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Revisão taxonômica e filogenia de *Poecilanthe s.l.* (Leguminosae, Papilionoideae, Brongniartieae)

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Dedico essa tese à minha família,

que está se lixando para as plantas,

mas me ensinou o que levo de mais importante

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RESUMO

Poecilanthe (Leguminosae, Papilionoideae, Brongniartieae) é em gênero sul-americano que inclui atualmente dez espécies. A heterogeneidade morfológica e química encontrada em *Poecilanthe* dificulta sua circunscrição e coloca em dúvida sua monofilia. Além disso, limites interespecíficos imprecisos e falta de chave de identificação dificultam o reconhecimento das espécies. Este trabalho tem como objetivos testar a monofilia de *Poecilanthe* e estabelecer as relações entre suas espécies, bem como revisar a taxonomia do gênero. Para tanto, uma análise filogenética de máxima parcimônia baseada em caracteres morfológicos e seqüências de ITS/5.8S (nrDNA) foi realizada. Como subsídio para a análise cladística, foi feito um estudo sobre a morfologia das sementes e embriões de *Poecilanthe*, que resultou no reconhecimento de quatro padrões distintos de morfologia. Os resultados da filogenia mostram que *Poecilanthe* não é um gênero monofilético, sendo composto por três clados parafiléticos em relação à tribo. Estes três clados foram caracterizados morfologicamente e considerados como gêneros distintos. *Poecilanthe* é recircunscrito para incluir apenas as espécies extra-amazônicas (*Poecilanthe s.s.*), compreendendo então seis espécies. O gênero *Amphiodon* é restabelecido, e *P. ovalifolia* combinada neste. Um gênero novo é descrito para incluir *P. amazonica* e *P. hostmannii*. Cada um destes gêneros foi tratado taxonomicamente, constando em cada tratamento descrições, ilustrações e chave para a identificação das espécies.

ABSTRACT

The genus *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae) currently comprises ten South-American species. The morphological and chemical diversity that is found within this genus renders its circumscription imprecise and brings *Poecilanthe*'s monophyly into question. This work aims to test the monophyly of *Poecilanthe* and to revise the taxonomy of the genus. A parsimony analysis based on both morphological and ITS/5.8S data was carried out. In order to provide characters to the cladistic analysis, the morphology of the seeds and embryos of *Poecilanthe* was analyzed, and resulted in the identification of four different morphological patterns. The phylogeny does not support *Poecilanthe* as monophyletic, but resolves three different well-supported lineages that are paraphyletic with respect to the tribe. These clades are morphologically characterized and ranked at the generic level. *Poecilanthe* is recircumscribed to include the six extra-Amazonian species only. The genus *Amphiodon* is reinstated and *P. ovalifolia* is combined. *Poecilante amazonica* and *P. hostmannii* are segregated into a new genus. Each genus was revised and descriptions, illustrations and identification key for the species are presented.

INTRODUÇÃO GERAL

Poecilanthe Benth. é um gênero neotropical de Leguminosae que compreende atualmente dez espécies. Nesta conceituação, o gênero inclui árvores e arbustos de folhas unifolioladas ou multifolioladas imparipinadas, folíolos alternos ou opostos, inflorescência racemosa ou paniculada, flores papilionáceas, cálice turbinado-campanulado com 5 lobos, sendo os dois superiores altamente conatos, alas mais longas que a quilha, estames monadelfos ou diadelfos com anteras subiguais ou dimórficas e pelo fruto deiscente (Meireles & Tozzi, in press)

O posicionamento taxonômico de *Poecilanthe* no nível de tribo é historicamente controverso. O gênero já foi subordinado às tribos Dalbergieae (Bentham, 1860; Lavin, 1987), Galegeae (Ducke, 1953), Millettieae (Geesink, 1981 [sob Tephrosieae], Polhill, 1994) e Robinieae (Geesink, 1984). Mais recentemente, evidências químicas (Greinwald *et al.*, 1995) e filogenias moleculares indicam que *Poecilanthe* está inserido na tribo Brongniartieae (Crisp *et al.*, 2000; Hu *et al.*, 2000; Hu *et al.*, 2002; Lavin *et al.*, 1998; Pennington *et al.*, 2001; Wojciechowski *et al.*, 2004; Lavin *et al.* 2005). Esta tribo faz parte do "clado genistóide *s.l.*" e engloba 152 espécies em dez gêneros, dos quais quatro americanos e seis australianos (Ross & Crisp, 2005).

Poecilanthe apresenta grande heterogeneidade morfológica que dificulta sua delimitação e coloca em dúvida sua unidade como um gênero monofilético. Diversos autores (Tozzi, 1994; Klitgaard, 1995; Ross & Crisp, 2005) sugerem que *Poecilanthe* seja composto por dois grupos, contrastando principalmente as espécies amazônicas e extra-amazônicas. Tal sugestão é baseada principalmente em indícios de perfis de alcalóides (Greinwald, 1995) e tipos de folha e inflorescência (Geesink, 1981). Dados sobre a morfologia das sementes e embriões (Kirkbride *et al.*, 2003) também corroboram essa divisão, mas apesar de interessantes, não foram explorados com profundidade. A despeito da suspeita de que *Poecilanthe* seja composto por dois grupos distintos, apenas uma espécie tem sido amostrada nos estudos filogenéticos (Wojciechowski *et al.* 2004), não permitindo fazer inferências sobre a monofilia do gênero.

Uma problemática em outro nível diz respeito ao reconhecimento de espécies, o que pode se dever a diferentes fatores. Um deles diz respeito à imprecisão de limites interespecíficos como observado para *P. falcata* (Vell.) Heringer e *P. grandiflora* Benth., que foram já consideradas como sinônimos (Bentham, 1860; Heringer, 1952; Ducke, 1953). Outro fator é a grande variação morfológica encontrada em uma mesma espécie, como citado por Lewis (1987) para *P. ulei* (Harms) Arroyo & Rudd. Por fim, a própria ausência de um tratamento taxonômico e chave que englobe de todas as espécies de *Poecilanthe* dificulta a determinação. Cabe ressaltar que o trabalho taxonômico mais abrangente para *Poecilanthe* ainda é o tratamento de Bentham (1862) na *Flora Brasiliensis*, que inclui apenas três das atuais dez espécies do gênero.

Sendo assim, esta tese tem como objetivos principais: **1)** Testar a monofilia de *Poecilanthe* e esclarecer as relações entre suas espécies, e **2)** Revisar taxonomicamente o gênero, estabelecendo limites específicos mais precisos, fornecendo chaves de identificação e verificando nomenclatura e tipificação.

Organização e considerações sobre a tese

Considerando o potencial taxonômico da morfologia de sementes de *Poecilanthe* mencionado por Kirkbride *et al.* (2003), foi realizado um estudo sobre a morfologia das sementes e embriões do gênero (**Capítulo 1**). Para testar a monofilia de *Poecilanthe*, foi realizada uma análise cladística (**Capítulo 2**) baseada em dados moleculares e morfológicos, incluindo os resultados gerados no primeiro capítulo. Frente aos resultados da filogenia, que sugerem a segregação de *Poecilanthe* em três gêneros, a parte taxonômica é apresentada em três capítulos distintos, tratando separadamente *Poecilanthe s.s.* (**Capítulo 3**), *Amphiodon* Huber (**Capítulo 4**) e o novo gênero, com o nome provisório de *Semnomea* Meireles & A.M.G. Azevedo (**Capítulo 5**).

Os diferentes capítulos estão citados nesta tese como: Meireles (chapter [1, 2, 3, 4, ou 5]). Quatro desses capítulos estão formatados nas normas das revistas para as quais serão submetidos. No entanto, alguns itens como a numeração das páginas, cabeçalho e rodapé, posicionamento de figuras, tabelas e suas legendas, foram padronizados para a tese inteira, independente das normas de cada revista. As figuras apresentadas no capítulo 3 estão inseridas em um anexo no final do capítulo, já que esta prancha não será submetida para publicação.

Esta tese não é considerada pelo autor como uma publicação com fins nomenclaturais e, consequentemente, as mudanças na nomenclatura e tipificação aqui apresentadas não são válidas para a ciência. A extração de DNA, PCR e sequenciamento do ITS (capítulo 2) foram realizadas pelo Dr. Matt Lavin em Montana, e as etapas seguintes (alinhamento das seqüências e análise filogenética em si) realizadas pelo autor.

Referências bibliográficas

Bentham, G. 1860. Synopsis of Dalbergieae, a tribe of Leguminosae. Journal of the Proceedings of the Linnean Society. Botany. 4, Suppl.: 1-134.

_____________1862. Dalbergieae & Sophoreae. *In:* Martius, C. F. P. von; Eichler, A. W. & Urban, I. (eds.), Flora Brasiliensis. Monachii, Lipsiae, Frid. Fleischer in comm. Vol. 15, part 1. p. 217-324.

Crisp, M. D., Gilmore, S. & Van Wyk, B. 2000. Molecular phylogeny of the genistoid tribes of Papilionoid legumes. *In:* Herendeen, P. S. & Bruneau, A. (eds.). Advances in Legume Systematics, part 9. Royal Botanic Gardens, Kew. p. 249-276.

Ducke, A. 1953. As Leguminosas de Pernambuco e Paraíba. Memórias do Instituto Oswaldo Cruz 51: 446-461.

Geesink, R. 1981. Tephrosieae (Benth.) Hutch. *In:* Polhill, R. M. & Raven, P. H. (eds.), Advances in Legume Systematics, part 1. Royal Botanic Gardens, Kew. p. 245-260.

___________ 1984. Scala Milletiearum. A survey of the genera of the tribe Millettieae (Legum.-Pap.) with methodological considerations. Leiden Botanical Series 8. Leiden, E.J. Brill/Leiden University Press. p. 1-131.

Greinwald, R., Bachmann, P., Lewis, G. P., Witte, L., Czygan, F. C. 1995. Alkaloids of the genus *Poecilanthe* (Leguminosae: Papilionoideae). Biochemical Systematics and Ecology 23(5): 547-553.

Heringer, E. P. 1952. Reabilitação de uma espécie de Fr. Velloso. Arquivos do Serviço Florestal, Rio de Janeiro 6: 197-200.

Hu, J. M. Lavin, M., Wojciechowski, M. F. & Sanderson, M. 2000. Phylogenetic systematics of the tribe Millettieae (Leguminosae) based on chloroplast trnK/matK sequences and its implications for evolutionary patterns in Papilionoideae. American Journal of Botany 87(3): 418-430.

Hu, J.M., Lavin, M., Wojciechowski, M. F. & Sanderson, M. 2002. Phylogenetic analysis of nuclear ribosomal ITS/5.8S sequences in the tribe Millettieae (Fabaceae): *Poecilanthe-Cyclolobium*, the core Millettieae, and the *Callerya* group. Systematic Botany 27(4): 722-733.

Kirkbride, J. H., Gunn, C. R. & Weitzman, A. L. 2003. Fruits and seeds of genera in the subfamily Faboideae (Fabaceae). U.S. Department Agriculture, Technical Bulletin 1890: 1-212.

Klitgaard, B. B. 1995. Systematics of *Platymiscium* (Leguminosae: Papilionoideae: Dalbergieae): taxonomy, morphology, ontogeny and phylogeny. Thesis (Ph.D.). University of Aarhus, Aarhus.

Lavin, M. 1987. A cladistic analysis of the tribe Robinieae (Papilionoideae, Leguminosae). *In:* Stirton, C. H. (ed.), Advances in Legume Systematics, part 3. Royal Botanic Gardens Kew. p. 31-64.

Lavin, M., Eshbaugh, E., Hu, J. M., Mathews, S. & Sharrock, R. A. 1998. Mophyletic subgroups of the tribe Milletieae (Leguminosae) as reaveled by phytochrome nucleotide sequence data. American Journal of Botany 85(3): 412-433.

Lavin, M., Herendeen, P. S. & Wojciechowski, M. F. 2005. Evolutionary rates analysis of Leguminosae implicates a rapid diversification of lineages during the Tertiary. Systematic Biology 54: 575-594.

Lewis, G. P. 1987. Legumes of Bahia. Royal Botanic Gardens, Kew. p. 236-237.

Meireles, J. E. & Tozzi, A. M. G. A.. A synopsis of *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae). Rodriguésia. (aceito para publicação)

Pennington, R. T., Lavin, M., Ireland, H., Klitgaard, B., Preston, J. & Hu, J. 2001. Phylogenetic relationships of Basal Papilionoid Legumes based upon sequences of the chloroplast trnL intron. Systematic Botany 26(3): 537-556.

Polhill, R. M. 1994. Classification of Leguminosae. *In:* Bisby, F.A.; Buckingham, J. & Harborne, J. B. (eds.). Phytochemical Dictionary of the Leguminosae. Chapman & Hall, London.

Ross, J. H. & Crisp, M. D. 2005. Brongniartieae. *In:* Lewis, G. P., Schrire, B., Mackinder, B. & Lock, M. (eds.), Legumes of the World. Royal Botanic Gardens, Kew. p. 252-259.

Tozzi, A. M. G. A. 1994. Contribuição ao conhecimento de *Poecilanthe* (Leguminosae, Papilionoideae, Millettieae). Libro de Resumenes - Sesiones Tecnicas. 6º Congreso Latinoamericano de Botanica, Mar del Plata. p. 259.

Wojciechowski, M. F., Lavin, M. & Sanderson, M. J. 2004. A phylogeny of legumes (Leguminosae) based on analysis of the plastid matK gene resolves many well-supported subclades within the family. American Journal of Botany 91(11): 1846-1862.

CAPÍTULO 1

Seed and embryo morphology of *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae)[1]

José Eduardo Meireles[2, 3] & Ana Maria G. de A. Tozzi[2]

ABSTRACT

This work analyses and describes seed and embryo morphology of 8 *Poecilanthe* species. *Poecilanthe* species can be divided in 4 groups based on seed and embryo characters. One group has overgrown seeds, bears cataphylls on the epicotyl and has an inflexed hypocotyl-root axis (pattern 1); the other has 2 types of trichomes on the epicotyl, which is longer than the hypocotyl-root axis (pattern 2); the third group presents a visible lens and the raphe runs around 3/4 of the seed circumference (pattern 3); and the last group bears a one-lipped rim aril (pattern 4). *Poecilanthe* presents a remarkable diversity both in seed and embryo which both provide good characters to separate groups of species within the genus.

ADDITIONAL KEYWORDS: Aril - Cataphylls - Chalaza - Hypocotyl-root axis - Lens - Legume - Neotropics - Plumule - Taxonomy - Trichomes

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INTRODUCTION

The genus *Poecilanthe* (Leguminosae, Papilionoideae), established by Bentham (1860), comprises ten South American species distributed from Colombia and French Guiana to East Argentina and Uruguay (Meireles & Tozzi, in press). *Poecilanthe* species are shrubs or trees occurring in a wide range of habitats, such as flooded and non-flooded Amazonian forest, Atlantic rain forest, savanna (cerrado), and seasonally dry forests including caatinga and restinga.

The genus has a remarkable morphological diversity. Geesink (1981) pointed out that *Poecilanthe* could be divided in two groups, one with unifoliolate leaves and racemose inflorescences and the other with imparipinate leaves and paniculate inflorescences. Androecium can be monadelphous or diadelphous and anthers strongly dimorphic or just sub-equal. According to Greinwald *et al.* (1995), one group of species accumulates α-pyridone alkaloids while the other group accumulates bicyclic quinolizidine alkaloids, with the α-pyridone type being absent.

Kirkbride, Gunn & Weitzman (2003) analysed 4 species of *Poecilanthe* and remarked that this genus presents two distinct seed morphologies. One group has hard and glossy testa, straight embryonic axis and the seed length at right angle to the fruit length (e.g., *P. effusa* (Huber) Ducke, *P. itapuana* G.P. Lewis, and *P. subcordata* Benth.). The other group has thin and dull testa, curved embryonic axis and the seed and fruit length parallel, as in *P. amazonica* (Ducke) Ducke.

Seed and embryo characters have been traditionally used in legume taxonomy. Many authors including Gunn (1981, 1984), Lima (1985), Lima (1989), Oliveira (1999) and Kirkbride *et al*. (2003), have shown the importance of such characters to legume taxonomy.

This work aims to improve knowledge about *Poecilanthe* seeds and embryos in order to provide characters to a generic revision and cladistic analysis, which the authors are undertaking.

METHODS

The analysed material was identified by the authors. Voucher specimens are: *P. amazonica* (Ducke) Ducke: P.Lisbôa 755 (INPA); M.F.Silva 1290 (INPA); D.G.Campbell P20822 (MG). *P. effusa* (Huber) Ducke: N.T.Silva 606 (IAN); M.G.Silva 5319 (MG); N.A.Rosa 4652 (MG). *P. falcata* (Vell.) Heringer: J.E.Meireles 398 (UEC). *P. grandiflora* Benth: H.C.Lima 3932 (RB). *P. hostmannii* (Benth.) Amshoff: J.Lanjow 2688 (IAN). *P. itapuana* G.P. Lewis: J.Costa 326 (HUEFS). *P. parviflora* Benth: J.E.Meireles 456 (UEC). *P. subcordata* Benth.: R.M.Harley 21805 (UEC). *P. ulei* (Harms) Arroyo & Rudd: J.E.Meireles 441 (UEC). There is no seed material of *P. ovalifolia* Kleinhoonte and the material of *P. itapuana* had only one available seed to examine, which was very insect-damaged.

In preparing the material for dissection, mature seeds were hydrated in boiling water for variable time, depending on testa resistance. The embryonic axis and its details were photographed in a Nikon SMZ-U stereoscopic microscope with a Nikon D70s camera attached.

Descriptive terminology follows mainly Kirkbride *et al.* (2003). However, we decided to use hypocotyl-root axis (Esau, 1977) rather than radicle, since these structures were not easily distinguishable from each other.

Measurements were taken with a milimetric-scaled ruler or with the microscope micrometer ocular when appropriate. Contrary to Kirkbride *et al.* (2003) seed measurements were taken with regard to the hilum position. Seed length was measured perpendicular to the hilum, and width measured at the widest part at right angles to the other axis Thickness was measured perpendicular to the plane formed by the other measures.

RESULTS

Poecilanthe seeds are parallel to fruit length, hilum lack faboid split (hilar groove), and endosperm is absent in mature seeds. The embryo fills the seed cavity and the cotyledons are easily distinguishable from the embryonic axis; cotyledons are of the storage type, with a convex outer face, a basically smooth inner face, and the base lobate.

However, the other characters are quite variable. The seeds may present overgrowth (Figures 1A-B) or normal growth (Figure 1C), and its face parallel (Figure 1C) or transversal (Figure 1D) oriented to the fruit length. The hilum is parallel to the fruit suture (Figure 1E) or curved downward to the endocarp (Figures 1F-G). A rim-aril is present (Figure 1H) or absent (Figure 1I), the micropyle is visible (Figures 1H-I) or not, and the lens is distinguishable (Figure 1I) or not. The raphe runs around 1/2 (Figure 1J), 3/4 (Figure 1L) of the seed circumference or it is not visible (Figure 1M). A chalaza can be present (Figures 1J-L) or absent (Figure 1M); not branched (Figure 1L) or presenting post-chalazal branches, which can reach the hilum (Figure 1K) or not (Figure 1J).

Cotyledons base is notched (Figure 1N), split (Figure 1O) or groined (Figures 1P-Q), concealing totally (Figures 1O, 1Q), partially (Figure 1P) or not. The hypocotyl-root axis is inflexed (Figure 2A) or straight (Figures 2B-C). The plumule is poorly (Figures 2D-E) or moderately (Figures 2C, 2F) developed, presenting villose trichomes (Figure 2C) or being glabrous (Figures 2D, 2F). Epicotyl may present some accessory structures like thick reddish trichomes (Figure 2C) or cataphylls (Figure 2D). The most important differences are summarized in Table 1.

Based on these differences, we could distinguish four patterns of seed and embryo morphology within the genus, which allowed us to separate the *Poecilanthe* species within four groups. The first one is composed of *P. amazonica* and *P. hostmannii*; the second is represented by *P. effusa*; the third is composed of *P. parviflora* and the last group comprises *P. falcata*, *P. grandiflora*, *P. subcordata* and *P. ulei*.

SPECIES SEED AND EMBRYO DESCRIPTIONS

Poecilanthe amazonica (Ducke) Ducke

Seeds 1 or 2 in number, overgrown, asymmetrical, if 1 the seed is transversally oblong, 11-18 x 22-27 x 4-5 mm, if 2 the seeds are D-shaped, 15-18 x 12-2 x 4-5 mm; compressed in cross section; margins irregular; face longitudinal to the fruit length. Testa thin (papyraceous), dull, smooth; hilum about 2-3 mm, parallel to the suture, depressed in the seed, completely concealed by a funiculus remnant; aril absent; visible hypocotyl-root lobe; micropyle not visible; lens not visible; chalaza visible, opposite to the hilum, darker and more wrinkled than the testa; post chalazal branches present, under 6 in number, not reaching the hilum; raphe visible externally, slightly elevated. Cotyledons notched; hypocotyl-root axis not concealed, smooth outer face, plain inner face; embryonic axis 1,5-2,5 mm long, essentially aligned with the cotyledon length (just slightly oblique); hypocotyl-root axis inflexed, truncate; plumule bipartite, concave-triangular, glabrous, poorly developed, shorter than a quarter of the hypocotyl-root axis, both sides of it bearing a series of membranaceous cataphylls.

Figures: 1A, 1B, 1E, 1J, 1N, 2D.

Poecilanthe effusa (Huber) Ducke

Seeds (1-)2-4(-5) in number, not overgrown, symmetrical, widely elliptic, orbicular or slightly oblate, 9-13 x 7-12 x 3,5-6 mm; compressed or often plane-convex in cross-section;

margins regular; face transversal to the fruit length. Testa thin (papyraceous), dull, smooth; hilum 0,3-0,4 mm, curved downward, slightly projected, not concealed by a funiculus remnant; aril absent; hypocotyl-root lobe not visible; micropyle not visible; lens not visible; chalaza visible, opposite to the hilum, darker and more wrinkled than the testa; post chalazal branches present, usually 8-12 in number, longitudinally oriented and reaching the hilum; raphe not distinguishable from the post chalazal branches. Cotyledon base split, hypocotyl-root axis concealed; striate on outer face, concave on inner face; embryonic axis 2-3 mm, aligned with cotyledons length; hypocotyl-root axis straight, truncate to triangular; base of epicotyl surrounded by reddish, thick trichomes, crown-like; plumule bipartite, sagittate to oblong, margins and sometimes the "blades" densely villose, moderately developed, longer than hypocotyl-root axis (usually twice its length); cataphylls absent.

Figures: 1D, 1F, 1K, 1O, 2C

Poecilanthe falcata (Vell.) Heringer

Seeds 2-5 in number, not overgrown, symmetrical or asymmetrical, wide ovate-elliptic, sub-orbicular or orbicular, 18-22 x 16-20 x 3-5 mm; flattened in cross-section, margins regular; face parallel with the fruit length. Testa thick (coriaceous), glossy, smooth; hilum 1,5-2 mm, curved downward to the endocarp, obliquely projected, not concealed; rim-aril present, one-lipped, tongued or not, lighter than the testa; hypocotyl-root lobe visible; micropyle visible, punctiform; lens not visible; chalaza not visible; raphe not visible. Cotyledon base groined, hypocotyl-root axis concealed; outer face smooth, inner face plane; embryonic axis 2,8-3,3 mm long; aligned with cotyledon length; hypocotyl-root axis straight, triangular; plumule bipartite, concave-triangular, glabrous, poorly developed, shorter than a quarter of the hypocotyl-root axis length; cataphylls absent.

Figures: 1H, 1M.

Poecilanthe grandiflora Benth.

Seeds 3-5 in number, not overgrown, somewhat symmetrical, wide ovate-elliptic or sub-orbicular, 18-23 x 15-18 x 2-4 mm; flattened in cross-section, margins regular; face parallel with the fruit length. Testa thick (coriaceous), glossy, smooth; hilum 1-1,5 mm, curved downward to the endocarp, at most only very slightly projected, not concealed; rim-aril present, one-lipped, tongued or not, lighter than the testa; hypocotyl-root lobe not visible or difficult to distinguish; micropyle visible, punctiform; lens not visible; chalaza not visible; raphe not visible. Cotyledon base groined, hypocotyl-root axis concealed; outer face smooth, inner face plane; embryonic axis 3-3,5 mm long; aligned with cotyledon length; hypocotyl-root axis straight, triangular; plumule bipartite, concave-triangular, glabrous, poorly developed, shorter than a quarter of the hypocotyl-root axis length; cataphylls absent.

Figures: 1C, 1G.

Poecilanthe hostmannii (Benth.) Amsh.

Seeds 3-7 in number; overgrown, symmetrical or asymmetrical, ovate, wide-elliptic or somewhat D-shaped, rarely transversally oblong, 15-22 x 12-21 x 4-8 mm; compressed or rectangular in cross-section; margins irregular; face parallel with the fruit length. Testa thin (chartaceous), dull, wrinkled; hilum 0,8-1 mm, parallel to the suture, not projected, concealed by a funiculus remnant; aril absent; hypocotyl-root lobe not visible; micropyle not visible; lens not visible; chalaza not visible externally, but internally visible, opposite to the hilum; post chalazal branches present, under 8 in number, usually not reaching the hilum; raphe visible externally, slightly elevated. Cotyledons notched or groined; hypocotyl-root axis concealed at the base (tip exposed) or not, outer face smooth, inner face plane; embryonic axis 2.5-3 mm long, almost aligned with the cotyledon length (just slightly oblique); hypocotyl-root axis inflexed, truncate or triangular; plumule bipartite, concave-triangular, glabrous, poorly developed, shorter than a quarter of the hypocotyl-root axis length, both sides of it bearing a series of membranaceous cataphylls.

Figure: 2A.

Poecilanthe itapuana G.P.Lewis

Unfortunately the single available seed was very insect-damaged. We could observe, however, that the hilum is curved downward to the fruit wall and that it presents a one-lipped rim aril.

Poecilanthe parviflora Benth.

Seeds 1-2 in number, not overgrown, symmetrical or asymmetrical, wide-elliptic, orbicular or D-shaped in outline, 13-15 x 11-14 x 3-4 mm; flattened in cross-section, margins regular, face parallel with the fruit length. Testa thin (chartaceous), dull, smooth; hilum 0,6-0,8 mm, parallel to the suture, not projected, partially (or rarely not) concealed by a funiculus remnant, rim darker than the testa; aril absent; hypocotyl-root lobe not visible; micropyle visible, filled with a spongy tissue; lens visible, confluent with the hilum, mounded, linear; chalaza visible, more wrinkled and thicker than the testa, 90º from the hilum; raphe visible, slightly elevated, running around 3/4 of the seed circumference. Cotyledon base groined, hypocotyl-root axis concealed or with the tip exposed; outer face smooth, inner face plane; embryonic axis 2,5-3 mm long; parallel with cotyledon length; hypocotyl-root axis straight, triangular; plumule bipartite, oblong (margin convex), glabrous; moderately developed, shorter than, or rarely the same length as the hypocotyl-root axis; cataphylls absent.

Figures: 1I, 1L, 1P, 2F.

Poecilanthe subcordata Benth.

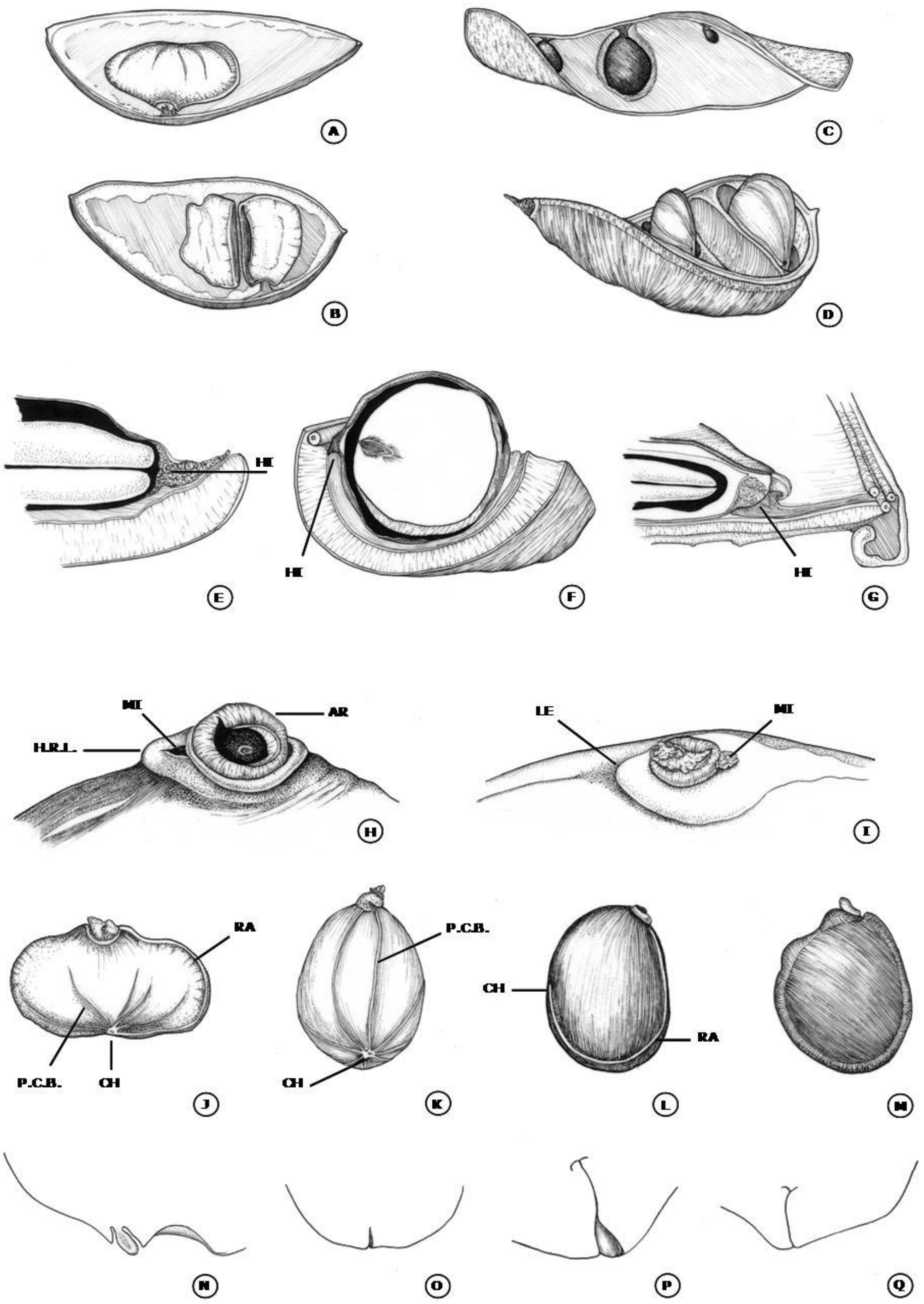
Seeds 1 (-2), not overgrown, symmetrical or asymmetrical, elliptic or D-shaped in outline, 11 x 8 x 2 mm; flattened in cross-section, margins regular or nearly so; face parallel with the fruit length. Testa thick (coriaceous), glossy, smooth; hilum 0,6-0,8 mm, curved downward to the endocarp, slightly projected, not concealed; rim-aril present, one-lipped, tongued or not, colour similar to that of the testa; hypocotyl-root lobe slightly visible; micropyle visible, punctiform; lens not visible; chalaza not visible; raphe not visible. Cotyledon base groined, hypocotyl-root axis concealed; outer face smooth, inner face plain; embryonic axis 1,3-1,6 mm long; parallel with cotyledon length; hypocotyl-root axis straight, triangular; plumule bipartite, glabrous; poorly developed, shorter than a quarter of the hypocotyl-root axis length; cataphylls absent.

