

Cuscuta indecora var. *indecora*

Collared Dodder

Cuscutaceae



Cuscuta indecora by Larry Allain, USGS

Cuscuta indecora var. *indecora* Rare Plant Profile

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

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Life History

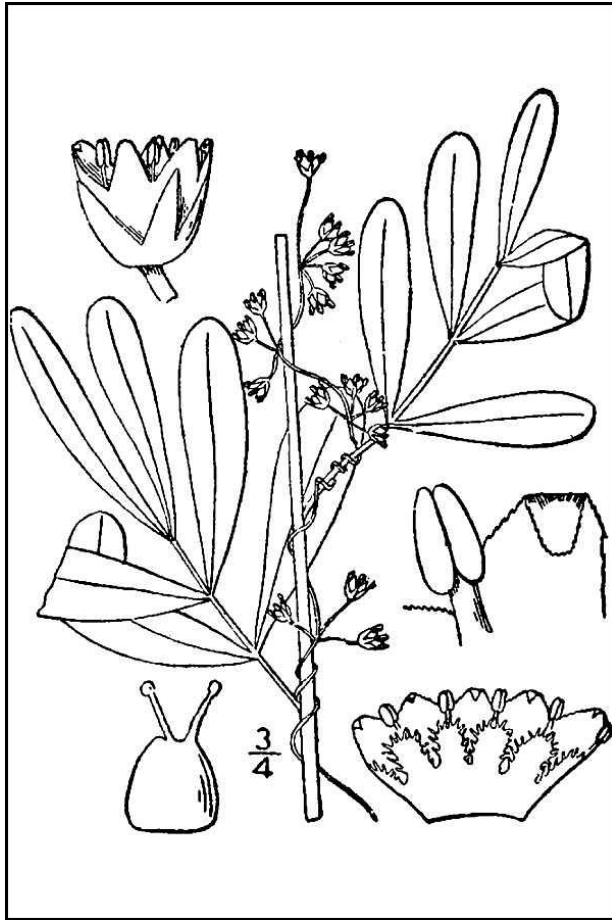
Cuscuta indecora var. *indecora* (Collared Dodder) is one of nine species of dodder that occurs in New Jersey (Kartesz 2015). *Cuscuta* has traditionally been placed in its own family (Cuscutaceae) and more recently designated as a tribe (Cuscuteae) in the morning-glory family on the basis of molecular studies (Stefanović et al. 2003). Either way, *Cuscuta* is a distinct genus of rootless, leafless, twining, vines that are obligate parasites. *Cuscuta* stems are usually orange, yellow or purple. Seedlings may be greenish and capable of photosynthesis before attaching to a host but once the connection is established their photosynthetic ability declines. Dodder stems that are severed from their host plant may turn light green, indicating that some chlorophyll can still be produced (Fessehaie 1988). A weak capacity for photosynthesis is retained in *C. indecora* but the rates are so low that they are not sufficient to maintain the plants through nighttime (Pattee et al. 1965).

Cuscuta seeds hold enough nutrients to sustain the young plants through germination and a brief period of development, usually less than three weeks (Furuhashi et al. 2011). Dodder seedlings begin life with ephemeral root-like structures that contain the stored nutrients and are briefly capable of absorbing water and interacting with mycorrhizal fungi (Behdarvandi 2014). Each seedling emerges as an arch-shaped stem that straightens and elongates before beginning a slow, counter-clockwise rotation as it forages for a host (Fessehaie 1988). The root-like organ withers within a few days (Behdarvandi 2014) after which the seedling is unable to absorb water or nutrients on its own so the dodder cannot survive or produce offspring without a host plant. When a foraging seedling contacts an elongated object it twines around it and, if the object is a suitable host, it penetrates the stem with a slender projection called a haustorium that connects the phloem of the *Cuscuta* plant with that of the host (Fessehaie 1988). In addition to water and nutrients, the haustoria also serve as a conduit for various macromolecules, mRNA, and hormones (Olszewski 2019). Some exchange of proteins and RNA may be bidirectional (Kim and Westwood 2015). Additional information regarding host selection is included in the Habitat section.

