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 pentameric 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, aclorophyllate, 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.
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 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), Pará (PB), Pernambuco (PE), Piauí (PI), Rio Grande do Norte (RN) and Sergipe (SE). It comprises an area of 1,561,177.8 km² (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

*Figure 1 – Brazil’s northeast region political delimitation.*
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
6. Flowers < 3 mm long; calyx funnelform, lobes overlapping only at base; corolla lobes with an acute apex
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

7. Infrastaminal scales with bridge ca. or more (1–2 mm long) of the scale length (2–3 mm long) ................................................... 6. Cuscuta racemosa
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

Taxonomic treatment

Cuscuta L. Sp. Pl. 1: 124. 1753.

Branchlets 0.05–1.7 mm diam., green, orange or yellow. Inflorescence cyme, cyme umbeliform, glomeruliform, dichasial or dichasial compound; bracte ovate, rhomboid, rotund, lanceolate, obovate or deltoid; bracteoles absent or, when present, obovate. Bissexual flowers, with radial symmetry, sessiles or pedicelate, pentamemous, 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 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 capitate. 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 Engelmann 1859, LINN 170.5!

Branches ca. 1.5 mm diam., orange. Inflorescence glomeruliform, 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 infelexed, 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 texture, ca. 0.2 mm long. Carpels 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, intrastylarly opening absent, opaque, completely involved by the persistent corolla. Seeds 1–2, ca. 1 mm long.

Examined material: ALAGOAS: Água Branca, REVIS do Crãuand e do Padre, Morro do Crãuan, 09°26’08”W, 37°99’61”S, 22.VII.2014, fl. and fr., M.W. Tavares-Silva 96 (MAC). BAHIA: Amélia Rodrigues, 4 km SE de Amélia Rodrigues, 20.III.1987, fl. and fr., L.P. de Queiroz 1459 (HUEFS). Conceição de Feira, V.1980, fl. and fr., Grupo Pedra do Cavalo 9 (ALCB, CEPEC, HRB, HUEFS). Feira da Santana, 8.VII.1982, fl. and fr., K.B. Brito 61 (ALCB, HUEFS); VIII.1980, fl. and fr., Grupo Pedra do Cavalo 564 (ALCB, CEPEC, HRB, HUEFS). Glória, 5.VI.2004, fl. and fr., M.V.M. Oliveira 687 (HUEFS). Ipuaçu, XL.1980, fl. and fr., Grupo Pedra do Cavalo 938 (HUEFS). Jacobina, 11°16’S, 40°27’W, 25.VII.1980, fl. and fr., R.P. Orlandi 254 (ALCB, HRB). CEARÁ: Aurora, Serra do Vaqueiro Ademar, cume da Serra, 11.IX.2014, fl. and fr., A.P. Fontana 8522 (HUEFS). Baixio, estrada vicinal entre Baixio-CE e Santa Helena-PB, trecho 5 Ramal IV do Eixo Norte (PB-RN), 21.V.2014, fl. and fr., J.L. Costa-Lima 1287 (HUEFS). Mauriti, São
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).
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.

2. *Cuscuta corniculata* Engelm. Trans. Acad. Sci. St. Louis 1(3): 504. 1859. Type: VENEZUELA. Rio Meta: *H. Karsten* s.n. (holotype K 000196076!).

**Figs. 4g-k; 6b**

Branches ca. 0.4 mm diam., yellow. Inflorescence a cyme, flowers 3–9; pedicels 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. Fruit opened by circumscision, 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.

**Examined material:** BAHIA: Piatá, Gerais da Inháua 22-26 km de Cotelês, 10.III.1992, fl. and fr., *B. Stannard et al.* 51861 (SPF). PERNAMBUCO: Belém de São Francisco, 5.IX.1990, fl. and fr., *J.N. Tabosa* IPA-52533 (IPA). Brejo da Madre de Deus, fl., *IPA-53343* (IPA).

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

A. CEARÁ: Itatira, Serra do Céu, flowers ca. 2 mm long, bracteoles can be confused by its spherical 4 mm in typical), calyx. 2021 is Kunth Nov. Gen. Sp. 3: comments.

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 November.

