideration, but there are certain cultural practices that can help keep mildew at a lower level in the garden. Management considerations include: 1) thinning out stems to increase air movement; 2) planting in full sun where possible; 3) eliminating or reducing overhead watering; and 4) reducing the overwintering spores by removing infected leaves and stems each autumn. Fungicides and horticultural oils can also be used to control powdery mildew.

Leaf spot and leaf blight are two other foliar diseases that can threaten the health and ornamental quality of phlox. Many fungi cause leaf spots on phlox. The dark brown, circular spots with whitish centers are found primarily on the lower leaves. Leaf blight is a physiological disease that afflicts older stems that are unable to supply enough water to the rapidly growing leaf tips (Pirone 1978). There is no pathogen associated with leaf blight, which is characterized by the death of the lower leaves progressively upward until the shoot is killed.

Phlox, nonetheless, is a very popular garden plant and can be grown in a variety of situations. Tall species, including *Phlox paniculata*, *P. carolina* and *P. maculata*, are good plants for the middle or back of the border. The large flower clusters provide a dramatic impact in the garden, and the erect stems show off the flowers to full advantage. These plants mix well with perennials such as beebalms, shasta daisies, balloonflowers, daylilies and grasses. Shorter species,



Cathy Provost

*Phlox paniculata* 'Katherine'

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including *Phlox glaberrima*, *P. pilosa* and *P. pulchra*, can be used effectively in the front of the border or as edging plants along paths. If grown in partial shade, they combine well with hostas, ferns, bellflowers and columbines, while complementary plants for sunny sites include sedums, penstemons and grasses.

### The Evaluation Project

In 1993 the Chicago Botanic Garden (USDA Hardiness Zone 5b, AHS Plant Heat-Zone 5) began a four-year evaluation project to observe a select group of phlox, including such distinct plants as the spring-blooming 'Chattahoochee' and the late summer-blooming *Phlox paniculata*. The primary goal was to determine the powdery mildew resistance of the *Phlox* species and cultivars. Observing the performance of the more shade-tolerant spring-blooming phlox when grown in a full sun environment was a secondary purpose. Twenty-two taxa of *Phlox* were grown and evaluated between spring 1993 and autumn 1996.

Maintenance practices were kept to a minimum to simulate home garden culture. Irrigation from overhead sprinklers was supplemented as needed, and no fertilizer was applied. The plants were periodically cut back in late summer to remove declining or diseased stems. Fungicides were not used to control powdery mildew so that accurate disease-resistance information could be

collected. Infected leaves were removed from the ground each autumn to decrease the level of fungal spores overwintering in the test garden. A mulch of shredded leaves and wood chips was placed around the plants for aesthetic purposes, water conservation and weed control.

The evaluation plots received approximately eight to 10 hours of full sun daily during the growing season and were openly exposed to wind in all directions. The well-drained soil consisted of one part composted leaves to four parts clay-loam soil, with a pH of 7.4. Turf grass pathways surrounded the beds on all sides, and the plots, each comprised of 16 plants, were separated within the beds by mulched strips.

### Observations

Flowers are the most significant ornamental attribute of phlox. Color, size and quality of the flowers and the length of bloom determined the ornamental effectiveness of the floral display. Habit and health were also important to the overall ornamental value of the plant. In the case of the spring-flowering species, the habits and foliage became the primary ornamental traits later in the season. Foliar diseases, such as powdery mildew and leaf spot, often contributed to the decline in the health and vigor of some plants, resulting in an unfavorable display.

Information was collected on flower color, size, coverage and bloom period; plant size and form; disease and pest resistance; cultural adaptability; and winter hardiness. Plant traits and evaluation specifics are highlighted in Table 1. A summary rating was assigned to each taxon based on flower coverage, plant health, habit, disease resistance and winter injury. A four-star rating indicates a good performance, whereas a one-star rating signifies a poor performance. Only two of the 22 taxa did not complete the four-year trial. *Phlox* 'Green Spring' died during its second winter, and *Phlox maculata* 'Delta' was misidentified and subsequently removed.

