

Plant Evaluation Notes

An Evaluation Report on Barrenworts for the Shade Garden

Mark R. Rudy, Plant Evaluator

Epimedium, or barrenwort, has a long history of both garden and herbal use. With the ability to tolerate deep shade and extreme drought as well as compete successfully with tree roots, barrenworts grow in places where other shade plants fail. Spring is the peak season to enjoy them; however, they can provide an attractive backdrop throughout the year. Due to leaf emergence and flowering in April and May, barrenworts are most attractive when not many other perennials are blooming in the Midwest. They complement bulb plantings and later serve as an effective cover-up for declining daffodil and tulip leaves.

In addition to its garden uses, *Epimedium* has made contributions to the world of medicine. Given the common name barrenwort, these plants have roots that were believed to cause barrenness in women. More recently, barrenworts have been studied for their potential to combat disorders of the human heart, kidneys and bones.

Barrenworts are low-growing, and their habits range from dense mounds to wide-spreading ground covers. The often heart-shaped or arrowhead-shaped foliage distinguishes *Epimedium* from other shade-lovers such as dead nettle, English ivy, pachysandra and wild ginger. The first

ternately compound leaves often emerge with a more dissected appearance than the mature foliage. At times, these new leaves are colorful and may precede or follow flowering, depending on the variety. Foliage with burgundy and red accents in the spring matures to green for the summer and then fades to yellow, red or bronze in the fall.

An herbaceous member of the mostly woody barberry family (Berberidaceae), *Epimedium* has a wider range of flower colors than many of its relatives. White, yellow, rose, crimson and violet, as well as combinations of these on the same flower, give the gardener a wide palette of colors for dry, shaded landscapes. On the nodding blooms, the outer sepals attach to an arching flower stem and are generally diminutive in comparison to the other parts. The inner sepals of most varieties are located adjacent to the outer sepals and are the most petal-like structures of the flowers. They typically extend perpendicular to the peduncle or flower stem. Furthest from the flower stem reside the true petals, which in different species have adapted into a variety of shapes, including spurs that are contained in, or extend beyond, the colorful sepals. *Epimedium* is also commonly called bishop's hat because the flowers resemble the miter of a clergyman.

While its natural dispersal ranges from Japan across Asia into northern Africa, the greatest concentration of *Epimedium* is in China. However, the overwhelming majority of varieties available to the gardening public are species and hybrids native to places other than China. *Epimedium alpinum* and *E. pubigerum* naturally occur in Europe, the Caucasus and northern Turkey; *E. diphyllum*, *E. grandiflorum* and *E. sempervirens*, in Japan, Korea and Far Eastern Russia; and *E. pinnatum*, in northern Africa. These species have been cultivated and hybridized for more than 150 years in Europe and even longer in Japan, yielding not only cultivars but also interspecific hybrids such as *E. × rubrum*, *E. × versicolor*, *E. × warleyense* and *E. × youngianum*.

Once established, barrenworts are long-lived plants that are able to stand up to the variable stresses of the Midwest and other challenging environments. Superior varieties couple this toughness with a profusion of blooms and excellent winter hardiness. Despite its reputation as a utilitarian plant, *Epimedium* has the pedigree to be a mainstay in any shade garden.

The Evaluation Project

The Chicago Botanic Garden (USDA Hardiness Zone 5b, AHS Plant Heat Zone 5) conducted an evaluation study of 40 taxa of *Epimedium* from 1995 to 2001, although not all the taxa were grown for the full duration. The initial evaluation group included plants that were commercially available in 1995, with subsequent additions as new varieties became available. The goal of this project was to select superior taxa of *Epimedium* based on winter hardiness, ornamental merit, pest and disease resistance, and cultural adaptability.

Three plants of each taxon were grown in the Pullman Shade Evaluation Garden, a site that features a variety of light levels and diverse microclimates. Mature trees, including oak, maple, birch and pine, provided shade. Most plants received medium dappled shade for the entire day and were protected from wind by wood fencing around the perimeter



Epimedium × versicolor 'Neosulphureum'

Photo: Jenny Lee

of the garden. The clay-loam soil was well-drained and had an average pH of 7.5.