3. Cuscuta corymbosa var. grandiflora Engelm. Trans. Acad. Sci. St. Louis 1: 483. 1859. Cuscuta popayanensis Kunth Nov. Gen. Sp. 3: 123. 1818.

Type: COLOMBIA. Popayan: K.T. Hartweg 1237 (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, in flexed 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 circumcision, 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.

Examined material: CEARÁ: Itatira, Serra do Céu, IX.1980, fl. and fr., Chagas-Mota 12778.

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 was 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.

Flowering in August.

4. Cuscuta globosa Ridl. J. Linn. Soc., Bot. 27: 48. 1890. Type: BRAZIL. Fernando de Noronha: H.N. Ridley 72 (holotype K 000196099!).

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 inf lexed, 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.

Examined material: ALAGOAS: Maceió, Farol, próximo ao batalhão do Exército, 16.I.2008, fl. and fr., Chagas-Mota 252 (MAC). BAHIA: Campo Alegre de Lourdes, 26.V.2002, fl. and fr., A.M. Miranda 3908 (HST); Conceição de Feira, mata a NE de Bananeiras, vale dos ríos Paraguaçu e Jacuípe, 12°32'W, 39°05'S, IX.1980, fl. and fr., Grupo Pedra do Cavalo 766 (ALCB, HBR, HUEFS). Feira de Santana, Ipuacu, 12°15'W, 38°58'S, 2.XII.2003, fl. and fr., J.G. Carvalho-Sobrinho et al. 157 (HUEFS). CEARÁ: Mauriti, lote...
VI, 30.VI.2009, fl. and fr., J.R. Maciel 1269 (HVASF). PARAÍBA: São José de Piranhas, reservatório Morros, 07°09’09.35”W, 38°26’21.73”S, 393 m, 19.V.2011, fl. and fr., F.F.S. Silva 454 (HVASF). PERNAMBUCO: Águas Belas, 17.XI.1999, fl. and fr., V.C. Lima et al. IPA-65560 (IPA). Arcoverde, Estação Experimental do IPA, 21.VII.1971, fl. and fr., D. Andrade-Lima 71-6321 (IPA). Carupa, entrada de Carpinha, 26.XI.1952, fl. and fr., D. Andrade-Lima 52-1186 (IPA). Caruaru, Estação Experimental do IPA, 08°14’13”S, 35°55’14”W, 19.IX.2017, fl. and fr., S.C. Nepomuceno 42 (PEUFR). Fernando de Noronha, 09.XI.1980, fl. and fr., D. Andrade-Lima 80-8895 (IPA). Recife, IX.1994, fl. and fr., J. Braga-Filho IPA-990 (IPA). Tapera, 20.X.1927, fl. and fr., B. Pickel 1500 (IPA). RIO GRANDE DO NORTE: Florânia, Serra de São Bento, 23.VII.2016, fl. and fr., A.M. Marinho 307 (PEUFR).

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* Choisy (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.

5. *Cuscuta partita* Choisy Mém. Soc. Phys. Genève 9: 284, t. 5, f. 3. 1841[1842]. Type: BRAZIL. J.S. Blanchet 3047 (holotype MO 2756986!).

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. Infrastructural scales ca. 1.5 mm long, shorter than corolla tube, obovate, apex rounded, bridge ca. 0.4 mm long; fimbriae of moderate density, 0.1 mm long. Carpel ca. 1.8 mm long, included; styles cylindrical 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.

