Original Paper

Disentangling *Cuscuta* identification in Brazil: a first taxonomic contribution to the northeast region species

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Abstract

*Cuscuta* is a genus of Convolvulaceae distributed worldwide and comprises about 200 species, of which 26 were reported to Brazil. They are characterized by being holoparasites, leafless, gamopetalous, bisexual and usually pentamerous flowers. Studies available for South American *Cuscuta* are mostly from late XIX and early XX centuries. The restriction of taxonomic bibliographies, together with the fact that taxonomic informative characters are restricted to their tiny flowers, make the species identification a challenge. In this context, this work aimed to study the diversity of *Cuscuta* for the northeast region of Brazil and allow species identification. Field works were carried out in all northeast region states and about 150 specimens from 17 herbarium collections were analyzed. A lectotypification is proposed for *C. racemosa*. *Cuscuta orbiculata*, cited to Mexico, Guatemala and Brazil (Goiás and northeast region), is synonymized under *C. tinctoria*. Eight species were recognized, occurring mainly in areas of Caatinga, that predominates in the region. Descriptions, taxonomic comments, illustrations and an identification key are presented.

Key words: dodders, floristic, Holoparasites, parasitic plants.

Introduction

*Cuscuta* L. (1753a: 124) is represented by leafless plants, with haustoria, achorophyllate, non-photosynthetic and therefore, these individuals suck the elaborate sap of a host plant (Andrade et al. 2007). It comprises about 200 species, and according with BFG (2018) 26 species were recognized, of which 11 were recorded in the northeast region. About 15 to 20 species of *Cuscuta* are pests that can cause up to 80% yield losses in plants cultivated, ornamental and wild plants (Pereira 1998) preventing healthy growth of the host species.

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In addition of being an economic concern, as parasitic weeds, some species also stand out by its medicinal and ecological importance. Popular recommendations for treatment of urinary disorders, icterus, muscular pain, cough, biliary disorders, as purgative also for itchy skin are found in literature (Wright et al. 2011; Khan et al. 2010). Ecologically, because of their parasitic condition, they can compromise the development of the host plant, possibly generating changes in the competitive interactions and influencing the community structure, observed diversity, nutrient cycling and vegetation zoning (Pennings & Callaway 2002).

The taxonomic position of *Cuscuta* in a historical perspective has been largely discussed, with disagreement about its belonging either to Convolvulaceae (Jussieu 1789; Choisy 1841; Engelmann 1842, 1859; Engler & Gilg 1924) or to a monogeneric family, Cuscutaceae (Cronquist 1981; Pfeiffer 1845; Progel 1869; Austin 1998). This discordance is because *Cuscuta* is quite distinct from other Convolvulaceae, for being holoparasites, with leaves reduced to scales and calyx usually gamosepalous (vs. photosynthetic plants, foliolated and calyx dialisepalous), although remnant flower morphology is mostly congruent. The most recent phylogenetic hypothesis indicated the monophyly of Convolvulaceae only with the inclusion of *Cuscuta*, despite its position within the family has not been completely elucidated (Stefanović et al. 2003; Stefanović & Olmstead 2004).

The last comprehensive taxonomic treatment of the genus was carried out in 1932 by Yuncker, for the American species. Despite its importance, this treatment is sometimes hard to use, since the identification key starts with fruit characters - frequently missing in herbarium material - and also species descriptions are not comparable to each other since they have different formats. Besides that, the infrageneric classification proposed by Yuncker was considered unnatural by recent phylogenetic studies (Costea et al. 2015), indicating that more in depth studies are needed.

The lack of recent taxonomic literature together with informative characters restricted to its small flowers, led to severe difficulty to identify taxa. Most of the available literature that includes *Cuscuta* species in Brazil deals with the consequences of the parasitic relationship to the host plants, or are references in local floras (Simão-Bianchini & Pirani 1997; Andrade et al. 2007; Alves & Kolbek 2009; Simão-Bianchini et al. 2016), and more rarely new species descriptions, as *Cuscuta taimensis* P.P.A. Ferreira & Dettke (Ferreira et al. 2014). The present study aimed to evaluate the diversity of *Cuscuta* in northeast region of Brazil, providing tools to the correct identification of species.

### Material and Methods

This study was carried out in the northeast region of Brazil (Fig. 1), which is composed by nine states: Alagoas (AL), Bahia (BA), Ceará (CE), Maranhão (MA), Paraíba (PB), Pernambuco (PE), Piauí (PI), Rio Grande do Norte (RN) and Sergipe (SE). It comprises an area of 1,561,177 km$^2$ (18.3% of Brazilian territory) and is limited by the Atlantic ocean to the east and north, by the states of Espírito Santo and Minas Gerais to the south and by the states of Pará, Tocantins and Goiás to the west (SUDENE 2015). Caatinga is the predominant phytogeographic domain, occupying more than 50% of all states. In this region, other phytogeographic domains such Amazonia (in a small portion of Maranhão state), Cerrado and the Atlantic Forest are also found (IBGE 2017).

