

RE-ESTABLISHMENT, SYNOPSIS AND NEW COMBINATIONS IN THE GENUS *BIONIA* MART. EX BENTH. (LEGUMINOSAE: PAPILIONOIDEAE)

L. P. DE QUEIROZ¹

¹Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana, BR116 Km3, Feira de Santana, Bahia, 44031-460, Brazil. e-mail: lqueiroz@uefs.br

ABSTRACT

Bionia Mart.ex Benth. is a small genus of tribe Phaseoleae subtribe Diocleinae (Leguminosae). It was considered as a synonym of *Camptosema* W.J.Hook. & Arn. for the last 160 years. The genus is re-established based on previous phylogenetic analysis of the subtribe Diocleinae which showed that *Bionia* is unrelated to *Camptosema*. *Bionia* is distinct from *Camptosema* by macromorphological and palynological characters and is restricted to eastern and central Brazil. New combinations are presented here, resulting in a circumscription of *Bionia* including five species.

The genus *Bionia* Mart.ex Benth. was created by Bentham (1837) based on an earlier proposal by Martius based on herbarium sheets. In the same work, Bentham (1837) recognised seven species for this genus. Later, Bentham (1840, 1859) synonymised *Bionia* under *Camptosema* W.J.Hook. & Arn., a genus formerly proposed by Hooker & Arnott (1833), and classified *Camptosema* in tribe Phaseoleae subtribe Diocleinae (as Diocleae; Bentham 1865), position maintained in the more recent classifications of the Papilionoid legumes (Polhill 1994).

Subsequent authors accepted the circumscription of *Camptosema* as presented by Bentham (1859) and moved to *Camptosema* species of *Collaea* DC. (Burkart 1970), *Cratylia* Mart.ex Benth. (Burkart 1957) and *Galactia* P.Browne (Hassler 1919). As a result of these generic changes, *Camptosema* could be differentiated from other genera in the subtribe Diocleinae only by the red petals (Burkart 1970), although it is heterogeneous in vegetative, flower and fruit characters.

Queiroz et al. (2003) carried out cladistic analyses in the subtribe Diocleinae based on morphological characters. These studies indicated that *Camptosema* is polyphyletic (Figure 1), probably reflecting independent acquisitions of ornithophily in different lineages within Diocleinae (Queiroz et al. 2003). The type species of *Camptosema* (*C. rubicundum* W.J.Hook. & Arn.) and the related *C. paraguariense* (Chodat & Hassl.) Hassl. were supported as sister to a clade bringing together the species of *Galactia*, *Collaea*, *Lackeya* Fortunato, L.P.Queiroz & G.P.Lewis and some other species of *Camptosema*. The species of *Camptosema* sect. *Macropetalum* Benth. (*C. spectabilis* (Tul.) Burkart and *C. isopetalum* (Lam.) Taub.) were also supported as unrelated to the type species of *Camptosema* and appeared as sister to the genus *Cratylia*. The species of *Camptosema* previously ascribed to *Bionia* (sensu Bentham, 1837: *Camptosema bellum* (Mart.ex Benth.) Benth., *C. coccineum* (Benth.) Benth. and *C. coriaceum* (Nees & Mart.) Benth.) formed



Figure 1. Strict consensus of the 168 most parsimonious trees from a cladistic analysis of the Diocleinae based on morphological characters (Queiroz et al. 2003). Numbers above branches represent taxon jackknife support values and those below bootstrap values.

a monophyletic group, which in turn was sister to a clade composed by *Cymbosema* Benth. and representatives of *Dioclea* Kunth sect. *Dioclea* (*D. burkartii* R.H.Maxwell, *D. lasiophylla* Mart.ex Benth., *D. macrantha* Huber, *D. sericea* Kunth and *D. virgata* (Rich.) Amshoff).