Examined material: ALAGOAS: Água branca, REVIS do Craunã e do Padre, Morro do Craunã, 30.IV.2014, fl. and fr., A. Santos et al. 2 (MAC). BAHIA: Casa Nova, Caripa da Bragas, 23.III.1988, fl., J.D.C. Arouck-Ferreira et al. 442 (MBM). Itaberaba, BR-242, 12°31’15”S, 40°08’30”W, 19.V.2015, fl. and fr., G. Staples et al. 1645 (PEUFR). Urandi, BR-122, próximo à divisa com Ouro Branco, 4.IV.1992, fl., G. Hatschbach 56532 (MBM). Xique-Xique, 25.VI.1996, fl., M.L.S. Guedes 3074 (ALCB, CEPEC, HRB, HUEFS). CEARÁ: Cidade, Fazenda Feijão, 19.V.1991, fl., P.R. Noronha EAC-18723 (EAC). Caucaia, Salgadinho, 17.VII.2006, fl., A.S.F. Castro 1828 (EAC). Jaguaribe, Macio do Pereira, 10.IV.2011, fl., A.M. Miranda 6263 (EAC, HST). São Benedito, Faz. Penha, trilha do Buraco da Velha, Planalto do Ibiapaba, 22.II.2000, fl., E.B. Souza EAC-29910 (EAC). PIAUI: Piracuruca, PI-110, entre Piracuruca e BR-232, 03°58’43”S, 41°28’22”W, 11.VI.2016, fl. and fr., J.A.A.M. Lourenço et al. 110 (PEUFR). PERNAMBUCO: Parnamirim, Sítio Olho d’água, 08°08’39”S, 39°35’48”W, 8.IV.2009, fl. and fr., J.A. Siqueira-Filho 2013 (HVASF, HUEFS). Sagueiro, Reservatório Negroes, 08°06’07.9”S, 39°12’14.4”W, 454 m, 10.IV.2011, fl. and fr., F.F.S. Silva et al. 251 (HVASF). RIO GRANDE DO NORTE: Apodi, próximo ao açude da Baixa Grande, 05°21’S, 37°35’W, 70 m, 27.IV.1980, fl. and fr., O.F. Oliveira 661. Jucurutu, RPPN Stoessell de Britto, 1.III.2018, fl., A.A. Roque 456 (HUFRN). Caicó, sito pelados, próximo à Serra de São Bernardo, estrada para São José do Seridó, 14.III.2009, fl., A.A. Roque 667 (HUFRN). Caraúbas, 05°35’15.4”S, 37°31’20.9”W, 23.IV.2016, fl. and fr., A.M. Marinho 237 (PEUFR). Jucurutu, 20.IV.2016, fl. and fr., A.M. Marinho 298 (PEUFR). Lages, Fazenda Barra da Cruz, 05°41’26”S, 36°22’56”W, 13.IV.2016, fl. and fr., L.O.F. de Souza 873 (MOSS). São João do Sabugi, base da Serra do Mulungu, 06°42’32”S, 37°10’13”W, 240 m, 18.IV.2014, fl. and fr., J.G. Jardim 6653 (HUFRN). SERGIPE: Canindé do São Francisco, Fazenda Xinó, perto de Xingozinho, 3 km da divisa com a Bahia, 25.IV.2001, fl. and fr., R.M. Harley 54297 (HUEFS).
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

![Distribution maps](image)

**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.

6. *Cuscuta racemosa* Mart. Reise Bras. 1: 285. 1823. Type: BRAZIL. Herbidis ad Sebastianopolis. Provinciae Rio de Janeiro. Mandiocca: *C.F.P. von Martius 72* (lectotype, designated here, M0184374!; isolectotypes M0184376!).

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*.
exserted, longer than corolla tube; anthers ca. 0.4 mm long, filament ca. 2.5 mm long. Infrastralinal 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.

Examined material: BAHIA: Ituberá, estrada entre Ituberá e Taperoá, BA-001, 13°41’01.13’S, 39°07’40.18”W, 11.IV.2018, fl. and fr., S.C. Nepomuceno 60 (PEUFR). Palmeiras, trilha para Cachoeira da Fumaça em local encharcado, 12°36’14”S, 41°27’59”W, 18.V.2019, fl. and fr., J.A.A.M. Lourenço 300 (UFRPE). PERNAMBUCO: Recife, Av. 17 de agosto, Praça do Monteiro, em frente à escola Silva Jardim, 08°01’40.50’S, 34°55’40.89”W, 15.III.2017, fl. and fr., J.A.A.M. Lourenço 64 (PEUFR).

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 handwritings 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.

7. Cuscuta tinctoria Mart. ex Engelm. Trans. Acad. Sci. St. Louis 1: 480-481. 1859. Type: MEXICO. Oaxaca, San Luis Potosí: W.F. von Karwinsky (lectotype, designated by Yuncker 1932, MO 152731!; isolecotype N 336675).

