

# **Important Seed Characters for Certain Species in the Morning-glory Family (Convolvulaceae)**



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**Important Seed Characters for Certain Species in  
Convolvulaceae and Other Closely Related Families**

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## INTRODUCTION

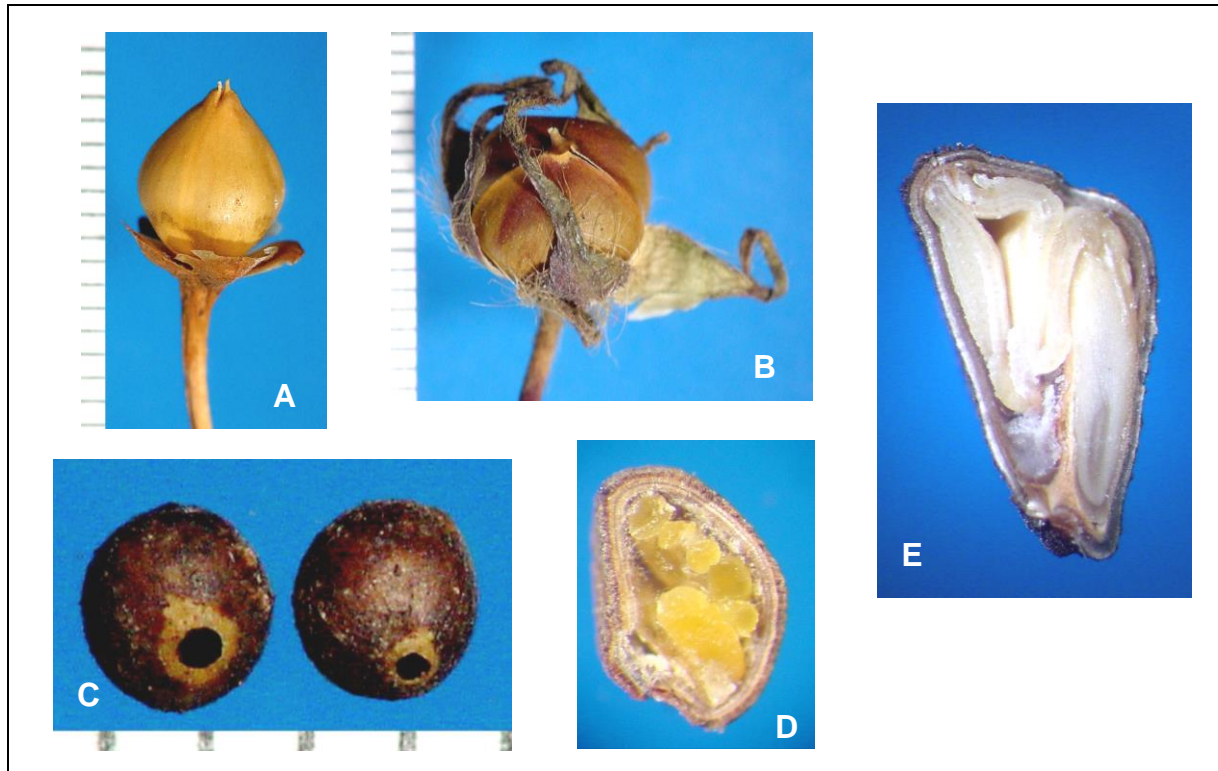
The morning-glory family (Convolvulaceae) is comprised of annual and perennial herbs, vines, shrubs, and rarely trees. Several species are of economic importance. The variously colored root tubers of sweet potatoes (*Ipomoea batatas* var. *batatas*) are a popular food item as well as a source of industrial alcohol, sugar, and livestock feed (Heywood et al., 2007). The leaves of *Ipomoea aquatica* (water spinach) are used in Asian cuisine (Molinar, 2012). Purgatives are obtained from tuberous roots and neurologically active alkaloids are found in the seeds of various genera in the family (e.g., lysergic acid or LSD is a synthetic derivative of *Ipomoea*-type alkaloids) (Heywood et al., 2007; Simpson and Ogorzaly, 2001). Many species are used as ornamentals because of their brightly colored, funnel-shaped flowers, although the flowers usually remain open for only one day (Zomlefer, 1994). *Dichondra* species are used for groundcover as a lawn substitute (Heywood et al., 2007). Several species are considered noxious weed pests (Table 1) (USDA-AMS, 2020). Most notable of noxious weeds in this family is the genus *Cuscuta*, a widespread parasitic plant genus with several species attacking economically important agricultural and horticultural host plants.

Convolvulaceae encompasses an estimated 52 - 59 genera and 1,650 - 1,840 species, (Heywood et al., 2007; Mabberley, 2008; Zomlefer, 1994), with the number of recognized species continuing to increase as new species are discovered and described. Historically, there has been considerable disagreement about inclusion of certain taxa in this family; *Dichondra*, *Humbertia madagascariensis* (a tree endemic to Madagascar), and *Cuscuta*. For various reasons some authors have placed these taxa in separate families (Dichondraceae, Humbertiaceae, and Cuscutaceae). Current treatments based on recent molecular analyses include these taxa in Convolvulaceae. For further information on historical taxonomic treatments see Wilson (1960) and for the current treatment see Stefanović et al. (2003).

**Table 1.** Genera included in this manual, numbers of species within each genus, and noxious weed seed designation in the United States.

