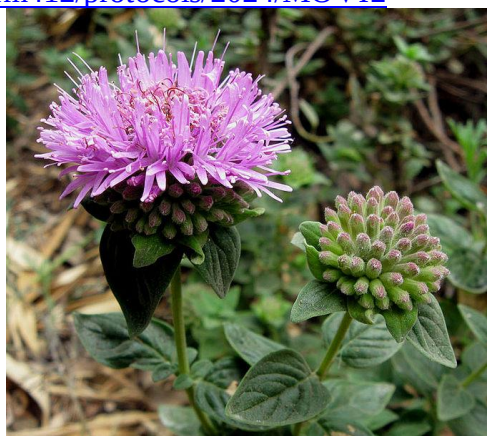
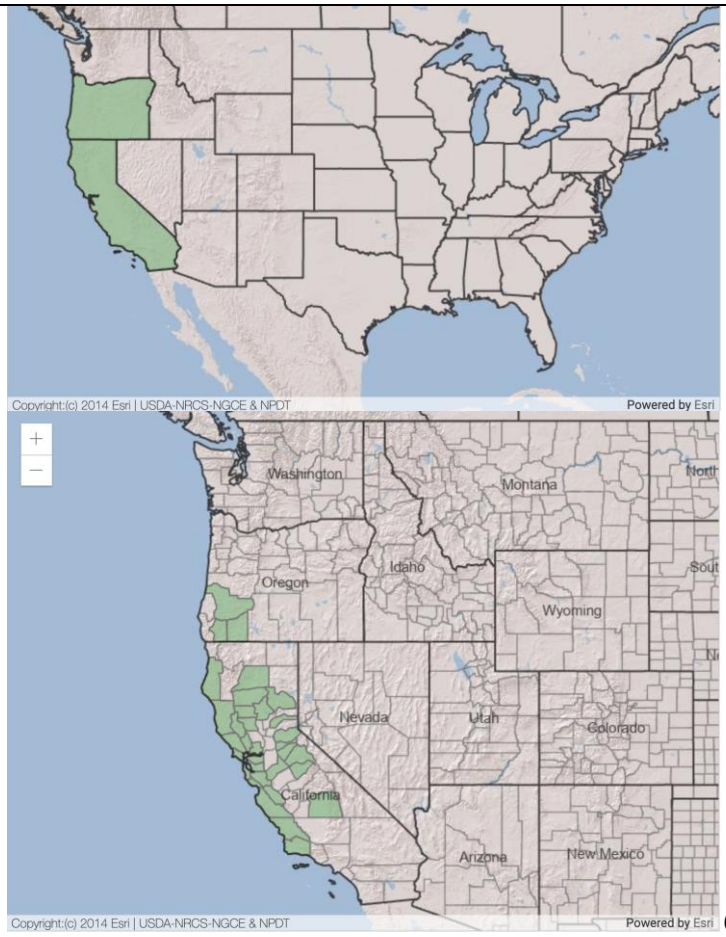
Plant Propagation Protocol for *Monardella villosa*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/2024/MOVI2

Credits for left Image[11] and right image[12].

TAXONOMY	
Plant Family	
Scientific Name	Lamiaceae
Common Name	Mint
Species Scientific Name	
Scientific Name	*Monardella villosa* Benth.
Varieties	
Sub-species	*Monardella villosa* Benth. ssp. *franciscana* (Elmer) Jokerst *Monardella villosa* Benth. ssp. *globosa* (Greene) Jokerst *Monardella villosa* Benth. ssp. *obispoensis* (Hoover) Jokerst *Monardella villosa* Benth. ssp. *villosa*
Cultivar	
Common Synonym(s)	*Monardella villosa* Benth. ssp. *franciscana* (Elmer) Jokerst – Russian River Coyote Mint *Monardella villosa* Benth. ssp. *globosa* (Greene) Jokerst – Robust Coyote Mint *Monardella villosa* Benth. ssp. *obispoensis* (Hoover) Jokerst – San Luis Obispo Coyote Mint *Monardella odoratissima* Benth. ssp. *Villosa* Brunell – *Mountain Coyote Mint* *Monardella antonina*
Common Name(s)	Coyote Mint
Species Code (as per USDA Plants database)	MOVI2
GENERAL INFORMATION	