=Cuscuta orbiculata Yunck. Amer. J. Bot. 9: 572, pl. 4. 1923. syn. nov. Type: BRAZIL. Cachoeira, Goiás, Glaziou 21809 (holotype K 000196090!).

Figs. 5k-p; 7c

Branches ca. 1.7 mm diam., yellow, with papillae in the Branches more development. Inflorescence dichasial 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 overlapped, 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 con apex straight or inflexed, margin entire, smooth. Stamens exserted, longer than corolla tube; anthers ca. 0.6 mm long, filament ca. 3 mm long. Infrastralinal 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. 3.7 mm long, included; styles conical ca. 0.3 mm diam.;
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.

**Examined material.** ALAGOAS: Traipu, Serra da Mãos, 21.VIII.2010, fl. and fr., R.P. Lira-Lemos et al. 13116 (MAC). BAHIA: Sãoito Amaro, 1 km após Lagoa da Boa Vida, vindo de Campinho, 20.III.1980, fl. and fr., A.P. de Araújo 274 (CEPEC). CEARÁ: Parambam, margem BR-020, 30 km da divisa CE/PI, 9.V.2008, fl. and fr., A.S.F. Castro 2018 (EAC). PARAÍBA: São José de Piranhas, reservatório Morros, 07°09’09.35”S, 38°26’21.73”W, 19.V.2011, fl. and fr., E.F.S. Silva 458 (HVSASF, PEUFR).

**Examined material.** PERNAMBUCO: Fernando de Noronha, Ilha da Rata, 03°50’10”S, 32°25’30”W, 1.VI.1993, fl. and fr., A.M. Miranda 857 (ALCB, HST); Gravatá, estrada para Pedra Branca, 08°39’35.1”S, 37°14’46.5”W, 26.IX.2017, fl. and fr., S.C. Nepomuceno et al. 43 (PEUFR). PIAUÍ: Caracol, Serra Grande, 09°09’48”S, 43°23’07”W, 668 m, 18.VII.2011, fl. and fr., E. Melo et al. 10139 (HUEFS); RIO GRANDE DO NORTE: Mossoró, Serra do Carno, 05°11’15”O, 16 m, 13.V.1980, fl. and fr., O.F. Oliveira 826 (MOSS).

**Cuscuta tinctoria** is cited for Mexico, Guatemala and Brazil. In the latter, 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 distinguished 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.

8. **Cuscuta umbellata** Kunth Nov. Gen. Sp. (quarto ed.) 3: 121-122. 1818[1819]. Type: MEXICO. Queretaro Salamanca [Nov. gen. sp. : Crescit in Nova Hispania, inter Queretaro et Salamanca]: A.J.A. Bonpland & F.W.H.A. von Humboldt 4338 (holotype P 00670787!, isotype MO 4074374!).

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 infl exed, margin entire, smooth. Stamens exerted (included when the corolla lobes are erect) longer than corolla tube; anthers ca. 0.3 mm long, filamen ca. 1 mm long. Infrastructural 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. Carpel 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.

**Examined Material.** RIO GRANDE DO NORTE: Areia Branca, salina Augusto Severo, 17.V.2007, fl. and fr., A.A. Roque 53 (HUFRN). Grossos, salina Caenga, 12.V.2007, fl. and fr., A.A. Roque 96 (HUFRN); salina Salmar, 28.VI.2017, fl. and fr., A.A. Roque 203 (HUFRN).

**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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**References**

Alves RJV & Kolbek J (2009) Summit vascular flora of Serra de São José, Minas Gerais, Brazil. Check list 5: 035-073.

Andrade RAS, Araújo LS & Neves FS (2007) Ocorrência de *Cuscuta racemosa* (Convolvulaceae) no Parque Estadual do Rio Preto, Minas Gerais, Brasil. Revista Unimontes Científica 9: 119-123.

Austin DF (1982) Convolvulaceae. In: Harling GW & Sparre BB (eds.) Flora Ecuador. University of Göteborg & Swedish Museum of Natural History 15: 1-98.

Austin DF (1998) Parallel and convergent evolution in the Convolvulaceae. In: Mathews P & Sivadasan (eds.) Biodiversity and taxonomy of tropical flowering plants. Vol. 1. Ed. Mentor Books, Calicut. Pp. 201-234.

