



## Intraspecific variation of insertion/length of stamens in homostylous flowers of a new species and three other species of *Borreria*: an unusual case in Rubiaceae<sup>#</sup>

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### Abstract

Four species of *Borreria* subsection *Latifoliae* (Rubiaceae) present intrafloral variations in the insertion/length of stamens in homostylous flowers. *Borreria heteranthera* is described and illustrated as new species from the state of Pará, Brazil. The emended descriptions of *Borreria hispida*, *B. semiamplexicaule* and *B. xanthophylla*, with details on stamens morphology and insertion, are provided. The inclusion of *B. xanthophylla* in the subsection *Latifoliae* is proposed. Staminal arrangement, pollen grains and seed morphology of the four species are compared. A comparative table with ecological, palynological, and morphological features of each species is provided. In addition, *Borreria semiamplexicaule* is mentioned as a new record for the state of Mato Grosso, Brazil, and the lectotype of *B. hispida* is here designated.

**Key words:** *Borreria* subsect. *Latifoliae*, *Borreria heteranthera*, *Borreria hispida*, *Borreria semiamplexicaule*, *Borreria xanthophylla*, Brazil, French Guiana, stamen organization, pollen grains, seed morphology, Spermaceae, Spermaceae

### Introduction

*Borreria* Meyer (1818: 79) belongs to tribe Spermaceae, Rubiaceae. About 100 species of this Neotropical genus are distributed in the Americas, ranging from southern United States to southern Uruguay and central Argentina. Brazil is the country with the highest diversity, where ca. 77 species are found (Bacigalupo & Cabral 2007; Cabral & Salas 2013).

In the last decades, the taxonomic delimitation of *Borreria* and its relative *Spermaceae* Linnaeus (1753: 102) has been debated. This debate is due to morphological variation, incomplete understanding of the group, and divergent taxonomic views. Some authors consider the two taxa as separate genera based on morphological characters (Steyermark 1972; Bacigalupo & Cabral 1996, 2007; Bacigalupo *et al.* 2010; Cabral *et al.* 2010, 2011, 2012a, 2012b; Miguel & Cabral 2013; Salas *et al.* 2011). These authors circumscribe *Spermaceae s.str.* by having relatively small flowers arranged in pseudoaxillary glomerules, corolla lobes internally pilose, stamens sessile, style short, all included, and indehiscent capsules or capsules with only one dehiscent valve. These authors grouped ca. 10 American species with these features (Salas *et al.* unpubl. data) in the genus *Spermaceae*. In contrast, they consider *Borreria* as possessing relatively large flowers [except species that belong to *Borreria* section *Pseudodiodia* Hassler (1915: 166–167), which are under study (Salas *et al.* unpubl. data)], arranged in axillary and spherical glomerules, corolla lobes mostly glabrous or glabrescent, stamens with well-developed filaments, style long and exerted, and dehiscent capsules with both mericarps dehiscent septically or with indehiscent mericarps. According to these authors, while *Spermaceae s.str.* has zonocolporate pollen grains with long ectocolpi surrounded by spinules and endoapertures forming an endocingulum (Type 1 *sensu* Pire 1996), *Borreria* has several pollen types and is an eurypalynous genus (Pire 1996). In contrast, other authors treated *Borreria* as synonymous with *Spermaceae* [In the Paleotropics: Verdcourt (1976), Sivaraman *et al.* (1987), Dessein (2003), Dessein *et al.* (2003a, 2003b) and Harwood & Dessein (2005); in the Neotropics: Adams in Burger & Taylor (1993), Adams & Taylor (2012) Delprete (2007, 2010), Delprete *et al.* (2005) and Delprete & Cortés (2006)].

Recent molecular phylogenetic studies are inconclusive with respect to well supported clade delimitations and morphology. For example, the most comprehensive studies (Kårehed *et al.* 2008, Groeninckx *et al.* 2009) found that