Maintenance practices were kept to a minimum to simulate home garden culture. Overhead sprinklers provided water as needed, and no fertilizer was applied. Mulch consisting of shredded leaves and wood chips was placed on the soil around the plants for water conservation and weed suppression.

Observations

Of the 40 taxa that began this trial, 33 survived to receive final ratings. In order to receive a final rating, at least one of the three original plants of each taxon had to survive a minimum of three years. All plants of *Epimedium* × *cantabrigiense*, *E.* × *perralchicum* ‘Frohneiten’, *E.* × *warleyense*, *E.* × *youngianum* ‘Roseum’ and *E.* × *youngianum* ‘Yenomoto’ died in the first winter of the trial and were not retested. *Epimedium davidii* and *E. grandiflorum* ‘Roseum’ were removed from the trial in poor

overall health after two years or less. Among the surviving taxa, four criteria determined the overall performance rating for the plants ranging from excellent to poor.

First, flower coverage was averaged across all years. Considering that species of *Epimedium* are seldom totally covered by blooms even at their peak performance, 60% and greater coverage was considered excellent for this particular trial. Secondly, health quality was summarized over the entire trial period. Plant health was determined by overall foliar appearance and pest and disease resistance throughout the growing season. When health varied during a single year, early-season health was given greater consideration than health later in the season. Thirdly, plants of each taxon were rated on overall habit quality. Finally, assembled taxa were rated on winter hardiness. Plants with no injury throughout the trial period were considered excellent while taxa that lost one or two of the three

plants to winter injury were rated fair and poor, respectively. Plants that received an overall rating are featured in Table 1.

One of the most significant characteristics that separated the best performers from the mediocre and poor performers in this trial was winter hardiness. Generally speaking, most plant loss to winter injury occurred in the first two years of the trial. This was not surprising since the plants were still becoming established at this stage. Due to the rhizomatous nature of *Epimedium*, older plants typically covered more area and were better able to withstand winter injury. In addition to the varieties that lost all plants in the first winter, several varieties lost two of three plants in the first two years. The poor overall ratings of *E. diphyllum*, *E. grandiflorum* ‘Album’, *E. grandiflorum* ‘Rose Queen’, *E. grandiflorum* ‘Silver Queen’ and *E. pubigerum* were heavily influenced by winter loss of plants. In addition, *E. grandiflorum* ‘Lilafee’ and *E.*

