

RMBL Field Botany Class Summer 2009, Dichotomous Key of the Onagraceae Family
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Introduction:

The Onagraceae, or Evening Primrose, family has several different species that are found within the Gothic area. The plants of the family are characterized by having 4 petals and an inferior ovary. They usually possess 8 stamens and an often 4-lobed stigma. They can be either annual or perennial, have alternate or opposite leaves and are exstipulate. The flowers are perfect and mostly regular.

Genus and species within the family can be distinguished using various characteristics. On the family level they are different in their number of locules within the ovary (2 or 4), whether their inflorescence is open during the day or night, and whether the hypanthium is prolonged past the ovary or not. Species can be differentiated by using leaf characteristics (opposite or alternate, leaf length, margins), their preferred habitat and how they grow in relation to other plants (in clumps or singly), their root structure and so forth. We will compile these characteristics to create a comprehensive dichotomous key for the Onagraceae plant species found within the Gothic, CO area.

Within Gothic there are 4 different genus of Onagraceae; *Epilobium*, *Oenothera*, *Gayophytum* and *Chamerion*. Within these families there are 15 species; *Chamerion augustifolium*, *Chamerion latifolium*, *Epilobium anagallidifolium*, *Epilobium brachycarpum*, *Epilobium ciliatum*, *Epilobium clavatum*, *Epilobium hallianum*, *Epilobium hornemanii*, *Epilobium lactiflorum*, *Epilobium saximontanum*, *Gayophytum diffusum*, *Gayophytum diffusum*, *Gayophytum ramosissimum*, *Oenothera flava*, *Oenothera elata* and *Oenothera villosa*. These were found using the Third Edition of Vascular Plants of the Gothic Area by Barbara A. Frase and Paul Buck.

Methods:

For this project we created a dichotomous key using the various characteristics of the Onagraceae species found in the area. We are choosing a dichotomous key over an interactive one because it makes the user notice all parts of the plant. Interactive keys allow the user to use major characteristics to define the plant, thereby only reinforcing what the user already knows or can easily distinguish. With a dichotomous key the user is forced to identify the plant using different characteristics, perhaps some they would not have noticed otherwise. We therefore feel that a dichotomous key would be more beneficial and informative than an interactive key.

The key will be made by both researching information about the relative genus and species encountered, as well as hands-on identification of the plants. We will also attempt to either find the plants and take digital images in order to accompany the key, or use pre-existing images to help define different forks in the key.

Results:

Online Dichotomous Key found at:

<http://fm1.fieldmuseum.org/keystonature/rmb/>

Dichotomous Key to the Members of the Onagraceae Family Found in the Gothic, Colorado Area

Compiled by Courtney Gomola and Deb Bartholomew
Field Botany Class, RMBL, Summer 2009

ONAGRACEAE FAMILY

The Onagraceae Family of plants is the Evening Primrose Family. There are four genera with fifteen individual species of this family that have been found in the vicinity of Rocky Mountain Biological Laboratory in Gothic, Colorado. The evening primroses are

not related to true primroses. Their floral formula is unique: 4 sepals, 4 petals, 8 stamens, and 4 united carpels in an inferior ovary. Because of their parts in fours, care must be taken not confuse them with the mustards. The four genera found in the Gothic area are the *Epilobium*, *Chamerion*, *Gayophytum*, and *Oenothera*.

1. A. Ovary has 4 locules.....2
B. Ovary has 2 locules.....11
2. A. Radial or bilateral flowers open in the day, stigmas spherical or club-like.....3
B. Radial flowers generally opening in the evening, deeply lobed stigmas, anthers attached at middle.....12

3. **Epilobium**

Annual to sub-shrub plant with generally opposite fine-toothed leaves with obscure veins. Inflorescence generally a raceme with bracts, flowers with radial or bilateral symmetry with straight cylindric to club-like fruit and seeds generally in 1 row per chamber with white, deciduous hair-tuft.

A. Smaller flowers with notched petals, hypanthium prolonged past ovary.....4

B. Larger flowers with long entire petals, hypanthium not prolonged past ovary.....14

4. A. Annual plant, with alternate leaves, seed has tuft of pale yellow hairs at tip, stems peeling.....*Epilobium brachycarpum* C. Presl

A common annual plant in dry open woodlands, grasslands and roadsides below 3300 m. 20-200cm in height, glabrous and peeling below, generally glandular-hairy above. Linear to narrowly elliptical leaves 10-50mm, acuminate and generally folded along midrib. White to rose-purple petals with stamens < or = to pistil, fruits glabrous or glandular.



