# NEW COMBINATIONS AND NEW SYNONYMIES IN THE GENUS *SPERMACOCE* (RUBIACEAE) FOR THE FLORA OF GOIÁS AND TOCANTINS (BRAZIL) AND THE FLORA OF THE GUIANAS

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## ABSTRACT

The genus *Spermacoce* has been variably circumscribed by Rubiaceae specialists, including or excluding *Borreria* and/or other related taxa. Multidisciplinary studies showed that *Spermacoce* is better treated as widely delimited to include *Borreria* with strong support from morphology, anatomy, palynology, and molecular phylogenies. Accordingly, twelve new combinations and several new synonymies in *Spermacoce* are here proposed to have these names available for the Rubiaceae treatments of the *Flora de Goiás e Tocantins*, *Flora do Distrito Federal*, and the *Flora of the Guianas*.

KEY WORDS: *Borreria*, *Spermacoce*, Rubiaceae, Goiás, Tocantins, Brazil, Guianas, Neotropics

## RESUMEN

O gênero *Spermacoce* foi variavelmente circunscrito por vários especialistas de Rubiaceae, incluíndo ou excluíndo *Borreria* e/ou outros taxa relacionados. Estudos multidisciplinares demonstraram que é melhor tratar *Spermacoce* como amplamente delimitado, incluíndo *Borreria*, sendo que este conceito tem um forte suporte da morfologia, anatomia, palinologia e filogenias moleculares. Por estas razões, doze novas combinações e vários sinónimos novos são aqui propostos em *Spermacoce*, para ter estes nomes disponiveis pelos tratados da *Flora de Goiás e Tocantins*, *Flora do Distrito Federal* e da *Flora of the Guianas*.

PALAVRAS CHAVE: *Borreria*, *Spermacoce*, Rubiaceae, Goiás, Tocantins, Brasil, Guianas, Neotropicos

## INTRODUCTION

The definition of the genera in the tribe Spermacoceae has been debated since their establishment, mostly due to the diverging opinions among specialists. A complete taxonomic history of this tribe and its generic delimitations was presented by Delprete et al. (2005); however, the main facts regarding the history of *Borreria* and *Spermacoce* are here summarized. Linnaeus (1753) established the genera *Spermacoce* [with *S. tenuior* L. (later selected as the type of the genus), *S. verticillata* L., and *S. hispida* L.] and *Diodia* L.

Meyer (1818) founded *Borreria* G. Mey. (describing *B. suaveolens* G. Mey.), distinguishing it by having a capsule with both cocci dehiscent, while the fruit of *Spermacoce* has one coccus dehiscent and the other indehiscent. In the same work he characterized *Diodia* by having fruits with two indehiscent locules.

Richard (1830), in the first important system of classification of the Rubiaceae, synonymized *Borreria*, *Diodia* and *Spermacoce*, with the following statement (Richard 1830: 150–151, free translation from French): "A careful exam of a great number of species convinced me of the necessity to reunite *Spermacoce*, *Diodia* and *Borreria* into one genus. It is always the same kind of organization, not only in all floral parts, but also in the fruit, upon which was based the distinction among the three genera. In fact, the two cocci remain closed in *Diodia*, or dehisce longitudinally in *Borreria*, and the septum might be completely adherent to one coccus or missing, as in the *Spermacoce* species; I just want to repeat that it is the same organization, and these characters are not always clearly distinct, as it is possible to find one or two of these three types in the same species. I think that instead of forming types of genera, they can be used to establish subdivisions or sections within *Spermacoce*, which has a large number of species."

Hooker (1873), following Richard, maintained *Borreria* and *Spermacoce* as synonymous, describing the

fruit of *Spermacoce* as with two dehiscent cocci, or with one indehiscent and the other indehiscent, with a persistent, membranaceous axis, and a persistent calyx.

Schumann (1888), in his contribution to the *Flora Brasiliensis*, recognized the following genera in the tribe Spermacoce: *Diodia*, *Hemidiodia* K. Schum. [= *Spermacoce*], *Psyllocarpus* Mart. ex Mart. & Zucc., *Spermacoce*, *Endlichera* C. Presl [= *Emmeorhiza* Pohl ex Endl.], *Borreria* (treating *Galianthe* as a section of this genus), *Staelia* Cham. & Schltdl., *Mitracarpus* Zucc. in. Schult. & Schult. f., *Perama* Aubl., *Richardsonia* Kunth [= *Richardia* L.], *Schwendenera* K. Schum., and *Machaonia* Bonpl.

Bremekamp (1934), although he usually adopted rather narrow generic concepts (resulting in the separation of many taxa from several Rubiaceae genera), stated that the differences between *Spermacoce* and *Borreria* are small and of little taxonomic significance; however, he opted to maintain them separate for "purely opportunistic reasons."