Initially, a literature survey together with consultation of collections available online were carried out to determine species occurring in the study area, in addition to identifying priority areas for fieldwork. Collections of 17 herbaria were consulted (ALCB, CEPEC, EAC, HRB, HST, HUEFS, HUFRN, HV ASF, IPA, JPB, MAC, MBM, MOSS, PEUFR, RB, SPF and UFP) (acronyms according to Thiers, continuously updated), resulting in about 150 specimens analyzed; whenever was possible identifications were updated. Specimens identification were made...
by comparison with species previously identified by experts, type material available online, Digital Atlas of Cuscuta (Costea 2007-onwards) and by using specialized literature (Progel 1869; Yuncker 1921, 1922, 1923, 1932).

Field work have been carried out by the Laboratory of Integrative Systematics of Angiosperms team (LASIA-UFRPE) focusing on Convolvulaceae since 2015. Expeditions were carried out in all northeast region states of Brazil. Specimens collected were processed and deposited in PEUFR herbaria according to the usual botanical material management techniques (Mori et al. 1985). Duplicates were sent to JPB, ALCB and K. A database was compiled containing information available about all vouchers studied (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.14669889.v1>.

The terminology used followed Harris & Harris (2001) and Yuncker (1932) and measurements were made using the ImageJ© software (Schneider et al. 2012; Rasband 1997-2018) calibrated in centimeters. An identification key was elaborated accompanied by detailed morphological descriptions, taxonomical comments and geographical distribution. Diagnostic characters were illustrated, and distribution maps were constructed using DIVA-GIS© 7.5 software (Hijmans et al. 2012).

Results and Discussion
Despite all effort employed in field trips, only 15 specimens of five different species were found (Fig. 2) (Cuscuta americana L. (1753a: 124), C. racemosa Mart. (1823: 286), C. globosa Ridl. (1890: 48), C. partita Choisy (1841: 284) and C. tinctoria Mart. ex Engelm. (1859: 480-481)), which indicate the rarity of this group in the NE Brazil. Some species showed preferences for humid habitat such as C. americana, while others for shaded environments such as C. globosa.

A total of eight species of Cuscuta are listed occurring in the NE Brazil, in discordance with the 11 species indicated in BFG (2018); no records for Cuscuta indecora Choisy (1841: 278-279) and Cuscuta insquamata Yunck. (1923: 12) were found. A specimen identified in herbaria as C. indecora (Mendes et al. 548, UB) is actually C. partita. However, considering that fruit may present a late dehiscence in C. partita, to observe this character is sometimes challenging. Other morphological difference between these two species are the corolla papillate and calyx smooth in C. partita, while C. indecora has both the calyx and corolla papillate.

Cuscuta insquamata was indicated for Brazil only by one record from Abaíra, Bahia state. This specimen (Stannard et al. 51588, NY) could not be seen. Cuscuta insquamata presents flowers with less than 2 mm long, with calyx and corolla lobes acute and 4-divided. Two specimens from Bahia (ALCB 3456 e ALCB 9900) that present similar size and shape of the lobes, but are 5-divided and with ovary and infrastaminal scales still in early stages of development were observed. Comparing with floral buds of C. partita specimens, since it also presents calyx and corolla lobes acute and 5-divided, we noted that these buds are quite similar to the ALCB samples. Thus, since only one record of C. insquamata is cited and it could not be checked, this species is not included in this treatment. Cuscuta insquamata is considered here as occurring only in Bolivia (Yuncker 1932), therefore.

Identification key of Cuscuta species occurring in Brazilian northeast region

1. Calyx lobes with acuminate to acute apex ........................................................................................................... 2
2. Inflorescence glomeruliform, many flowered (> 20); fruit indehiscent, only partially involved by the persistent corolla ................................................................................................................................................................................ 4 Cuscuta globosa
2'. Inflorescence dichasial or umbeliform, up to 10 flowers; fruit dehiscent, completely involved by the persistent corolla ................................................................................................................................................................................ 3
3. Calyx with lobes overlapping at base (imbricate), erect, not reflexed; corolla smooth; fruit opaque ................................................................................................................................................................................ 8 Cuscuta umbellata
3'. Calyx with lobes not overlapping, often reflexed; corolla papillate; fruit translucent ................................................................................................................................................................................ 5 Cuscuta partita
1'. Calyx lobes with obtuse to rounded apex ................................................................................................................ 4
4. Bracts with obtuse to rounded apex; flowers spherical (as long as wide or wider) ........................................ 5
5. Flowers > 5 mm long; calyx urceolate, with completely overlapping lobes; corolla lobes with a rounded apex ................................................................. 7. *Cuscuta tinctoria*