Genus	Approximate number of species	Noxious Weed Seed Designation (USDA-AMS, 2020)
<i>Calystegia</i>	25 (JFP, 2020)	<i>Calystegia</i> spp.: KS <i>Calystegia sepium</i> : AL, AR, GA, HI, KS, LA, MI, MO, MS, NC, ND, NJ, OH, OK, PA, SC, SD, TN, TX, WA
<i>Convolvulus</i>	250 (JFP, 2020) 125 (Mabberley, 2008)	<i>Convolvulus</i> spp. RI, UT <i>C. arvensis</i> : AK, AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, OH, OK, OR, PA, SC, SD, TN, TX, VA, VT, WA, WI, WV, WY
<i>Cuscuta</i>	194 (Costea et al., 2015)	<i>Cuscuta</i> spp.: AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND (except <i>C. coryli</i> ), NE, NH, NJ, NM, NV, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, and WY
<i>Dichondra</i>	15+ (JFP, 2020)	Not noxious.
<i>Ipomoea</i>	500-600 (JFP, 2020) 650 (Mabberley 2008)	<i>Ipomoea alba</i> : GA; <i>Ipomoea aquatica</i> US; <i>Ipomoea triloba</i> AZ; <i>Ipomoea purpurea</i> : NE (when found in field crop seed), OK and WV; <i>Ipomoea muricata</i> [ <i>Ipomoea turbinata</i> ] AR, GA, KY, LA, and MS; <i>Ipomoea</i> spp. AZ (except <i>I. carnea</i> , <i>I. arborescens</i> , <i>I. tribola</i> , <i>I. batatas</i> , <i>I. quamoclit</i> , and <i>I. noctiflora</i> ), AR, KS, LA, MI, MS, NE (when found in field crop seed), NM, NC, OK, and TX

In Convolvulaceae, the ovary is superior (usually comprised of two carpels) and may be entire or deeply two- or four-lobed (Zomlefer, 1994). The fruit is usually a capsule, which may or may not be dehiscent (Figure 1 A-C). The endosperm is hard and clear or semi-transparent. Embryos in this family are large, straight or curved, with folded or coiled cotyledons (cotyledons are lacking in *Cuscuta*; Costea et al., 2015) (Figure 1 D-E).



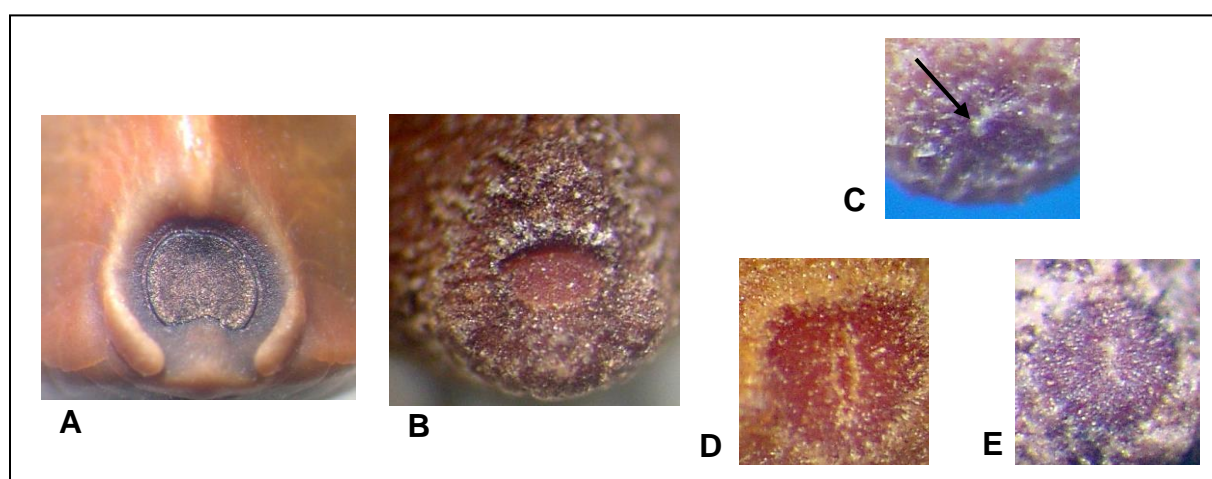
**Figure 1.** A - capsule from *Convolvulus arvensis*; B – capsule from *Ipomoea purpurea*; C - two lobes of a *Dichondra* fruit, each containing one seed (only one ovule in each locule of the ovary matures); D – longitudinal section of a *Cuscuta* seed showing coiled embryo (yellow) and transparent endosperm; E – longitudinal section of a *Convolvulus arvensis* seed showing the folded embryo surrounded by transparent endosperm.

The characters of importance to seed identification in this group include seed size, shape, color, and texture, plus hilum type, size and color. As described by Gunn (1969), the shape of *Calystegia*, *Convolvulus*, and *Ipomoea* seeds are either wedge-shaped (+/- flattened), or spheroidal when viewed in cross-section. Seeds of *Dichondra* are spheroid. In *Cuscuta* the seeds may be variously shaped (e.g., ovate, obovate, oblong or spherical) and variously angled (Costea et al., 2006a, 2006b, 2006c; Olszewski et al., 2020; USDA, 1952). For all genera considered here, the number of seeds (usually 1 to 4) developing in the fruit may influence the shape of the mature seed.

The seed coat is derived from a single integument (Corner, 1976), and may be smooth, tuberculate or rugose. Seeds of some *Ipomoea* species have long hairs in various locations on the seed and may be pubescent on or around the hilum (Gunn, 1969). The epidermal cells of seed coat in most *Cuscuta* species alternate between two states: papillose or dome-shaped

when seeds are hydrated, and alveolate (honeycomb-like or pitted) giving a reticulate or net-like appearance when the seeds are dry (Olszewski et al., 2020).