Studies in pollen morphology reinforce the distinction between *Bionia* and *Camptosema*. Queiroz (1999) investigated pollen morphology of four species of *Camptosema* formerly included in *Bionia*: *C. coccineum*, *C. coriaceum*, *C. pedicellatum* Benth. and *C. tomentosum* Benth. These species have heteropolar pollen, triangular amb and reticulate exine at the mesocolp and microrreticulate to perforate exine at the apocolp (Figure 2). They are distinctive in these characters with respect both to the species of *Camptosema* sect. *Macropetalum* (*C. spectabile*) and to the species included in the *Camptosema-Galactia* clade (*Camptosema ellipticum* (Desv.) Burkart, *C. paraguayense*, *C. rubicundum* and *C. scarlatinum* (Mart.ex Benth.) Burkart). *Camptosema spectabile* has pollen slightly heteropolar with the exine perforate-rugulate, similar to the one found in *Cratylia* (Kavanagh & Ferguson, 1981; Queiroz, 1999). The remaining species of *Camptosema* have isopolar pollen with reticulate or microreticulate exine and circular amb (Figure 2). Heteropolar pollen grains are also found in *Cymbosema* and in *Dioclea* sect. *Dioclea* (Kavanagh & Ferguson 1981) and further reinforce the close relationship among these taxa and the species formerly ascribed to genus *Bionia*.

The re-establishment of the genus *Bionia* is formally proposed here based on the results the cladistic analysis mentioned above (Queiroz et al. 2003) and supported by distinctive macromorphological and palynological characters. This genus may be diagnosed by inflorescences with swollen brachyblasts, flowers with long tubular calyx (the calyx tube longer than the lobes),

glabrous at the inner surface, petals red and glabrous, standard straight and kept longitudinally folded in the mature flower, without basal auricles, pollen heteropolar and ovarium long stipitate (stipe at least of the same length of the ovarium).

Bionia Mart. ex Benth. Comm. Legum. Gen.: 66. 1837. Type species (lectotype here designated): *Bionia coccinea* Mart. ex Benth.

Low **shrubs** with virgate, little ramified branches, with or without underground woody rhizomes, less frequently twinning vines with branches woody or slightly woody. **Stipules** persistent, usually with secreting swollen base. **Leaves** pinnately trifoliolate and petiolate, stipellate, rarely unifoliolate, or simple and sessile, exstipellate. **Inflorescence** a nodose pseudoraceme; first order bracts (at the base of the brachyblasts) lanceolate with secreting base, usually persistent; second order bracts (at the base of the flower) flabellate, caducous; bracteoles flabellate, semi-persistent; brachyblasts woody, swollen, capitate, 6-9-flowered. **Flowers** 2.5-4.0cm long, showy; flower buds lanceolate with narrow acuminate apex; **calyx** cylindrical, tube longer than lobes, outer surface glabrous to slightly indumented, inner surface glabrous, lobes triangular with acute to acuminate apex; **petals** dark red to orange-red, glabrous; standard narrowly elliptical, without callus on the lamina, base not auriculate; wings oblong-linear to linear, free from the keel, base sagittate to auriculate; keel petals joined near the apex of the lower margin, free at the upper margin, base sagittate to auriculate; **androecium** pseudomonadelphous, with the 10 stamens joined in a tube but the vexillar one free at the base; staminal tube straight; anthers uniform, glabrous; **ovarium** straight, densely indumented,

