FLOWERING PLANTS WITHOUT CHLOROPHYLL IN THE PRESERVE

S.A. Mori, R.F.C. Naczi & M. Rothman
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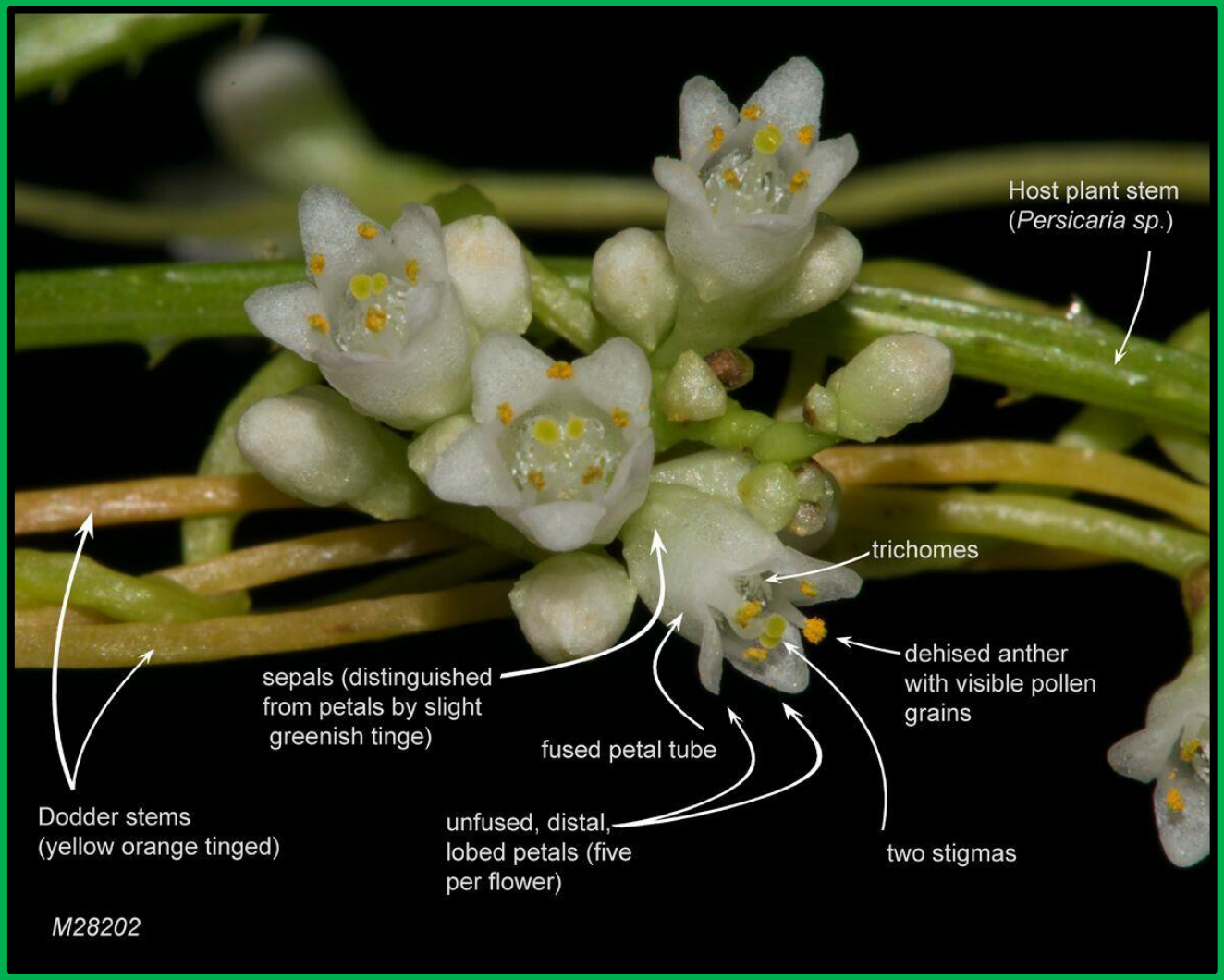
As far as we know there are only four species of flowering plants in the Westchester Wilderness Walk/Zofnass Family Preserve that lack chlorophyll. Dodder (*Cuscuta gronovii*) was previously placed in the Cuscutaceae but, based on molecular and morphological data, the genus has been retained in the morning glory family (Convolvulaceae). The following two species belong to the Blueberry Family (Ericaceae): *Monotropa uniflora* (Indian-pipe) and *Monotropa hypopithys* (pinesap) and a fourth species, beech-drops (*Epifagus viriginiana*), belongs to the Broom-Rape Family (Orobanchaceae).