Powdery mildew is a serious problem of *Phlox paniculata*, *P. carolina* and *P. maculata*. The leaves, stems and flowers can be affected in severe cases. Infection periods and severity varied each year, depending on the weather. Mildew typically began in early August and reached the greatest degree of infection in September. Many plants were severely infected in 1994 when abnormally high temperatures and humidity were noted in late April and continued throughout the summer months. The first symptoms were observed on the *Phlox paniculata* cultivars by early June and on the *Phlox maculata* and *P. carolina* cultivars in early July of that year.

For comparative purposes the phlox were placed into three groups based on plant

Table 1: Plant Characteristics and Performance Summary Ratings

Overall Rating	Phlox <sup>1</sup>	Powdery Mildew Resistance <sup>2</sup>	Flower Color	Flower Size	Inflorescence Size		Flower Coverage	Bloom Period	Height Range	Width Range
★★★★	<i>carolina</i> 'Reine du Jour'	good	white, pink eye	½-¾ in.	5 in. long	3 in. wide	80-100%	mid Jun-Sept	25-37 in.	22-27 in.
★★★★	'Chattahoochee'	excellent	lavender-blue, violet eye	1 in.	4 in. long	4 in. wide	80-100%	May-Jun	7-12 in.	20-28 in.
★★★	<i>glaberrima</i> 'Don Hackenberry'	excellent	purple	1 in.	3 in. long	3 in. wide	40-60%	late Jun-late Jul	12-17 in.	18-22 in.
★★★	<i>glaberrima</i> ssp. <i>triflora</i>	excellent	purple	1¼ in.	3 in. long	3 in. wide	40-60%	Jun-early Jul	19-25 in.	25-33 in.
★★➔	<i>maculata</i> 'Alpha'	very poor	rose-pink	½-1 in.	6 in. long	5 in. wide	60-80%	early Jul-Sept	30-39 in.	30-40 in.
★★	<i>maculata</i> 'Omega'	very poor	white, lilac eye	½-¾ in.	8 in. long	5 in. wide	40-60%	mid Jul-Sept	15-32 in.	10-24 in.
★★➔	<i>maculata</i> 'Rosalinde'	very poor	dark pink	¾ in.	6 in. long	3 in. wide	60-80%	late Jun-mid Aug	28-36 in.	30-36 in.
★★➔	<i>paniculata</i> 'Blue Lagoon'	poor	purple	1-1½ in.	4 in. long	5 in. wide	40-60%	Jul-Sept	26-32 in.	26-30 in.
★★★★➔	<i>paniculata</i> 'Bright Eyes'	fair	pink, ruby-red eye	1¼ in.	7 in. long	5 in. wide	60-80%	early Jul-Sept	29-32 in.	26-34 in.
★★★★➔	<i>paniculata</i> 'David'	fair	white	1 in.	6 in. long	7 in. wide	80-100%	mid Jul-Sept	34-49 in.	29-40 in.
★★★	<i>paniculata</i> 'Eva Cullum'	fair	pink, dark red eye	1-1¼ in.	7 in. long	4 in. wide	40-60%	mid Jul-Sept	28-40 in.	28-37 in.
★★★★➔	<i>paniculata</i> 'Franz Schubert'	fair	lilac, darker eye	1¼-1½ in.	6 in. long	6 in. wide	60-80%	early Jul-Sept	30-36 in.	39-48 in.
★★	<i>paniculata</i> 'Fujiyama'	poor	white	1 in.	4 in. long	4 in. wide	40-60%	Aug-Sept	31-39 in.	27-40 in.
★★★★	<i>paniculata</i> 'Katherine'	good	lavender, white eye	1 in.	5 in. long	6 in. wide	60-80%	early Jul-Sept	36-43 in.	32-38 in.
★★	<i>paniculata</i> 'Prime Minister'	good	white, red eye	¾-1 in.	3 in. long	4 in. wide	<20%	late Jul-Sept	23-28 in.	24-27 in.
★★	<i>paniculata</i> 'Starfire'	poor	cherry-red	1 in.	6 in. long	6 in. wide	60-80%	mid Jul-Sept	25-28 in.	24-31 in.
★★★	<i>paniculata</i> 'The King'	fair	purple-lavender	1 in.	6 in. long	6 in. wide	60-80%	mid Jul-early Sept	35-39 in.	28-45 in.
★★★	<i>pilosa</i>	excellent	pale purple	½ in.	2 in. long	2 in. wide	80-100%	mid May-early Jul	10-12 in.	32-36 in.
★★★★	<i>pulchra</i> 'Morris Berd'	excellent	light purple	1 in.	3 in. long	3 in. wide	80-100%	early Jun-mid Jul	20-24 in.	24 in.
★★	'Spring Delight'	excellent	rose-pink	1 in.	3 in. long	3 in. wide	40-60%	mid Jun-Aug	12-19 in.	21-32 in.