Poecilanthe ulei (Harms) Arroyo & Rudd

Seeds 1-3 in number, not overgrown, asymmetrical, wide-elliptic, sub-orbicular or oblate, 13-18 x 11-17 x 3-4 mm; flattened in cross-section, margins regular; face parallel with the fruit length. Testa thick (coriaceous), glossy, smooth; hilum 1 mm, curved downward to the endocarp, slightly projected, not concealed; rim-aril present, one-lipped, tongued or not, lighter than the testa; hypocotyl-root lobe slightly visible; micropyle visible, punctiform; lens not visible; chalaza not visible; raphe not visible. Cotyledon base groined, hypocotyl-root axis concealed; outer face smooth, inner face plane; embryonic axis 2-2,7 mm long; parallel with the cotyledon length; hypocotyl-root axis straight, triangular; plumule bipartite, glabrous, poorly developed, shorter than a quarter of the hypocotyl-root axis length; cataphylls absent.

Figures: 1Q, 2B, 2E.

Figure 1. Morphological aspects of *Poecilanthe* seeds and embryo. The pattern of each species is given within square brackets. **A.-B.** *P. amazonica* [1], Overgrown seeds in the fruits; **C.** *P. grandiflora* [4], parallel orientation of the seed face with the fruit length; **D.** *P. effusa* [2], transverse orientation of the seed face with the fruit length; **E.** *P. amazonica* [1], cross section of the seed in the fruit showing the hilum parallel to the suture; **F.** *P. effusa* [2] and **G.** *P. grandiflora* [4], cross section of the seed in the fruit showing the hilum downward to the endocarp; **H.** *P. falcata* [4], detail of the hilum region showing the micropyle and the rim-aril; **I.** *P. parviflora* [3], detail of the hilum region showing the micropyle and the lens; **J.** *P. amazonica* [1] seed showing the rafe, chalaza and post-chalazal branches; **K.** *P. effusa* [2], seed showing the chalaza and post-chalazal branches; **L.** *P. parviflora* [3], seed showing the rafe running around 3/4 of the seed circumference; **M.** *P. falcata* [4] showing the hypocotyl-root axis lobe; **N.** *P. amazonica* [1], cotyledon base notched; **O.** *P. effusa* [3], cotyledon base split; **P.** *P. parviflora* [3], cotyledon base groined, with the tip exposed; **Q.** *P. ulei* [4], cotyledon base concealing totally the hypocotyl-root axis. AR- aril; CH- chalaza; HI- hilum; H.R.L.- hypocotyl-root lobe; LE- lens; MI- micropyle; P.C.B.- post-chalazal branches; PL- plumule; RA- raphe.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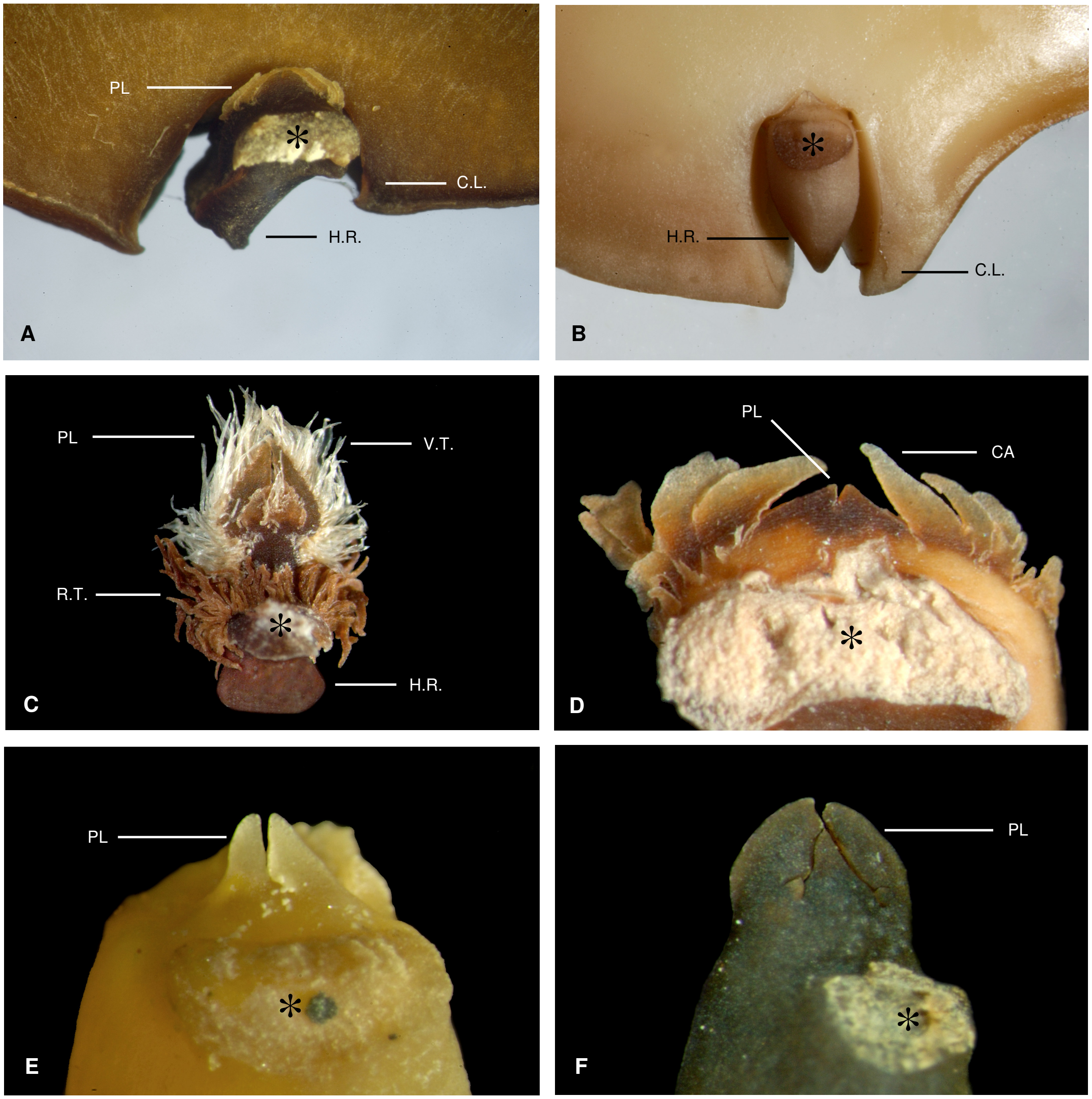

Figure 2. Morphological aspects of *Poecilanthe* embryo. The pattern of each species is given within square brackets. **A.** *P. hostmannii* [1]; **B.** *P. ulei* [4]; **C.** *P. effusa* [2]; **D.** *P. amazonica* [1]; **E.** *P.ulei* [4]; **F.** *P. parviflora* [3]. CA- cataphyll; C.L.- cotyledon lobe; EP- epicotyl; H.R.- hypocotyl-root axis; PL.- plumule; R.T.- thick, reddish trichomes; V.T.- villose trichomes; *- cotyledon attachment zone.

DISCUSSION

MORPHOLOGICAL PATTERNS OF SEED AND EMBRYO

The four different morphological patterns of seed and embryo that are found within *Poecilanthe* are characterized below, and summarized in table 1.

Pattern 1

The first group is composed of the Amazonian species *P. amazonica* and *P. hostmannii*. Both have overgrown seeds, post chalazal branches not reaching the hilum (Figure 1J), an inflexed hypocotyl-root axis (Figure 2A) and presence of cataphylls on the epicotyl (Figure 2D), as diagnostic characters.

We identified the seeds of *P. amazonica*, *P. hostmannii* as overgrown. Corner (1951) coined this term to refer to some seeds for which growth is limited by the fruit cavity. These overgrown seeds may be recognized by their relatively large size, filling the seed cavity and often becoming distorted in shape (Figure 1A-B), and by the poorly differentiated testa. However, Kirkbride *et al.* (2003) pointed out that it is very difficult to determinate unlimited seed growth in the absence of anatomical studies. Consequently we identified those seeds as overgrown because they appear to be, but this observation needs to be confirmed by further studies.

The notched cotyledon base (Figure 1N) exposing the hypocotyl-root axis is the most common pattern in this group, but the concealment of the part of the hypocotyl-root axis was also found.

We consider the structures adjacent to the plumule as cataphylls for the following reasons: they are hyaline and fragile, and apparently not primordial leaves, so not part of the plumule.

Many seedlings present cataphylls between the eophylls and cotyledons (Lima, 1989), corresponding to the part where the structures are attached in the embryo of this *Poecilanthe* group. Oliveira (1999) has shown that embryos of *Platypodium elegans* Vog. present primordial cataphylls in the epicotyl, and Lima (1989) described cataphylls on seedlings of this species.

Lima (1989) suggested that the presence of cataphylls on seedling epicotyls is associated to environmental stress, especially in periodically flooded forests. Interestingly, *P. amazonica* is a typical tree from Amazonian flooded forests and *P. hostmannii*, despite not growing in flooded forests, occur in riverside vegetation.

Pattern 2

The second group is represented by the Amazonian species *P. effusa*. This species occurs mainly in dryer vegetation, never in flooded forests or riparian vegetation.

It presents a transverse orientation of the seed face with the fruit length (Figure 1D), the post chalazal branches reaching the hilum (Figure 1K), a concave inner cotyledon face, a split cotyledon base (Figure 1O), reddish trichomes surrounding the base of the epicotyl (Figure 2C), and the villose plumule (Figure 2C), 2x longer than the hypocotyl-root axis, as unique characters.

There are two different trichome types on the embryo of this species. The plumule trichomes are thin, long and greyish and the epicotyl's basal ones are thick and reddish. The nature and function of these two different trichome types deserves more detailed anatomical studies and histochemical tests.

Pattern 3

The third group comprises only *P. parviflora*. This species is distributed from Argentina and Paraguay to southern Brazil, mainly along riparian forests. The diagnostic characters for this group are the presence of a visible lens (Figure 1I), a raphe running up to 3/4 of the seed circumference (Figure 1L) and a moderately developed, glabrous plumule (Figure 2F).

This species has the most different seed morphology when comparing to the other extra-Amazonian species. It is thus notable that *P. parviflora* is also peculiar in the riparian habitat and in the passive and late dehiscence of the fruit, which usually fall still closed from the tree and probably represent the dispersal unit.

Pattern 4

The last group contains the extra-Amazonian species *P. falcata*, *P. grandiflora*, *P. subcordata* and *P. ulei*, all occurring mainly in dry vegetation types. The group is easily recognized by its thick (coriaceous) testa, a hilum curved downwards to the endocarp (Figure 1G), and a one-lipped rim-aril (Figure 1H). *Poecilanthe itapuana* presents all characters cited above and, even without complete material, we suggest it belongs to this group.

Contrasting to *P. parviflora*, these species grow in dryer habitats and have explosive dehiscence of the fruits while still on the tree, dispersing not the entire fruit but only the seeds.

Table 1. Summary of the most important diagnostic characters of *Poecilanthe* seeds and embryos and habitat of the species. Hypocotyl-root axis (H.R.); present (+), absent (-). (*) Probably present, but not distinguishable from the post chalazal branches.

Character / Pattern	**1**	**2**	**3**	**4**
Seed growth	overgrown	normal	normal	normal
Seed position with the fruit	longitudinal	transversal	longitudinal	longitudinal
Testa	papery	papery	membranaceous	coriaceous
Hilum	straight	downward	straight	downward
Aril	-	-	-	+
Micropyle	-	-	+	+
Lens	-	-	+	-
Raphe	1/2	0*	3/4	0
Chalaza	+	+	+	-
Post-chalazal branches	**not** reaching the hilum	reaching the hilum	absent	absent
H.R. axis inflection	inflexed	straight	straight	straight
H.R. axis concealment	exposed	concealed	exposed tip / concealed	concealed
Plumule development	poor	moderate	moderate	poor
Plumule / H.R. axis	< 1/3	± 2	1/3 - 1	< 1/3
Plumule trichomes	-	+	-	-
Epicotyl base trichomes	-	+	-	-
Cataphylls	+	-	-	-
Habitat moisture	moister (flooded / riparian)	dryer (terra-firme)	moister (riparian)	dryer (i.e. caatinga / restinga)

The morphology of the seeds and embryos of *Poecilanthe* provides interesting characters to separate groups of species within the genus. Based on these characters we could separate the *Poecilanthe* species within four groups. We could also note that these four patterns can be somehow related to the habitat of the species. This result contributes to the knowledge of the morphological diversity of *Poecilanthe* and reinforces the necessity of testing the monophyly of this genus.

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REFERENCES

Bentham G. 1860. A Synopsis of the Dalbergieae. *The Journal of the Proceedings of the Linnean Society*, Botany , **4**, Suppl.: 1-134.

Corner EJH. 1951. The leguminous seed. *Phytomorphology* **1:**117-150

Esau K. 1977. *Anatomy of seed plants*. New York: J.Wiley.

Geesink R. 1981. Tephrosieae (Benth.) Hutch. In: Polhill, RM. & Raven, PH., eds. *Advances in Legume Systematics*, part 1. Royal Botanic Gardens, Kew. p. 245-260.

Greinwald R, Bachmann P, Lewis G, Witte L, Czygan FC. 1995. Alkaloids of the genus *Poecilanthe* (Leguminosae: Papilionoideae). *Biochemical Systematic and Ecology* **23(5):** 547-553.

Gunn CR. 1981. Seeds of Leguminosae. In: Polhill RM, Raven PH, eds. *Advances in legume systematics*, part 2. Royal Botanic Gardens, Kew. p. 913-925.

Gunn CR. 1984. Fruits and seeds of genera in the subfamily Mimosoideae (Fabaceae). *U.S. Department Agriculture Technical Bulletin* **1681:**1-194.

Kirkbride JH, Gunn CR, Weitzman AL. 2003. Fruits and seeds of genera in the subfamily Faboideae (Fabaceae). *U.S. Department Agriculture Technical Bulletin* **1890:** 1-212.

Lima HC. 1989. Tribo Dalbergieae (Leguminosae-Papilionoideae) - morfologia dos frutos, sementes e plântulas e sua aplicação na sistemática. *Arquivos do Jardim Botânico do Rio de Janeiro* **30:**1-42.

Lima MPM. 1985. Morfologia dos frutos e sementes dos gêneros da tribo Mimoseae (Leguminosae - Mimosoideae), aplicada à sistemática. *Rodriguésia* **37:**53-78.

Meireles JE & Tozzi AMGA. A synopsis of *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae). *Rodriguésia* **(in press)**.

Oliveira DMT. 1999. Morfo-anatomia do embrião de leguminosas arbóreas nativas. *Revista Brasileira de Botânica* **22(3):** 413-427.

CAPÍTULO 2

Phylogeny and a re-evaluation of the taxonomic circumscription of *Poecilanthe* Benth. (Leguminosae, Papilionoideae, Brongniartieae).

José Eduardo Meireles[4], Matt Lavin[5], Ana Maria G. A. Tozzi[1]

Abstract

Separate and combined parsimony analyses of the species of the legume genus *Poecilanthe* and other genistoid genera were performed with morphological data and nrDNA ITS/5.8S sequences. Molecular and morphological data are in excellent agreement that *Poecilanthe* comprises three lineages that are paraphyletic with respect to other genera of the recently recircumscribed tribe Brongniartieae. These three clades are each apomorphically diagnosed and ranked at the generic level. A key to the New World genera of Brongniartieae is provided to highlight morphological distinction of the newly circumscribed lineages that once composed the genus *Poecilanthe*.

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Introduction

The genus *Poecilanthe* Benth. (Leguminosae, Papilionoideae, Brongniartieae) comprises ten South American species of shrubs or trees. They occur in a wide range of habitats, including flooded and non-flooded Amazonian forest, Atlantic rain forest, savanna, and seasonally dry forests including caatinga and restinga (Meireles & Tozzi, in press.). *Poecilanthe* is characterized only by generalized or polymorphic characters, such as unifoliolate or imparipinnate leaves, leaflets alternate or opposite, racemose or paniculate inflorescences, flowers bilaterally symmetric, calyces turbinate or campanulate and having five teeth with the upper two largely united, wing petals longer than the keel, stamens monadelphous or diadelphous, anthers monomorphic to distinctly dimorphic, and dehiscent pods.

The taxonomic history of *Poecilanthe* has seen this genus shifted among several Papilionoideae tribes. It was originally described in Dalbergieae (Bentham 1860) and latter placed in Galegeae (Ducke 1953). Geesink (1981) transferred it to the Millettieae (Tephrosieae), but stated that *Poecilanthe* was apparently transitional to Robinieae because of its lack of the fascicled flowers of a pseudoraceme or pseudopanicle. Using this inflorescence morphology, Geesink (1984) moved *Poecilanthe* into Robinieae. Although Lavin (1987) placed *Poecilanthe* back in Dalbergieae, he noted that the dehiscent pod with some spongy tissue on the endocarp and dimorphic anthers were otherwise characteristic of Brongniartieae. A chemotaxonomic survey reported *Poecilanthe* to produce a quinolizidine alkaloid profile otherwise found only in Brongniartieae and some Sophoreae (Greinwald *et al.* 1995). Molecular phylogenies using different markers largely agree in placing *Poecilanthe* with Brongniartieae (Crisp *et al.* 2000; Hu *et al.* 2000; Hu *et al.* 2002; Lavin *et al.* 1998; Pennington *et al.* 2001; Wojciechowski *et al.* 2004).

The Brongniartieae now includes *Poecilanthe*, and is placed in the genistoid clade *s.l.* (Wojciechowski *et al.*, 2004) along with tribes Genisteae, Euchresteae, Thermopsideae, Podalyrieae, Liparieae, Crotalarieae, and some genera of Sophoreae, such as *Acosmium* Schott, *Bolusanthus* Harms, *Bowdichia* Kunth, *Cadia* Forssk., *Diplotropis* Benth., *Dicraeopetalum* Harms, *Ormosia* Jacks., and probably *Clathrotropis* (Benth.) Harms (Pennington *et al.*, 2001; Lavin *et al.* 2005). The presence of quinolizidine alkaloids is the potentially non-molecular synapomorphy of an expanded genistoid clade (Pennington *et al.*, 2001; Wojciechowski *et al.*, 2004). The tribe Brongniartieae forms a subclade within the genistoids, and comprises ten genera and 152 species (Ross & Crisp, 2005). The tribe is geographically disjunct with a group of American (*Brongniartia* Kunth, *Cyclolobium* Benth., *Harpalyce* Moç & Sessé ex DC., and *Poecilanthe* Benth.) and Australian genera (*Cristonia* J.H.Ross, *Hovea* R.Br. ex W.T. Aiton, *Lamprolobium* Benth., *Plagiocarpus* Benth., *Templetonia* R.Br. ex W.T. Aiton and *Thinicola* J.H.Ross).

Poecilanthe comprises two distinct groups of species with different morphological and chemical features, which are usually contrasted as the Amazonian to extra-Amazonian species (Geesink, 1981; Greinwald *et al.* 1995; Klitgaard, 1995; Kirkbride *et al.* 2003; Ross & Crisp 2005; Meireles & Tozzi, *in press*; Meireles, chapter 1). Geesink (1981) pointed out that the Amazonian species have unifoliolate leaves and racemose inflorescences and the extra-Amazonian species have imparipinate leaves and paniculate inflorescences. Kirkbride *et al.* (2003) observed much heterogeneity in seed morphology within *Poecilanthe*, which Meireles (chapter 1) has used to delineate four species groups. One group has overgrown seeds, inflexed hypocotyl-root axes, and cataphylls on the epicotyl. The second has seeds transversally arranged to the fruit and a villose plumule that is twice the length of the hypocotyl-root axis. The remaining groups share a plumule lacking appendages and shorter than the hypocotyl-root axis. However, the third group has a visible chalaza and has nor aril, while the last group has no chalaza and has a rim aril. Many additional neglected morphologies also corroborate the three main *Poecilanthe* groups, and involve calyx aestivation, wing and keel petals features, staminal adelphy, degree of anthers dimorphism and fruit septation, for example.

The present work aims to clarify the relationships among the species of *Poecilanthe* with a combined phylogenetic data set involving morphological characters and DNA sequence data. The monophyly of the genus will be tested, the main constituent clades of *Poecilanthe* will be circumscribed, and a generic circumscription will be revised if necessary.

Materials and Methods

Taxon sampling – 20 species representing nine genistoid genera were sampled for the molecular analysis, including all *Poecilanthe* except *P. grandiflora* Benth. and *P. ovalifolia* Kleinhoonte, which were sampled only for the morphological data set. The other 8 sampled genera are assigned to the genistoids *s.l.* (Pennington *et al.*, 2001; Wojciechowski *et al.* 2004; Lavin *et al.* 2005), including *Acosmium* (sect. *Leptolobium*) and *Diplotropis* from the Sophoreae, and *Brongniartia*, *Cyclolobium*, *Harpalyce* and *Hovea* from the Brongniartieae. *Clathrotropis* is possibly associated to the genistoids (Pennington *et al.* 2001), but its position is not defined yet. Specimen vouchers are detailed in appendix 1.

Morphological data – A total of 58 characters were identified from the analysis of herbarium material and partially from the literature. The morphological data set was initiated with the information provided in Arroyo (1976), Bentham (1862), Lewis *et al.* (2005), Lima (1985), Rodrigues (2005), Rudd (1965), Tompson *et al.* (2001), and Warwick & Pennington

(2002). Seed and embryo morphology is derived from Meireles (chapter 1) for *Poecilanthe* species and on personal observations and Kirkbride *et al.* (2003) for the remaining taxa. Character states (Appendix 2) were scored and the data matrix (Appendix 3) was produced with Nexus Data Editor (Page, 2001).

DNA sequence data – DNA sequences from the nuclear ribosomal 5.8S and flanking internal transcribed spacers (the ITS region) were analyzed because of how phylogenetically informative these loci are in many legume groups (e.g., Delgado-Salinas *et al.* 2006; Lavin *et al.* 2005). PCR primers for the ITS region are described in Delgado-Salinas *et al.* (1999). Paralogy in the ribosomal repeats of legumes (e.g., Bailey *et al.* 2003; Hughes *et al.* 2006) is not known to cause problems in most papilionoid groups. Concerted evolution must be rapid and complete enough to render a single ribosomal repeat (cf. Sanderson and Doyle 1992) in the genistoids if only because only GC-rich sequences with identical 5.8S sequences are amplified and sequenced. For legume groups where paralogous ITS products are amplified, they are readily identified as pseudogenes by the numerous small insertion-deletion regions that occur even within the 5.8S region (e.g., Hughes *et al.* 2003).

DNA isolations, polymerase chain reaction (PCR) amplifications, and template purifications were performed by Matt Lavin with Qiagen Kits (i.e., DNeasy Plant Mini Kit, Taq PCR Core Kit, QIAquick PCR Purification Kit; Qiagen, Santa Clarita, California, USA). DNA sequencing was performed at Northwoods DNA (http://www.nwdna.com/). Sequences were aligned manually with Se-Al (Rambaut 1996). Multiple alignments of the ITS region were evaluated with parsimony analyses and only results not influenced by alignment variation are reported. The ITS data set included 23 sequences and 761 sites in one alignment configuration. Data are available upon request.

Phylogenetic analyses – Parsimony analysis was performed with PAUP* (version 4.0b10; Swofford, 2002). The relatively small size of the data set allowed using the branch and bound search option. Clade support was assessed with 1000 bootstrap replicates (Felsenstein, 1985) using TBR branch swapping and one random addition replicate per bootstrap replicate. A partition-homogeneity test was performed with settings similar to those of the bootstrap analysis to verify incongruence between the different data sets.

Results

The parsimony analysis of 51 informative morphological characters yielded two most parsimonious trees of 119 steps (CI= 0.64, RI= 0.84). The strict consensus (Fig. 1) resolves *Poecilanthe* as three paraphyletic clades. *Poecilanthe effusa* and *P. ovalifolia* form a clade that is an early branching sister to a large clade containing *Cyclolobium*, *Harpalyce*, *Hovea*, *Brongniartia*, and the remaining species of *Poecilanthe*. *Poecilanthe amazonica* and *P. hostmannii* are resolved as the well supported sister of *Cyclolobium*. The extra-Amazonian species, *P. falcata*, *P. grandiflora*, *P. itapuana*, *P. parviflora*, *P. subcordata*, and *P. ulei* are resolved as sister to *Brongniartia*, but without bootstrap support. This clade is included in a moderately supported clade that includes also *Harpalyce* and *Hovea*.

The parsimony analysis of the ITS data resulted in five equally most parsimonious trees each with 648 steps (CI= 0.68, RI=0.77) involving 229 informative sites. The strict consensus (Fig. 2) resolves three very well-supported subclades within *Poecilanthe*: a clade with only *P. effusa*, one with *P. amazonica* and *P. hostmannii*, and the third comprising the extra-Amazonian species. These three subclades were also resolved in the morphological analysis. Within the extra-Amazonian clade, a moderately supported clade comprising *P. falcata* and *P. ulei* is resolved as sister to a very well supported clade that includes *P. itapuana*, *P. parviflora*, and *P. subcordata*.

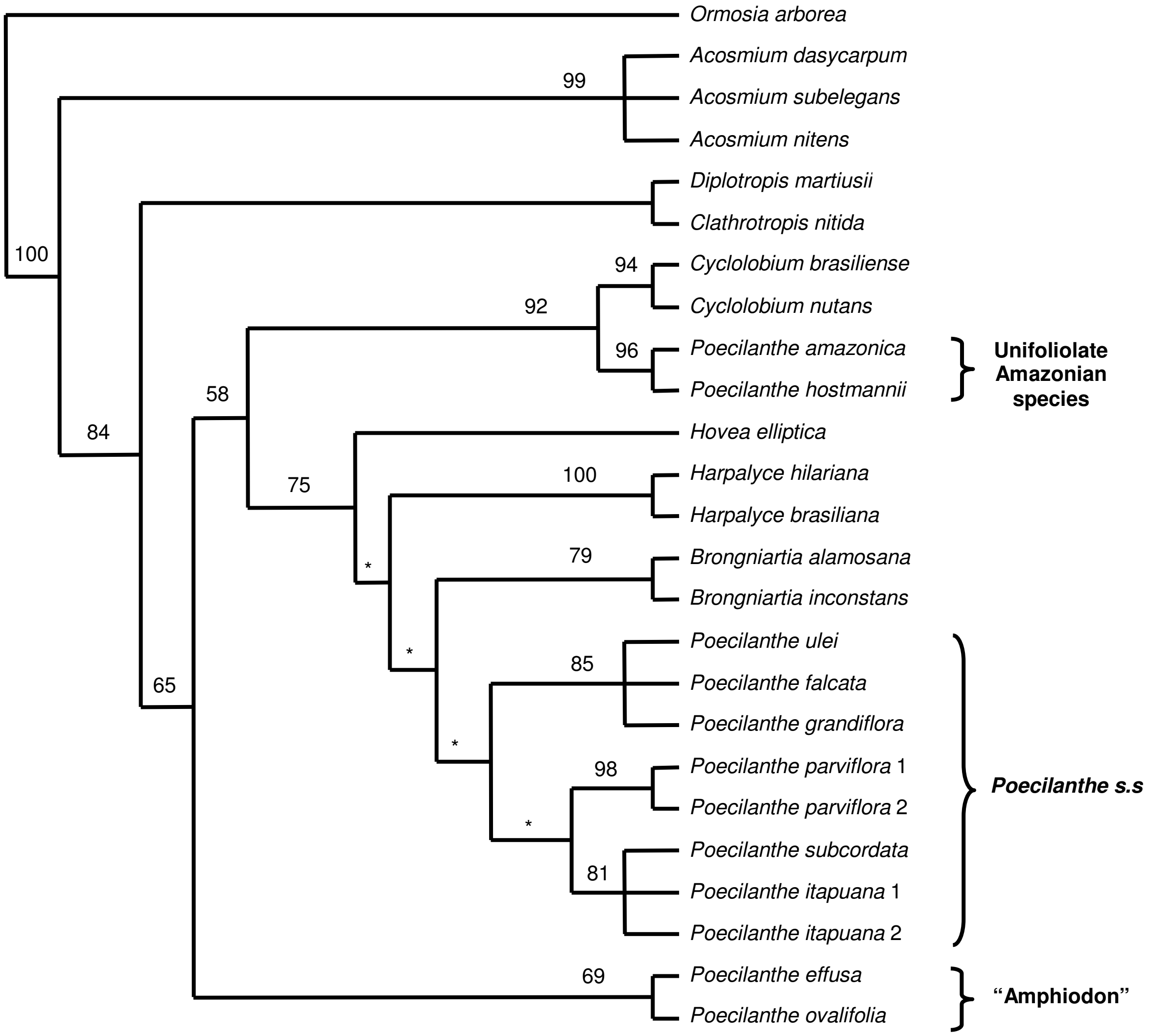

Fig. 1- Strict consensus of the two most parsimonious morphological trees (both 119 steps, CI= 0.64 and RI= 0.84). Bootstrap values > than 50% are given above the branches and * indicates that the branch is collapsed in the bootstrap analysis.

The partition homogeneity test between the morphological and molecular datasets suggested incompatibility (p=0.001). However, comparisons of the morphological and molecular trees did not reveal any conflict among clades supported by more than 75%. As such, parsimony analysis of the combined morphological and ITS data set yielded six most parsimonious trees of788 steps (CI=0.65, RI=0.76), with 279 informative sites. The strict consensus (Fig. 3) resolves the same three *Poecilanthe* clades that are each monophyletic but paraphyletic with respect to other Brongniartieae, as in the separate morphological and ITS/5.8S analyses.

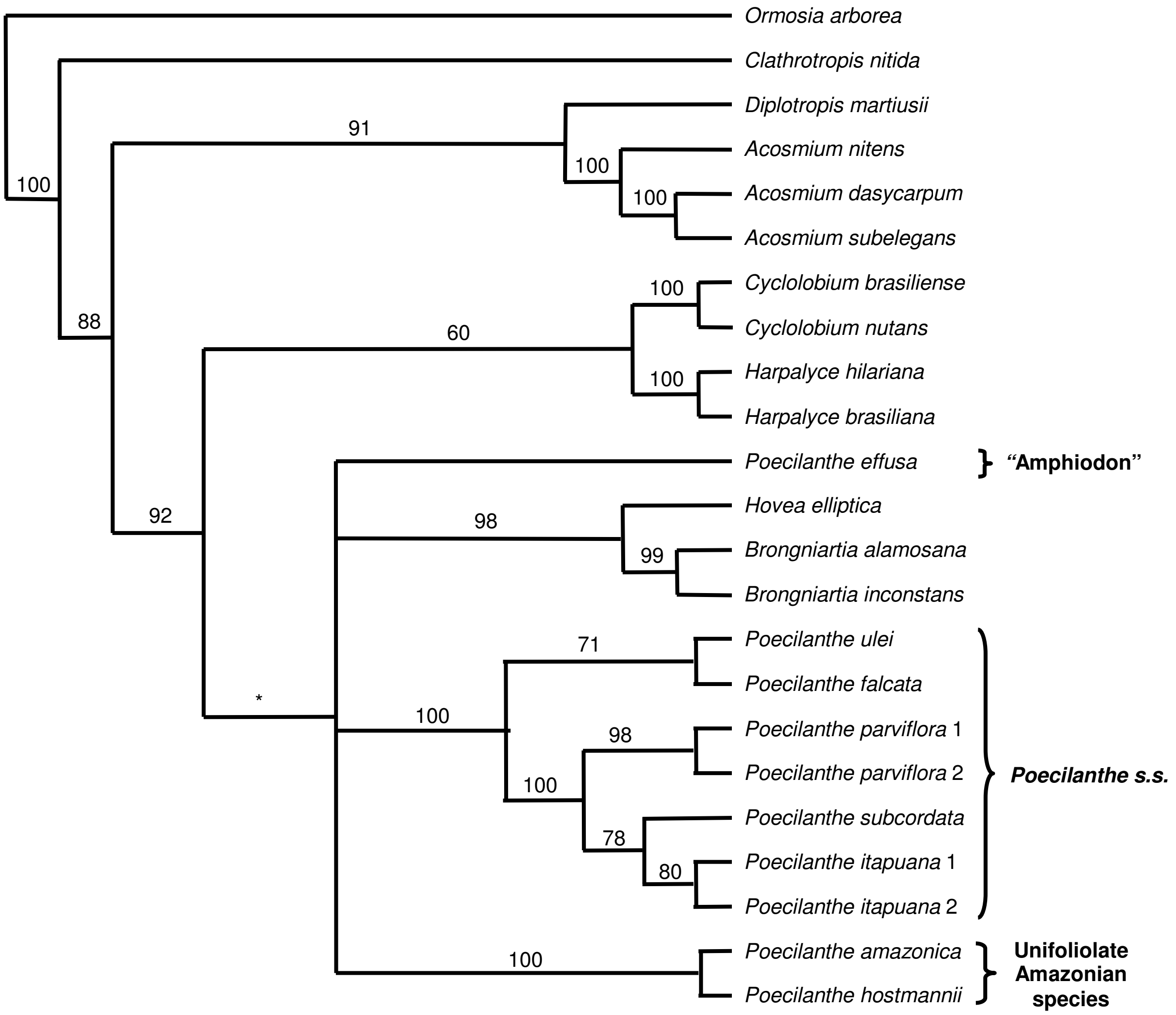

Fig. 2- Strict consensus of the five most parsimonious ITS trees (each 648 steps, CI= 0.68 and RI=0.77). *Poecilanthe grandiflora* and *P. ovalifolia* are excluded from this analysis. Bootstrap values > than 50% are given above the branches and * indicates that the branch is collapsed in the bootstrap analysis.

