

Plant Propagation Protocol for *Chlorogalum pomeridianum*
ESRM 412 – Native Plant Production



Photo credit Ken Gardiner
Taken from Stanford.edu



Calflora.net

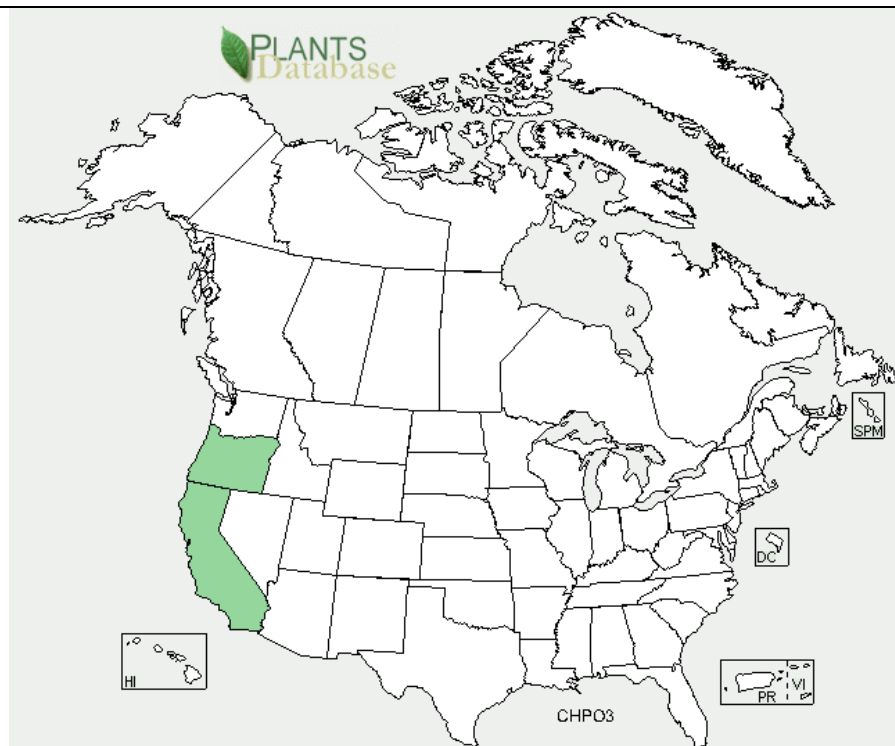
TAXONOMY

Family Names	
Family Scientific Name:	Liliaceae *It should be noted that some sources now list this plant as in the <i>Agavaceae</i> Family
Family Common Name:	Lily
Scientific Names	
Genus:	<i>Chlorogalum</i> Kunth
Species:	<i>pomeridianum</i>
Species Authority:	(DC.) Kunth

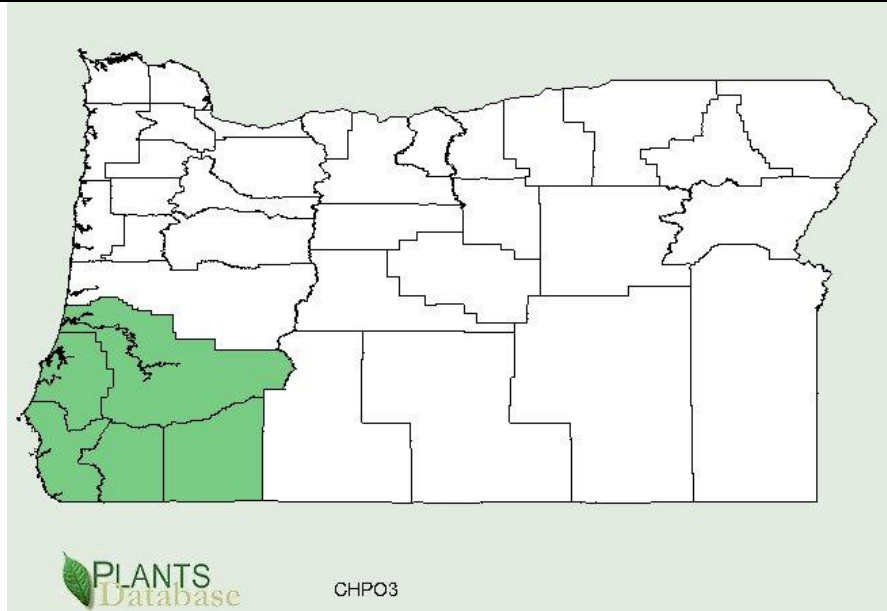
	DC-Augustin Pyramus de Candolle (1778-1841) Kunth- Carl Sigismund Kunth (1788-1850) (5)
Variety:	var. <i>divaricatum</i> (Lindl.) var. <i>minus</i> Hoover var. <i>pomeridianum</i>
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	Lindl.
Common Synonym(s) (include full scientific names (e.g., <i>Elymus glaucus</i> Buckley), including variety or subspecies information)	
Common Name(s):	Amole, Soap root, Wavyleaf soap plant (10)
Species Code (as per USDA Plants database):	CHPO3