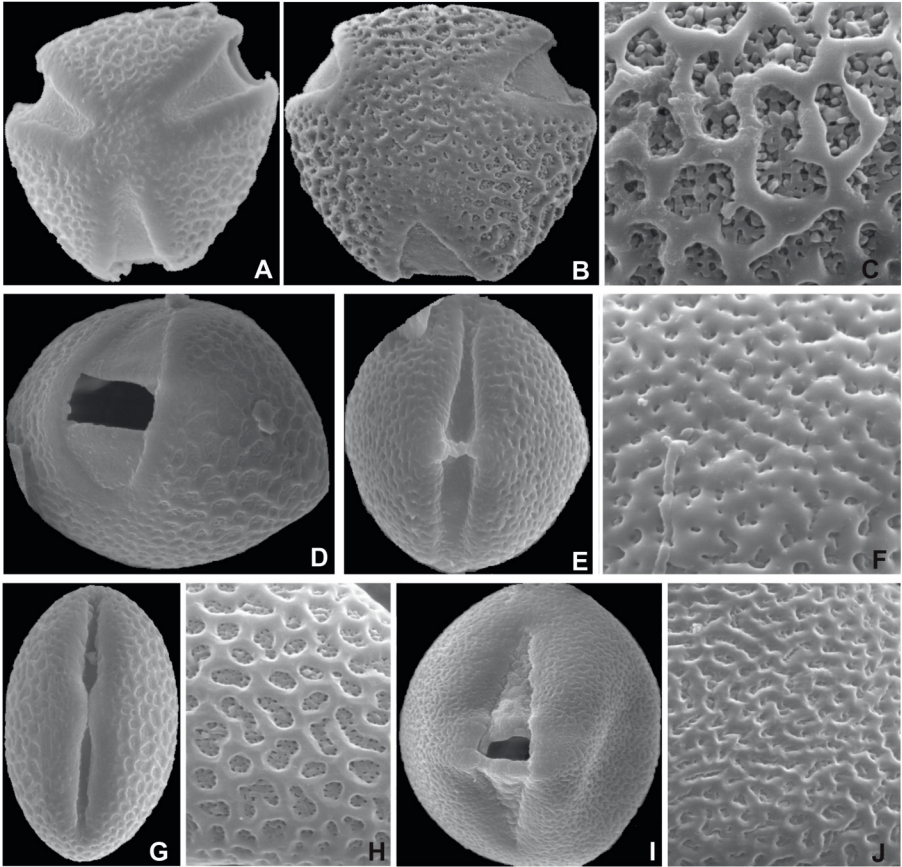


Figure 2. Aspects of pollen morphology of selected species of the *Camptosema - Bionia* complex (Queiroz 1999). A-C: *Bionia coccinea*; A: polar view from the upper pole (x 2500); B: polar view from the lower pole (x 2500); C: exine at the mesocolp showing the reticulate sculpture and free collumelae (x 8000); D: *Bionia tomentosa*, equatorial view (x 2500); E-F: *Camptosema rubicundum*; E: equatorial view (x 2500); F: exine at the mesocolp showing the perforate sculpture (x 8000); G-H: *Camptosema scarlatinum*; G: equatorial view (x 2500); H: exine at the mesocolp showing the reticulate sculpture (x 8000); I-J: *Camptosema spectabile*; I: equatorial view (x 2500); J: exine at the mesocolp showing the perforate sculpture (x 8000) (A-C, Mello-Barreto 5680, SP; D, Scatenna et al. CFCR 10613, SPF; E-F, Pirani & Yano 502, SPF; G-H, Mello-Silva et al. 107, SPF; I-J, Pirani & Mello-Silva 2821, SPF).

long stipitate, the stipe equal or longer than the ovary; style straight, glabrous; stigma truncate. **Fruit** a legume with elastic dehiscence, the valves becoming longitudinally twisted to release the seeds, linear, apex with the remaining of the style persistent as an incurved rostrum, margins slightly undulated between the seeds; valves woody, constricts between the seeds, densely indumented; endocarp forming translucent packages around the seeds. Seeds compressed, lenticular, suborbiculate; testa coriaceous, smooth, brownish; hylum oblong, subterminal.

The genus includes five species ranging from the mountains of Eastern Brazil (States of Ceará, Pernambuco, Bahia, Minas Gerais and Espírito Santo) to Central Brazilian Plateau (States of Goiás, Tocantins, Maranhão and Distrito Federal).

SYNOPSIS OF THE GENUS

Bionia bella Mart. ex Benth., *Comm. Legum. Gen.*: 66. 1837. *Camptosema bellum* (Mart. ex Benth.) Benth. in *Mart., Fl. bras.* 15(1): 156. 1859. Holotype: Brazil. Minas Gerais: “ad Vila Rica”, *Martius Herb. Fl. Bras.* 845 (holotype: M !, photo: F, G, HUEFS, US).