Discussion

Individual and combined data analyses all suggest that *Poecilanthe* is nested within the tribe Brongniartieae, in agreement with Crisp *et al.* (2000), Hu *et al.* (2000, 2002), and Wojciechowski *et al.* (2004). However both morphological and combined analyses suggest the non-monophyly of the genus (Fig. 1 & 3). Three lineages of *Poecilanthe* are consistently well resolved with interrelationships that are paraphyletic with respect to the other sampled Brongniartieae. Among the five most parsimonious ITS trees, selecting the one that resolves *Poecilanthe* as monophyletic reveals that no morphological synapomorphy or unique combination of morphological characters can be traced to the most recent common ancestor of *Poecilanthe*. On the other hand, the combined analysis reveals that the three *Poecilanthe* subclades are supported by morphological features, as given below. These diagnostic features are plotted onto one of the most parsimonious trees of the combined analysis (Fig. 4) and summarized in Table 1.

1) *Poecilanthe effusa* and *P. ovalifolia*: Huber (1909) described this species as a new genus, *Amphiodon*, and distinguished it from *Poecilanthe* by having diadelphous stamens, biauriculated wing petals, and obovoid pod. Latter, Ducke (1932) considered the vexillary stamen fused to the others at its base, and the lower base of the wing petal only plicate, and combined *Amphiodon* into *Poecilanthe*. Character optimization shows that this clade is diagnosed by having highly branched panicles with the 1st axis shortened (Character 5, state 0), valvate aestivation of the calyx (Character 8, state 0), the vexillary stamen mostly adherent to the standard claw (Character 23, state 1), well developed anther connectives (Character 27, state 1), sessile ovaries (Character 28, state 0), internally septate pods (Character 32, state 1), seeds arranged transversally to the fruit axis (Character 48, state 1), post chalazal branches reaching the hilum (Character 46, state 2), and a villose plumule (Character 56, state 1) that is twice the length of the hypocotyl-root axis (Character 51, state 1). The last three of these traits were elucidated by Meireles (chapter 1).

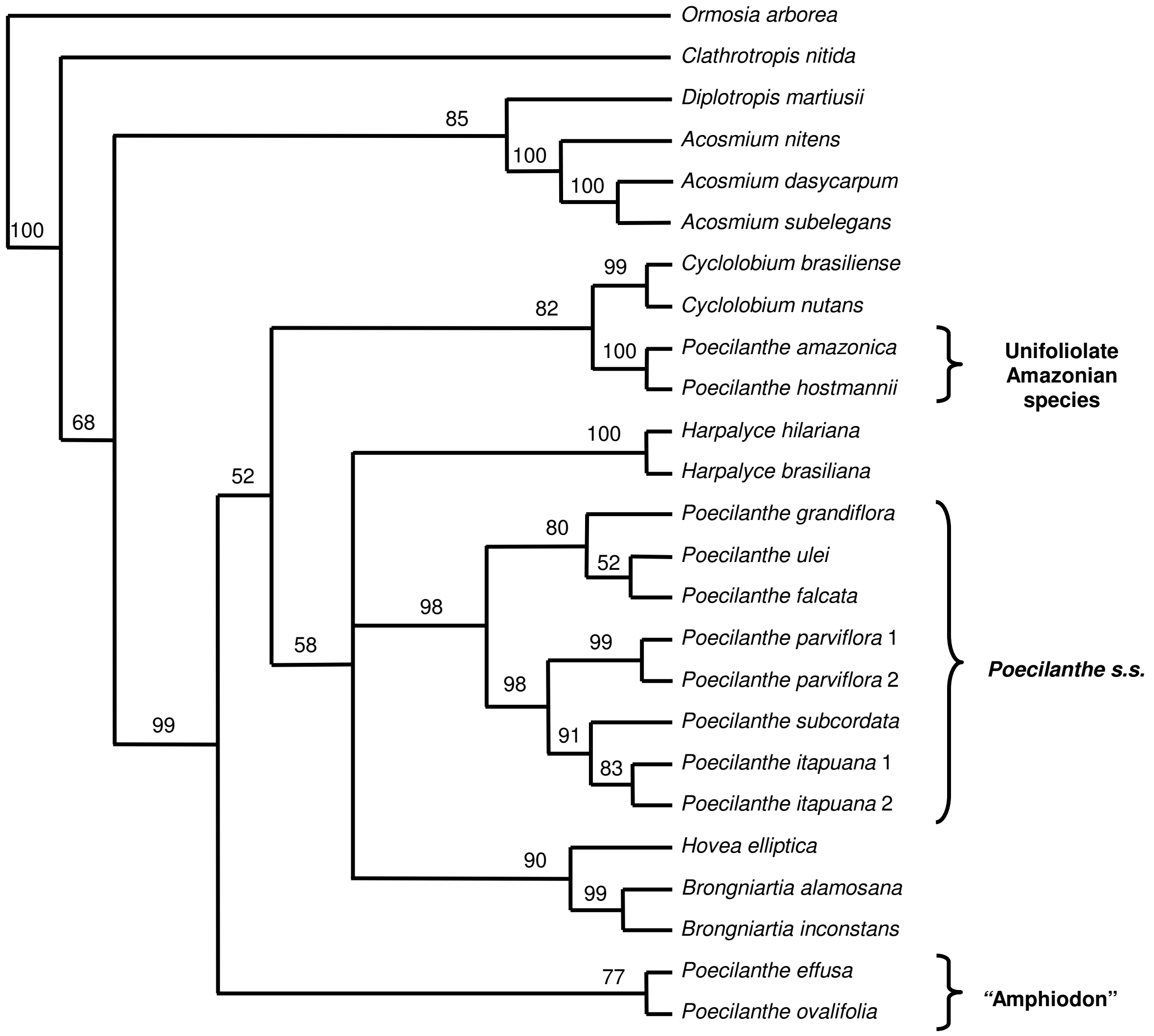

Fig. 3- Strict consensus of the six most parsimonious trees of the combined molecular and morphological analysis (both 788 steps, CI=0.65 and RI=0.76). Bootstrap values > than 50% are given above the branches.

2) *Poecilanthe amazonica* and *P. hostmannii:* The literature has recognized this group as distinct from the other *Poecilanthe* (Geesink, 1981; Klitgaard, 1995; Ross & Crisp 2005). This clade is apomorphically diagnosed mainly by unifoliolate leaves (Character 1, state 1). In contrast to the other *Poecilanthe*, the stamens are always diadelphous (Character 22, state 0), the anthers are sub-equal (not distinctly dimorphic) (Character 25, state 1), the wing petals are biauriculate (Character 14, state 2), and the keel petals form a boss (a lateral protusion) (Character 19, state 1). Also in this group, the seeds are overgrown (Character 33, state 1) (seed growth is limited by the fruit cavity, thus resulting in seeds that are usually large and distorted in shape) and covered with a papery testa (Character 34, state 2), the post-chalazal branches do not reach the hilum (Character 46, state 1), cataphylls occur on the epicotyl (Character 52, state 1), and the hypocotyl-root axis is inflexed (Character 57, state 1). This clade shares with its sister *Cyclolobium* all of these characters except for cataphylls on the epicotyl and is essentially distinguished by a dehiscent woody legume that contrasts to the samaroid pod of *Cyclolobium.*

3) Extra-Amazonian species: This clade is distinguished from other *Poecilanthe* by alternate leaflets (Character 2, state 1), resting buds protected by scales (Character 4, state 1), strongly dimorphic anthers (Character 25, state 2) (the difference in size being around 100% between the two types), and the plumule shorter than the hypocotyl-root axis (Character 51, state 0) and without appendages (Characters 52, 53 and 56, all scored state 0) (i.e., bearing neither cataphylls nor trichomes). Excepting alternate leaflets, this clade shares all of these traits with *Brongniartia*. A subclade formed by *P. falcata*, *P. ulei* and probably *P. grandiflora* (Fig 1) is independently resolved with morphological and molecular data and is marked by the synapomorphies of marginally ridged fruits (Character 31, state 1) (i.e., a cross section of the legume margin is "T" shaped), a monadelphous androecium (Character 22, state 2), and unpaired axillary racemes or poorly-branched panicles (Character 5, state 1). The subclade comprising *P. itapuana*, *P. parviflora*, and *P. subcordata* is marked by fruits with plane margins (Character 31, state 0), an androecium varying from monadelphous to diadelphous within the same individual (Character 22, state 1), and by paired axillary racemes (Character 5, state 2). Neither of these two lineages within the extra-Amazonian clade correspond to previously recognized taxa.

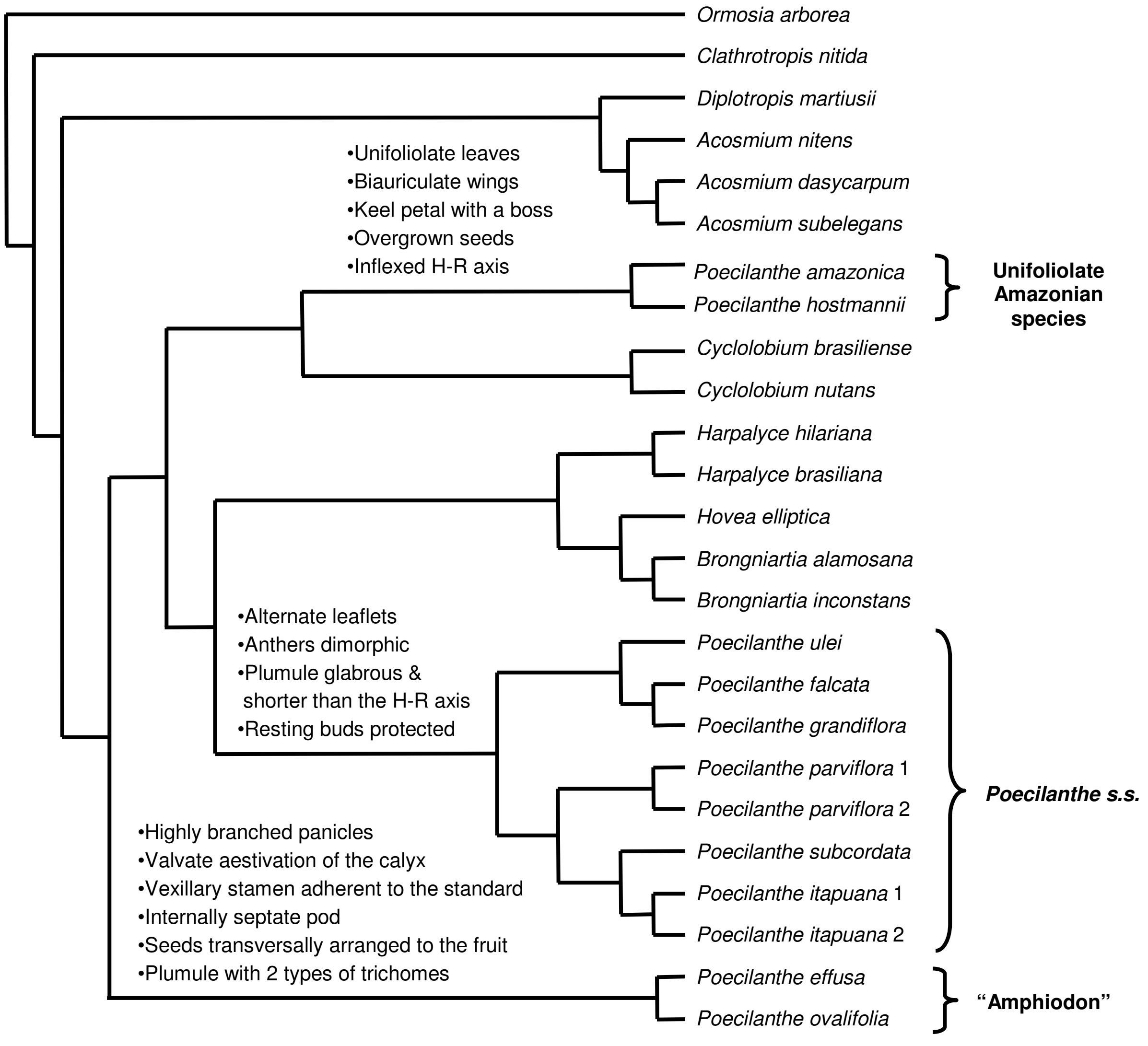

Fig 4. One of the six most parsimonious trees of the combined molecular and morphological analysis. The most important diagnostic features for the three *Poecilanthe* clades are indicated.

Taxonomic recircumscription of *Poecilanthe*. *Poecilanthe* in its traditional circumscription is not supported as monophyletic in this study by either morphology, molecular, or combined data. In contrast, the monophyly of three constituent lineages of *Poecilanthe* are each well supported, although the interrelationships among these three are not fully resolved with respect to the other genera of the tribe Brongniartieae. We therefore suggest recircumscribing *Poecilanthe* by restricting its application to the extra-Amazonian species, which includes the type species of the genus, *P. grandiflora* (Fig 1 & 3). We also reinstate *Amphiodon* Huber (Meireles, chapter 4), to accommodate *P. effusa* and *P. ovalifolia*; and segregate *P. amazonica* and *P. hostmannii* into a distinct genus, which will be published elsewhere (Meireles, chapter 5). As part of the recircumscription of the generic limits of *Poecilanthe* and closely related taxa, we provide here a key to the New World genera of the legume tribe Brongniartieae, including the segregate lineages of *Poecilanthe* revealed in this current study.

Key to the New World Genera of Brongniartieae

1. Leaves mostly unifoliolate (very rarely multifoliolate leaves in upper part of tree); keel petal forming a boss; hypocotyl-root axis inflexed
    2. Fruit a dehiscent and woody legume......................................***P.amazonica* + *P. hostmannii***
    2. Fruit a coriaceous samara..***Cyclolobium***
1. Leaves mostly multifoliolate; keel petal plane or plicate, but not forming a boss; hypocolyl-root axis straight
    3. Plant covered by glandular trichomes; calyx strongly bilabiate; keel contorted .... ***Harpalyce***

3. Plant not covered by glandular trichomes; calyx with 5 teeth, the upper two highly connate; keel straight (not contorted)

  4. Inflorescence a highly branched panicle with the primary axis very short; vexillary stamen mostly adherent to the standard claw base; the seeds transversally oriented to the fruit length..***Amphiodon***

  4. Inflorescences racemes or poorly branches panicles; vexillary stamen free from the standard claw; the seeds parallel with the fruit length

    5. Leaflets opposite..***Brongniartia***

    5. Leaflets alternate...***Poecilanthe s.s.***

Other genera. Regarding the genera closely related to the tribe Brongniartieae, the ITS data corroborates the close relationship of *Diplotropis* and *Acosmium*, which concurs with Wojciechowski *et al.* (2004) and Lavin *et al.* (2005). *Clathrotropis* was also previously assigned to the genistoids by Pennington *et al.* (2001). However, this is the first time that *Clathrotropis* and *Diplotropis* are sampled in the same molecular phylogenetic analysis. These two genera have been considered closely related, and *Clathrotropis* was even considered a section of *Diplotropis* (Bentham 1962). It is thus notable that *Diplotropis* is firmly resolved as closer to *Acosmium* than to *Clathrotropis*. Our data also corroborate the closer relationship of *Brongniartia* to the Australian genera (represented here by *Hovea*) than to the other American genera of Brongniartieae, which agrees with Hu *et al.* (2002), Wojciechowski *et al.* (2004), Ross & Crisp (2005), and Lavin *et al.* (2005).

Characters	*Poecilanthe s.s.* (extra-Amazonian species)	*Amphiodon* (*P. effusa* + *P. ovalifolia*)	*P. amazonica* + *P. hostmannii*
Leaves	multifoliolate	multifoliolate	unifoliolate
Inflorescence type	racemes or poorly branched panicle	highly branched panicle, with the 1st axis shortened	racemes
Calyx aestivation	imbricate	valvate	imbricate
Wing petals base	auriculate	auriculate	biauriculate
Keel petal	plane	plane	forming a boss
Androecium	monadelphous or monadelphous /diadelphous	diadelphous	diadelphous
Vexilar stamen	free from the standard	adherent to the standard claw	free from the standard
Anthers	distinctly dimorphic	subequal	subequal
Anthers connective	inconspicuous	conspicuous	inconspicuous
Ovary	stipitate	sessile	stiptate
Fruit	not septate	septate	not septate
Seed position to the fruit length	parallel	transversal	parallel
Seed growth	regular	regular	overgrown
Post chalazal branches	absent	reaching the hilum	not reaching the hilum
Hypocotyl -root axis	straight	straight	inflexed
Plumule / Hypocotyl - root axis	shorter	longer (twice)	shorter
Appendages on the epicotyl	absent	reddish trichomes	cataphylls

Table 1: Summary of the most important diagnostic characters for the three *Poecilanthe* lineages.

Acknowledgments

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Literature cited

Arroyo, M. T. K. 1976. The sytematics of the legume genus *Harpalyce* (Leguminosae: Lotoideae). Memoirs of the New York Botanical Garden 26(4): 1-80.

Bailey, C. D., Carr, T. G., Harris, S. A. & Hughes, C. E. 2003. Characterization of angiosperm nrDNA polymorphism, paralogy, and pseudogenes. Molecular Phylogenetics and Evolution 29: 435–455

Bentham, G. 1860. Synopsis of Dalbergieae, a tribe of Leguminosae. Journal of the Proceedings of the Linnean Society. Botany. 4, Suppl.: 1-134.

_____________1862. Dalbergieae & Sophoreae. *In*: Martius, C. F. P. von; Eichler, A. W. & Urban, I. (eds.), Flora Brasiliensis. Monachii, Lipsiae, Frid. Fleischer in comm. Vol. 15, part 1. p. 217-324.

Crisp, M. D., Gilmore, S. & Van Wyk, B. 2000. Molecular phylogeny of the genistoid tribes of Papilionoid legumes. *In*: Herendeen, P. S. & Bruneau, A. (eds.). Advances in Legume Systematics, part 9. Royal Botanic Gardens, Kew. p. 249-276.

Delgado-Salinas, A. Bibler, R. & Lavin, M. 2006 Phylogeny of the Genus *Phaseolus* (Leguminosae): A Recent Diversification in an Ancient Landscape. Systematic Botany 31(4): 779-791.

Ducke, A. 1932. Reunion Mensuelle des Naturalists du Museus. Bulletin du museum d’historie naturelle. Paris; sér. 2, 4: 733-734.

___________ 1953. As Leguminosas de Pernambuco e Paraíba. Memórias do Instituto Oswaldo Cruz 51: 446-461.

Felsenstein, J. 1985. Confidence limits on phylogenies: an approach using the bootstrap. Evolution 39: 783-791.

Geesink, R. 1981. Tephrosieae (Benth.) Hutch. *In*: Polhill, R. M. & Raven, P. H. (eds.), Advances in Legume Systematics, part 1. Royal Botanic Gardens, Kew. p. 245-260.

___________ 1984. Scala Milletiearum. A survey of the genera of the tribe Millettieae (Legum.-Pap.) with methodological considerations. Leiden Botanical Series 8. Leiden, E.J. Brill/Leiden University Press. p. 1-131.

Greinwald, R., Bachmann, P., Lewis, G. P., Witte, L. & Czygan, F. C. 1995. Alkaloids of the genus *Poecilanthe* (Leguminosae: Papilionoideae). Biochemical Systematics and Ecology 23(5): 547-553.

Hu, J. M.; Lavin, M., Wojciechowski, M. F. & Sanderson, M. 2000. Phylogenetic systematics of the tribe Millettieae (Leguminosae) based on chloroplast trnK/matK sequences and its implications for evolutionary patterns in Papilionoideae. American Journal of Botany 87(3): 418-430.

Hu, J. M., Lavin, M., Wojciechowski, M. F. & Sanderson, M. 2002. Phylogenetic analysis of nuclear ribosomal ITS/5.8S sequences in the tribe Millettieae (Fabaceae): *Poecilanthe-Cyclolobium*, the core Millettieae, and the *Callerya* group. Systematic Botany 27(4): 722-733.

Huber, J. 1909. Materiaes para a flora amazônica VII. Boletim do Museu Paraense de História Natural e Ethnographia 5: 294-412.

Hughes, C. E., Bailey, C. D., Krosnick, S. & Luckow, M. A. 2003. Relationships among genera of the informal *Dichrostachys* and *Leucaena* groups (Mimosoideae) inferred from nuclear ribosomal ITS sequences. *In*: Klitgaard, B. B. & Bruneau, A. (eds.). Advances in Legume Systematics, part 10. Royal Botanic Gardens, Kew. p. 221-238.

Hughes, C. E., Eastwood, R. J. & Bailey, C. D. 2006. From famine to feast? Selecting nuclear DNA sequence loci for plant species-level phylogeny reconstruction. Phil. Trans. R. Soc. B 361: 211–225

Kirkbride, J. H., Gunn, C. R. & Weitzman, A. L. (2003). Fruits and seeds of genera in the subfamily Faboideae (Fabaceae). U.S. Department Agriculture, Technical Bulletin 1890: 1-212.

Klitgaard, B. B. 1995. Systematics of *Platymiscium* (Leguminosae: Papilionoideae: Dalbergieae): taxonomy, morphology, ontogeny and phylogeny. Thesis (Ph.D.). University of Aarhus, Aarhus.

Lavin, M. 1987. A cladistic analysis of the tribe Robinieae (Papilionoideae, Leguminosae). *In*: Stirton, C. H. (ed.), Advances in Legume Systematics, part 3. Royal Botanic Gardens, Kew. p. 31-64.

Lavin, M., Eshbaugh, E., Hu, J. M., Mathews, S. & Sharrock, R. A. 1998. Mophyletic subgroups of the tribe Milletieae (Leguminosae) as reaveled by phytochrome nucleotide sequence data. American Journal of Botany 85(3): 412-433.

Lavin, M., Herendeen, P. S. & Wojciechowski, M. F. 2005. Evolutionary rates analysis of Leguminosae implicates a rapid diversification of lineages during the Tertiary. Systematic Biology 54: 575--594.

Lewis, G. P., Schrire, B., Mackinder, B. & Lock, M. (eds.). 2005. Legumes of the World. Royal Botanic Gardens, Kew.

Lima, H. C. 1985. *Diplotropis* Benth. (Leguminosae-Faboideae) – estudo dos táxons infragenéricos. Acta Amazonica 15: 61-75.

Meireles, J. E. & Tozzi, A. M. G. A. A synopsis of *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae). Rodriguésia. (in press)

Page, R. D. M. 2001. Nexus Data Editor, v. 0.5.0.

Pennington, R. T., Lavin, M., Ireland, H., Klitgaard, B., Preston, J. & Hu, J. (2001). Phylogenetic relationships of Basal Papilionoid Legumes based upon sequences of the chloroplast trnL intron. Systematic Botany 26(3): 537-556.

Rambaut, A. 1996. Se-Al: Sequence Alignment Editor. University of Oxford.

Ross, J. H. & Crisp, M.D. 2005. Brongniartieae. *In*: Lewis, G. P., Schrire, B., Mackinder, B. & Lock, M. (eds.), Legumes of the World. Royal Botanic Gardens, Kew. p. 252-259

Rodrigues, R. S. 2005. Sistemática de *Acosmium* s.l. (Leguminosae, Papilionoideae, Sophoreae) e estudos de morfologia de plântulas e números cromossômicos. Ph.D. Thesis. Universidade Estadual de Campinas, Campinas, Brazil.

Rudd, V. E. 1965. The American species of *Ormosia* (Leguminosae). Contributions to the U. S. National Herbarium 32: 279-384.

Sanderson, M. T., Doyle, J. J. 1992. Reconstruction of organismal and gene phylogenies from data on multigene families: concerted evolution, homoplasy and confidence. Systematic Biology 41: 4–17.

Swofford, D. L. 2002. PAUP*. Phylogenetic analyses using parsimony (*and other methods), version 4.0beta10. Sinauer Associates, Inc., Sunderland.

Tompson, I. R., Ladiges, P. Y. & Ross, J. H. 2001. Phylogenetic Studies of the Tribe Brongniartieae (Fabaceae) Using Nuclear DNA (ITS-1) and Morphological Data. Systematic Botany 23(3): 557-570

Warwick, M. C. & Pennington, R. T. 2002. Revision of *Cyclolobium* (Leguminosae-Papilionoideae). Edinburgh Journal of Botany 59: 247-257.

Wojciechowski, M.F.; Lavin, M. & Sanderson, M.J. 2004. A phylogeny of legumes (Leguminosae) based on analysis of the plastid matK gene resolves many well-supported subclades within the family. American Journal of Botany 91(11): 1846-1862.

Appendix 1. Voucher specimens used in the molecular study. ITS sequences of the boldfaced terminal taxa belong to Martin Wojciechowski.

Terminal taxa	Locality	Collector	GenBank acession
Acosmium dasycarpum (Vog.) Yakovlev	BRAZIL. São Paulo. Mogi-Guaçu	F. Sacrpa s.n. (UEC)	
Acosmium subelegans (Mohlembr.) Yakovlev	BRAZIL. São Paulo. Campinas	J.E. Meireles s.n. (UEC)	
Acosmium nitens (Vog.) Yakovlev	BRAZIL. Amazonas. Manaus	J.E. Meireles 476 (UEC)	
Diplotropis martiusii Benth.	BRAZIL. Pará. Belém	J.E. Meireles 396 (UEC)	
Ormosia arborea (Vell.) Harms	BRAZIL. Rio de Janeiro. Macaé	J.E. Meireles 400 (UEC)	
Clathrotropis nitida (Benth.) Harms	BRAZIL. Amazonas. Manaus	J.E. Meireles 377 (UEC)	
Cyclolobium brasiliense Benth.	BRAZIL. São Paulo. Campinas (cultivated)	J.E. Meireles 486 (UEC)	
Cyclolobium nutans Rizzini & Heringer			AF467041
Harpalyce hilariana Benth.	BRAZIL. Goiás. São Jorge	A. P. F. Perez 43 (UEC)	
Harpalyce brasiliana Benth.	BRAZIL. Mato Grosso. Alto Garças	R. Rodrigues 1153 (UEC)	
Brongniartia alamosana Rydb.			AF467022
Brongniartia inconstans S. Watson		**WOJ_1202**	
Hovea elliptica (Sm.) DC.			AF287640
Poecilanthe effusa (Huber) Ducke	BRAZIL. Pará. Moju.	J.E. Meireles 395 (UEC)	
Poecilanthe amazonica (Ducke) Ducke)	BRAZIL. Amazonas. Manaus	J.E. Meireles 390 (UEC)	
Poecilanthe hostmannii (Benth) Amsh.	BRAZIL. Amazonas, Manaus	J.E. Meireles 462 (UEC)	
Poecilanthe ulei (Harms) Arroyo & Rudd	BRAZIL. Bahia. Itabuna	J.E. Meireles 422 (UEC)	
Poecilanthe falcata (Vell.) Heringer			AF467492
Poecilanthe parviflora Benth. 1			AF187089
Poecilanthe parviflora Benth. 2	BRAZIL. São Paulo. Campinas (cultivated)	J.E. Meireles 487 (UEC)	
Poecilanthe subcordata Benth.		**WOJ_1222**	
Poecilanthe itapuana G.P. Lewis 1	BRAZIL. Bahia. Salvador	J.E. Meireles 433 (UEC)	
Poecilanthe itapuana G.P. Lewis 2		**WOJ_1218**	

Appendix 2- Morphological characters and states used in the cladistic analyses.

1. Leaf type (mostly): [0] multifoliolate, [1] unifoliolate, [2] simple; **2.** Leaflet attachment: [0] opposite, [1] alternate; **3.** Leaflet peltate glands: [0] absent, [1] present; **4.** Resting buds protected by scales: [0] absent, [1] present; **5.** Inflorescence type: [0] highly branched panicle, [1] single raceme / poorly branched panicle, [2] paired racemes, [3] single flowers; **6.** Floral symmetry: [0] radial, [1] bilaterally symmetrical, [2] asymmetrical; **7.** Hypanthium: [0] straight, [1] curved; **8.** Calyx lobes aestivation: [0] valvate, [1] imbricate; **9.** Calyx lobes differentiation: [0] equal/subequal, [1] two upper highly connate, [2] strongly bilabiate; **10.** Standard petal differentiation: [0] absent, [1] present; **11.** Standard petal base: [0] acute, [1] obtuse/rounded, [2] distinctly auriculate; **12.** Standard petal auricles: [0] straight, [1] inflexed; **13.** Wing petals differentiation from the keel petals: [0] absent (subequal), [1] present (distinct); **14.** Wing petal base: [0] attenuate, [1] auriculate (upper part), [2] biauriculate (lower auricle smaller); **15.** Wing petal articulation to the keel: [0] absent, [1] upper part depression (plicate wing), [2] inner turgid callous (wing not plicate); **16.** Wing petal sculpturing: [0] absent, [1] present; **17.** Keel petals: [0] free, [1] adherent; **18.** Keel contortion: [0] absent, [1] present; **19.** Keel petal boss (lateral protusion): [0] absent, [1] present; **20.** Keel petals margin: [0] glabrous, [1] ciliate; **21.** Stamens fusion: [0] absent, [1] present; **22.** Stamens adelphy: [0] diadelphous, [1] diadelphous to monadelphous, [2] monadelphous; **23.** Vexilary stamen: [0] free, [1] adherent to the base of the standard claw; **24.** Filaments length: [0] equal/subequal, [1] two clearly distinct lengths; **25.** Anthers size (among the two whorls): [0] equal, [1] subequal (less than 50% difference), [2] distinctly dimorphic (difference around 100%); **26.** Anthers (filament attachment): [0] all basifixed, [1] all dorsifixed, [2] alternating basifixed / dorsifixed; **27.** Anther connective: [0] inconspicuous, [1] conspicuous; **28.** Ovary stipe: [0] absent (sessile), [1] present (stipitate); **29.**

Stigma shape: [0] punctiform (including subcapitate), [1] capitate, [2] bilobed; **30.** Fruit type: [0] samaroid, [1] nucoid, [2] legume; **31.** Fruit sutural margin: [0] plane, [1] ridged, [2] longitudinally winged; **32.** Fruit septation: [0] absent, [1] present; **33.** Seed growth: [0] regular, [1] overgrown; **34.** Testa consistency: [0] hard, [1] coriaceous, [2] membranaceous/papery; **35.** Testa colour: [0] unicoloured, [1] bicoloured; **36.** Funicle distinctiveness: [0] indistinct, [1] distinct; **37.** Funicle type (when distinct): [0] free, [1] adherent to the endocarp; **38.** Hilum direction: [0] straight (to the suture), [1] curved downward (to the endocarp); **39.** Hilum (persistence of a funicle remnant): [0] absent, [1] present; **40.** Hilar groove (faboid split): [0] absent, [1] present; **41.** Aril: [0] absent, [1] poorly developed, [2] well developed; **42.** Aril type: [0] annular (symmetrical), [1] one-lipped (asymmetrical); **43.** Micropyle: [0] not visible, [1] visible; **44.** Lens: [0] not visible, [1] visible; **45.** Raphe: [0] not visible, [1] running around 1/2 of the seed, [2] running around 3/4 of the seed; **46.** Post chalazal ramifications: [0] absent, [1] not reaching the hilum, [2] reaching the hilum; **47.** Endosperm: [0] absent, [1] present; **48.** Seed position to the fruit length: [0] longitudinal, [1] transversal; **49.** Cotyledon base: [0] obtuse to rounded, [1] distinctly auriculate; **50.** Cotyledon lobes overlapping: [0] absent, [1] present; **51.** Epicotyl / hypocotyl-root axis: [0] shorter, [1] longer (around twice); **52.** Epicotyl cataphylls: [0] absent, [1] present; **53.** Epicotyl reddish-trichomes: [0] absent, [1] present; **54.** Plumule development: [0] rudimentary, [1] bipartite; **55.** Plumule symmetry: [0] symmetric, [1] asymmetric; **56.** Plumule vestiture: [0] glabrous, [1] villous; **57.** Hypocotyl-root axis: [0] straight, [1] inflexed; **58.** Hypocotyl-root axis concealment: [0] not concealed, [1] partially concealed, [2] completely concealed.