Steyermark (1972, 1974) in several occasions admitted to agree with Bremekamp about the similarity of *Borreria* and *Spermacoce*, and also preferred to maintain them separate, as traditionally recognized in the New World, to avoid many new combinations, even though many African species have already been transferred to *Spermacoce* by contemporary authors. As a matter of fact, Verdcourt (1975, 1976, 1989) treated *Borreria* as a section of *Spermacoce*, and proposed the necessary new combinations for the African taxa.

In a series of multidisciplinary studies Cabral, Bacigalupo and collaborators (Cabral 1991, 1993; Cabral et al. 2006; Cabral & Bacigalupo 1997, 2000; Pire 1997; Pire & Cabral 1992) maintained *Borreria* and *Spermacoce* separated, and re-established *Galianthe*, where they transferred many species previously positioned in *Borreria*. In a successive work, Bacigalupo and Cabral (1999) transferred several species from *Diodia* to *Borreria*, *Galianthe* and *Diodella* (although without proposing the new combinations in the last genus), based primarily on the type of fruits dehiscence and inflorescence architecture, restricting *Diodia* to five species with indehiscent fruits. At the same time, they preferred to maintain them as separate, based on the same generic concepts and fruit characters used by Meyer (1818) and Grisebach (1879).

Govaerts (1996) in his contribution to the *World Checklist of Seed Plants* treated *Borreria*, *Galianthe* and *Spermacoce* as synonymous, publishing a total of 80 new combinations and new names in *Spermacoce*, mostly of Neotropical taxa.

De Vré (2000), after a general pollen overview of the tribe Spermacoceae, concluded that there is no palynological evidence to maintain *Borreria* separate from *Spermacoce*. He also showed that the pollen of *Spermacoce* (incl. *Borreria*) is highly variable, and ranging from 3- to 20-colporate, with tectum foveolate, microspinulate or non-spinulate, with colpi regularly spaced or in couples, in equatorial position or in two series, or arranged in an 8-shaped line.

Terrell and Wunderlin (2002) studied the seed morphology of several genera of the tribe Spermacoceae. They concluded that *Borreria* and *Spermacoce* (and *Galianthe*) are not sufficiently distinct to warrant taxonomic separation.

In the molecular phylogenies of Dessein (2003) and Dessein et al. (2006), species with fruit types traditionally attributed to *Borreria* and *Spermacoce* are intercalated within the same clades. Therefore, data from morphology, anatomy, palynology, and molecular phylogeny support the wide delimitation of *Spermacoce*, and the two taxa should be treated as synonymous.

In the floristic treatments of Costa Rica, Central French Guiana and Santa Catarina (Brazil), Adams (apud Burger & Taylor 1993), Boom and Delprete (2002) and Delprete et al. (2004, 2005), respectively, opted to treat the two genera as synonymous, and arranged all the species under *Spermacoce*. Therefore, according to Delprete et al. (2004, 2005), *Spermacoce* is delimited to include species with septicidal fruits with persistent calyx, commonly dehiscent from the top [basipetally] or exceptionally from the bottom [acropetally; e.g., *S. palustris* (Cham. & Schltdl.) Delprete; *S. spicata* (Miq.) Delprete, see below], with both cocci dehiscent, one dehiscent and the other indehiscent, or both of them indehiscent. A complete description of *Spermacoce* as here delimited was recently presented by Delprete & Cortés-B. ("2006" [2007]). Continuing with this line of thinking, twelve new combinations are here proposed in *Spermacoce* to have these names available for my Rubiaceae treatments of the *Flora de Goiás e Tocantins*, *Flora do Distrito Federal*, and *Flora of the Guianas*.

Two new combinations necessary for these treatments have already been published in Delprete & Cortés-B. ("2006"[2007]), and are also reported here to reach a wider distribution in the international botanical community. Specimens cited were all personally examined, unless otherwise indicated by "n.v." after the herbarium acronym.

## SYSTEMATIC TREATMENT

**1. Spermacoce burchellii** (E.L. Cabral & Bacigalupo) Delprete, comb. nov. *Borreria burchellii* E.L. Cabral & Bacigalupo, Bonplandia 10:126. 2000. *Borreria tenella* (Kunth) Cham. & Schltdl. var. *pumila* K. Schum., in Mart., Fl. Bras. 6(6):56. 1888; non *Borreria pumila* DC.,1830. TYPE: BRAZIL. TOCANTINS: Porto Nacional [as "Goyaz, ad Porto Real"], s.d. [1828–1829] (fl.), *Burchell 8679-10* (LECTOTYPE selected by Cabral & Bacigalupo 2000: BR!).

Additional specimens examined: **BRAZIL: Tocantins:** Porto Nacional [as "Goyaz, ad Porto Real"], s.d. [1828–1829] (fl) *Burchell 8679-22* (BR) and *8657* (BR); without locality, s.d. [1818–1819], *Pohl 2497* (B†; cited by K. Schumann: 1888, p. 56).

