

Denscantia calcicola (Rubiaceae), A New Species from Limestone Outcrops in the Brazilian Caatinga

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Communicating Editor: Molly Nepokroeff

Abstract—The first new species of *Denscantia* from the caatinga biome is described and illustrated. *Denscantia calcicola* is easily distinguished by its plicate-nerved and scabrous leaves, axillary inflorescences with 7–15 glomerules, calyx tube 0.85–1.2 mm long, bifid stigma and pollen grains with only one endocingulum.

Keywords—*Emmeorhiza*, endemism, limestone, Spermaceae, taxonomy.

Resumen—La primera especie de *Denscantia* del bioma caatinga es descrita e ilustrada. *Denscantia calcicola* se distingue fácilmente por las hojas plegado-nervosas y escabras, las inflorescencias axilares con 7–15 glomérulos, el tubo calicino 0.85–1.2 mm de largo, el estigma bifido y granos de polen con un endocíngulo.

Palabras Clave—Calcáreos, *Emmeorhiza*, endemismo, Spermaceae, taxonomía.

Scandentia E. L. Cabral & Bacigalupo was described by Cabral & Bacigalupo (Cabral and Bacigalupo 2001a) based on species of the tribe Spermaceae (Rubiaceae) with scandent habit. They transferred two species from *Borreria*: *B. cymosa* (Spreng.) Cham. & Schtdl. [= *Scandentia cymosa* (Spreng.) E. L. Cabral & Bacigalupo] and *B. monodon* K. Schum. [= *S. monodon* (K. Schum.) E. L. Cabral & Bacigalupo], and described two new species: *S. andreii* E. L. Cabral & Bacigalupo and *S. macrobracteata* E. L. Cabral & Bacigalupo. Their generic name was not validly published because it coincided with a Latin technical term in use in morphology, so they (Cabral and Bacigalupo 2001b) proposed a new name for the genus, *Denscantia* E. L. Cabral & Bacigalupo, because *Scandentia* alludes to a morphological feature (Art. 20.2 ICBN).

Denscantia comprised four species from northeastern and southeastern Brazil. This genus differs from other genera of tribe Spermaceae by its scandent habit, the tubular stipule sheath, thyrse or pleiothyrsis inflorescences, isostylous flowers, pollen grains with multiple endoaperture, and complanate seeds. Additionally, a distinct pollen type, with pollen grain zonocolpo 3–4-orate with perforated tectum, was established by Cabral and Bacigalupo (2001a) as one of the diagnostic features of the genus. However, this pollen type was redefined by Dessein (2003), who added additional information on endoaperture and textum ornamentation (3–4-endocingulate and tectum microreticulate). Pollen grains like those of *Denscantia* are rare in Rubiaceae, as well as in other angiosperms (Cabral and Bacigalupo 2001a).

Denscantia is a poorly known genus. None of the species have been previously included in a molecular phylogeny, and hence their affinities with other genera are uncertain. Dessein (2003) pointed out that axillary inflorescence, isostylous, flowers and unique type of pollen grains, are a strong support for the recognition of this genus. He also pointed out its close relationship of the genus *Denscantia* with *Galianthe* Griseb. and *Emmeorhiza* Pohl ex Endl.

In the course of revising the tribe Spermaceae for the state of Bahia in Brazil, we found a specimen misidentified as *Diodia radula*, which comprises a new species of *Denscantia*. The new species is here described and illustrated, and its affinities with the remaining species of *Denscantia* and other genera of Spermaceae are discussed. An extension of

the genus concept of *Denscantia* is proposed based on new morphological characters found in *D. calcicola*.

TAXONOMIC TREATMENT

Denscantia calcicola R. M. Salas & E. L. Cabral, sp. nov.—

TYPE: Brazil. Bahia: Cocos, extensive limestone outcrop, 6 km S of Cocos, 14°10'50"S, 44°32'15"W, 579 m, 17 Mar 1972, W. R. Anderson, M. Stieber, J. H. Kirkbride Jr., S. G. da Fonsêca, R. Souza & J. Fonsêca Filho 37032 (holotype: UEC!; isotypes: NY, UB).