The hilum characters for *Calystegia*, *Convolvulus*, and *Ipomoea* can be assigned to one of two types (Gunn 1969). The *Ipomoea*-type hilum is nearly circular in outline, usually indented (emarginate) at the base, surrounded by a flattened area and encircled by a hilar ridge (Figure 2A). The *Convolvulus*-type hilum is oval shaped, wider than long, entire, and lacks a hilar ridge (Figure 2B). The *Cuscuta*-type hilum is a flat, round to elliptic area, and may or may not have a well-defined margin. Epidermal cells of the *Cuscuta* hilum are significantly smaller than those the rest of the seed coat and are concentrically arranged from the center out to the margin (Olszewski et al., 2020). Near the center of the hilum is the funicular scar that appears as either a raised line, point, or slit (fissure) under light microscopy (Figure 2C-E). For details of *Cuscuta* seed surface morphology under scanning electron microscopy see Olszewski et al. (2020). In Table 2, hilum types are indicated as (1) *Ipomoea*-type or (2) *Convolvulus*-type.



**Figure 2.** Examples of hilum types in Convolvulaceae as characterized by Gunn (1969). A – *Ipomoea*-type hilum. B – *Convolvulus*-type hilum. C – raised point *Cuscuta*-type hilum. D – slit *Cuscuta*-type hilum. E – raised white line *Cuscuta*-type hilum.

It should be noted that species-level identification of seeds (and sometimes even whole plants) can be quite challenging in many genera of this family, e.g. *Convolvulus*, *Cuscuta*, *Ipomoea*, due to considerable variation in seed color and hairiness or texture and size within species and overlapping characters among species. According to the GRIN database (USDA-GRIN, accessed 11 June 2020), the specific identity of commercial dichondra is a matter of current debate (*D. repens* J. R. Forst. & G. Forst. versus *D. micrantha* Urb.). Two closely related species of field dodder (*Cuscuta pentagona* Engelm. and *C. campestris* Yunck.) are now recognized as taxonomically distinct based on Costea and Tardif (2006). Both species are native to North America and can be significant agricultural pests. The species found in a greater number of states, and the only one of the two found in California, is *C. campestris*. Caution should be used when referring to literature and herbarium specimens related to these two species because prior to the treatment by Costea and Tardif (2006) [further discussed in Costea et al. (2006a)], *C. campestris* was often treated as a synonym of *C. pentagona* because of difficulty in distinguishing subtle diagnostic characters in pressed herbarium specimens. The naturalized populations of alfalfa dodder from North America that have been treated in Volume 3 of the AOSA Rules as littleseed alfalfa dodder (*C. planiflora* Ten.) actually represent the related Old World species *C. approximata* Bab. (smooth-seeded alfalfa dodder) as indicated in the

geographic range given in the USDA GRIN database (accessed 9 September 2020) and confirmed by Mihai Costea (pers. comm. to Robert A. Price, 8/7/2020).

Information on diagnostic seed characters provided in Table 2 is based on Gunn (1969), USDA (1952), and personal observations. Seed descriptions given in Table 3 are based on information from Bojňanský and Fargašová (2007), Costea et al. (2006a, 2006b, 2006c), Gaertner (1950), Olszewski et al. (2020), USDA (1952), Yuncker (1965), and personal observations. Scientific nomenclature used in this document is in accordance with the USDA GRIN database (USDA-GRIN, accessed 11 June 2020). Comparisons of *Cuscuta* species seed lengths and widths are shown in Figure 3. All photographic images included have been made from specimens in the CDFA Seed Herbarium (CDA-SFC) using a Nikon SMZ1500 stereomicroscope with Nikon DS-Fi1 or Leica MC170HD camera.

## Key to Selected Species in Convolvulaceae

- 1a Seed 2 mm or less in length
  - 2a Hilum Convolvulus-type ..... *Dichondra repens*
  - 2b Hilum Cuscuta-type
    - 3a Scar area distinct, usually dark colored
      - 4a Hilum a white line or short slit .... *Cuscuta campestris*, *C. gronovii*, *C. pentagona*, *C. suaveolens* (see Table 3)
      - 4b Hilum a raised or depressed point ..... *Cuscuta epilinum*, *C. suaveolens* (see Table 3)
    - 3b Scar area mostly indistinct
      - 5a Hilum a raised point..... *Cuscuta approximata*
      - 5b Hilum a short slit or white line ..... *Cuscuta epithimum*, *C. indecora* (see Table 3)
- 1b Seed greater than 2 mm in length
  - 6a Seed coat with tubercles
    - 7a Seed greater than 3 mm wide ..... *Calystegia sepium*
    - 7b Seed 3 mm or less wide
      - 8a Seed nearly as wide as long ..... *Convolvulus tricolor*
      - 8b Seed usually longer than wide ..... *Convolvulus arvensis*
  - 6b Seed coat smooth or minutely stippled
    - 9a Seed broadest below mid-point (orient seed hilum down)
      - 10a Seed coat dark or light, not mottled ..... *Ipomoea tricolor*
      - 10b Seed coat generally dark with light mottling
        - 11a Seed narrowly ovate ..... *Ipomoea quamoclit*
        - 11b Seed broadly ovate
          - 12a Seed less than 4 mm wide ..... *Ipomoea sloteri*
          - 12b Seed 4 mm or more wide ..... *Ipomoea lobata*
    - 9b Seed broadest at mid-point or above (orient seed hilum down)
      - 13a Hilum area glabrous
        - 14a Hilum lighter in color than seed coat ..... *Ipomoea alba*
        - 14b Hilum the same color or darker than seed coat

- 15a Seed strongly keeled, 5 mm or less in length ... *Ipomoea triloba*
- 15b Seed irregularly keeled, greater than 5 mm long .... *Ipomoea muricata*
- 13b Hilum surrounded by ring of hairs
  - 16a Hilum white ..... *Ipomoea aquatica*
  - 16b Hilum dark colored
    - 17a Hilum obscured by hairs ..... *Ipomoea hederacea*
    - 17b Hilum reddish-brown, emarginate lower edge clearly marked ... *Ipomoea purpurea*

**Table 2.** Important seed characters for certain species in Convolvulaceae. Information based on Gunn (1969) is indicated by single asterisk (\*) next to species name. The hilum type is characterized as *Ipomoea*-type (1) or *Convolvulus*-type (2).