*Geographic distribution.*—Known only from the historical the collections of early 1800s by Johann Pohl and William Burchell in the northern portion of the Province of "Goyaz" (now the state of Tocantins).

**2. Spermacoce crispata** (K. Schum.) Delprete, comb. nov. *Borreria tenella* (Kunth) Cham. & Schltdl. var. *crispata* K. Schum. in Martr., Fl. Bras. 6(6):55. 1888. *Borreria crispata* (K. Schum.) E.L. Cabral & Bacigalupo, Bonplandia 10:126. 2000. SYNTYPES: BRAZIL. GOIÁS: without locality, s.d. [1840], *Gardner 4173* (B†, photo at NY!) and *4175* (B†).

*Distribution and ecology.*—Restricted to northeastern and central Brazil, known from the states of Bahia, Minas Gerais, Goiás, and Tocantins. Growing in open fields in the Cerrado Biome.

**3. Spermacoce delicatula** (E.L. Cabral) Delprete, comb. nov. *Borreria delicatula* E.L. Cabral, Hikenia 3:21. 1999 (nom. nov. based on *Borreria filiforme* E.L. Cabral, Bonplandia 9:35. 1996, nom. illeg.); non *Borreria filiformis* (Hiern.) Hutch. & Dalziel, Fl. W. Trop. Afr. 2:135. 1931. TYPE: BRAZIL. "MATO GROSSO"[RONDONIA]: Serra da Paca Nova, extreme North of Mato Grosso [this area is part of the state of Rondonia], cabeceira do Rio Cantario, Mar 1917 (fl, fr), *"Rondon" [J.G. Kuhlmann] 2337* (HOLOTYPE: R! 53522; ISOTYPE: CTES n.v.).

*Taxonomic observations.*—This species is similar to *Spermacoce neotenuis* Govaert (see below), from which it could be distinguished by the glomerules 1–3 mm in diameter (vs. 3–15 mm in diameter in *S. neotenuis*), 2-lobed calyx (vs. 4-lobed), corollas 1.5–1.7 mm long (vs. 6–7 mm long), and filaments 0.5–0.7 mm long (vs. anthers sessile or subsessile, filaments to 0.2 mm long).

*Distribution and ecology.*—Species know only from the type, collected in the Serra dos Pacaás Novos, state of Rondonia.

**4. Spermacoce dimorpha** (J.H. Kirkbr.) Delprete, comb. nov. *Borreria dimorpha* J.H. Kirkbr., Brittonia 49:373. 1997. TYPE: BRAZIL. GOIÁS: Mun. Alto Paraíso, Chapada dos Veadeiros, a 9 km da cidade, rod. GO-118 para Teresina de Goiás, 14°03'02"S, 47°31'26"W, 1520 m, 28 Jul 1994 (fl, fr), *A. Silva et al. 2117* (HOLOTYPE: IBGE!; ISOTYPE: US!).

*Distribution and ecology.*—Apparently known only from the type. Small, annual herb, growing in open fields, below the grass layer.

**5. Spermacoce incognita** (E.L. Cabral) Delprete, comb. nov. *Borreria incognita* E.L. Cabral, Opera Bot. Belg. 7:322. 1996. TYPE: BRAZIL. GOIÁS: Mun. Campo Alegre, Rod. BR-050, km 222, 6 Feb 1994 (fl, fr), *G. Hatschbach & J. Silva 59881* (HOLOTYPE: MBM!; ISOTYPES: CTES n.v., SI n.v.).

Selected specimens studied: **BRAZIL: Goiás:** Chapada dos Veadeiros, 40 km N of Veadeiros, 1000 m, 16 Mar 1969 (fl), *Irwin et al. 24512* (NY, UB); Mun. São João da Aliança, 3 km S of São João da Aliança, 850 m, 14 Mar 1971 (fl), *Irwin et al. 31719* (NY, UB). **Tocantins:** Mun. Arraias, rd. Arraias-Paraná, 22 km NW of Arraias, 12 Feb 1994 (fl), *Hatschbach 60426* (MBM).

*Distribution and ecology.*—Endemic to central Brazil, and known from the states of Minas Gerais, Goiás, and Tocantins. Small herb, seldom collected because of its inconspicuous habit, restricted to open grassy fields ("campos limpos"), on sandy soils.

**6. Spermacoce irwiniana** (E.L. Cabral), Delprete, comb. nov. *Borreria irwiniana* E.L. Cabral, Bonplandia 9(1–2):36. 1996. TYPE: BRAZIL. TOCANTINS [AS "GOIÁS"]: ca. 27 km S of Paraíso [now Paraíso do Tocantins; ca. 10°22'S, 48°52'W], gallery forest, ca. 500 m, 22 Mar 1968 (fl), *Irwin, Maxwell & Wasshausen 21617* (HOLOTYPE: NY!; ISOTYPE: F n.v.).