5’. Flowers < 3 mm long; calyx funnelform, lobes overlapping only at base; corolla lobes with an acute apex ........................................................................................................... 2. *Cuscuta corniculata*

4’. Bracts with acute to subacute apex; flowers cylindrical to funnelform (longer than wide) .......... 6

6. Calyx much shorter than the corolla tube, reaching approx. half of the tube; corolla campanulate........................................................................................................ 6. *Cuscuta racemosa*

6’. Calyx as long or almost as long as corolla tube; corolla cylindrical to urceolate .................. 7

7. Infrastaminal scales with bridge ca. or more (1–2 mm long) of the scale length (2–3 mm long) ........................................................................................................................................ 1. *Cuscuta americana*

7’. Infrastaminal scales with bridge measuring ca. 1/3 or less (0.3–0.6 mm long) of the scale length (2.5–5 mm long) ................................................................. 3. *Cuscuta corymbosa* var. *grandiflora*

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**Taxonomic treatment**


Branchlets 0.05–1.7 mm diam., green, orange or yellow. Inflorescence cyme, cyme umbeliform, glomerulfiform, dichasial or dichasial compound; bracts ovate, rhomboid, rotund, lanceolate, oblanceolate or deltoid; bracteoles absent or, when present, obovate. Bisexual flowers, with radial symmetry, sessiles or pedicellate, pentamerosus, white or light-yellow. Pedicels and perianth with or without papillae. Calyx fused at least in the base, cylindrical, campanulate or funnelform, sometimes angled, lobes rounded to lanceolate, overlapping or not (Fig. 3a,b). Corolla gamopetalous, campanulate to cylindrical, lobes erect, inflexed or reflexed, always erect on buds Anthers ellipsoid with longitudinal aperture, ca. 0.5 mm, yellow-light to yellow; stamens alternate with the corolla lobes; infrastaminal scales present (Fig. 3c) alternate with corolla lobes, adhered to corolla tube similar to a corona, very variable in shape, size and ramification (Fig. 3d). Ovary superuous, globose, two locules with two ovules per locule. Stigmas capitulate. Capsule indehiscent (Fig. 3e) or dehiscent opened by a circumcision on the base (Fig. 3f), completely (Fig. 3g) or partially (Fig. 3h) enclosed by the persistent corolla. One to four seeds with ca. 1 mm.

1. *Cuscuta americana* L. Sp. Pl. 1: 124 1753. Lectotype, designated by Engelmman 1859, LINN 170.5!.

Branches ca. 1.5 mm diam., orange. Inflorescence glomerulfiform, flowers 7-many; pedicels absent to 1.5 mm long; bracts ca. 1.3 × 1 mm, ovate to rhomboid, apex subacute, margin entire; bracteoles absent. Flowers cylindrical to funnelform, 2–4 × 1.5–2 mm, green when fresh and brown or yellow when dried; 5-merous. Calyx green, cylindrical to campanulate, 2–3.5 × 1.5–2 mm, as long as the corolla tube, tube 1.5–2.5 mm long, equal lobes, ca. 0.5 × 1 mm, overlapping at base, apex obtuse, erect, margin entire, smooth. Corolla white to light yellow, cylindrical, tube 2–3.5 mm long, lobes 0.2–0.5 × 0.5 mm, ca. 1/4 of the corolla size, obtuse to rounded, inflexed with apex straight or inflexed, margin entire. Stamens included, as long as the corolla tube; anthers ca. 0.5 mm long, filaments 1.8–3 mm long. Infrastaminal scales 2–3 mm long, as long as the corolla tube, obovate, apex acute to rounded, rare bifurcate, bridge 1–2 mm long; fimbriae of light to dense yellow density, ca. 0.2 mm long. Carpel 2–3 mm long, included; styles cylindrical ca. 0.1 mm diam.; stigma globose, 0.1–0.2 mm long. Fruit opened by circumcision, globose to ovoid, ca. 1.5 × 1.3 mm, intrastylar opening present, opaque, completely involved by the persistent corolla. Seeds 1–2, ca. 1 mm long.