Because the above species lack chlorophyll, they are not able to photosynthesize and, thus, must rely on other plants for their energy. Plants with chlorophyll are called autotrophs because they produce their own carbohydrates whereas plants without chlorophyll are heterotrophs because they “steal carbohydrates” from autotrophs. The latter get their food in two different sources. They either directly parasitize autotrophic species or they are myco-heterotrophic. In the latter case, mycorrhizal fungi carry carbohydrates from an autotrophic plant to a heterotrophic plant. For example, beech-drops directly take carbohydrates from the roots of American beech trees (*Fagus grandifolia*) or a mycorrhizal fungus serves as a conduit of carbohydrates from an autotrophic species to Indian-pipe. There are many other variations on these themes, e.g., mistletoe plants (not present in this Preserve) both photosynthesize and parasitize autotrophic plants. According to Evert and Eichhorn (2013), there are nearly 3,000 species of flowering plants that depend upon other plants for the carbohydrates they need for survival.

DODDER (*Cuscuta* gronovii) DIRECTLY PARASITIZES *PERSICARIA ARIFOLIA*

The stem of dodder coils around the stem of *Persicaria arifolia* where it produces haustoria that penetrate the stem of the host

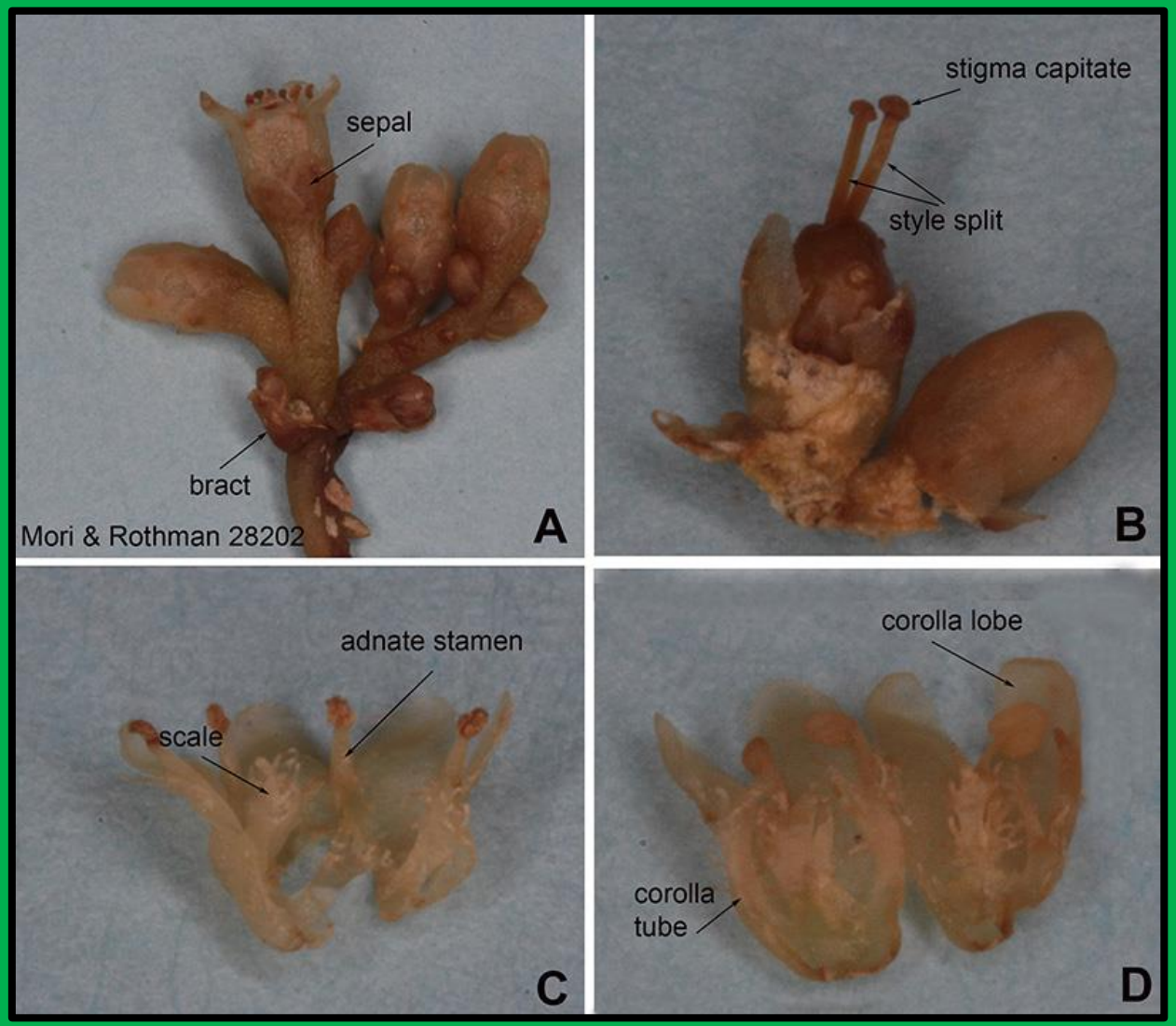
MORPHOLOGY OF *CUSCUTA GRONOVII*



Cuscutaceae is now treated as a subfamily of the Convolvulaceae

HAUSTORIA OF *DODDER* STARTING TO PENETRATE THE STEM OF THE HOST

FLOWER FEATURES OF *CUSCUTA GRONOVII*

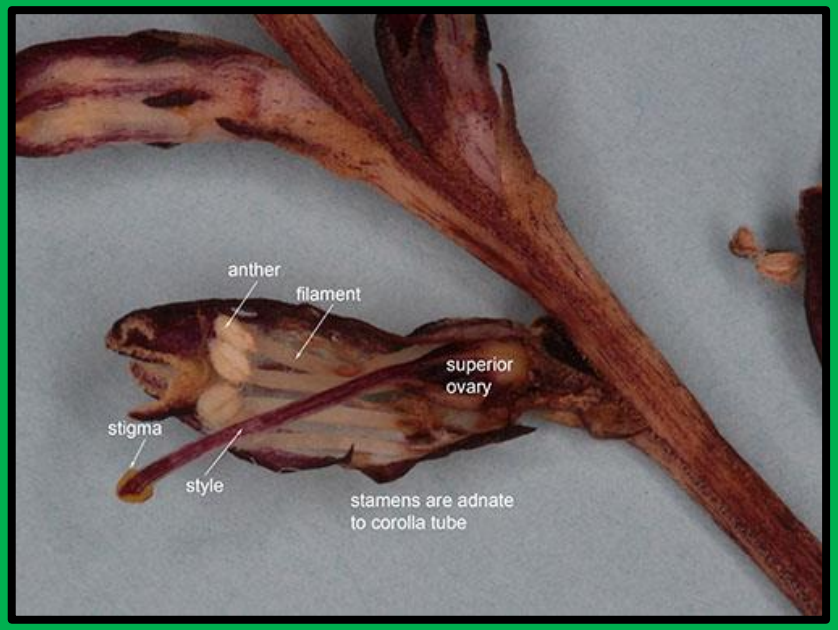


A. Each flower is subtended by a single bract. The sepals are imbricate.
B. There are 2 styles, the stigmas are capitate, and the ovary is superior.
C. The stamens are adnate to the corolla tube. Note the fimbriate scales.
D. The petals are fused into a corolla tube.

BEECH-DROPS (*Epifagus virginiana*) DIRECTLY PARASITIZE TREES OF THE AMERICAN BEECH

The roots of beech-drops penetrate the roots of the American beech. The parasite uses the carbohydrates both for energy and for constructing new structures such as flowers and fruits. Beech-drops are parasitic heterotrophs. This species belongs to the Orobanchaceae family.

FLOWERS OF BEECH-DROPS



Beech-drops have two type of flowers.

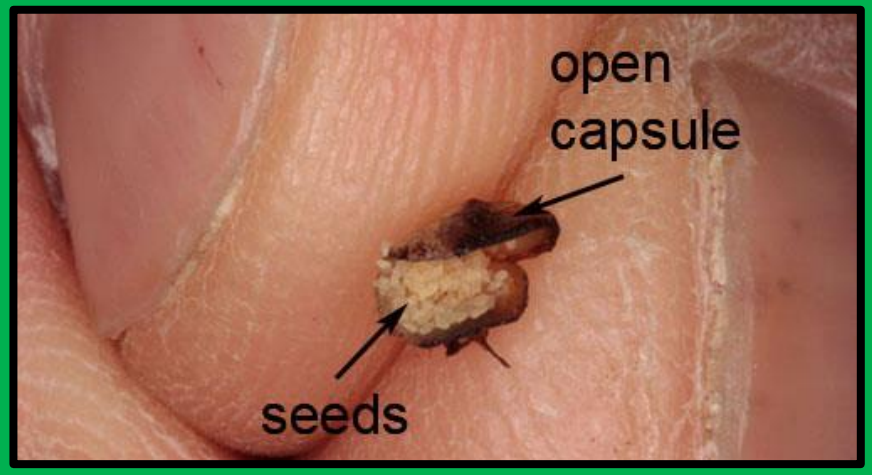
Chasmogamous flowers that open and are able to cross pollinate. The flowers shown here are this type.