Bentham G (1844) The botany of the Voyage of H.M.S. Ed. Sulphur, London. Pp. 138.

BFG - The Brazil Flora Group (2018) Brazilian Flora 2020: innovation and collaboration to meet Target 1 of the Global Strategy for Plant Conservation (GSPC). Rodriguésia 69: 1513-1527.

Breedlove DE (1986) Flora of Chiapas. Part 1. Introduction to the Flora of Chiapas. California Academy of Sciences, Mexico. Pp. 1-246.

Choisy JD (1841) Convolvulaceis dissertatio tertia, complectens Cuscutarum hucusque cognitarum methodicam enumerationem et descriptionem, necnon et brevem gallicam de *Cuscutis* praefationem. Memoires de la Société de Physique et d’histoire naturelle de Genève 9: 261-288.

Correll DS & Johnston MC (1970) Manual of the vascular plants of Texas. Contributions from Texas Research Foundation. A series of botanical studies, The University of Texas at Dallas, Richardson 6: 1-1881.

Costea M (2007-onwards) Digital atlas of *Cuscuta* (Convolvulaceae).Wilfrid Laurier University Herbarium, Ontario. Available at <https://specialprojects.wlu.ca/herbarium/digital-atlas-of-cuscuta-convolvulaceae/>.

Costea M, Garcia MA & Stefanović S (2015) A Phylogenetically based infrageneric classification of the parasitic plant genus *Cuscuta* (Dodders, Convolvulaceae). Systematic Botany 40: 269-285.

Cronquist A (1981) An integrated system of classification of flowering plants. Columbia University Press, New York. 1262p.

Engelmann G (1842) Monography of North American Cuscutineae. American Journal of Science and Arts 43: 333-344.

Engelmann G (1859) Systematic arrangement of the species of the genus Cuscuta with critical remarks on old species and descriptions of new ones. Transactions of the Academy of Science of Saint Louis 1: 453-523.

Engler A & Gilg E (1924) Syllabus der Pflanzenfamilien. Ed. Gebruder Borntraege, Berlin. 420p.

Ferreira PAA, Dettke GA, Waechter JL & Miotto STS (2014) *Cuscuta taimensis* (Convolvulaceae), a New Species from South America. Brittonia 66: 269-273.

Funk VA, Hollowell TH, Berry PE, Kelloff CL & Alexander S (2007) Checklist of the plants of the Guiana Shield (Venezuela: Amazonas, Bolivar, Delta Amacuro; Guyana, Surinam, French Guiana). Vol. 55. Ed. National Museum of Natural History, Washington. 279p.

GBIF Secretariat (2019) *Cuscuta partita* Choisy. GBIF Backbone Taxonomy. Accessed via GBIF.org. Available at <https://doi.org/10.15468/39omei>. Access on 03 March 2020.

Harris JG & Harris MW (2001) Plant identification terminology: an illustrated glossary. Vol. 2. Ed. Spring Lake, Utah. 216p.

Hijmans RJ, Guarino L, Bussink C, Mathur P, Cruz M, Barrentes I & Rojas E (2012) DIVA-GIS: a geographic information system for the analysis of species distribution data. Versão 7.5. Available at <http://www.diva-gis.org>. Access on 20 March 2020.

Hokche O, Berry PE & Huber O (2008) Nuevo catálogo de la flora vascular de Venezuela. Vol. 1. Ed. Fundación Instituto Botánico de Venezuela, Caracas. Pp. 859.

IBGE - Instituto Brasileiro de Geografia e Estatística (2017) Mapa de clima do Brasil. Rio de Janeiro. Escala 1:5000000. Available at <http://atlas.escolar.ibge.gov.br/images/atlas/mapas_brasil/brasil_clima.pdf>. Access on 29 May 2017.

Jussieu AL (1789) *Genera Plantarum*. Secundum ordines naturales disposita, juxta methodum in Horto lobo lobosee exaratam. Vol 2. Herissant et d’histoire naturelle de Genève 9: 261-288.