Once attached to a vascular plant *Cuscuta* can grow and branch freely. *C. indecora* produces additional non-twining stems with nodes and internodes, and new branches and tendrils develop at the nodes. The tendrils twine around the host plant branches to support the growing dodder vine, and stems from the original host can establish connections with new hosts (Fessehaie 1988, Prather 1987). Once a relationship with a new host has been established the stem that made the connection between the plants frequently breaks off (Prather 1987). However, the dodder can also transmit certain types of viruses from one plant to another and may continue to serve as the carrier of a virus even after the connection with the source has been severed (Fessehaie 1988).

Cuscuta is typically described as an annual plant in the temperate zone, but at least some species have the ability to perennate inside the stem of a host (Prather 1987). Dean (1937) extensively studied gall formation in plants that had been parasitized by dodder and documented *Cuscuta indecora* as one of the gall-inducing species. In a follow-up study utilizing several other species of dodder he found that haustorial tissue can remain alive and continue to grow inside of a gall, then subsequently produce new shoots. *Cuscuta* can regenerate from galls during the growing season (Truscott 1958), but can also overwinter in the stems of woody hosts and emerge as new

shoots in the spring (Dean 1954). During a four-season study of *Cuscuta indecora* in a Texas salt marsh, Marquardt and Pennings (2010) observed no germination from seeds; instead, the dodder re-emerged each spring from galls in woody host plants.



Left: Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Larry Allain, USGS.

Because *Cuscuta* plants have such a simple structure, flowers and/or fruits are essential for the accurate identification of a species. The flowers of *C. indecora* may be present from July–October (Weakley 2015). The small petals are white, and the stigmas are often yellow or purple (Britton and Brown 1913). Several subgenera have been defined within *Cuscuta* and the groups are separated by style number and stigma shape (Wright et al. 2011). *Cuscuta indecora* belongs to subgenus *Grammica* which has two styles and capitate stigmas. Some characteristics that help to separate *C. indecora* from other members of the subgenus are the absence of bracts at the base of individual flowers, flowers that are mostly five-parted, and sharply acute corolla lobes with inward-curving tips (Gleason and Cronquist 1991, Spaulding 2013). The fruits are completely covered by the withered corollas and have evident thickening at the base of the styles so that they appear to be surrounded by a collar (Gleason and Cronquist 1991). *Cuscuta indecora* and *C. coryli* can be distinguished from many other dodders by their flowers which are somewhat fleshy and have a densely granular-papillose surface (pimple-covered flowers per Allain et al. 2022), but the flowers of *C. indecora* are mostly five-parted while those of *C. coryli* are mostly four-parted (Costea et al. 2004, Spaulding 2013). Many *Cuscuta* plants are inconsistent in their

number of floral parts so it is important to examine a sufficient number of flowers to determine the prevalent form.

Between 0–5 named varieties of *Cuscuta indecora* are currently accepted by various sources. Weakley (2015) does not break out any subtaxons for *Cuscuta indecora*. Authors who recognize *C. indecora* var. *attenuata*, var. *bifida*, and var. *longisepala* consistently show those subtaxons only west of the Mississippi River (POWO 2022, Kartesz 2015, USDA NRCS 2022b). *Cuscuta indecora* var. *neuropetala*—as differentiated in Yuncker (1932) and Fernald (1950)—is presently included in *C. indecora* var. *indecora* by Costea et al. (2006), Kartesz (2015) and POWO (2022). However, *C. indecora* var. *neuropetala* is still accepted by both NatureServe (2022) and USDA NRCS (2022b). Although NatureServe did not report *C. indecora* var. *neuropetala* in New Jersey, the USDA map indicated that the variety occurred in the state but no county data was available and the source for the record was cited as an anonymous personal communication. Mid-Atlantic Herbaria (2022) did not show any records of *C. indecora* var. *neuropetala* from New Jersey; however, a number of *C. indecora* specimens were not identified to varietal level. Nomenclature in this profile follows Kartesz (2015) so *C. indecora* var. *neuropetala* is included in *C. indecora* var. *indecora*.

