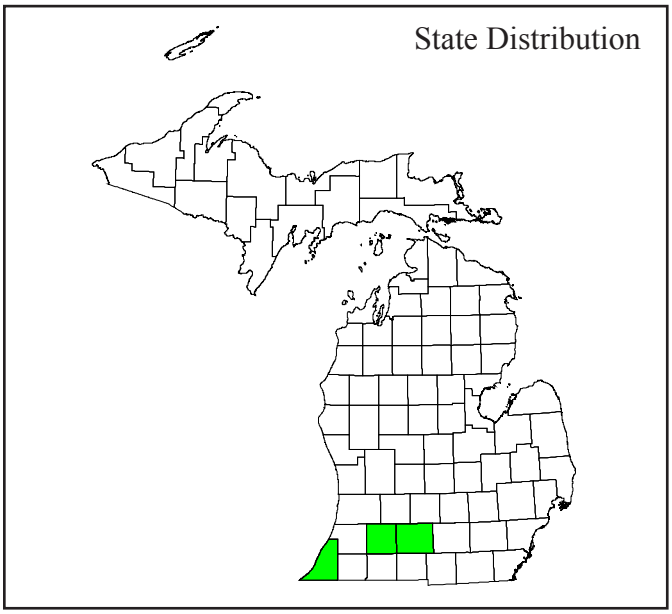
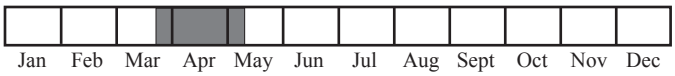
# *Corydalis flavula* (Raf.) DC. — yellow fumewort

Photo by Bradford S. Slaughter




Best Survey Period




**Status**: State threatened

**Global and state rank**: G5/S2

**Other common names:** yellow corydalis; yellow harlequin

**Family**: Papaveraceae (poppy family)

**Synonyms:** *Capnoides flavulum* (Raf.) Kuntze; *Fumaria flavula* Raf.

**Taxonomy**: The Papaveraceae is a family of ca. 660 species of herbaceous plants with watery or colored, acrid sap, pinnately lobed leaves, 2- or 3-merous hypogynous flowers, biseriate corollas commonly with 4 or 6 petals, capsular fruits with arillate seeds, and the presence of various alkaloids within laticifers or secretory cells (Zomlefer 1994). The genus *Corydalis* is often segregated into the family Fumariaceae, which is recognized by some botanists as a distinct family on the basis of several morphological characteristics that often, but not always, differ from character states found in members of the Papaveraceae (Zomlefer 1994, Stevens 2001). Members of the genus *Corydalis* are herbs with bipinnately dissected leaves and short, bracteate racemes bearing asymmetrical flowers with dilated, keeled outer petals, dilated, keeled or winged inner petals coherent over the sigma, and slender, bivalved capsules containing black, shining seeds.

**Range**: Yellow fumewort is widespread in the eastern and central United States and Canada, where the species occurs from Rhode Island south to Florida, west to Michigan, Illinois, Iowa, and South Dakota, and south to Oklahoma, Arkansas, and Louisiana (Gleason and Cronquist 1991). The species is considered rare in Connecticut, Delaware, Georgia, Nebraska, New Jersey, New York, and Ontario (NatureServe 2009).

**State distribution**: Yellow fumewort is restricted to southwestern Lower Michigan, where the species is known from 17 occurrences in Berrien, Cass, Kalamazoo, and Calhoun counties.