B. Perennial plants, mostly opposite leaves, stems not peeling.....5

5. A. Plants in clumps.....6
B. Plants not in clumps, erect stems.....7

6. A. Inflorescence nodding in bud, lines of hair down 2 raised ridges along stem, red sepals, seeds 1 mm long.....*Epilobium anagallidifolium* Lam.

Perennial plant found in moist alpine slopes, meadows and stream banks at elevations between 2100-3700m. Less than 20cm height. Leaves <2cm long, basal leaves spoon-shaped to oblong, glabrous; upper leaves elliptic to lanceolate, petiole 1-6mm. Pink to rose-purple petals, subglabrous fruit 17-36mm. Hairs persistent on seeds.



B. Inflorescence erect in bud, seeds 1.5 – 2 mm long.....*Epilobium clavatum* Trel.

Perennial plant found on subalpine scree and rocky stream banks at elevations between 1200-3600m. Less than 22cm height. Leaves 12-28mm long, more or less elliptic to ovate, obtuse to subacute, petiole 0-3mm. Hypanthium 0.6-2mm. Sepals 2.5-4.5mm. Petals 3.5-6mm, pink to rose-purple. Stigma widely club-like. Fruit 20-40mm, generally sparsely hairy with pedicel 2-18mm. Seeds 1.5-2.1mm, papillate.



7. A. Leaves >5cm long, plants up to 100cm tall, pink or white petals, found in montane zones.....*Epilobium ciliatum* (Lehm.) Dorn

Perennial plant abundant in disturbed area, moist meadows, stream banks and roadsides at elevations less than 4100m. Loosely clumped plants <190cm, basal rosettes or fleshy bulbles with narrowly lanceolate to ovate leaves (1-15cm) and conspicuous veins. Inflorescence is densely strigose and generally glandular with white to rose-purple petals on flower. Stigmas club or head-like; hairy fruit. Seeds are ridged.



B. Leaves <5cm long, plants <30 cm tall, found in montane and subalpine zones.....8

8. A. Leaves not clasping stem, winged petioles, petals all white or with pink tips (turn pink after pollination), found in boreal and montane zone.....*Epilobium lactiflorum* Haussk.

Perennial plant generally clumped 150-500cm high found in moist meadows, stream banks and talus at



elevations 1400-3300 m with short, leafy stolons. Leaves are narrowly ovate-narrowly lanceolate, obtuse to acute and have winged petioles. Glandular inflorescence is nodding to erect, flowers with white/pink petals. Hairy fruit with netted seed.

B. Not as described above, petals not usually white.....9

9. A. Leaf elliptic to ovate with rounded base, grows from fleshy, scaly, underground shoots, found in moist meadows and stream sides.....
.....*Epilobium saximontanum* Haussk.

Perennial plant <60cm found at elevations 1400-3500m. Has subsessile, generally clasping leaves and a glandular hypanthium. White/pink petals with hairy fruit and low-papillate seeds.



B. Leaves lanceolate to ovate, obtuse to acute, pedicels >5mm.....10

10. A. More or less nodding inflorescence, white petals, lanceolate often irregularly dentate leaves, turions present.....*Epilobium hallianum* Haussk.

Erect, perennial plant growing up to 500cm in height at moist meadows and stream banks at elevations 600-3200m. Small winter bulblets found underground. Ovate leaves on lower stem and lanceolate leaves higher up, obtuse to subacute. Inflorescence a nodding raceme of glandular flowers with white to pink petals, sometimes hairy fruit with papillate seeds.



B. Leaves entire or with few shallow teeth, magenta petals, stems with 4 or glabrous leaves, turions absent.....*Epilobium hornemannii* Rchb.

Perennial plant, 100-450cm in height found loosely clumped in moist meadows and streambanks at 1500-3400m. Short, leafy stolons, leaves lanceolate to ovate (narrower above) 15-55mm, generally glabrous, obtuse to acute. Glandular inflorescence with white/pink to rose/purple petals, hairy fruit with papillate seeds.