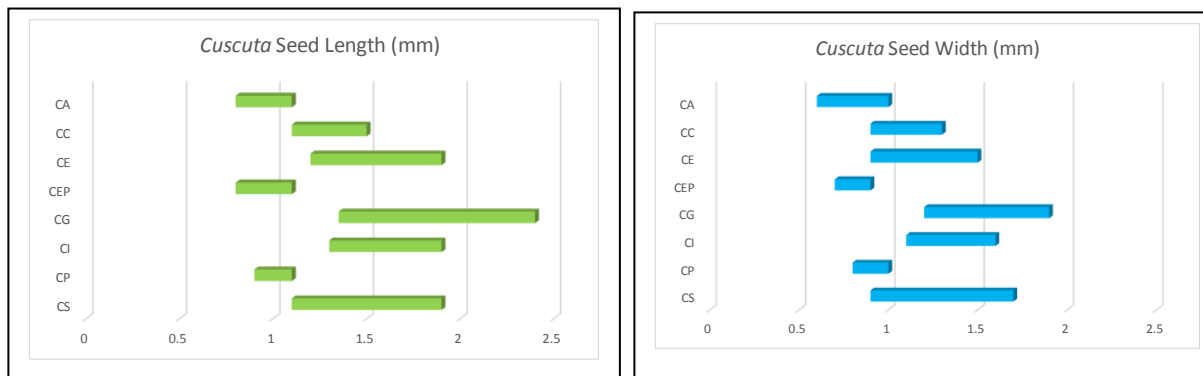
Species	Length (mm)	Width (mm)	Cross-section Shape	Color	Texture	Hilum Type	Hilum Size (mm)	Hilum Color
<i>Calystegia sepium</i> (L.) R. Br. *	(3.8) 4 – 6	3.5 – 4.5 (5.4)	Wedge (+/- flattened) or spheroid, +/- keeled	Dark to light brown	Minute widely spaced tubercles	1 or 2	0.5 – 1.5 wide	Reddish or color of seed coat
<i>Convolvulus arvensis</i> L. *	(2.5) 3 – 4	2 – 3	Wedge (+/- flattened) or spheroid, +/- keeled	Dark ochre	Numerous blunt tubercles, or glabrous	2	0.3 long; 0.5 wide	Reddish or color of seed coat
<i>Convolvulus tricolor</i> L.	2.4 – 3	2.4 – 2.7	Wedge (+/- flattened) or spheroid, +/- keeled	Dark reddish-brown	Numerous blunt tubercles	2		Reddish or color of seed coat
<i>Dichondra repens</i> J. R. Forst. & G. Forst.	1.5 – 2	1 – 1.5	Spheroid	Ochre - brown	Glabrous	2	0.3 wide	Color of seed coat
<i>Ipomoea alba</i> L.*	(8.5) 10 – 12	(7) 8 – 9	Spheroid, +/- keeled	Light ochre, brown, blackish-brown	Smooth, glabrous, +/- minute hairs near hilum	1	2.5 – 3 wide	Lighter or equal to seed coat
<i>Ipomoea aquatica</i> Forssk.	5 – 5.5	3.5 – 4	Wedge or spheroid, margins +/- ridged, back arched, +/- keeled	Reddish-brown	Minutely stippled, glabrous or covered tawny hairs	1	1 wide	White w/ ring of tawny hairs
<i>Ipomoea hederacea</i> Jacq.*	3.5 – 5	2.5 – 3	Wedge (+/- flattened), margins ridged,	Black, mottled, or gray-black	Minutely stippled, minute silvery or tawny hairs	1	0.5 – 0.6 wide	Color of seed coat, covered
<i>Ipomoea lobata</i> (Cerv.) Thell.	3.5 – 4.6	4 – 4.5	Back arched	Dark brownish-black w/ light brown mottling	Minutely stippled, pubescent around hilum	1	0.5 – 1 wide	With minute hairs
<i>Ipomoea muricata</i> (L.) Jacq. [ <i>Ipomoea turbinata</i> Lag.]*	8 – 9.5	6 – 7.5	Wedge or spheroid, +/- keeled	Grayish-brown to reddish-brown	Smooth, glossy, glabrous	1	1 – 1.5 wide	Reddish-brown to color of seed coat, w/ ring of tawny hairs
<i>Ipomoea purpurea</i> (L.) Roth*	3.5 – 4.5	2.5 – 3	Wedge, keeled	Dark brown	Minutely stippled, glabrous	1	0.5 - 6 wide	Color of seed coat
<i>Ipomoea quamoclit</i> L.	4.5 – 5.2	2 – 2.5	Wedge (+/- flattened), margins ridged,	Brownish-black w/ light mottling	Minutely stippled, glabrous	1	0.8 long; 1.2 wide	Reddish-brown or color of seed coat, +/- ring of silver hairs
<i>Ipomoea sloteri</i> Macfarl. ex E. T. Reichert	4 – 4.8	3.2 – 3.8	Back arched, +/- keeled	Dark brownish-black w/ light mottling	Minutely stippled, glabrous	1	0.8 – 1 wide	Color of seed coat, w/ ring of tawny hairs
<i>Ipomoea tricolor</i> Cav.	4.8 – 7.2	3 – 4.8	Spheroid, back arched, +/- slightly keeled	Light yellow or reddish-brown to nearly black	Minutely stippled to smooth, glabrous, pubescent around hilum	1	0.5 – 1 wide	Same color as seed coat, w/ ring of hairs
<i>Ipomoea triloba</i> L.	4 – 5	2.5 – 3 (4)	Wedge or spheroid, +/- keeled, margins +/- ridges	Reddish-brown	Smooth, glabrous	1	0.8 wide	Same color or lighter than seed coat, w/ ring of hairs



**Table 3.** Characteristic seed features for eight *Cuscuta* species. Descriptions are based on Bojňanský and Fargašová (2007), Costea et al. (2006a, 2006b, 2006c), Gaertner (1950), Olszewski et al. (2020), USDA (1952), Yuncker (1965), and personal observations. Distribution data based in USDA GRIN (2020).