Appendix 3- Morphological data matrix. Characters and states are listed in appendix 2. Polymorphisms are indicated by "a" (0+1), "b" (0+2) and "c" (1+2). Dashes indicate inapplicable characters; question marks indicate unknown states.

	1 10	20	30	40	50	58
Acosmium dasycarpum	0a00000000	0-00000000	0-00011100	000000-001	100000100-	00000010
Acosmium subelegans	0a00000000	0-00000000	0-00011100	000000-001	100000100-	00000010
Acosmium nitens	0000000000	0-00000000	0-00011101	000000-001	100000100-	00000010
Diplotropis martiusii	0100011011	2102000000	0-01111011	001200-000	0-0?1?0010	01000010
Ormosia arborea	0000010111	1-01010000	0-01211122	0000110001	100000000-	00000000
Clathrotropis nitida	0a00010011	2001001001	0-00001012	0012010010	0-00110010	00100000
Cyclolobium brasiliense	1-00110111	1-11211010	1000120110	2012010010	0-00200010	00010010
Cyclolobium nutans	1-00110111	1-11211010	1000120110	2012010010	0-00200010	00010010
Harpalyce hilariana	0010120121	2011101100	?2-0220012	0101011000	2110000011	00011001
Harpalyce brasiliana	0010120121	2011101100	1200220012	0101011000	2110000011	00011001
Brongniartia alamosana	0001110111	1-11101000	1000220102	2001011100	2110000011	0001000c
Brongniartia inconstans	0001110111	1-11101000	1000220102	2001011100	2110000011	0001000c
Hovea elliptica	2-00310011	1-11101000	1200220112	0001010001	201000001?	00010001
Poecilanthe effusa	0a00010011	0-11101000	1010121002	010200-000	0-00120110	10110102
Poecilanthe amazonica	1000110111	2012211010	1000120112	0012010010	0-00110010	01010010
Poecilanthe hostmannii	1000110111	2012211010	1000120112	0012010010	0-00110010	01010010
Poecilanthe ulei	0101110111	1-11111000	12-0220102	1001011100	2110000011	00010002
Poecilanthe falcata	0101110111	1-11111000	12-0220102	1001011100	2110000011	00010002
Poecilanthe parviflora1	0101210111	1-11101000	1100220102	b002?10010	0-11200011	0001000c
Poecilanthe parviflora2	0101210111	1-11101000	1100220102	b002?10010	0-11200011	0001000c
Poecilanthe subcordata	0101210111	2011101000	1100220112	0001011100	2110000011	00010002
Poecilanthe itapuana1	0101210111	2011101000	1100220112	0001011100	21?????0??	????????
Poecilanthe itapuana2	0101210111	2011101000	1100220112	0001011100	21?????0??	???????

CAPÍTULO 3

A taxonomic revision of the neotropical genus *Poecilanthe s.s.* (Leguminosae, Papilionoideae, Brongniartieae)[6]

José Eduardo Meireles[7*] & Ana Maria G. de A. Tozzi[2]

Summary. *Poecilanthe* is here circumscribed in a narrower sense to comprise the extra-Amazonian species only. *Poecilanthe s.s.* includes six species distributed from north-eastern to southern Brazil, with one species extending to Argentina, Paraguay and Uruguay. The genus is recognized by the multifoliolate leaves with alternate leaflets, the bilaterally papilionaceous flowers arranged in racemes or poorly branched panicles, the two upper lobes of the calyx highly connate, the stamens monadelphous or both monadelphous and diadelphous on the same plant, the anthers strongly dimorphic (the larger anthers around twice the length of the smaller ones), the non-septate and dehiscent legume, the seeds with the faces parallel to the fruit length, and by the straight hypocotyl-root axis. Descriptions, illustrations, distribution maps, and an identification key for the six species are presented.

Key words. *Poecilanthe,* Fabaceae, morphology, taxonomy, Neotropics, South America.

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Introduction

The legume genus *Poecilanthe* Benth., as currently circumscribed (*sensu lato*), comprises ten South-American species, occurring from Colombia and French Guiana to Argentina and Uruguay (Meireles & Tozzi in press).

In this sense, *Poecilanthe* is characterized by the unifoliolate or imparipinnate leaves, with the leaflets alternate to opposite; the racemose or paniculate inflorescences; the flowers papilionaceous and bilaterally symmetrical; the calyx turbinate or campanulate with 5 teeth, the upper 2 highly united; the wing petals longer than the keel; the stamens monadelphous or diadelphous, with the anthers from sub-equal to distinctly dimorphic, and by the dehiscent, woody pod.

The tribal position of *Poecilanthe* within the Papilionoideae is historically controversial. It has been shifted among tribes Dalbergieae (Bentham, 1860; Burkart, 1952; Lavin 1987; Macbride 1943), Galegeae (Ducke 1953), Millettieae (Tephrosieae) (Geesink 1981; Hutchinson 1964; Lavin & Sousa 1995; Polhill 1994) and Robinieae (Geesink 1984).

According largely to molecular and chemical data, *Poecilanthe* is presently known to be related to the genistoid legumes (Crisp *et al.* 2000; Doyle *et al.* 2000; Greinwald *et al.* 1995; Hu *et al.* 2000 & 2002; Pennington *et al.* 2001; Ross & Crisp 2005; Wojciechowski *et al.* 2004), especially to the tribe Brongniartieae. Brongniartieae includes four American genera (*Brongniartia*, *Cyclolobium*, *Harpalyce* and *Poecilanthe*) and six Australian genera (*Cristonia*, *Hovea*, *Lamprolobium*, *Plagiocarpus*, *Templetonia* and *Thinicola*) (Ross & Crisp 2005)

A phylogeny of *Poecilanthe* based on morphological and molecular data (Meireles, chapter 2) reveals that *Poecilanthe* comprises three lineages that are paraphyletic with respect to the other Brongniartieae. Therefore, Meireles (chapter 2) has suggested splitting *Poecilanthe s.l.*

into three different genera, and restricting *Poecilanthe* to the extra-Amazonian species (*Poecilanthe s.s.*).

Within *Poecilanthe s.s.*, some species are known to present remarkable morphological variation (as cited, for example, by Lewis (1987) for *P. ulei*). Distinction between species can be difficult, as is the case with the taxonomic boundaries between *P. falcata* and *P. grandiflora*. In fact, Bentham (1860, 1862) and Ducke (1953) considered them to be synonyms, Heringer (1952) and Meireles & Tozzi (in press) have accepted them as two distinct species.

In this paper we circumscribe *Poecilanthe* in a narrower sense, as suggested by Meireles (chapter 2). A taxonomic revision of the genus is presented, addressing issues of species delimitation, nomenclature and typification. In addition, we provide an identification key, geographic distribution maps, descriptions and illustrations for the six accepted species of *Poecilanthe s.s.*.

Materials and methods

This taxonomic study is based on 292 herbarium specimens. Herbarium collections of the following herbaria (abbreviations according to Holmgren *et al.* 1990) have been analyzed: AAU, ALCB, BHCB, BM, BR, C, CEPEC, CVRD, ESA, HRB, HUEFS, IAN, ICN, IPA, MAC, MBM, MG, NY, PACA, RB, SP, SPF, SPSF, UB, UEC, US. All specimens and duplicates cited have been seen.

The species in the taxonomic treatment are arranged in an order of estimated relationship (see "Relationships among the species" in page 60, and Meireles, chapter 2). Descriptive terminology employs terms that are largely used in legume taxonomic works (see Klitgaard 2005 for an example), except for seed and embryo, which follows Meireles (chapter 1). Leaflet measurements were taken from the three distal leaflets, which are mostly larger than the basal ones. The length of the flowers was measured from the base of the calyx to the tip of the non-reflexed standard. Information on geographic distribution, habitat, vernacular names and phenology are based on specimen labels. Maps were made using DIVA-GIS 5.2 (Hijmans *et al.* 2005).

We are following the dates given in Taxonomic Literature (Stafeu & Cowan 1976-1988) when the publication date is doubtful.

Taxonomic history

Poecilanthe was established by Bentham (1860). In his synopsis of the tribe Dalbergieae he described three species: *P. grandiflora* and *P. subcordata*, based on the material collected by Martius in Minas Gerais (Brazil), and *P. parviflora*, based on Tweedie's material from Uruguay. Bentham, however, designated no type material but cited his treatment of *Poecilanthe* in Flora Brasiliensis, which was published just two years later (Bentham 1862). The treatment in Flora Brasiliensis includes better descriptions and more complete citations of herbarium material. Neither in the Synopsis nor in Flora Brasiliensis did Bentham designate a type for the genus. According to the Index Nominum Genericorum, the type of *Poecilanthe* is *P. grandiflora* (Farr *et al.* 1979).

Hassler (1913) described a new variety, *Poecilanthe parviflora* var. *floribunda* for the Paraguayan flora; Klenihoonte (1925) described a new species, *P. ovalifolia*, from Surinam. Subsequently, five species were transferred into *Poecilanthe*: *Amphiodon effusus* and *Cyclolobium amazonicum* by Ducke (1932), *Cyclolobium hostmannii* by Amshoff (1939), *Pterocarpus falcatus* by Heringer (1952) and *Machaerium ulei* by Arroyo & Rudd (1973).

Finally, Lewis (1989) described *P. itapuana* based on a collection from Bahia (Brazil) and Meireles & Tozzi (in press) are placing *P. parviflora* var. *floribunda* in the synonymy of the typical variety.

Morphology

Habit

Poecilanthe species range from 1 m tall shrubs to medium sized trees (rarely to 30 m tall). *Poecilanthe subcordata* is reported to have a semi-scandent habit (*G. Hatschbach 44400*). Some species, such as *P. falcata,* present a huge variation in habit depending on the habitat where they grow in, varying from small shrubs in dry seasonal coastal vegetation to 18 m tall trees in less restrictive (moister) vegetation, such as "Tabuleiro" Forests. We observed a clear pattern of yearly-growth in the species we analyzed in the field (*P. falcata*, *P. itapuana* and *P. ulei*), which may be related to the dry habitat, where these species occur. With this in mind, the scale-protected resting buds may play an important role for the plant to be able to overcome the effects of the dry season. The size of these resting buds divides the genus into two groups: *P. itapuana*, *P. parviflora* and *P. subcordata* have inconspicuous, small buds (1-2 mm long) while *P. falcata*, *P. grandiflora* and *P. ulei* have conspicuous, large buds (3-7 mm long).

Leaf

The leaves are alternate and imparipinnate. The stipules are persistent (e.g. *Poecilanthe parviflora*, *P. itapuana*) or early caducous in the remaining species. The petiole has a wrinkled pulvinus at its base, and the rachis may or may not bear minute setaceous stipels at each leaflet insertion point. The leaflets are alternate, mostly 3-11 per leaf, but sometimes *P. ulei* may have only one leaflet. The leaflet size usually decreases from the apex to the base of the leaf and its shape, size, hairiness and texture, vary considerably. The midvein is slightly depressed on the upper face and prominent on the lower face; it is usually straight, but often zig-zag-shaped (at least somewhat) in *P. ulei*. The secondary venation is brochidodromous, prominent or impressed on the leaflet abaxial blade.

Inflorescence

The genus splits into two groups based on inflorescence morphology. *Poecilanthe itapuana*, *P. parviflora* and *P. subcordata* have two racemes per leaf axil that are separated by a bud that is not protected by scales. Occasionally, it is possible to find one or three racemes per leaf axil or, in some cases, the subtending leaf is not developed. Differently, *P. falcata*, *P. grandiflora* and *P. ulei* have poorly-branched panicles or solitary racemes, either in the leaf axils or not. At anthesis, the subtending leaves in *P. falcata* and *P. grandiflora* often fall and the inflorescence may appear to be a more branched panicle. The bract varies in size and shape, but it is always somewhat cymbiform and its inner face is glabrous.

Flower

The flowers in *Poecilanthe* are papilionaceous and bilaterally symmetrical, varying in length from 0.8 to 3 cm; they appear to be jointed from the tip of the pedicel. Two opposite bracteoles are inserted either along or at the apex of the pedicel; their inner face is glabrous.

Calyx

The calyx in *Poecilanthe* has five sepals basally fused. The calyx shape is campanulate, with the base gibbous and the apex toothed; the upper 2 teeth are connate almost to their apices. The hypanthium is short and turbinate, into which nectar is secreted from a non-differentiated nectary, at least in *P. falcata* and *P. parviflora* (pers. obs.).

Corolla

The corolla in *Poecilanthe* species is whitish, lilac or purple, composed of five petals, which are glabrous and unguiculate. The predominant colour of the corolla also allows us to separate two groups within the genus: the whitish-flowered group (*P. itapuana*, *P. parviflora* and *P. subcordata*) and the purplish-flowered group (*P. falcata*, *P. grandiflora* and *P. ulei*). The standard petal reflexes after anthesis, exposing the inner blotch that contrasts in colour with the rest of the blade. The wings are longer than the keel and their blades are longitudinally plicate (as an extension of the claw). The upper base of the wing petal is slightly or distinctly auriculate, and the outer face of the upper basal region is sculptured. According to Stirton (1981), wing petal sculpturing is widespread among the Papilionoideae, and serves mainly as foothold for pollinating insects. The keel petals are slightly overlapped and adherent along part of the lower margin, and their upper bases are also auriculate.

Androecium

The androecium is composed of 10 stamens, mostly fused in an open sheath. However, *Poecilanthe itapuana*, *P. parviflora* and *P. subcordata* have both monadelphous and diadelphous stamens within the same individual, a character that is recorded for the first time in the literature for these species. When the stamens are monadelphous, the sheath presents an aperture at its base on the upper side (pseudofenestra), as is also the case in *Platymiscium*, *Machaerium* (Klitgaard 2005) and *Centrolobium tomentosum* Guillem. ex Benth. (pers. obs.). According to Klitgaad (2005), the pseudofenestra may have the same function of the true fenestrae, which allow the visitor to access the nectariferous tissue (Geesink 1981; Lavin 1990).

The anthers are distinctly dimorphic; the larger anthers are twice the length of the smaller ones. The larger anthers are basifixed and lanceolate, alternating with the smaller anthers that are dorsifixed (and versatile) and suborbicular. Both anther types are dehiscent at anthesis. In the young bud, the smaller anthers are positioned under the larger ones. The larger anthers open first, followed by an elongation of the filaments of the smaller anthers, which open then.

Polhill (1976 *apud* Klitgaard 2005) studied the functional implications of dimorphic anthers in some groups of Papilionoideae. He concluded that in the species he studied the keel is narrow, leaving little space to the anthers, and that having dimorphic anthers with different opening times could extend the pollen presentation of each flower. *Poecilanthe* does not seem to fit in this explanation, since the keel is not that narrow (*Crotalaria*-like) and, as we described above, even the small anthers are usually opened at anthesis.

Arroyo (1981), on the other hand, suggests that the dimorphic anthers with different opening times are mostly associated with an explosive pollination system. The smaller anthers can first push up the pollen of the larger ones, while their filaments elongate; then they open to expose their own pollen and serve as a “dish” to hold all the pollen at the tip of the keel.

Gynoecium

The ovary always has a stipe, which is usually about the same length as the hypanthium. The style is curved to the standard and presents a punctiform or capitate stigma at its apex. The ovules are 3 to 7 per ovary and well-spaced from each other. The ovary vestiture also splits the genus into two groups: one group is densely hairy at least along the suture (*P. itapuana*, *P. parviflora* and *P. subcordata*), while the other group has few, scattered hairs mainly along the dorsal margin or is completely glabrous along both margins (*P. falcata*, *P. grandiflora* and *P. ulei*).

Fruit

The fruits of *Poecilanthe* species are woody or coriaceous legumes. The dehiscence is explosive, with the valves becoming helically contorted (in all species except *P. parviflora*), or is passive and lately, with the valves just reflexing (only in *P. parviflora*).

Poecilanthe presents two basic fruit types that divide the genus into two groups: *P. falcata*, *P. grandiflora* and *P. ulei* have the sutural margin enlarged or broadened into a woody ridge, while the remaining species present basically plane-margined fruits; however, *P. parviflora* occasionally presents a narrow longitudinal wing on the sutural margin of the fruit.

Explosive dehiscence is often associated with self-dispersion (autochory) (Van der Pijl 1982); however, autochory may not be the main dispersal event, since the seeds can be subjected to another type of secondary dispersion (Martins et al. 2006). In *P. parviflora*, for example, the fruit falls from the tree while still closed, this being the reason why Burkart (1952) considered it as indehiscent pod. The fruit only dehisces on the floor, when the valves get dried. The flotation of the closed pods (pers. Obs.) and the preference of the species for riparian forests, allow us to speculate about the occurrence of water dispersion in *P. parviflora*.

The inner face of the fruit often presents some farinaceous tissue around the seeds or along the margins. The funicle is mostly anvil-shaped, flattened in cross-section and adherent to the fruit wall. Only *P. parviflora* has the funicle subterete and free from the fruit wall.

Seed and embryo

The morphology of the seed and embryo is better discussed and illustrated in Meireles (chapter 1). Summarizing, the seeds of all the species of *Poecilanthe* are regular (not overgrown), flattened in cross section, parallel with the fruit length, have the hilum without hilar groove, endosperm is absent, and the plumule is bipartite, glabrous, and shorter than the straight hypocotyl-root axis. While the seeds of most of the species have a rim aril, not concealed hilum and the raphe and chalaza not visible, the seeds of *P. parviflora* have no aril, the hilum is concealed by a funicle remnant, and the raphe and chalaza are visible.

Relationships among the species

The phylogeny of *Poecilanthe* (Meireles, chapter 1) revealed that two major clades are resolved within the *Poecilanthe* s.s.. The first group is formed by *Poecilanthe itapuana, P. subcordata* and *P. parviflora*. These species share the inconspicuous axillary resting buds (to 3 mm long), the paired axillary racemes with whitish flowers, the androecium varying from monadelphous to diadelphous in the same individual, the ovary margins densely haired (at least the sutural margin) and the fruits with basically plane margins. The second group contains *P. falcata*, *P. grandiflora* and *P. ulei,* and is diagnosed by the conspicuous axillary resting buds (3-7 mm long), the poorly-branched panicles or solitary racemes which are terminal or axillary and bear purplish flowers, the androecium always monadelphous, the ovay margins with few hairs or completely glabrous and the sutural margin of the fruit enlarged or broadened into a woody ridge. The differences cited above are summarized in Table 1.

Feature / Group of species	*P. falcata, P. grandiflora, P.ulei*	*P. itapuana, P. parviflora, P. subcordata*
Axillary resting bud	Conspicuous, 3-7 mm long	Inconspicuous, 1-2 mm long
Inflorescence type	Poorly branched panicle or Solitary axillary raceme	Paired racemes in the leaf axil
Corolla predominant colour	Purplish	Whitish
Androecium	Monadelphous	Monadelphous or diadelphous in the same individual
Gynoecium vestiture	Densely haired along the margins	Few haired along the margins to totally glabrous
Fruit margins	Sutural margin broadened into a woody ridge	Sutural margin essentially plane

Table 1: Summary of the characters used for separating the two major groups within *Poecilanthe*

Taxonomic treatment

Poecilanthe Benth., J. Proc. Linn. Soc., Bot. 4, Suppl.: 80. 1860. Type: *P. grandiflora*

Trees, erect or semi-scandent shrubs; axillary resting buds protected by two or more scales; stipules persistent or caducous. **Leaves** alternate, imparipinnate, stipels setaceous, present or absent; leaflets (1-) 3-11, alternate; pulvinule wrinkled, secondary venation brochidodromous, prominent or impressed. **Inflorescences** in racemes or poorly-branched panicles, terminal, axillary or cauliflorous, erect; bracts varying in shape, but always cymbiform. **Flowers** papilionaceous and bilaterally symmetrical, pedicellate; bracteoles 2, opposite, inserted at the base of the calyx or along the pedicel. **Calyx** campanulate, with 5 sepals fused at the base, basally gibbous, the upper 2 teeth connate almost to their apices, the inner face of the tube glabrous; hypanthium turbinate. **Corolla** with 5 petals, glabrous, clawed; the wing petals longer than the keel, their blades plicate and basally auriculate on the upper part; keel petals slightly adherent along part of the lower margin, the base auriculate on the upper part. **Androecium** with 10 stamens fused into an open sheath or the vexilary stamen free, filaments apically free and curved upward; anthers distinctly dimorphic (length difference between the two types around 100%), the shorter anthers dorsifixed and suborbicular, alternating with the longer, basifixed and lanceolate ones. **Ovary** stipitate, glabrous to villous along the margins, ovules 3-7 per ovary and well-spaced from each other. **Fruits** explosively or passively dehiscent, flattened in cross-section; upper margin plane, broadened into a woody ridge or into a narrow longitudinal wing; the endocarp often presenting some farinaceous tissue. **Seeds** not overgrown, flattened in cross section, the faces parallel to the fruit length, rim aril present or not, hilum without hilar groove, endosperm absent in mature seeds. Embryo with cotyledons base groined, hypocotyl-root axis straight, plumule bipartite, glabrous and shorter than the hypocotyl-root axis length.

Etymology: From the Greek "*poecilo*" vari-colored and "*anthos*" flower (Allen & Allen 1981; Ross & Crisp 2005).

Poecilanthe s.s. includes six species distributed from north-eastern to southern Brazil, with one species extending to Argentina, Paraguay and Uruguay. *Poecilanthe s.s.* can be recognized by the imparipinnate leaves with alternate leaflets, the papilionaceous and bilaterally symmetrical flower, the keel shorter than the wing petals, the stamens monadelphous or diadelphous and monadelphous in the same individual, the anthers distinctly dimorphic, the larger ones basifixed and at least twice the length of the smaller and dorsifixed anthers, the non-septate and dehiscent pod, the seeds with the faces parallel with the fruit length, and by the straight hypocotyl root axis.

Key to the species of *Poecilanthe s.s.*

1. Axillary resting buds inconspicuous (to 3 mm long)**;** inflorescence a paired axillary raceme; flowers whitish; fruit margins essentially plane

  2. Leaflets subsessile (pulvinule ca. 1 mm long), abaxial face usually presenting some pubescence; flower pedicel 3-5 mm long .... **P. subcordata**

  2. Leaflets distinctly pulvinulate (pulvinule over 2 mm long), abaxial face glabrous; flower pedicel 1-2 mm long

    3. Leaflets coriaceous; inflorescence 5.5-8 cm long; fruit over 5 cm long, oblong-elliptic to obovate, with explosive dehiscence .... **P. itapuana**

    3. Leaflets membranaceous; inflorescence 3-4.5 cm long; fruit under 3.5 cm long, wide elliptic to orbicular, with passive dehiscence .... **P. parviflora**

1. Axillary resting buds conspicuous (3-7 mm long)**;** inflorescence poorly-branched panicle or solitary raceme in the leaf axils; flowers purplish; fruit upper margin enlarged or broadened into a woody ridge

  4. Leaflets 1 to 5 per leaf, midvein often somewhat zig-zag-shaped; inflorescence an umbeliform raceme; flowers under 11 mm long .... **P. ulei**

4. Leaflets 6-9 per leaf, midvein straight; inflorescence a pyramidal raceme or panicle; flowers over 14 mm long

5. Floral bud apex acuminate and twisted; calyx over 13 mm long, the teeth longer than the tube .... **P. falcata**

5. Floral bud apex acute and straight; calyx under 11 mm long, the teeth equalling or a little shorter than the tube .... **P. grandiflora**

Poecilanthe falcata (Vell.) Heringer, Arquiv. Serv. Florest. 6: 197. 1952. *Pterocarpus falcatus* Vell., Fl. Flum.: 300. 1829. Brazil, Rio de Janeiro: Rio de Janeiro, "Habitat silvis, et fruticetis maritimis Regii Praedii Sanctae Crucis", Vellozo, Fl. Flum. V.7, tab. 93. 1831. (Lectotype designated in Meireles & Tozzi, in press)

Shrub or tree to 18 m tall; terminal branches greyish, presenting resting buds above the leaf scars, lenticels often present; axillary bud conspicuous, triangular-falcate, 3-7 x 2-4.7 x 1.8-3 mm; stipules oblong-linear, 7.5-9 x 1.4-2.3 mm, early caducous, sparsely tomentose. **Leaf** (6-)7-9 foliolate; petiole 0.8-3.5 cm long; rachis 5-12.5 cm long; stipels setaceous, 1-2(-3) mm long, occasionally caducous or rarely absent; pulvinule 2-4 mm long. Leaflets ovate to elliptic, elliptic-obovate, less commonly suborbicular or oblong, distal leaflets (2.5-)3.5-9(-11.5) x (1.4-)2-6 cm, the basal ones often smaller; base obtuse to subcordate, sometimes asymmetric when subcordate; apex acuminate to acute, rarely slightly obtuse, often mucronate; membranaceous to sub-coriaceous; discolour; midvein straight, secondary veins prominent; upper face sparsely sericeous to glabrate; lower face pilose to sericeous, often turning glabrate when mature. **Inflorescence** raceme or poorly branched panicle (1-2 basal branches); terminal, axillary, or cauliflorous; 3-7 cm long, pyramidal, tomentose; peduncle 0.5-2.8 cm long, sometimes presenting some small resting buds along its base; rachis 1.8-5.5 cm long; bract elliptic-ovate, 2.5-3 x 1.3-1.5 mm, outer face sparsely tomentose, caducous; floral bud oblong-ovate, sub-falcate, 1.5-1.7 cm long, base sub-gibbous, apex acuminate and twisted, tomentose. **Flower** 2-2.8(-3) cm long; pedicel 3-6 mm long; bracleoles wide-ovate to ovate, 2.4-3 x 1-1.6 mm, inserted on the base of the calyx, outer face sparse tomentose; caducous. Calyx 13-20 mm long, sparsely tomentose; tube 5.5-10 mm long, teeth narrowly triangular to lanceolate, 7-12 mm long, inner face woolly; apex of the upper two acute, 1.2-3.5 mm separated; lateral teeth acuminate, lower tooth acuminate and slightly hooked; hypanthium 1.8-2.5 mm long. Corolla violet; standard wide-elliptic to orbicular, claw 5-8 mm long, blade 12-20 x 13-20 mm, base obtuse, rounded to subcordate, apex emarginated; wings obovate in outline, claw 6-10 mm, blade 11-18 x 6.5-11 mm, base distinctly auriculated, apex truncate or emarginated; keel petals falcate, claw 6-10 mm long, blade 6.5-11 x 3-5 mm, base slightly auriculated, apex rostrate. Androecium monadelphous, 14-20 mm long, filaments free for 1.8-3(-3.5) mm; basifixed anthers 1-1.6 mm long; dorsifixed anthers 0.5-0.9 mm long. Gynoecium 15-22 mm long; stipe 2-3 mm long; ovary **7-**10 mm long, sparsely sericeous along the lower margin to the base of the style; style 5.5-7 mm long; stigma subcapitate; ovules 7. **Fruit** woody and explosively dehiscent; elliptic to oblong in outline, 12-23 x 2.8-5.5 cm, stipe 4-10 mm long, upper margin broadened into a woody ridge, 6-14 mm wide; outer face basically smooth; funicle anvil-shaped, flattened, adherent to the fruit inner face but prominent to the hilum distally. **Seeds** 2-5, wide ovate-elliptic, sub-orbicular or orbicular, 18-22 x 16-20 x 3-5 mm. Testa coriaceous, glossy; hilum 1.5-2 mm, curved downward to the endocarp, not concealed; rim-aril present, one-lipped; hypocotyl-root lobe visible; lens, chalaza and raphe not visible.

Fig. 1.

Distribution and habitat: Occurring in Brazil, from southern Bahia to central Rio de Janeiro, mainly on coastal vegetation (Map 1). *Poecilanthe falcata* is more frequent in costal vegetation on sandy soil (restinga) or in dry vegetation on coastal slopes (Cabo Frio region) however it also occurs in some moister forests (e.g. "mata de tabuleiro").

Phenology: Flowering from late August to January; fruiting from February to October. The fruits take a long time to mature and sometimes the fruits of the past season are present while the plant is beginning the new flowering season.

Vernacular names: sucupira-amarela, angelim-ferro.

Comments: One year after Heringer (1952) published the new combination *Poecilanthe* falcata (Vell.) Heringer, Ducke (1953) again made a combination for *Pterocarpus falcatus* Vell. in *Poecilanthe*, creating the illegitimate name *Poecilanthe falcata* (Vell.) Ducke.

Poecilanthe falcata is related to *P. grandiflora* and *P. ulei*, from which it is distinguished mainly by the floral bud with the acuminate and twisted apex, the larger flowers (2-2.8 cm long) and the longer calyx (over 1.3 cm long).

In the absence of flowering material, it is very difficult to distinguish *Poecilanthe falcata* from *P. grandiflora*, since the fruits of these two species are identical and both are highly variable concerning vegetative characters, thus presenting considerable overlapping in leaf length and leaflets number, size and shape. However, the leaves of *P. falcata* are mostly 7-9-foliolate and the stipels are often persistent while *P. grandiflora* usually has 7-foliolate leaves and the stipels are early caducous. So, the 9-foliolate leaf and the mostly persistent stipels may indicate a *P. falcata* identity. In addition, there is apparently no overlap in the geographic distributions of these two species; thus, the collection locality may be useful to identify the material.

When growing in dryer habitats (Cabo Frio region) *P. falcata* becomes a branched shrub with the leaflets more coriaceous, contrasting to the arboreal habit and membranaceous leaflets when growing in moister forests (e.g. Tabuleiro forests).

