

Variety Trials

Growth, Flowering, and Cold Hardiness of Rockrose in Western Oregon

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SUMMARY. Ninety-three species, cultivars, and hybrid selections of rockrose (*Cistus* spp., *Halimium* spp., and \times *Halimicistus* spp.) were evaluated for growth, flowering, and cold hardiness in a landscape trial in Aurora, OR, from 2004 to 2009. Plants were irrigated to aid establishment when planted in summer 2004, but thereafter were not watered, fertilized, or pruned throughout the trial. Cold damage was recorded following freezing events in Feb. 2006 and Dec. 2008 in which low temperatures were 20 and 17 °F, respectively. Those plants that consistently suffered the most cold damage were *Halimium atriplicifolium*, *Cistus creticus* ssp. *creticus* ‘Tania Compton’, *Cistus* \times *pauranthus*, and *Cistus albidus* forma *albus*. Other plants showed cold damage related to poor vigor. The length of the flowering period and foliage quality varied widely among plants in the evaluation. The plants with the longest flowering period were *Halimium* \times *pauanum*, *Cistus inflatus*, *Cistus* \times *pulverulentus* ‘Sunset’, and \times *Halimicistus* ‘Ingwersenii’, all of which flowered for more than 55 days. Plant form and foliage quality declined drastically for some plants during the evaluation. Those that retained the best foliage quality included *Cistus* \times *obtusifolius*, *Cistus* \times *laxus*, *Cistus salviifolius* ‘Gold Star’, *Cistus* ‘Gordon Cooper’, *Halimium lasianthum* ‘Sandling’, *Halimium* ‘Susan’, and \times *Halimicistus sabucii*. Based on ratings of foliage and bloom time, as well as hardiness, several *Cistus* are recommended as drought-tolerant groundcovers, including *Cistus* \times *gardiannus* and *C. obtusifolius*. *Cistus* \times *laxus*, *C. inflatus*, *Cistus* ‘Gordon Cooper’, *Cistus* ‘Ruby Cluster’, and *Cistus* ‘Snow Fire’ are suggested as tall groundcovers or landscape specimens. Several *Halimium* are recommended for landscape use, including *H. lasianthum* ‘Sandling’, *Halimium* ‘Susan’, *H. x pauanum*, and \times *Halimicistus* ‘Ingwersenii’.

Rockroses are genera of evergreen, woody shrubs of the family Cistaceae, native principally to the Mediterranean basin. The 20 species of *Cistus* and seven species of *Halimium* have remained as separate genera since the 18th century (Page, 2009). The hybrid of these two genera (\times *Halimicistus*) contains three species. Recently, Demoly (2006) has proposed assigning all the *Halimium* and \times *Halimicistus* to *Cistus*. As the plants in this evaluation were obtained and evaluated under their

previous names, those will be retained for the purposes of this evaluation.

The distribution of *Cistus* ranges from the Canary Islands to the Caucasus

Mountains. *Halimium* are confined to the western Mediterranean and Greece. The climate in which these plants originated is Mediterranean, with mild, rainy winters and warm to hot, dry summers. Throughout this region, rockroses form an important component of the xeric maquis shrub community. All the species are evergreen shrubs and range in habit from prostrate to sprawling or, in some cases, erect large shrubs. Although evergreen, they are considered drought semideciduous (malacophyllous), possessing the ability to develop different types of leaves in summer and winter, and to drop leaves during prolonged periods of drought (Acosta et al., 1997). As a result, rockroses are well adapted to growing in hot, dry situations, and in relatively poor soils.

Western Oregon is characterized by a climate with a mild, wet winter and a pronounced summer drought and is comparable to the cool humid Mediterranean climate characteristic of southern France (Nahal, 1981). Nevertheless, few rockroses are grown or used extensively in landscapes in western Oregon or Washington. The most commonly grown are *Cistus* \times *hybridus* and *Cistus* \times *purpureus*, both of which may be used as tall groundcovers or specimen shrubs. The genus has suffered from a reputation of being short-lived and tender. This reputation may partly be a result of the limited selections cultivated, but may also be attributed to plants being grown in landscapes that are watered regularly in summer, a common practice in summer-dry areas such as western Oregon.

Published studies on hardiness of rockroses are rare and tend to be anecdotal in nature. Johnson (1947) commented briefly on the relative hardiness of some common *Cistus* in the United Kingdom after cold weather in Feb. 1947. Mulligan (1953) evaluated \approx 18 species and cultivars of *Cistus* and \times *Halimicistus* in Seattle, WA, from 1949 to 1953 and found significant variations in

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.4047	acre(s)	ha	2.4711
0.3048	ft	m	3.2808
2.54	inch(es)	cm	0.3937
28.3495	oz	g	0.0353
(°F - 32) ÷ 1.8	°F	°C	(1.8 × °C) + 32

hardiness and ornamental qualities. Mundie (2001) evaluated *Cistus* in northern England from 1997 to 2001. However, most research on response of rockroses to winter conditions has focused on physiological responses of the plants to cool winter temperatures, not necessarily their specific cold hardiness. Various studies have demonstrated changes in chlorophyll content (Nunez-Olivera et al., 1994), pigments and antioxidants (Garcia-Plazaola et al., 2000), and photosynthesis (Oliveira and Penuelas, 2004). These studies do not typically relate these changes to hardiness, although in a study of physiological responses of eight Mediterranean shrubs to winter stress, Varone and Gratani (2007) found *Cistus incanus* (synonym = *Cistus creticus*) to be one of the least cold hardy and suggested that in addition to summer drought, winter temperatures might represent an additional limitation to Mediterranean species productivity. The objective of our study was to determine the growth and relative hardiness of rockrose species and cultivars under western Oregon conditions.

Materials and methods

Species, selections, and cultivars of rockroses were from two main sources. A total of 98 species and cultivars was obtained from nursery sources in California or from the United Kingdom. Fifteen of these were obtained as stock plants from nurseries in California in Sept. 2003. These plants were grown on through early October, at which time 4-inch-long tip cuttings were taken. Unrooted tip

cuttings of the other 83 plants were obtained from the National Collection of *Cistus* and *Halimium* held by R. Page in Leeds, UK, in Oct. 2003. These cuttings, and those from the stock plants, were stuck in early Oct. 2003 in 4 perlite:1 peatmoss (v/v) mix at the Oregon State University (OSU) North Willamette Research and Extension Center (NWREC) in Aurora. Cuttings were rooted in a polyethylene-covered hoop house, using bottom heat, but no mist. Five cultivars failed to root in sufficient number and were not included in the evaluation. Rooted cuttings were potted into 6-inch square nursery pots in Mar. 2004 and were top-dressed with 10 g of 18N-3.5P-6.6K controlled-release fertilizer (Apex® Evergreen; Pursell Technologies, Sylacauga, AL). Plants were maintained until planting in the evaluation site on 22 June.