Pollinator Dynamics

Cuscuta indecora var. *indecora* seems able to utilize multiple pathways to fertilization. The floral morphology of dodder flowers appears to target an assortment of generalist pollinators including flies, moths, and beetles (Riviere 2012, Olszewski 2019). Wright et al. (2011) reported that all *Cuscuta* species have a nectary ring at the base of the ovary, and the flowers of *C. indecora*—unlike those of most other dodders—have a faint, sweet smell that may aid in attracting insects (Musselman 1986). However for one variety, *C. indecora* var. *attenuata*, Prather (1987) reported no insect visitors and a complete reliance on self-pollination. Many dodder plants in the subgenus *Grammica* have unequal style development and the stigmas mature sequentially (Wright et al. 2011). The authors suggested that the strategy could facilitate self-fertilization of one stigma and cross-fertilization of the other.

Seed Dispersal

Dodder fruits typically develop rapidly, and a span of 2–3 weeks from bud initiation to mature capsules was reported for *Cuscuta indecora* var. *attenuata* (Prather 1987). *Cuscuta indecora* var. *indecora* fruits may contain 2–4 seeds, and the capsules do not split open prior to their release from the plant (Costea et al. 2012). Four seeds per capsule is typical for the species (Gleason and Cronquist 1991). *C. indecora* seeds are ≥ 1.4 – < 1.6 mm in length and ≥ 1.4 – < 1.5 mm in width (Olszewski 2019). The seeds have a rough surface and a hard coat that permits extended dormancy (Fessehaie 1988) as well as a hilar fissure that is thought to be the route by which water enters the seed to initiate germination (Olszewski 2019).

Cuscuta seeds do not have any specialized adaptations for dispersal. Capsules may be dispersed by gravity or aided by wind for a short distance. Depending on the setting, some capsules may

also be transported by water as they are able to float (Prather 1987). Extended inundation increases the likelihood of decomposition, although a small percentage of dodder seeds can still sprout after a lengthy period of submergence (Bruns 1965). Long-distance dispersal by waterfowl has been reported for the genus, and Costea et al. (2016) documented a germination rate of 55% in *Cuscuta campestris* seeds that had been consumed by Northern Pintails (*Anas acuta*).



Cuscuta indecora var. *indecora* seeds by D. Walters and C. Southwick, USDA APHIS PPQ, Bugwood.org. The white arrows indicate the hilar depressions where water may penetrate prior to germination.

Seeds of *Cuscuta indecora* can remain viable in the soil for 10 years or more (Cudney et al. 1992). Germination rates are highest for *C. indecora* seeds that are near the surface (within the top 2.5 cm) of the soil (Allred and Tingey 1964). Warm spring temperatures are required for germination. Prather (1987) reported the emergence of *C. indecora* var. *attenuata* seedlings during mid-May when soil temperatures were around 25°C. A study of temperature influence on the emergence of *C. indecora* seedlings reported germination at temperatures from 50–95°C, with only minimal germination occurring at temperatures below 50°C (Allred and Tingey 1964).

Habitat

Cuscuta indecora can be found in a broad range of habitats including salt marshes, bogs, pine savannas, open woods, roadsides, and other open disturbed areas (Spaulding 2013, Weakley 2015). Spaulding (2013) indicated that *C. indecora* was most frequently found along the coast in Alabama and adjacent states. Because dodders have little to no interaction with the substrate,

their habitat is primarily defined by the host plants upon which they are dependent. Most *Cuscuta* species are not host-specific, and some can even secondarily infect their own stems after establishing on a primary host (Furuhashi et al. 2011). A broad range of plants have been documented as hosts for *C. indecora* including *Agalinis*, *Aster*, *Baccharis*, *Borrchia*, *Chenopodium*, *Eupatorium*, *Helianthus*, *Heterotheca*, *Hypericum*, *Ipomoea*, *Iva*, *Kosteletzkya*, *Lepidium*, *Ligustrum*, *Myrica*, *Phragmites*, *Pluchea*, *Polygonum*, *Rhynchosia*, *Solidago*, *Sueda*, *Tephrosia*, and *Vernonia* (Gandhi et al. 1987). *C. indecora* has been documented on *Ambrosia*, *Artemisia* and *Asclepias* in Michigan (Santanna et al. 2013) and on *Coreopsis* in Rhode Island (Underwood 2022). Additional genera documented as hosts in New Jersey include *Erigeron*, *Euthamia*, *Mikania*, and *Rhus* (NJNHP 2022). Allain et al. (2022) noted that *C. indecora* has a preference for members of the Aster family. In salt marshes, Collared Dodder is most frequently found on *Iva frutescens* (Silberhorn 1998, Weakley 2015, NJNHP 2022), while *Lespedeza* is a common host for roadside populations in Virginia (Silberhorn 1998). Musselman (1986) pointed out that while *Cuscuta indecora* is able to utilize multiple hosts it is the only dodder that occurs on *Iva frutescens*. The western variety, *C. indecora* var. *attenuata*, is almost exclusively found on *Iva annua* (Prather 1987).