Examined material: BRAZIL. Without locality: *Glaziou* 12549 (C); *Glaziou* s.n. (MG); 31 July 1997, *M. R. Moreno* s.n. (RB). **BAHIA:** BELMONTE, 27 Sept. 1979, *L. A. Mattos Silva* & *J. L. Hage* 610 (CEPEC); ILHÉUS, Olivença, 14 May 1995, *W. W. Thomas* & *J. Kallunki* 10910 (RB, CEPEC, NY). **ESPÍRITO SANTO:** CACHOEIRO DE ITAPEMIRIM, Ilha da Luz, 8 April 1955, *A. B. Souza* s.n. (RB); CARIACICA, Foz do Rio Bubu, 21 Aug. 1991, *O. J. Pereira* 2370 (RB); LINHARES, Reserva florestal, 13 Nov. 1993, *B. B. Klitgaard* 25 (RB, AAU); RNCVRD, 25 Oct. 1979, *D. A. Folli* 150 (CVRD); RNCVRD, 22 June 1994, *D. A. Folli* 2339 (CVRD); RNCVRD, 13 Nov. 1993, *G. L. Farias* 648 (CVRD); RNCVRD, 9 Nov. 2005, *G. S. Siqueira* 194 (CVRD); RNCVRD, 9 Nov. 2005, *G. S. Siqueira* 195 (CVRD); RNCVRD, 9 Nov. 2005, *G. S. Siqueira* 196 (CVRD); Reserva natural da CVRD, 26 Nov. 2004, *J. E. Meireles* 26 (RB, CVRD); VILA VELHA, Dec. 1992, *J. M. L. Gomes* 1800 (RB); 7 Nov. 1992, *P. C. Vinha* 1432 (RB). **RIO DE JANEIRO:** without locality,1868, *Glaziou* 2546 (BR, C); Serra do Caçador, 3 Aug. 1953, *J. Lobão* 475 (RB); ARARUAMA, Iguaba, 1 June 1989, *H. C. de Lima* & *D. Araujo* 3577 (RB); ARMAÇÃO DE BÚZIOS, Restinga de Manguinhos, 12 Nov. 1999, *D. Fernandes* & *J. Caruso* 278 (RB); Restinga da praia de Manguinhos, 28 March 2000, *D. Fernandes* & *A. Oliveira* 497 (RB); José Gonçalves, 22 March 1997, *P. R. Farág* 567 (RB); APA do Pau-Brasil, 5 May 2004, *R. D. Ribeiro* 209 (RB, RUSU); ARRAIAL DO CABO, Morro do Miranda, 3 Sept. 1987, *D. Araujo* & *S. R. R. Souza* 8208 (RB); Morro do Miranda, 23 Sept. 1987, *D. Araujo* 8224 (RB); Morro do

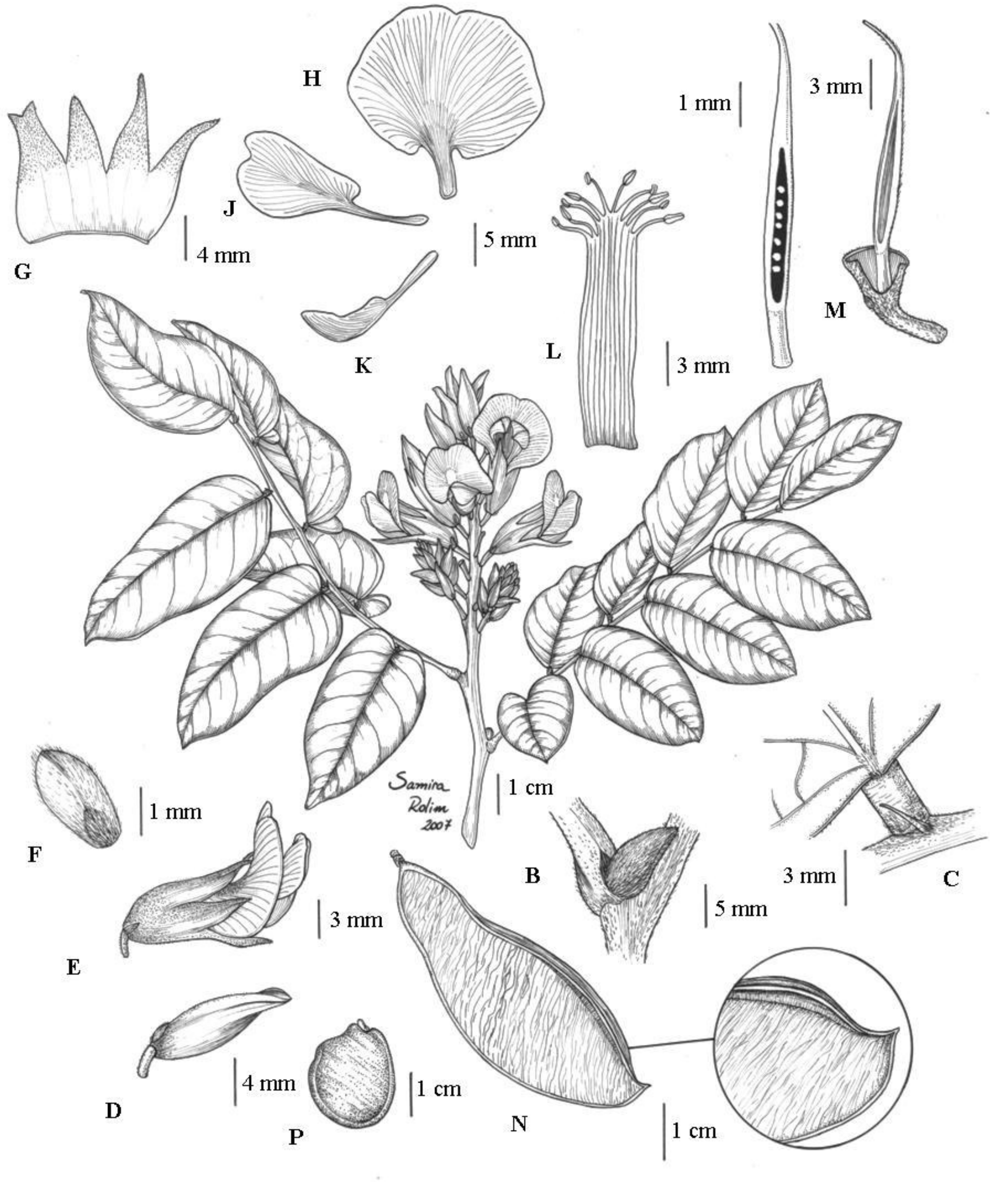


Fig. 1. *Poecilanthe falcata*. **A.** flowering branch; **B.** resting bud; **C.** stipel; **D.** floral bud; **E.** flower; **F.** bracteole; **G.** calyx opened out; **H.** standard; **J.** wing; **K.** keel petal; **L.** androecium; **M.** gynoecium; **N.** ovary longitudinal section; **P.** fruit; **Q.** seed.

Map 1. Geographic distribution map of *P. falcata*, *P. grandiflora* and *P. ulei*.

Miranda, 31 May 1989, *D. Araujo & H. C. de Lima* 8953 (RB); Morro da Praia do Pontal, 29 July 1953, *F. Segadas-Vianna et al.* 619 (US); Ilha de Cabo Frio, 1 Sept. 2004, *R. D. Ribeiro et al.* 328 (RB); AVELAR, March 1928, *G. Machado Nunes* s.n. (SP, BM); CABO FRIO, Estrada para Praia das Conchas, 3 Nov. 1993, *B. B. Klitgaard & H. C. de Lima* 4 (RB, AAU, NY); Estrada para Praia das Conchas, 6 May 1987, *H. C. de Lima et al.* 2864 (RB); MARICÁ, Ponta Negra, 5 May 1987, *H. C. de Lima* 2852 (RB, BR, NY); PARAÍBA DO SUL, 3 Jan. 1938, *E. Kuhlmann* s.n. (SP, NY); RIO DAS OSTRAS, Balneário Morada das Garças, 9 May 2004, *R. D. Ribeiro & N. M. S. Ribeiro* 225 (RB, RUSU); RIO DE JANEIRO, Horto da S.B.A., 8 Oct. 1951, *E. P. Heringer* 3210 (SP); Barra de Guaratiba, 7 Sept. 1982, *H. C. de Lima* 1854 (RB, INPA, MG, MBM, CEPEC, NY); arboreto do Jardim Botânico do Rio de Janeiro, 19 Oct. 1999, *H. C. de Lima* 5694 (RB);

Estrada Velha da Tijuca, 6 Jan. 1927, *Pessoal do Horto Florestal* s.n. (RB, UB, RB, NY); SÃO FRANCISCO DE ITABAPOANA, Mata do Carvão, 17 Nov. 2004, *M. C. Gaglianone et al.* 60 (RB); SÃO PEDRO DA ALDEIA, Próximo ao Morro dos milagres, 28 March 2004, *R. D. Ribeiro* 159 (RB, RUSU); SAQUAREMA, Reserva Ecológica de Jacarepiá, 23 April 1991, *C. Farney* 3175 (RB); Reserva Ecológica de Jacarepiá, 1992, *C. Farney* 3678 (RB); Reserva Ecológica de Jacarepiá, 1992, *C. Farney* 3754 (RB); Reserva Ecológica de Jacarepiá, 5 April 1994, *S. M. de Faria* 703 (RB); Reserva Ecológica de Jacarepiá, 1993, *S. M. Schneider* s.n. (RB); VASSOURAS, Andrade Costa, 10 July 1949, *J. G. Kuhlmann* s.n. (RB).

Poecilanthe grandiflora Benth., J. Proc. Linn. Soc., Bot. 4, Suppl.: 80. 1860. Brazil, Minas Gerais: “habitat in sylvis Capoés, Serro Frio”, *Martius s.n.* (Lectotype M! [14071], designated by Meireles& Tozzi (in press), photos K).

Tree to 11 m tall; terminal branches with greyish bark and presenting dormant buds above the leaf scars; axillary bud conspicuous large, obovate or triangular-falcate, 3-5.5 x 2.7-4 x 1.2-2.5 mm; stipules not seen, early caducous. **Leaf** (6-)7(-8) foliolate; petiole 2-5.6 cm long; rachis 5-15 cm long; stipels setaceous, 1-2 mm long, early caducous or absent; pulvinule 2-4.5 mm long. Leaflets cordate, trullate, ovate to elliptic or wide elliptic, distal leaflets 4.6-11 x 2.5-6 cm, the basal ones often considerably smaller, base subcordate, truncate, rounded or obtuse to acute cuneate (usually the base is wider in the basal leaflets); apex acuminate to acute, rarely slightly obtuse, often mucronate; chartaceous to coriaceous; discolour; midvein straight, secondary veins prominent on the lower face; upper face sparsely pubescent to glabrous; lower face sparsely villous to glabrate. **Inflorescence** raceme or moderately branched panicle (2-5 branches); terminal, axillary or cauliflorous; 4-7(-8.5) cm long, pyramidal, densely velutinous; peduncle 1-2.3 cm long, sometimes presenting some small resting buds along its base; rachis 3.5-7.5 cm long; bract linear, 3-3.5 x 0.9-1.3 mm, outer face villous, early caducous; floral bud elliptic-ovate, 6.5-8.3 mm long, base sub-gibbous, apex acute and straight (not twisted), densely velutinous. **Flower** 1.6-2.2 cm long; pedicel 2.5-4.5 mm long; bracteoles narrow triangular to acicular, 2-2.8 x 0.7-1 mm, inserted on the base of the calyx; outer face velutinous to glabrescent; caducous. Calyx 7.5-10.5(-12) mm long, densely velutinous; tube 4.5-6 mm; teeth triangular, rarely lanceolate, 3-5.7 mm long, inner face woolly; apex of the upper two acute, to 1 mm separated; lateral teeth acute to acuminate; lower tooth acuminate and sometimes slightly hooked; hypanthium 1.5-2 mm long. Corolla violet to purple; standard wide-elliptic to sub-orbicular, claw 2.5-5 mm, blade 14-16 x 11-12 mm, base attenuate to obtuse, apex emarginated; wings obovate in outline, claw 4.5-5 mm long, blade 10-11 x 5-6 mm, base distinctily auriculated, apex truncate; keel petals falcate, claw 4-5 mm long, blade 5-6.5 x 2.3-2.6 mm, base slightly auriculated, apex rostrate. Androecium monadelphous, 11-12 mm long, filaments free for 1.5-3 mm; basifixed anthers 0.8-1 mm long; dorsifixed anthers 0.3-0.4 mm long. Gynoecium 12.5-14 mm long, stipe 1.5-2 mm long; ovary 6-7 mm long, glabrous or sparsely sericeous along the upper margin; style 5-6 mm long, glabrous; stigma subcapitate; ovules 6-7. **Fruit** woody and explosively dehiscent; elliptic to oblong in outline, 12-21 x 3.7-5.5 cm, stipe 4-7 mm long, upper margin broadened into a woody ridge, 5-12 mm wide; outer face basically smooth; funicle anvil-shaped, flattened, adherent to the fruit inner face but prominent to the hilum distally. **Seeds** 3-5, wide ovate-elliptic, sub-orbicular or orbicular, or sub-orbicular, 18-23 x 15-18 x 2-4 mm. Testa coriaceous, glossy; hilum 1-1.5 mm, curved downward to the endocarp, not concealed; rim-aril present, one-lipped; hypocotyl-root lobe visible; lens, chalaza and raphe not visible.

Fig. 2.

Distribution and ecology: Occurring in the Brazilian states of Alagoas, Bahia, Ceará, Minas Gerais, Paraíba and Pernambuco (Map 1). *Poecilanthe grandiflora* is found especially in gallery forests and secondary vegetation.

Phenology: Flowering occasionally in April, and from July to November; fruiting throughout the year.

Vernacular names: cabo-de-facão, chorão.

Comments: We found four specimens at M belonging to the material collected by Martius in the locality cited in the protologue. Probably they represent the same collection; however, a small label sequentially numbered from 14071 to 14074 has been attached on each specimen. Meireles & Tozzi (in press) considered all of these materials as being syntypes, and selected the specimen bearing no. 14071 as the lectotype, since it presents notes by Bentham.

Bentham (1860) suggested that *Pterocarpus falcatus* (presently *P. falcata*) was a synonym of *Poecilanthe grandiflora.* Ducke (1953) considered *P. grandiflora* as a synonym of his illegitimate name *Poecilanthe falcata* (Vell.) Ducke. However, due to the morphological differences cited under *P. falcata*, both species are accepted as separate taxonomic entities in the present study.

Examined material: BRAZIL. Without locality: 1883, *Glaziou* 12591 (C, BR); *Glaziou* 13716 (C). **ALAGOAS:** CACIMBINHAS, Fazenda Lagoa do Jirau, 13 April 1996, *M. Carnaúba* s.n. (MAC). **BAHIA:** ABAÍRA, Rio da água Suja (volta), 12 Nov. 1993, *W. Ganev* 2223 (HUEFS, SPF); BOQUIRA, Serra Geral, 11 March 1998, *G. Hatschbach* 67661 (MBM, HUEFS);

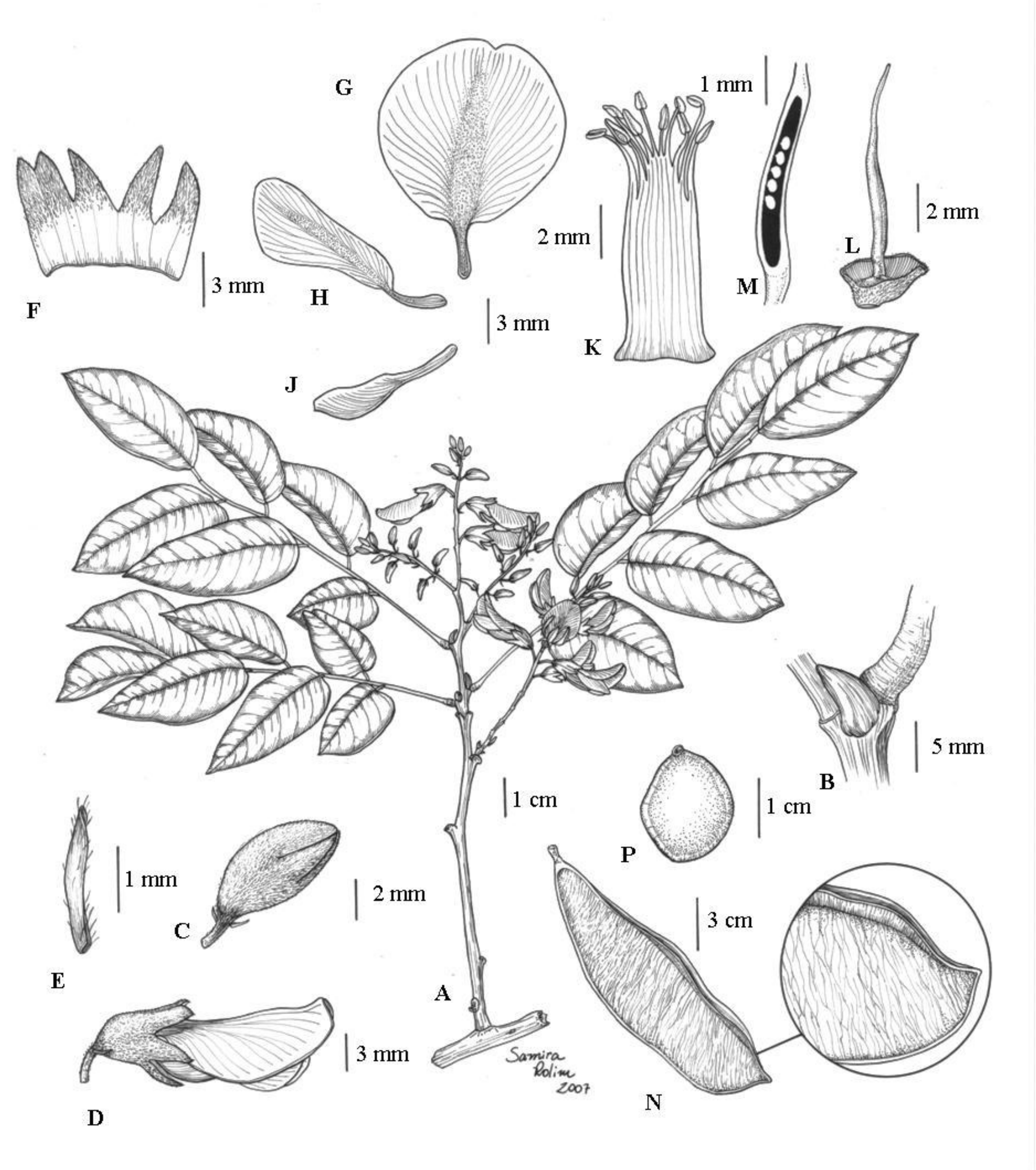


Fig. 2. *Poecilanthe grandiflora*. **A.** flowering branch; **B.** resting bud; **C.** floral bud; **D.** flower; **E.** bracteole; **F.** calyx opened out; **G.** standard; **H.** wing; **J.** keel petal; **K.** androecium; **L.** gynoecium; **M.** ovary longitudinal section; **N.** fruit; **P.** seed.

CORRENTINA, Distrito de São Manoel do Norte, 8 April 2005, *E. B. Miranda et al.* 704 (HUEFS); GENTIO DO OURO, Serra do Acuruá, 10 Sept. 1990, *H. C. de Lima et al.* 3932 (RB, CEPEC); IBITIARA, Rio dos Remédios, 4 June 1984, *M. M. Santos* 99 (HUEFS, IPA, MG, CEPEC, ALCB, HRB, GUA); IRAQUARA, 13 Sept. 1956, *E. Pereira* 2159 (RB); JEREMOABO, Estrada p/ Cancho, próximo a Jeremoabo, 7 Sept. 1996, *A. Fernandes* s.n. (UEC); MACAÚBAS, Cachoeira do Tingui, 26 Nov. 2004, *G. Hatschbach* 78594 (MBM); SÃO DESIDÉRIO, Sítio Grande, 10 April 1989, *A. O. Scariot et al.* 546 (UEC, IBGE). **CEARÁ:** AIUABA, Estação Ecológica Aiuaba, 5 Nov. 2003, *J. R. Lemos* 131 (HUEFS, SPF); ARARIPE, Dec. 1945, *R. Miranda* 52 (IAN); CARIRIAÇU, Entre Granjeiro e Caririaçu, 2 Sept. 1996, *A. Fernandes & E. Nunes* s.n. (UEC). **DISTRITO FEDERAL:** BRASÍLIA, 10 Nov. 1989, *B. A. S. Pereira* 1373 (RB); 19 July 1989, *B. A. S. Pereira* 1389 (UEC, RB, NY). **MARANHÃO:** 11 Jan. 1950, *R. L. Fróes* 25690 (IAN, NY). **MINAS GERAIS:** CRISTÁLIA, Fazenda Curral Velho, 11 Sept. 1991, *M. G. C. et al.* 508 (RB); Fazenda Curral Velho, 23 April 1991, *M. G. C. et al.* 79 (UEC); ITAOBIM, 4 March 1982, *C. T. Rizzini & A. de Mattos Filho* 1559 (RB); JANAÚBA, *E. M. Teixeira* s.n. (BHCB); JANUÁRIA, Vale do Peruaçú, 15 Feb. 1998, *A. Salino & A. Gotschalg* 4058 (BHCB, NY); Oct. 1992, *L. V. Costa* s.n. (BHCB); RUBELITA, 12 Nov. 1981, *O. A. Salgado* 232 (RB, CEPEC, ALCB, HRB); SÃO JOÃO DA PONTE, 3 Oct. 1953, *M. Magalhães* 6121 (RB). **PARAÍBA:** MONTEIRO, Fazenda Limão, 16 Feb. 1952, *L. P. Xavier* 1588 (IPA, IAN); SÃO JOSÉ DOS CORDEIROS, RPPM Fazenda Almas, 31 May 2003, *I. B. Lima et al.* 113 (HUEFS, HUEFS); TEIXEIRA, Sopé do Pico do Jabre, 30 Aug. 1979, *A. Fernandes & F. J. A. Matos* s.n. (UEC). **PERNAMBUCO:** ALAGOINHA, Fazenda pé de Serra do Majé, 3 Aug. 2001, *P. Silva* s.n. (HUEFS); ANGELIM, Pindorama, Sítio Fama, 23 Feb. 1953, *D. Andrade-Lima* 53-1220 (IPA, IAN); Estrada de Garanhuns, 15 Nov. 1991, *D. Andrade-Lima* 54-1924 (UEC); PESQUEIRA, *D. Andrade-Lima* s.n. (IAN); SÃO JOÃO, Dec. 1963, *J. L.*

Zoby s.n. (IPA); <u>VENTUROSA</u>, 8 Oct. 1971, *D. Andrade-Lima* 71-6541 (UEC, IPA, MBM, HRB, ASE).

Poecilanthe ulei (Harms) Arroyo & Rudd, Phytologia 25: 398. 1973. *Machaerium* ? *ulei* Harms, Bot. Jahrb. Syst. 42: 214. 1909. Brazil, Bahia: "Strauch in der Catinga bei Calderão", X.1906, *E. Ule 7248* (holotype B, destroyed, photo GH!, NY!; lectotype L!, designated by Meireles & Tozzi (in press); isolectotypes: G; K).

Shrub or tree to 15 m tall; terminal branches bark greyish, presenting dormant buds above the leaf scars; axillary buds conspicuous, conical to globose, straight or rarely subfalcate, 3.5-6.3 x 2.5-5 x 2-4.5 mm ; stipules not seen, early caducous. **Leaf** 1-5 foliolate; petiole 1.7-4 cm long; rachis 2.2-6 cm long; stipels 0.8-2 mm long, sometimes caducous or absent; pulvinule 1-3 mm long. Leaflets ovate to elliptic, less commonly suborbicular, sometimes asymmetrical, distal leaflets (3-)4.5-10 x (1.6-)2-5 cm; base subcordate, rounded, obtuse or rarely acute cuneate; apex acute or obtuse, rarely rounded, not mucronate; chartaceous to coriaceous; discolour; midvein zig-zaged; secondary veins prominent; upper face appressed pubescent to glabrous; lower face densely to sparsely pubescent when mature. **Inflorescence** single raceme, axillary or cauliflorous, 1.2-2.5(-4.6) cm long; umbeliform; tomentose to velutinous; peduncle 0.3-1.6(-3.2) cm long, the longer ones presenting some small resting buds along its base; rachis 0.6-1(-1.4) cm long; bract not seen; early caducous; floral bud ovoid, 3.6-4 mm long, base rounded, apex acute and straight, tomentose. **Flower** 8-1.1 mm long; pedicel 1.5-2.2 mm long; bracleoles inserted on the base of the calyx, not seen; early caducous. Calyx 4.6-5.5 mm long, tomentose; tube 2.6-2.8 mm long; teeth triangular to narrowly triangular, inner face woolly, 1.5-2.6 mm long, apex of the upper two acute, 0.2-0.6 mm separated; laterals and lower acute to acuminate; hypanthium 1-1.2 mm long. Corolla purple; standard suborbicular, claw 5-8 mm long, blade 5.1-5.5- x 4.8-5 mm, base obtuse, attenuate, apex emarginated; wings obovate or wide elliptic in outline, claw 1.5-2.2 mm, blade 4.6-5.6 x 2.2-3.4 mm, base slightly auriculated, apex subtruncate to rounded; keel petals falcate, claw 2-2.4 mm long, blade 3.4-4.8 x 1.8-2 mm, base just slightly or not auriculated, apex obtuse to rounded. Androecium monadelphous, 5.7-8 mm long, filaments free for 1.4-2.6 mm; basifixed anthers 0.6-0.7 mm long; dorsifixed anthers 0.3 mm long. Gynoecium 7-8 mm long, stipe 1-1.3 mm long; ovary 3.4-3.8 mm long, glabrous or rarely sparsely sericeous; style 3-3.2 mm long, glabrous; stigma subcapitate; ovules 4-5. **Fruit** woody and explosively dehiscent; elliptic to oblong, somewhat D-shaped or obovate in outline, 8-16.5 x 2.8-4.3 cm, stipe 4-6(-8) mm long, upper margin broadened into a woody ridge, 6-10 mm wide; outer face basically smooth; funicle anvil-shaped, flattened, adherent to the fruit inner face but prominent to the hilum distally. **Seeds** 1-3, wide-elliptic, sub-orbicular or oblate, 13-18 x 11-17 x 3-4 mm. Testa coriaceous, glossy; hilum 0.8-1.1 mm, curved downward to the endocarp, not concealed; rim-aril present, one-lipped; hypocotyl-root lobe slightly visible; lens, chalaza and raphe not visible.

Fig. 3.

Distribution and ecology: Found in open arboreal steppe (“caatinga”) in the Brazilian states of Alagoas and Bahia (Map 1). The native occurrence of *Poecilanthe ulei* in the southern Bahian moist coastal forest is doubtful. As the species is used to provide shade in cocoa plantations (cabruca), it may have in fact been introduced into this moist coastal forest type.

Phenology: Flowering from October to April; fruiting throughout the year.

Vernacular names: carrancudo; mucitaíba-branca.

Comments: *Poecilanthe ulei* is related to *P. falcata* and *P. grandiflora*, due to inflorescence and fruit features. *Poecilanthe ulei* is, however, distinct from the other two species in the shorter (usually to 2.5 cm long) and umbeliform racemes, and in the smaller flowers (to 1.1 cm long). In the absence of flowering material the leaflet midvein somewhat zig-zag-shaped and the axillary resting buds which are often more globose may help to recognize the species.

In caatinga, *P. ulei* usually has 1 and 3 coriaceous leaflets and becomes a small tree. When growing in moister forests (e.g. southern Bahia) this species often becomes a high tree (to 16 m tall) and usually has 5 chartaceous leaflets.

Examined material: BRAZIL. ALAGOAS: COITÉ DO NÓIA, Fazenda Boa Esperança, 22 Aug. 1983, *M. N. R. Staviski et al.* 621 (MG, MAC, HRB)**. BAHIA:** Mina Boqueira, Morro do Maranhão, 3 April 1966, *A. Castellanos* 26037 (MBM); leste de Machado Portello, 19-23 June 1915, *J. N. Rose & P. G. Russell* 19899 (US, NY); Itahype, March 1822, *L. Riedel* 682 (RB); ÁGUA PRETA, 28 March 1937, *G. Bondar* 2209 (SP); ALMADINA, 12 March 1971, *Raimundo S. P.* 1130 (CEPEC); ANGUERA, 30 Nov. 1991, *L. P. de Queiroz* 2508 (MBM, MBM, ALCB, HUEFS, HRB, ESA); ANTÔNIO GONÇALVES, a 2 km de Caldeirão Grande, 9 May 1985, *S. J. Filho* 222 (MG, HRB); BOA VISTA, Estrada para Boa Vista do Tupim, 26 April 1994, *L. P. de Queiroz* 3877 (MBM, CEPEC, HUEFS, NY); CACHOEIRA, Feb. 1981, *Grupo flora "Pedra do Cavalo"* 1120 (CEPEC); Aug. 1980, *Grupo flora "Pedra do Cavalo"* 539 (CEPEC, ALCB,

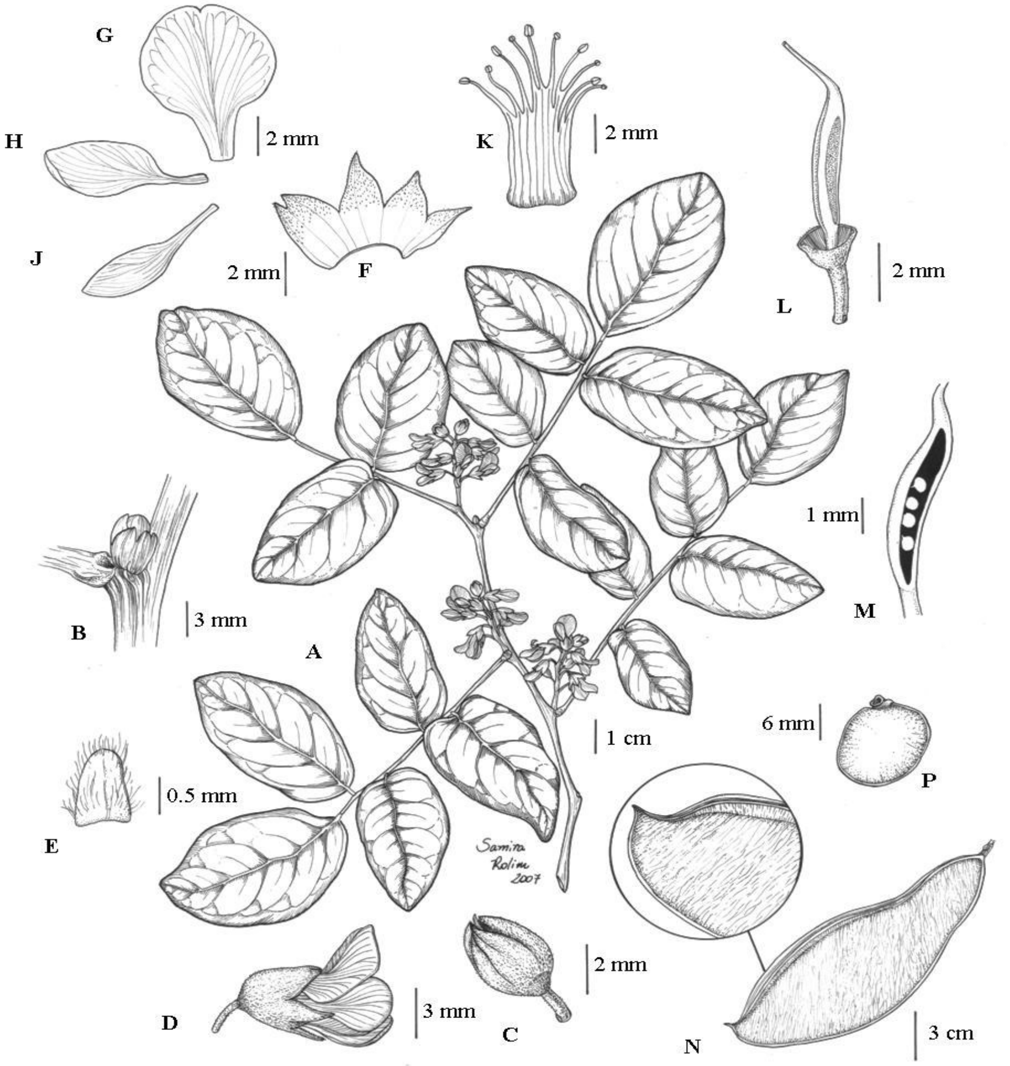


Fig. 3. *Poecilanthe ulei*. **A.** flowering branch; **B.** resting bud; **C.** floral bud; **D.** flower; **E.** bracteole; **F.** calyx opened out; **G.** standard; **H.** wing; **J.** keel petal; **K.** androecium; **L.** gynoecium; **M.** ovary longitudinal section; **N.** fruit; **P.** seed.

