REFERÊNCIA
Abstract

Cyperus is a Pantropical genus and the second richest in species in Cyperaceae. It encompasses about 550 species worldwide, with about 100 of these occurring in Brazil. Studies on the taxonomy of this genus are scarce and punctual in Brazil. In this study, the occurrence of species was surveyed through 27 collecting expeditions across different regions in the state of Rio Grande do Norte and analysis of specimens of several herbaria. Twenty-four species of Cyperus were identified, including six new occurrences and one new species, here described, but that will be properly published in other work. This study includes a dichotomous key for the identification of the species, as well as illustrations, descriptions, taxonomic comments and geographical distribution.

Key words: Cyperoideae; Taxonomy; Monocots.

Introduction

Cyperaceae is a cosmopolitan family represented by about 5,500 species (Govaert et al. 2014), with about 650 of these occurring in Brazil (Alves et al. 2014). Recent studies reportedly subdivided this family into two clades, which are represented by the subfamilies Mapanioideae and Cyperoideae (Simpson et al. 2007; Muasya et al. 2009a, 2009b). Among Cyperoideae, the tribe Cyperaeae may be subdivided into two subclades (Larridon et al. 2013): one - "Ficinia Clade", with about 160 species - represents the species of southern Africa, the majority of these bearing spirally arranged glumes; the other - "Cyperus Clade", with about 950 species - represents the Pantropical species, most of them with distichous glumes.

The circumscription of Cyperus L. inside the Cyperus Clade has been non-consensual. Kükenthal (1936) and Haines & Lye (1983) accepted Cyperus sensu lato and treated some taxa, as Kyllinga Rothb. and Pycreus P. Beauv., as of infrageneric rank. On the other hand, Goetghebeur (1998) kept Kyllinga, Pycreus and other taxa at generic level and proposed Cyperus sensu stricto encompassing two subgenera, that is, Cyperus (including the species with C4 photosynthetic pathway) and Anosporum (Nees) C.B. Clarke (including the species with C3 photosynthetic pathway).

Recently, phylogenetic studies by Larridon et al. (2011a, 2011b, 2011c, 2013) led to the proposition of a more comprehensive classification, which demonstrates that Cyperus is paraphyletic and the “Cyperus Clade” encompasses at least 13 genera. In the subclade Cyperus C3, it was included the genera Courtoisina Soják, Oxycaryum Nees and Kylingiella R.W. Haines & Lye; in the subclade Cyperus C4, it was included nine genera, viz., Alinula J. Raynal, Ascolepis Nees ex Steud., Lipocarpha R. Br., Kyllinga Rothb., Pycreus P. Beauv., Queenslandiella Domin, Remirea Aubl., Sphaerocyperus Lye, and Volkiella Merxm. & Czech.

Since the results from the phylogenetic studies by Larridon et al. (2011a, 2011b, 2011c, 2013) have not yet been incorporated into the nomenclature of Cyperus, the taxonomic classification used in...
the Flora of Brazil (Alves et al. 2014), as well as in most of the regional studies (Araújo & Longhi-Wagner 1996; Luceño et al. 1997; Hefler & Longhi-Wagner 2012), follows that proposed by Goetghebeur (1998). The present study also followed this classification and included in the taxonomic treatment the *Cyperus* s. s. species as treated by Goetghebeur (1998).

The genus *Cyperus* s. s. has about 550 species and is recognized by the presence of a rosette of leaves - formed as the result of a combination of the short internodes with the spirally alternate phyllotaxis, terminal inflorescence, distichous glumes, hermaphroditic flowers, trifid style, and trigonous achene (Goetghebeur 1998). In Brazil, there are registered about 100 species, which are found in varied habitats and vegetation types (Alves et al. 2014).

In the South Region of Brazil, *Cyperus* was extensively studied: Araújo & Longhi-Wagner (1996) dealt with the flora of *Cyperus* subg. *Anosporum* in the state of Rio Grande do Sul; and Hefler & Longhi-Wagner (2012) on *Cyperus* subg. *Cyperus* to the South Region.

In the Northeast Region, the most complete treatment was made by Luceño et al. (1997), which contains identification keys and taxonomic comments to species of Cyperaceae occurring in the states of Paraíba and Pernambuco (*Cyperus* represented by 31 species). Besides that Alves & Martins (2009) included six species of *Cyperus* for local flora of Mirandiba (Pernambuco), as well as Costa (2013) with 22 species the state of Sergipe.

In the state of Rio Grande do Norte, Ribeiro et al. (2014) studied the flora of Cyperaceae related to the Apodi-Mossoró river, including 14 species of *Cyperus* with descriptions and identification key. The other works that include species of *Cyperus* occurring in the state are only lists (Almeida Júnior & Zickel 2009; Henry-Silva et al. 2010; Oliveira et al. 2013).

The present work aims to provide a taxonomic study of the species of *Cyperus* occurring in the state of Rio Grande do Norte, northeastern Brazil. It includes, besides comments on the geographical distribution of the species and delimitation of taxa, descriptions, illustrations, and a key for the identification of the species.

Material and Methods

The study was based on an intensive program of collection from July 2006 to May 2010 throughout the state of the Rio Grande do Norte: 21 field expeditions along Apodi–Mossoró river (supported by the project Petrobrás Ambiental/rio Apodi-Mossoró), one expedition to the middle West and Seridó regions, one to the Low Açu valley, one to the Agreste Potiguar, and three to the East Littoral region. In addition, it was analyzed the specimen collections deposited in the herbaria EAC, HUEFS, MOSS, UB, UFRN and UFP (abbreviations according to Thiers [continuously updated]). The descriptions of the character states followed Radford et al. (1974).

The vegetation was classified according to IDEMA (2007) (Figure 1), in which the following types are recognized: Forests (Evergreen, Semideciduous, Deciduous, Riparian with Carnauba, and Floodplain), Secondary Formations (= Capoeiras), Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridó), Cerrado, Campos (Floodplain, Human-Impacted, and Secondary), and other formations (Sandbanks, Mangroves, Rupicolous Formations, and Halophilous Formations in Saline Desert).

Results and Discussion

It was identified 24 species of *Cyperus* in the state of Rio Grande do Norte, including a new species (*Cyperus* sp. 1), here described, but that will be properly published elsewhere. This new species was found in vegetation of Caatinga and is morphologically similar to *C. alvesii* G.C. Tucker and *C. ligularis* L., but can be recognized by the spikelets, glumes and rachilla internodes.

In this study, it is included also six new occurrences for the state of Rio Grande do Norte, not cited by Alves et al. (2014) and Ribeiro et al. (2014). The occurrence of *Cyperus digitatus* in the Northeast Region had been previously reported only to the states of Bahia, Maranhão and Pernambuco (Hefler & Longhi-Wagner 2012; Alves et al. 2014), but analysis of specimens in the herbaria EAC and UFRN revealed that this species has a wider distribution, which includes the states of Rio Grande do Norte and Ceará.

Araújo & Longhi-Wagner (1996) treated *C. enterrianus* Boeckeler as a variety of *C. luzulae* (L.) Rothb. ex Retz. In the present study followed Alves et al. (2014), in which *C.
Cyperus in Rio Grande do Norte

Rodriguésia 66(2): 571-597. 2015

distributed species, there are humid forest formations. Among the widely found in environments from Caatinga to more of the Rio Grande do Norte State and were littoral. found in patches of Cerrado in eastern humid associated forest formations, 
*C. luzulae* was found in the Caatinga and 
*C. luzulae* was found in patches of Cerrado in eastern humid littoral.

Some species are widely distributed throughout the distinct vegetation formations of the Rio Grande do Norte State and were found in environments from Caatinga to more humid forest formations. Among the widely distributed species, there are *C. aggregatus* (Willd.) Endl., *C. compressus* L., *C. odoratus* L. and *C. surinamensis* Rothb. Despite the scant documentation in herbaria, *C. rotundus* L. is also widely distributed in Rio Grande do Norte, but always in association with human activities.

In the state, other species are restricted to Caatinga as *C. schomburgkianus* Nees, *C. uncinulatus* Schrad. ex Nees and the Cyperus sp. 1 species. Luceño et al. (1997) also reported *C. schomburgkianus* and *C. uncinulatus* to Caatinga in the states of Paraiba e Pernambuco. According to Costa (2013), *C. schomburgkianus* occurs in a similar habitat, but *C. uncinulatus* occurs also in the Atlantic Forest, in the state of Sergipe.