**Recognition**: Yellow fumewort is a **small, semi-succulent, spreading or sprawling annual forb** to 30 cm tall. The species is characterized by **green to glaucous, cauline, alternate, bipinnately dissected leaves** and **axillary racemes** with few to 10 or more irregular **flowers with 4 unequal yellow petals.** The **uppermost petal** is **7-10 mm long with a short, incurved spur** and a **toothed, undulate crest**, the **lowermost petal is similarly crested but unspurred**, and the inner two petals are coherent over the stigma. Inflorescences equal or are surpassed by the leaves. Some plants bear cleistogamous (closed, self-pollinating) flowers. The fruit is a **slender, terete to**

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**torulose, glabrous, pendant capsule** to 25 mm long and 2.5 mm wide that contains **small, smooth, shiny seeds** that bear **elaiosomes** and undeveloped embryos. Two other species of *Corydalis* occur in Michigan; *C. sempervirens* (pink corydalis) is an erect plant bearing pink, yellow-tipped flowers on terminal inflorescences that surpass the leaves, and *C. aurea* (golden corydalis) bears yellow flowers 11-14 mm long and shiny but reticulate seeds (Voss 1985). Both pink corydalis and golden corydalis are primarily distributed in northern Michigan.

**Best survey time/phenology**: In Michigan, yellow fumewort flowers in April and early May, and fruits in May and June. Following seed set in summer, mature plants senesce, and the species is not visible above ground until new seedlings germinate in late summer or early fall. In addition, foliage of sterile plants can be easily mistaken for *Dicentra canadensis* (squirrel-corn) or *D. cucullaria* (Dutchman's breeches), thus the species is best sought when in flower.

**FQI Coefficient and Wetland Category:** 8, FACW+

**Habitat**: Most Michigan populations of yellow fumewort occur in early- to mid-successional degraded forest dominated by the non-native *Robinia pseudoacacia* (black locust) in the Fort Custer Training Center and Fort Custer Recreation Area in eastern Kalamazoo and western Calhoun counties. In these areas, yellow fumewort is associated with species typical of degraded, successional forest, including *Acer nigrum* (black maple), *A. rubrum* (red maple), *A. saccharum* (sugar maple), *Alliaria petiolata* (garlic mustard), *Fraxinus pennsylvanica* (green ash), *Galium aparine* (annual bedstraw), *Geum canadense* (white avens), *Juglans nigra* (black walnut), *Osmorhiza claytonii* (hairy sweet-cicely), *O. longistylis* (smooth sweet-cicely), *Parietaria pensylvanica* (pellitory), *Pilea pumila* (clearweed), *Poa compressa* (Canada bluegrass), *Prunus serotina* (black cherry), *P. virginiana* (choke cherry), *Quercus alba* (white oak), *Q. rubra* (red oak), *Q. velutina* (black oak), *Ribes cynosbati* (prickly gooseberry), *Rubus allegheniensis* (common blackberry), *R. occidentalis* (black raspberry), *R. pensylvanicus* (dewberry), *Sassafras albidum* (sassafras), *Stellaria media* (common chickweed), and *Toxicodendron radicans* (poison-ivy) (Nuzzo 2005). These forests have developed on former farm fields that were historically characterized by oak openings and dry-mesic southern forest. The lack of unaltered soils and conservative native associates, in addition to the presence of yellow fumewort in a nearby abandoned homestead, suggests the species may be adventive at some or all of the Fort Custer sites. However, the species was noted in the vicinity of Fort Custer at several sites along the Kalamazoo River in Comstock Township by Hanes and Hanes (1947), so the Fort Custer populations may have originated from colonization events associated with soil disturbances that approximated those that typically occur in its native floodplain habitat.

At one Michigan site in which yellow fumewort occurs in an intact, natural community, the species occurs in a floodplain forest, where it is associated with *Cryptotaenia canadensis* (honewort), *Floerkea proserpinacoides* (false mermaid), green ash, *Impatiens capensis* (spotted touch-me-not), *Polemonium reptans* (Jacob's ladder), *Ranunculus abortivus* (small-flowered buttercup), *Symplocarpus foetidus* (skunk-cabbage), *Trillium recurvatum* (red trillium), *Viola striata* (cream violet), and *Ulmus rubra* (slippery elm). Forested stream terraces, slopes, and bluffs are typical habitat of yellow fumewort throughout its range (Deam 1940, Ownbey 1947, Steyermark 1963, Swink and Wilhelm 1994).