A *D. cymosa* foliis plicato-nervosis, scabris (non nervis secundari inconspicuis, glabris vel puberulis), inflorescentiis axillaribus, inflorescentiis partialibus in glomeruli, 7–15 glomeruli in ramis floriferis (non inflorescentiae thyrsioidea, inflorescentiis partialibus fasciculatis), calyx tubo conspicuis, 0.85–1.2 mm longis (non calyx tubo nulis), stigma bifidis (non bilobatis, inconspicuis), pollinis cum endocingulum unico (vesus endocingulum 3-plo vel 4-plo) differt.

Shrub scandent, 2 m tall, stems subterete, puberulous to pubescent. Leaves pseudopetiolate, pseudopetiole 2–5 mm long, blade 15–34 × 7–20 mm, elliptic or elliptic-lanceolate, plicate-nerved, base attenuate, apex acuminate, discolorous, slightly lighter abaxially, scabrous, indumentum more evident on the abaxial surface, especially on veins, with 5–6 pairs of subopposite secondary veins; stipule sheath tubular, prolonged above the corresponding pair of leaves, 2–2.5 mm long, with 5–7 bristles, the longest 1–1.6 mm long, the other 2–3 shorter than 0.3–0.5 mm, glabrous, with colleters on the apex. Inflorescences with indeterminate growth, glomerules 5–16 on each flowering branch, subspherical, 0.8–2 mm in diam., internodes 1.5–6.5 mm long, gradually shorter towards the apex of the inflorescence, subterete, puberulous, leaf-like bracts elliptic or elliptic-lanceolate, scabrous, opposite, 15–34 × 6–18 mm, 1.5–2 times larger than the glomerules, bracteoles 0.8–2 mm long, with apex glandular. Flowers sessile, pedicel 0.5–1.2 mm long, hypanthium 2–2.3 mm long, pubescent; calyx 4-lobed, calyx tube 0.85–1.2 mm long, calyx lobes 2.2–3.2 mm long, narrowly triangular, internally glabrous, external surface and margin pilose, with 1–2 intercalary glandular teeth; corolla 5–6.5 mm long, infundibuliform,