Overall Ratings: ★★★★★ good, ★★★ fair, ★★ poor, ★ very poor; half-star ratings included in table.

<sup>1</sup>Nomenclature in this report follows *The New Royal Horticultural Society Dictionary of Gardening*.

<sup>2</sup>Powdery Mildew Resistance: excellent = no injury; good = <25% infection/leaf drop; fair = 26-50% infection/leaf drop; poor = 51-75% infection/leaf drop; very poor = >76% infection/leaf drop.

type and bloom time: garden phlox (*Phlox paniculata*); summer-blooming species (*Phlox carolina*, *P. glaberrima*, *P. maculata* and *P. pulchra*); and spring-blooming phlox ('Chattahoochee', *Phlox pilosa* and 'Spring Delight').

### Garden Phlox

*Phlox paniculata* 'Katherine' was the only garden phlox that received a good rating in all categories. It exhibited heavy flower coverage, a robust habit and less than 10% mildew infection each year, except when it reached 80% in August of 1994. *Phlox paniculata* 'Prime Minister' was the only garden phlox with greater mildew resistance, less than 5% injury.

High flower production, strong upright habits and good health were observed on 'Bright Eyes', 'David' and 'Franz Schubert'. But in each case, mildew infection was noted between 25% and 50%, and contributed to the fair-to-good overall rating. 'Bright Eyes' and 'David' consistently maintained fair ratings for mildew resistance during all years of the evaluation term. Leaf spot infection was observed on 'Bright Eyes', 'David' and 'Franz Schubert' in 1996 only.

The final rating of fair for 'Eva Cullum' reflected flower coverage of 40% to 60%, a consistent mildew infection rate between 25% and 50%, winter injury in two years and 50% leaf spot infection in 1996. The final rating for 'The King' was based on good flower production, fair mildew resistance and leaf spots in 1995 only. In the winter of 1994-95, about one-half of the plants of 'The King' were killed and all remaining plants had severe crown injury resulting in poor health and vigor in 1995. The plants regained vigor and good health in 1996.

The remaining garden phlox received fair to poor ratings for a variety of reasons. 'Blue Lagoon' received a lower rating because of its flopping stems and inferior habit, fewer flowers, 50% to 75% mildew infection each year and severe leaf spotting in 1996. The plants of 'Fujiyama' were robust and tall, but low flower production and severe mildew infection in 1995 and 1996 caused it to receive a poor rating. Because 'Fujiyama' bloomed later than the other phloxes, its flowers were at peak when mildew was most severe, effectively diminishing the floral display. Low flower coverage, typically less than 20%, and moderate leaf blight and leaf spots were problems for 'Prime Minister' although mildew infection was less than 5% in three out

of four years. The cherry-red blossoms of 'Starfire' were produced in abundance, but the weak habit and severe mildew infection resulted in a poor overall rating.