Cleistogamous flowers that do not open and are only able to self pollinate.

Look under beech trees in late summer to find beech drops in flower.

FRUITS AND SEEDS OF BEECH-DROPS

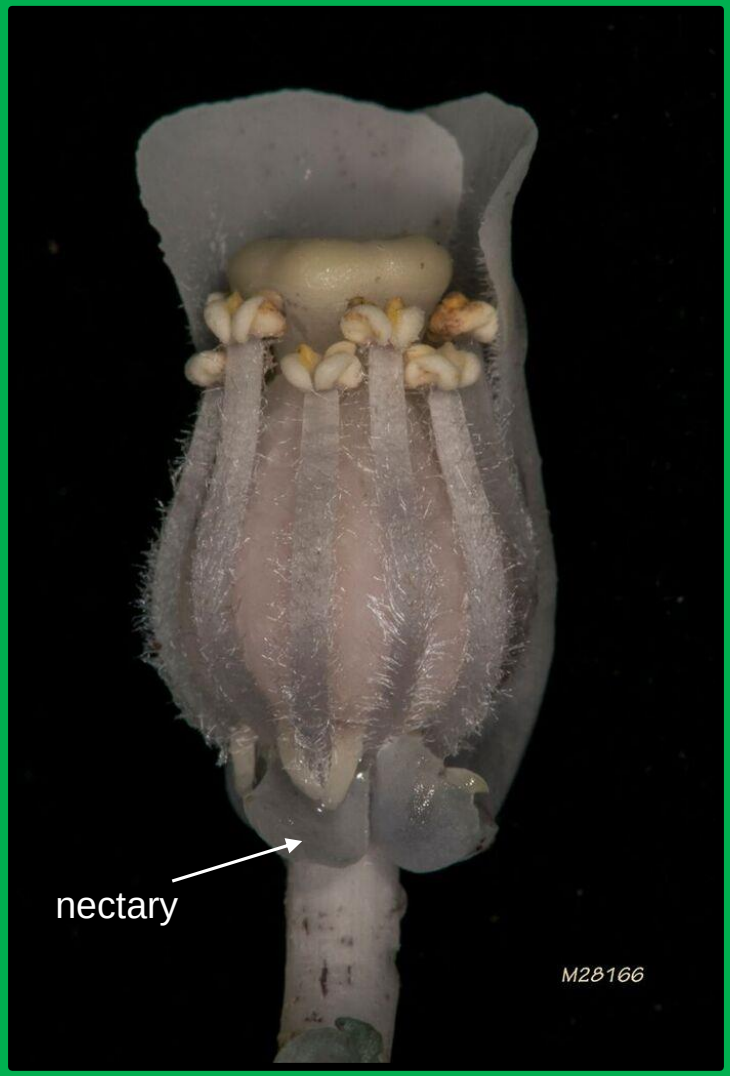
Images by C. A. Gracie



MONOTROPA UNIFLORA IS A MYCOHETEROTROPH

Indian-pipe (*Monotropa uniflora*) has no chlorophyll and its leaves are reduced to vestigial scales. It does not photosynthesize. This species belongs to the blueberry family (Ericaceae).

FLOWERS OF INDIAN-PIPE



FRUITS AND SEEDS OF THE INDIAN-PIPE

This species flowers in mid-summer to early autumn and fruits in the autumn. The fruits split open into five valves and the seeds are very small and dust-like. They are most likely dispersed by the wind.

FLOWERS AND STEM OF PINESAP (*MONOTROPA HYPOPITHYS*)

More than one flower per stem versus one flower per stem in *M. uniflora*.

Buff-colored stem with dense pubescence versus usually white, glabrous stem in *M. uniflora*. Both species belong to the Ericaceae.