Additional specimen examined: **BRAZIL: Tocantins:** Mun. Araguaína, BR-153, Km 1095, 5 Km S of Araguaína, 7°13'S, 48°14'W, 210 m, 9 Feb 1982 (fl), *Krapovickas et al. 37839* (UB).

*Distribution and ecology.*—Rare species, known from only two collections from the central and northern portion of the state of Tocantins: one from sandy soil among rocky outcrops, and the other from the margin of gallery forest.

**7. Spermacoce multiflora** (DC.) Delprete, comb. nov. *Diodia multiflora* DC., Prodr. 4:564. 1830. *Borreria multiflora* (DC.) Bacigalupo & Cabral, Opera Bot. Belg. 7:307. 1996. TYPE: BRAZIL: Locality, date, and collector unknown s.n. (HOLOTYPE: G-DC!).

Selected specimens examined: **BRAZIL: Distrito Federal:** Brasília, Área do Zoobotânico, 10 Jan 1967 (fl, fr), *Duarte 10118* (UB); Brasília, REIBGE, 30 Mar 1981 (fr), *Heringer et al. 6678* (IBGE); Sobradinho, próximo ao Rio Torto, 975 m, 7 Jan 1966 (fl), *Irwin et al. 11429* (NY, UB); Planaltina, 12 km S de Planaltina, DF-13, 1000 m, 21 Feb 1970 (fl-fr), *Irwin et al. 26464* (NY, UB); Atoleiro, 15°40'S, 47°40'W, 900 m, 26 Jan 1972 (fl, fr), *Kirkbride 1701* (NY, UB); near Cachoeira da Forquilha, Ribeirão-Sobradinho, 15°44'S, 47°44'W, 990 m, 6 Apr 1983 (fr), *Kirkbride 5178* (UB); Brasília, Ponte do Lago Paranoá, near Seminário D. Bosco, 14 Mar 1990 (fr), *Silva et al. 965* (IBGE). **Goiás:** Serra Dourada, 2 Jan 1965 (fr), *Heringer 10940* (UB); Mun. Corumbá de Goiás, Serra dos Pireneus, 12 km N de Corumbá de Goiás, 1000 m, 17 Jan 1972 (fl, fr), *Irwin et al. 34416* (NY, UB); Mun. Mossâmendes-Goiás, Serra Dourada, Área da UFG, campo rupestre, 2 Jan 1970 (fl, fr), *Rizzo 4630* (UFG); Mun. Jataí, 16 Jan 1973 (fl-fr), *Rizzo 8733* (UB, UFG).

*Taxonomic observations.*—Bacigalupo and Cabral (1996) transferred several species traditionally positioned in *Diodia* and *Hemidiodia* to *Borreria* subgenus *Dasycephala*; e.g., *B. gardneri* (K. Schum.) Bacigalupo & Cabral, *B. hyssopifolia* (Willd. ex Roem. & Schult.) Bacigalupo & Cabral, *B. ocymifolia* (Willd. ex Roem. & Schult.) Bacigalupo & Cabral, and *B. spicata* (Miq.) Bacigalupo & Cabral. They characterized this subgenus by having "fruits septicidally dehiscing into two mericarps, each mericarp indehiscent and with a median longitudinal preformed line of dehiscence on the ventral surface or exceptionally one of them opening at the base." This definition is encompassed in the present delimitation of the genus *Spermacoce*, and therefore the new combinations *Spermacoce multiflora* (DC.) Delprete and *S. spicata* (Miq.) Delprete (see below) are here proposed.

*Distribution and ecology.*—Widespread in South America, from Colombia, Venezuela, the Guianas, Brazil, Bolivia, and Paraguay. Herb or subshrub, 50–100 cm tall, erect, climbing or decumbent, usually found at margins or inside gallery forests.

**Spermacoce neotenuis** Govaerts, World Checklist Seed Pl. 2:18. 1996. *Borreria tenuis* DC., Prodr. 4:543. 1830; non *Spermacoce tenuis* Sessé & Moç., Fl. Mexic.: 25. 1893. TYPE: BRAZIL: Locality unknown, s.d. [1818–1819], *Pohl s.n.* (HOLOTYPE: G-DC).

*Borreria gracillima* DC., Prodr. 4:543. 1830, **syn. nov.** *Spermacoce gracillima* (DC.) Delprete, Rev. Biol. Neotrop. 3:72. "2006" [2007]. TYPE: BRAZIL. [GOIÁS OR TOCANTINS]: Locality unknown, s.d. [1818–1819], *Pohl s.n.* (HOLOTYPE: G-DC; ISOTYPE: F n.v.).