Some species were found associated with either Cerrado or forest formations in the humid eastern littoral (Atlantic Forest) as well as in the inland portions of Rio Grande do Norte (relicts of Semideciduous, and Deciduous Forests situated at higher altitudes). *Cyperus distans* L. f. was always found associated with forest-border environments and *C. haspan* L. with Cerrado areas in Canguaretama-RN as well as with forest-border environments, in both the humid littoral and inland reliefs of vegetation formations. *Cyperus laxus* Lam., although often occurring in ombrophilous environments under forest canopies, was also found in forest borders and Cerrado. Luceño et al. (1997) reported *C. laxus* to occur in ombrophilous environments associated with nitrified soils in the states of Paraiba and Pernambuco.

The species found exclusively occurring in Sandbanks, suggesting tolerance to coastal salinity, are *C. crassipes* Vahl, *C. hermaphroditus* (Jacq.) Standl., and *C. sphacelatus* Rothb. A similar distribution was observed in the states of Paraiba, Pernambuco and Sergipe (Luceño et al. 1997; Hefler & Longhi-Wagner 2012; Costa 2013). The geographical distribution of *C. crassipes* is even wider, including the semiariad coast of Rio Grande do Norte. According to Martins et al. (2008), *C. crassipes* (under the name *C. maritimus* Poir.) bears a combination of morpho-anatomical and physiological characters which provide resistance to xeric and saline environments. On the other hand, the geographical distribution of *C. hermaphroditus* and *C. sphacelatus* is restricted to the humid coastal areas. In the state of Rio Grande do Norte, there is an abrupt pluviometric transition delimiting two coastal strips: one semiariad adjacent to the Caatinga at the septentrional coast and the other humid adjacent to the Atlantic Forest at the eastern coast (IDEMA 2007) (Figure 1). This climatic pattern may explain the geographical distribution of *C. hermaphroditus* and *C. sphacelatus*, as well as *Remirea maritima* Aubl., suggesting a higher water requirement for these species.

Some species of *Cyperus* listed by CRIA (2014) need to be confirmed in the Rio Grande do Norte State. The specimen R.A. Pontes 779 (JPB) identified as *C. atlanticus* Hemsl. was not found at the cited herbarium as well as *D.S.D. Araújo* 7626 (NY) as *C. laevigatus* L., and *Andrade-Lima* 68-5387 & 68-5389 (IPA) as *C. planifolius* Rich.

Taxonomic Treatment

*Cyperus* L., Sp. Pl.: 44. 1753.

Herbs cespitose or rhizomatous. Rhizome absent or present. Culm simple, trigonous or cylindrical, glabrous, rarely scabrous. Leaves alternate, spirally arranged in a basal rosette. Leaf blade absent or present. Ligule absent, rarely present. Contraligule absent. Involute bracts present. Inflorescence terminal, simple or compound, in 1–5 orders, as anthelodia, glomerules, spikes, subdigitate spikes, digitate clusters or fascicles. Bract of the spikelet present. Prophyll of the spikelet present. Spikelets 3–many per inflorescence, persistent or deciduous, basally subtended by an abaxial bract and an adaxial prophyll. Rachilla articulate or not, wings absent or present. Glumes 2–many, distichous, persistent or deciduous, 1–2-carinate, glabrous; carina rarely scabrous. Flowers hermaphroditic. Style trifid; stigmata 3. Stamina 1–3; anthers yellowish, with connective prolonged or not. Achene trigonous. Stylodium absent.
Dichotomous key for the identification of the species of *Cyperus* L. occurring in Rio Grande do Norte

1. Culm cylindrical........................................................................................................................................2

2. Transverse septa present in the culm; inflorescence with anthelodia in the 1st order; glumes 2.5–3.8 × 1–1.6 mm ........................................................................................................................................3. *Cyperus articulatus*

2’. Transverse septa absent in the culm; inflorescence with either glomerule or spike in the 1st order; glumes 6.7–8.6 × 3.5–4.2 mm........................................................................................................................................5. *Cyperus crassipes*

1’. Culm trigonous........................................................................................................................................3

3. Culm retrorsely scabrous ......................................................................................................................22. *Cyperus surinamensis*

3’. Culm smooth or papillose, rarely antrorsely scabrous................................................................4

4. Leaf blade chartaceous, glaucous........................................................................................................5

5. Spikelets 3.5–8 mm long; rachilla internodes 0.4–0.8 mm long; glumes 2.2–2.6 mm long, 5–8 per spikelet.................................................................................................................................15. *Cyperus ligularis*

5’. Spikelets 6–14 mm long; rachilla internodes 0.9–1.2 mm long; glumes 2.7–3 mm long, (5)7–11 per spikelet........................................................................................................................................24. *Cyperus* sp. 1

4’. Leaf blade membranaceous, green....................................................................................................6

6. Rachilla articulate at the base and all nodes, spikelet splitting into diaspores composed of 1 glume, 1 achene and 1 rachilla internode; rachilla wings spongy and rigid, becoming marginally membranaceous.................................................................................................17. *Cyperus odoratus*

6’. Rachilla non-articulate or articulate only at the base; spikelet persistent or falling as a 2–many-glumed unity; rachilla wings absent or completely membranaceous...................................................7

7. Glumes brown with a vinaceous area near each margin, forming a longitudinal line along the center of each lateral side of the spikelet........20. *Cyperus sphacelatus*

7’. Glumes homogeneously colored, not forming a vinaceous longitudinal line along the lateral sides of the spikelet...............................................................................................................................8

8. Glumes mucronate or aristate; mucron/arista longer than or equal to 0.3 mm long.................................9

9. Glumes wider than or equal to 1.6 mm wide; achene wider than or equal to 0.8 mm wide........................................................................................................................................10

10. Glumes 2.3–2.9 mm long; connective prolongation glabrous or absent at the anther apex; achene 1.1–1.2 mm long........................................................................................................................................4. *Cyperus compressus*

10’. Glumes 1.2–1.5 mm long; connective prolongation with antrose bristles; achene 1.3–1.6 mm long.......................................................14. *Cyperus laxus*

9’. Glumes narrower than or equal to 1 mm wide; achene narrower than or equal to 0.4 mm wide........................................................................................................................................11

11. Rachilla articulate at the base, spikelets falling as a unity; glumes persistent, mediately 7–9-nervate..........21. *Cyperus squarrosus*

11’. Rachilla non-articulate, spikelets persistent; glumes deciduous, mediately 3(5)-nervate.................................................................12

12. Herb 3.5–6.5 cm tall; rachilla internodes 0.3–0.5 mm long; androecium 3-staminate; anther 0.15–0.20 mm long............................6. *Cyperus cuspidatus*

12’. Herb 6.5–29 cm tall; rachilla internodes 0.2–0.3 mm long; androecium 1-staminate; anther 0.4–0.6 mm long.............................................23. *Cyperus uncinulatus*

8’. Glumes muticous or mucronate; mucron shorter than or equal to 0.2 mm long..................................................................................13

13. Rachilla articulate at the base, spikelets falling as a unity.................................................................14

14. Glumes 2–3.2 mm long; anther 0.4–0.7 mm long; achene 1.5–2 mm long.................................................................1. *Cyperus aggregatus*

14’. Glumes 3.9–4.9 mm long; anther 0.7–1.3 mm long; achene 2.3–3 mm long.................................................................12. *Cyperus hermaphroditus*

13’. Rachilla non-articulate; spikelets persistent.................................................................15
15. Glumes medially bicarinate .......................................................... 16
16. Spikelets in serial fascicles at the ultimate order of the inflorescence; rachis 0.3–0.5 mm long; achene 0.6–0.8 mm long ................................................................................................. 22. *Cyperus surinamensis*

16'. Spikelets in glomerules or in spikes at the ultimate order of the inflorescence; rachis longer than 1 mm; achene 0.8–1 mm long ................................................................................................................ 17
17. Spikelets in spherical to hemispherical glomerules at the ultimate order of the inflorescence; rachis shorter than 3 mm; glumes green, becoming brown when dehydrating; anther 0.6–0.9 mm long .................................................................................. 9. *Cyperus entrieanus*

17'. Spikelets in spikes at the ultimate order of the inflorescence; rachis longer than 3.5 mm; glumes white becoming brown when dried; anther 0.4–0.5 mm long .................................................................................................................................................. 16. *Cyperus luzulae*

15'. Glumes unicarinate ............................................................................................................................. 18
18. Inflorescence glomerule (spherical to hemispherical) forming a single order; glumes with margins and carina white, becoming to brown when dried ................................... 19. *Cyperus schomburgkianus*

18'. Inflorescence with 2 or more orders, but with anthelodia in the first order; glumes maroon, vinaceous, ferruginous, yellowish or brown at the margins and green to brown at the carina ................................... 19
19. Glumes persistent on the rachilla; anther 1.1–1.8 mm long ................................................................................................................ 20
20. Rachilla internodes 0.6–0.8 mm long; glumes brown to ochraceous .......................................................... 10. *Cyperus esculentus*