HRB); Castro Alves, 26 Jan. 1956, *D. Andrade-Lima* s.n. (UEC); 7 June 1980, *Grupo flora "Pedra do Cavalo"* 270 (RB, ALCB); Contendas do Sincorá, Serra Geral, Fazenda Corcovado, 27 April 2003, *D. Rigueira et al.* 04 (SPF, ALCB); Cravolândia, assentamento Palestina, 14 Aug. 2001, *D. M. Loureiro et al.* 438 (CEPEC, ALCB); Cruz das Almas, Castro Alves, 27 Jan. 1956, *M. Magalhães* 7407 (IAN); Euclides da Cunha, 20 March 2004, *M. L. Guedes et al.* 10910 (ALCB); Feira de Santana, Serra de São José, 5 Nov. 1994, *E. Melo* 1115 (MBM, CEPEC, ALCB, HUEFS), 28 Jan. 1993, *L. P. de Queiroz et al.* 3066 (SPF, MBM, CEPEC, HUEFS, ESA); Iaçu, 8 Aug. 1979, *A. P. Araújo* 145 (RB, CEPEC, ALCB, HRB); Estrada Iaçú/Itaberaba, 17 Dec. 1981, *G. P. Lewis et al.* 847 (RB, MBM, CEPEC, NY); 17 March 2004, *L. P. de Queiroz et al.* 9167 (HUEFS); Fazenda Suibra, 12 March 1985, *R. L. Noblick & Lemos* 3577 (HUEFS, CEPEC); Estrada Iaçú/Milagres, 20 July 2001, *V. C. Souza et al.* 26541 (ESA); Ibicuí, 11 Aug. 1972, *R. S. Pinheiro* 1915 (CEPEC, CEPEC); Ilhéus, Cepec-Fazenda Viana, 11 Feb. 1988, *J. L. Hage* 2244 (RB, CEPEC); Cepec, 5 March 1981, *J. L. Hage & E. B. dos Santos* 538 (RB, CEPEC, MBM); Cepec, 20 May 1981, *J. L. Hage* 698 (RB, CEPEC); Cepec, 10 June 1981, *J. L. Hage* 956 (RB, CEPEC); Cepec, 1 June 1967, *J. P. Lanna* 1453 (CEPEC); Campus da UESC, 8 May 1995, *L. A. Mattos Silva* 3129 (CEPEC, ALCB, HUEFS); Cepec, 22 May 1965, *R. P. Belém & M. Magalhães* 1125 (IPA, UB, CEPEC, UB, IAN, NY); Cepec, 26 July 1965, *R. P. Belém et al.* 1376 (UB, IPA, CEPEC, IAN, NY); Cepec, 31 March 1965, *R. P. Belém & M. Magalhães* 596 (IPA, IAN, IAN, CEPEC, NY); Cepec, 1 April 1965, *R. P. Belém & M. Magalhães* 630 (UB, IPA, CEPEC, IAN, NY); Cepec, 25 Feb. 1971, *Raimundo S. P.* 1033 (RB, CEPEC); Cepec, 9 Nov. 1988, *S. M. de Faria & Talmon S. dos Santos* 259 (CEPEC); Cepec, 13 April 1971, *T. S. dos Santos* 1600 (CEPEC); Cepec, 12 Jan. 1989, *T. S. dos Santos* 4477 (CEPEC, ALCB, HUEFS); Ipirá, 24 Oct. 1970, *D. Andrade-Lima* 70-6107 (IPA, ALCB); Fazenda Boa Vista., 18 April 1985, *E. L. P. G. de Oliveira* 777 (CEPEC, HRB); Serra Preta, 7 Sept. 1990, *H. C. de Lima et al.* 3874 (RB, CEPEC); IRAMAIA, 26 Sept. 1996, *G. P. Silva et al.* 3682 (HUEFS, NY); estrada para Contendas do Sincorá, 9 April 1999, *S. C. Sant'Ana et al.* 744 (NY); ITABERABA, km 85 da BR 242, 13 March 1998, *J. D. Peixinho* 3 (HUEFS); 4 Feb. 2005, *J. P. Souza et al.* 5404 (ESA); ITABUNA, Cepec, 26 Aug. 1967, *J. P. Lanna* 949 (IPA); ITAOBIM, Itaobim-V. da Conquista, 27 Oct. 1999, *S. M. de Faria* 1820 (RB); Itaobim-V. da Conquista, 26 Sept. 1999, *S. M. de Faria et al.* 1891 (RB); Itaobim-V. da Conquista, 21 Feb. 2000, *S. M. de Faria* 2003 (RB); Itaobim-V. da Conquista, 21 Feb. 2000, *S. M. de Faria* 2023 (RB); ITATIM, Morro do Agenor, 25 Feb. 1996, *E. Melo et al.* 1476 (MAC, HUEFS, ASE); Morro do Agenor, 20 July 1996, *F. França & E. Melo* 1723 (HUEFS); estrada para Lajedo, km 1, 29 July 2001, *V. C. Souza et al.* 26717 (ESA); ITIÚBA, 20 km de Camaleão, 26 Feb. 2000, *A. M. Giulietti & R. M. Harley* 1828 (SPF, MBM, CEPEC, HUEFS); Fazenda da EPABA, 27 May 1983, *G. C. Pinto & H. P. Bautista* 102/83 (RB, ICN, MG, HRB, NY); Margem do açude Jacurici, 23 Oct. 2001, *J. G. Nascimento & C. Correia* 28 (SP, HUEFS, NY); Fazenda Grotão, 10 May 2002, *J. G. Nascimento & T. S. Nunes* 89 (HUEFS); Serra de Itiúba, 19 Feb. 1974, *R. M. Harley* 16206 (RB, RB, CEPEC, UNY); JACOBINA, Estrada para o Morro do Chapéu, 14 March 1990, *A. M. de Carvalho & J. Saunders* 2789 (RB, CEPEC); Estrada Jacobina/Capim Grosso km 24, 21 Sept. 1996, *G. P. Silva et al.* 3636 (HUEFS, NY); Rod. Jacobina/Umburanas km 2, 22 Sept. 1992, *L. Coradin* 8691 (RB, HUEFS); Serra do Tombador, 21 Aug. 1993, *L. P. de Queiroz & N.S. Nascimento* 3511 (MBM, HUEFS); Estrada p/ mundo novo, 15 May 1999, *L. P. de Queiroz* 5566 (HUEFS); 12 July 1997, *M. L. Guedes & Eudes* 5081 (MBM, ALCB, HUEFS); JAGUARA, Fazenda Belmonte, 11 July 1993, *L. P. de Queiroz et al.* 3458 (HUEFS); JAGUARARI, Rodovia Juazeiro-Senhor do Bonfim (B 407). Km 100, 25 June 1983, *L. Coradin et al.* 6013

(CEPEC, NY); JEQUIÉ, Manoel Vitorino, 27 Aug. 1964, *C. M. M.* 267 (CEPEC); Amaralina, 2 Nov. 2001, *D. L. Santana et al.* 502 (ALCB); 14 July 1979, *S. A. Mori & R. M. King* 12205 (CEPEC); JEQUIÉ, 6.7 km S of Mandacaru, 26 July 2003, *W. W. Thomas et al.* 13621 (CEPEC); MARACÁS, p/ Pouso Alegre, km 27, 1 Jan. 1971, *R. S. Pinheiro* 1451 (CEPEC); MIGUEL CALMON, Estrada Brejo Grande/Miguel Calmon, 5 April 2001, *H. P. Bautista et al.* 3041 (HUEFS, HRB); MILAGRES, Morro de São Cristóvão, 28 June 2003, *G. Hatschbach et al.* 75855 (MBM); Estrada para Itaberaba, 17 Dec. 1981, *G. P. Lewis et al.* 835 (RB, UEC, CEPEC, NYM); Morro Tyresoles, 30 Aug. 1996, *M. A. Mayworm* 14 (HUEFS); MONTE SANTO, 5 km Monte Santo - Uauá, 25 Aug. 1996, *L. P. de Queiroz & N. S. Nascimento* 4616 (CEPEC, HUEFS); Comunidade Capivara, 10 Jan. 2006, *M. L. Guedes et al.* s.n. (ALCB); Fazenda Pedra d'água, 31 March 2000, *M. R. Fonseca et al.* 1369 (RB, SPF, ALCB, NY); MORRO DO CHAPÉU, Estrada p/ Fedegosos, 30 April 1999, *F. França et al.* 2746 (HUEFS); Caminho para Ventura, na estrada, 7 Sept. 2002, *M. L. Guedes* 9818 (ALCB); MURITIBA, Oct. 1950, *G. C. Pinto* 50-96 (IAN); PARAGUAÇU, Boa Vista do Tupim, 28 April 2001, *D. L. Santana* 325 (ALCB); Boa Vista do Tupim, 14 April 2001, *D. L. Santana et al.* 340 (ALCB); PAU BRASIL, Estrada vicinal Pau Brasil-Potiraguá, 19 May 2004, *G. F. Árbocz* 405 (UEC); Vadiação - Fazenda Bom Jardim, 1 Aug. 2001, *H. C. de Lima* 5828 (RB, CEPEC); PINTADAS, 1 Sept. 1980, *R. Orlandi* 285 (RB, CEPEC, HUEFS, HRB); PORTO SEGURO, CVRD, 21 April 1982, *V. C. Souza* 321 (CVRD); RUY BARBOSA, Estrada entre a BR-242 e Boca do Leão, 28 July 2004, *L. P. de Queiroz et al.* 9410 (HUEFS); SANTA TEREZINHA, Estrada entre Santa Terezinha e Pedra Branca, 22 Dec. 1992, *L. P. de Queiroz* 3009 (MBM, CEPEC, HUEFS, ESA); Estrada Santa Terezinha-Castro Alves, 18 June 1993, *L. P. de Queiroz & T. S. N. Senna* 3248 (MBM, CEPEC, HUEFS); SÃO FÉLIX, Margem direita do Rio Paraguaçu, 10 Sept. 2004, *L. P. de Queiroz et al.* 9584 (HUEFS); SAÚDE, Cachoeira Paulista, 22 Feb. 1993, *J. G. Jardim et al.* 88 (RB, CEPEC, MBML, ALCB, NY); Km 23 Norte na BR 324, 23 Aug. 1993, *L. P. de Queiroz et al.* 3563 (HUEFS); SEABRA, Caminho para Lençóis, 19 Sept. 2004, *M. L. Guedes* s.n. (ALCB); TUCANO, Estrada Tucano/Araci, 28 Feb. 1992, *A. M. de Carvalho* & *D. J. N. Hind* 3830 (RB, CEPEC, HRB, NY); Povoado Bizamum, 20 April 2005, *D. Cardoso* & *W. J. Lima* 478 (HUEFS); Povoado da Pedra grande, 4 Jan. 2006, *D. Cardoso* 891 (HUEFS); km 1,5 da BR 116 (Tucano-Caldas do Jorro), 7 Jan. 1993, *L. A. Mattos Silva* 2904 (RB, MBM, CEPEC, ALCB, HUEFS, NY); 26 May 1981, *L. M. C. Gonçalves* 91 (RB, HRB, NY); UTINGA, Fazenda Segredo, 1 April 1986, *A. C. Sarmento* & *H. P. Bautista* 852 (RB, MG, ALCB, HRB); São Roque, 10 April 1986, *H. P. Bautista* 1104 (HRB); VALENTE, Santa Bárbara, 29 Dec. 1992, *L. P. de Queiroz* 3023 (MBM, CEPEC, HUEFS); VITÓRIA DA CONQUISTA, Rodovia BA 262, 25 April 1998, *J. G. Jardim* 1777 (MBM, NY); p/ Itaobim, 26 Sept. 1999, *S. M. de Faria et al.* 1815 (RB)

Poecilanthe itapuana G.P.Lewis, Kew Bull. 44: 167. 1989. Brazil, Bahia: Salvador, dunas da Praia de Itapuã, 16.II.1982*, R.Ribeiro 347, A.Ilha & L.Duarte 8* (holotype HRB!; isotypes GUA!; K, photo UEC!; RB!).

Tree to 6 m tall; the trunk and young branches with grey, fissured or flanking bark; axillary bud inconspicupus, triangular-ovoid, 1.5-2 x 1.2-1.8 x 0.7-1.2 mm; stipules triangular, 1.4-2.6 x 0.8-1.3 mm, persistent, tomentose or pubescent to glabrescent. **Leaf** (4-)5-7 foliolate; petiole 1.8-3.2 cm long; rachis 3-7 cm long; stipels not seen; pulvinule wrinkled, 2-4 mm long. Leaflets obovate, elliptic or wide-elliptic, distal leaflets 5.2-9 x 3.2-5 cm, lateral and basal ones considerably smaller; base obtuse, rounded or slightly subcordate; apex acute, rarely slightly obtuse, not mucronate; subcoriaceous; discolour; midvein straight, secondary veins just slightly prominent; both faces glabrous but for a few hairs along the midvein; the upper face shiny. **Inflorescence** paired racemes, rarely single per node, axillary, subtending leaf sometimes caducous; 5.5-8.5 cm long; rusty tomentose; peduncle 0.5-1.1 cm long; rachis 5-8 cm long; bract triangular, 0.6-0.8 x 0.5-0.7 mm, apex acute, outer face tomentose, persistent; floral bud narrowly conical to obovoid, 4.2-5.5 mm long, base obtuse, apex acute to acuminate, often straight but sometimes slightly falcate, densely rusty tomentose. **Flower** 9-12 mm long; pedicel 0.6-1.2 mm long; bracleoles triangular-ovate, 0.3-0.5 x 0.3-0.4 mm, inserted on the base of the calyx, outer face tomentose; persistent. Calyx 5-6.6 mm long, rusty tomentose; tube 2.6-3.2 mm long; teeth narrowly triangular, 2.5-3.4 mm long, inner face woolly; apex of the upper two acute, 1 mm separated, rarely not separated; the lateral and lower teeth acute to acuminate; hypanthium 0.5-0.8 mm long. Corolla whitish; standard depressed ovate, veined purple and with a purplish central blotch, claw 2-3 mm long, blade 4.3-6.2 x 5.5-10(-17) mm, base cordate, apex emarginated; wings obovate in outline, claw 1.3-2.8 mm long, blade 5.2-7 x 3-5 mm, base distinctly auriculated, apex rounded to rostrate; keel petals sub-falcate, claw 2-3 mm long, blade 3.5-5.2 x 2.2-2.5 mm, base auriculated, apex widely acute. Androecium monadelphous or diadelphous, 6-7.8 mm long, filaments free for 1.3-2.2 mm; basifixed anthers 0.8-1 mm long; dorsifixed anthers 0.4-0.5 mm long. Gynoecium 6.2-8.1 mm long; stipe 1.5-2.2 mm long; ovary 2.6-3 mm long, villous along both margins; style 2.8-3 mm long, glabrous; stigma capitate, ovules 4. **Fruit** woody, explosively dehiscent; obovate to oblong, (3.7-)5-10 x 1.8-2.5 cm, stipe 5 mm long; margins plane; outer face of the mature valves tending to fracture at right angles; funicle anvil-shaped, flattened, adherent to the fruit inner face but prominent to the hilum distally. **Seeds** ovate to elliptic, 10-12 x 9 mm. Testa coriaceous, glossy; hilum 1-1.5 mm, curved downward to the endocarp, not concealed; rim-aril present, one-lipped; hypocotyl-root lobe visible; lens, chalaza and raphe not visible.

Fig. 4.

Distribution and ecology: Apparently restricted to the northern coast of Bahia, Brazil, from Salvador to Conde (Map 2). *Poecilanthe itapuana* grows in white sand dunes vegetation, usually on dune summits.

Phenology: Flowering mainly from December to March, occasionally in July; fruiting from July to November.

Vernacular names: mucitaíba.

Comments: *Poecilanthe itapuana* is closely related to *P. parviflora* and *P. subcordata* due to its paired racemes in the leaf axil, monadelphous or diadelphous androecium on the same individual, ovary densely haired, and fruit margins plane. However, *P. itapuana* is easily distinguished from the other two species by its coriaceous leaflets and longer inflorescences (5.5-8.5 cm long). Moreover, *P. itapuana* can be distinguished from *P. subcordata* by its longer pulvinules (2-4 mm long) and shorter pedicels (to 1.2 mm long), and from *P. parviflora* in having larger (3.7-10 cm long) and explosively dehiscent pods.

Examined material: BRAZIL. BAHIA: CAMAÇARI, Busca Vida, 26 Jan. 2001, *E. P. Queiroz* 92 (HRB); CONDE, Fazenda do Bú, 12 Dec. 1995, *H. P. Bautista et al.* 1727 (RB, HUEFS, HRB); Fazenda do Bú, 2 Feb. 1996, *M. C. Ferreira* & *T. Jost* 889 (RB); Sítio do Conde, 12 Dec. 1999, *M. L. Guedes et al.* 7404 (ALCB); Barra de Itarirí, 21 Sept. 2003, *N. G. Jesus et al.* s.n. (ALCB, HRB); Fazenda do Bú, 12 Dec. 1995, *T. Jost et al.* 144 (RB, MBM, HUEFS);

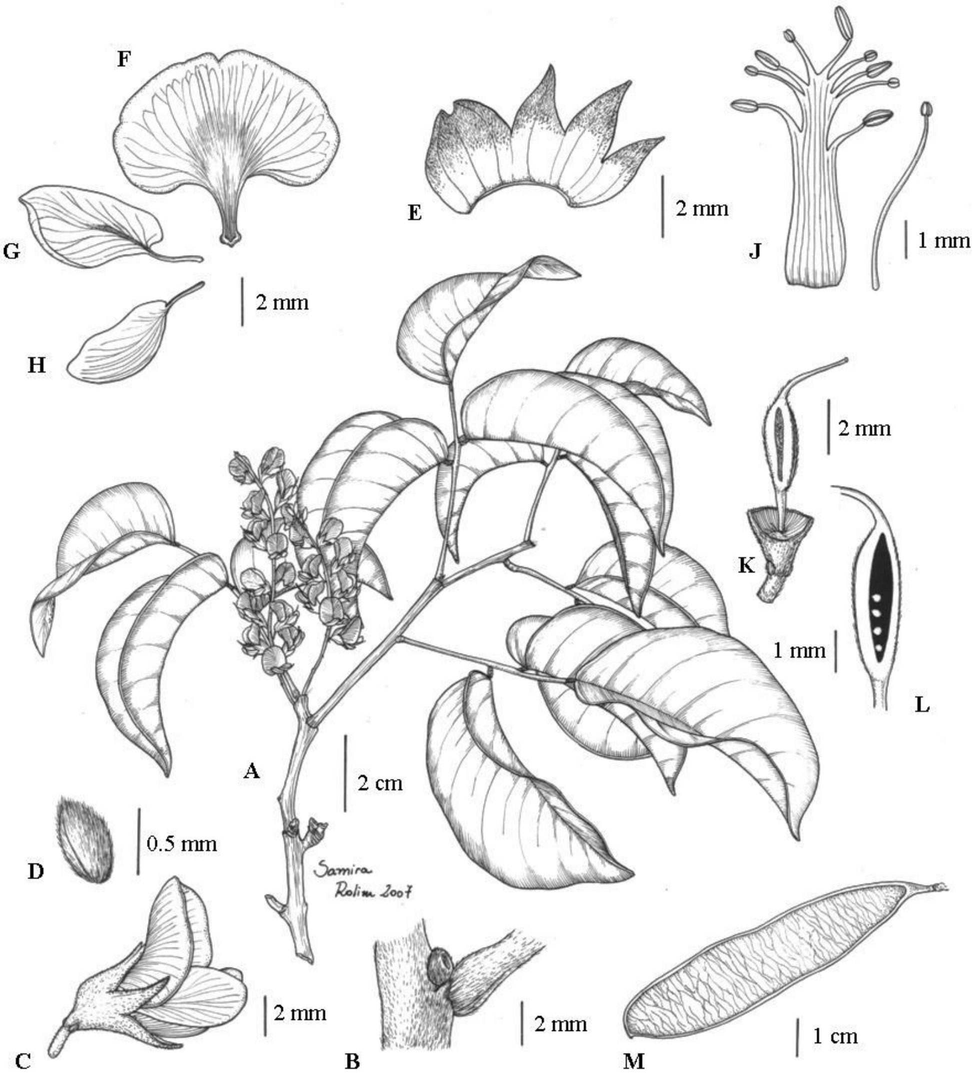
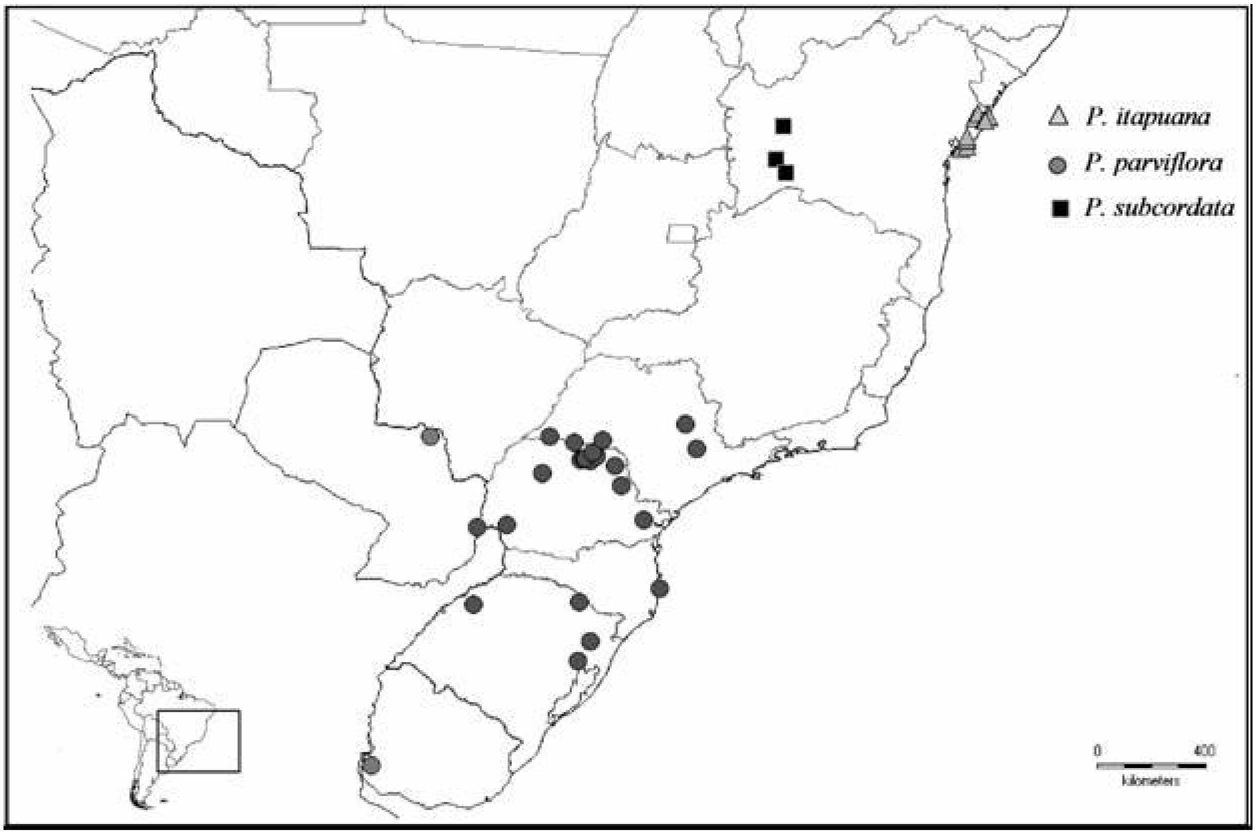


Fig. 4. *Poecilanthe itapuana*. **A.** flowering branch; **B.** resting bud and stipule; **C.** flower; **D.** bracteole; **E.** calyx opened out; **F.** standard; **G.** wing; **H.** keel petal; **J.** androecium; **K.** gynoecium; **L.** ovary longitudinal section; **M.** fruit.



Map 2. Geographic distribution map of *P. itapuana*, *P. subcordata* and *P. parviflora*

Fazenda do Bú, 1 Dec. 1994, *T. Jost et al.* 55 (RB, HUEFS); ENTRE RIOS, Dunas de Subaúma, March 2000, *E. P. Queiroz* 23 (ALCB, HUEFS); ESPLANADA, Dunas de baixo, 26 Feb. 2000, *E. P. Queiroz* 25 (CEPEC, ALCB, HUEFS); Dunas de Baixios, 15 July 2000, *E. P. Queiroz* 63 (ALCB, HUEFS); LAURO DE FREITAS, Dunas de Busca Vida, 9 Dec. 1999, *E. P. Queiroz* 24 (ALCB, HUEFS); MASSARANDUPIÓ, Próximo à região de Brejos, 29 March 1991, *M. L. Guedes & N. G. Jesus* 8095 (ALCB); MATA DE SÃO JOÃO, Costa do Sauípe, Fazenda Sauípe, 17 Oct. 2003, *D. M. Loureiro et al.* 753 (ALCB); Sauípe, 24 April 2004, *E. P. Queiroz* 547 (HRB); SALVADOR, Dunas de Itapuã, 26 Jan. 1974, *A. L. Costa et al.* s.n. (ALCB); Dunas de Itapuã, 20 Oct. 1974, *A. L. Costa* s.n. (ALCB); Lagoa de Abaeté, 4 Feb. 2000, *A. M. de Carvalho* 6846

(MBM, CEPEC, ALCB, HUEFS, NY); Dunas de Abaeté, 9 Jan. 1993, *Alunos de Botânica 3 (UFBA)* s.n. (MBM, CEPEC, ALCB); Abaeté, 10 Jan. 1996, *B. F. Viana et al.* 29 (HUEFS); Apa do Aaeté, 14 Feb. 1999, *C. B. Nascimento* 93-A (HRB); Stella Maris, 11 Dec. 1999, *E. P. Queiroz* 94 (HRB); Dunas de Itapuã, 5 May 1991, *G. P. Lewis* & *S. M. M. de Andrade* 2018 (CEPEC); Apa do Abaeté, 2 July 1999, *J. Costa* 262 (HRB); Bairro Stella Maris, APA do Abaeté, 14 Sept. 2001, *J. Costa* & *C. B. N. Costa* 326 (MG, MBM, HUEFS); Dunas de Abaeté, 6 Aug. 1999, *M. L. Guedes et al.* 6477 (ALCB); Lagoa de Abaeté, 18 Sept. 1994, *M. L. Guedes et al.* s.n. (CEPEC, ALCB); Dunas de Itapuã, 15 June 1991, *R. T. Pennington et al.* 289 (CEPEC); Lagoa de Abaeté, 26 April 1997, *S. M. de Faria et al.* 1321 (RB); Lagoa de Abaeté, 26-27 April 1997, *S. M. de Faria* & *H. C. Lima* 1321 (RB).

Poecilanthe subcordata Benth., J. Proc. Linn. Soc., Bot. 4, Suppl.: 80. 1860. Brazil, Minas Gerais: “habitat in deserto Chapada do Paranan et ad fl. Carinhanha”, *Martius s.n.* (holotype M!; photo K).

Shrub, erect or scandent, to 6 m tall trees; young branches with grey, slightly fissured bark; axillary bud inconspicuous, ovoid to sub-globose, 1.5-2 x 1.7-2.2 x 1.1-1.6 mm; stipules early caducous, not seen. **Leaf** 7-11 foliolate; petiole 1.3-2.2 cm long; rachis (3.8-)5.3-9.5 cm long; stipels setaceous, 0.6-0.8 mm long, sometimes caducous; pulvinule wrinkled, 0.5-1.1 mm long. Leaflets ovate to elliptic, distal leaflets 3-4(-5) x 1.4-2(-2.6) cm, the basal ones just slightly smaller; base cordate to slightly subcordate; apex acute, rarely slightly obtuse, not mucronate; chartaceous; discolour; midvein straight; secondary veins just slightly prominent; upper face pubescent to glabrous; lower face densely villous to glabrescent. **Inflorescence** paired racemes, rarely single per node, axillary, subtending leaf sometimes caducous; 2.8-4 cm long; velutinous; peduncle 0.3-0.9 cm long; rachis 2.5-3.6 cm long; bract ovate, 1-1.6 x 0.7-0.9 mm, apex acute to obtuse, outer face velutinous, caducous; floral bud narrowly elipsoid to obovoid, 4-5.2 mm long, base attenuate, apex acute, straight (not twisted), velutinous. **Flowers** 08-11 mm long; pedicel 3.5-5 mm long; bracleoles ovate, 0.8-1 x 0.5-0.6 mm, inserted from 2/3 of the pedicel to the base of the calyx, outer face velutinous; caducous. Calyx 5.8-6.3 mm long, densely velutinous; tube 2.8-3.7 mm long; teeth narrowly triangular, 2.3-2.8 mm long, inner face woolly; apex of the upper two usually not separated, if so, than each apex acute, the lateral teeth acute and lower teeth acute to acuminate; hypanthium 0.7-0.9 mm long. Corolla whitish; standard depressed ovate, with a purplish central blotch, claw 2.5-3 mm long, blade 6-6.5 x 8-8.3 mm, base cordate, apex emarginated; wings obovate in outline, claw 1.7-2 mm long, blade 5.6-6.3 x 3-3.2 mm, base slightly auriculated, apex rounded to rostrate; keel petals sub-falcate, claw 2-2.1 mm long, blade 4.7-5 x 2.5-3 mm, base auriculated, apex widely acute. Androecium monadelphous or diadelphous, 6.3-7.4 mm long, filaments free for 1-2 mm; basifixed anthers 0.9-1.2 mm long; dorsifixed anthers 0.5-0.6 mm long. Gynoecium 6.4-7.3 mm long; stipe 0.7-1 mm long; ovary 2.8-3.1 mm long, villous along the upper margin and glabrescent along the lower; style 2.8-3.2 mm long, glabrous; stigma capitate, ovules 4-5. **Fruit** woody, explosively dehiscent; obovate to oblanceolate in outline, 3.4-6.3 x 1.5-2.2 cm; stipe 1.3-2 mm long; margins plane; outer face prominent-veined; funicle anvil-shaped, flattened, adherent to the fruit inner face but prominent to the hilum distally. **Seeds** 1 (-2), ovate-elliptic or D-shaped in outline, 10-12 x 8-9 x 2 mm. Testa coriaceous, glossy; hilum 0.6-0.8 mm, curved downward to the endocarp, not concealed; rim-aril present, one-lipped; hypocotyl-root lobe slightly visible; lens, chalaza and raphe not visible. Fig. 5.