Cuscuta seedlings play an active role in the selection of their host plants. Directional growth toward a potential host is initially guided by photoreceptors that can detect ratios of red:far red light to differentiate sunlit and shady sites (Furuhashi et al. 2011). Seedlings may twine around the first vertical stem they encounter but a connection is not always established, and some seedlings grow away from stems following the initial contact (Fessehaie 1988, Press and Phoenix 2005). Chemical cues from the potential host plants are thought to guide selection. Some plants have defense systems that prevent penetration, such as certain species of Malvaceae that use a type of wound tissue to block haustorial connections, and many *Cuscuta* species cannot parasitize monocots which might be due to vascular structure or to chemical signaling of incompatibility (Kaiser et al. 2015). In addition to the use of chemical cues for mediating penetration, volatile organic compounds emitted from potential host plants may also help to guide growing *Cuscuta* seedlings toward compatible species (Runyon et al. 2006). Selection of the most nutritionally rewarding hosts has been reported for *Cuscuta europa* (Kelly 1992) and *C. campestris* (Koch et al. 2004), but Marquardt and Pennings (2010, 2011) found that *C. indecora* selectively foraged on the host species that was most abundant. *C. indecora* was also more likely to favor taller plants and to utilize the upper portions of its hosts, perhaps to access the most actively growing tissue or to avoid flooding (Marquardt and Pennings 2010).

The expression of host preferences by *Cuscuta* can impact the habitat by altering community structure. Host plants for dodder experience significant reductions in biomass, vigor, and seed production, an effect that has been well-documented in alfalfa and a variety of other crop plants (e.g. Fessehaie 1988, Lanini and Kogan 2005). Selective parasitism on the most abundant species can create diversity by providing a greater opportunity for other species to thrive (Pennings and Callaway 1996). Zonation within communities may be reinforced because *Cuscuta* can limit a dominant species to certain portions of a habitat by shifting the competitive advantage (Callaway and Pennings 1998). Consequently, *Cuscuta* can perform a function similar to that of a keystone predator by initiating cycles of alternate dominance and managing the species balance within a community (Pennings and Callaway 2002).

Wetland Indicator Status

Cuscuta indecora is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is normally considered to be Upland (UPL) in all regions where it occurs (U. S. Army Corps of Engineers 2020). However, Collared Dodder is a parasite that grows on other plants rather than on a typical substrate so it is likely to be facultative depending on its host.

USDA Plants Code (USDA, NRCS 2022b)

CUINI

Coefficient of Conservatism (Walz et al. 2018)

CoC = 5. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The native global range of *Cuscuta indecora* var. *indecora* extends from North America south to Columbia including parts of the Caribbean, and the species has been introduced in other South American countries and in Africa (POWO 2022). The map in Figure 1 depicts the extent of Collared Dodder in the United States and Canada.

Throughout much of its range in the U. S., *C. indecora* var. *indecora* has been labeled as a noxious weed. The dodder is indeed a significant agricultural pest in North and South America and is particularly damaging to alfalfa (*Medicago sativa*) crops, resulting in numerous studies that have focused on control or eradication of the species (e.g. Lanini and Kogan 2005, Cudney et al. 1992, Fessehaie 1988). There may also be some bias that exaggerates the extent of the threat in parts of the species' range, as a number of states indiscriminately label all dodders as weeds based on negative stereotypes of parasites (Costea and Stefanović 2009). One scientist attempted to combat prejudice by promoting the slogan *Equal rights for parasites* but somehow it never caught on (Windsor 1995).