Species	Length × Width (mm)	Shape (hilum oriented downward)	Color	Seed Coat Surface	Hilum	Vascular Scar of Funiculus	Distribution and Hosts
<i>Cuscuta approximata</i> Bab.	0.8 – 1.1 × 0.6 – 1.0	Outline elliptic to obovate; angular in cross-section (one side convex, two sides compressed flat) or round in cross-section (no compression).	Light grey, yellow-tan, brown, some seeds with purplish tint.	Alveolate/papillate, finely scurfy; dull.	Indistinct (margin not clearly defined), small, round, +/- slightly darker than rest of seed coat.	Raised white point	Native to Europe and temperate Asia, tropical Asia, Europe  Naturalized in British Columbia, central and western United States  Hosts: various species of herbs and shrublets
<i>Cuscuta campestris</i> Yuncker	1.1 – 1.5 × 0.9 – 1.3	Outline nearly round to broadly elliptic, slightly pointed below hilum; angular in cross-section (one side convex, two sides compressed flat to slightly concaved).	yellowish-brown to brown.	Alveolate/papillate; epicuticular wax absent; grainy; dull.	Distinct, large, round, +/- lighter in color than the rest of the seed coat.	Short oblong slit.	Native to 42 US states and at 11 Canadian provinces, 8 Mexican states. Native to 5 Caribbean nations. The second most common <i>Cuscuta</i> species in North America (Costea et al., 2006a).  Naturalized widely, possibly the most widespread <i>Cuscuta</i> weed world-wide.  Hosts: numerous species from hundreds of genera in various families
<i>Cuscuta epilinum</i> Weihe ex Boenn.	1.2 – 1.9 × 0.9 – 1.5	Outline broadly elliptic, broadly obovate, round, broadly ovate; often two seeds glued together in pairs; paired seed units dorsoventrally compressed (one side flat and one side convex); single seeds angular in cross-section (one side convex, two sides compressed flat).	Greenish- or yellowish-grey, greyish-white, brown.	Alveolate/papillate; coarsely scurfy; dull.	+/- Distinct, round or oval, usually darker colored than rest of the seed coat, finely striate radially. Scar area of attached seeds at right angles to each other.	A raised white point or short white line.	Native to Iran, Kazakhstan, Kyrgyzstan, Tajikistan.  Naturalized in Africa, Russian Federation, Europe, Canada, United States, Netherlands Antilles, and Argentina.  Host: flax, <i>Linum</i> spp.
<i>Cuscuta epithymum</i> (L.) L.	0.8 – 1.1 × 0.7 – 0.9	Outline elliptic, obovate, ovate, or round; dorsoventrally compressed (one side flat and one side convex) or angular in cross-section (one side convex, two sides compressed flat).	Yellowish-grey, brown to grey-brown.	Alveolate/papillate; coarsely granular (like particles of earth) to finely scurfy; dull.	Mostly indistinct, round or oval, heavily scurfy striate, +/- similar in color to rest of seed coat.	Very short white line or oblong slit.	Native to northern Africa, temperate Asia, Europe.  Naturalized in South Africa, Australia, New Zealand, Canada, United States, Argentina, and Chile.  Hosts: numerous members of Fabaceae and other families.
<i>Cuscuta gronovii</i> Willd.	1.35 – 1.7 (2.4) × 1.2 – 1.9	Outline elliptic; angled in cross-section (one side convex, two sides compressed flat to slightly concaved).	Reddish-brown to yellow- brown.	Alveolate/papillate; finely scurfy; dull.	Distinct, round, darker in color than the rest of the seed coat, finely striate radially.	Short oblong slit with white edges.	Native in 9 Canadian provinces, 44 US states, and the Dominican Republic. Believed to be the most common and widespread dodder species in North America (Costea, et al., 2006a).  Naturalized in Czech Republic, Belgium, Germany, Netherlands, Poland, Ukraine, Bulgaria, Italy, and France.  Hosts: numerous species from hundreds of genera of herbaceous and woody plants in various families.