20'. Rachilla internodes 0.9–1.4 mm long; glumes vinaceous ........ 18. *Cyperus rotundus*

19'. Glumes deciduous; anther 0.3–0.6(0.7) mm long ................................................................................................. 21
21. Spikelets in digitate group or rarely subdigitate spike at the ultimate order of the inflorescence, rachis 0.2–1.0 mm long; achene 0.4–0.7 mm long ................................................................................................................ 22
22. Culm 0.4–0.7(1.5) mm wide; bracts of 1st order 3–9; androecium 1-staminate................... 2. *Cyperus amabilis*

22'. Culm 1.2–6 mm wide; bracts of 1st order 2–3; androecium 3-staminate .................. 11. *Cyperus haspan*

21'. Spikelets in spike at the ultimate order of the inflorescence, rachis 1.2–55 mm long; achene 0.9–1.5 mm long ................................................................................................................ 23
23. Glumes 2.4–2.8 mm long; rachilla wings 0.3–0.4 mm wide; achene 0.6–0.7 mm wide ................................................................................................................................. 20. *Cyperus sphacelatus*

23'. Glumes 1.2–2.2 mm long; rachilla wings absent or up to 0.3 mm wide; achene 0.4–0.6 mm wide ................................................................................................................................. 24
24. Rachilla internodes 0.8–1.1 mm; glumes maroon-vinaceous to brown; achene 1.4–1.5 mm long ................................................................................................................................. 8. *Cyperus distans*

24'. Rachilla internodes 0.3–0.7 mm; glumes yellow to yellowish-brown; achene 0.9–1.2 mm long ................................................................................................................................. 25
25. Rachilla wings yellow, 0.2–0.3 mm wide; glumes 0.6–1 mm wide, medially 7–9-nervate, without a hyaline marginal stripe at the apex ...................................................................................... 7. *Cyperus digitatus*

25'. Rachilla wings absent or hyaline to vinaceous up to 0.1 mm wide; glumes 1.4–1.8 mm wide, medially 3–5-nervate, with a hyaline marginal stripe at the apex ................................................................................................. 13. *Cyperus iria*

---

Herb cespitose, 15.5–65 cm tall. Culm 135–620 × 1–3.2 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade membranaceous, green. Bracts of 1st order 4–10, 20–290 × 0.8–7 mm. Inflorescence 1.8–2.6 × 2.2–6.2 cm, in 2 orders: hemispherical glomerule in the 1st order, spike in the ultimate order. Rachis 4–20 mm long, apparent or hidden by spikelets. Spikelets 2.1–4.6 × 0.9–1.5 mm, 0.6–1.1 mm thick. Rachilla articulate at the base, spikelet falling as a unity, internodes 1.1–1.6 mm long. Rachilla wings present, 0.6–1.3 mm wide,
membranaceous, hyaline or greenish-hyaline, sometimes with vinaceous areas. Glumes 2–3, 2–3.2 × 1.6–2.5 mm, persistent, uncinicinate, medially 9–13-nervate (including carina), brown, greenish-brown to yellowish-brown, sometimes with vinaceous-maculated margins, green at the carina, glabrous, muticous to rarely mucronate; mucron straight, up to 0.2 mm long. Stamina 3; anther 0.4–0.7 × 0.15–0.2 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, hyaline, reddish to vinaceous, glabrous. Achene 1.5–2 × 0.6–1 mm, 0.6–1 mm thick, obovoid, sometimes ellipsoid or oblong, rarely ovoid, mucron 0.1 mm long.


Geographical distribution and phenology: Widely distributed: Atlantic Forest (Evergreen), Inland Forests in higher altitudes (Semicludicous and Deciduous), Riparian Forest with Carnauba, Caatingas (Hypoxerophilous and Hyperxerophilous), Sandbanks, and Saline Desert. Flowers and fruits: February, April-July.

Comments: recognized by the spherical to hemispherical glomerule of spikes of spikelets, densiflorous spikes, and spikelets greenish to yellowish with 2–3 glumes.
Figure 2 – a. Cyperus aggregatus – spikelet. b-d. C. enterrianus – b. habit; c. glomerule; d. spikelet. e-g. C. hermaphroditus – e. habit; f. spike; g. spikelet. h. C. luzulae – spike. i-j. C. odoratus – i. spikelet; j. diaspore: glume above, rachilla segment involving achene below. k. C. surinamensis – serial fascicle (a A.R.O. Ribeiro et al. 175; b-d A.R.O. Ribeiro et al. 151; e-g M. Araújo Junior s.n. (MOSS 5569); h A.R.O. Ribeiro et al. 49; i-j A.R.O. Ribeiro 82; k A.R.O. Ribeiro 157).

Herb cespitose 11.5–22(30) cm tall. Culm 55–185 × 0.4–0.7(1.5) mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 3–9, 5–43 × 0.5–2 mm. Inflorescence 3.8–8.5(12) × 2.6–12(23) cm, in 2–3 orders; antelodium in the 1st order; antelodium or digitate group, rarely spike subdigitate in the 2nd order; digitate group or rarely subdigitate spike in the ultimate order. Rachis 0.2–0.8 mm long, apparent. Spikelets 6–9(19) × 1.1–1.4(3) mm, 0.3 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.3–0.5 mm long. Rachilla wings absent or present, up to 0.1 mm wide, membranaceous, hyaline. Glumes 9–22(34), 1.2–1.6 × 0.8–1 mm, deciduous, unicarinate, medially 3-nervate (including carina), maroon-vinaceous to maroon-ferruginous at the margins, green at the carina, glabrous, mucronate; mucron 0.1–0.2 mm, straight to slightly recurvate at the anther apex, up to 0.1 mm long, reddish to vinaceous, glabrous. Achene 0.5–0.7 × 0.3–0.4 mm, 0.3–0.4 mm thick, obovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** restricted to Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridó), Sandbanks, and Saline Desert. Flowers and fruits: April-August.

**Comments:** At first sight, *C. amabilis* may be confused with *C. haspan*, since its spikelets are reddish to maroon and have a short, straight to slightly recurvate arista. However, *C. amabilis* has 3–9 1st order bracts, the androecium is 1-staminate and the achene is maroon to maroon-ferruginous to brown, whereas in *C. haspan* there are 2–3 1st order bracts, the androecium is 3-staminate, and the achene color varies from white to beige.


Herbs rhizomatous 63–181.5 cm tall. Culm 570–1750 × 2.8–10 mm, cylindrical, transverse septa present, glabrous, smooth. Leaf blade absent, rarely present, membranaceous, green. Bracts of 1st order 3–6, 4–23 × 0.4–6 mm. Inflorescence 2.5–15 × 2–10 cm, in 2–3 orders: antelodium in the 1st order; antelodium or spike in the 2nd order; spike in the ultimate order. Rachis 2–3 mm long, apparent. Spikelets (5)9–40 × 1.1–1.4 mm, 0.4–0.7 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.7–1.2 mm long. Rachilla wings present, 0.2–0.5 mm wide, membranaceous, hyaline, sometimes vinaceous-maculate. Glumes (5)12–33, 2.5–3.8 × 1–1.6 mm, deciduous, unicarinate, medially 5–11-nervate (including carina), brown, yellowish-brown or brown-vinaceous at the margins, green at the carina, glabrous, muticous, rarely mucronate, mucron up to 0.1 mm long, straight. Stamina 3; anther 1.2–2 × 0.15–0.3 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish to vinaceous, glabrous. Achene 1.1–1.4 × 0.4–0.7 mm, 0.4–0.5 mm thick, oblong-obovoid to oblaneceoloid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** widely distributed: border of the Atlantic Forest (Evergreen), Riparian Forest with Carnauba, Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridó), Sandbanks, and Saline Desert. Flowers and fruits along the year.
**Comments**: recognized by the culm cylindrical and segmented by transverse septa, which become visible after being dried. In *R.C. Oliveira et al. 1840*, the leaf blade is present, a variation quite unusual in *C. articulatus* among studied specimens. This blade-bearing form is typical of the *Cyperus articulatus var. nodosus* (Humb. & Bonpl. ex Willd.) Kük., according Adams (1994) and Kükenthal (1936).

Sometimes the 1st order rays are very short, as in *R.C. Oliveira et al. 1840* (EAC, MOSS), giving a compact aspect to the inflorescence. Among all specimens analyzed, presence of tuber (25 × 18 mm) was seen only in *A.A. Roque 382*. The tubers and rhizomes produce an essence, commercially known as *primi-pioca* or *piri-piri*, which is used in the perfume industry. In the municipality of Mossoró-RN, the culms with inflorescence are of importance for composing floral arrangements.