Figure 2 – a-f. Species sampled – a-b. Cuscuta americana – a. habit; b. inflorescence; c. Cuscuta racemosa; d. Cuscuta globosa; e. Cuscuta partita; f. Cuscuta tinctoria.
Figure 3 – a-h. Taxonomically useful morphological characters in the specific determination of *Cuscuta* – a. calyx overlapped in *Cuscuta tinctoria*; b. calyx not overlapped in *Cuscuta partita*; c. infrastaminal scales in *Cuscuta tinctoria*; d. infrastaminal scales similar to a corona in *Cuscuta corniculata*; e. capsule indehiscent in *Cuscuta globosa*; f. capsule dehiscent by circumcision on the base in *Cuscuta partita*; g. capsule completely enclosed by the persistent corolla in *Cuscuta racemosa*; h. capsule partially enclosed by the persistent corolla in *Cuscuta globosa*. (a, c. S.C. Nepomuceno 43; b, f. J.A.A.M. Lourenço et al. 110; d. J.N. Tabosa IPA-52533; e, h. S.C. Nepomuceno 42; g. S.C. Nepomuceno 60).

There are records of C. americana from the United States to northern Argentina (Austin 1982). In Brazil is widely distributed in northeast region, Midwestern (Mato Grosso and Goiás) and Southeastern regions (Minas Gerais) (BFG 2018). New records for Alagoas, Piauí and Rio Grande do Norte are here presented. It is often found in humid environments.

Yuncker (1932) indicates in his keys, illustrations and descriptions that this species is closely related to Cuscuta globulosa Benth. (1844: 138). He indicate that it could be distinguished by the following set of characters, many of them overlapping: C. globulosa has larger flowers (3–4 mm long), yellow when dried, inflorescence less dense, capsules depressed-globose with two seeds and infrastaminal scales more fringed and with lower bridge, while C. americana has smaller flowers (2–3 mm long), brownish when dried, inflorescence more dense, capsules ovoid with one seed and infrastaminal scales less fringed and with higher bridge.

Phylogenetic studies in which C. globulosa and C. americana samples were included, shows C. globulosa together with Cuscuta cozumelensis Yunck. (1922: 108), and Cuscuta macrocephala Yunck. (1921: 126), appearing as sister of C. americana with high support (Stefanović et al. 2007). Thus, considering that characters used by Yuncker (1932) does not seem consistent enough to differentiate these species, and phylogenetic studies show them as closely related, further morphological or population level investigations are recommended to improve specific delimitation.

Despite the overlapping characters, specimens are here identified as C. americana due to predominant characteristics and wider distribution, considering that C. globulosa seems to be more common throughout West India and Mexico and is not cited for South America (Yuncker 1932). In NE Brazil, is similar to Cuscuta corymbosa var. grandiflora Engelm. (1859: 483) because it presents similar calyx but can be distinguished by infrastaminal scales with bridge measuring ca. 1/2 or more of the total scale size in C. americana, and bridge measuring ca. 1/3 or less of the total scale size in C. corymbosa var. grandiflora.

Flowering from May to December.


Figs. 4g-k; 6b

Branches ca. 0.4 mm diam., yellow. Inflorescence a cyme, flowers 3–9; pedicles 1.3–1.5 mm long; bracts ca. 1.3 × 1 mm, rotund, apex rounded, margin entire; bracteoles absent. Flowers spherical, 2–3 × 2–3 mm, yellow when dried, 5-merous. Calyx funnelform, ca. 1.5 × 2.1 mm, as long as the corolla tube, tube ca. 0.4 mm long, lobes equal, 0.9 × 1.1 mm, overlapping at base, apex rounded, erect, margin entire, smooth. Corolla urceolate, tube ca. 1.5 mm long, lobes ca. 1 × 0.8 mm, ca. 1/2 of the corolla size, acute, straight or reflexed with apex inflexed, margin entire. Stamens included, longer than the corolla tube; anthers ca. 0.5 mm long, filament ca. 1.1 mm long. Infrastaminal scales ca. 1.5 mm long, as long as the corolla tube, rotund, apex rounded, bridge ca. 0.6 mm long; fimbriae of moderate density, 0.2 mm long. Carpel ca. 1.3 mm long, included; styles cylindrical ca. 0.1 mm diam.; stigma globose, 0.1–0.2 mm long. Fruit opened by circumcision, depressed-globose, 0.7–1.1 × 1.5–2.1 mm, intrastylar opening present, translucent, partially involved by the persistent corolla. Seeds 3–4, 0.7–1.1 mm long.