Selected specimens examined: **BRAZIL: Goiás:** Mun. Monte Alegre, 8 km W of Monte Alegre, 600–700 m, 11 Mar 1973 (fl), *Anderson 6844* (NY, UB); Mun. Cavalcante, Chapada dos Veadeiros, 8 km S of Cavalcante, 1000 m, 10 Mar 1969 (fl), *Irwin et al. 24189* (NY, UB); Mun. Ponte Alta, 15 Mar 1974 (fl), *Rizzo 9666* (UFG). **Tocantins:** Mun. Ipueiras, near Rio Tocantins, 11°14'S, 48°27'W, 6 Dec 2001 (fl), *E.A. Soares et al. 1858* (HTO, UFG); Mun. Ipueiras, near Rio Formiga, 11°15'S, 48°26'W, 20 Dec 2001 (fr), *E.A. Soares et al. 1966* (HTO, UFG).

Specimens cited by Schumann (1888): **BRAZIL: Tocantins:** "São João da Palma" [now Paranã], s.d. [1818–1819], *Pohl 1242* (B†); **Goiás or Tocantins:** "prope Gamelleira", s.d. [1818–1819], *Pohl 1916* (B†); "Rio Reason" [now Rio Razão], s.d. [1818–1819], *Pohl 2292* (B†).

*Taxonomic observations.*—In agreement with Schumann [1888, p. 45–47, tab. 75, fig. I (*B. tenuis*), fig. II (*B. gracillima*)], Cabral & Bacigalupo (1996) maintained *Borreria gracillima* DC. and *B. tenuis* DC. as distinct species. In their dichotomous key, they indicated that *B. gracillima* has corollas 4.5–4.8 mm long, but in the description they wrote that the corollas are 4–4.8 mm long. Aside from this, in the key they distinguished *B. tenuis* from *B. gracillima* by the corollas 2.5–4.5 mm long (vs. 4–4.8 mm long in *B. gracillima*), corolla lobes longer then the tube (vs. shorter then the tube), and leaf blades 0.3–0.5 mm wide with scabrous margin (vs. 0.5 mm wide and glabrous). After careful comparison of more than 50 herbarium specimens and personal observations of natural populations, I concluded that all the characters used by Cabral and Bacigalupo to separate the two taxa are widely overlapping. For example, several populations on white sand areas near the city of Ipueiras (state of Tocantins), were observed to have leaves varying from linear to narrowly lanceolate (from 0.2 to 5 mm wide, sometimes even on the same individual), completely glabrous or with scabrous margins, and corollas ranging from 3 to 5 mm long. Therefore, the two taxa are here treated as synonymous.

*Distribution and ecology.*—Endemic to central Brazil, known from the states of Mato Grosso, Tocantins, and Goiás. Delicate, single-stemmed or few-branched herb, mostly found in seasonally flooded fields, on sandy soils and white sand areas of alluvial origin.

**8. Spermacoce paraensis** (E.L. Cabral & Bacigalupo) Delprete, comb. nov. *Borreria paraensis* E.L. Cabral & Bacigalupo, Darwiniana 37:268. 1999. TYPE: BRAZIL. PARÁ: Marabá, Alto da Serra, 12 May 1982 (fl, fr), *R. Secco, C. Sperling, M. Condon, A. Mesquita, B. Gilberto & L. Marinho 117* (HOLOTYPE: MG!; ISOTYPES: CTES n.v., NY!, SI n.v.).

Selected specimens examined: **BRAZIL: Bahia:** "Ad Cabulla", Aug 1834 (fl, fr), *Martius 601* (NY). **Pará:** Marabá, Serra dos Carajás, 6°00'S, 50°18'W, 700 m, 22 May 1969 (fl), *P. Cavalcante 2107* (NY); Marabá, Serra dos Carajás, 1 Apr 1977 (fl), *P. Silva et al. 2994* (NY); 5 km W of AMZA, 6°04'S, 50°10'W, 700–800 m, 15 May 1982 (fl, fr), *Sperling et al. 5595* (NY).

*Distribution and ecology.*—It is known only by a few collections from the states of Pará and Bahia, and it may also occur in northern Tocantins.

**Spermacoce perangusta** (S. Moore) Delprete, Rev. Biol. Neotrop. 3:72. "2006" [2007]. *Borreria perangusta* S. Moore, J. Bot. 42:100. 1904. TYPE: BRAZIL. MATO GROSSO: Porto Murtinho, s.d., *A. Roberts 884* (HOLOTYPE: BM!).

*Geographic distribution.*—Apparently known only from the type, without any ecological observations available.

**9. Spermacoce pulchristipula** (Bremek.) Delprete, comb. nov. *Diodia pulchristipula* Bremek., Rec. Trav. Bot. Néerl. 33:713. 1936. *Borreria pulchristipula* (Bremek.) Bacigalupo & E.L.Cabral, Bol. Soc. Argent. Bot. 34:151. 2000. TYPE: SURINAME: Sipaliwini Savanna, Camp XI, near the Brazilian border, 10 Dec 1935 (fl, fr), *Rombouts 360* (HOLOTYPE: U!; ISOTYPE: US!; photo-US at NY!).