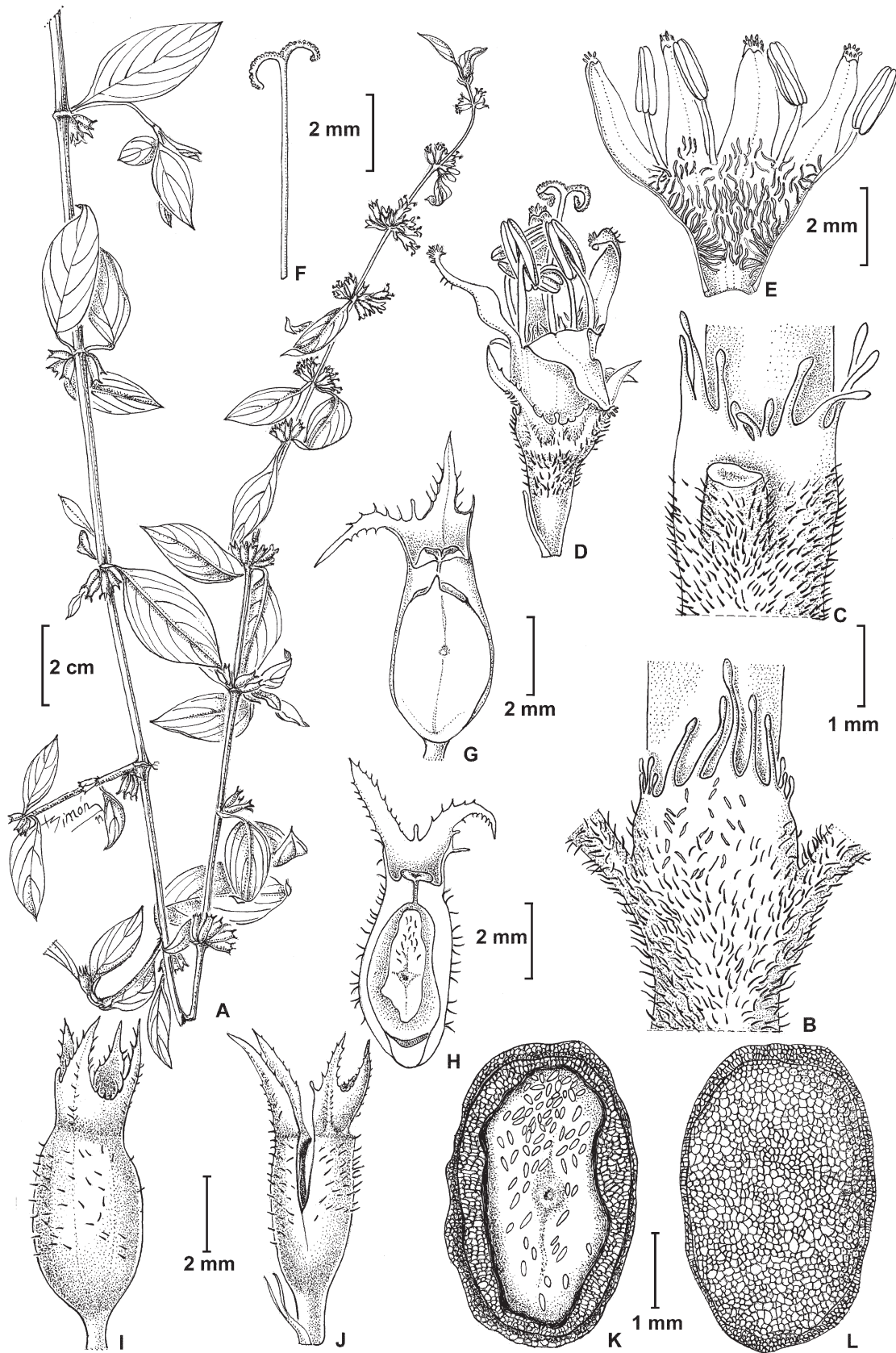


FIG. 1. *Denscantia calcicola*. A. Apex of a flowering branch. B, C. Stipule sheath. B. Front view. C. Lateral view. D. Lateral view of a flower. E. Inside of corolla. F. Bifid stigma. G-J. Fruit. G. Inside of mericarp showing the intercarpelar septum and calyx tube. H. Inside of mericarp showing the seed and calyx tube. I. Dorsal view of fruit. J. Lateral view of fruit showing the compressed profile. K, L. Seed. K. Ventral view. L. Dorsal view. Drawn from W. R. Anderson *et al.* 37032 (UEC).



FIG. 2. Geographical distribution of *Denscantia calcicola* in Bahia, Brazil.

4-lobed, lobes the same length as, or shorter than the tube, tube externally glabrous or glabrescent, internally with a fringe of moniliform hairs from base of the corolla lobes to base of tube; ovary 2-carpellate, 2-locular, each locule 1-seeded. Stamens exserted, filaments 1.5–1.7 mm long, anthers 1.6–1.8 mm long, pollen grains of medium size, colpi long, 7–8 zono-colporate, endoaperture in endocingulum. Style 6–7 mm long, stigma bifid, with nectariferous disc at base. Capsule 3.8–4.3 mm long, puberulous or pubescent, laterally compressed; seed 2.8–3.8 × 1.8–2.2 mm, complanate, seed coat surface reticulate-areolate, with a wing around the seed 0.05–0.3 mm wide. Figure 1.

Distribution and Habitat—*Denscantia calcicola* inhabits the caatinga biome, and is apparently endemic to Bahia, Brazil (Fig. 2). The caatinga is the dominant vegetation form in the semi-arid area of northeastern Brazil. It covers more than 850,000 km², from the states of Ceará and Rio Grande do Norte to northern Minas Gerais state. The caatinga may be characterized as a low forest composed mostly of small trees and shrubs, frequently having twisted trunks and thorns, with small leaves that are deciduous in the dry season. Succulent plants of the family Cactaceae are common, and there is an ephemeral herbaceous layer present only during the short rainy season (Queiroz 2006).

The only known specimen was found on limestone outcrops in the municipality of Cocos. The vegetation of this region is considered as an ecotone between the cerrado (to the northwest, west and south) and the caatinga (to the north and northeast) biomes. In this context, *Denscantia calcicola* is situated inside the caatinga biome ca. 15 km north of the state line of Minas Gerais by road. Due to the continuity of

the caatinga biome between Bahia and Minas Gerais, the distribution of the new species might be greater. According to Pérez-García and Meave (2005), the vegetation of limestone outcrops are considered relict communities with many endemic species.

