Plant Propagation Protocol for *Cleome serrulata*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/*2022/CLSE.pdf*

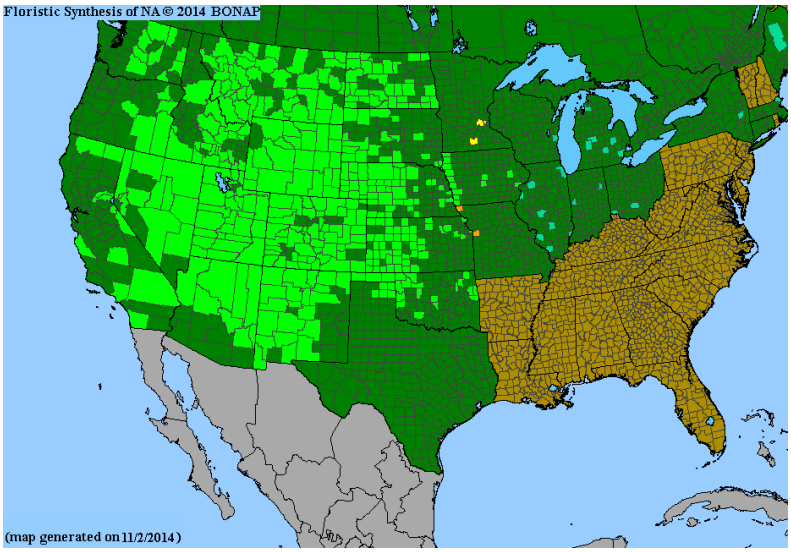

Figure 1. Map of geological distribution in North America (Kartesz, 2015)


Figure 2. Image of *C. serrulata* (Keen, 2010)

Species present in state and native

Species present in county and not rare

Species not present in state

TAXONOMY	
Plant Family	
Scientific Name	Capparidaeceae, as it is currently recognized by the USDA, but some inconsistency exists regarding the taxonomic family classification of *C. serrulata*. Within the research literature, *C. serrulata* can often be seen under an updated classification belonging to the Cleomaceae or spiderflower family (Roalson et al., 2015).
Common Name	Caper Family
Species Scientific Name	
Scientific Name	*Cleome serrulata* Pursh
Varieties	
Sub-species	
Cultivar	
Common Synonym(s)	*Peritoma serrulata* Pursh (Winslow, 2014).
Common Name(s)	Rocky Mountain beeplant

Species Code (as per USDA Plants database)	CLSE
GENERAL INFORMATION	
Geographical range	*C. serrulata* occurs in both Canada and the United States in North America. Within the Canadian Provinces, *C. serrulata* can be found in British Columbia, Alberta, Manitoba, Ontario, and Saskatchewan. Within the U.S., *C. serrulata* occurs east of the Cascade and Sierra Nevada Mountains from Washington to the American Southwest regions (including California, Arizona, New Mexico, and Texas) (Shaw & Gucker, 2020).
Ecological distribution	*C. serrulata* can be found in moist areas within disturbed sites within sandy and well-drained soils. Occurs in valleys, dry prairies, open woodlands, and mountain foothills (Winslow, 2014).
Climate and elevation range	Elevation range varies from state to state but *C. serrulata* can generally grow from 980 to 8,200 feet in elevation (Shaw & Gucker, 2020).
Local habitat and abundance	Occurs in mixed desert shrublands, as well as pinyon-juniper and ponderosa pines (*Cleome serrulata*, 2012) Associated species include western wheatgrass *Pascopyrum smithii*, bluebunch wheatgrass *Pseudoroegneria spicata*, prairie Junegrass *Koeleria macrantha*, Sandberg bluegrass *Poa secunda*, common gaillardia *Gaillardia aristata*, big sagebrush *Artemisia tridentata*, and prairie coneflower *Ratibida columnifera* (Winslow, 2014).
Plant strategy type / successional stage	*C. serrulata* is a colonizer, drought tolerant, can survive in a range of pH levels, and can tolerate full sun or light shade (Winslow, 2014).
Plant characteristics	Annual wildflower that typically grows from 2-5 feet tall with alternately arranged compound leaves. Flowers range from pink to purplish in color and consist of 4 sepals, 4 petals, and 6 narrow, wispy stamens. Taproot Slender, downward- drooping fruit consists of a 1-3” pod-like capsule (Winslow, 2014).
PROPAGATION DETAILS	
Ecotype	Protocol was adopted using Wytsalucy’s germination study, in which C. serrulata seeds were sourced from Chinle, Arizona (36.1544° N, 109.5526° W; elevation 1698 m) in 2015 (Wysalucy, 2019).

Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container or flatbed
Stock Type	
Time to Grow	Information regarding time length of active growth and hardening phases is limited, but time to grow should be at least three months considering germination and establishment time.
Target Specifications	Information regarding specific target characteristics is limited but include general plant vigor and flower and seed production (Shaw & Gucker, 2020).
Propagule Collection Instructions	Collection should occur when fruit valves begin to split along sutures typically through the months of May to October. Fruits can be collected by hand or using a flat beater into bags for temporary storage (Shaw & Gucker, 2020).
Propagule Processing/Propagule Characteristics	64,500 seeds per pound (Winslow, 2014). Seed longevity is at least five years in dry storage (Shaw & Gucker, 2020).
Pre-Planting Propagule Treatments	Dry seed of *C. serrulata* can be cleaned through using a debearder and an air screen separator Seeds are classified as orthodox and must be stored dry (Shaw & Gucker, 2020). While little is known regarding the germination requirements of *C. serrulata*, some studies have shown that germination rate can be improved through treatment of GA_{4+7} over the course of 4 hours, followed by drying and chilling at 4°C (Wysalucy, 2019). The pre-germination practice should occur over the course of 6-8 weeks (*Cleome serrulata*, 2012).
Growing Area Preparation / Annual Practices for Perennial Crops	Growing media should be well-draining clay loam soil within a flatbed or conetainer (Shaw & Gucker, 2020; Cane, 2008).
Establishment Phase Details	In late fall, seeds can be sown in greenhouse environment at 27°C in the day and 21°C at night (Shaw & Gucker, 2020). Use drill to sow seeds in a seedbed in early spring at a depth of ¼ - ½" in alternate rows (Winslow, 2014).
Length of Establishment Phase	10-20 days (Shaw & Gucker, 2020).
Active Growth Phase	Once seedlings are large enough to handle, carefully transfer seedlings out from flatbed into individual pots (*Cleome serrulata* Rocky Mountain Beeplant PFAF Plant Database).
Length of Active Growth Phase	Information regarding exact length of active growth phase is lacking.

Hardening Phase	While little is known regarding the hardening phase of *C. serrulata*, plants require low to moderate watering in full sun *(Cleome serrulata* | Granite Seed).
Length of Hardening Phase	Information regarding length of hardening phase is lacking.
Harvesting, Storage and Shipping	Information regarding harvesting, storage and shipping is lacking.
Length of Storage	Information regarding exact length of seedling storage is lacking.
Guidelines for Outplanting / Performance on Typical Sites	Flowering occurs from May through September (Prendusi).
Other Comments	
INFORMATION SOURCES	
References	Cane. (2008). Breeding biologies, seed production and species-rich bee guilds of Cleome lutea and Cleome serrulata (Cleomaceae). *Plant Species Biology*, *23*(3), 152–158. https://doi.org/10.1111/j.1442-1984.2008.00224.x *Cleome Serrulata | Granite Seed*. https://graniteseed.com/seed/wildflowers-forbs/cleome-serrulata/. Accessed 24 May 2022. *Cleome Serrulata Rocky Mountain Beeplant PFAF Plant Database*. https://pfaf.org/user/Plant.aspx?LatinName=Cleome+serrulata. Accessed 24 May 2022. Hitchcock, C. L., & Cronquist, A. (1973). *Flora of the Pacific Northwest: An illustrated manual*. University of Washington Press. Kartesz, J.T., The Biota of North America Program (BONAP). 2015. *North American Plant Atlas.* (http://bonap.net/MapGallery/County/Peritoma%20serrulata.png). Chapel Hill, N.C. [maps generated from Kartesz, J.T. 2015. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP). (in press)]. Keen, Rich. (2010). *Rocky Mountain Bee Plant* [Photograph]. USFWS Mountain-Prairie. https://flickr.com/photos/51986662@N05/15242507237

	Prendusi, Teresa. *Rocky Mountain Bee Plant*. https://www.fs.fed.us/wildflowers/plant-of-the-week/cleome_serrulata.shtml. Accessed 24 May 2022. Roalson, Eric H., et al. "A Revision of Generic Boundaries and Nomenclature in the North American Cleomoid Clade (Cleomaceae)." *Phytotaxa*, vol. 205, no. 3, Apr. 2015, p. 129. *DOI.org (Crossref)*, https://doi.org/10.11646/phytotaxa.205.3.1. Shaw Nancy L.; Gucker, Corey L. 2020. Rocky Mountain beeplant (Peritoma [Cleome] serrulata). In: Gucker, C.L. ; Shaw, N.L., eds. Western forbs: Biology, ecology, and use in restoration. Reno, NV: Great Basin Fire Science Exchange. 18 p. Online: http:// greatbasinfirescience.org/western-forbs-restoration Winslow, S. (2014). *Rocky Mountain Beeplant* (Plant Materials Technical Note MT-104). United States Department of Agriculture. https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mtpmctn12314.pdf\ Wytsalucy, R. C. (2019). *Explorations and collaborations on two under-recognized native american food crops: Southwest peach and navajo spinach* (Order No. 22621643). Available from ProQuest Dissertations & Theses Global. (2316417093). https://www.proquest.com/dissertations-theses/explorations-collaborations-on-two-under/docview/2316417093/se-2?accountid=14784
Other Sources Consulted	Gilkey, H. M., Johnston, L. D., & Gilkey, H. M. (1980). *Handbook of Northwestern plants*. Oregon State University Bookstores. Piper, Charles, and R. Kent Beattle. *Flora of the Northwest Coast*. Press of The New Era Printing Company, 1915.
Protocol Author	Katie Nelson
Date Protocol Created or Updated	05/13/2022