Selected specimens examined: **GUYANA:** Rupununi River, N of Shea, 2°57'N, 59°09'W, 190 m, 20 Jan 1994 (fl, fr), *Jansen-Jacobs et al. 3286* (NY, U, US). **SURINAME:** Sipaliwini Savanna, 27 Aug 1966 (fl, fr), *Donselaar 3631* (U). **BRAZIL: Distrito Federal:** Brasília, REIBGE, ponte do corujão, na margem do Córrego Roncador, 28 Feb 1978 (fr), *Heringer et al. 370* (IBGE). **Goiás:** Between Jataí and Caiapônia, 40 km from Caiapônia, 28 Jun 1966, *Hunt 6259* (UB); Alto Paraíso, 21 Mar 1969, *Irwin 24810* (UB). **Tocantins:** near Natividade, Jan 1840, *Gardner 3241* (BM); Uruaçu BR-153, km 256, 14°30'S, 49°08'W, 3 Mar 1982, *Krapovickas et al. 38142* (CEN); Mun. Pirenópolis, Serra dos Pireneus, lateral rd towards Fazenda Portal do Lazaro, towars Cachoeira do Coqueiro, area permanently flooded, 15°47'29"S, 48°54'01"W, 1020 m, 26 Mar 2006 (fl, fr), *P.G. Delprete & L.B. Bosquetti 9672* (CTES, HTO, K, MO, NY, R, RB, UB, UFG); Mun. Presidente Kennedy, road from highway BR-153 to Itaporá, 12 km W of Presidente Kennedy, Faz. Primavera, 3 Feb 1980, *Plowman et al. 8349* (UB).

*Distribution and ecology.*—Amply distributed in South America, from Suriname throughout Brazil, Bolivia (Beni, Santa Cruz) and Paraguay (Amambay, Caaguazú, Central, Cordillera, Paraguarí, San Pedro). In Brazil it is known from the states of Pará, Tocantins, Mato Grosso, Goiás to São Paulo. Present in grassy fields, sometimes seasonally flooded, borders of water courses, and margins of gallery forests.

**Spermacoce scabiosoides** (Cham. & Schltdl.) Kuntze, Revis. Gen. Pl. 3:123. 1898 (como "scabiosodes"). *Borreria scabiosoides* Cham. & Schltdl., Linnaea 3:318. 1828. TYPE: BRAZIL. RIO DE JANEIRO: WITHOUT LOCALITY, S.D., *SELLOW S.N.* (HOLOTYPE: B†, photo at NY!).

*Borreria scabiosoides* var. *glabrescens* Huber, Bull. Soc. Bot. Genève 6:211. 1914, **syn. nov.** TYPE: BRAZIL. PARÁ: "Arumandaba" [Arumanduba], flooded field, 3 May 1903 (fl), *A. Ducke 3556* (HOLOTYPE: MG!).

*Borreria anderssonii* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 7:245. 1931, **syn. nov.** *Borreria scabiosoides* var. *anderssonii* (Standl.) Steyerm., Acta Bot. Venez. 6:194. "1971" [1972]. TYPE: ECUADOR: Puna Island, near Guayaquil, 1852 (fl, fr), *N.J. Andersson 71* (HOLOTYPE: S!).

*Borreria flexuosa* E.L. Cabral, Bonplandia 9:36, fig. 2. 1999, **syn. nov.** (non *Spermacoce flexuosa* Lour., Fl. Cochinch.: 79. 1790). TYPE: BRAZIL. MATO GROSSO: Cuiabá, Santarem Road, next to BR-163, km 601, artificial wet area, 22 Feb 1977 (fl), *J.H. Kirkbride & E. Lleras 2986* (HOLOTYPE: NY!; ISOTYPES: BR!, F n.v.).

*Taxonomic observations.*—Cabral (1999) distinguished *Borreria flexuosa* E.L. Cabral from *Spermacoce scabiosoides* (Cham. & Schltdl.) Kuntze because of the leaves 1–2 mm wide and without secondary veins (vs. 5–8 mm wide and with 4–5 veins each side in *S. scabiosoides*), stipular setae 0.5–3.5 mm long (vs. 3–4 mm long), and white corollas (vs. pale blue). However, the variation among the three varieties of *B. scabiosoides* recognized by Steyermark and *B. flexuosa* is within the degree of variation seen in several natural populations in the state of Tocantins. In large populations of *S. scabiosoides* (Mun. Lagoa da Confusão, *Delprete et al. 6542* and *6558*), growing in standing water 30–70 cm deep, it has been personally observed that the habit and leaf shape of this species is quite variable, even within the same individual. Generally, the submersed

leaves tend to be slightly narrower, and with 1–2 or no secondary veins, while the emerged ones are usually slightly wider and with (1–)2–4 secondary veins. Also, in the same large populations, the plants growing at the margins of the flooded area had narrower, sturdier stems, while the submersed plants had succulent to sub-succulent stems. Therefore, all the taxa mentioned above are here treated as synonymous, and no subspecific rank is recognized within the species.