Geographical range	 Coastal California and S. Oregon[1]
Ecological distribution	Rocky cliffsides, California chapparal and woodland[6] All geographic regions besides high mountains and deserts in California[2].
Climate and elevation range	Below 3,000 elevation[3]. Mediterranean climate with short rainy seasons as it tolerates drought well[2].
Local habitat and abundance	Supports local butterfly and moth populations.[4] Planting with other low-growing perennials, annuals, native grasses, or succulents including; Chinese Houses (*Colllinsia heterophylla*), Monkeyflower (*Mimulus* sp.), Blue-eyed Grass (*Sisyrinchium bellum*), Yellow-eyed Grass (*Sisyrinchium californicum*), groundcover Manzanitas (*Arctostaphylos* sp.), low-growing Buckwheats (*Eriogonum grande* var. *rubescens* or *umbellatum*), California Poppy (E*schscholzia californica*), and *Dudleya* spp. has proven to be beneficial.[4] Coyote can be planted with other drought-tolerant natives Sandmat Manzanita (*Arctostaphylos pumila*), Sticky Monkeyflower (*Diplacus aurantiacus*), Naked Stem Buckwheat (*Eriogonum nudum*), California fuchsia (*Epilobium canum*), Hairy Gumplant (*Grindelia hirsutula*), Foothill Penstemon (*Penstemon heterophyllus*), California Sagebrush (*Artemisia californica*), Black Sage (*Salvia mellifera*), and White Sage (*Salvia apiana*).[5]
Plant strategy type / successional stage	Tolerant of drought conditions, cold temperatures up to 15°C and deer resistant with a moderate growth rate[4]. Unlike most of the mint family, Coyote Mint doesn't send out stolons and instead grows out semi-woody stems, which then fall over onto the ground and root into the ground, creating a new daughter plant that can be separated from the mother[7]. Other plants in the Monardella genus have a habit of sprawling across surfaces, especially rocky ones[9].

Plant characteristics	Perennial subshrub[1] flowering from May to August[5]. Does best in well-draining soil and can be placed in full sun to partial shade[2]. Very pungent smell with brightly colored flowers to attract pollinators[9].
PROPAGATION DETAILS BY SEED As Explained by Lee Riley[6]	
Ecotype	Rogue River-Siskiyou National Forest, Oregon
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	262 ml (16 in3) container
Time to Grow	14 weeks
Target Specifications	Stock Type: Container seedling Root System: Firm plug in container
Propagule Collection Instructions	Seeds are collected within the flowers between July 1st and September 1st, looking for mature plants are brown inflorescence and have dark brown seeds[3].
Propagule Processing/Propagule Characteristics	Seed Cleaning: Rub heads over a screen that allows the seeds to fall through without the chaff Storage Conditions: Seeds are kept dry and stored in a refrigerator
Pre-Planting Propagule Treatments	Due to the small seed size, the easiest method is to sow seed into trays filled with stabilized medium plugs (Q-plugs). Trays are sealed inside plastic bags and placed into refrigeration at 1 to 3 °C for 14 days. Trays are checked weekly and kept moist throughout the stratification period. If mold is evident, trays should be treated with 1% hydrogen peroxide by spraying on the solution. Concurrently, another source also found no treatment is needed to stimulate germination of this species[8].
Growing Area Preparation / Annual Practices for Perennial Crops	Greenhouse growing facility. Q-plugs are lightly covered with nursery grit. Seedlings are transplanted to target containers approximately 2 weeks following removal from stratification. Growing medium used is 40:20:20:20 peat:composted fir bark:perlite:pumice with Nutricote controlled release fertilizer (18N:6P2O5:8K2O with minors; 180-d release rate at 21C) at the rate of 1.5 gram Nutricote per 262 ml container.
Establishment Phase Details	Germination is uniform and quite rapid. It is usually complete in 10 days. Following germination (while still in Q-plugs), plants are fertilized with soluble 12-2-14-6Ca-3Mg at 75 ppm for 1 week.
Length of Establishment Phase	2 weeks
Active Growth Phase	Seedlings grow rapidly throughout the active growth phase. During the growing season, fertilization depends on weather conditions. Soluble 20-9-20 NPK, 20-18-18 NPK, or 17-5-24 NPK at a rate of 100 ppm is applied weekly throughout the growing season.
Length of Active Growth Phase	12 weeks
Hardening Phase	No dry-down is done to induce dormancy. Seedlings are moved to an outdoor growing area in late September.
Length of Hardening Phase	2 weeks
Harvesting, Storage and Shipping	Harvest Date: Late October