GENERAL INFORMATION

Geographical range
(distribution maps for North America and Washington state)



North America Distribution (10)



Oregon State Distribution (10)

Ecological distribution (ecosystems it occurs in, etc):

Bluffs, grassland, chaparral, coastal sage scrub, dry open oak woodland (10)

Climate and elevation range

Below 1500 m (10)
Thrives in climates with cool, wet winters, and warm, dry summers (4).

Local habitat and abundance; may include commonly associated species

Found in coastal sage scrub, valley grassland, and central oak woodland (2).

The following table of associated species is a list of the top 40 plants observed in conjunction with *Chlorogalum pomeridianum* taken from the California Native Plant Link Exchange. A score of 1 indicates 100% co-occurrence based on number of observations. Example- *Lotus corniculatus*, or Bird's foot trefoil, has a score of .861, or 86.1 %, based on 9 observations/sources (2).

Scientific Name	Common Name	Lifeform	Score	•
Chlorogalum pomeridianum	Amole	Perennial herb	1.000	25
Lotus corniculatus	Bird's foot trefoil	Perennial herb	0.861	9
Mimulus aurantiacus	Sticky monkeyflower	Shrub	0.721	59


<i>Lupinus bicolor</i>	Lupine	Annual, Perennial herb	0.714	18
<i>Solidago californica</i>	Oreja de liebre	Perennial herb	0.710	27
<i>Thysanocarpus curvipes</i>	Common fringe pod	Annual herb	0.691	1
<i>Lomatium utriculatum</i>	Hog fennel	Perennial herb	0.691	3
<i>Lupinus nanus</i>	Valley sky lupine	Annual herb	0.691	13
<i>Bromus laevipes</i>	Narrow flowered brome	Annual, Perennial herb	0.683	3
<i>Lasthenia californica</i>	Goldfields	Annual herb	0.683	11
<i>Lupinus albifrons</i>	Silver bush lupine	Shrub	0.675	30
<i>Platystemon californicus</i>	Cream cups	Annual herb	0.675	5
<i>Poa secunda</i> ssp. <i>secunda</i>	Sandberg's bluegrass	Perennial herb	0.668	18
<i>Eschscholzia californica</i>	California poppy	Annual, Perennial herb	0.668	46
<i>Trifolium willdenovii</i>	Tomcat clover	Annual herb	0.664	8
<i>Vulpia myuros</i> var. <i>hirsuta</i>	Fox tail fescue	Annual herb	0.664	3
<i>Toxicodendron diversilobum</i>	Poison oak	Vine, Shrub	0.660	7
<i>Eremocarpus setigerus</i>	Turkey mullein	Annual herb	0.656	4
<i>Agoseris grandiflora</i>	Giant mountain dandelion	Perennial herb	0.656	4
<i>Uropappus lindleyi</i>	Silver puffs	Annual herb	0.656	1
<i>Elymus multisetus</i>	Big squirreltail grass	Perennial herb	0.656	11
<i>Quercus chrysolepis</i>	Gold cup live oak	Tree	0.656	26