Selected specimens examined: **BRAZIL: Tocantins:** Mun. Lagoa da Confusão, 1 km W da cidade, 10°47'S, 49°37'W, 170 m, area seasonally flooded, 17 Aug 1998 (fl), *Delprete et al. 6542* (NY, UFG); Mun. Lagoa da Confusão, Fazenda Trindade, ca. 35 km de Lagoa da Confusão, 10°39'S, 49°51'W, 210 m, flooded area at the margin of a forest, 18 Aug 1998 (fl), *Delprete et al. 6558* (NY, UFG); Mun. Palmas, Córrego Santa Luzia, 22 Mar 2000 (fl, fr), *E.A. Soares et al. 607* (HTO).

**Spermacoce schumanniana** (Taub. ex Ule) Govaerts, World Checklist Seed Pl. 2:18. 1996. *Borreria schumanniana* Taub. ex Ule in Cruls, Rapp. Comm. Expl. Plat. Centr. Bresil: 351. 1894. TYPE: BRAZIL. GOIÁS: "Auf freien stellen an Paranahyba" [open fields near Rio Paranaíba], Feb 1893 (fl, fr), *Ule 2960* (LECTOTYPE here selected: HBG; HOLOTYPE: B†).

*Taxonomic observations.*—Cabral & Bacigalupo (1999) reported that *Borreria schumanniana* was originally published by Ule in "Bot. Jahrb. Syst. 21:453. 1895," but this name was first published by Ule a year earlier (see above). The same authors, knowing that the HOLOTYPE: *Ule 2960*, deposited at B was destroyed during WWII, assumed that no duplicates of this collection are to be found. Therefore, they proceeded in selecting *Ule 427* (P) as a neotype, which is a collection made from practically the same location of the holotype. However, at the HBG herbarium is kept a complete set of Ule up to collection number *7575*, and among them is present a duplicate of *Ule 2960*, that is here selected as the lectotype of this species.

Selected specimens examined: **BRAZIL: Goiás:** Mun. Calda Novas, Serra de Calda Novas, 28 Feb 1970 (fl), *Rizzo & Barbosa 4801* (UFG, UB); Mun. Cristalina, Serra dos Topázios, 20 km antes de Cristalina, rod. Brasília-Belo Horizonte, campo rupestre, local arenoso, 26 Apr 1973 (fl, fr), *Rizzo 9014* (UFG); Chapada dos Veadeiros, 4 May 1972 (fl), *Rizzo 8077* (UFG); Mun. Mossâmendes, Serra Dourada, da Reserva Biológica até os Córregos Cafundó e Piçarrão, 18 Oct 1994 (fl, fr), *Rizzo 11088* (UFG).

**10. Spermacoce semiamplexicale** (E.L. Cabral) Delprete, comb. nov. *Borreria semiamplexicale* E.L. Cabral, Bonplandia 9:37, fig. 4. 1996. TYPE: BRAZIL. PARÁ: 25 km NW of camp at Serra Norte, ca. 5°54'S, 50°37'W, 13 Dec 1981 (fl), *D. Daly, R. Callejas, M.G. da Silva, E. Taylor, C. Rosario & M. dos Santos 1993* (HOLOTYPE: NY!; ISOTYPE: CTES n.v.).

*Distribution and ecology.*—A species characterized by the basally overlapping, cordate to auriculate involucral bracts. It is known only from the type, collected in flooded grassy fields from the state of Pará, and it may occur also in northern Tocantins.

**11. Spermacoce tocantinsiana** (E.L. Cabral & Bacigalupo) Delprete, comb. nov. *Borreria tocantinsiana* E.L. Cabral & Bacigalupo, Kew Bull. 59:277. 2004. TYPE: BRAZIL. TOCANTINS: Mun. Conceição do Tocantins, Faz. Cartão de Visita, 11 May 2000 (fl), *Hatschbach, Schinini & Barboza 70928* (HOLOTYPE: MBM!; ISOTYPES: CTES n.v., SI n.v.).

*Distribution and ecology.*—Apparently known only from the type. Annual herb, found in open grassy fields, in sandy soils.

**12. Spermacoce spicata** (Miq.) Delprete, comb. nov. *Diodia spicata* Miq., Stirp. Sur. 179, t. 52. 1850. *Dasycephala spicata* (Miq.) Hook. f. in Benth. & Hook. f., Gen. Pl. 2:144. 1873. *Borreria spicata* (Miq.) Bacigalupo & Cabral, Opera Bot. Belg. 7:307. 1996. TYPE: SURINAME: Bergendaal, s.d. (fl, fr), *Focke 1140* (HOLOTYPE: U!; PROBABLE ISOTYPE: K!; photo-K at NY!).