Bionia coccinea Mart. ex Benth., *Comm. Legum. Gen.*: 66. 1837. *Camptosema coccineum* (Mart. ex Benth.) Benth., *J. Bot. (Hooker)* 2: 60. 1840. *Camptosema coccineum* var. *glabrum* Benth. in *Mart., Fl. bras.* 15(1): 154. 1859. *nom. superfl.* Holotype. Brazil. Minas Gerais: “inter Columbi et Tejuco, Serro Frio”, *Martius Herb. Fl. Bras.* 1391 (M !; photo: F, G, HUEFS, NY).

Bionia coccinea var. ***nitens*** (Benth.) L.P.Queiroz, **comb. nov.**

Basionym: *Bionia nitens* Benth., *Comm. Legum. Gen.*: 66. 1837. *Camptosema*

coccineum var. *nitens* (Benth.) Benth. in *Mart., Fl. bras.* 15(1): 154. 1859. Type: Brazil. Minas Gerais: “in Serro Frio”, *Vauthier 118* (holotype: K - Benth. !, isotypes: F !, G !, GH !, L !, P !, W !).

Bionia coriacea (Nees & Mart.) Benth., *Comm. Legum. Gen.*: 66. 1837. *Galactia coriacea* Nees & Mart., *Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur.* 12: 30. 1824. *Camptosema coriaceum* (Nees & Mart.) Benth. in *Mart., Fl. Brasil.* 15(1): 155. 1859. Holotype: Brazil: “ad valor in campis generalibus”, *Pr. Wied-Neuwied 134* (BR !, photo: HUEFS).

Bionia acuminata Benth., *Comm. Legum. Gen.*: 66. 1837. *Camptosema acuminatum* (Benth.) Benth. in *Mart., Fl. bras.* 15(1): 155. 1859. Type: Brazil. Goiás (fide Bentham): “ad Congo do Padre”, *E. Pohl 2004* (holotype: K - Benth.!, isotypes: M !, W !, fragment F; photo of the holotype: C, GH, NY, S; photo of the isotype at W: F, US), *syn. nov.*

Bionia marginata Benth., *Comm. Legum. Gen.*: 66. 1837. Type: Brazil. Minas Gerais: “in sylvis Capoes deserti”, *Martius s.n.* (holotype: M !, isotype: M !, photo of the holotype: F, G, GH, HUEFS, MO, NY, US).

Bionia rigida Benth., *Comm. Legum. Gen.*: 66. 1837. Lectotype (chosen from the syntypes, here designated): Brazil. Minas Gerais: “in sylvis Capoes M. Morro de Villa Rica”, *Martius 445* (M !).

Camptosema ulei Harms in *Engl., Bot. Jahrb. Syst.* 42: 215. 1908. Type: Brazil. Bahia: “Serra do S. Ignacio”, *Ule 7220* (lectotype, chosen from the isotypes, here designated: HBG !, isolectotypes: G !, K !, L !; photo of the holotype formerly at B: F, G, GH, LIL, MO, NY, US; photo of the isotype at K: C, F, GH, NY, S).

Bionia pedicellata (Benth.) L.P.Queiroz, **comb. nov.**

Basionym: *Camptosema pedicellatum*

Benth. J. Bot. (Hooker) 2: 60. 1840. Type: Brazil. Ceará: *Gardner 1552* (holotype: K-Benth.!, isótipos: BM !, E !, F !, G !, GH !, K-Hook.!, L !, NY !, P !, S !, US !, W !; photo of the holotype: C, F, GH, HUEFS, US; photo of the isotype of G: F, IPA, MO, US)

Bionia tomentosa (Benth.) L.P.Queiroz, **comb. nov.**

Basionym: *Camptosema tomentosum* Benth. in Mart., Fl. bras. 15(1): 155. 1859. Lectotype (chosen from the syntypes, here designated): Brazil. Minas Gerais: “Serra de Itambé”, A. *Saint-Hilaire 324* (lectotype: K - Benth. !, isolectotypes: P !; photo of the lectotype: C, GH, NY, S; fragment of the isolectotype: F !).

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