Table 1: Plant Characteristics and Performance Summary Ratings

Overall Rating	Epimedium	Flower Color	Flower Coverage	Flower Size	Spurs ¹	Bloom Period	Height	Width
★★★★★	‘Black Sea’	creamy yellow, orange	20-40%	5/8 in.	short	mid April-mid May	13 in.	24 in.
★★★★★	‘Crimson’	lavender, white highlights	40-60%	7/8 in.	short	late April-late May	13 in.	23 in.
★★★★★	‘Purple Pixie’	purple, white spurs	20-40%	1 1/4 in.	short	mid April-mid May	9 in.	12 in.
★★★★★	<i>alpinum</i>	rose red, yellow spurs	40-60%	1/2 in.	short	late April-mid May	13 in.	18 in.
★★★★	<i>diphyllum</i>	white	<20%	5/8 in.	none	mid May-early June	7 in.	14 in.
★★★★	<i>grandiflorum</i>	white	<20%	1 5/8 in.	long	late April-mid May	10 in.	24 in.
★★★★	<i>grandiflorum</i> ‘Album’	white	<20%	1 1/2 in.	long	mid April-early May	7 in.	12 in.
★★★★	<i>grandiflorum</i> ‘Lilac Sdly’	lilac purple	20-40%	1 1/2 in.	long	mid April-mid May	10 in.	17 in.
★★★★	<i>grandiflorum</i> ‘Lilafee’	lavender	<20%	1 1/4 in.	long	early May-late May	6 in.	14 in.
★★★★★	<i>grandiflorum</i> ‘Orion’	purple	40-60%	1 1/2 in.	long	mid April-mid May	9 in.	17 in.
★★★	<i>grandiflorum</i> ‘Rose Queen’	purple	<20%	5/8 in.	long	mid April-early May	11 in.	15 in.
★★★★★	<i>grandiflorum</i> ‘Rubinkrone’	purple, white spurs	<20%	1 1/4 in.	long	late April-late May	9 in.	13 in.
★★★★★	<i>grandiflorum</i> ‘Saturn’	white	20-40%	1 1/2 in.	long	late April-mid May	9 in.	12 in.
★★★★	<i>grandiflorum</i> ‘Silver Queen’	white	<20%	1 3/8 in.	long	late April-mid May	7 in.	14 in.
★★★★	<i>grandiflorum</i> ‘Sirius’	pale pink	<20%	1 3/4 in.	long	late April-late May	9 in.	13 in.
★★★★★	<i>grandiflorum</i> ‘Sonoyzki’	white	40-60%	1 1/4 in.	long	early May-late May	9 in.	14 in.
★★★★	<i>grandiflorum</i> ‘White Queen’	white	<20%	1 1/2 in.	long	late April-late May	8 in.	14 in.
★★★★★	<i>grandiflorum</i> ssp. <i>koreanum</i>	white	<20%	1 1/2 in.	long	late April-late May	7 in.	14 in.
★★★★★	<i>higoense</i>	white	<20%	1 in.	long	late April-late May	8 in.	13 in.
★★★★	<i>pinnatum</i>	yellow	<20%	3/4 in.	short	mid April-mid May	9 in.	25 in.
★★★★	<i>pinnatum</i> ssp. <i>colchicum</i>	yellow	<20%	3/4 in.	short	late April-late May	11 in.	32 in.
★★★★	<i>pubigerum</i>	white, red-tinged sepals	<20%	3/8 in.	short	mid April-mid May	10 in.	23 in.
★★★★★	× <i>rubrum</i>	red, white spurs	20-40%	3/4 in.	short	mid April-mid May	14 in.	24 in.
★★★★	<i>sagittatum</i>	white	<20%	1/4 in.	short	mid April-late May	11 in.	21 in.
★★★★	<i>sempervirens</i> ‘Aurora’	lavender	<20%	1 1/4 in.	long	late April-mid May	6 in.	13 in.
★★★★★	<i>sempervirens</i> ‘Mars’	dark purple	<20%	3/4 in.	long	late April-mid May	6 in.	15 in.
★★★★★	<i>sempervirens</i> ‘Vega’	white	20-40%	1 1/4 in.	long	early April-mid May	9 in.	20 in.
★★★★★	× <i>setosum</i>	white	20-40%	1/2 in.	none	mid April-mid May	8 in.	15 in.
★★★★★	× <i>versicolor</i> ‘Neosulphureum’	yellow	>60%	7/8 in.	short	late April-late May	11 in.	17 in.
★★★★★	× <i>versicolor</i> ‘Sulphureum’	yellow	20-40%	7/8 in.	short	late April-late May	13 in.	28 in.
★★★★★	× <i>warleyense</i> ‘Orangekönigin’	orange, yellow	20-40%	5/8 in.	short	early April-early May	13 in.	24 in.
★★★★★	× <i>youngianum</i> ‘Capella’	magenta	20-40%	3/4 in.	short	early May-late May	7 in.	11 in.
★★★★	× <i>youngianum</i> ‘Pink Ruffles’	pink	<20%	1 in.	short	early May-late May	11 in.	13 in.

Overall Ratings: ★★★★★ excellent, ★★★★ good, ★★★ fair, ★★ poor, ★ very poor; half stars included in ratings.

¹Flower spurs: long=extend beyond inner sepals; short=shorter than or even with inner sepals.



Photo: Jenny Lee

Epimedium × *rubrum*

pinnatum ssp. *colchicum* would have received higher ratings had they not lost two of three plants to winter injury. Conversely, none of the varieties that were given a good or greater overall rating lost a single plant to winter injury over the entire trial period.