The USDA PLANTS Database (2022b) shows records of *Cuscuta indecora* var. *indecora* only from Cape May County in New Jersey (Figure 2), which is consistent with the current state distribution of the species (NJNHP 2022). Specimens collected from other southern New Jersey counties (Atlantic, Burlington, Ocean, and Salem) which are located in herbariums at Harvard and the University of Tennessee were labeled as *Cuscuta indecora* but no variety was specified (Mid-Atlantic Herbaria 2022).

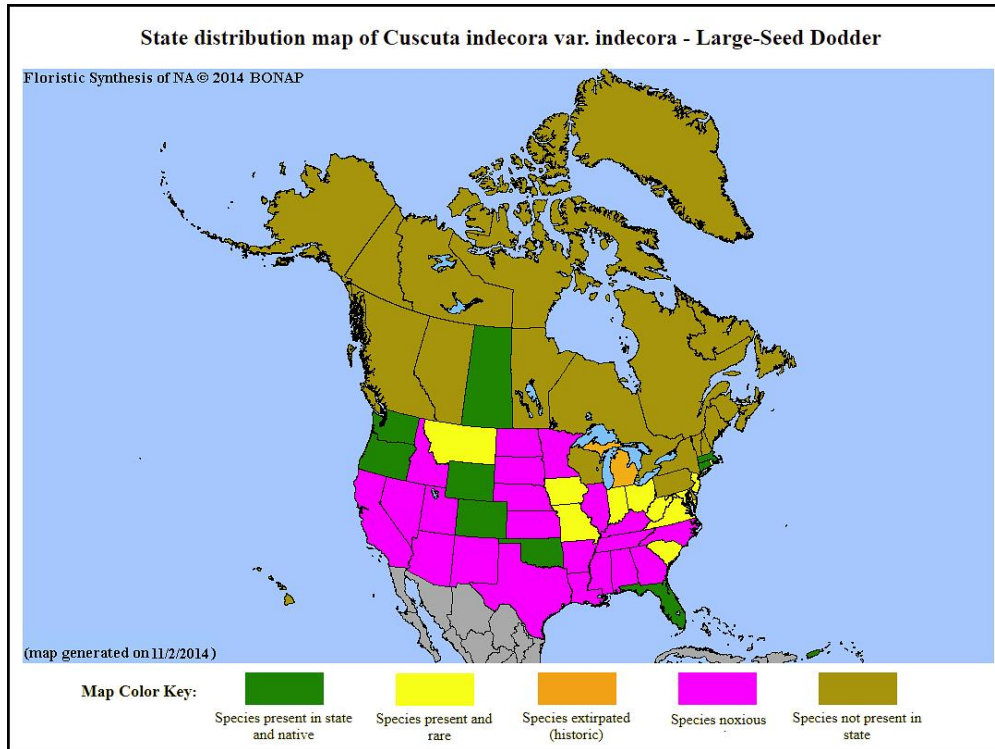


Figure 1. Distribution of *C. indecora* var. *indecora* in North America, adapted from BONAP (Kartesz 2015).