The evaluation site was a south-facing slope at NWREC (lat. 45°57'N, long. 122°45'W, 155 ft elevation). The evaluation site was ≈0.5 acre. The soil series was a Willamette silt loam. Before planting, the site was subsoiled to a depth of 1 ft, and was then disked to break up and level the soil. The trial was divided into 12 rows 185 ft long, spaced 10 ft apart, orientated north to south. Individual plants were randomly assigned to rows and planted at an in-row spacing of 5 ft. Plants were planted in a completely randomized design with four replicates.

After planting, plants were watered in by hand, and then received periodic overhead water sufficient to keep the top 6 inches of soil moist through the end of Aug. 2004. Plants received no supplemental irrigation after this time. No fertilizer was applied at planting or thereafter for the duration of the trial. Plants were not pruned. Because irrigation was not provided in summer, the plot remained mostly weed-free, and weed management involved occasional hand weeding. The exception to this was a one-time spot application of glyphosate (Roundup; Monsanto, St. Louis) to control a crabgrass (*Digitaria* spp.) infestation in Summer 2004 caused by the irrigation during establishment.

Data collected included plant height and width, flowering season, cold hardiness evaluation, and plant form and foliage quality. Plant height (ground level to tallest shoot) and width (mean of the widest diameter

and width perpendicular to the widest diameter) were measured at establishment and again each year in fall. Flowering was evaluated by rating bloom on the plants weekly on a 0 to 5 scale. A rating of "0" was given to plants with no open flowers; "1" meant at least one open to less than 20% bloom; "2" meant 20% to less than 40% bloom; "3" meant 40% to less than 60% bloom; "4" meant 60% to less than 80% bloom; "5" meant 80% bloom or greater and was reserved for shrubs whose foliage was obscured by bloom.

Cold hardiness evaluations were done in early spring after mild weather allowed for full symptom development from any prior cold injury. Data were collected only in Apr. 2006 and in Apr. 2009, as there was no apparent damage following Winter 2004–05, 2006–07, and 2007–08. Cold damage was rated on a 0 to 5 scale, adapted from Lonard and Judd (1991) with "0" indicating no damage; "1" meant minor leaf damage (browning); "2" meant leaf and stem damage restricted to the exterior 30% of the plant; "3" meant leaf and stem damage to the exterior 60% of the plant; "4" meant the plant was killed to the crown with resprouting; and "5" indicated the plant was dead. Regional weather data were obtained from the U.S. Bureau of Reclamation Agrimet weather station at NWREC, located ≈400 ft from the trial site (U.S. Bureau of Reclamation, 2009).

Foliage quality and overall plant form were rated on a 1 to 5 scale, with "1" meaning a plant with less than 20% of a full canopy, indicating a sparsely foliated plant with poor form and dieback; "2" meant 20% to 40% canopy, with foliage thinly distributed over the canopy and some dieback; "3" meant 40% to 60% canopy, with foliage well distributed on the plant and minimal dieback; "4" meant 60% to 80% canopy, a well-shaped plant with a dense canopy and minor foliage discoloration or dieback; "5" meant greater than 80% canopy, essentially a flawless canopy with dense foliage.

Growth, cold damage, and foliage data were summarized by calculating the mean and standard deviation for each accession. Flowering charts were generated in Excel (Microsoft, Redmond, WA) as floating bar charts, indicating the dates on which average flower ratings exceeded the value 2.

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Results and discussion

A total of 372 rockroses were planted and these grew and filled in the rows by 2007. There were some significant plant losses over the course of the trial affecting some cultivars in particular. All plants of *C. ‘Enigma’* died shortly after planting, a fact we attributed to the poor rooting and consequent small size of the plants at planting. Other than the loss of all plants of this cultivar, other losses occurred sporadically throughout the evaluation from undetermined causes. Among the other *Cistus*, three ‘Silver Ghost’ as well as two each of *Cistus* \times *pauranthus*, *Cistus albidus* var. *albus*, *Cistus* \times *argenteus* ‘Silver Pink’, and *Cistus* \times *dansereau* ‘Jenkyn Place’ were lost, as well as individual plants of *Cistus heterophyllus*, *Cistus* \times *ralletii*, *Cistus* \times *aguilarii*, *Cistus monspeliensis*, *C. dansereau* ‘Decumbens’, *Cistus* ‘Victor Reiter’, and *Cistus* \times *heterocalyx* ‘Chelsea Bonnet’. Among the *Halimium*, two *Halimium atriplicifolium* and one each of *Halimium* \times *pauanum* and *Halimium* ‘Susan’ died over the course of the evaluation.

Although aphids (Aphididae) are known to be a pest of *Cistus*, no serious infestations were observed. The only noticeable disease problem was sooty mold (Capnodiales), which was observed on the foliage of some *Cistus* cultivars in spring, being especially noticeable on the previous season leaves as the bright green new foliage was emerging. The sooty mold did not appear to be growing

on honeydew caused by an aphid infestation; instead, it was apparently using the labdanum that certain plants produce in abundance. The affected plants were *Cistus* \times *ledon*, *C.* \times *purpureus*, *Cistus ladanifer* var. *sulcatus* forma *bicolor*, *C. ladanifer* cultivars (including Bashful and Blanche), *Cistus* \times *cyprius* ‘Troubadour’, and *Cistus* \times *stenophyllus*. Despite this, most of the affected plants continued to grow and flower well and this could be regarded as more of an aesthetic problem. A search of the literature did not reveal any prior research linking labdanum with sooty mold.

PLANT GROWTH. By Fall 2006, many plants had filled their allocated space and some were beginning to grow into one another (Tables 1–4). There was a significant effect ($P < 0.0001$) of cultivar on height and width. The results show that rockroses have a wide range of vigor and growth habit and can be divided into three broad groups based on growth habit: 1) upright shrubs with similar height and width that exceeds 100 cm; 2) mounding shrubs that are wide spreading with heights between 80 and 130 cm and widths about twice that; and 3) low spreading groundcovers with heights not exceeding 80 cm and twice that in width. In general, white, blotched-flowered *Cistus* tend to be the most vigorous, followed by white-flowered, then pink-flowered plants. Because of the predominance of low-growing

plants, the yellow-flowered *Halimium* tend to be the most diminutive overall.