*Fig. 4c*

Herb cespitose 14–47 cm tall. Culm 40–370 × 0.6–2 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 3–7, 10–230 × 0.2–3 mm. Inflorescence 0.8–8.5(11) × 0.6–10.5(16) cm, in 1–2 orders: antelodium, digitate group or subdigitate spike in the 1st order; digitate group or subdigitate spike in the ultimate order. Rachis 1.8–3.5 mm long, apparent. Spikelets 7–19 × 2–3.1 mm, 0.8–1 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.6–1 mm long. Rachilla wings absent or present, up to 0.2 mm wide, membranaceous, hyaline to ferruginous. Glumes 9–28, 2.3–2.9 × 1.6–2 mm, deciduous, unicarinate, medially 9–17-nervate (including carina), yellowish-glaucous or brown at the margins, green to brown at the carina, glabrous, mucronate or aristate; mucron/arista 0.4–0.9 mm long, straight, sometimes slightly recurvate (angle up to 20°). Stamina 3; anther 0.4–0.7 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, hyaline, reddish to vinaceous, glabrous. Achene 1.1–1.2 × 0.9–1 mm, 0.8–0.9 mm thick, largely obovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology**: Widely distributed: Atlantic Forest (Evergreen), Inland Forests in higher altitudes (Semideciduous and Deciduous), Riparian Forest with Carnauba, Caatingas (Hypoxerophilous and Hyperxerophilous), Sandbanks, and Saline Desert. Flowers and fruits: January-June, August, and November.

**Comments**: recognized by the green spikelets arranged in either digitate groups or subdigitate spikes, with glumes 2.3–2.9 × 1.6–2 mm, mucronate or aristate, the mucron/arista straight, rarely recurvate up to a 20° angle.


*Fig. 4d-f*

Herb cespitose 7.5–59 cm tall. Culm 60–540 × 1.2–4.8 mm, cylindrical, transverse septa absent, glabrous, smooth. Leaf blade present, chartaceous, glaucous. Bracts of 1st order 3–8, 10–230 × 1–8 mm. Inflorescence 1.8–6.5 × 2.9–6.5 cm, in 1–2 orders: glomerule spherical to hemispherical or spike in the 1st order; spike in the ultimate order. Rachis 3–7 mm long, hidden by spikelets or rarely apparent. Spikelets 8–28 × 2.5–6 mm, 2–2.5 mm thick. Rachilla articulate at the base, spikelet falling after abscission of the basal glumes, internodes 0.6–1.2 mm long. Rachilla wings absent or rarely present, 0.1 mm wide, membranaceous, hyaline to brown. Glumes 6–30, 6–7.8 × 3.5–4.2 mm, deciduous, unicarinate, medially 11–19-nervate (including carina), brown, becoming gradually hyaline toward the margins, brown at the carina, glabrous, mucronate or aristate; mucron/arista 0.1–0.4 mm long, straight. Stamina 3; anther 1.2–1.8 × 0.15–0.2 mm; connective prolongation absent or present at the anther apex, 0.1–0.2 mm long, reddish to vinaceous, glabrous. Achene 2.1–2.5 × 0.9–1.2 mm, 0.4–0.5 mm thick, obovoid to oblong-obovoid, with a mucron 0.1–0.2 mm long.

Geographical distribution and phenology: restricted to the Sandbanks including the humid eastern and semiarid northern coasts. Flowers and fruits: February-December.

Comments: recognized by the culm cylindrical; spikelets disposed in a dense spherical to hemispherical glomerule or globose spike at the apex of the culm, and glumes 6–7.8 × 3.5–4.2 mm. Bracts of the first order 10–14, 45–350 × 2.3–12 mm. Inflorescence 28 × 26 mm, deciduous, unicarinate, medially 3–nervate. Its differentiation from C. maritimus combines a set of morpho-anatomical and physiological characteristics that confers resistance to both xeric and saline environments.

6. Cyperus cuspidatus Kunth, F. W. H. von Humboldt, A. J. A. Bonpland & C. S. Kunth, Nov. Gen. Sp. 1: 204. 1817. Fig. 3b

Herb cespitose 3.5–6.5 cm tall. Culm 15–35 × 0.3–0.5 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of the 1st order 3, 4–27 × 0.4–1.2 mm. Inflorescence 0.8–1.9 × 1.2–1.9 cm, in a single order: glomerule spherical to hemispherical or spike. Rachis 0.2–1.5(2) mm long, apparent. Spikelets 4.9–9 × 1.1–1.5 mm, 0.3–0.4 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.3–0.5 mm long. Rachilla wings absent or present, 0.1–0.2 mm wide, membranaceous, hyaline to yellow. Glumes 9–25. 1–1.4 × 0.7–1 mm, deciduous, unincarinate, medially 3–nervate (including carina), vinaceous to brown at the margins, green to yellowish at the carina, glabrous, aristate; arista 0.5–1.2 mm long, recurvate 60–90º. Stamina 3; anther 0.15–0.2 × 0.1 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, hyaline, reddish to vinaceous, glabrous. Achene 0.5–0.6 × 0.3 mm, 0.3 mm thick, obovoid, with a mucron 0.1 mm long.


Geographical distribution and phenology: Until now it has been found only in the Inland Forests (Deciduous) in higher altitudes on Serra de Luís Gomes, source of the Apodi-Mossoró river. Flowers and fruits: May.

Comments: As reported by Tucker (1994) and Kukenthall (1936), in C. cuspidatus the number of stamina is variable and the androecium may have 1, 2 or 3 stamina. In the Rio Grande do Norte collections, all C. cuspidatus available specimens possessed 3 stamina.

This species may be confused with C. squarrosus or C. uncinulatus, since it presents recurvate mucron/arista. In C. squarrosus the rachilla is articulate at the base, the spikelet falls as a unity, and the glumes are persistent and medially 7–9-nervate. Its differentiation from C. uncinulatus is more complex, since both have the rachilla is non-articulate, the spikelet is persistent, and the glumes are deciduous and medially 3(5)-nervate. However, in C. cuspidatus plant height reaches 3.5–6.5 cm, the rachilla internode is 0.3–0.5 mm long, the androecium 3-staminate and the anther 0.15–0.2 mm long, while in C. uncinulatus plant height reaches 6.5–29 cm, the rachilla internode is 0.2–0.3 mm long, the androecium 1-staminate and the anther 0.4–0.6 mm long.

7. Cyperus digitatus Roxb., Fl. Ind. 1: 209. 1820. Fig. 5a-c

Herb cespitose 52–70 cm tall. Culm 340–580 × 5–6 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 10–14, 45–350 × 2.3–12 mm. Inflorescence 28 × 26
cm, in 3 orders: antelodium in the 1st and 2nd orders; spike in the ultimate order. Rachis 23–55 mm long, apparent. Spikelets 10–19 × 1.2–1.5 mm, 0.5–0.6 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.3–0.6 mm long, Rachilla wings present, 0.2–0.3 mm wide, membranaceous, yellow. Glumes 20–43, 1.4–2 × 0.6–1 mm, deciduous, uncinate, medially 7–9-nerved (including carina), yellowish-brown, longitudinally vinaceous-maculate at the margins, yellowish-brown at the carina, glabrous, muticous, rarely mucronate; mucron up to 0.2 mm long, straight. Stamina 3, anther 0.4–0.6 × 0.15–0.2 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish, glabrous. Achene 0.9–1 × 0.4–0.5 mm, 0.3 mm thick, ovoid or sometimes oblong-ovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** Widely distributed: Atlantic Forest (Evergreen), Inland Forests in higher altitudes (Semideciduous), Caatingas (Hyperxerophilous and Seridó) and Sandbanks. Flowers and fruits: January-February, May, and December.

**Comments:** can be confused with *Cyperus giganteus* Vahl, which was not found in Rio Grande do Norte. According to Tucker (1983; 1994), *C. giganteus* is 200–350 cm tall, the leaf is bladeless, the anther 0.7–1 mm long, and the connective prolongation present at the anther apex and 0.2–0.5 mm long; in *C. digitatus* plants are 50–150 cm tall, the leaf blade present, the anther 0.4–0.5 mm long, and the connective prolongation absent or present at the anther apex and up to 0.1 mm long. The occurrence of *C. giganteus* can be eventually confirmed, since its natural habitat also occurs in the state, in addition to the registers of the species in the nearby state of Pernambuco.