	Storage Conditions: Seedlings are usually outplanted in fall. No storage except in outdoor growing areas. Plants are well irrigated prior to shipping and shipped in containers.
Length of Storage	N/A
Other Comments	M. villosa is a beneficial pollinator herb for bees and butterflies. It has been used by indigenous populations as a medicine for upset stomach.
PROPAGATION DETAILS OF *MONARDELLA SHELTONII* BY SEED As Explained by John W. Hunt [10]	
Ecotype	Seed was collected from 3 locations within eastern Tehama County, California: along Lower and Upper Dye Creek at The Nature Conservancy's Dye Creek Preserve, along Antelope Creek and from the Hog's Back ridge.
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	Potted nursery stock
Time to Grow	No information was provided in this section.
Target Specifications	First year seedling approximately 4 cm tall with vigorous, fibrous and rhizomatous root system.
Propagule Collection Instructions	Relatively clean seed may be shaken from whole fruiting heads collected from mid to late summer.
Propagule Processing/Propagule Characteristics	Propagule processing is not generally necessary, though tiny seed is difficult to separate from any chaff collected with the seed. Approximately 1,500-2,000 seeds per gram, depending on individual, population, year and cleanliness of seed.
Pre-Planting Propagule Treatments	None, though clean dry seed was placed in dry, cold storage following collection and prior to sowing.
Growing Area Preparation / Annual Practices for Perennial Crops	During November 2004, seed was directly sown into 1.5" deep flats containing a potting mixture of approximately 1:1:1:2 sand:pumice:peat moss:fir bark mixture. Flats were placed in an outdoor cold frame from late-fall though spring. Most seedlings were transplanted into various sized pots ranging form D-pots to 3x4" plastic containers (some seedlings were not transplanted) using the same potting mixture. Active growth occurs well into summer, though summer watering may result in fungal growth and rot. Better growth may be obtainined during the first year by avoiding transplanting (seed directly into larger containers rather than flats). Based on results of direct seeding in the field, better above and below gound growth may be obtained by planting in native soil (e.g.loam) rather than potting soil. Loam appears to have lower fluctuations in moisture and temperature which may stress seedlings and reduce growth during the first year. Growth from seed to dormant seedling follows the first fall rains through the spring-summer dry-down. Under good growing conditions, this species may flower within the first year.
Establishment Phase Details	Initial germination was observed within 2 weeks. Highly variable germination rates were observed for individuals from different populations. Observed germination rates were as follows: Seed sown in an outdoor cold frame - 15% (Vina Plains), 25% (Hogback) and 30% (Dye Creek); Seed cold-stored at approximately 44F in moist vermiculite - 70% (Cone Grove Park), 68% (Dye Creek), 34% (Hogback), 33% (Lower Dye Creek), and 53% (Vina Plains). Robust seedlings approximately 4 cm tall with vigorous fibrous root system may be established the first summer (within 7-8 months).