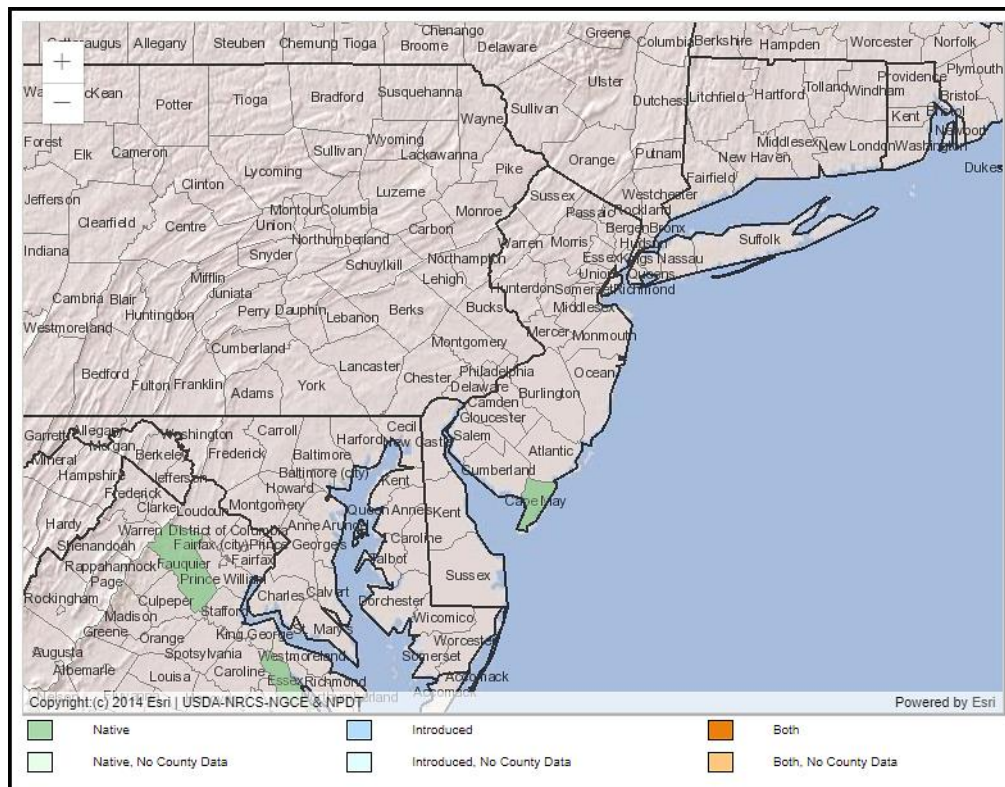


Figure 2. County records of *C. indecora* var. *indecora* in New Jersey and vicinity (USDA NRCS 2022b).

Conservation Status

The global rank of *Cuscuta indecora* var. *indecora* is G5T2T4. The G5 rank means the species as a whole has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats. The T2T4 rank indicates some uncertainty regarding the status of the variety. A T2 rank signifies that the taxon faces a high risk of extinction or collapse due to a restricted range, few populations or occurrences, steep declines, severe threats, or other factors, while a T4 rank means that the taxon is at fairly low risk of extinction or collapse due to an extensive range and/or many populations or occurrences although there is some cause for concern as a result of local recent declines, threats, or other factors (NatureServe 2022). As previously discussed, NatureServe recognizes *Cuscuta indecora* var. *neuropetala* as distinct and that variety has a rank of T5 (secure). The maps in Figures 3 and 4 indicate that *C. indecora* var. *indecora* is ranked as critically imperiled (very high risk of extinction) in two states and *C. indecora* var. *neuropetala* is ranked as critically imperiled in three additional states (NatureServe 2022).