Fig. 5d

Herb cespitose 52–99 cm tall. Culm 440–860 × 3.5–5 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 7–11, 20–460 × 1.2–12 mm. Inflorescence 8–36 × 12–26 cm, in 3–4 orders: antelodium in the 1st and 2nd order; antelodium or spike in the 3rd order; spike in the ultimate order. Rachis 8–36 mm long, apparent. Spikelets 11–20 × 1.4–1.6 mm, 0.5–0.6 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.8–1.1 mm long. Rachilla wings present, 0.2 mm wide, membranaceous, hyaline. Glumes 10–21, 1.8–2.2 × 0.9–1.1 mm, deciduous, uncinate, medially 3–7-nerved (including carina), maroon-vinaceous to brown at the margins, often with a marginal hyaline stripe at the apex, green at the carina, glabrous, muticous, rarely mucronate; mucron up to 0.1 mm long, straight. Stamina 3, anther 0.3 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish, glabrous. Achene 1.4–1.5 × 0.4–0.5 mm, 0.3–0.4 mm thick, lanceoloid to oblanceoloid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** restricted to border of the Atlantic Forest (Evergreen) or Inland Forests in higher altitudes (Semideciduous and Deciduous), and to Sandbank vegetation in the humid eastern coast. Flowers and fruits: April-June.

**Comments:** recognized by the spikelets arranged in spikes, long rachis (8–36 mm), rachilla internodes 0.8–1.1 mm long, and glumes 1.8–2.2 × 0.9–1.1 mm, maroon-vinaceous to brown at the margins, often with a marginal hyaline stripe at the apex, green at the carina, and muticous to rarely mucronate.


**Fig. 2 b-d**

Herb cespitose 30–79 cm tall. Culm 70–670 × 1.5–3.5 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present,
membranaceous, green. Bracts of 1st order 6–8, 19–340 × 1–5 mm. Inflorescence 3.5–7.5 × 4.6–6.5 cm, in 2–3 orders: antelodium in the 1st order; antelodium, glomerule spherical to hemispherical or spike in the 2nd order; glomerule spherical to hemispherical or spike in the ultimate order. Rachis 1–3 mm long, hidden by spikelets. Spikelets 3–5 × 1.6–2 mm, 0.3–0.4 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.2–0.3 mm long. Rachilla wings absent or present, 0.1 mm wide, membranaceous, hyaline to vinaceous. Glumes 8–16, 1.2–1.5 × 1–1.2 mm, deciduous, bicusinate, medially 2–3-nervate (including carinas), green (becoming brown, yellowish-brown to ochraceous at the margins, green (sometimes to brownish) and rachis 0.3–0.5 mm long (vs. 0.6–0.8 mm long in C. surinamenis). In C. luzulae the glumes are greenish, becoming brown when dehydrating; the anthers are 0.6–0.9 mm long. In C. luzulae the spikelets, which have long rachises (3.5–12 mm long), are arranged in spikes; the glumes are white, becoming brown during the process of preparing herbarium specimens; the anthers are 0.6–0.9 mm long.


Geographical distribution and phenology: Widely distributed: Inland Forests (Semideciduous and Deciduous), Riparian Forest with Carnauba, and Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridó) to Saline Desert. Flowers and fruits: April–June, August, October, and December.

Comments: There is divergence with regard to the classification of this species. Denton (1978) and Araújo & Longhi-Wagner (1996) treated it as a variety of C. luzulae. The present work follows Kükenthal (1936), Tucker (1994), Luceño et al. (1997) and Guarise & Vegiotti (2007), in which it was raised to the species level. Similarly, as reported by Tucker (1994), it was found allopatric distinction between C. entrerianus and C. luzulae, besides significant morphological differences between them. In Rio Grande do Norte, C. entrerianus is distributed from less humid to dry areas, both in the Caatinga and in relics of forest formations present at higher altitudes. The occurrence of C. luzulae was registered only at the humid eastern coast, in an area of Cerrado, in the municipality of Canguaretama.

In C. entrerianus the spikelets are disposed in spherical to hemispherical glomerules or globose spikes with short rachis (1–3 mm long); the glumes are greenish, becoming brown when dehydrating; the anthers are 0.6–0.9 mm long. In C. luzulae the spikelets, which have long rachises (3.5–12 mm long), are arranged in spikes; the glumes are white, becoming brown during the process of preparing herbarium specimens; the anthers are 0.4–0.5 mm long.

It is possible that C. entrerianus be confused also with C. surinamenis. In C. entrerianus the culms are glabrous (vs. retrorsely scabrous to rarely glabrous in C. surinamenis) and the anphere is 0.9–1 mm long (vs. 0.6–0.8 mm long in C. surinamenis). Additionally, C. surinamenis has spikelets arranged in serial fascicles (not in glomerules or globose spikes as in C. entrerianus) and rachis 0.3–0.5 mm long (shorter than in C. entrerianus).


Fig. 4g

Herb cespitose 37–60 cm tall. Culm 320–540 × 1–1.9 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 5, 10–140 × 1.6–3.6 mm. Inflorescence 5–8 × 3–4 cm, in 2 orders: antelodium in the 1st order; spike subdigitate, rarely digitate group in the ultimate order. Rachis 0.5–10 mm long, apparent. Spikelets 6.3–22 × 1.8–2.8 mm, 0.4–0.5 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.6–0.8 mm long. Rachilla wings present, 0.2 mm wide, membranaceous, ferruginous. Glumes 7–30, 2.8–3.4 × 1.4–1.6 mm, persistent, unicarinate, medially 7–11-nervate (including carina), brown to ochraceous at the margins, green (sometimes
brown) at the carina, glabrous, muticous or mucronate; mucron up to 0.3 mm long, straight. Stamina 3, anther 1.1–1.8 × 0.15–0.2 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish, glabrous. Achene (1.1)1.3–1.5(1.6) × 0.3–0.6(0.8) mm, 0.3–0.6(0.8) mm thick, obovoid, sometimes ellipsoidal or ovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** Always associated with the impact of human activities in areas of Riparian Forest with Carnauba and Caatinga Hyperxerophilous. Flowers and fruits: May.

**Comments:** Since no achenes were available in the analyzed material, the description of this character was based on Tucker (1994).

Can be mistaken for *C. rotundus* because of its persistent glumes and spikelets. Nevertheless, in *C. esculentus* the glumes are brown to ochraceous at the margins and rachilla internodes 0.6-0.8 mm long, whereas in *C. rotundus* the glumes are vinaceous to rarely brown-vinaceous at the margins and rachilla internodes 0.9-1.4 mm long.

According to Hefler & Longhi-Wagner (2012), *C. esculentus* and *C. rotundus* can also be distinguished by leaves and arrangement of tubers. In *C. esculentus* the stolon-like rhizomes have distal tubers and the adaxial ligule is absent on the leaves. Already in *Crotundus* the stolon-like rhizomes have intercalary tubers and the adaxial ligule formed by a reduced membrane is present on the leaves.

*Cyperus esculentus* is commonly known as yellow nutsedge (*tiririca-amarela* or *junca* in Brazil) and referred as a weed of recent agricultural importance, but less aggressive than *C. rotundus*. The impact of *C. esculentus* as a weed has been reported in connection with 21 crop species in about 40 countries (Bendixen & Nandihalli 1987). However, in spite of its undesirable effects as a crop invader, its tubers, which are edible and resemble nuts, are marketed under the name of *chufa*.

11. *Cyperus haspan* L., Sp. Pl.: 45. 1753. Fig. 3c

Herb cespitose 19–60 cm tall. Culm 100–520 × 1.2–6 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade absent or present, membranaceous, green. Bracts of 1st order 2–3, 14–92 × 1.8–6 mm. Inflorescence 3–7.5 × 3.5–11.5 cm, in 2–4 orders: antelodium in the 1st order; antelodium, digitate group or subdigitate spike in the 2nd and 3rd orders; subdigitate spike or digitate group in the ultimate order. Rachis 0.5–1 mm long, apparent. Spikelets 5–12 × 1–1.5 mm, 0.4–0.6 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.4–0.6 mm long. Rachilla wings absent or present, 0.1–0.2 mm wide, membranaceous, hyaline to vinaceous. Glumes 12–23, 1.2–1.4 × 0.7–1 mm, deciduous, uncarinate, medially 1–3-nervate (including carina), yellowish to vinaceous at the margins, brown to yellowish at the carina, glabrous, mucronate, rarely muticous; mucron up to 0.2 mm long, straight. Stamina 3; anther 0.4–0.6 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, white to ferruginous, glabrous to antrorsely scabrous. Achene 0.4–0.6 × 0.3–0.4 mm, 0.3–0.4 mm thick, spheroidal, ovoid to very largely ovoid or obovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** registered in the humid eastern coast (Atlantic Forest Evergreen, Cerrado, and Sandbanks) and Inland Forests in higher altitudes (Semideciduous and Deciduous). Flowers and fruits: April-May, August, and November.