Occurs in Brazil, Venezuela and Colombia (Yuncker 1932). Registered to Brazil in Bahia, Goiás, Rio de Janeiro, Santa Catarina and Rio Grande do Sul (BFG 2018), with this study it was verified its occurrence also in Pernambuco.
Figure 4 – a-f. *Cuscuta americana* – a. flower; b. calyx; c. corolla with infrastaminal scales; d. habit; e. fruit; f. infrastaminal scales. g-k. *Cuscuta corniculata* – g. flower; h. calyx; i. corolla with infrastaminal scales; j. infrastaminal scales; k. fruit. l-p. *Cuscuta corymbosa* var. *grandiflora* – l. infrastaminal scales; m. corolla with infrastaminal scales; n. calyx; o. flower; p. fruit. q-v. *Cuscuta globosa* – q. habit; r. infrastaminal scales; s. flower; t. corolla with infrastaminal scales; u. calyx; v. fruit. (a-f. S.C. Nepomuceno 15; g-k. J.N. Tabosa IPA-52533; l-p. A. Fernandes EAC-12778; q-v. S.C. Nepomuceno 42).
Cuscuta from northeast region Brazil

state. Even though it was not found in the field, herbarium labels indicated the occurrence of the species in irrigated areas.

It resembles C. tinentoria by its spherical flowers but can be distinguished by the flowers ca. 6 mm long, bracteoles present, calyx lobes completely overlapped and corolla lobes rounded in C. tinentoria vs. flowers ca. 2 mm long, bracteoles absent, calyx lobes slightly overlapping and corolla lobes acute in C. corniculata.

Flowering in November.


Type: COLOMBIA. Popayan: K.T. Hartweg J237 (holotype P 622284!; isotype E 388772!).

Branches ca. 1 mm diam., yellow. Inflorescence dichasial, flowers sessiles 7–9; pedicels absent to 3 mm long; bracts ca. 1 × 0.5 mm, lanceolate, apex acute, margin entire; bracteoles absent. Flowers funnelform, 4.2–6.7 × 2–4 mm, yellow when fresh and dried, 5-merous. Calyx funnelform, 3–5 × 2–4 mm, almost as long as the corolla tube, tube 2–4 mm long, lobes equal, 0.5–1 × 1.2–1.5 mm, overlapping at base, apex obtuse, erect, margin entire, smooth. Corolla cylindrical to urceolate, tube 3.5–5.5 mm long, lobes 1.2–1.5 × 1–1.5 mm, ca. 1/4 of corolla size, acuminate, inflexed with apex straight or inflexed, margin entire. Stamens included, as long as the corolla tube; anthers ca. 0.5 mm long, filament 1–1.5 mm long. Infrastaminal scales 2.5–5 mm long, shorter than corolla tube, elliptic, apex rounded, bridge 0.3–0.6 mm long; fimbriae of light density, 0.05–0.2 mm long. Carpel 3–6 mm long, included; styles slightly conical 0.1–0.5 mm diam.; stigma globose, ca. 0.3 mm long. Fruit opened by circumscission, globose, 2.5–3.5 × 2–3.5 mm, intrastylar opening present, translucent, completely involved by the persistent corolla. Seeds 1–2, ca. 2 mm long.


Cuscuta corymbosa var. grandiflora is recorded from Mexico to Ecuador (Austin 1982; Breedlove 1986), and for Brazil was considered as endemic to Fernando de Noronha island (BFG 2018). No specimens from the island were here confirmed as this variety, but with our investigation was possible to confirm a single occurrence from Serra do Céu, Itatira-CE, in the year 1984, without more accurate information about its location.

This variety differs from the typical one, which was not found in the study area, by its larger flowers (ca. 5 mm long vs. 4 mm in typical), calyx with more than half corolla tube (vs. reaching the middle of the corolla tube) and subsessile stamens (vs. sessile stamens). In NE Brazil, C. corymbosa var. grandiflora can be confused with C. americana for presenting similar calyx, but differ in the features identified in C. americana comments.

Flowering in August.


Branches ca. 0.6 mm diam., green. Inflorescence glomeruliform, more than 20 flowers; pedicel 1.5–3 mm long; bracts ca. 1.7 × 0.7 mm, lanceolate, apex acute, margin entire; bracteoles absent. Flowers ovoid to spherical, ca. 2.6 × 1.7 mm, green when fresh and yellow when dried, (4–)5-merous. Calyx green, campanulate, ca. 1.5 × 2 mm, longer, rare as long as the corolla tube, tube ca. 0.4 mm long, lobes unequal, the longest four 1.1 × 1.1 mm, the shorter 0.7 × 0.4 mm long, absent when 4-merous, not overlapped, apex acute, erect, margin serrated due to the presence of papillae. Corolla white, ovoid, tube ca. 1 mm long, lobes ca. 0.9 × 0.8 mm, ca. 1/2 of the corolla size, acute, straight with apex straight or inflexed, margin serrated due to the presence of papillae. Stamens included, longer than corolla tube; anthers ca. 0.4 mm long, filament ca. 1.2 mm long. Infrastaminal scales ca. 1 mm long, longer than corolla tube, oblong, apex rounded, bridge ca. 0.3 mm long; fimbriae of moderate density, 0.1 mm long. Carpel ca. 2 mm long, included; styles cylindrical ca. 0.1 mm diam.; stigma globose, ca. 0.1 mm long. Fruit indehiscent, globose to depressed-globose, ca. 1.6 × 2 mm, intrastylar opening present, translucent, partially involved by the persistent corolla. Seeds 2–3, ca. 1.5 mm long.