Among the rated plants, three varieties stood apart from the others: *Epimedium* ‘Crimson’, *E. grandiflorum* ‘Sonoyzki’ and *E. × versicolor* ‘Neosulphureum’. ‘Crimson’ has lavender flowers with white striations. Flowers are held just above the foliage in inflorescences of six to eight flowers each. Average peak flower coverage was 40% to 60%, but coverage was greater than 60% in 1999. ‘Crimson’ maintained a clumped and mounded habit that was rounded throughout the year. Also, winter hardiness was excellent, including frost-resistant flowers.

Epimedium grandiflorum ‘Sonoyzki’ has eye-catching flowers featuring long, white, arching petal spurs that extend well beyond the matching clear white sepals. These large blooms frost the top of the foliage in a more uniform distribution than with other varieties. ‘Sonoyzki’ is less spherical than ‘Crimson’ in habit and has the tendency to spread slowly over time. Like ‘Crimson’, this cultivar of longspur barrenwort displayed excellent winter hardiness and a complete lack of frost damage. *Epimedium grandiflorum* ‘White Queen’ is similar in appearance to ‘Sonoyzki’ but was less frost- and winter-hardy and had

several years of chlorotic foliage.

Epimedium × *versicolor* ‘Neosulphureum’ is a newer introduction than its close relative ‘Sulphureum’. ‘Neosulphureum’ has blooms featuring pale yellow sepals and creamy lemon yellow petals and anthers. The overall effect is a yellow center surrounded by four pale yellow rays. Petal spurs are shorter than the sepals and are yellow with a tinge of brown. Flowers are clumped in simple inflorescences containing seven to 16 flowers each. Average flower coverage was 40% to 60% during the trial period but greater than 80% in 1999. Unlike the other top performers, ‘Neosulphureum’ is highly effective as a ground cover because of its tendency to spread quickly over time. The three plants in the trial grew together into a single uniform mass within two years of planting. Aside from some frost injury to the leaves in 1998, this cultivar displayed excellent winter hardiness compared to ‘Sulphureum’, which lost a plant to winter injury during the trial.

Other plants receiving good ratings were yellow-flowered *Epimedium* ‘Black Sea’, red-flowered *E. alpinum* and *E. × rubrum*, white-flowered *E. grandiflorum* ‘Saturn’ and *E. × setosum*, and purple-flowered *E. grandiflorum* ‘Orion’. In general, each of these plants performed as well as the top performers with the exception of flower production.

Most barrenworts are rhizomatous in

nature, and several varieties with fast rhizome growth rates were determined to be favorable for use as ground covers. In other varieties, slow-growing rhizomes resulted in clump-forming plants that spread very slowly over the life of the plant. Taxa determined to have significant potential to be used as ground covers included *Epimedium* ‘Black Sea’, *E. alpinum*, *E. grandiflorum*, *E. pinnatum*, *E. pubigerum*, *E. × rubrum*, *E. × versicolor* ‘Neosulphureum’, *E. × versicolor* ‘Sulphureum’ and *E. × warleyense* ‘Orangekönigin’.

In the spring as *Epimedium* first emerges, there is a high concentration of anthocyanins (red pigments) in the new leaves. Anthocyanins accumulate in leaves and stems in response to low temperature and increases in light intensity. This results in red, burgundy or bronze leaves or in some cases colored margins. This colored foliage provides a secondary season of interest while the plants are setting flower buds. As temperatures increase and the overhead canopy fills in going into summer, anthocyanin concentration decreases and the leaves become green from chlorophyll. Foliage can color up again in the fall as temperatures decrease and light to the plants increases from the loss of foliage on overhead plants. The varieties in this trial that displayed significant early-season color are listed in Table 2.

Since most barrenworts bloom in early spring, the flowers and buds can be susceptible to frost damage if nighttime temperatures drop below freezing in April and May. In April of 2000, following a nighttime warming trend, temperatures suddenly dropped to 30 degrees toward the end of the month. *Epimedium* ‘Black Sea’, *E. alpinum*, *E. sempervirens* ‘Vega’ and *E. × youngianum* ‘Capella’ all suffered noticeable damage to flowers and buds, ultimately resulting in decreased flower production. In the case of *E. grandiflorum*