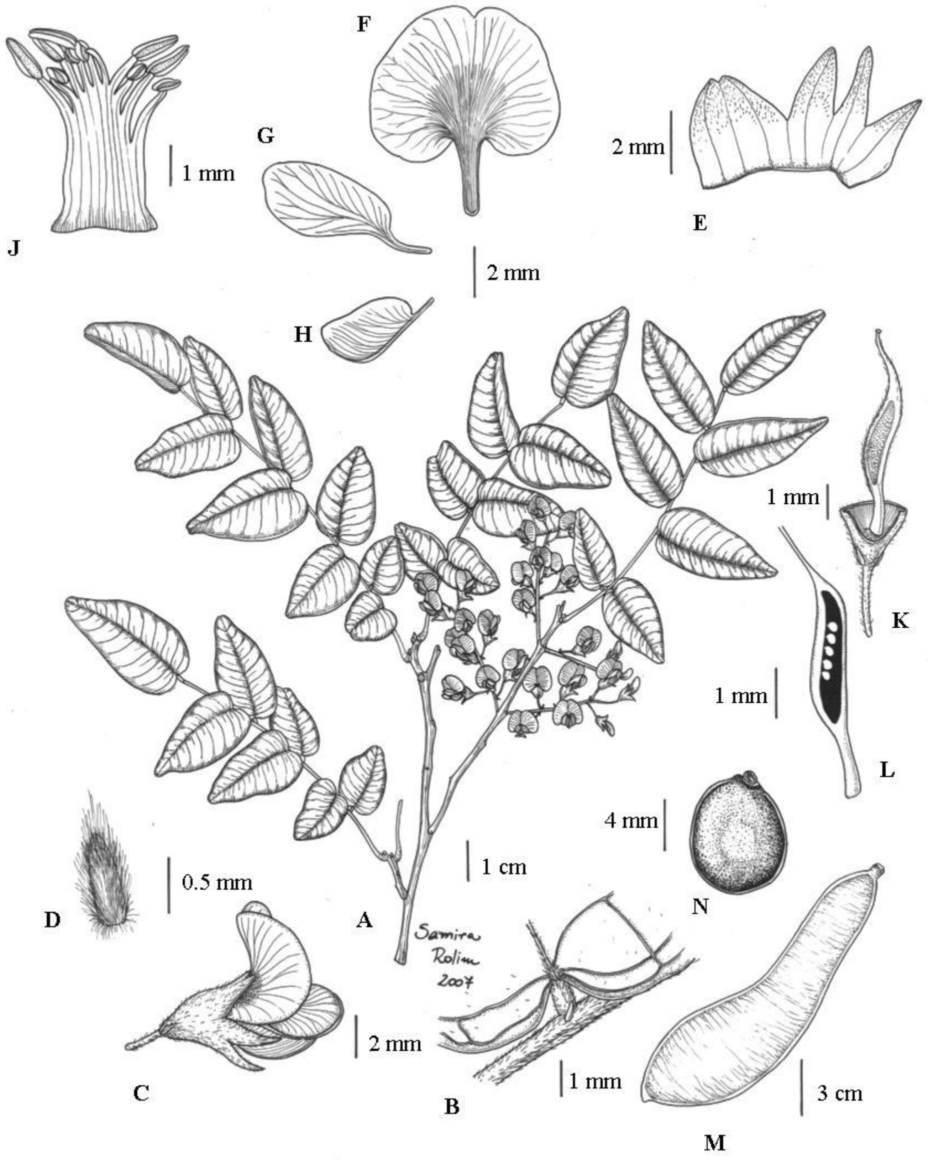


Fig. 5. *Poecilanthe subcordata*. **A.** flowering branch; **B.** base of the leaflet and stipel; **C.** flower; **D.** bracteole; **E.** calyx opened out; **F.** standard; **G.** wing; **H.** keel petal; **J.** androecium; **K.** gynoecium; **L.** ovary longitudinal section; **M.** fruit; **N.** seed.

Distribution and ecology: Occurring in south-western Bahia and northern Minas Gerais, Brazil; in low "caatinga" and habitats transitional between "caatinga" and savanna ("cerrado") (Map 2). The species has been poorly collected (only six collections have been found) and appears to be rare.

Phenology: Flowering in October and in January; fruiting in January and from April to June.

Comments: *Poecilanthe subcordata* is morphologically related to *P. itapuana* and *P. parviflora*, from which it is easily distinguished by the subsessile leaflets (pulvinule ca. 1 mm long) and the long pedicellate flowers (3-5 mm long).

Examined material: BRAZIL. BAHIA: CORIBE, Estrada Coribe/Descoberto, 17 April 2002, *F. França et al.* 3844 (HUEFS); CORRENTINA, Chapadão Ocidental da Bahia, 26 April 1980, *R. M. Harley et al.* 21805 (RB, UEC, CEPEC, IPA, U, AAU, NY); CRISTÓPOLIS, BR 242, 31 Jan. 1978, *A. Fernandes & E. Nunes* s.n. (UEC); Rodovia Br-242, 10 Oct. 1981, *G. Hatschbach* 44400 (US, MBM, CEPEC); **BRAZIL. PIAUÍ:** CURIMATÁ, Apa de Curimatá, 12 June 1999, *A. Fernandes* s.n. (UEC).

Poecilanthe parviflora Benth., J. Proc. Linn. Soc., Bot. 4, Suppl.: 80. 1860. Uruguay: *Tweedie 186* (Lectotype K (designated by Meireles & Tozzi, in press), photos C!, NY!, S!, US!)

Poecilanthe parviflora var. *floribunda* Hassl., Repert. Spec. Nov. Regni Veg. 12: 372. 1913. Paraguay: "In altaplanitie Sierra de Amambay, ad ripas fluminis Aguaray", X.1912, *E.Hassler 11438* (holotype G; isotype S!; B, destroyed, photo NY!, US!).

Tree to 30 m tall; the trunk and terminal branches greyish and often bearing lenticels, the trunk ones organized in horizontal lines; axillary bud inconspicuous, triangular, 1-2 x 1-1.8 x 0.5 mm; stipules triangular, 0.9-1.3 x 0.5-0.7 mm, persistent, tomentose. **Leaf** (3-)5-7 foliolate; petiole 0.7-2 cm long; rachis 1.5-3.4(-4.2) cm long; stipels setaceous, 0.4-0.8 mm long, often early caducous or absent; pulvinule wrinkled, 2-3.7 mm long. Leaflets ovate, elliptic, rarely wide elliptic, distal leaflets 3.4-7.5 x 1.7-3.3 cm, lateral and basal ones considerably smaller; base attenuate to rounded; apex acuminate to acute, rarely slightly obtuse, not mucronate (actually the very apex is often slightly retuse); membranaceous; discolour; midvein straight; secondary veins inconspicuous (not prominent); both sides glabrous, rarely sparsely pubescent, the upper face shiny. **Inflorescence** paired racemes, rarely single or three per node, axillary, subtending leaf sometimes caducous or rarely not developed; 3-4.5 cm long; tomentose; peduncle 0.3-0.5 cm long; rachis 2.8-4.6 cm long; bracts suborbicular, 0.8-1 x 0.7-0.8 mm, apex rounded, outer tomentose, caducous; floral bud elliptic to slightly obovoid, 4-4.5 mm long, base attenuate, apex acute and straight (not twisted). **Flower** 8-9(-10) mm long; pedicel 1-1.2 mm long; bracleoles suborbicular, 0.5 x 0.4 mm, inserted on the base of the calyx, outer face tomentose; caducous. Calyx 4-5 mm long, tomentose; tube 2.3-2.6 mm long; teeth narrowly triangular, 1.8-2.3(-2.5) mm long, inner face woolly; apex of the upper two often not separated, if so, than each apex acute, the lateral and lower teeth acute; hypanthium 0.8-1 mm long. Corolla whitish; standard slightly oblate, central blotch pale green basally and violet apically, claw 1-1.3 mm long, blade 6.5-7 x 5-5.5 mm, base rounded, apex emarginated; wings obovate in outline, claw 1.2-1.6 mm long, blade 6-6.8 x 2.5-2.8 mm, base slightly auriculated, apex rounded to rostrate; keel petals subfalcate, claw 1-1.4 mm long, blade 4.8-5 x 2-2.3 mm, base auriculated, apex widely acute. Androecium monadelphous or diadelphous, 5-5.5 mm long, filaments free for 1.7-2 mm;

basifixed anthers 0.65-0.7 mm long; dorsifixed anthers 0.3 mm long. Gynoecium 6-7.3 mm long; stipe 1-1.5 mm long; ovary 2.5-3 mm long, villous along the upper margin, sparser beneath; style 2.5-3 mm long, glabrous; stigma punctiform; ovules 3. **Fruit** coriaceous, lately dehiscent; suborbicular, oblong, obovate or D-shaped in outline, 1.8-2.7 x 1.4-2 cm, stipe 1-2 mm long; upper margin plane or sometimes extending into a discrete longitudinal wing; outer face prominent-veined; funicle subterete, free. **Seeds** 1-2, wide-elliptic, orbicular or D-shaped in outline, 13-15 x 11-14 x 3-4 mm. Testa chartaceous, dull; hilum 0,6-0,8 mm, parallel to the suture, partially (or rarely not) concealed by a funiculus remnant; aril absent; hypocotyl-root lobe visible or not; micropyle visible; lens visible, confluent with the hilum, mounded, linear; chalaza visible, more wrinkled and thicker than the testa, 90º from the hilum; raphe visible, slightly elevated, running around 3/4 of the seed circumference.

Fig. 6.

Distribution and ecology: Found in Argentina (Burkart 1952), Brazil and Uruguay (Map 2). In Brazil, *Poecilanthe parviflora* occurs from Rio Grande do Sul to southern São Paulo. *Poecilanthe parviflora* grows mainly in gallery forests, but is also found in secondary vegetation and as remnant in pasture fields. Cultivated as an ornamental in São Paulo (Brazil) and Buenos Aires (Argentina: Burkart 1952).

Phenology: Flowering from October to January; fruiting from February to November.

Vernacular names: coração-de-negro (Brazil), lapachillo (Argentina: Burkart 1952, and Uruguay: Bentham 1862).

Comments: Bentham (1862) cited two specimens, one collected by Tweedie and the other collected by Fox in Higuerita. We were not able to find Fox's material; however, the sheet of *P.*

parviflora from Higuerita that is deposited at K but lacks–collector information (G. Lewis, RBGKew, pers. comm.) may be this type specimen.

Poecilanthe parviflora is related to *P. itapuana* and *P. subcordata*, from which it is distinguished by its short (3-4.5 cm long) paired racemes in the leaf axil, and by its coriaceous, passively and lately dehiscent pods.

Examined material: BRAZIL. without locality: 23 Aug. 1910, *P. Dusén* 10135 (NY). **PARANÁ:** ARAPOTI, Rio das Cinzas, 16 April 1997, *M. V. F. Tomé* 1115 (MBM); ASSAÍ, Rio Tibagi, 1 Nov. 1997, *S. R. Ziller* 1831 (NY); BANDEIRANTES, Campus da FFALM, 18 Nov. 1996, *M. V. F. Tomé* 1085 (MBM); CAMPINA GRANDE DO SUL, Rio Capivari, 14 July 1986, *J. M. Silva & F. G. Zelma* 127 (RB); CAPITÃO LEÔNIDAS MARQUES, Rio Iguaçu, 15 April 1999, *J. M. Silva et al.* 2944 (SPF, MBM, ESA, C); CORNÉLIO PROCÓPIO, Sítio Nossa Senhora Aparecida, 25 Oct. 2000, *J. A. Ferreira et al.* s.n. (SP); Aguativa-Rio Conggonhas, 2 April 1998, *J. Alves* s.n. (MBM, ESA, FUEL); FOZ DO IGUAÇU, Parque Nacional do Iguaçu, 15 Oct. 1991, *A. C. Cervi* 3405 (MBM); GUAPIRAMA, 5 Dec. 1989, *V. P. de Oliveira* 30 (MBM); IBIPORÃ, Rio Tibagi, 7 April 1999, *A. L. Cavalheiro* 50 (MBM); Fazenda Doralice, 18 Nov. 1991, *F. Chagas* 1451 (UEC, NY); JATAIZINHO, 24 April 1999, *E. M. Fransisco & O. C. Pavão* s.n. (SP); Fazenda São José, 12 Dec. 1997, *L. R. M. Souza* s.n. (UEC); LEÓPOLIS, Estrada Primavera, 10 Feb. 1999, *J. Alves et al.* s.n. (RB); LONDRINA, Rio Tibagi, 23 Nov. 1987, *J. da Cruz* 43 (UEC); PORECATU, May 196, *R. J. S. Jaccoud* s.n. (SP); TERRA BOA, Rio Ivai, 16 May 1969, *G. Hatschbach* 21529 (RB, SPF, UEC, MBM, CEPEC, C, NY). **RIO DE JANEIRO:** RIO DE JANEIRO, JBRJ, 13 Jan. 1994, *B. B. Klitgaard* 89 (AAU); 8 Feb. 1983, *H. C. de Lima* 1891 (RB); 11 March 1987, *H. C.*

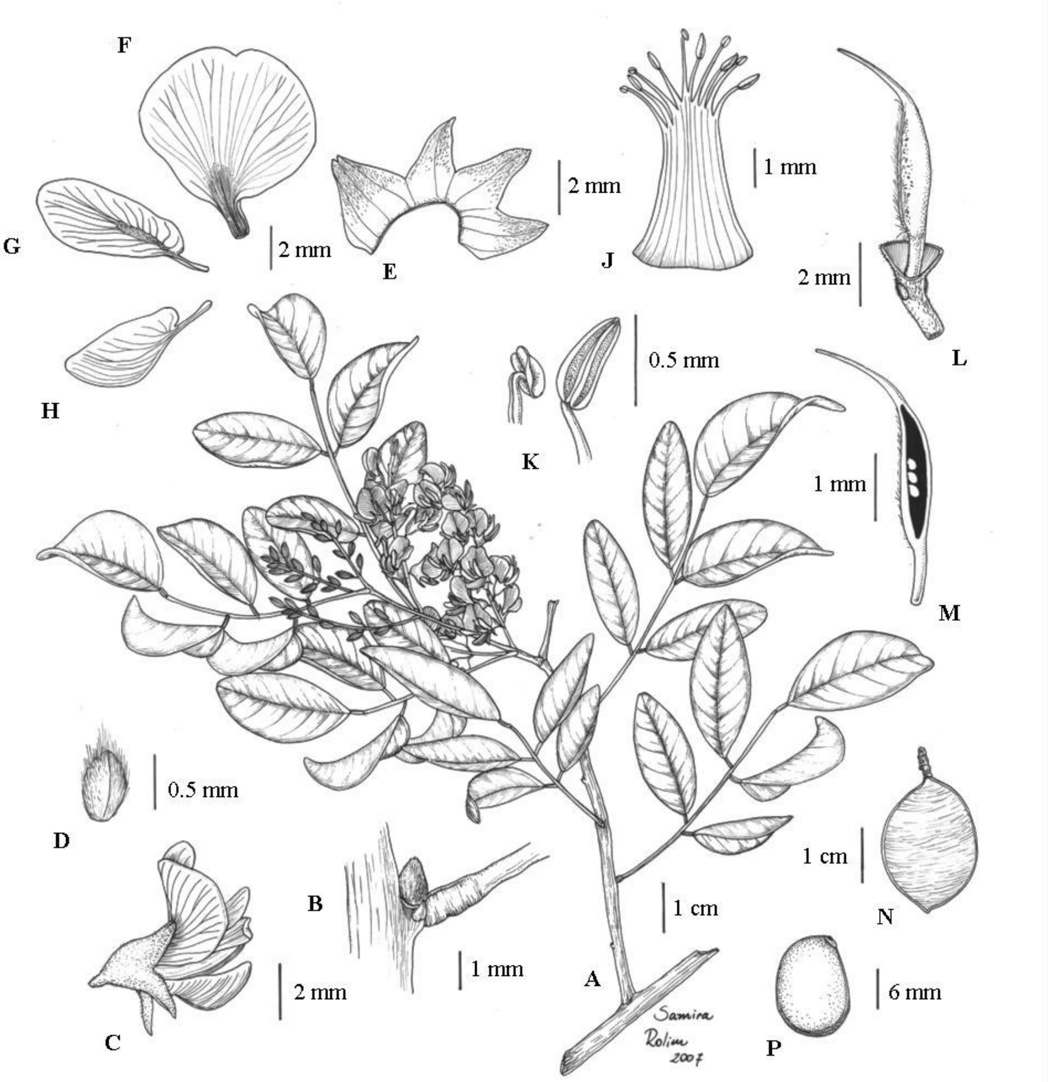


Fig. 6. *Poecilanthe parviflora*. **A.** flowering branch; **B.** resting bud and stipule; **C.** flower; **D.** bracteole; **E.** calyx opened out; **F.** standard; **G.** wing; **H.** keel petal; **J.** androecium; **K.** detail of the two anther types; **L.** gynoecium; **M.** ovary longitudinal section; **N.** fruit; **P.** seed.

de Lima 2816 (RB, MBM); 20 Nov. 1985, *I. R. de Carvalho et al.* 858 (RB). **RIO GRANDE DO SUL:** CANELA, p/ Caracol, March 1945, *K. Emrich* s.n. (PACA); CERRO LARGO, Cerro Largo para São Luiz, 3 Oct. 1946, *Augusto* s.n. (PACA); ESMERALDA, Estação Ecológica Aracuri, 4 July 1983, *J. A. Jarenkow* 156 (ICN); PORTELA, Parque Estadual do Turvo, Oct. 1982, *P. Brack* 1455 (ICN); Parque Estadual do Turvo, *P. Brack et al.* 1456 (ICN); PORTO ALEGRE, Itapoã, 21 Jan. 1963, *A. Sehnem* 8159 (MBM); Morro do Sabiá, 28 Dec. 1948, *B. Rambo* s.n. (BM); 22 Jan. 1947, *K. Emrich* s.n. (PACA); Jan. 1945, *Turbino* s.n. (PACA). **SANTA CATARINA:** FLORIANÓPOLIS, Lagoa do Peri, 1 April 1970, *Bresolim et al.* 8654 (RB, ICN, MBM); Morro do Rio Vermelho, 15 May 1969, *Klein* & *Bresolin* 8279 (MBM); Morro do Rio Vermelho, 22 Jan. 1969, *R. M. Klein* 8087 (RB, ICN, PACA, MBM); Morro do Rio Vermelho, 15 April 1969, *R. M. Klein* & *Bresolin* 8279 (ICN, PACA)**.** **SÃO PAULO:** ANALÂNDIA, Parque Rawvitscher, 17 Sept. 1992, *R. J. Almeida* s.n. (HRCB); ASSIS, 1995, *A. E. Brina* s.n. (BHCB); BAURU, Estação experimental, Instituto Florestal, 10 June 1989, *O. Brabosa* 1 (MBM); CAMPINAS, Unicamp, 16 Jan. 1998, *A. M. G. A. Tozzi* 98-1 (UEC); 13 July 1993, *J. C. Galvão & A. M. G. A. Tozzi* s.n. (UEC); IAC, 16 March 1997, *L. C. Bernacci* 2234 (UEC); MONTE MOR, Haras Vanguarda, March 1998, *J. P. Souza* 2286 (ESA); Haras Vanguarda, 12 Nov. 1998, *J. P. Souza* 2762 (ESA); PIRACICABA, Esalq, 19 Dec. 1993, *B. B. Klitgaard et al.* 55 (RB, ESA, AAU); Esalq, 27 Nov. 1983, *E. L. M. Catharino* 2 (UEC); Esalq, 28 Oct. 1986, *E. L. M. Catharino & Costa Pereira* 987 (UEC); Esalq, 21 Nov. 1983, *E. Luis* s.n. (RB); Esalq, 19 March 1993, *G. D. Fernandes* 125 (ESA); Esalq, 19 March 1993, *G. D. Fernandes* 129 (ESA); Esalq, 17 Nov. 1994, *J. A. Nogueira* 2 (UEC); Esalq, 23 Dec. 1984, *J. A. Zandoval* s.n. (UEC); Esalq, 26 March 1993, *K. D. Barreto* 166 (ESA); Esalq, 1 May 2001, *R. Tsuji* 17 (ESA); Esalq, 27 Nov. 1992, *V. C. Souza* 2108 (MBM, GFJP); SÃO PAULO, 2 Sept. 1946, *A. A. Jordão* s.n. (SPSF); SÃO PAULO, Interlagos, 30

April 1994, *I. Cordeiro* 1388 (SP); <u>TEODORO SAMPAIO</u>, Parque Estadual do Morro do Diabo, 24 Nov. 1987, *A. L. K. M. Albernaz* s.n. (SPSF); Parque Estadual do Morro do Diabo, 16 Nov. 1987, *A. L. K. M. Albernaz* s.n. (SPSF); Parque Estadual do Morro do Diabo, 25 Feb. 1988, *E. C. Fonseca* s.n. (SPSF). **URUGUAY. COLONIA:** 30 Nov. 1932, *A. L. Cabrera* 2629 (SP, NY).

Excluded names

The following names have been excluded since they do not fit the new circumscription of *Poecilanthe* (see Meireles, chapter 2):

Poecilanthe amazonica (Ducke) Ducke
Poecilanthe effusa (Huber) Ducke
Poecilanthe hostmannii (Benth.) Amshoff
Poecilanthe ovalifolia Kleinhoonte

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We are grateful to Enrique Forero for critical comments and for his help with the English text, and to João Aranha for their helpful suggestions on the manuscript. This paper is part of J. E. Meireles' Masters thesis developed while being a student in the graduate program in Plant Biology at the Institute of Biology, Campinas State University (Unicamp). Support received from the CNPq in the form of a scholarship, and a grant from FAPESP, are gratefully acknowledged.

Literature cited

Allen, O. N. & Allen, E. K. (1981). The Leguminosae: A Source Book of Characteristics, Uses and Nodulation. The University of Wisconsin Press, Washington. p. 539-540

Amshoff, G. J. H. (1939). On South American Papilionaceae. Mededelingen van het Botanisch Laboratorium der Rijksuniversiteit te Utrecht 52: 1-73.

Arroyo, M. T. K. & Rudd, V. E. (1973). New taxa and combinations in Leguminosae. Phytologia 25: 167.

Arroyo, M. T. K. (1981). Breeding systems and pollination biology in Leguminosae. In: Polhill, R. M. & Raven, P. H. (eds.).Advances in Legume Systematics, part 2. Royal Botanic Gardens, Kew. p. 723-769.

Bentham, G. (1860). Synopsis of Dalbergieae, a tribe of Leguminosae. Journal of the Proceedings of the Linnean Society. Botany. 4, Suppl.: 1-134.

_____________ (1862). Leguminosae I. In: Martius, C. F. P. von; Eichler, A. W. & Urban, I. (eds.), Flora Brasiliensis. Monachii, Lipsiae, Frid. Fleischer in comm. Vol. 15, part 1. p. 270-271.

Burkart, A. (1952). Las leguminosas argentinas, silvestres y cultivadas. San Isidoro, Buenos Aires, Acme. p. 358-360.

Crisp, M. D., Gilmore, S. & Van Wyk, B. (2000). Molecular phylogeny of the genistoid tribes of Papilionoid legumes. In: Herendeen, P.S. & Bruneau, A. (eds.). Advances in Legume Systematics, part 9. The Royal Botanic Gardens, Kew. p. 249-276.

Doyle, J. J., Chappill, J. A., Bailey, D. C. & Kajita, T. (2000). Towards a comprehensive phylogeny of legumes: evidence from rbcL sequences and non-molecular data. In: Herendeen, P. S. & Bruneau, A. (eds.). Advances in Legume Systematics. The Royal Botanic Gardens, Kew. P. 1–20.

Ducke, A. (1932). Reunion Mensuelle des Naturalists du Museus. Bulletin du Museum d'historie Naturelle. Paris; sér. 2, 4: 733-734.

___________ (1953). As Leguminosas de Pernambuco e Paraíba. Memórias do Instituto Oswaldo Cruz 51: 446-461.

Farr, E. R., Leussink, J. A. & Stafleu, F. A. (eds.) (1979). Index Nominum Genericorum (Plantarum). Regnum Veg. 100-102: 1-1896.

Geesink, R. (1981). Tephrosieae (Benth.) Hutch. In: Polhill, R. M. & Raven, P. H. (eds.). Advances in Legume Systematics, part 1. Royal Botanic Gardens, Kew. p. 245-260.

___________ (1984). Scala Milletiearum. A survey of the genera of the tribe Millettieae (Legum.-Pap.) with methodological considerations. Leiden Botanical Series 8. Leiden, E.J. Brill/Leiden University Press. p. 1-131.

Greinwald, R., Bachmann, P., Lewis, G., Witte, L. & Czygan, F-C. (1995). Alkaloids of the genus *Poecilanthe* (Leguminosae: Papilionoideae). Biochemical Systematics and Ecology 23(5): 547-553.

Harms, H. (1909). Beiträge zur Flora von Bahia, I. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 42: 214.

Hassler, E. (1913). Novitates Argentinae II. Repertorium specierum novarum regni vegetabilis. Centralblatt für Sammlung und Veröffentlichung von Einzeldiagnosen neuer Pflanzen 12: 372.

Heringer, E. P. (1952). Reabilitação de uma espécie de Fr. Velloso. Arquivos do Serviço Florestal, Rio de Janeiro 6: 197-200.

Hijmans, R. J., Guarino, L., Jarvis, A., O'Brien, R., Mathur, P., Bussink, C., Cruz, M., Barrantes, I. & Rojas, E. (2005). Diva-GIS (version 5.2). www.diva-gis.org

Hoehne, F.C. (1941). Leguminosas Papilionadas. Flora Brasílica. São Paulo, Secretaria da Agricultura, Indústria e Comércio de São Paulo. 25(3): 37-38.

Holmgren, P. K., Holmgren, N. H. & Barnett, L. C. (1990). Index Herbariorum part I, The Herbaria of the world. 8th ed. New York Botanical Garden.

Hu, J. M.; Lavin, M.; Wojciechowski, M. F. & Sanderson, M. (2000). Phylogenetic systematics of the tribe Millettieae (Leguminosae) based on chloroplast trnK/matK sequences and its implications for evolutionary patterns in Papilionoideae. American Journal of Botany 87(3): 418-430.

Hu, J.M.; Lavin, M.; Wojciechowski, M.F. & Sanderson, M. 2002. Phylogenetic analysis of nuclear ribosomal ITS/5.8S sequences in the tribe Millettieae (Fabaceae): *Poecilanthe-Cyclolobium*, the core Millettieae, and the *Callerya* group. Systematic Botany 27(4): 722-733.

Hutchinson, J. (1964). The Genera of Flowering Plants, vol. 1. Oxford University Press, Oxford.

Kirkbride, J. H., Gunn, C. R. & Weitzman, A. L. (2003). Fruits and seeds of genera in the subfamily Faboideae (Fabaceae). U.S. Department Agriculture, Technical Bulletin 1890: 1-212.

Kleinhoonte, A. (1925). Novitates taxonomicae. Recueil des Travaux Botaniques Néerlandais 22: 398-400.

Klitgaard, B. B. (2005). *Platymiscium* (Leguminosae: Dalbergieae): biogeography, systematics, morphology, taxonomy and uses. Kew Bulletin 60: 321-400.

Lavin, M. (1987). A cladistic analysis of the tribe Robinieae (Papilionoideae, Leguminosae). In: Stirton, C. H. (ed.), Advances in Legume Systematics, part 3. Royal Botanic Gardens Kew. p. 31-64.

Lavin, M. (1990). The genus *Sphinctospermum* (Leguminosae): taxonomy and tribal relationship as inferred from a cladistic analysis of traditional data. Systematic Botany 16(4): 544-559.

Lavin, M. & Sousa, M. (1995). Phylogenetic systematics and biogeography of the tribe Robinineae (Leguminosae). Systematic Botany Monographs 45: 1-165.

Lewis, G. P. (1987). Legumes of Bahia. Royal Botanic Gardens, Kew. p. 236-237.

__________ (1989). A new species of *Poecilanthe* (Leguminosae, Papilionoideae) from Brazil. Kew Bulletin 44: 167-169.

Macbride, J. F. (1943). Flora of Peru. Field Museum of Natural History. Botanical series 13 (3): 228-267.

Martins, V. F., Guimarães Jr., P. R., Silva, R. R. & Semir, J. (2006). Secondary seed dispersal by ants of *Ricinus communis* (Euphorbiaceae) in the Atlantic forest in Southern Brazil. Sociobiology 47(1): 265-274.

Meireles, J. E. & Tozzi, A. M. G. A.. A synopsis of *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae). Rodriguésia. (in press)

Pennington, R.T., Lavin, M., Ireland, H., Klitgaard, B., Preston, J. & Hu, J. (2001). Phylogenetic relationships of Basal Papilionoid Legumes based upon sequences of the chloroplast trnL intron. Systematic Botany 26(3): 537-556.

Polhill, R. M. (1976). Genistae (Adans.) Benth. and related tribes. Academic Press, Oxford.

___________ (1994). Classification of Leguminosae. In: Bisby, F.A.; Buckingham, J. & Harborne, J. B. (eds.). Phytochemical Dictionary of the Leguminosae. Chapman & Hall, London.

Ross, J. H. & Crisp, M. D. (2005). Brongniartieae. In: Lewis, G. P., Schrire, B., Mackinder, B., Lock, M. (eds), Legumes of the world. Royal Botanic Gardens, Kew. p. 252-259.

Stafleu, F. A. & Cowan, R. S. (1976-1988). Taxonomic Literature. 2nd ed., I-VII. Utrecht, Bohn, Scheltema & Holkema.

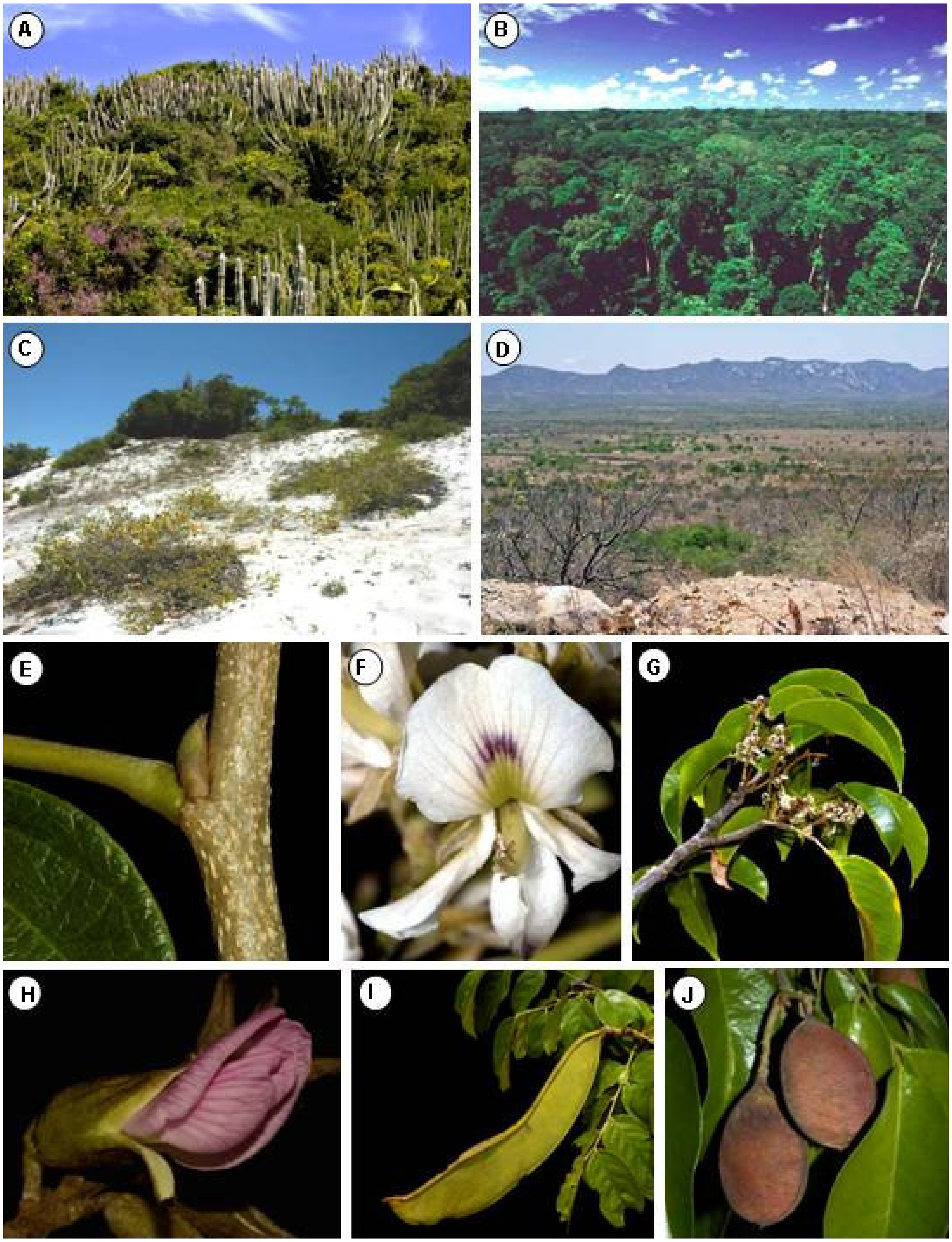
Stirton, C. H. (1981). Petal sculpturing in papilionoid legumes. In: Polhill, R. M. & Raven, P. H. (eds.). Advances in Legume Systematics, part 2. Royal Botanic Gardens, Kew.p. 771-788.