Winter injury was observed on all the garden phlox in one or more years. In most cases injury was minor, although some losses ranged from severe crown injury to death of plants. Only 'Eva Cullum' and 'Franz Schubert' had crown injury in consecutive winters, both in 1994-95 and in 1995-96. Severe crown injury occurred in 1994-95 on 'Franz Schubert' (50%), 'Prime Minister' (50%), 'Starfire' (90%) and 'The King' (90%). In addition, one-half of the plants of 'Starfire' and 'The King' were killed that winter. In each case, the plants were severely infected by powdery mildew in 1994, resulting in weak and stunted stems.

A curious injury on some *Phlox paniculata* cultivars in 1996 was eventually attributed to late frost in mid-May (Paulsrud letter 1996). Plants were first observed with stunted or distorted terminal leaves. Upon closer inspection, small scars were noted on many stems just below the apical buds. The death of the apical buds resulted in the proliferation of shoots below the scar tissue. Stems with an eastern exposure were most affected, although not all plants were injured. All affected plants outgrew the damage and recovered by late July and early August. Flowering was delayed from two weeks to one month in most cases, and the low flower production that year was attributed to the cold injury. The plants that were injured included 'Blue Lagoon', 'David', 'Eva Cullum', 'Franz Schubert', 'Fujiyama' and 'Katherine'. The asterisk denotes those plants with a significant decrease in flower production in 1996.

### Summer-Blooming Phlox

The summer-blooming phlox, *Phlox carolina* and *P. maculata*, are similar in ornamental character to *P. paniculata*. Contrary to the popular literature, powdery mildew was as much of a problem with the *Phlox maculata* cultivars as with *P. paniculata*. Powdery mildew infection rates between 75% and 100% contributed to the poor overall ratings for all three cultivars of *P. maculata*. The cultivars 'Alpha' and 'Rosalinde' received a slightly higher final rating because of better flower coverage than 'Omega'. The cultivars were otherwise similar in quality of habit and frequency of mildew and leaf spot infection.

*Phlox carolina* 'Reine du Jour' exhibited a far greater resistance to mildew than

most of the cultivars of *Phlox maculata* or *P. paniculata*. Mildew infection was noted as less than 20% in most years, except in 1994 when it was observed at 75%. *Phlox carolina* 'Reine du Jour' was one of the best phlox overall because of abundant and attractive flowers, a long bloom period and healthy foliage.

The other summer-blooming species, *Phlox glaberrima* and *P. pulchra*, were both unaffected by powdery mildew. *Phlox pulchra* 'Morris Berd' received a good final rating based on healthy, robust plants, good flower coverage and no mildew infection. Its bloom period was not as long as many other phlox, but it displayed an attractive, vase-shaped habit with healthy leaves all season. Low leaf spot infection was noted in 1996. Winter injury, low flower production and inferior habits contributed to the fair ratings for *Phlox glaberrima* 'Don Hackenberry' and *P. glaberrima* ssp. *triflora*. A bloom period of less than one month was a drawback, and spent flowers detracted from the appearance later in the summer. Habits were a bit open and sprawling as the season progressed. Winter injury in one or more years affected how quickly the plants regenerated in the spring. Leaves of *Phlox glaberrima* ssp. *triflora* were severely disfigured in 1995 by the fourlined plant bug.

### Spring-Blooming Phlox

Due to the early flowering nature of 'Chattahoochee', *Phlox pilosa* and 'Spring Delight', the appearance of the foliage was an important attribute to consider for the remainder of the season. 'Chattahoochee' received one of the highest overall ratings. It maintained a good habit and health throughout most of the growing season, but its vigor would decrease in late summer, resulting in yellow-to-brown foliage throughout the entire planting. It was the first phlox to bloom each year, with fragrant blue flowers opening as early as May 5 and lasting through June and sometimes into early July.