**Comments:** can be confused with *C. amabilis* (v. comments under this species). It was observed large variation in character states of leaves, inflorescences, and achenes in the collections of *C. haspan* from Rio Grande do Norte: leaf blades may be absent or present; inflorescences vary from lax and branched to contracted and few-branched; achene shape varies from spheroidal or obovoid to ovoid. Tucker (1994) and Luceño et al. (1997) also found large variation in such characters in this species. On the other hand, Araújo & Longhi-Wagner (1996) reported uniformity in this species with regard to the vegetative part, but found that its inflorescence varies largely in the plants from Rio Grande do Sul, which led these authors to accept two varieties in their taxonomic treatment.
12. *Cyperus hermaphroditus* (Jacq.) Standl., Contr. U. S. Natl. Herb. 18: 88. 1916. Fig. 2e–g

Herb cespitose 23–67 cm tall. Culm 200–605 × 1–4 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 3–6, 10–170 × 0.9–4.5 mm. Inflorescence 0.9–12.5 × 1.1–12.5 cm, in 1–2 orders: antelodium or spike in the 1st order; spike in the ultimate order. Rachis 6–15 mm long, apparent. Spikelet 3.3–13 × 0.8–2.1 mm, 0.8–1.1 mm thick. Rachilla articulate at the base, spikelet falling as a unity, internodes 1.5–2 mm long. Rachilla wings present, 0.5–0.8 mm wide, membranaceous, brown to hyaline, with ferruginous, vinaceous or maroon areas. Glumes 2.2–13 × 0.4–5.5 mm, 0.4–0.5 mm thick, obovoid to oblanceoloid, with a mucron up to 0.2 mm long, straight. Stamina 2; anther 0.3–0.4(0.7) × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish to vinaceous, glabrous. Achenes 2.3–3 × 0.6–0.8 mm, 0.6–0.7 mm thick, lanceoloid to oblanceoloid or narrowly oblong, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** restricted to the Sandbanks at the humid eastern coast. Flowers and fruits: May-August, November.

**Comments:** recognized by the spikelets lanceoloid to subulate, maroon to ferruginous, disposed in spikes with long rachis (6–15 mm long). The achenes (2.3–3 mm long) were longer than reported by Tucker (1994), Adams (1994) and Hefer & Longhi-Wagner (2012).

Large variations in the dimensions of some characters were found in the specimen *M. Luceño* 224: in the same plant, it was found spikelets 7–13 mm long and achenes 2.3–2.8 mm long.

13. *Cyperus iria* L., Sp. Pl.: 45. 1753. Fig. 5e

Herb cespitose 36.5–82 cm tall. Culm 300–680 × 1.9–3.6 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 4–7, 9–130 × 0.4–5.5 mm. Inflorescence 6.5–13 × 6–15 cm; in 3–4 orders: antelodium in the 1st order; antelodium or spike in the 2nd and 3rd orders; spike in the ultimate order. Rachis 1.2–33 mm long, apparent. Spikelets 4.5–9.5 × 1.5–2 mm, 0.5–0.7 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.5–0.7 mm long. Rachilla wings absent or present, 0.1 mm wide, membranaceous, hyaline to a vinaceous. Glumes 6–17, 1.2–1.6 × 1.4–1.8 mm, deciduous, unicarinate, medially 3–5-nervate (including carina), yellow to yellowish-brown at the margins, with a marginal hyaline stripe at the apex, green at the carina, glabrous, mucronate, rarely muticous; mucron up to 0.2 mm long, straight. Stamina 2; anther 0.3–0.4(0.7) × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, hyaline, ferruginous, reddish to vinaceous, glabrous. Achenes 1.1–1.2 × 0.4–0.6 mm, 0.4–0.5 mm thick, obovoid to oblancoeloid, sometimes ellipsoidal or ovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** registered in the Atlantic Forest (Evergreen), Inland Forests in higher altitudes (Semideciduous and Deciduous), Riparian Forest with Carnauba, Caatinga Hyperxerophilous, and Sandbanks (only at the humid eastern coast). Flowers and fruits: January-May.
**Comments:** recognized by the spikelets (4.5–9.5 × 1.5–2 mm) arranged in spikes and the glumes (1.2–1.6 × 1.4–1.8 mm) largely obovate, yellow to yellowish-brown at margins, with a marginal hyaline stripe at the apex, green at the carina.

Herb cespitose 22–76 cm tall. Culm 170–630 × 0.9–2.5 mm, trigonous, transverse septa absent, glabrous, smooth, rarely antrorsely scabrous at the apex. Leaf blade present, membranaceous, green. Bracts of 1st order 6–9, 16–210 × 0.8–6 mm. Inflorescence 4–15 × 6–24 cm, in 2–3 orders: antelodium in the 1st order; antelodium, digitate group or subdigitate spike in the 2nd order; digitate group or subdigitate spike in the ultimate order. Rachis 0.4–1.5 mm long, apparent. Spikelets 5–11 × 1.8–2.3 mm, 0.9–1.1 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.6–0.8 mm long. Rachilla wings absent or present, 0.1–0.2 mm wide, membranaceous, hyaline to vinaceous. Glumes 6–16, 1.2–1.5 × 1.6–2.2 mm, deciduous, uncarinate, medi ally 9–15-nervate (including carina), brown to yellowish-brown, sometimes with ferruginous areas at the margins), green to brown at the apex, with a mucron 0.3–0.7 mm long, straight or recurvate up to a 45º angle; connective prolongation with antrorse bristles; achene 1.3–1.6 mm long.

**Material examined:** Canguaretama, Barra do Cunhaú, ca. 3 km, 6º19’43” S, 35º03’44” W, 3.XI.2007, fl. e fr., A.R.O. Ribeiro et al. 1157, A.R.O. Ribeiro et al. 4 and R.T Queiroz 786, it was observed culms antrorsely scabrous at the edges of the apical portion. According to Tucker (1994), culms sparsely scabrous at the apex are uncommon in C. laxus.

**Geographical distribution and phenology:** restricted to the Cerrado, Atlantic Forest (Evergreen), and Inland Forests in higher altitudes (Semideciduous and Deciduous). Flowers and fruits: February-June, August, and November.

**Comments:** recognized by: spikelets (5–11 × 1.8–2.3 mm) arranged in a digitate group or subdigitate spike, rachis 0.4–1.5 mm long; glumes (1.2–1.5 × 1.6–2.2 mm) aristate to mucronate, brown to yellowish-brown (sometimes with ferruginous areas at the margins), green to brown at the apex, with a mucron 0.3–0.7 mm long, straight or recurvate up to a 45º angle; connective prolongation with antrorse bristles; achene 1.3–1.6 mm long.

**Material examined selected:** Areia Branca, Salina Augusto Severo, 11.V.2007, fl. e fr., A.A. Roque & A.C.P. Oliveira 55 (UFP, UFRN); Baia Formosa, entrada para Vila do Sagti, 6º27’51” S, 34º58’40” W, 1.XI.2007,

Geographical distribution and phenology:
Widely distributed: border of the Atlantic Forest (Evergreen), Riparian Forest with Carnauba, Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridó), Sandbanks, and Saline Desert. Flowers and fruits: January-June, August-December.

Comments: recognized by culms papillose, leaf blades chartaceous, glaucous, and spikelets vinaceous to brown-vinaceous, arranged in dense spikes hidden by the spikelets. It is morphologically close to species Cyperus sp. 1, which presents similar culms and leaf blades, but can be distinguished by the inflorescence.

In C. ligularis the spikelet is 3.5–8 mm long, the rachilla internode 0.4–0.8 mm long, the glumes 5–8 per spikelet and 2.2–2.6 mm long. In Cyperus sp. 1 the spikelet is 6–14 mm long, the rachilla internode 0.9–1.2 mm long, the glumes (5)7–11 per spikelet and 2.7–3 mm long.

In A.R.O. Ribeiro et al. 23 (EAC, MOSS), the 1st order rays are very short and the inflorescence is glomerule-like and compact, giving the impression of having a single order.