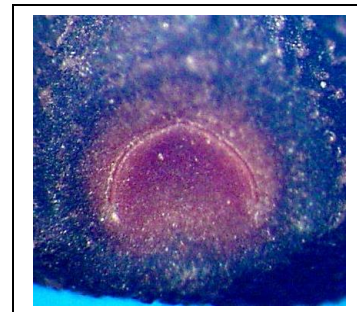
Species	Length × Width (mm)	Shape (hilum oriented downward)	Color	Seed Coat Surface	Hilum	Vascular Scar of Funiculus	Distribution and Hosts
<i>Cuscuta indecora</i> Choisy	1.3 – 1.9 × 1.1 – 1.6	Outline broadly elliptic to oblong; dorsoventrally compressed (one side flat and one side convex) or round in cross-section (no compression).	Yellowish-brown, light greyish-brown, reddish-brown, dark brown.	Alveolate/papillate; coarsely scurfy, dull.	Indistinct, oval (mostly broader than long), similar in color to rest of seed coat.	Short slit or white line.	Native to Saskatchewan, 36 US states, 16 Mexican states, 5 Caribbean nations, most of Central America, Venezuela, Colombia, and parts of Argentina, and Paraguay.  Naturalized in Brazil, and parts of Argentina, and Paraguay.  Hosts: a wide range of herbaceous and woody species.
<i>Cuscuta pentagona</i> Engelm.  No photograph available here, but available on USDA GRIN 2020.	0.9 – 1.1 × 0.8 – 1	Outline nearly round to elliptic; dorsoventrally compressed (one side flat and one side convex).		Alveolate/papillate; epicuticular wax absent; scurfy.	Distinct, round.	Short slit or white line.	Native to 26 eastern, southern, and mid-western US states, 2 Mexican states, and Manitoba, Canada  Hosts: numerous hosts found in a wide variety of habitats.
<i>Cuscuta suaveolens</i> Ser. Syn = <i>Cuscuta racemosa</i> Brand var. <i>chiliana</i> Engelm.	1.1-1.9 × 0.9-1.7	Outline elliptic, round, oblong; somewhat angular in cross-section (one side somewhat convex and two sides flat to slightly concaved).	Reddish-brown to dark brown	Fine alveolate/papillate; finely scurfy; dull	Distinct, large, round, darker in color than the rest of the seed coat.	Raised or depressed white point or very short slit.	Native to Brazil, Argentina, Chile, and Uruguay.  Naturalized in Algeria, Kenya, Czech Republic, Switzerland, Germany, Poland, Ukraine, Greece, Italy, Spain, France, Portugal, and 5 US states.  Hosts: primarily alfalfa and clover, rarely on other herbs.



**Figure 3.** Comparison of *Cuscuta* species seed lengths and widths. Measurements are in millimeters. CA = *Cuscuta approximata*; CC = *C. campestris*; CE = *C. epilinum*; CEP = *C. epithymum*; CG = *C. granovii*; CI = *C. indecora*; CP = *C. pentagona*; CS = *C. suaveolens*.

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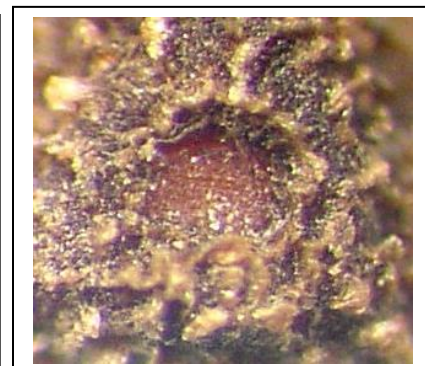
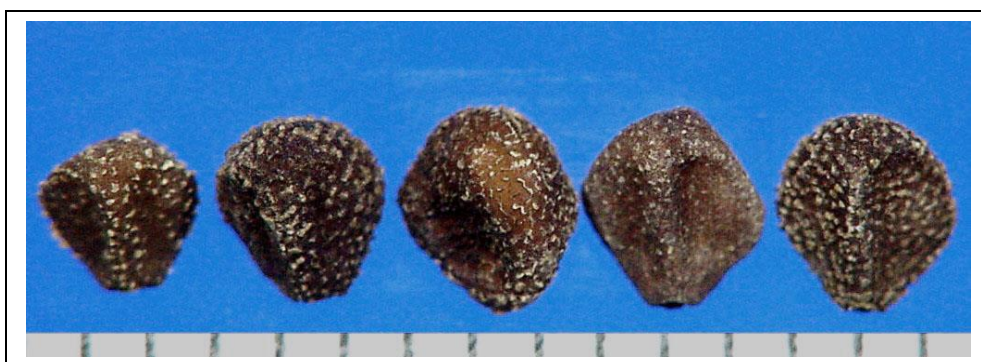


*Calystegia sepium* (L.) R. Br., hedge bindweed, wild morning-glory, hedge false bindweed

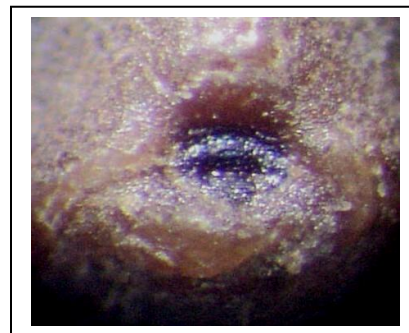
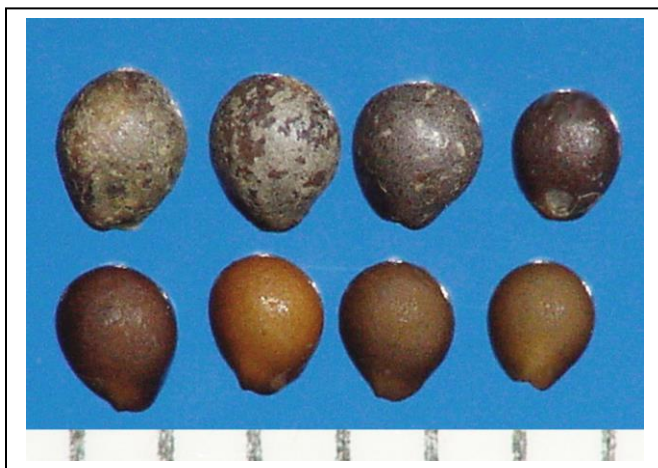
[*Convolvulus sepium* L.]