<i>Bromus carinatus</i> var. <i>carinatus</i>	California brome	Perennial herb	0.656	23
<i>Plantago erecta</i>	California plantain	Annual herb	0.652	4
<i>Gnaphalium californicum</i>	California everlasting	Annual, Perennial herb	0.648	10
<i>Collinsia heterophylla</i>	Chinese houses	Annual herb	0.648	17
<i>Triteleia laxa</i>	Ithuriel's spear	Perennial herb	0.648	12
<i>Eriodictyon californicum</i>	Yerba santa	Shrub	0.648	9
<i>Trichostema lanceolatum</i>	Vinegarweed	Annual herb	0.644	2
<i>Amelanchier utahensis</i>	Pale leaved serviceberry	Shrub	0.636	11
<i>Koeleria macrantha</i>	June grass	Perennial herb	0.636	30
<i>Marah fabaceus</i>	Manroot	Perennial herb, Vine	0.636	8
<i>Senecio flaccidus</i> var. <i>douglasii</i>	Bush groundsel	Shrub	0.636	2
<i>Symphoricarpos mollis</i>	Snowberry	Shrub	0.629	21
<i>Calandrinia ciliata</i>	Redmaids	Annual herb	0.629	9
<i>Eschscholzia caespitosa</i>	Tufted eschscholzia	Annual herb	0.629	12
<i>Agrostis pallens</i>	Leafy bent grass	Perennial herb	0.629	15
<i>Silene californica</i>	California indian pink	Annual herb	0.625	3
<i>Sedum spathulifolium</i>	Pacific stonecrop	Perennial herb	0.625	32
<i>Mentzelia laevicaulis</i>	Giant blazingstar	Perennial herb	0.625	8
<i>Cryptantha muricata</i>	Prickly cryptantha	Annual herb	0.621	2

	NB: Coincidence of plants shown on this page is based on observation and specimen data compiled by various sources.
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	
Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc)	<p>Perennial, herbaceous plant. Forb. Reproduces by seed and by bulbs. The bulbs have a brown, fibrous outer coat, and can reach sizes from 7-15 cm across. Leaves are linear and basal with strongly wavy margins. Leaves are 2-7 dm long, and shrink to scarious bracts in the flowering stage (7).</p> <p>Developing bulbs bury themselves; studies showed an average depth of 23.2 mm in 10 weeks and 63.6 mm 29 weeks after seed germination (8).</p> <p>Flowers open evenings with highly branched inflorescences growing to .5-1.0 m in height. The flowers are white with green or purple midveins, recurved at flowering. Flowers have 6 stamens and a 3-cleft style typical of the Liliaceae family (10).</p> <p>Flowers open for a few hours only one day. The flowers open rapidly in late afternoon, produce nectar, and close 6-8 hours later. Senescence sets in quickly once flowers have closed. This is strongly influenced by the length of alternating light and dark periods, with experiments showing that the length of uninterrupted light periods is of primary control (8).</p> <p>Flowering is stimulated by fire, but is not strictly fire-dependent (1).</p> <p>Pollination: The pollination window is very small as the flowers open only for a few hours on only one day. Large bees (honeybees, carpenter bees, and 2 species of bumblebee) are the only effective pollinators. Seed is not set in the absence of an animal pollinator (13).</p>
PROPAGATION DETAILS	
Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed	

that was tested came from):	
Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):	Plants, Bulbs
Propagation Method (Options: Seed or Vegetative):	Seed
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Container (plug) (6) (11)
Stock Type:	Potted nursery stock (6) (11)
Time to Grow (from seeding until plants are ready to be outplanted):	2 years old (10) Plants that start from seed take 5 to 7 years to reach reproductive age (13).
Target Specifications (size or characteristics of target plants to be produced):	
Propagule Collection (how, when, etc):	Seed may be rapidly collected by stripping fruit capsules when capsules split open, typically 3 seeds per capsule (6).
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Seed may be collected from June through July. Seed can be retained on the heads well into summer depending on year. Approximately 85 seeds per gram depending on individual, population, year, and cleanliness of seed (6) (11).
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	None, though seed was placed in dry, cold storage after collection and prior to sowing (6) (11). Seeds stored at 32 °F for a minimum of 3 months, germinated on moist vermiculite (9).
Growing Area Preparation / Annual	Seed was directly sown into 1.5” flats containing a potting mixture of approx. 1:1:1:2 sand: pumice: peat moss: fir bark mixture. Flats