Of the upright shrubs, the tallest in the evaluation was *Cistus* \times *verguinii* ‘Salabert’, which formed a very open V-shaped shrub and produced many ascending, sparsely foliated stems (Table 1). Somewhat shorter than this, but forming a much denser shrub, was *C. xaguilarii* (often erroneously sold in North America as *Cistus* ‘Blanche’), which has thick, wavy-edged leaves and from an ornamental standpoint is far superior to *C. xverguinii* (Table 2). Slightly smaller than this were ‘Bennett’s White’, ‘Blanche’, and ‘Troubadour’, all of which form well-shaped shrubs, although as mentioned previously, sooty mold did mar the foliage of the latter two cultivars. The tallest of the pink-flowered *Cistus*, ‘Victor Reiter’, was only slightly smaller than these three (Table 3). The tallest of the *Halimium* was *H. xpauanum* by a considerable margin, followed by *Halimium* \times *santae* and *Halimium halimifolium* (Table 4). The majority of *Halimium* are low-growing plants.

Among the mounding, spreading shrubs, the most vigorous were *Cistus* \times *laxus* ‘Snow White’, *Cistus* \times *oblongifolius*, *Cistus* ‘Snow Fire’, *Cistus* ‘Jessamy Beauty’, *Cistus* ‘Gordon Cooper’, and *Cistus* ‘Ann Baker’, which vary somewhat in height but which typically form broad, dense domes (Tables 1 and 2). These cultivars would all be effective as tall groundcovers for

Table 1. Plant size, foliage rating, and cold injury rating for blotched, white-flowered rockrose evaluated in Aurora, OR, from 2004–09. Mean of four replications.

Plant name	Plant size		Foliage rating		Cold injury	
	[mean \pm SD (cm)] ^z		[mean \pm SD (1–5 scale)] ^y		[mean \pm SD (0–5 scale)] ^x	
	Ht	Width	2006	2007	2006	2009
<i>Cistus</i> ‘Ann Baker’	113 \pm 10	196 \pm 22	4.3 \pm 0.5	3.4 \pm 0.5	0.5 \pm 0.5	0.8 \pm 1.4
<i>Cistus</i> ‘Gordon Cooper’	104 \pm 18	212 \pm 18	4.8 \pm 0.5	4.5 \pm 0.6	0.8 \pm 0.5	0.5 \pm 0.6
<i>Cistus</i> ‘Jessamy Beauty’	128 \pm 10	205 \pm 17	3.8 \pm 0.5	2.8 \pm 0.5	0.5 \pm 0.6	1.0 \pm 0.8
<i>Cistus ladanifer</i> var. <i>sulcatus</i> forma <i>bicolor</i>	125 \pm 30	116 \pm 29	2.8 \pm 0.5	3.0 \pm 0.0	0.0 \pm 0.0	0.5 \pm 0.6
<i>Cistus</i> ‘Ruby Cluster’	110 \pm 8	179 \pm 16	4.8 \pm 0.5	4.3 \pm 0.5	0.3 \pm 0.5	1.3 \pm 0.5
<i>Cistus</i> ‘Snow Fire’	105 \pm 17	216 \pm 7	4.9 \pm 0.4	4.4 \pm 0.7	0.4 \pm 0.5	0.1 \pm 0.4
<i>Cistus</i> \times <i>aguilarii</i> ‘Maculatus’	138 \pm 4	176 \pm 9	3.0 \pm 0.0	3.0 \pm 0.0	0.0 \pm 0.0	1.0 \pm 0.0
<i>Cistus</i> \times <i>cyprius</i> ‘Troubadour’	154 \pm 13	179 \pm 21	3.0 \pm 0.0	3.0 \pm 0.8	0.0 \pm 0.0	1.3 \pm 0.5
<i>Cistus</i> \times <i>dansereau</i> ‘Decumbens’	78 \pm 5	136 \pm 9	4.0 \pm 0.0	3.3 \pm 0.5	0.3 \pm 0.5	1.0 \pm 0.0
<i>C. xdansereau</i> ‘Jenkyn Place’	134 \pm 11	181 \pm 14	4.8 \pm 0.5	2.8 \pm 0.8	0.0 \pm 0.0	1.7 \pm 1.6
<i>Cistus</i> \times <i>stenophyllus</i>	134 \pm 16	144 \pm 27	3.3 \pm 0.5	2.8 \pm 0.5	0.5 \pm 0.6	1.0 \pm 0.0
<i>Cistus</i> \times <i>verguinii</i> ‘Salabert’	210 \pm 22	210 \pm 26	3.0 \pm 0.0	3.0 \pm 0.0	0.3 \pm 0.6	1.7 \pm 0.6
\times <i>Halimiocistus wintonensis</i>	76 \pm 11	136 \pm 17	3.9 \pm 0.7	3.0 \pm 0.0	0.3 \pm 0.5	1.7 \pm 0.5

^zPlant size measured in Sept. 2006 after 2 years of growth; 1 cm = 0.3937 inch.

^y1 = sparse foliage and dieback, 5 = full canopy with no irregularities.

^x0 = no injury, 5 = complete plant death.

Table 2. Plant size, foliage rating, and cold injury rating for white-flowered rockrose evaluated in Aurora, OR, from 2004–09. Mean of four replications.