Based on field observations, the vegetation of the limestone outcrops is apparently well conserved (at least in this area), because these outcrops cannot be used for agricultural or livestock activities. However, the main threat to the conservation of this vegetation is the intense mining of rock for public paving and construction. Besides, many plants that inhabit these areas are appreciated for their ornamental value and are harvested by local people to be sold along the roads in the region (França and Melo 2006).

Conservation—*Denscantia calcicola* is considered critically endangered (CR B1ab) according to the IUCN red list criteria (IUCN 2001): extent of occurrence estimated to be less than 100 km² in an extremely fragmented area.

Phenology—Flowers and fruits in March.

Etymology—The epithet “*calcicola*” refers to the limestone outcrop, the only habitat known for this species.

Taxonomy—The new species here described presents a unique combination of morphological characters. The scandent habit, tubular stipule sheath, isostylous flowers, interior of the corolla tube with a fringe of hairs, capsule with longitudinal dehiscence (both dehiscent mericarps) and seeds complanate with winged edges fully agree with the diagnostic features of the genus. However, the axillary inflorescences with indeterminate growth, flowers with a bifid stigma and pollen with a single endocingulum are not previously documented in *Denscantia*. As stated above, with this publication, we extend the generic concept, incorporating the diagnostic characters of *Denscantia calcicola*.

The new species also shares the scandent habit, bifid stigma, complanate seeds, zonocolporate pollen grains with long colpi and single endocingulum with *Emmeorrhiza umbellata* (Spreng.) K. Schum., which also belongs to tribe Spermaceae. However, it differs from that species in possessing a tubular stipule sheath (vs. non-tubular), axillary inflorescences with indeterminate growth (vs. umbellate, determinate inflorescences), subsessile flowers (vs. pedicellate flowers), interior of the corolla tube with a fringe of hairs (vs. ring of hairs), fruit without apical extension of the carpel (vs. fruit with apical extension of the carpels), and strophiole shorter than the seed (vs. strophiole longer than the seed). *Emmeorrhiza umbellata* also grows in Bahia state but inside of the Atlantic Forest biome. The morphological affinity between *Emmeorrhiza* and *Denscantia* was initially pointed out by Dessein (2003). Recently, Kårehed et al. (2008) resumed the discussion, but suggested *Denscantia* as the closest relative of the *Emmeorrhiza-Crusea* clade.

The four previously described species of the genus *Denscantia* inhabit only the Atlantic Forest biome of Brazil, in areas of Restinga. This vegetation comprises low forests and open scrub that grow on the coastal sands that border the Atlantic Ocean (Silva et al. 2006). Therefore, *D. calcicola* is the first species inhabiting a seasonally dry region inside the caatinga biome of northeastern Brazil.

KEY OF SPECIES OF *DENSCANTIA*

1. Flowers pedicellate with pedicels 5–10 mm long. Corolla 12–16 mm long, subtubular, pink, internally with ring of hairs near the base of the tube, the rest glabrous (southeastern Bahia, Brazil) *Denscantia andreii* (E. L. Cabral & Bacigalupo) E. L. Cabral & Bacigalupo.