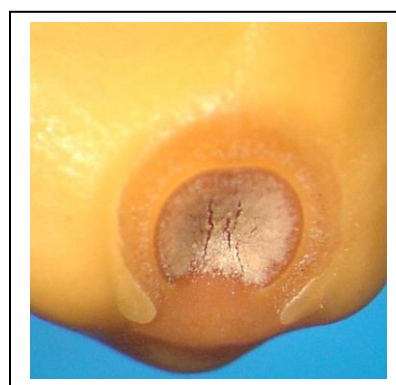
*Convolvulus arvensis* L., field bindweed



*Convolvulus tricolor* L., dwarf morning-glory

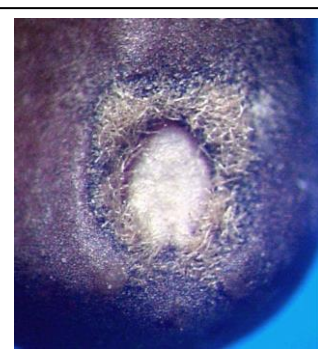


*Dichondra repens* J. R. Forst. & G. Forst., dichondra



*Ipomoea alba* L., moonflower, white morning-glory, tropical white morning-glory

[*Calonyction aculeatum* (L.) House, *Calonyction album* (L.) House, *Ipomoea bona-nox* L.]



*Ipomoea aquatica* Forssk., Chinese water-spinach, swamp morning-glory, water-convolvulus, water-spinach

[*Ipomoea reptans* Poir.]



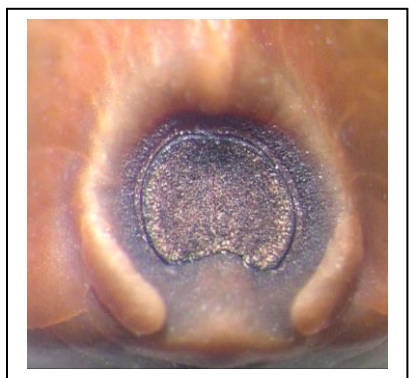
***Ipomoea hederacea* Jacq.**, ivyleaf morning-glory

[*Ipomoea barbiger*a Sweet, *Pharbitis hederacea* (Jacq.) Choisy]



***Ipomoea lobata* (Cerv.) Thell.**, Spanish-flag

[*Ipomoea versicolor* Meisn., *Mina lobata* Cerv., *Quamoclit lobata* (Cerv.) House]



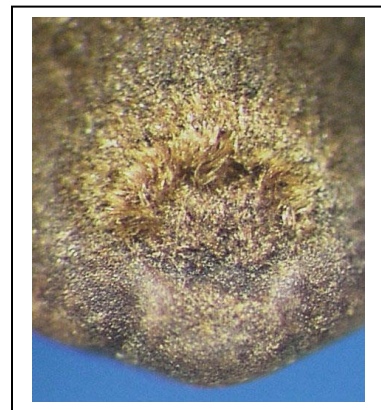
***Ipomoea muricata* (L.) Jacq.**, purple moonflower, giant morning-glory, lilac-bell

[*Calonyction muricatum* (L.) G. Don, *Convolvulus muricatus* L., *Ipomoea turbinata* Lag.]



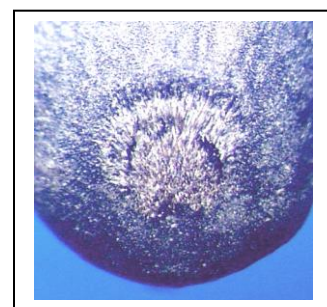
***Ipomoea purpurea* (L.) Roth**, tall morning-glory, wild morning-glory, woolly morning-glory

[*Convolvulus purpureus* L., *Ipomoea hirsutula* J. Jacq., *Pharbitis purpurea* (L.) Voigt]



***Ipomoea quamoclit* L.**, cardinal-climber, cypressvine, cypress-vine morning-glory, hummingbird-vine, Indian-pink, red-jasmine, star-of-Bethlehem, star-glory, sweet-Willy

[*Convolvulus pennatus* Desr., *Quamoclit pennata* (Desr.) Bojer, *Quamoclit vulgaris* Choisy]



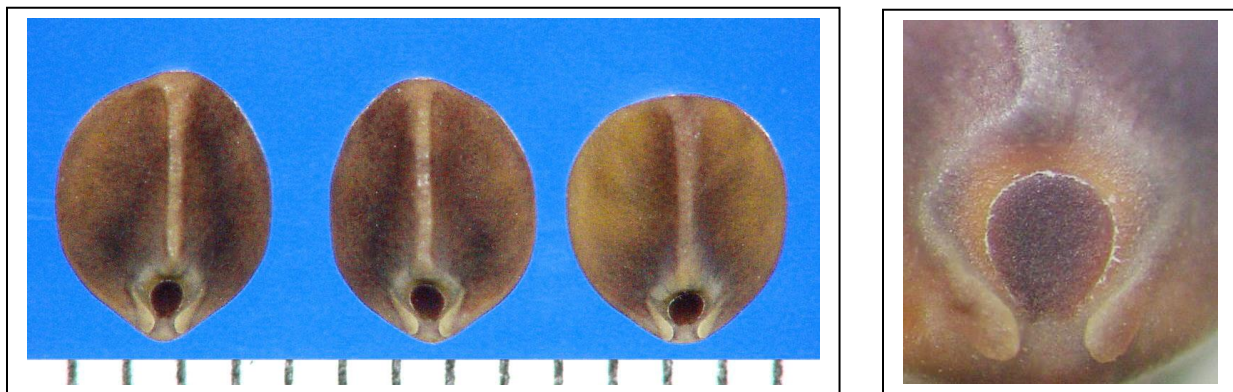
***Ipomoea sloteri* Macfarl. ex E. T. Reichert**, cardinal climber, hearts and honey vine

[*Quamoclit sloteri* (Macfarl. ex E. T. Reichert) House, *Ipomoea xmultifida* auct. mult.]



*Ipomoea tricolor* Cav., flying-saucers, heavenly-blue morning-glory, morning-glory, pearly-gates

[*Ipomoea rubrocaerulea* Hook., *Ipomoea violacea* auct.]