It is endemic to northeast region of Brazil, where it occurs mainly in the states of Bahia and Pernambuco (Yuncker 1932) in both Caatinga and Atlantic Forest areas. According to the BFG (2018) it also occurs in Alagoas, Ceará and Paraíba states. We also record it to Rio Grande do Norte and Sergipe states. Cuscuta globosa was usually found in shaded areas parasitizing the stem of herbs.

It is easily identified by its glomeruliform inflorescence, with flowers of ca. 2.6 mm long, with acute apex in calyx and corolla lobes. Considering species occurring in the northeast region of Brazil is the only one that can also present individuals with tetramerous flowers. Yuncker (1932) still indicates its similarities with C. acuta Engelm. (1859: 497) and C. micrantha Choisy (1841: 271) for its flowers with about 1.5 mm in length and calyx with acute lobes, and the C. globosa differs from these by its long pedicels, minute flowers and long stamens. In addition, C. acuta is endemic to Ecuador and C. micrantha to Chile.

Flowering from July to December.


Figs. 5a-e; 7a

Branches ca. 0.5 mm diam, orange. Inflorescence dichasial, 6–10-flowers; pedicels ca. 2 mm long; bracts 1.8 × 0.9 mm, lanceolate, apex acuminate, margin entire; bracteoles absent. Flowers ca. 2.5 × 2 mm, white to pink when fresh and reddish when dried, 5-merous. Calyx white, campanulate, ca. 1.7 × 1.6 mm, as long as the corolla tube, tube 0.3 mm long, lobes equal, 1.2 × 0.8 mm, not overlapped, apex acute to acuminate, often reflexed, margin entire, striated. Corolla white to pink, urceolate, tube 1.6 mm long, lobes 0.8 × 0.5 mm, ca. 1/3 of corolla size, acute, reflexed with apex inflexed, margin entire, papillate. Stamens exserted, longer than corolla tube; anthers ca. 0.6 mm long, filament ca. 1.8 mm long. Infrastaminal scales ca. 1.5 mm long, shorter than corolla tube, obovate, apex rounded, bridge ca. 0.4 mm long; fimбриae of moderate density, 0.1 mm long. Carpel ca. 1.8 mm long, included; styles cylindric ca. 0.1 mm diam.; stigma globose, ca. 0.1 mm long. Fruit opened by circumcision, depressed-globose, ca. 1 × 1.5 mm, intrastylar opening present, translucent, completely involved by the persistent corolla. Seeds 2–3, ca. 0.1 mm long.

Figure 5 – a-e. *Cuscuta partita* – a. flower; b. calyx; c. corolla with infrastaminal scales; d. infrastaminal scales; e. fruit. f-j. *Cuscuta racemosa* – f. corolla with infrastaminal scales; g. flower; h. infrastaminal scales; i. calyx; j. fruit. k-p. *Cuscuta tinctoria* – k. infrastaminal scales; l. habit; m. calyx; n. corolla with infrastaminal scales; o. fruit; p. fruit. q-u. *Cuscuta umbellata* – q. calyx; r. fruit; s. corolla with infrastaminal scales; t. flower; u. infrastaminal scales. (a-e. J.A.A.M. Lourenço et al. 110; f-j. S.C. Nepomuceno 60; k-p. S.C. Nepomuceno et al. 43; q-u. A.A. Roque 203).
It is distributed in Bolivia, Colombia, Paraguay, Venezuela and Brazil (GBIF 2019), where is predominant in northeast region, besides records Minas Gerais, Goiás, Mato Grosso and Acre states (BFG 2018). This work recorded new occurrences for Alagoas, Ceará and Rio Grande do Norte states. Usually reported parasitizing *Evolvulus* L. (1762: 391) (Convolvulaceae) and *Sida* L. (1753b: 683) (Malvaceae).

In the study area can be confused with *C. umbellata* Kunth (1818: 121–122) for presenting corolla with acute lobes, but can be distinguished by its umbelliform cymes, calyx with lobes overlapping at base and erect, smooth corolla and opaque fruit, while *C. partita* has a dichasial inflorescence, calyx with lobes not overlapped, often reflexed, papillate corolla and translucent fruit. Specimens branches are usually orange when dried. Its fruit may present

Figure 6 – a-d. Distribution maps – a. *Cuscuta americana*; b. *Cuscuta corniculata*; c. *Cuscuta corymbosa* var. *grandiflora*; d. *Cuscuta globosa*.
a late dehiscence, being difficult sometimes to determine this species employing this character. Flowering from March to June.