*Phlox pilosa* was usually smothered with flowers beginning in mid-May. Flower coverage was consistently high, but the open, sprawling habit was not ornamental after flowering was completed and contributed to its fair final rating. Its habit in the later season was usually a patchwork of new growth among older, dying stems. No foliar diseases were observed on *Phlox pilosa*.

'Spring Delight' was a misnomer given its bloom time of mid-June to early August. Peak bloom was usually in late June, but



Michael P. Harvey

*Phlox paniculata* 'Bright Eyes'

Michael P. Harvey

*Phlox* 'Chattahoochee'

Lynette Rodriguez

*Phlox paniculata* 'David'

flower coverage was never rated high. Crown injury, from 40% to 90%, was noted after each winter resulting in weakened plants in the spring. Leaf spotting was a minor problem in 1994, but over 90% of the leaves were affected in 1995. None of the spring-flowering species were infected with powdery mildew.

Several general maintenance points concerning habit and flowering were observed each year. Although most of the tall species remained upright during the season, lodged or fallen stems were troublesome on 'Blue Lagoon', 'Prime Minister' and *Phlox maculata* 'Alpha'. Open centers and sprawling habits were commonly observed on *Phlox glaberrima* 'Don Hackenberry', *P. glaberrima* ssp. *triflora* and *Phlox pilosa*. The ornamental display of the following plants was improved by removing spent flowers and seedheads: 'Chattahoochee', *Phlox glaberrima* 'Don Hackenberry', *P. glaberrima* ssp. *triflora*, *P. paniculata* 'David' and *P. pulchra* 'Morris Berd'.

### Summary

There is a keen interest among gardeners to identify and grow mildew-resistant phlox. The dramatic, bright-colored flowers are as popular as ever. But of what value are the flowers when paired with a diseased and weakened plant? There are certainly garden phlox that are beautiful in flower and form and resistant to powdery mildew.

A comprehensive evaluation of phlox would include over a hundred species and

cultivars for different sites within the garden. Our evaluation was limited by space in the number of garden phlox we observed, but the results were nonetheless noteworthy. For instance, *Phlox paniculata* 'David' did not prove to be as mildew-resistant as commonly touted, whereas a lesser-known cultivar, 'Katherine', surpassed all the others. It was the only garden phlox to combine all the good qualities – less mildew, strong habit, healthy foliage and heavy flower production.

There were other garden phlox that also demonstrated a resistance to powdery mildew, including 'Bright Eyes', 'David', 'Eva Cullum', 'Franz Schubert' and 'The King'. Mildew levels varied in each year of the evaluation, although levels were consistent on some plants, including 'Bright Eyes', 'David', 'Katherine' and *Phlox carolina* 'Reine du Jour'.

Another aspect of the project was to evaluate the phlox that bloom from spring up to the season of the garden phlox. The spring-blooming species and hybrids were outstanding in floral display but often lacking in late-season interest. Some plants grew admirably in full sun, but in the end, suffered too much in the abundance of sunlight and heat to recommend them for general use in that culture. Grown in partial shade, these plants are good choices for the spring and early summer garden.

The very best plants from our trials were *Phlox carolina* 'Reine du Jour', *Phlox*

'Chattahoochee', *Phlox paniculata* 'Katherine' and *Phlox pulchra* 'Morris Berd'. These phlox combine good health, strong habits and high flower production in superior plants for a variety of landscape uses. The garden phlox, 'Bright Eyes', 'David' and 'Franz Schubert', are promising because of their mildew resistance and good ornamental qualities.

The diversity of plant types and flower colors insures there is a phlox for most gardens. The dramatic, colorful flowers can punch up the perennial border or brighten the shade of the naturalized landscape. Be mindful of the powdery mildew issue and select your phlox accordingly. By choosing the right phlox, you will be rewarded with a handsome plant and a long season of bloom.

### Reading List

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