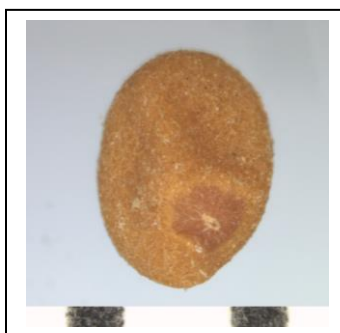


*Ipomoea triloba* L., Aiea morning-glory, little-bell

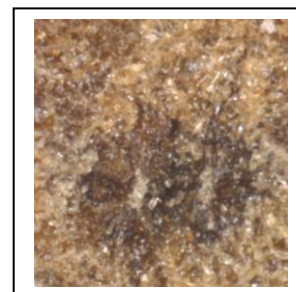




*Cuscuta approximata* Bab., smooth-seed alfalfa dodder



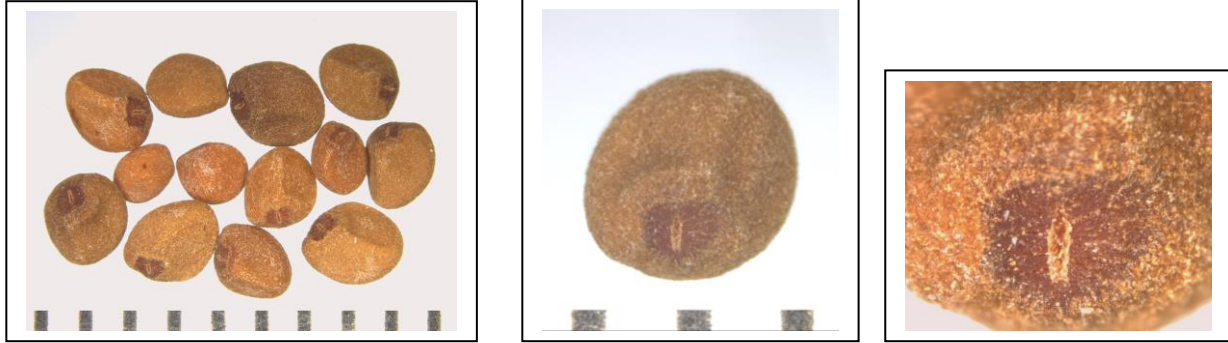
*Cuscuta campestris* Yunck., field dodder



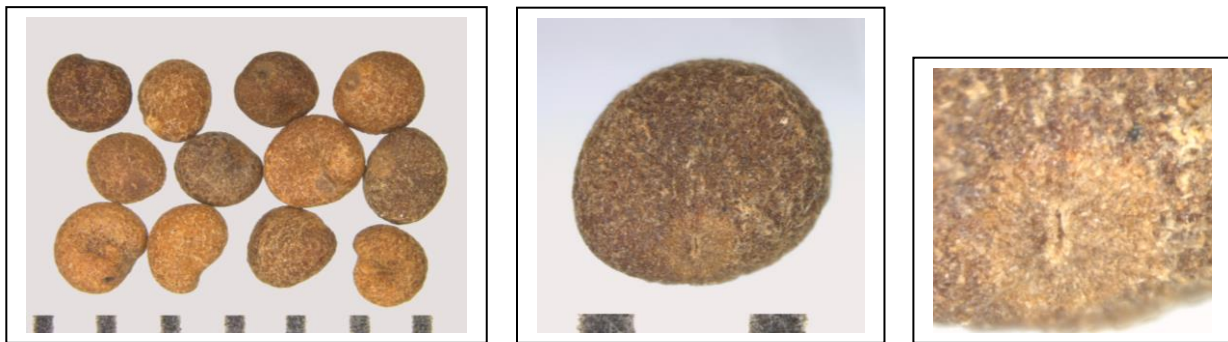
*Cuscuta epilinum* Weihe ex Boenn., flax dodder



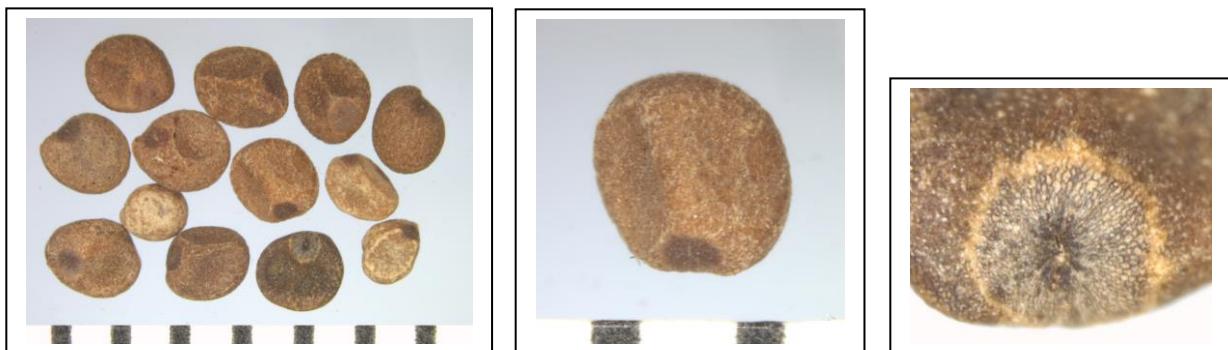
*Cuscuta epithymum* (L.) L., clover dodder, common dodder, lesser dodder



***Cuscuta gronovii* Willd.**, swamp dodder, scaldweed



***Cuscuta indecora* Choisy**, big-seed alfalfa dodder, large-seed alfalfa dodder, large-seed dodder



***Cuscuta suaveolens* Ser.**, Chilean dodder, fringe dodder, lucerne dodder  
[*C. racemosa* Brand var. *chiliana* Engelm.]