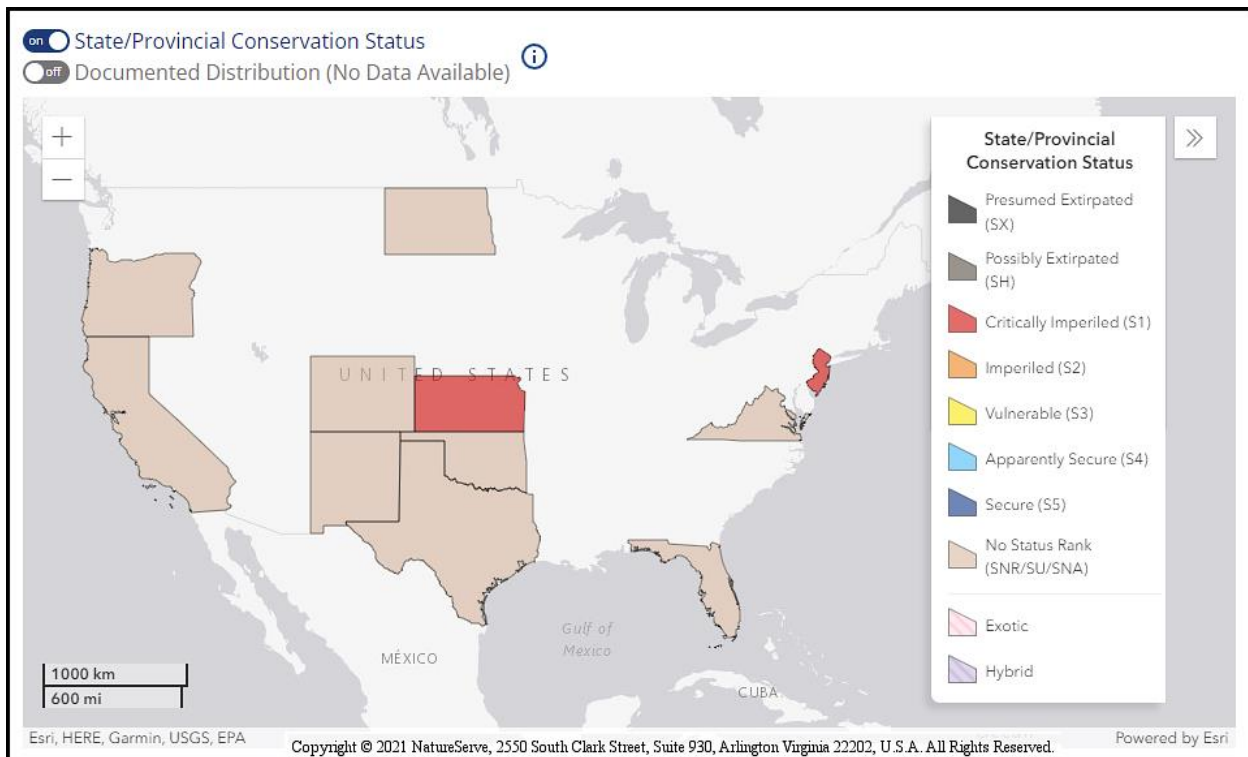


Figure 3. Conservation status of *C. indecora* var. *indecora* in North America (NatureServe 2022).