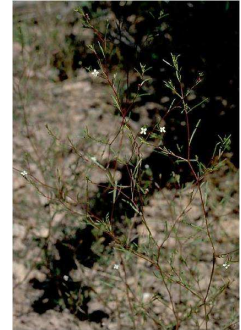


11. *Gayophytum*

Annual plants with generally erect stems. Leaves are cauline, alternate (or lowest subopposite), entire, and narrow-lanceolate. Flowers are axillary and are white, fading pink. Hypanthium is inconspicuous. Sepals 4, staying fused in 2's or coming free; petals 4; and stamens 8, those opposite the sepals being larger. Ovary chambers 2. Stigma generally does not extend beyond the anthers, and is generally touching them. Fruit is a capsule with 4 valves, generally coming free.

11. A. Petals 0.7 - 1.5 mm, ovary glabrous or puberulent.....
*Gayophytum ramosissimum* Torr. & A. Gray

Plant herbage is more or less glabrous. Stem is less than 50 cm, branching throughout, forked except at the base. Leaves 1 – 4 cm, much reduced above. First flower in inflorescence is 5 – 15 nodes above the base. Fruit is 3 – 9 mm and slightly knobby. Habitat: sagebrush scrub.



- B. Petals 1.2 - 7 mm, ovary hairy.....*Gayophytum diffusum* Torr. & A. Gray

Stem is less than 60 cm, may branch at base or not, is generally forked above. Leaves 1 – 6 cm, generally reduced above. First flower in inflorescence is 1 – 20 nodes above the base. Fruit is 3 – 15 mm and slightly to very knobby. Common. Habitat: open montane forest, sagebrush scrub.



12. Oenothera

Perennial or biennial plants. Leaves alternate and generally lanceolate. Flowers yellow and generally opening at dusk. Flowers have radial symmetry. Sepals 4, and reflexed; petals 4, with notched tips; stamens 8, with anthers attached at middle. Ovary chambers 4.

12. A. Plant stemless; leaves irregularly-pinnately-lobed in basal rosette.....
*Oenothera flava* (A. Nelson) Garrett

Perennial plant with a fleshy taproot. Hairs glandular and generally minutely strigose. Leaves oblanceolate and somewhat fleshy. Flowers are axillary. Hypanthium 24 – 80



mm. Sepals 10 – 34 mm, with free tips in bud. Petals 10 – 30 mm. Fruit 10 – 40 mm long and 4 – 7 mm wide, narrowly elliptic, with wings 2 – 6 mm wide. Habitat: drying depressions, streambanks, generally clay soils, sagebrush scrub to pinyon/juniper woodland.

B. Plant with stem; leaves cauline.....13

13. A. Sepals 9-18mm, often reddish; petals 7-20 mm.....*Oenothera villosa* Thunb.

Biennial plant, rosetted, minutely strigose, and especially in inflorescence also glandular. Hairs also long and spreading, generally with red, blister-like bases. Stem erect, 5 – 20 dm. Cauline leaves 10 – 30 cm, entire or minutely dentate. Inflorescence is a spike, open and few-flowered. Hypanthium 25 – 40 mm. Sepals have free tips in bud 0.5 – 2.5 mm. Fruit 20 – 35 mm long and 4 – 7 mm wide, narrowly lanceolate and more or less straight. Habitat: moist openings in forests.



B. Sepals 27 – 48 mm; petals 25 – 52 mm.....*Oenothera elata* Kunth

Biennial or short-lived perennial, densely minutely strigose, and especially in inflorescence also glandular. Hairs also long, appressed to spreading, sometimes with red, blister-like bases. Stem erect, 4 – 25 dm. Cauline leaves 4 – 25 cm, dentate to subentire. Inflorescence is a spike. Hypanthium 20 – 48 mm. Sepals have free tips in bud 1 – 7 mm. Fruit 20 – 65 mm long and 4 – 7 mm wide, narrowly lanceolate and more or less straight. Habitat: moist places.



14. **Chamerion**

Perennial plants. Leaves alternate, finetoothed, and lanceolate. Flowers pink to purple. Inflorescence is a raceme with bracts. Sepals 4, and are erect; petals 4; stamens 8 with anthers attached at middle. Ovary chambers 4. Fruit straight and cylindric.

14. A. Plant less than 30 dm tall; racemes elongate, many-flowered, not leafy; style longer than the stamens.....*Chamerion angustifolium* L.