Khan S, Mirza KJ & Abdin MZ (2010) Development of RAPD markers for authentication of medicinal plant...
Cuscuta reflexa. EurAsian Journal of BioSciences 4: 1-7.
Kunth KS (1818) Nova Genera et Species Plantarum. In: Humboldt FWHA, Aimé JA & Kunth KS (eds.) Ed. Open Shelves, Paris. 377p.
Martius CFP (1823) Reise in Brasilien. M. Lindauer, Munich. 885p.
Mori SA, Mattos-Silva LA, Lisboa G & Coradin L (1985) Manual de manejo do herbário fanerogâmico. Ed. Centro de Pesquisas do Cacau, Ilhéus. 104p.
Pennings SC & Callaway RM (2002) Parasitic plants: parallels and contrasts with herbivores. Oecologia 131: 479-489.
Pereira W (1998) Prevenção e controle da parasita Cuscuta em áreas cultivadas com hortalícias. Ed. EMBRAPA-CNPH (Comunicado Técnico da Embrapa Hortalícias, 9), Brasília. 6p.
Pfeiffer L (1845) Characteristik der in der Gegend von Kassel beobachteten Gattungen und Arten von Cuscuteen. Botanische Zeitung 3: 673-674.
Progel A (1869) Cuscutaceae. In: Martius CFP & Eichler AG (eds.) Flora brasiliensis. Flischer, Lipsiae. Vol. 7, pp. 371-390.
Rasband WS (1997-2018) ImageJ, U.S. National Institutes of Health, Bethesda, Maryland, USA. Available at <https://imagej.nih.gov/ij/>. Access on August 2018.
Ridley HN (1890) Notes on the Botany of Fernando de Noronha. Journal of the Linnean Society, Botany 27: 48.
Schneider CA, Rasband WS & Eliceiri KW (2012) NIH Image to ImageJ: 25 years of image analysis. Nature Methods 9: 671-675. DOI: <https://doi.org/10.1038/nmeth.2089>.
Simão-Bianchini R & Pirani JR (1997) Flora da Serra do Cipó, Minas Gerais: Convolvulaceae. Boletim de Botânica da Universidade de São Paulo 16: 125-149.
Simão-Bianchini R, Vasconcelos LV & Pastore M (2016) Flora of the cangas of the Serra dos Carajás, Pará, Brazil: Convolvulaceae. Rodriguésia 67: 1301-1318.
Stefanović S, Kuzmina M & Costea M (2007) Delimitation of major lineages within Cuscuta subgenus Grammica (Convolvulaceae) using plastid and nuclear DNA sequences. American Journal of Botany 94: 568-589.
Stefanović S & Olmstead RG (2004) Testing the phylogenetic position of a parasitic plant (Cuscuta, Convolvulaceae, Asteridae): bayesian inference and the parametric bootstrap on data drawn from three genomes. Systematic Biology 53: 384-399.
Stefanović S, Austin AD & Olmstead RG (2003) Classification of Convolvulaceae: a phylogenetic approach. Systematic Botany 28: 791-806.
SUDENE - Superintendência do Desenvolvimento do Nordeste. Caracterização do território nordestino. Available at <https://www.gov.br/sudene/pt-br/centrais-de-contenido/nordestem numeros2015.pdf>. Access on 09 May 2021.
Thiers B [continuously updated] Index Herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden’s Virtual Herbarium. Available at <http://sweetgum.nybg.org/science/ih/>. Access on 27 Dec 2018.
Villaseñor RJL (2016) Checklist of the native vascular plants of Mexico. Catálogo de las plantas vasculares nativas de México. Revista Mexicana de Biodiversidad 87: 559-902.
Willdenow CL (1820) Systema vegetabilium. Stuttgardtiae, Huthana. 642p.