Selected specimens examined: **SURINAME:** Brakopondo Distr., Brownsberg Nature Park, trail to Mazaruni Valley, 4°56'N, 55°11'W, 400–450 m, 24 Jan 1999 (fl, fr), *Delprete et al. 7083* (BBS, MO, NY); along Makambie Creek, ca. 121 km of railro ad, 21 Mar 1951, *J. Florschuütz & P.A. Florschuütz 1877* (NY, U); Sipaliwini savanna area on Brazilian frontier, 280 m, 14 Jan 1969 (fl, fr), *Oldenburger et al. 933* (NY, U). **FRENCH GUIANA:** Saül, rd between Saül and airport, 3°37'N, 53°12'W, 200–400 m, 2 Sep 1994, *B.M. Boom 10728* (CAY, NY). **GUYANA:** 5 mi N of Tunuwan, E. Kanuku Mountains, ca. 110 m, 6 Sep 1958, *Cook 107* (NY); Kamakusa, Upper Mazaruni River, ca. 59°50'W, 23–29 Nov 1922, *De La Cruz 2808* (NY); Rupuruni Distr., Eastern Kanuku Mountains, NE of Warimure, 23 Jan 1991 (fl, fr), *Jansen-Jacobs et al. 2189* (NY, U); Rupuruni Distr., Kanuku Mountains, Crabwood Creek, Camp 2, 4 Feb 1994 (fl, fr), *Jansen-Jacobs et al. 3564* (NY, U); Basin of Shodirak Creek (Essequibo River tributary), 1°18'N, 8–22 Jan 1938, *A. C. Smith 2894* (NY).

*Morphological observations.*—The fruit of this species, at maturity, dehisces acropetally (from the pedicel upwards), up to the medial portion of the capsule. The two cocci remain attached to each other at the medio-distal

portion. Often the whole fruit, divided at base or still unopened, falls off with the pedicel, functioning as a dispersal unit.

*Distribution and ecology.*—Apparently endemic to the Guianas, but it might be present also in contiguous areas in southern Venezuela and northern Brazil.

**Spermacoce wunschmannii** (K. Schum.) Kuntze, Revis. Gen. Pl. 3(2): 123. 1898. *Borreria wunschmannii* K. Schum. in Mart., Fl. Bras. 6(6): 53. 1888. TYPE. BRAZIL: TOCANTINS: "prope Porto Real" [now Porto Nacional], s.d. [Nov 1828–Apr 1829], *Burchell 8683* (LECTOTYPE [selected by Cabral & Bacigalupo 2005]: BR!).

Selected specimens examined: BRAZIL: **Tocantins:** "inter Funil et São João ad fluvium Tocantins," s.d. [1828–1829], *Burchell 8950* (BR) and *8977* (BR); Mun. Mateiros, Região do Jalapão, 10°33'S, 46°45'W, 400 m, 8 May 2001 (fl), *C. Proença et al. 2492* (UB, UFG); Mun. Mateiros, Região do Jalapão, 10°33'S, 46°45'W, rd. between Ponte Alta and Mateiros, near Rio Novo, 8 May 2001 (fl), *A.B. Sampaio et al. 515* (UFG).

*Distribution and ecology.*—Species known to occur in the state of Tocantins, and recently reported by several collections from the lowlands of Bolivia, Santa Cruz (Cabral & Bacigalupo 2005). It is therefore expected to occur also in the state of Mato Grosso. In Tocantins, aside from the historical material, it is also known by two recent collections from the Jalapão Region, in seasonally flooded fields on white sands of alluvial origin.

## ACKNOWLEDGMENTS

This work was undertaken during a fellowship for Visiting Scientist from the National Counsel of Technological and Scientific Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq) of the Brazilian Government (grant 309885/2003-5), at the Federal University of Goiás (UFG), under the coordination of Vera Lúcia Gomes-Klein (UFG). Research at the Nationaal Herbarium Nederland, Utrecht University branch (U), in 2004, was supported by a fellowship from the Netherlands Organization for Scientific Research NWO (grant B 85-368; Rubiaceae treatment for the *Flora of the Guianas*), under the coordination of Marion Jansen-Jacobs (U). My gratitude also goes to Rob van Aubel (U) and Hendrik Rypkema (U) for help in finding and reproducing relevant taxonomic literature. The directors and curators of the following herbaria are kindly acknowledged for loan of material, sending digital images, and/or providing working space during my visits: BR, CPAP, CTES, F, G, HTO, IBGE, K, MBM, NY, NX, R, RB, S, U, UB, UFG, UFMT, and US. I am very grateful to Joseph Kirkbride (USDA) and Steven Dessein (BR) for their careful and efficient revision of the manuscript, and to Guy Nesom (BRIT) and Barney Lipscomb (BRIT) for reviewing and editing the final version of this work.

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