Practices for Perennial Crops (growing media, type and size of containers, etc):	<p>placed in outdoor cold frame from late fall through spring. Most seedlings were transplanted into various sized pots (D-pots to 3x4" plastic containers) using same potting mixture (6) (11).</p> <p>For seed establishment. Plant in fall by October 1st and place seeds in a deep, 1-gallon container (six inches deep). Water container thoroughly and allow it to drain. Plant seed next day by scattering the seed on top of sandy soil. Sprinkle a light layer of soil over the top of the seeds, and then place a one-quarter inch layer of gravel on top. Set pots outside and let rains come. If it is a drought year, supplement with hand watering. Containers should get early morning and late afternoon sun, shade during the hottest times of the day (10).</p>
Establishment Phase (from seeding to germination):	Seeds germinate approximately 7 days post-imbibition (8)
Length of Establishment Phase:	
Active Growth Phase (from germination until plants are no longer actively growing):	Active growth observed following onset of autumn rains (seed swelling) until drying down (die-back and dormancy) in late spring/early summer. Length of active growth phase can be somewhat controlled with irrigation; species requires summer dormancy (6) (11).
Length of Active Growth Phase:	6-8 months (late fall-early summer) (6)
Hardening Phase (from end of active growth phase to end of growing season; primarily related to the development of cold-hardiness and preparation for winter):	Hardening is not necessary as the active growth phase starts with the onset of fall rains and plants senesce around the end of spring or summer (6).
Length of Hardening Phase:	
Harvesting, Storage and Shipping (of seedlings):	Individuals become dormant following spring to summer dry down, dying back to the root. Dormant individuals should be placed in dry storage at 60-70 degrees F (6).
Length of Storage (of seedlings, between nursery and	3-5 months (6)

outplanting):	
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	Transplanted seedling showed some signs of stress, with earlier transplanted seedlings showing more vigorous growth after transplanting. Seed sown directly in the field showed comparable, or superior to growth rates both below and above ground than seed grown under controlled conditions. Heavier native soils may provide better growing conditions when kept moist compared to well-drained potting soils, whose moisture and temperature may fluctuate more readily (6).
Other Comments: Ethnobotanical significance	<p><i>Chlorogalum pomeridianum</i> was used as soap by local peoples of California and Oregon, including but not limited to the Miwok, Hulpumne Yokuts, and Wailakis. The bulbs contain saponins, which produce the foam typical of soaps, and were used as such. The bulbs can be eaten after cooking to remove the saponins (3) (10). The bulbs can be boiled to make glue, with glue and fibers from the bulb used to make acorn brushes that were used to collect acorn meal after processing (personal experience from protocol author). The bulbs were once used to stupefy fish, achieved by crushing soap plants and rubbing them into a lather, then throwing the lather into streams and ponds. Fish became stupefied from the lather, and floated to the top of the water, where they were easily caught. This is now an illegal practice (10).</p>  <p>Sliced bulbs of soaproot (10)</p>



Soap root brush (sonoma.edu)

PROPAGATION DETAILS

<p>Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):</p>	
<p>Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):</p>	<p>Plants</p>
<p>Propagation Method (Options: Seed or Vegetative):</p>	<p>Vegetative: from bulbs (10) Bulbs may remain dormant for 10 or more years under drought or other adverse conditions, sprouting when conditions become favorable (12).</p>
<p>Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))</p>	
<p>Stock Type:</p>	
<p>Time to Grow (from seeding until plants are ready to be outplanted):</p>	