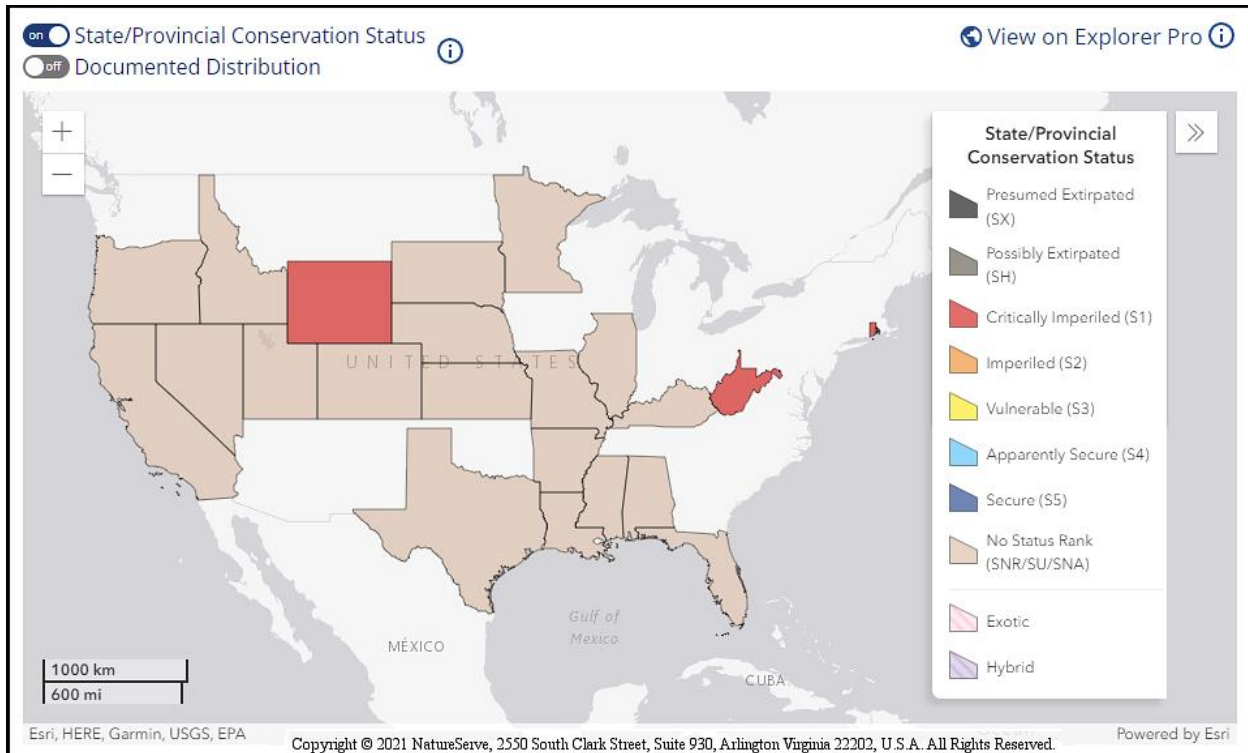


Figure 4. Conservation status of *C. indecora* var. *neuropetala* in North America (NatureServe 2022).

Cuscuta indecora var. *indecora* is ranked S1.1 in New Jersey (NJNHP 2022), meaning that it is critically imperiled due to extreme rarity. A species with an S1.1 rank has only ever been documented at a single location in the state. Collared Dodder is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities, being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to the species signify that *C. indecora* var. *indecora* is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

The sole documented occurrence of *Cuscuta indecora* var. *indecora* in New Jersey was discovered in 1993. Although the original population was destroyed by a construction project, the dodder subsequently re-established at the site and the colony has persisted (NJNHP 2022).

Threats

A potential threat to the New Jersey occurrence of *Cuscuta indecora* var. *indecora* was noted as a result of local herbicide application for the control of an invasive plant species (NJNHP 2022). However, the severity of the threat depends on the type of herbicide in use. For example, Fessehaie (1988) found that *C. indecora* was fairly tolerant of Glyphosate. In an effort to protect crops, numerous herbicides have been evaluated for use against *Cuscuta* species with varying

degrees of success, and while some were effective in achieving temporary suppression of dodder growth few resulted in complete eradication (Lanini and Kogan 2005).

Management Summary and Recommendations

Despite being ranked as critically imperiled in five states, *Cuscuta indecora* var. *indecora* is more likely to be perceived as a threat than as a threatened species. In areas where *C. indecora* is rare or endangered, protection should focus on conservation of extant occurrences and the plant communities that support them. Little else is needed in the way of management, as Collared Dodder can germinate readily, is able to utilize a broad selection of host plants, and has demonstrated the ability to persist even when vigorous efforts have been focused on its elimination.

Synonyms

The accepted botanical name of the species is *Cuscuta indecora* var. *indecora* Choisy. Orthographic variants, synonyms, and common names are listed below (Kartesz 2015, POWO 2022). While Buckley (2010) noted that *indecora* means unattractive, one of the names commonly applied to the species is Pretty Dodder. Other common epithets that broadly refer to the genus *Cuscuta* include Love Vine, Angel's Hair, Tangle Gut, Strangle Vine, Devil's Gut, and Witches Shoelaces (Gandhi et al. 1987).

Botanical Synonyms

Cuscuta decora Choisy ex Engelm.
Cuscuta decora var. *pulcherrima* (Scheele) Engelm.
Cuscuta decora var. *subnuda* Engelm.
Cuscuta hispidula (Engelm.) Engelm.
Cuscuta indecora var. *hispidula* (Engelm.) Yunck.
Cuscuta indecora var. *neuropetala* (Engelm.) Hitchc.
Cuscuta indecora var. *portoricensis* Urb.
Cuscuta indecora var. *subnuda* (Engelm.) Yunck.
Cuscuta neuropetala Engelm.
Cuscuta neuropetala var. *littoralis* Engelm. & A.Gray
Cuscuta neuropetala var. *minor* Engelm. & A.Gray
Cuscuta parviflora var. *vestita* Progel
Cuscuta pulcherrima Scheele
Cuscuta verrucosa var. *hispidula* Engelm.
Grammica indecora ssp. *neuropetala* (Engelm.) W.A.Weber

Common Names

Collared Dodder
Bigseed Alfalfa Dodder
Large-seed Dodder
Pretty Dodder
Showy Dodder

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