Plant name	Plant size		Foliage rating		Cold injury	
	[mean ± SD (cm)] ^z		[mean ± SD (1–5 scale)] ^y		[mean ± SD (0–5 scale)] ^x	
	Ht	Width	2006	2007	2006	2009
<i>Cistus albidus</i> forma <i>albus</i>	83 ± 18	106 ± 27	3.0 ± 0.0	2.5 ± 0.7	2.0 ± 0.0	2.0 ± 1.4
<i>Cistus creticus</i> ssp. <i>creticus</i> ‘Tania Compton’	74 ± 8	101 ± 8	3.5 ± 0.6	3.0 ± 0.0	2.3 ± 0.5	2.8 ± 0.5
<i>Cistus inflatus</i>	73 ± 10	141 ± 21	4.8 ± 0.5	4.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0
<i>Cistus ladanifer</i> ‘Bashful’	98 ± 10	134 ± 9	4.0 ± 0.0	3.8 ± 0.5	0.0 ± 0.0	1.0 ± 0.0
<i>C. ladanifer</i> ‘Blanche’	154 ± 31	149 ± 36	3.3 ± 0.5	3.5 ± 0.6	0.0 ± 0.0	0.8 ± 0.5
<i>C. ladanifer</i> var. <i>petiolaris</i> ‘Bennett’s White’	165 ± 7	160 ± 14	3.0 ± 0.0	2.5 ± 0.7	0.0 ± 0.0	1.0 ± 0.0
<i>Cistus libanotis</i> ‘Major’	109 ± 10	135 ± 22	3.3 ± 0.5	2.5 ± 0.6	0.0 ± 0.0	0.3 ± 0.5
<i>Cistus monspeliensis</i>	111 ± 13	143 ± 19	3.5 ± 0.8	2.6 ± 0.7	1.3 ± 1.0	0.9 ± 0.7
<i>C. monspeliensis</i> ‘Vicar’s Mead’	116 ± 11	132 ± 28	3.3 ± 0.5	3.3 ± 0.5	1.0 ± 0.8	1.0 ± 0.0
<i>Cistus populifolius</i> ssp. <i>Major</i>	101 ± 10	151 ± 23	4.5 ± 0.6	3.8 ± 0.5	0.3 ± 0.5	0.3 ± 0.5
<i>Cistus salviifolius</i> ‘Gold Star’	106 ± 27	186 ± 11	3.8 ± 0.5	4.8 ± 0.5	1.0 ± 0.0	1.0 ± 0.0
<i>C. salviifolius</i> ‘Prostratus’	45 ± 12	128 ± 22	4.8 ± 0.5	3.5 ± 0.6	1.3 ± 1.0	1.3 ± 1.0
<i>Cistus</i> × <i>aguilarii</i>	176 ± 18	185 ± 18	3.9 ± 0.4	3.7 ± 0.5	0.0 ± 0.0	0.9 ± 0.4
<i>Cistus</i> × <i>argenteus</i> ‘Paper Moon’	125 ± 21	120 ± 11	2.5 ± 0.7	2.0 ± 0.0	0.0 ± 0.0	0.5 ± 0.7
<i>C. × argenteus</i> ‘Silver Ghost’	69 ± 6	79 ± 7	2.0 ± 0.0	1.0 ± 0.0	0.0 ± 0.0	5.0 ± 0.0
<i>Cistus</i> × <i>canescens</i> ‘Albus’	103 ± 6	123 ± 12	3.7 ± 1.1	3.3 ± 0.6	0.0 ± 0.0	0.7 ± 1.1
<i>Cistus</i> × <i>cyprinus</i> var. <i>ellipticus</i> ‘Elma’	130 ± 8	169 ± 13	3.0 ± 0.0	2.8 ± 0.5	0.3 ± 0.5	0.3 ± 0.5
<i>Cistus</i> × <i>dansereaui</i> ‘Portmeirion’	104 ± 7	153 ± 10	4.3 ± 0.5	3.3 ± 0.5	0.0 ± 0.0	0.3 ± 0.5
<i>Cistus</i> × <i>dubius</i> (costei group)	90 ± 4	161 ± 5	4.5 ± 0.6	3.0 ± 0.0	0.3 ± 0.5	0.8 ± 0.5
<i>Cistus</i> × <i>florentinus</i> ‘Fontfroide’	131 ± 13	158 ± 9	4.3 ± 1.0	3.3 ± 1.0	1.0 ± 0.0	0.5 ± 0.5
<i>C. × florentinus</i> ‘Tramontane’	63 ± 16	156 ± 20	5.0 ± 0.0	3.8 ± 0.5	0.8 ± 0.5	0.0 ± 0.0
<i>Cistus</i> × <i>heterocalyx</i> ‘Chelsea Bonnet’	109 ± 23	162 ± 31	3.1 ± 0.6	2.1 ± 0.7	1.1 ± 0.6	1.6 ± 1.1
<i>Cistus</i> × <i>hybridus</i>	99 ± 14	179 ± 9	3.5 ± 0.6	3.0 ± 0.0	1.0 ± 0.0	0.3 ± 0.5
<i>Cistus</i> × <i>laxus</i>	88 ± 5	189 ± 44	5.0 ± 0.0	5.0 ± 0.0	0.5 ± 0.6	0.3 ± 0.5
<i>C. × laxus</i> ‘Snow White’	124 ± 3	228 ± 21	5.0 ± 0.0	4.3 ± 1.0	0.0 ± 0.0	0.8 ± 0.5
<i>Cistus</i> × <i>ledon</i>	91 ± 9	126 ± 15	4.3 ± 0.5	3.3 ± 0.5	0.0 ± 0.0	0.5 ± 0.6
<i>Cistus</i> × <i>nigricans</i>	109 ± 10	186 ± 13	4.0 ± 0.0	3.0 ± 0.0	0.0 ± 0.0	0.8 ± 0.5
<i>Cistus</i> × <i>oblongifolius</i>	115 ± 14	208 ± 15	4.5 ± 0.6	3.5 ± 1.0	0.5 ± 0.6	0.3 ± 0.5
<i>Cistus</i> × <i>obtusifolius</i>	71 ± 3	156 ± 4	5.0 ± 0.0	5.0 ± 0.0	1.0 ± 0.0	0.3 ± 0.5
<i>Cistus</i> × <i>platysepalus</i>	108 ± 32	160 ± 30	4.3 ± 1.5	3.5 ± 1.0	0.0 ± 0.0	0.0 ± 0.0
<i>Cistus</i> × <i>stenophyllus</i> forma <i>albiflorus</i>	115 ± 21	131 ± 21	3.0 ± 0.0	2.8 ± 0.5	0.5 ± 0.6	0.8 ± 0.5
<i>Cistus</i> × <i>verguinii</i> forma <i>albiflorus</i>	106 ± 18	189 ± 23	3.3 ± 0.5	3.0 ± 0.0	0.3 ± 0.5	1.0 ± 0.0
<i>Halimium umbellatum</i> ssp. <i>umbellatum</i>	49 ± 12	137 ± 20	4.0 ± 0.0	3.8 ± 0.5	0.0 ± 0.0	0.0 ± 0.0
× <i>Halimiocistus</i> ‘Ingwersenii’	50 ± 4	116 ± 13	5.0 ± 0.0	3.5 ± 0.6	0.0 ± 0.0	0.0 ± 0.0
× <i>Halimiocistus sabucii</i>	29 ± 10	127 ± 24	4.4 ± 0.5	4.1 ± 0.6	0.0 ± 0.0	0.1 ± 0.4

^zPlant size measured in Sept. 2006 after 2 years of growth; 1 cm = 0.3937 inch.

^y1 = sparse foliage and dieback, 5 = full canopy with no irregularities.

^x0 = no injury, 5 = complete plant death.

large areas. The most vigorous pink-flowered selection of this group was *C. × purpureus*. Among *Halimium*, the largest plants were *Halimium lasianthum* ‘Hannay Silver’, and *Halimium* ‘Sarah’. The former is the most vigorous cultivar of *H. lasianthum*.