Table 2:
Observed colors of spring foliage in *Epimedium*

<i>Epimedium</i>	Foliage Color
‘Black Sea’	burgundy
‘Purple Pixie’	burgundy
<i>grandiflorum</i> ‘Album’	bronze
<i>grandiflorum</i> ‘Lilac Sdly’	red margins
<i>grandiflorum</i> ‘Rose Queen’	bronze
<i>grandiflorum</i> ‘Silver Queen’	bronze
<i>grandiflorum</i> ssp. <i>koreanum</i>	burgundy
× <i>rubrum</i>	red
<i>sagittatum</i>	burgundy
<i>sempervirens</i> ‘Mars’	bronze
× <i>versicolor</i> ‘Neosulphureum’	burgundy
× <i>youngianum</i> ‘Pink Ruffles’	bronze



Photo: Jenny Lee

Epimedium 'Crimson'

Photo: Jenny Lee

Epimedium 'Black Sea'

Photo: Jenny Lee

Epimedium grandiflorum 'Sonoyzki'

'Silver Queen' and *E. grandiflorum* 'White Queen', the same frost terminated flowering for that year. This was likely a result of those varieties being close to peak bloom at the time of the frost. Although it was a factor, frost damage was not solely a function of the relatively early bloom times of the barrenwort varieties identified above. Most of the barrenworts in this trial began flowering in mid- to late-April and were unaffected by frost.

Like many garden plants, barrenworts prefer neutral to slightly acidic soils. This preference is largely attributed to their origin in rich woodlands and on moist rock outcroppings. However, the soils of the Chicago Botanic Garden's test gardens are predominantly clay. These soils are alkaline and have a tendency to bind critical nutrients such as nitrogen, phosphorus and iron. Such a situation can result in chlorosis, the periodic yellowing of foliage between the veins of the leaf. In this trial, chlorosis usually occurred in midsummer and into early fall. Barrenworts with low or no incidence of chlorosis, and therefore exhibiting more tolerance for alkaline clay soils, included *Epimedium* 'Black Sea', *E.* 'Purple Pixie', *E. alpinum*, *E. diphyllum*, *E. grandiflorum* 'Lilafee', *E. grandiflorum* 'Sirius', *E. grandiflorum* 'Sonoyzki', *E. pinnatum*, *E. × rubrum*, *E. sagittatum* and *E. × warleyense* 'Orangekönigin'.

Other minor pest problems included rabbits and chewing insects. Rabbit damage to flower buds and foliage was sporadic and

usually occurred when spring leaves were first emerging. While the timing of this damage may have affected overall flower coverage for that year, it was difficult to gauge its impact. Two-thirds of the taxa in this trial exhibited some degree of rabbit damage, but overall health and habit performance were rarely affected. Likewise, the vast majority of taxa exhibited foliar damage from chewing insects. However, this damage generally occurred later in the season when barrenwort leaves were beginning to decline. Similar to rabbit damage, chewing insect damage had no bearing on the year-to-year performance of the barrenworts.

Conclusion

Home gardeners are constantly in search of ornamental plants to adorn the shady spots in their gardens where other plants have failed. Barrenworts are an ideal option because their toughness and ability to compete with tree roots make them a must-have in any shade garden. Whether massed or interspersed among bulbs and early-season perennials, *Epimedium* provides a variety of unique, colorful flowers and leaves in the spring and a backdrop of green waves throughout the remainder of the year.

The outstanding performers from our trials were *Epimedium* 'Crimson', *E. grandiflorum* 'Sonoyzki' and *E. × versicolor* 'Neosulphureum'. While each is unique in flower color and habit, all share a combination of excellent winter hardiness, strong health and habit qualities, and superior flower

coverage. Although a cut above the rest, these were not the only good performers. Six other taxa received good ratings and possess the characteristics to perform well in the garden; these were *E.* 'Black Sea', *E. alpinum*, *E. grandiflorum* 'Orion', *E. grandiflorum* 'Saturn', *E. × rubrum* and *E. × setosum*.

Barrenwort is a tough, long-lived perennial that is an invaluable garden plant for the challenging environment of the Midwest. *Epimedium* boasts historical significance in both gardening and medicine, and the continued introduction of new species and varieties into the market will ensure its use in the garden.

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