Wright MAR, Welsh M & Costea M (2011) Diversity and evolution of the gynoecium in Cuscuta (dodders, Convolvulaceae) in relation to their reproductive biology: two styles are better than one. Plant Systematics and Evolution 296: 51-76.
Yuncker TG (1921) Revision of the North American and West Indian species of Cuscuta. Illinois Biological Monographs 6: 91-231.
Yuncker TG (1922) Revision of the South American species of Cuscuta I. American Journal of Botany 9: 557-575.
Yuncker TG (1923) Revision of the South American species of Cuscuta II. American Journal of Botany 10: 1-17.
Yuncker TG (1932) The genus Cuscuta. Memoirs of the Torrey Botanical Club 18: 113-331.
Exsiccate list
Almeida NM 159 (1). Andrade-Lima D 51-2148 (1), 52-1117 (7), 52-1186 (4), 71-6321 (4), 80-8895 (4). Araújo AP 272 (7). Araújo F 176 (7). Barreto R 413 (1), 786 (1). Braga DV (IPA 73874) (5). Braga-Filho J (IPA 990) (4). Britto KB 61 (1). Buril MT 325 (5). Campos PCS (MOSS 3722) (5). Carvalheiro G 1253 (7). Carvalho AM 2715 (5). Carvalho-Sobrinho JG 157 (4), 1906 (5). Castro ASF 1828 (5), 2018 (7). Castro MS (CEPEC 107718) (5). Castro-Motta 252 (4), 8572 (1). Chaves EMF 271 (7). Chiappeta 523 (1). Coelho MM 13 (5). Colla F 7 (5). Conceição AA 2542 (5). Costa AL (ALCB 3455) (5), (ALCB 3457) (5), 443 (5). Costa-Lima JL 1287 (1). Felix LP (HST 5147) (5), (JPB 53738) (5), 8178 (5). Fernandes A (EAC 12788) (3). Fernandes ER 2 (5). Ferreira JDC 422 (5). Fontana AP 8522 (1), 7029 (1). Gadelha-Neto PC1876 (1), PC2248 (1). Gonçalves LMC 46 (7). Gonçalves LMC 23094 (5). Grupo Pedra do Cavalo 9 (1), 564 (1), 766 (4), 906 (1), 938 (1). Guedes MLS 259 (7), 3074 (5), 5207 (5), 16811 (5), 17383 (5), 21166 (1). Harley RM 21452 (7), 54297 (5), 54850 (5). Hatchesbach G 55177 (5), 56523 (5). Heringer EP 143 (5), 471 (5). IPA 55343 (2). Jardim JG 5784 (1), 5791 (5), 6653 (5). Lanna JP 1373 (5). Lima VC 381 (1), (IPA 32023) (1), (IPA 65560) (4). Lira-Lemos RP 13116 (7). Lourenço JAAM 61 (4), 64 (6), 110 (5), 300 (6). Lucena MFA 1736 (1). Marcel J 1269 (4). Melo E 5486 (5), 7743 (1), 10139 (7). Miranda AM 810 (7), 857 (7), 952 (7), 1985 (4), 3230 (7), 3520 (4), 3878 (7), 3908 (4), 4113 (4), 4210 (4), 4235 (1), 6263 (5). Mori 9489 (5). Moura D 504 (1). Nepomuceno SC 43 (7), 60 (6). Noblick LR 3621 (5). Noronha PR (EAC 18723). Oliveira ACP 2538 (1). Oliveira LB 39 (7). Oliveira M 2301 (5), 2816 (5), 3834 (5), 3872 (5), 5571 (5). Oliveira MVM 687 (1). Oliveira OF 661 (5), 826 (7), 1891 (5). Oliveira RC 2181 (4). Orlandi RP 254 (1). Paixão JL 1588 (5). Pereira R 7 (1). Pessoa LM 82 (5). Pickel DB 1066 (1), 1500 (4), 4697 (1). Pinheiro RS 1764 (5). Pinto GCP (ALCB 6947) (5), (ALCB 9322) (5). Queiroz EP 1459 (1), 4959 (5). Queiroz RT 287 (5), 927 (5). Roque AA 34 (5), 53 (8), 96 (8), 203 (8), 456 (5), 667 (5), 828 (4). Santo FSE 56 (1). Santos A 2 (5), 11 (1). Santos TS 1586 (5). Sarmento 751 (5). Silva FFS 168 (1), 251 (5), 454 (4), 458 (7). Silva SB 171 (5). Siqueira-Filho JA 2013 (5), 2656 (1). Smidt EC 278 (5). Sousa LOF 873 (5). Sousa E (EAC 29910) (5). Staples G 1644 (5). Tabosa JN (IPA 52533) (2). Tavares-Silva MW 96 (1). Thomas WW 15552 (5).