The lower-growing groundcovers in the trial generally form dense mats of foliage between 50 and 80 cm tall, with widths approaching three times their height. Many of these would make good small- to medium-scale groundcovers for dry areas. The tallest is ‘Sunset’, which is a fairly common cultivar. Somewhat lower-growing than this are *Cistus* ‘Grayswood Pink’, *Cistus × florentinus*

‘Tramontane’ *Cistus × gardianus*, and *H. lasianthum* ‘Sandling’. The other *H. lasianthum* cultivars in the evaluation are somewhat lower-growing than these, although all of the aforementioned cultivars form dense, wide-spreading groundcovers. The lowest-growing plant in the entire evaluation was × *Halimiocistus sabucii*, which was less than 30 cm tall after 3 years (Table 2).

COLD HARDINESS. Plants were rated for cold damage in Apr. 2006 and Apr. 2009 (Tables 1–4). The lowest minimum winter temperatures from 2004–09 occurred in Dec. 2005 and Feb. 2006, and in Dec. 2008. The low temperatures on Dec. 15 and

16, 2005 were 20 and 19 °F, respectively. A relatively late freeze occurred on 20 Feb. 2006, when the temperature dropped to 20 °F. The coldest temperatures over the duration of the evaluation occurred on 16 Dec. and 17 Dec. 2008, when the minimum temperatures were 17 °F and 19 °F, respectively.

The same cultivars tended to show significant damage when evaluated in spring following these events. These include *C. creticus* ‘Tania Compton’, *C. × paورانthus*, *C. albidus* forma *albus*, and *H. atriplicifolium*. ‘Tania Compton’ was a selection made at relatively low elevation near Meskla, Crete, and has a reputation as being

Table 3. Plant size, foliage rating, and cold injury rating for pink-flowered rockrose evaluated in Aurora, OR, from 2004–09. Mean of four replications.

Plant name	Plant size		Foliage rating		Cold injury	
	[mean ± SD (cm)] ^z		[mean ± SD (1–5 scale)] ^y		[mean ± SD (0–5 scale)] ^x	
	Ht	Width	2006	2007	2006	2009
<i>Cistus creticus</i> ssp. <i>creticus</i> ‘Lasithi’	38 ± 3	109 ± 10	4.0 ± 0.0	3.5 ± 0.6	0.0 ± 0.0	1.5 ± 1.0
<i>C. creticus</i> ‘Lasca Select’	70 ± 9	148 ± 8	3.5 ± 0.6	3.0 ± 0.0	0.0 ± 0.0	0.5 ± 0.6
<i>Cistus crispus</i>	55 ± 11	119 ± 21	3.5 ± 0.6	3.5 ± 0.6	0.3 ± 0.5	2.0 ± 1.2
<i>C. crispus</i> ‘Decanso’	31 ± 3	116 ± 22	4.0 ± 0.0	3.0 ± 1.2	0.8 ± 0.5	2.0 ± 0.8
<i>Cistus</i> ‘Doris Hibberson’	76 ± 8	93 ± 14	3.3 ± 0.5	2.8 ± 0.5	0.0 ± 0.0	1.0 ± 0.0
<i>Cistus</i> ‘Grayswood Pink’	64 ± 7	154 ± 14	4.3 ± 0.6	3.8 ± 0.6	0.0 ± 0.0	0.0 ± 0.0
<i>Cistus heterophyllus</i>	80 ± 17	124 ± 19	3.3 ± 0.6	2.7 ± 0.6	0.0 ± 0.0	1.0 ± 0.0
<i>Cistus</i> ‘Bicolor Pink’	54 ± 5	152 ± 14	4.3 ± 0.5	4.0 ± 0.8	0.0 ± 0.0	0.0 ± 0.0
<i>Cistus</i> ‘Santa Cruz’	74 ± 8	101 ± 10	3.3 ± 0.5	3.0 ± 0.0	0.8 ± 0.5	0.0 ± 0.0
<i>Cistus</i> ‘Victor Reiter’	142 ± 11	161 ± 28	3.0 ± 0.5	2.1 ± 0.4	0.0 ± 0.0	0.6 ± 0.5
<i>Cistus</i> × <i>argenteus</i> ‘Blushing Peggy Sammons’	132 ± 5	175 ± 23	3.0 ± 0.0	2.5 ± 1.0	0.0 ± 0.0	1.0 ± 0.8
<i>C. × argenteus</i> ‘Peggy Sammons’	115 ± 30	136 ± 29	3.0 ± 0.8	1.8 ± 1.0	0.3 ± 0.5	2.0 ± 1.4
<i>C. × argenteus</i> ‘Silver Pink’	64 ± 5	95 ± 19	2.3 ± 0.5	1.3 ± 0.5	0.0 ± 0.0	5.0 ± 0.0
<i>C. × argenteus</i> ‘Stripey’	130 ± 0	167 ± 27	3.0 ± 0.0	2.0 ± 0.0	0.3 ± 0.5	1.5 ± 0.6
<i>Cistus</i> × <i>bornetianus</i> ‘Jester’	98 ± 12	143 ± 26	3.3 ± 0.5	2.3 ± 0.5	0.3 ± 0.5	1.5 ± 1.0
<i>Cistus</i> × <i>canescens</i>	83 ± 17	111 ± 14	4.0 ± 0.0	3.3 ± 0.5	0.0 ± 0.0	0.0 ± 0.0
<i>Cistus. × crispatus</i> ‘Warley Rose’	60 ± 8	124 ± 14	3.8 ± 0.5	3.0 ± 0.0	0.3 ± 0.5	0.0 ± 0.0
<i>Cistus</i> × <i>fernandesiae</i> ‘Anne Palmer’	96 ± 19	125 ± 27	3.0 ± 0.0	2.3 ± 0.5	1.0 ± 0.0	3.3 ± 2.1
<i>Cistus</i> × <i>gardianus</i>	66 ± 9	163 ± 12	4.0 ± 0.0	3.8 ± 0.5	0.0 ± 0.0	0.5 ± 0.6
<i>Cistus</i> × <i>lucasii</i>	93 ± 3	155 ± 10	3.3 ± 0.6	2.7 ± 0.6	0.7 ± 0.6	2.7 ± 0.6
<i>Cistus</i> × <i>mesoensis</i>	70 ± 0	127 ± 5	4.0 ± 0.0	3.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0
<i>Cistus</i> × <i>pagei</i>	99 ± 10	132 ± 25	3.8 ± 0.5	2.8 ± 0.5	0.0 ± 0.0	0.5 ± 0.6
<i>Cistus</i> × <i>pauranthus</i>	100 ± 0	152 ± 7	2.0 ± 1.7	3.0 ± 0.0	2.3 ± 0.5	4.0 ± 0.0
<i>Cistus</i> × <i>pulverulentus</i> ‘Sunset’	78 ± 5	144 ± 8	4.0 ± 0.0	3.0 ± 0.0	0.5 ± 0.6	1.3 ± 1.5
<i>Cistus</i> × <i>purpureus</i>	108 ± 10	175 ± 21	4.0 ± 0.0	3.3 ± 0.5	0.3 ± 0.5	1.3 ± 0.5
<i>C. × purpureus</i> nothoforma <i>holorbodos</i>	124 ± 9	141 ± 8	3.0 ± 0.0	2.0 ± 0.0	0.5 ± 0.6	1.0 ± 0.0
<i>C. × purpureus</i> nothoforma <i>stictus</i>	134 ± 5	153 ± 18	3.0 ± 0.0	2.3 ± 0.5	1.0 ± 0.0	2.0 ± 0.8
<i>Cistus</i> × <i>ralletii</i>	113 ± 21	144 ± 9	4.0 ± 1.0	2.7 ± 0.6	1.0 ± 0.0	2.5 ± 0.7
<i>Cistus</i> × <i>rodiaei</i> ‘Jessica’	56 ± 11	66 ± 3	2.8 ± 0.5	2.0 ± 0.0	0.0 ± 0.0	5.0 ± 0.0
<i>Cistus</i> × <i>skanbergii</i>	98 ± 17	159 ± 42	3.9 ± 0.6	3.0 ± 0.0	0.9 ± 0.6	0.4 ± 0.5