A strongly colonial plant, more or less glabrous to densely strigose above. Leaves are 15 – 200 mm, with more or less conspicuous veins and the midrib strigose below. Leaf petioles are 2 – 7 mm. The inflorescence is dense,

generally canescent. Flower nodes in bud. Sepals are 7 – 16 mm; petals are 10 – 25 mm and entire. Stamens are shorter than the pistil, maturing before the stigma. Pollen is bluish gray, shed singly. Stigma is 4-lobed. Fruit is 40 – 100 mm, gray-hairy, with a pedicel of 7 – 20 mm. Common. Habitat: open places, gravel bars, roadsides, especially after fires.



B. Plant less than 7 dm tall; racemes few-flowered, leafy; style shorter than the stamens.....*Chamerion latifolium* L. Holub

Plant is clumped from a woody caudex, more or less glabrous to densely strigose. Leaves are 10 – 100 mm, widely lanceolate, and can be glabrous or hairy on margins and veins. Leaf petioles are 0 – 3 mm. The inflorescence is more or less strigose. Flower nodes in bud. Sepals are 10 – 24 mm; petals are 13 – 32 mm and entire. Stamens are shorter than the pistil, maturing before the stigma. Pollen is grayish, shed singly. Stigma is 4-lobed. Fruit is 30 – 105 mm, subglabrous to gray-hairy, with a pedicel of 5 – 18 mm. Habitat: gravel bars, talus slopes, glacial outwashes.



Conclusions:

Overall, this key proved to be beneficial in identifying the Onagraceae species, although it does have its limitations. For the Onagraceae family, particularly within the *Epilobium* genus, there are very few differences between species. Thus, when creating the key we had to use characteristics that may not always be apparent for all specimens. Using characteristics such as fruits and seeds are quite useful when they are developed, but can be very unreliable depending on the time of year and duration of fruiting time.

Another example was when keying out herbarium specimens. When using them there were characteristics that would only be apparent if the user had taken the specimen directly from the field or had detailed notes describing the situation it was found in. For example in some species defining characteristics are whether the plants grow singularly or in clusters. Clearly this would be impossible to determine with an

herbarium specimen unless detailed notes were taken- which can be a pretty rare occurrence.

An additional problem when using the herbarium specimens was with the labeling of the actual plants. It was noted that a large quantity of the Onagraceae specimens were collected and labeled well over 40 years ago. Seeing as in the data differentiating Onagraceae species is still fuzzy today, it brings into question how well the taxonomic labeling of almost half a century ago can be trusted.

Lastly, we ran into trouble when using specific size measurements for the plants. As growth of individual plants can be somewhat variable to begin with, and then a fair amount of the species had overlapping measurement ranges regarding things like leaf and petal lengths, it offers little help if this is the last fork in the key.

Despite these setbacks, the key did prove to be effective in identifying numerous species found within the Gothic area. Both the online and paper dichotomous keys were useful in providing defining characteristics for an elusive family of plants and efficiently narrowing the plants down to the species level. Overall the key proved to be successful in its attempts but there are certainly ways (as stated above) in which it could be improved upon in the future.

Works Cited:

Species Names for the Gothic Area:

Frase, Barbara A. and Paul Buck. 2007. *Vascular Plants of the Gothic Area*. Third edition. Rocky Mountain Biological Laboratory. 28 pp.

Family Descriptions:

Weber, William A. and Ronald C. Wittman. 2001. Colorado Flora: Western Slope. Third edition. University Press of Colorado, Niwot, CO. 488 pp.

Genus and Species Descriptions:

Website of The Jepson Online Interchange, University of California at Berkeley:
<http://ucjeps.berkeley.edu/interchange/>.

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Gayophytum ramosissimum taken by W. L. Wagner, available on the website of the Smithsonian National Museum of Natural History: <http://botany.si.edu/onagraceae/>.

Epilobium hallianum taken by Doreen L. Smith, available on the CalFlora website
http://calphotos.berkeley.edu/cgi/img_query?enlarge=0000+0000+1108+1647

Epilobium clavatum taken by Susan McDougall, available on the website of the USDA Natural Resources Conservation Service: <http://plants.usda.gov/>.

All other photos taken by Mel Harte, available on the Rocky Mountain Biological Laboratory website: <http://rmbi.org/herbarium/index1.html>.