Figs. 5f-j; 7b

Branches ca. 0.4 mm diam., yellow or orange. Inflorescence dichasial compound, 6–9-flowers; pedicels 0.1–0.8 mm long; bracts 1.8 × 1.6 mm, oblanceolate, apex acute, margin entire, bracteoles absent. Flowers funnelform, ca. 4 × 2 mm, white when fresh and yellow when dried, 5-merous. Calyx green, funnelform, ca. 1.3 × 1.9 mm, much shorter than the corolla tube, tube ca. 0.5 mm long, lobes equal, ca. 0.8 × 0.6 mm, not overlapped or rare overlapped at the base, apex rounded, erect, margin entire, striated. Corolla white, campanulate, tube ca. 1.8 mm long, lobes ca. 1.5 × 0.8 mm, ca. 1/2 of the corolla size, acuminate, straight or reflexed with apex inflexed, margin entire, papillate. Stamens

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**Figure 7** – a-d. Distribution maps – a. *Cuscuta partita*; b. *Cuscuta racemosa*; c. *Cuscuta tinctoria*; d. *Cuscuta umbellata*. 

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exserted, longer than corolla tube; anthers ca. 0.4 mm long, filament ca. 2.5 mm long. Infrafloral scales ca. 2 mm long, as long as the corolla tube, ovate, apex rounded, bridge ca. 0.7 mm long; fimbriae of moderate density, 0.2 mm long. Carpel ca. 2.3 mm long, included; styles cylindrical ca. 0.1 mm diam.; stigma depressed-globose, ca. 0.2 mm long. Fruit indehiscent, globose to ovoid, ca. 1.6 × 1 mm, intrastylar opening present, opaque, completely involved by the persistent corolla. Seeds 4, ca. 0.7 mm long.


*Cuscuta racemosa* is endemic to Brazil, being common in the Southern region. According to the BFG (2018), this species should be widely distributed in northeast region, reported to all states but Maranhão. However, in this study only records for the states of Bahia and Pernambuco were found. In Bahia it was found in waterlogged regions, one on the roadside near areas of anthropic influence and another on the trail of the Fumaça waterfall (Chapada Diamantina National Park). In Pernambuco, the species was found parasitizing ornamental plants in a small urban park.

From Yuncker’s (1932) identification key, these specimens could be identified either as *C. decipiens* Yunck. (1921: 55) (a rare species from Mexico) or *C. gronovii* Willd. (1820: 205) (widespread in North America). But when comparing these specimens with illustrations and morphological descriptions (Yuncker 1932), the determination can easily reach *C. racemosa*. Futhermore, all morphological descriptions of *C. decipiens*, *C. gronovii* and *C. racemosa* are very similar and could be accepted to these specimens analyzed here. Thus, our decision is taken from the geographic distribution, since *C. racemosa* was described as endemic to Brazil. However, type material besides specimens from these other localities should be studied before a taxonomic decision as a synonym or not is undertaken.

The name “*Cuscuta racemosa*” was used arbitrarily in Brazilian collections for any species, sometimes completely different from each other (*C. americana* and *C. partita*, for example). This probably occurs due to the lack of elucidative bibliography for support correct identifications.

In the protologue, Martius does not report any examined material. However, exsiccates with the author’s handwrites were found in M. According to Art 9.4 of the International Code of Nomenclature for Plants, algae and fungi (ICN) adopted in Shenzhen (Turland et al. 2018) an original material comprises those specimens that the author associated with the taxon, and that were available to the author prior to, or at the time of, preparation of the description and/or diagnosis validating the name. Therefore, the material deposited in Munich is considered as original material because it was analyzed by Martius. We found two exsiccates with his handwriting (M0184374, M0184376) and we choose the M0184374 as lectotype because it is a complete collection with flowers and fruits and matches closely with the description provided by Martius.

Flowering from March to May.