^zPlant size measured in Sept. 2006 after 2 years of growth; 1 cm = 0.3937 inch.

^y1 = sparse foliage and dieback, 5 = full canopy with no irregularities.

^x0 = no injury, 5 = complete plant death.

less hardy. In contrast, ‘Lasithi’ is another cultivar of *C. creticus* collected in Crete, but on the Lasithi Plateau, which is considerably higher in elevation and may account for its greater hardiness (Tables 2 and 3). *C. × pauranthus* was originally selected in the Akamas, Cyprus, which is within a few miles of the Mediterranean and less than 500 ft in elevation and so originated in one of the mildest climates in the region. *C. albidus* forma *albus* is a white-flowered variant of *C. albidus*, which is reputed to be one of the shorter-lived species of the genus. Its short-lived reputation may be partly due to its susceptibility to cold injury. Several other cultivars, such as Silver Ghost, Silver Pink, Anne Palmer, Jessica, and *C. × purpureus* forma *stictus*, developed generally poor form and reduced as the evaluation progressed and may have predisposed them to cold

injury in 2009 (Table 3). *H. atriplicifolium* also has a reputation for tenderness and displayed poor foliage and vigor as well (Table 4).

Other species or hybrids that exhibited injury, particularly in 2009, included *Cistus* × *lucasii* and *C. × ralletii*. Both of these hybrids have tender Canary Island species in their parentage. Of the remaining plants, most exhibited good hardiness during both cold events. The industry standards, *C. × hybridus* and *C. × purpureus*, showed relatively minor foliar damage in 2006 and 2009.

PLANT FORM. Evaluations of foliage quality and plant form were undertaken in response to variations in plant quality that emerged as the trial progressed. Some cultivars that were showy in bloom would become sparse and exhibit dieback by the end of the summer. Leaf drop is a normal

response to summer drought in malacophyllous shrubs like rockroses, and the degree of defoliation in response to drought stress varies within Cistaceae (Zunzunegui et al., 2002, 2005). The appearance of some *Cistus* with bare stems and leaves remaining primarily at the shoot tips is typical of their strategy for survival in the wild, even if this detracts from their ornamental appeal (Acosta et al., 1997). The loss of leaf area to drought stress in summer has been shown to be as high as 61%, with the remaining leaves subject to photoinhibition damage (Werner et al., 1999). Some *Cistus*, such as *C. albidus*, have been shown to lose not only leaves, but stem and root tissues as well (Sanchez-Blanco et al., 2002). These responses may allow the plant to persist from one year to the next, but render them poor specimens in the landscape.

Table 4. Plant size, foliage rating, and cold injury rating for yellow-flowered rockrose grown in Aurora, OR, from 2004–09. Mean of four replications.

Plant name	Plant size		Foliage rating		Cold injury	
	[mean ± SD (cm)] ^z		[mean ± SD (1–5 scale)] ^y		[mean ± SD (0–5 scale)] ^x	
	Ht	Width	2006	2007	2006	2009
<i>Halimium atriplicifolium</i>	64 ± 14	70 ± 16	2.1 ± 0.6	1.9 ± 0.4	1.5 ± 0.8	2.1 ± 0.6
<i>Halimium calycinum</i>	46 ± 5	106 ± 11	4.3 ± 0.5	3.5 ± 0.6	0.5 ± 1.0	0.0 ± 0.0
<i>H. calycinum</i> (CA clone)	66 ± 13	138 ± 28	3.5 ± 0.6	2.8 ± 0.5	0.3 ± 0.5	2.3 ± 1.9
<i>Halimium halimifolium</i> forma <i>maculatum</i>	93 ± 21	138 ± 13	3.0 ± 0.0	2.3 ± 0.6	0.3 ± 0.6	2.0 ± 0.0
<i>Halimium lasianthum</i>	58 ± 8	170 ± 10	4.3 ± 0.8	3.8 ± 0.8	0.0 ± 0.0	0.0 ± 0.0
<i>H. lasianthum</i> ‘Concolor’	60 ± 14	103 ± 4	4.0 ± 0.0	3.5 ± 0.7	0.0 ± 0.0	0.0 ± 0.0
<i>H. lasianthum</i> ‘Formosum’	50 ± 10	154 ± 18	4.0 ± 0.8	3.5 ± 0.6	0.0 ± 0.0	0.0 ± 0.0
<i>H. lasianthum</i> ‘Hannay Silver’	126 ± 9	158 ± 18	4.0 ± 0.8	3.3 ± 0.5	0.0 ± 0.0	0.5 ± 0.6
<i>H. lasianthum</i> ‘Sandling’	66 ± 8	151 ± 12	4.5 ± 0.6	4.0 ± 0.0	0.0 ± 0.0	0.3 ± 0.5
<i>H. lasianthum</i> ssp. <i>alyssoides</i> ‘Farrall’	58 ± 10	110 ± 17	3.3 ± 0.5	3.3 ± 0.5	0.0 ± 0.0	0.0 ± 0.0
<i>Halimium ocyroides</i>	86 ± 8	166 ± 44	3.5 ± 0.5	2.5 ± 0.6	0.0 ± 0.0	1.0 ± 1.2
<i>Halimium</i> ‘Sarah’	101 ± 15	175 ± 19	4.3 ± 0.5	3.3 ± 0.5	0.0 ± 0.0	0.5 ± 1.0
<i>Halimium</i> ‘Susan’	45 ± 5	118 ± 24	4.3 ± 0.6	24.0 ± 0.0	0.0 ± 0.0	1.3 ± 1.2
<i>Halimium</i> × <i>pauanum</i>	151 ± 15	154 ± 20	4.0 ± 0.0	4.3 ± 0.6	0.0 ± 0.0	0.3 ± 0.6
<i>Halimium</i> × <i>santae</i>	133 ± 5	167 ± 27	3.3 ± 0.5	2.3 ± 1.0	0.0 ± 0.0	2.0 ± 1.4

^zPlant size measured in Sept. 2006 after 2 years of growth; 1 cm = 0.3937 inch.