**Biology**: Yellow fumewort is a winter annual. Mature plants flower in early spring and set seed by mid-summer, after which they senesce. Seeds germinate in late summer or fall, overwinter as seedlings, and flower the following spring. Seeds of this species are dormant at maturity in spring, only coming out of dormancy following exposure to warm summer temperatures, a process known as afterripening (Baskin and Baskin 1994). Embryos develop and germinate in mid-late August and afterward following the drop of day and night temperatures from peak summer levels. Most seeds germinate within one year of development, although some seeds retain viability for several years (Baskin and Baskin 1994). Seeds bear elaiosomes (food bodies) and therefore are presumably ant-dispersed.

**Conservation/management**: Michigan is at the northern edge of the native range of yellow fumewort, and the species was presumably never common in the state. Most extant populations occur in degraded, successional habitat dominated by a non-native tree, black locust. At least six of these populations have good viability, consisting of hundreds to thousands of plants

in some years. At these sites, black locust appears to be facilitating yellow fumewort by altering soil and litter properties via nitrogen fixation (Nuzzo 2005). Plants are absent from adjacent, less disturbed oak-dominated forest stands, where litter depth is substantially greater. Use of prescribed fire in yellow fumewort habitat at Fort Custer appears to benefit the species, possibly due to reduction of leaf litter and/or thinning of canopy and subcanopy layers. Reduction of leaf litter and thinning of canopy and subcanopy layers through use of prescribed fire and selective cutting may allow yellow fumewort to colonize oak forests and woodlands adjacent to currently occupied degraded, successional black locust stands. In intact floodplain forests and mesic southern forests, yellow fumewort likely relies on disturbances such as flooding, windthrow, and soil erosion or slippage that create bare microsites suitable for seedling germination and establishment.

The impacts of non-native, invasive species on populations of yellow fumewort are unknown. At many Michigan sites, yellow fumewort is associated with non-native species, including garlic mustard, *Leonurus cardiaca* (motherwort), *Lonicera ×bella* (hybrid honeysuckle), Canada bluegrass, and common chickweed. In these sites, yellow fumewort appears to be responding to the same disturbances that favor these invasive species and other weedy species, including many annuals and biennials (Nuzzo 2005). Potential impacts of non-native, aggressive species on yellow fumewort should be assessed through monitoring. In natural, high quality habitats, such as floodplain forest and mesic southern forest, populations of non-native, aggressive species should be eradicated to protect overall ecological integrity.

**Comments**: Yellow fumewort undergoes a process known as morphophysiological dormancy, in which physiological dormancy prevents embryo growth in freshly matured seeds in spring and high temperatures inhibit embryonic growth in summer (Baskin and Baskin 1994). The species often exhibits significant fluctuations in population size between years (Nuzzo 2005). The genus *Corydalis* is derived from the Greek *korudallis* for "crested lark," in reference to the crested outer petals characteristic of the genus. The specific epithet *flavula* is a reference to the yellow color of the flowers.

**Research needs**: The primary need is monitoring to assess the impacts of invasive species and habitat management (e.g., prescribed fire) on populations of yellow fumewort. Research on the impacts of fire and other management techniques on populations of yellow fumewort will provide land stewards with methods for maintaining and enhancing populations of the species. In addition to monitoring well-documented populations of this species, new populations should be sought in floodplain forest and mesic southern forest in southwestern Lower Michigan. Numerous studies have been conducted on the physiology, population biology, and autoecology of members of the genus *Corydalis*. Additional research on germination requirements and the impacts of seed predation on *C. flavula* will improve understanding of the factors that limit population size and growth.

**Related abstracts**: Dry-mesic southern forest, floodplain forest, mesic southern forest, beak grass, goldenseal, Jacob's ladder, large-flowered leafcup, prairie trillium, pumpkin ash, red mulberry, Virginia snakeroot, wahoo, cerulean warbler, eastern box turtle, Indiana bat, Louisiana waterthrush

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