Target Specifications (size or characteristics of target plants to be produced):	Plants
Propagule Collection (how, when, etc):	Dig up bulbs in summer when plants have gone to seed and the bulbs are dormant (10). *A harvesting strategy used by the Sierra Miwok is to break the bulbs off, purposefully leaving some bulb and root tissue behind to regenerate (10).
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Vegetative reproduction through formation of bulb offsets occasionally observed. In such instances, buds formed in axils of scale leaves become fleshy, expand, and emerge from sheathing bases of foliage and scale leaves (9).
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	
Growing Area Preparation / Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	
Establishment Phase (from seeding to germination):	
Length of Establishment Phase:	
Active Growth Phase (from germination until plants are no longer actively growing):	
Length of Active Growth Phase:	
Hardening Phase (from end of active growth phase to end of growing season; primarily related to	

the development of cold-hardiness and preparation for winter):	
Length of Hardening Phase:	
Harvesting, Storage and Shipping (of seedlings):	
Length of Storage (of seedlings, between nursery and outplanting):	
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	
Other Comments (including collection restrictions or guidelines, if available):	
INFORMATION SOURCES	
References (full citations):	See below
Other Sources Consulted (but that contained no pertinent information) (full citations):	See below
Protocol Author (First and last name):	Sarah Otto-Combs
Date Protocol Created or Updated (MM/DD/YY):	05/15/2012

Note: This template was modified by J.D. Bakker from that available at:
<http://www.nativeplantnetwork.org/network/SampleBlankForm.asp>

(1)

Borchert, M., & Tyler, C. M. (August 31, 2009). Patterns of post-fire flowering and fruiting in *Chorogalum pomeridianum* var. *pomeridianum* (DC.) Kunth in southern California chaparral. *International Journal of Wildland Fire*, 18, 5, 623-630. Mark Borchert^{A C}, Claudia M. Tyler^B

(2)

California Native Plant Link Exchange
www.cnplx.info

(3)

Dayton, William A. 1960. Notes on western range forbs: Equisetaceae through Fumariaceae. Agric. Handb. 161. Washington, DC: U.S. Department of Agriculture, Forest Service. 254 p.

(4)

Halvorson, William L.; Clark, Ronilee A. 1989. Vegetation and floristics of Pinnacles National Monument. Tech. Rep. No. 34. Davis, CA: University of California at Davis, Institute of Ecology, Cooperative National Park Resources Study Unit. 113 p.

(5)

Harvard University Herbaria
http://kiki.huh.harvard.edu/databases/botanist_index.html

(6)

Hunt, John W.; Boul, Rachelle D. ; Brown, Matthew R.; Koenig, David A.; Leigh, Mark.; Pushnik, James C. 2006. Propagation protocol for production of container *Chlorogalum pomeridianum* bulbs (Potted nursery stock); California State University Research Foundation, Chico, California. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 14 May 2012). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

(7)

Huxley, A. J., Griffiths, M., & Royal Horticultural Society (Great Britain). (1999). *The new Royal Horticultural Society dictionary of gardening*. New York: Grove's Dictionaries Inc.

(8)

Jernstedt, J. A. (June 01, 1980). Anthesis and Floral Senescence in *Chlorogalum pomeridianum* (Liliaceae). *American Journal of Botany*, 67, 5, 824-832.

(9)

Jernstedt, J. A. (January 01, 1984). Seedling Growth and Root Contraction in the Soap Plant, *Chlorogalum pomeridianum* (Liliaceae). *American Journal of Botany*, 71, 1, 69-75.

(10)

National Plant Data Center (U.S.), & United States. (n.d.). *Plants database*. Baton Rouge, LA: USDA Natural Resources Conservation Service.
http://plants.usda.gov/plantguide/pdf/cs_chpo3.pdf

(11)

Native Plant Network
<http://www.nativeplantnetwork.org/Network/ViewProtocols.aspx?ProtocolID=3100>

(12)

Pitschel, Barbara M. 1988. Value of propagule bank revealed by grassland restoration project (California). *Restoration & Management Notes*. 6(1): 35-36.

(13)

Stockhouse, Robert E., II; Wells, Harrington. 1978. Pollination ecology of *Chlorogalum pomeridianum* (D.C.) Kunth. (Liliaceae). *Bulletin of the Southern California Academy of Sciences*. 77(3): 124-129.

Other Sources

None