1. Flowers subsessile, pedicels 0.5–1.2 mm long. Corolla 4–6.5 mm long, infundibuliform, white, internally with a fringe or ring of hairs in the middle of the tube and scattered hairs near the base of lobes 2
2. Leaves plicate–nervose, scabrous. Inflorescences indeterminate, axillary, congested, 7–15 glomerules per flowering branch. Calyx tube 0.85–1.2 mm long, lobes 2.2–3.2 mm long, longer than the corolla tube. Stigma bifid. Pollen grains with 1 endocingulum (southern Bahia, Brazil) *Denscantia calcicola* R. M. Salas & E. L. Cabral.
2. Leaves with veins scarcely visible in the abaxial face, glabrous or puberulous. Inflorescences determinate, apical, lax. Calyx tube inconspicuous, lobes 1.4–2 mm long, shorter than the corolla tube. Stigma 2-lobed. Pollen grains internally with 3–4 endocingula 3
3. Stipule sheath 2.5–5 mm long, tubular, with 5–8 bristles. Calyx lobes elliptic–lanceolate, half as long as or shorter than half of the corolla tube (northeastern and southeastern Brazil) *Denscantia cymosa* (Spreng.) E. L. Cabral & Bacigalupo.
3. Stipule sheath 2–3 mm long, triangular or subtriangular, with 1–3(–5) bristles. Calyx lobes linear to narrowly triangular, more than half as long as the corolla tube 4
4. Leaves with 8–10 pairs of secondary nerves. Stipule sheath pubescent, with 3(–5) bristles, the central bristle longer than the lateral ones. Inflorescence thyrsoid, bracts longer than the glomerules. Calyx lobes pubescent, patent. Interior of the corolla with a ring of hairs in the middle of the tube and scattered hairs. Stamens half as long as the corolla lobes (southeastern Bahia, Brazil) *Denscantia macrobracteata* (E. L. Cabral & Bacigalupo) E. L. Cabral & Bacigalupo
4. Leaves with 4–5 pairs of secondary nerves. Stipule sheath glabrous, with 1 bristle. Inflorescence pleiothyrsoid, bracts shorter than the glomerules. Calyx lobes glabrous or with few hairs on the margin, apex often curved. Interior of the corolla with fringe of hairs. Stamens as long as the corolla lobes (southeastern Bahia, Brazil) *Denscantia monodon* (K. Schum.) E. L. Cabral & Bacigalupo.

ACKNOWLEDGMENTS. We are indebted to Washington Marcondes-Ferreira (UEC) for a loan of herbarium specimens and Laura Simón for the illustration. The first author also thanks CONICET for two post-graduate grants (2007–2012). We also thank reviewers for the valuable suggestions made in the text.

LITERATURE CITED

- Cabral, E. L. and N. M. Bacigalupo. 2001a. *Scandentia*, nuevo género de Rubiaceae–Spermacoceae. *Darwiniana* 39: 29–41.
- Cabral, E. L. and N. M. Bacigalupo. 2001b. *Denscantia*, nuevo nombre en reemplazo de *Scandentia* (Rubiaceae–Spermacoceae). *Darwiniana* 39: 353.
- Dessein, S. 2003. *Systematic studies in the Spermacoceae (Rubiaceae)*, Doctoral thesis. Leuven: Katholieke Universiteit.
- França, F. and E. Melo. 2006. Diversity in Inselbergs in the Semiarid of Bahia. Pp. 69–72 in *Towards greater knowledge of the Brazilian semiarid biodiversity*, eds. L. P. Queiroz, A. Rapini, and A. M. Giuliatti. Brasília: Ministry of Science and Technology.
- IUCN. 2001. IUCN red list categories and criteria: version 3.1. Gland, Switzerland and Cambridge, U. K.: IUCN Species Survival Commission.
- Kårehed, J., I. Groeninckx, S. Dessein, T. J. Motley, and B. Bremer. 2008. The phylogenetic utility of chloroplast and nuclear DNA markers and the phylogeny of the Rubiaceae tribe Spermacoceae. *Molecular Phylogenetics and Evolution* 49: 843–866.
- Pérez–García, E. and J. Meave. 2005. Heterogeneity of xerophytic vegetation of limestone outcrops in a tropical deciduous forest region in southern Mexico. *Plant Ecology* 175: 147–163.
- Queiroz, L. P. 2006. The Brazilian caatinga: phytogeographical patterns inferred from distribution data of the Leguminosae. Pp. 113–149 in *Neotropical savannas and dry forests: Plant diversity, biogeography and conservation*, eds. R. T. Pennington, G. P. Lewis, and J. A. Ratter. Oxford: Taylor and Francis CRC Press.
- Silva, T. R. S., A. M. Giuliatti, R. M. Harley, L. P. Queiroz, and F. França. 2006. Pp. 55–58 in *Towards greater knowledge of the Brazilian semiarid biodiversity*, eds. L. P. Queiroz, A. Rapini, and A. M. Giuliatti. Brasília: Ministry of Science and Technology.