Herb cespitose 32–51.5 cm tall. Culm 195–460 × 1.6 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 7, 13–185 × 0.5–3.4 mm. Inflorescence 1.8–5.5 × 2.8–3.4 cm, in 3 orders: glomerule hemispherical or antelodium in the 1st order; spike in the 2nd and ultimate orders. Rachis 3.5–12 mm long, hidden by spikelets. Spikelets 8–4.8 × 1.9–2.8 mm, 0.3 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.2–0.3 mm long. Rachilla wings absent or present, 0.1 mm wide, membranaceous, hyaline. Glumes 8–14, 1.3–1.7 × 0.7–0.9 mm, deciduous, bicarinrate, medially 2-nervate (including carinæs), white, becoming brown when dehydrating, glabrous, muticous, sometimes mucronate; mucron up to 0.1 mm long, straight. Stamen 1; anther 0.4–0.5 × 0.15–0.2 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, vinaceous, glabrous. Achene 0.8–0.9 × 0.3–0.4 mm, 0.2–0.3 mm thick, ovoid to lanceoloid, ellipsoidal or obovoid, mucron 0.1 mm long.

Material examined: Canguaretama, Barra do Cunhã, ca. 3 km, 6°19′43″ S, 35°03′44″ W, 3.XI.2007, fl. e fr., A.R.O. Ribeiro et al. 49 (EAC, MOSS).

Geographical distribution and phenology: registered until this moment only in Cerrado, municipality of Canguaretama. Flowers and fruits: November.

Comments: recognized by the antelodia of white spikes and glumes bicarinrate. It may be confused with *C. entrerianus* (v. comments under this species).

Fig. 2i-j
Herb cespitose 27–121 cm tall. Culm 200–1030 × 1.2–5.5 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 6–14, 17–570 × 1.5–11 mm. Inflorescence 5.5–20 × 5–19 cm, in 2–4 orders: antelodium in the 1st order; antelodium or spike in the 2nd order; spike in the 3rd and ultimate orders. Rachis 3–12 mm long, apparent. Spikelets 12–34 × 0.9–1.5 mm, 0.6–1.1 mm thick. Rachilla articulate at the base and all nodes, spikelet splitting into unities composed of rachilla 1 internode + 1 glume + 1 achene, internodes 1.3–2 mm long. Rachilla wings present, 0.6–1.3 mm wide, spongy, becoming membranaceous at the margins, yellowish-brown to ochraceous. Glumes 5–16, 1.3–1.7 × 0.7–2.8 mm, persistent, unicarinate, medianly 5–9-nervate (including carina), brown, ferruginous or vinaceous at the margins, green at the carina, glabrous, muticous or mucronate; mucron up to 0.1 mm long, straight. Stamina 1; anther 0.4–0.7 × 0.1–0.2 mm; connective prolongation absent or present.
at the anther apex, up to 0.1 mm long, vinaceous to reddish, glabrous. Achene 1.5–1.8 × 0.5–0.6 mm, 0.4–0.6 mm thick, oblanceoloid to oblong-oblancoeloid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:**
Widely distributed: Atlantic Forest (Evergreen), Inland Forests in higher altitudes (Semideciduous and Deciduous), Riparian Forest with Carneuba, Caatingas (Hypo- and Hyperxerophilous, Hyper- and Deciduous), Sandbanks, and Saline Desert. Flowers and fruits: January-August, October-November.

**Comments:** recognized by the rachilla articulate at the base and all nodes, spikelet splitting into diaspores composed of 1 glume + 1 achene + 1 rachilla internode, and rachilla wings spongy, becoming membraneous at the margins.

*Cyperus odoratus* is an extremely variable Pantropical species (Tucker 1994). Such a variation was observed in the specimens collected in Rio Grande do Norte, in terms of plant height, inflorescence and spikelets. In *A.A. Roque* 267 (UFP), the spikelets reach over 30 mm long, a length not so frequent in *C. odoratus*, according to Tucker (1994).


Herb cespitose 11–49 cm tall. Culm 75–440 × 0.8–2.7 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membraneous, green. Bracts of 1st order 3–4, 10–65 × 0.7–3.8 mm. Inflorescence 3.5–11 × 3.5–9 cm, in 2 orders: antelodium in the 1st order; spike in the ultimate order. Rachis 1.8–6 mm long, apparent. Spikelets 10–25 × 1.2–1.9 mm, 0.6–0.7 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.9–1.4 mm long. Rachilla wings present, 0.3–0.4 mm wide, membraneous, hyaline. Glumes 11–28, 2.7–3.8 × 1.5–2.6 mm, persistent, unicarinate, mediately 5–9-nervate (including carina), vinaceous, rarely brown-vinaceous at the margins, green at the carina, glabrous, muticous or mucronate; mucron up to 0.1 mm long, straight. Stamina 3; anther 1.2–1.8 × 0.15–0.2 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish to vinaceous, glabrous. Achene 1.4–1.6 × 0.7–0.8 mm, 0.5–0.6 mm thick, obovoid, sometimes ellipsoidal or ovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:**
Always associated with the impact of human agricultural activities in areas of Evergreen Forest, Riparian Forest with Carneuba, and Hyperxerophilous Caatinga. Flowers and fruits: January-May.

**Comments:** recognized by the rachis 1.8–6 mm long, apparent; spikelets 10–25 × 1.2–1.9 mm, persistent; glumes 2.7–3.8 × 1.5–2.6 mm, muticous or mucronate, persistent, vinaceous, rarely brown-vinaceous at the margins, green at the carina. Achenes are rarely present in the examined materials.

It has been cited as a weed in connection with at least 52 crop species in more than 90 countries (Bendixen & Nandihalli 1987). However, despite its negative effects being relevant to agriculture, many phytotherapeutic properties of *C. rotundus* were validated by recent studies (Sivapalan 2013). Distinct phytochemicals constitute biologically active principles can be extracted from the rhizomes, tubers, leaves and roots, for example, essential oils, alkaloids, flavonoids, tannins,
starch and sesquiterpenes (Sivapalan 2013), compounds known to have analgesic, antidiabetic, antiinflammatory, antimicrobial, antimitagenic, antioxidant, antiinflammatory and/or cytoprotective activities (Ahmad et al. 2012; Jahan et al. 2012; Sivapalan 2013).

19. *Cyperus schomburgkianus* Nees, J. Bot. (Hooker) 2: 393. 1840. Fig. 3e-g

Herb cespitose 15.5–30 cm tall. Culm 150–290 × 0.4–1.1 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 2–3, 12–150 × 0.7–1.8 mm. Inflorescence 0.8–1.1 × 0.8–1.3 cm, in 1 order: glomerule spherical to hemispherical. Rachis 0.7–1.2 mm long, hidden by spikelets. Spikelets 2.8–7 × 1.8–3 mm, 0.4–0.5 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.2–0.3 mm long. Rachilla wings absent, rarely present, up to 0.1 mm wide, membranaceous, hyaline to ferruginous. Glumes 8–14, 2.3–2.8 × 0.6–1 mm, deciduous, unicarinate, medi ally 5–7-nervate (including carina), margins and carina white, brown when dried, glabrous, muticous, rarely mucronate; mucron up to 0.1 mm long, straight. Stamina 3; anther 1–1.1 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, ferruginous to vinaceous, glabrous. Achene 0.9–1 × 0.2–0.3 mm, 0.2–0.3 mm thick, ob lanceoloid to oblong-oblanceoloid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** restricted to the Sandbanks at the humid eastern coast. Flowers and fruits: August, November.

**Comments:** recognized by the spikelets brown or greenish, ornate with a longitudinal vinaceous line at the center of each lateral side, rarely entirely brown or greenish, glumes 2.4–2.8 × 1.6–2 mm, and achenes 1–1.2 × 0.6–0.7 mm.

The specimen A.P. Mendes & A.C. Settini 404 has the margins of the some glumes entirely brown, thus the spikelet is devoid of the above mentioned vinaceous line.


Herb cespitose 6–31 cm tall. Culm 30–250 × 0.5–1.6 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 2–5, 9–100 × 0.5–3 mm. Inflorescence 1.2–5 × 1.1–5 cm, in 2 orders: antelodium in the 1st order; antelodium or spike in the 2nd order; spike in the ultimate order. Rachis (1.5)2–9 mm long, apparent. Spikelets 7–15 × 1.3–2 mm, 0.6–0.8 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.7–0.9 mm long. Rachilla wings present, 0.3–0.4 mm wide, membranaceous, hyaline. Glumes 9–18, 2.4–2.8 × 1.6–2 mm, deciduous, unicarinate, medially 5–9-nervate (including carina), brown with an area vinaceous-maculate at the margins forming a longitudinal vinaceous line at the center of each lateral side of the spikelet, rarely the margins entirely brown, green to brown at the carina, glabrous, muticous or mucronate; mucron up to 0.2 mm long, straight. Stamina 3; anther 0.4–0.6 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, hyaline to ferruginous, glabrous. Achene 1–1.2 × 0.6–0.7 mm, 0.5–0.6 mm thick, obovoid, ellipsoid or ovoid, with a mucron 0.1 mm long.