^y1 = sparse foliage and dieback, 5 = full canopy with no irregularities.

^x0 = no injury, 5 = complete plant death.

Foliage and form generally declined from 2006 to 2007 (Tables 1–4), but this may be partly the result of the cold injury suffered in Feb. 2006. Those plants that received high ratings generally continued to look good through the end of the evaluation in 2009. The best plants overall were *Cistus salviifolius* ‘Gold Star’, *C. ×laxus*, and *Cistus ×obtusifolius*, all of which exhibited near-flawless foliage, even at the end of the summer drought in 2007 (Table 2). Rated only slightly lower than these were *Cistus* ‘Gordon Cooper’ and *Cistus* ‘Snow Fire’, both of which have white flowers with blotched petals (Table 1). In general, pink-flowered rockroses seem to display lower foliage quality than white or white-blotched rockroses. Of the former, those with the highest ratings were *Cistus* ‘Grayswood Pink’, ‘Bicolor Pink’, and *C. ×gardianus*, all of which form dense, low-growing mats of foliage and which make excellent ground-covers (Table 3). Among the *Halimium*, most of the selections of *H. lasianthum* stood out as having good foliage quality, particularly ‘Sandling’ (Table 4). Others that retained good appearance included ‘Susan’ and *H. ×pauanum*, which as a large, upright-growing plant, was far superior in quality to *H. ×santae*.

FLOWERING. As might be expected with such a large number of

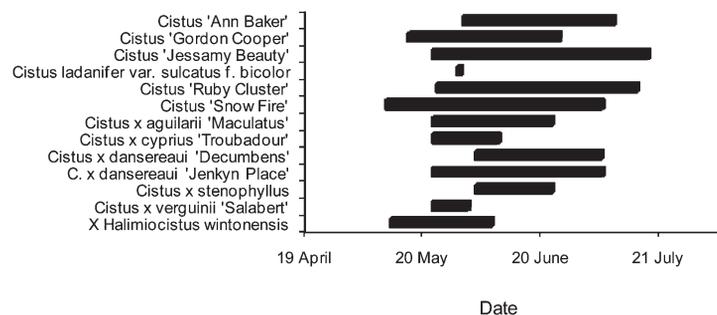


Fig. 1. Average flowering time and duration of blotched, white-flowered rockrose grown in a landscape evaluation at Aurora, OR, in 2005–06. Plants were considered in bloom when several open flowers were distributed through the shrub.

species and cultivars, the flowering characteristics of these plants were diverse. The effective flowering period for the three genera is late April to late July (Figs. 1–4). The earliest plant to bloom was *Halimium calycinum*, particularly the accession from California, which commenced blooming in the third week of April (Fig. 4), at about the same time as *Halimium umbellatum* ssp. *umbellatum* (Fig. 2). In the first week of May, other early-blooming cultivars such as *Cistus* ‘Grayswood Pink’ and *Cistus* ‘Bicolor Pink’ began flowering (Fig. 3), followed by *Cistus* ‘Snow Fire’ and ×*Halimicistus wintonensis* (Fig. 1). The majority of flowering for these genera occurs from mid-May through the end of June. A few cultivars

continue flowering quite strongly well into July, including *H. ×pauanum* and *H. halimifolium* forma *maculatum* (Fig. 4), *Cistus inflatus* (Fig. 2), *Cistus* × *pulverulentus* ‘Sunset’ (Fig. 3), *Cistus* ‘Ruby Cluster’, and *Cistus* ‘Jessamy Beauty’ (Fig. 1).

The duration of the flowering period varied dramatically. The shortest bloom duration was that of *C. ladanifer* var. *sulcatus* forma *bicolor*, which flowered for only a few days (Fig. 1). A number of plants flowered for 10 d or less, including *C. ×verguinii*, *C. ×argenteus* cultivars Paper Moon, Peggy Sammons, Blushing Peggy Sammons, and Stripey; *C. salviifolius* ‘Gold Star’, *Cistus libanotis* ‘Major’, *C. ladanifer* ‘Blanche’, *C. ×cyprius* ‘Elma’, and *Cistus ×rodiae*

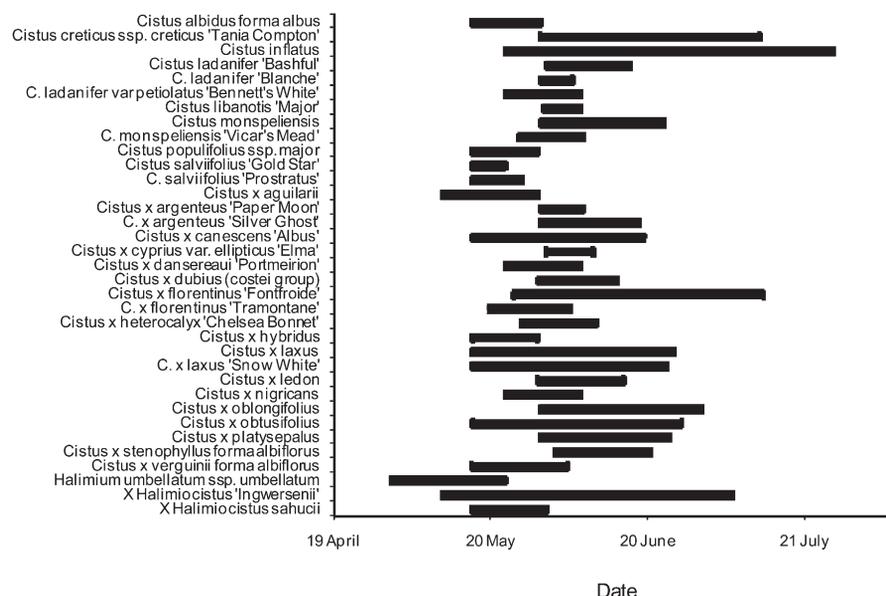


Fig. 2. Average flowering time and duration of white-flowered rockrose grown in a landscape evaluation at Aurora, OR, in 2005–06. Plants were considered in bloom when several open flowers were distributed through the shrub.