Figs. 5k-p; 7c

Branches ca. 1.7 mm diam., yellow, with papillae in the Branches more development. Inflorescence dichasia compound glomeruliform, 13–19-flowers; sessile; bracts 2.7 × 1.5 mm, rotund, apex obtuse to rounded, margin entire; bracteoles ca. 3 × 1.9 mm, obovate, apex rounded, margin entire. Flowers spherical, ca. 5.8 × 4 mm, green when fresh and brown when dried, 5-merous. Calyx green, urceolate, ca. 3.6 × 4 mm, as long, rare shorter than corolla tube, tube ca. 0.8 mm long, lobes equal, ca. 2.8 × 2.8 mm, totally overlapping, apex obtuse to rounded, erect, margin entire, slightly verrucose. Corolla white, urceolate, tube ca. 3.5 mm long, lobes ca. 1.5 × 1.3 mm, ca. 1/3 of the corolla size, rounded, reflexed com apex straight or inflexed, margin entire, smooth. Stamens exserted, longer than corolla tube; anthers ca. 0.6 mm long, filament ca. 3 mm long. Infrafloral scales ca. 3 mm long, shorter than corolla tube, round, apex rounded, bridge ca. 1.5 mm long; fimbriae dense, ca. 0.4 mm long. Carpel ca. 6.7 mm long, included; styles conical ca. 0.3 mm diam.;...
Cuscuta from northeast region Brazil

stigma depressed-globose, ca. 0.4 mm long. Fruit opened by circumcision, depressed-globose ca. 2.5 × 3 mm, intrastylar opening present, opaque, partially involved by the persistent corolla. Seeds 2, ca. 1.3 mm long.


Cuscuta tinctoria is cited for Mexico, Guatemala and Brazil. In the latter, it is recorded for Goiás (Yuncker 1932) and has a wider distribution in the northeast region, being here presented new records for Alagoas, Paraíba and Rio Grande do Norte states.

The species can be readily distinguished by its spherical flowers of ca. 5 mm and its calyx deeply divided and lobes totally overlapped, often coming to be confused with sepals free. In the northeast region of Brazil it resembles Cuscuta corniculata because both present spherical flowers, but C. tinctoria present flowers with ca. 5 mm, with bracteoles, calyx lobes completely overlapped and corolla lobes rounded, while C. corniculata has flowers with ca. 2 mm, without bracteoles, calyx lobes slightly overlapped and corolla lobes acute.

After analyzing the protologues, comparing descriptions and type materials we concluded that C. tinctoria and C. orbiculata do not present significant differences to be treated as different species. Moreover, the proportions calyx/corolla (calyx as long as the corolla tube in C. tinctoria vs. calyx shorter than corolla tube in C. orbiculata) indicated by Yuncker (1932) as the only character to distinguish them, can be observed in the same individual (see Miranda et al. 857 - ALCB 25577, HST 9727). Cuscuta tinctoria has priority over the C. orbicularia. Cuscuta orbiculata was described as endemic to Brazil, referred only for Goiás, Pernambuco (Fernando de Noronha) and Bahia being known only by the holotype and the one paratype.

Flowering from May to September.


Figs. 5q-u; 7d

Branches 0.05–0.2 mm diam., yellow. Inflorescence cyme umbelliform, flowers 5–8; pedicels 0.9–2.2 mm long; bracts 1–1.5 × 0.7–1 mm, deltoids to rhombic, apex acute, margin entire; bracteoles absent. Flowers ca. 2 × 1.5 mm, white when fresh and yellow when dried, 5-merous. Calyx funnelform, 1–1.4 × 1.2 mm, as long as the corolla tube, tube ca. 0.7 mm long, lobes equal, 0.4–0.7 mm long, overlapping at base, apex acuminate to acute, erect, margin entire, striated. Corolla white, urceolate, tube 0.5–1 mm long, lobes 1–1.5 × 0.3–0.7 mm, ca. 2/3 of the corolla size, acute, straight or reflexed with apex inflnxed, margin entire, smooth. Stamens exerted (included when the corolla lobes are erect) longer than corolla tube; anthers ca. 0.3 mm long, filament ca. 1 mm long. Infrastaminial scales 0.8–1 mm long, longer than corolla tube, ovate, apex rounded, bridge ca. 0.2 mm long; fimbriae of moderate density, 0.05–0.2 mm long. Carpels ca. 1.8 mm long, exserted; styles cylindrical ca. 0.1 mm diam.; stigma globose, ca. 0.1 mm long. Fruit opened by circumcision, globose to depressed-globose, ca. 1 × 1.2 mm, intrastylar opening present, opaque, completely involved by the persistent corolla. Seeds 2, ca. 0.8 mm long.


Cuscuta umbellata is found from United States, Mexico, Suriname, Guyana, Venezuela and Brazil (Yuncker 1932; Correll & Johnston 1970; Funk et al. 2007; Hokche et al. 2008; Villaseñor 2016), where, according with BFG (2018) was recorded for Piauí, Ceará and Rio Grande do Norte states. However, specimens from Ceará and Piauí were not located, and here we consider its distribution restricted to Rio Grande do Norte state, growing in saline regions.
It resembles *C. partita* due to corolla with acute to acuminate lobes but can be distinguished by a set of characteristics pointed out in the comments of this species.

Flowering from May to June.

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