**Geographical distribution and phenology:** restricted to the Sandbanks at the humid eastern coast. Flowers and fruits: August, November.

**Comments:** recognized by the spikelets brown or greenish, ornate with a longitudinal vinaceous line at the center of each lateral side, rarely entirely brown or greenish, glumes 2.4–2.8 × 1.6–2 mm, and achenes 1–1.2 × 0.6–0.7 mm.

The specimen A.P. Mendes & A.C. Settini 404 has the margins of the some glumes entirely brown, thus the spikelet is devoid of the above mentioned vinaceous line.
Cyperus in Rio Grande do Norte
Rodriguésia 66(2): 571-597. 2015


Geographical distribution and phenology: Widely distributed: border of the Atlantic Forest (Evergreen), Inland Forests in higher altitudes (Semideciduous and Deciduous), Riparian Forest with Carnauba, Cerrado, Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridô), and Sandbanks. Flowers and Fruits: January, March-August, November.

Comments: can be confused with C. entrerianus (v. comments under species 9). The arrangement of the spikelets, which was defined as a serial fascicle by Guarise & Vegetti (2007), is peculiar among the species of Cyperus. In this type of inflorescence, the spikelets are distichously arranged, with the lateral sides approximately parallel, facing each other. According to Guarise & Vegetti (2007), the presence of serial fascicles is peculiar among the species in Cyperus sect. Luzuloideae (Kunth) C.B. Clarke.

In A.R.O. Ribeiro et al. 207 (MOSS) there are culms slightly scabrous and smooth in the same plant, which confirms the character variation in the species as has been reported by Ribeiro et al. (2014). In O.F. Oliveira et al. 1007, the culms are smooth, even at the apex; the specimen identification was based on the presence of serial fascicles and achenes 0.6–0.8 mm long. In R.C. Oliveira et al. 2379, the serial fascicles are very congested into dense glomerules, which made it difficult to identify; however, the identification of the specimen was possible by the presence of culm retrorsely scabrous and achenes 0.6–0.8 mm long.


Herb cespitose 6.5–29 cm tall. Culm 40–260 × 0.2–0.6 mm, trigonous, transverse septa absent, glabrous, smooth. Leaf blade present, membranaceous, green. Bracts of 1st order 3–5, 6–95 × 0.5–1.5 mm. Inflorescence 0.5–1.2 × 0.4–1.5 cm, in 1 order composed of a glomerule spherical to hemispherical. Rachis 0.3–1 mm long, hidden by spikelets. Spikelets 3–7 × 1.5–2 mm, 0.3–0.4 mm thick. Rachilla non-articulate, spikelet persistent, internodes 0.2–0.3 mm long. Rachilla wings absent or present, up to 0.1 mm wide, membranaceous, hyaline, ferruginous to vinaceous. Glumes 9–36, 0.9–1.2 × 0.6–0.9 mm, deciduous, unicinate, medially 3(5)-nervate (including carina), brown, glaucous, yellowish to ochraceous at the margins, green to brown at the carina, glabrous; mucronate to aristate; mucron/arista 0.3–0.8 mm long, recurvate (22.5)30–60º. Stamen 1; anther 0.4–0.6 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, hyaline, ferruginous, reddish to vinaceous, glabrous. Achene 0.4–0.6 × 0.2–0.4 mm, 0.2–0.3 mm thick, ovoid, ellipsoidal or obovoid, with a mucron 0.1 mm long.


Geographical distribution and phenology: registered in areas of Caatinga (Hypoxerophilous, Hyperxerophilous, and Seridô) and Riparian Forest with Carnauba. Flowers and fruits: February-June.

Comments: can be confused with C. cuspidatus (v. comments under this species).

24. Cyperus sp. 1

Herb cespitose 90–114 cm tall. Culm 740–935 × 3.9–4.5 mm, trigonous, transverse septa absent, glabrous, papillose. Leaf blade present, chartaceous, glaucous. Bracts of 1st order 8–9, 23–755 × 1.3–11 mm. Inflorescence 18–20 × 21–24 cm, in 3 orders: antelodium in the 1st order; antelodium or spike in the 2nd order; spike in the ultimate order. Spikelets 6–14 × 1–1.8 mm, 0.6–0.8 mm thick. Rachilla articulate at the base, spikelet falling as a unity, internodes 0.9–1.2 mm long. Rachilla wings present, 0.4–0.6 mm wide, membranaceous, hyaline to greenish-hyaline. Glumes (5)7–11, 2.7–3 × 1.4–1.6 mm, persistent, unicinate, medially 9–11-nervate (including carina), vinaceous to brown at the margins, green at the carina, glabrous; muticous or mucronate; mucron up to 0.2 mm long, straight. Stamina 3; anther 0.5–0.7 × 0.1–0.15 mm; connective prolongation absent or present at the anther apex, up to 0.1 mm long, reddish to vinaceous, glabrous.
Figure 5 – a-c. Cyperus digitatus – a. habit; b. spike; c. spikelet. d. C. distans – spikelet. e. C. iria – spikelet. f-g. C. ligularis – f. spike; g. spikelet. h-k. Cyperus sp. 1 – h. habit; i. spike; j. spikelet; k. achene (a-c A.A. Roque 417; d A.R.O. Ribeiro et al. 177; e A.R.O. Ribeiro 160; f-g A.R.O. Ribeiro 19; h-k A.R.O. Ribeiro et al. 247).
Achene 1.4–1.6 × 0.6–0.7 mm, 0.6–0.7 mm thick, ovoid to lanceoloid, ellipsoidal or obovoid, with a mucron 0.1 mm long. **Material examined:** Campo Redondo, Fazenda Giromão, 5.VIII.2009, fl. e fr., A.A. Roque 1051 (UFRN); Equador, 14.IV.1981, fl. e fr., G.F.C. Lima 132 (MOSS); Jucurutu, Serra João do Vale, 06°00’43”S, 37°08’52”W, 29.V.2010, fl. e fr., A.R.O. Ribeiro et al. 247 (UB, MOSS, RB); São Paulo do Potengi, logo após o trevo São Paulo, A.R.O. Ribeiro et al. 247 (MOSS).

**Geographical distribution and phenology:** restricted to the Caatingas (Hypoxerophilous, Hyperxerophilous, and Seridó). Flowers and fruits: April–May, August.

**Comments:** It is a species related to *Cyperus* sect. *Turgiduli* (C.B. Clarke) Kük., since the spikelets are articulate at the base and falling entire at maturity, the rachilla largely winged, and the glumes appressed.

Among the species in the section *Turgiduli*, only *C. alvesii* G.C. Tucker, *C. javanicus* Houtt. and *C. ligularis* combine papillose culms and leaf blades, inflorescences of the compound antelodium type, and spikelets longer than 5 mm (Kükenthal 1936; Tucker 2008), but *C. javanicus* does not grow in Neotropics (Tucker 2008).

*Cyperus* sp. 1 can be distinguished from *C. ligularis* by the spikelets, glumes, and rachilla internodes (v. comments under this species) and from *C. alvesii* by the spikelets, glumes, and anthers. In *C. alvesii*, which is known to occur only in the states of Paraíba and Bahia, the spikelets have 3–4 glumes (vs. 5)7–11 in *Cyperus* sp. 1), the rachilla internodes are 2–2.2 mm long (vs. 0.9–1.2 mm in *Cyperus* sp. 1), the glumes are 3.2–4 mm long (vs. 2.7–3 mm in *Cyperus* sp. 1), and the anthers are (1.3)1.6–1.8 mm long (vs. 0.5–0.7 mm in *Cyperus* sp. 1).

Some specimens were misidentified as *C. pohlii* (Nees) Steud., but the analysis of the type specimens belonging to this species showed leaves non-papillose, green and M-shaped in cross section. These morphological characters are incompatible with specimens here examined.

**Acknowledgements**

This work was supported by CAPES, CNPq - Protax Program (Process 562340/2010-6), Petrobrás Ambiental, UFERSA and UnB. We thank the curators and staff of the herbaria EAC, HUEFS, UFP and UFRN for loans of exsiccatea. We are sincerely grateful to Anádria Stéphanie da Silva, Antônia Kátia Pinheiro de Medeiros, Caio César Pereira Leal, José Erivaldo de Araújo, Prof. Maiele Leandro da Silva, and Suzi Helena de Santana for their support during the preparation of specimens and botanical expeditions, and Kadja Milena for providing photos of the type of *C. crassipes*.

**References**


Cyperus in Rio Grande do Norte


Artigo recebido em 05/10/2014. Aceito para publicação em 27/03/2015.