Length of Establishment Phase	Transplantable sprouts were established within approximately 3-4 weeks.
Active Growth Phase	Active growth was observed within 2 weeks after seeding in November (i.e. germination) and continued until early summer (June).
Length of Active Growth Phase	7-9 months (fall to late summer). Older plants may not initiate above-ground growth until spring.
Other Comments	Flowering: Mid-May - September (Oswald and Ahart 2002); Seed collection: June-September.
INFORMATION SOURCES	
References	[1]United States Department of Agriculture. (n.d.). Monardella villosa Benth. USDA plants database. https://plants.usda.gov/home/plantProfile?symbol=MOVI2 (accessed 2024/04/25). [2] Bornstein, C., Fross, D., & O'Brien, B. (2005). Native Plant Care. In *California native plants for the garden*. essay, Cachuma Press. [3]Young, Betty. 2001. Propagation protocol for production of Container (plug) Monardella villosa Beth. plants Deepot 16; San Francisco, California. In: Native Plant Network. URL: https://NativePlantNetwork.org (accessed 2024/04/25). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources [4]Coyote Mint, Monardella villosa. California Native Plant Society. (n.d.). https://calscape.org/Monardella-villosa-(Coyote-Mint) (accessed 2024/04/27\5). [5]Giuliano, D. (2023, June 14). Native plant of the Month: Coyote Mint. Grassroots Ecology. https://www.grassrootsecology.org/from-the-field/2022/5/24/may-native-plant-of-the-month-coyote-mint#:~:text=You%20can%20find%20coyote%20mint,full%20sun%20to%20partial%20shade (accessed 2024/04/25). [6]Riley, Lee E. 2018. Propagation protocol for production of Container (plug) Monardella villosa Plants 262 ml (16 in3) container; USDA FS - Dorena Genetic Resource Center Cottage Grove, Oregon. In: Native Plant Network. URL: https://NativePlantNetwork.org (accessed 2024/04/25). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources [7]Fogle, D. (2023, April 13). Summer-flowering coyote mint makes a nice dry ground cover. Delightful Gardens Landscape Consulting and Design. https://mydelightfulgardens.com/summer-flowering-coyote-mint/ (accessed 2024/04/25). [8]Emery, D. E. (1995). Seed propagation of native California plants. Santa Barbara Botanic Garden. [9] Harlow, N., & Coate, B. D. (2004). *Plants and landscapes for summer-dry climates of the San Francisco Bay Region*. East Bay Municipal Utility District. [10] Leigh, Mark; Pushnik, James C.; Boul, Rachelle D.; Brown, Matthew R.; Hunt, John W.; Koenig, David A.. 2006. Propagation protocol for production of Container (plug) Monardella sheltonii plants Potted nursery stock; University of California - Chico Chico, California. In: Native Plant Network. URL:

	https://NativePlantNetwork.org (accessed 2024/04/27). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources. [11]Doyen, J. 2017 "Coyote Mint," (Photograph) California Native Plant Society https://calscape.org/view.php?pl=2581&img=222122&calphoto=1 [12] Toedrifter 2009 "Coyote Mint," (Photograph) California Native Plant Society https://calscape.org/view.php?pl=2581&img=222122&calphoto=1
Other Sources Consulted	Monardella villosa benth.: Plants of the World Online: Kew Science. Plants of the World Online. (n.d.). https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:452158-1#publications Monardella villosa ssp. Franciscana "Russian River," coyote mint, shrub, [Monardella Franciscana]. San Marcos Growers Wholesale Nursery, Santa Barbara, California. (n.d.). https://www.smgrowers.com/products/plants/plantdisplay.asp?plant_id=4554
Protocol Author	Ainsley Lawler
Date Protocol Created or Updated	April 26, 2024