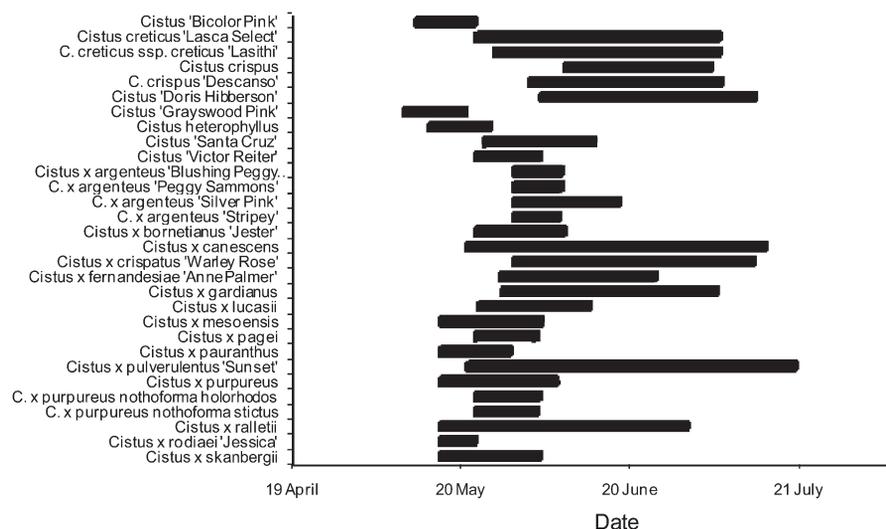


Fig. 3. Average flowering time and duration of pink-flowered rockrose grown in a landscape evaluation at Aurora, OR, in 2005–06. Plants were considered in bloom when several open flowers were distributed through the shrub.

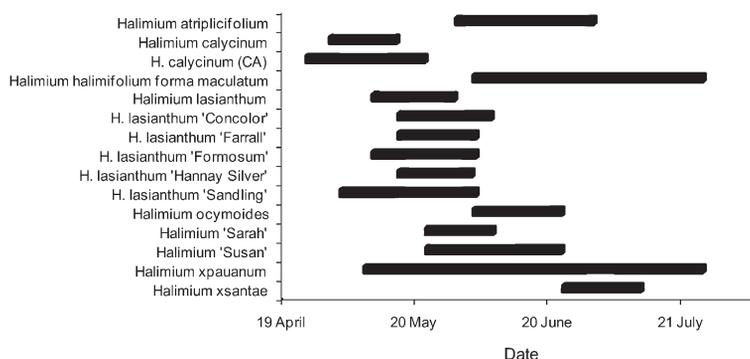


Fig. 4. Average flowering time and duration of yellow-flowered rockrose grown in a landscape evaluation at Aurora, OR, in 2005–06. Plants were considered in bloom when several open flowers were distributed through the shrub.

'Jessica'. The industry standards, *C. x purpureus* and *C. x hybridus*, flowered for 22 and 13 d, respectively.

The longest bloom period belonged to *H. xpauanum*, which bloomed for 79 d (Fig. 4). A number of other plants bloomed in excess of 50 d, including *Cistus x canescens*, *C. x pulverulentus* 'Sunset', *C. inflatus*, *C. x florentinus* 'Fontfroide', *Cistus* 'Jessamy Beauty', *Cistus* 'Ruby Cluster', *Cistus* 'Snow Fire', *H. halimifolium* forma *maculatum*, and *x Halimio cistus* 'Ingwersenii'. All of these can be counted on for a very long season of floral interest.

Differences in foliage quality, bloom time, and hardiness were readily evident throughout the evaluation. Some plants excelled in some areas but lacked considerably in others, thus their desirability is based on how important their particular strengths are. For example, *C. salviifolius* 'Gold Star' had excellent foliage ratings and would make a very good tall groundcover, but it has a very abbreviated bloom period. This is a similar problem with *Cistus* 'Grayswood Pink' and *Cistus* 'Bicolor Pink', which have attractive foliage and would make good small scale groundcovers, but exhibit bloom time of less than 2 weeks, short by the standards of this genus. Other plants, such as *H. halimifolium* forma *maculatum*, have very long bloom periods, but relative poor habit and foliage quality. And there were a few plants such as *H. atriplicifolium* and *Cistus creticus* 'Tania Compton' that have long bloom periods, but that are lacking in cold hardiness.

If foliage quality, length of bloom time, and hardiness are considered simultaneously, then a few of the plants evaluated are superior to the others. Many of these have a low, spreading or a mounding habit and would make good groundcovers for dry areas. Beginning with the most diminutive, these plants are *C. x gardianus*, which forms a flat groundcover and features pink flowers. Of similar size is *C. x pulverulentus* 'Sunset', which is already well-known in the northwestern U.S. and is popular for its magenta flowers and long bloom period. *C. x obtusifolius* forms a near-perfect dome of foliage and would make an excellent substitute for *C. x hybridus*, which is the standard white-flowering *Cistus* in the Pacific northwestern U.S. Unfortunately, *C. x hybridus* is

often massed as a groundcover in situations where it quickly outgrows its space, requiring repeated pruning to maintain its size. Most *Cistus*, including *C. ×hybridus*, do not tend to grow back from hard pruning. The flowering period for *C. ×obtusifolius* is nearly four times as long as for *C. ×hybridus*, and it is considerably smaller in size. Similar in size to *C. ×obtusifolius* is *C. inflatus*, which has a bloom period that approached 2 months, exceeded only by *H. ×pauanum*. Somewhat larger than *C. inflatus* is *C. ×laxus*, which along with *C. ×obtusifolius*, received the highest foliage rating of all plants in the evaluation. *C. ×canescens* has soft gray leaves, pink flowers, and a tighter habit than *C. ×laxus*, and also flowers for about 2 weeks longer. Larger than *C. ×laxus*, and all of similar size, are *Cistus* ‘Gordon Cooper’, *Cistus* ‘Snow Fire’, and *Cistus* ‘Ruby Cluster,’ all of which form fairly large domes of foliage and which have blotched, white flowers. All of these had excellent foliage, bloomed for at least 40 d or longer, and would make excellent specimen plants or tall groundcovers.

Among the *Halimium*, *H. lasianthum* ‘Sandling’ distinguished itself as the best of the cultivars of the species. The average bloom time of *H. lasianthum* is 21 d, and ‘Sandling’ bloomed for 32. In addition, it had a foliage rating of 4.5, superior to any other cultivar of that species (Table 1). *Halimium* ‘Susan’ received similarly high ratings for foliage and had a bloom period of 1 month, longer than most *Halimium*. Of those *Halimium* with an upright habit, the clear favorite was *H. ×pauanum*, which had a very long bloom time. Of the *×Halimiocistus*, the best was

×Halimiocistus ‘Ingwersenii’, which featured good foliage and had an exceptionally long bloom period.

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