Van der Pijl, L. (1982). Principles of dispersal in higher plants. Springer-Verlag, New York, N.Y.

Velloso, J. M. da C. (1829). Florae Fluminensis. Rio de Janeiro.

________________ (1831). Florae Fluminensis Icones. Paris. v. 7, Tab. 93

Wojciechowski, M. F., Lavin, M. & Sanderson, M. J. (2004). A phylogeny of legumes (Leguminosae) based on analysis of the plastid matK gene resolves many well-supported subclades within the family. American Journal of Botany 91(11): 1846-1862.



Appendix 1. Additional illustrations of *Poecilanthe* species habitat and morphology. Habitats of: *P. falcata*, **A**. Dry vegetation in Cabo Frio, **B**. Tabuleiro Forest; *P. itapuana*, **C**. Dune; *P. ulei*, **D**. Caatinga. *P. falcata*, **E**. Resting bud. *P. parviflora*, **F**. flower. *P. itapuana*, **G**. Flowering branch. *P. falcata*, **H**. Flower; **I**. Pod. *P. parviflora*, **J**. Pods.

CAPÍTULO 4

Revalidation of the genus Amphiodon (Leguminosae, Papilionoideae)[8]

JOSÉ EDUARDO MEIREES & ANA MARIA G. DE A. TOZZI

Meireles, J. E.* & Tozzi, A. M. G. A. (Departamento de Botânica, Instituto de Biologia, Universidade Estadual de Campinas, Caixa Postal 6109, CEP: 13083-970, Campinas, São Paulo, Brazil; *e-mail: jemeireles@gmail.com). Revalidation of the genus *Amphiodon* (Leguminosae, Papilionoideae). Brittonia 00:000-000.200X. -- The South-American genus *Amphiodon* Huber [Type = *A. effusus* Huber] is revalidated and recircumscribed to include *Poecilanthe ovalifolia* in addition to *P. effusus*. The genus is segregated from *Poecilanthe* and is diagnosed by a vexillary stamen that is mostly adherent to the standard claw and a septate pod with the seeds that are transversally arranged, for example. Descriptions, illustrations, and geographical distributions are provided for the two species now included in this genus.

Keywords: Amazonia, Fabaceae, *Poecilanthe*, South-America.

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[8] To be submitted to Brittonia.

The genus *Amphiodon* was described by Huber (1909) with a single species, *Amphiodon effusus*. Huber distinguished *Amphiodon* from *Poecilanthe* by having diadelphous stamens, biauriculated wing petals, and obovoid pods. However, Ducke (1932) combined *Amphiodon* into *Poecilanthe*, thus creating *P. effusa* (Huber) Ducke, because the base of vexillary filament was fused to the staminal column and the wing petal was only plicate at its lower base. Kleinhoonte (1925) had earlier described *Poecilanthe ovalifolia* from Surinam, which Ducke (1932) observed to be a very similar to *P. effusa*.

A phylogeny of *Poecilanthe* based on morphological and molecular data (Meireles, chapter 2) reveals that *P. effusa* and *P. ovalifolia* form a well supported clade that is sister to a large clade containing *Cyclolobium*, *Harpalyce*, *Hovea*, *Brongniartia*, and the remaining species of *Poecilanthe*. This clade can be distinguished from the other *Poecilanthe* by the highly branched panicles with a shortened primary axis, valvate aestivation of the calyx; vexillary stamens mostly adherent to the standard claw, well-developed connectives, sessile ovaries, and the internally septate pods. In addition, this study has shown that the transversally arranged seeds, the post chalazal branches reaching the hilum, and the villose plumule that is twice the length of the hypocotyl-root axis are unique features of this clade, in agreement with Meireles (chapter 1).

The combination of the characters cited above, as well as the phylogenetically early branching position of *Amphiodon* within the tribe Brongniartieae, are sufficient criteria to rank *Amphiodon* as a distinct genus, as suggested by Meireles (chapter 2). Thus, this work revalidates *Amphiodon* and transfers *Poecilanthe ovalifolia* to *Amphiodon* as *A. ovalifolius*. Moreover, we provide species delimitations, descriptions, illustrations, and geographical distributions for each of the two *Amphiodon* species.

Amphiodon Huber, Bol. Mus. Paraense Hist. Nat. 5: 398. 1909. TYPE: *A. effusus* Huber

Trees of medium stature. *Leaves* alternate, pulvinate; stipules minute, early caducous. Leaflets 5--7 per leaf, alternate, subopposite to opposite; stipels persistent or absent; secondary venation brochidodromous. *Inflorescences* paniculate, axillary, cauliflorous, or pseudo-terminal, primary axis very short, secondary axes long, clustered or fasciculate. *Flowers* bilaterally symmetrical, pedicelate; bracteoles 2, minute, opposite, inserted at the base of the calyx. Calyx turbinate, sepals 5, basally fused and apically toothed, the upper 2 teeth largely connate; hypanthium inconspicuous. Corolla papilionaceous, petals 5, glabrous, clawed; the wing petals slightly longer than the keel, their upper base auriculate; keel petals weekly adherent along part the lower margin. Androecium with 10 stamens, diadelphous, the vexillary stamen mostly adherent to the base of the standard claw or occasionally inserted on the hypanthium; filaments apically free, anthers sub-equal (length difference to 50% between the 2 types), the shorter ones subdorsifixed (almost basifixed), alternating with the longer basifixed; connective conspicuous. Ovary sessile. *Fruits* dehiscent, internally septate by a proliferation of papery tissue from the inner epidermis. *Seeds* with the broad faces transversally oriented with the fruit length; post chalazal branches reaching the hilum; plumule villose, hypocotyl-root axis straight, shorter than the plumule.

The genus comprises two very similar species. The distinction between them is tentative, and more field work is necessary to clarify their delimitation. *Amphiodon* is widely distributed in non-flooded Amazonian forest.

Key to the species of *Amphiodon*

1. Leaves with stipels .... ***A. ovalifolius***

1. Leaves without stipels .... ***A. effusus***

Amphiodon effusus Huber, Bol. Mus. Paraense Hist. Nat. 5: 398. 1909. TYPE: BRAZIL. Pará: “Faro, Serra do Dedal, in silvis”, 3.IX.1907, *A.Ducke 8585* (HOLOTYPE: MG). *Poecilanthe effusa* (Huber) Ducke, Bull. Mus. Hist. Nat. (Paris) ser. 2, 4: 733. 1932. (Fig.1)

Tree or treelet to 20 m high; terminal branches slightly fissured; stipules ephemeral. Petiole (3--)5--9 cm long, rachis (3.5--)8.5--14 cm long, pulvinule 3--5 mm long, stipels absent. Leaflets elliptic to ovate, rarely suborbicular or narrowly elliptic, (5--)7--14(--19) x (2--)2.5--6(--8.5) cm; base obtuse to rounded, occasionally acute-cuneate; apex acuminate to distinctly cuspidate, membranaceous or rarely coriaceous, glabrous. *Inflorescence* 5--26 cm long, delicate or rarely robust, pubescent to sparsely tomentose, bract 0.6--0.8 mm long. *Flower* 7--10 mm long; pedicel 1--3 mm long; calyx 4.7--6.3 mm long, sparse to distinctly tomentose; corolla deep-red; standard petal obcordate to widely depressed-obovate, 7.7--9.5 mm long, base obtuse to acute, apex emarginate; wing petals elliptic-obovate, 7--9.3 mm long, apex obtuse to rounded; keel petals elliptic-obovate to obovate, 6.6--7.8 mm long, apex obtuse to rounded; stamens 5.7--7.3 mm long; basifixed anthers 0.8--1 mm long, sub-dorsifixed anthers 0.6--0.8 mm long; gynoecium ca. 7--7.4 mm long; ovules 8--9. *Fruit* obovoid, 3.4--4.5 x 1.5--1.8 x 1--1.2 cm, apex rounded, base acute, slightly compressed in cross section. *Seeds* (1--)2--4(--5) per pod, widely elliptic, orbicular or slightly oblate, 9--13 x 7--12 x 3,5--6 mm; compressed or often plano-convex in cross-section; testa papery, dull, smooth.

Distribution and ecology.— Recorded from Bolivia, Brazil, French Guiana (Barneby & Heald, 2002) and Surinam (Fig. 2). Widely distributed in Amazonian terra-firme (non-flooded forest), especially in secondary forests and clearings.

Vernacular names.— cumaru-de-rato, gema-de-ovo.

Uses.— In the Brazilian state of Maranhão, the bark of *P. effusa* is used to treat snake bites (*W. L. Balée 971*).

Representative specimens examined.

SURINAM. 26 May 1957, *Schulz 7989* (U, AAU), *Kappler 969* (U); Brownsberg Nature Park, 90 km s of Paramaribo, 24 Sept. 1976, *Mori & Bolten 8386* (NY).

FRENCH GUIANA. 26 July 1990, *Sabatier & Prevost 3423* (U, NY), 26 Oct. 1968, *Oldeman 254* (NY). **CAYENNE:** Réserve de Petit-Saut, Oct. 1997, *Paget 2* (NY). **SAINT LEURENT DU MARONI:** Saul, Circuit de la montagne Ggrand Fossés, km 0.485, 1971, *Oldeman 4053* (U, NY)

BRAZIL. ACRE: Brasiléia, 2 June 1980, *Nelson 832* (RB, INPA, MG, NY); Rio Branco, Estrada Rio Branco/Brasiéia km 42, 16 Oct. 1980, *Lowrie et al. 559* (MG, INPA, RB); Rio Macahuan, 22 Aug. 1933, *Krukoff 5605* (SP, BM, U, US, NY); Sena Madureira, 27 Sept. 1980, *Cid Ferreira & Nelson 2553* (INPA, MG). **AMAPÁ:** Contagem, Entre Porto Platon e Serra do Navio, 1976, *Rosa 1322* (MG); Mazagão, 21 Oct. 1984, *Daly et al. 3947* (MG, GH, NY); Rio Araguari, 29 Aug. 1961, *Pires et al. 50588* (RB, IAN, MG, US, NY); Serra do Navio, 1961, *Rodrigues 2922* (INPA). **AMAZONAS:** Maués, Rio Urupadi, Igarapé Quininha, 19 July 1983, *Zarucchi et al. 3104* (INPA, MG); Novo Aripuanã, Transamazônica a 400 km de Humaitá, 3 May 1985, *Cid Ferreira 6002* (INPA); Parintins, Lago Uaicurapá, 5 Sept. 1932, *Ducke s.n.* (RB). **MARANHÃO:** Buritirama, Rio Itacaiunas, 21 June 1970, *Pires 12201* (IAN); Carutapera,

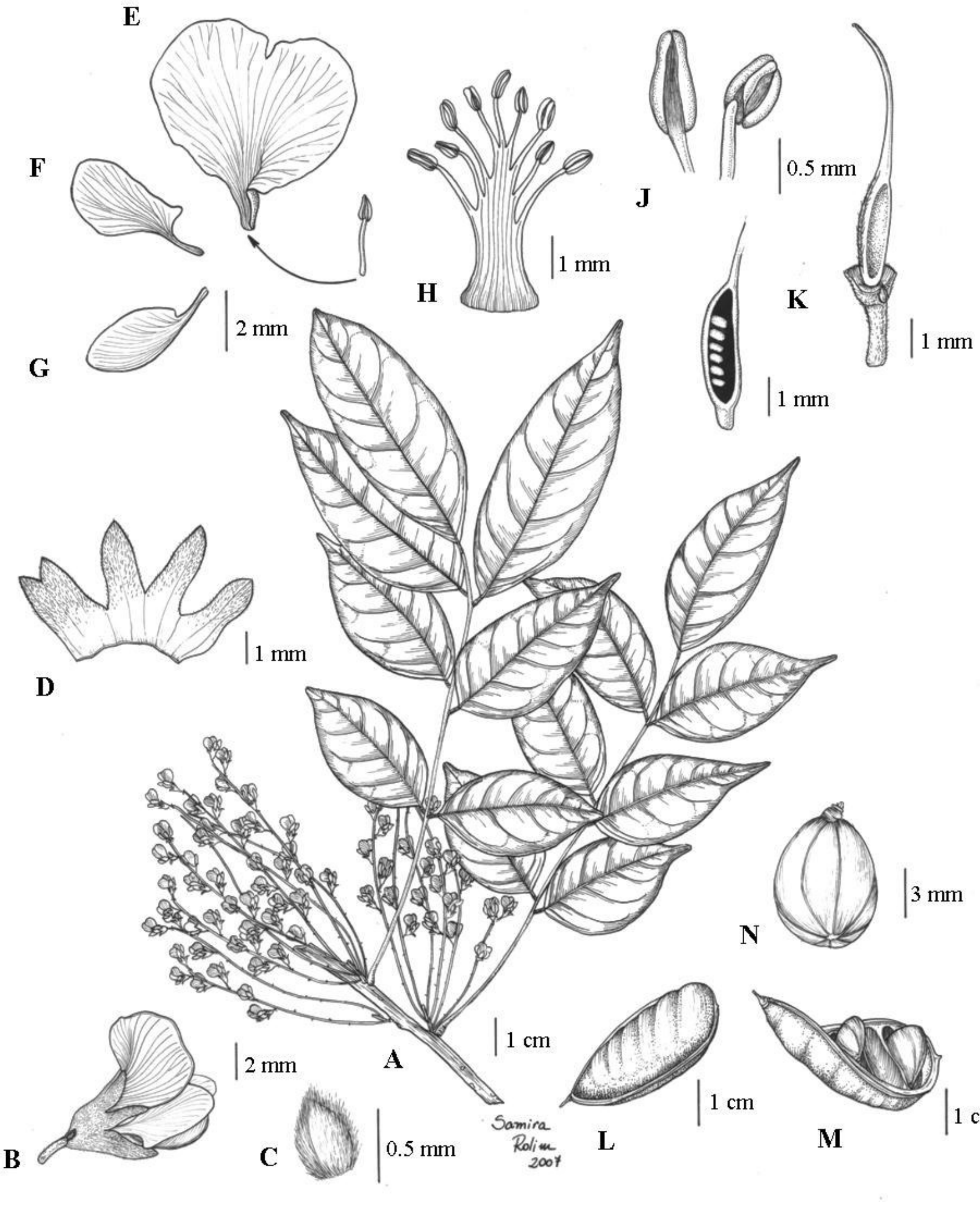

Fig. 1. *Amphiodon effusus.* **A.** Flowering branch. **B.** Flower. **C.** Bracteole. **D.** Calyx (inner face). **E.** Standard. **F.** Wing. **G.** Keel petal. **H.** Stamens. **J.** Two anther types. **K.** Gynoecium. **L.** Closed fruit. **M.** Opened fruit showing the tranversal arangment of the seeds. **N.** Seed.

Gurupiuna, 3 Nov. 1986, *Balée & Ribeiro 2786* (NY); Monção, Bacia do Rio Turiaçu, 5 June 1985, *Balée 971* (MG, NY); Santa Inês, Rodovia p/ Açailândia, km 100, 6 Aug. 1976, *Pinheiro 25* (IAN); Santa Luzia, Fazenda CVB, perto do km 130 da BR 222, 24 Oct. 1980, *Daly et al. D752* (INPA, MG, NY). **PARÁ:** 3 Dec. 1954, *Fróes 31102* (IAN); Acará, Fazenda Borba Gato, 7 Nov. 1980, *Daly et al. D867* (F, US, INPA, IAN, MG, HRB, GH, NY); Altamira, Igarapé Trindae, 3 Aug. 1971, *Cavalcante & M. Silva 2856* (RB, MG); Arumanduba, Serra da Arumanduba, 23 July 1961, *Egler & Irwin 45930* (RB, UB, IAN, MG, U, NY, S); Barcarena, Vila Itupanema, Reserva ALBRÁS, 17 Sept. 1983, *Cordeiro 1800* (IAN); Belterra, 5 Aug. 1947, *Black 47-1152* (IAN); Bragança, Colônia 3 de outubro, 23 Aug. 1952, *Pires 4125* (IAN, NY); Cachoeira, BR 22, Capanema - Maranhão, km 96, 27 Oct. 1965, *Prance 1716* (IAN, NY); Carajás, Serra dos Carajás, 21 May 1982, *Sperling et al. 5777* (NY); Faro; Fordlandia, Região do Rio Tapajós, Sept. 1931, *Krukoff 1016* (BM, U, S, NY); Ipixuna do Pará, Km 129, além de Ipixuma, 6 July 1966, *Duarte 9811* (RB, UB, RFA); Itaituba, 3 Sept. 1902, *Ducke 2972* (MG); Itinga do Pará, Fazenda Santa Rosa, 26 Oct. 1980, *Daly et al. D781* (INPA, MG); Jacundá, Remansão, 15 April 1981, *Silva et al. 1575* (INPA, MG); Lago Moiossú, 24 July 1959, *Egler 1009* (UB, INPA, IAN, MG, NY); Marabá, Carajás, Serra Norte, 6 Aug. 1982, *Maciel 766* (INPA, MG, MBM, NY); Melgaço, 13 Oct. 1991, *Silva & Silva 2371* (MG, NY), Flona de Caxiuanã, 2-15 Feb. 1991, *Silva et al. 2221* (MG); Moju, Campo experimental da Embrapa, km 30 da rodovia PA-150, 11 March 1996, *Ribeiro 2110* (IAN); Monte Dourado, Rio Jarí, 5 Oct. 1968, *Silva 1117* (IAN, NY); Oriximiná, BR 163 a 6 km da Cachoeira Porteira, 20 Aug. 1986, *Cid Ferreira et al. 7894* (F, INPA, MG, NY), Porto Trombetas, 3 July 1995, *Faria & Delmo Fonseca 1009* (RB, HUEFS); Rio Cuminá-mirim, 13 Oct. 1913, *Ducke 14977* (RB, MG); Rio Cachorro, Igarapé Cabeça de Onça, 25 Aug. 1986, *Cid Ferreira et al. 8020* (INPA, F, MG, NY);

Rio Paru do Oeste, 10 Sept. 1980, *Cid Ferreira et al. 2360* (INPA, MG, RB, NY); Ourém, Rio Guamá, July 1953, *Pires & Silva 4603* (INPA, IAN, NY); Paragominas, Fazenda da FFT, área da Cikel, 29 May 2002, *Ferreira 812* (IAN); Peixe-Boi, 22 July 1907, *Siqueira s.n.* (MG), E. de F. de Bragança, 23 April 1907, *Siqueira 8786* (RB, BM, INPA, MG); Ponta de Pedras, Rio Itacaiuna, 14 June 1949, *Fróes & Black 24484* (SP, IAN); Ponte Nova, Entre Ponte Nova e Boa Vista, 19 Aug. 1919, *Ducke s.n.* (RB); Rio Capim, 17 June 1897, *Huber 733* (RB, BM, MG, US); Rio Jarí, 20 June 1969, *Silva 2270* (IAN, NY); Rio Tapajós, 11 Sept. 1916, *Ducke 16480* (BM, MG); Rodovia Belém Brasília, km 94, 8 Sept. 1959, *Kuhlmann & Jimbo 208* (SP, UEC, IAN, MG, SPF, NY), Ipanema, 18 Aug. 1916, *Ducke 16352* (BM, MG, RB); Muji dos Campos, 13 Aug. 1969, *Silva & Sousa 2243* (RB, MG, S), Muji dos Campos, 19 Aug. 1969, *Silva & Sousa 2314* (RB, MG, US, S, NY); São Domingos do Capim, Rio Capim, 3 July 1974, *Cavalcante 2973* (RB, MG, INPA, NY); Tomé-Açu, Rio Acará, 29 Oct. 1979, *Silva & Pinheiro 5115* (MG, MAC, NY); Tucuruí, 3 Oct. 1983, *Revilla et al. 8437* (INPA, NY), 2 June 1980, *Silva & Rosário 5319* (RB, MG, INPA, SPF, NY), Igarapé Cagancho, 21 Aug. 1980, *Rodrigues et al. 10261* (INPA, MG, RB, NY); Ulianópolis, Fundação Floresta Tropical, 03-07 June 2000, *Lobato 2566* (MG). **RONDÔNIA:** Abunã, Serra próximo a Namorado Novo, 5 Aug. 1971, *Prance et al. 14716* (INPA, MG, NY); Alvorada d'Oeste, p/ Costa Marques, km 90, 25 June 1983, *Silva 6464* (INPA, MG); Ji-Paraná, 4 May 1987, *Cid Ferreira 9030* (INPA, MBM, NY), estrada Cuiabá/Porto velho, km 353, 26 June 1984, *Cid Ferreira et al. 4811* (RB, UEC, F, INPA, MG, NY), Porto Velho, reservatório da Usina Hidrelétrica de Samuel, 20 June 1986, *Cid Ferreira et al. 7528* (F, INPA, GH, NY); Santa Bárbara, 28 May 1982, *Teixeira et al. 840* (RB, F, INPA, MG, NY). **RORAIMA:** Boa Vista, Aug. 1932, *Capucho 388* (IAN)

BOLIVIA. PANDO: 20 July 1978, *Meneces 761* (MG); Nicolas Suárez, 3 Oct. 1989, *Beck et al. 19006* (MG), 28 Oct. 1978, *Meneces 803* (INPA)

Amphiodon effusus differs from *A. ovalifolius* not only by its leaves lacking stipels or that are at least not persistent, but also by its flowers with reddish petals. Delicate inflorescence axes and membranaceous leaves are generally associated with *A. effusus*. However, robust inflorescences and leaves are occasionally found among the specimens of *A. effusus* such that these features cannot be used with the greatest of certainty to distinguish it from *A. ovalifolius*.

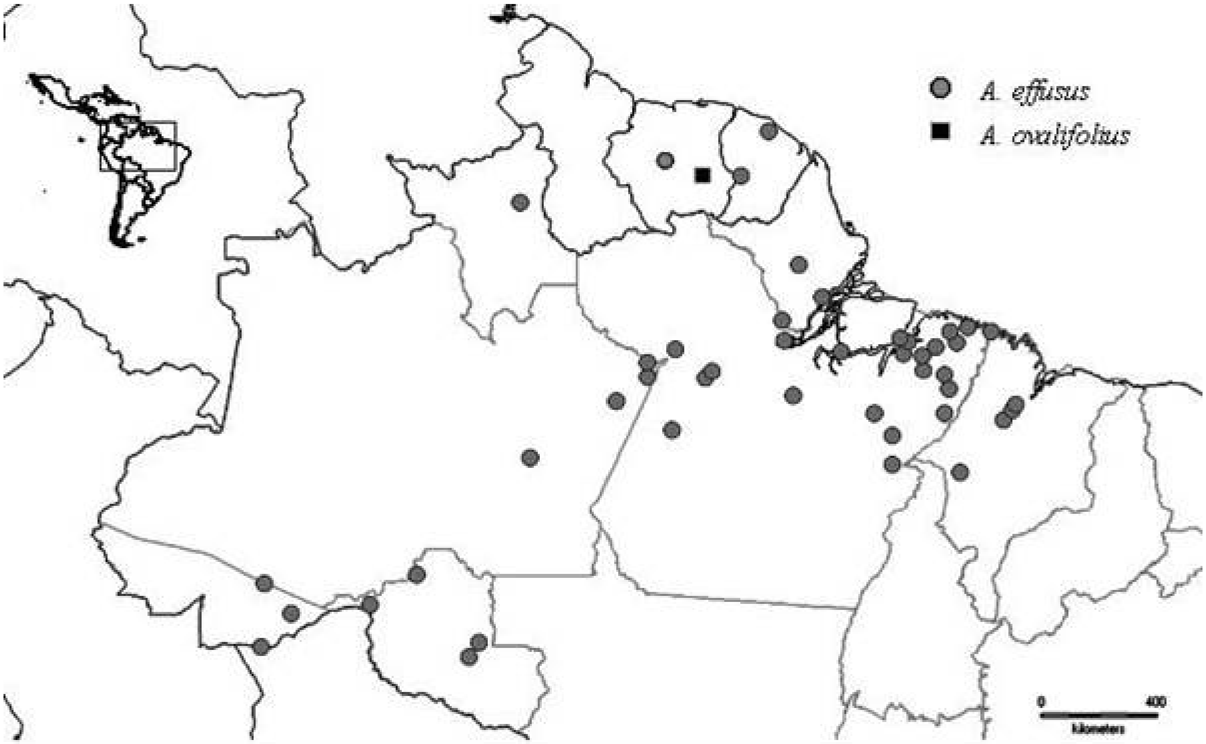

Fig. 2. Geographic distribution map of *A. effusus* and *A. ovalifolius*.

Amphiodon ovalifolius (Kleinhoonte) Meireles & A.M.G. Azevedo, **comb. nov.** *Poecilanthe ovalifolia* Kleinhoonte, Recueil Trav. Bot. Néerl. 22: 398. 1925. TYPE: SURINAM: "am Tapanahoniflusse", 11.XI.1918, *J. W. Gonggrijp s.n.* (HOLOTYPE: U; ISOTYPES: IAN, US). (Fig.3)

Tree to 15 m high; terminal branches slightly fissured; stipules not seen. Petiole 4--7.2 cm long, rachis 2.5--12.7 cm long, pulvinule 4--6 mm long, stipels persistent. Leaflets widely-elliptic to ovate, rarely suborbicular, 8.5--14 x 4.7--8 cm, the basal ones often smaller; base obtuse to rounded; apex shortly do distinctly cuspidate, coriaceous, glabrous. *Inflorescence* 5--8 cm long, robust, pubescent, bract 1 mm long. *Flower* 12 mm long; pedicel 2 mm long; calyx 7 mm long, tomentose; corolla blue; standard petal suborbicular, 10 mm long, base widely-obtuse, apex emarginated; wing petals wide elliptic-ovate, 10 mm long, apex obtuse to rounded; keel petals obovate, 7 mm long, apex rounded; stamens 7 mm long, anthers not measured; gynoecium ca. 6 mm long; ovules 9. *Fruit* and *seeds* unknown.

Distribution and ecology.— Amphiodon ovalifolius is apparently rare and restricted to the Tapanahoni River region in Surinam (Fig. 2).

Vernacular names.— kloemansingi (Amshoff, 1939).

Examined material. Represented only by the type collection.

The type material includes only very young floral buds and leaves, and so the description given in this paper stems from the protologue (Kleinhoonte, 1925). However, Kleinhoonte's description and illustration fit also *A. effusus*, so they are not very diagnostic. The only diagnostic character of *A. ovalifolius* that has yet been uncovered from the specimens examined is the leaves of *A. ovalifolius* bearing robust stipels. Like the robust inflorescence rachises and coriaceous leaves, the putatively blue corolla of *A. ovalifolia* is doubtful. Information concerning petal color is provided only in the protologue and not in the exsiccate label. More material from Surinam and adjacent regions obviously is needed to validate the distinction of *A. ovalifolius* from *A. effusus*.

Fig. 3. *Amphiodon ovalifolius.* Original illustration (Keinhoonte, 1925).

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We are grateful to Matt Lavin for his critical comments and for improving the English text, and to Samira Rolim for the illustration. This paper is part of J. E. Meireles' Masters thesis developed while in the graduate program in Plant Biology at the Institute of Biology, Campinas State University (Unicamp). CNPq and Fapesp are gratefully acknowledged for financial support.

Literature cited

Amshoff, G. J. H. 1939. Papilionaceae. *In*: Pulle, A. A., (ed.), Flora of Suriname. Amsterdam, Koninklijke Vereeniging Indisch Instituut. v.2, pt.2. Pp. 156-158.

Barneby, R. C. & Heald, S. V. 2002. Fabaceae. *In*: Mori, S. A., Cremers, G., Gracie, C. A., Granville, J. J., Heald, S. V., Hoff, M., Mitchell, J. D (eds.). Guide to the Vascular plants of central French Guiana. Memoirs of the New York Botanical Garden, 76(2): 312-313.

Ducke, A. 1932. Reunion Mensuelle des Naturalists du Museus. Bulletin du Museum d'historie Naturelle. Paris; sér. 2, 4: 733-734.

Huber, J. 1909. Materiaes para a flora amazônica VII. Boletim do Museu Paraense de História Natural e Ethnographia 5: 294-412.

Kleinhoonte, A. 1925. Novitates taxonomicae. Recueil des Travaux Botaniques Néerlandais 22: 398-400.

CAPÍTULO 5

A new genus of Leguminosae, Papilionoideae from South America[9]

José Eduardo Meireles[10, 11] & Ana Maria G. de A. Tozzi[2]

ABSTRACT

The new genus *Semnomea* Meireles & A.M.G. Azevedo (Leguminosae, Papilionoideae, Brongniartieae) from northern South America is described and illustrated, and two new combinations, *Semnomea amazonica* (Ducke) Meireles & A.M.G. Azevedo and *Semnomea hostmannii* (Benth.) Meireles & A.M.G. Azevedo, are made. The new genus differs from *Poecilanthe* in having mostly unifoliolate leaves (and when rarely mulifoliolate, the leaflets are opposite in contrast to the alternate leaflets of *Poecilathe*), an absence of resting buds protected by scales, biauriculate wings and bossed keel petals, stamens always diadelphous with subequal anthers, overgrown seeds, and an embryo bearing cataphylls on the epicotyl and with the hypocotyl-root axis inflexed. *Semnomea* has dehiscent, woody pods in contrast to its otherwise very similar sister genus *Cyclolobium*.

ADDITIONAL KEYWORDS: Amazonia – Fabaceae – Neotropics – *Poecilanthe – Semnomea.*

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INTRODUCTION

Poecilanthe amazonica (Ducke) Ducke and *Poecilanthe hostmannii* (Benth.) Amsh. are two small to medium sized trees from the Amazonian region. Both species were originally described in *Cyclolobium* (Ducke, 1922; Bentham, 1860) due to unifoliolate leaves, axillary or cauliflorous racemes, and other similarities including turbinate-campanulate calyces, purplish petals and the diadelphous androecium. Later, Ducke (1932) and Amshoff (1939) transferred both species into *Poecilanthe* because of the dehiscent pod, which contrasts to the samaroid pod of *Cyclolobium*.

These species have been long recognized as distinct from the other *Poecilanthe* (Geesink, 1981; Klitgaard, 1995; Ross & Crisp 2005) because of their unifoliolate leaves combined to racemose inflorescences. A phylogeny based on molecular and morphological data does not support *Poecilanthe* as monophyletic, and indeed resolves *P. amazonica* and *P. hostmannii* separately from the remaining species (Meireles, chapter 2). This clade markedly differs from other *Poecilanthe* not only by the mostly unifoliolate leaves, but also by having biauriculate wings, bossed keel petals, stamens always diadelphous with subequal anthers (only slightly dimorphic), overgrown seeds with a papery testa and post-chalazal branches that do not reach the hilum, cataphylls on the epicotyl, and inflexed hypocotyl-root axis (Meireles, chapter 1).

The phylogeny also shows that *P. amazonica* + *P. hostmannii* clade is firmly resolved as sister to *Cyclolobium*. This clade shares with its sister all of the characters scored in the morphological matrix except for cataphylls on the epicotyl and dehiscent legume. However, combining these species into *Cyclolobium* would render a problematic circumscription, since this genus is traditionally recognized by its samaroid pod.

Therefore, the combination of the characters cited above as well as their phylogenetic position, requires that *P. amazonica* and *P. hostmannii* be placed into a new genus, *Semnomea*, as described herein, with two combinations, *S. amazonica* and *S. hostmannii*.

SEMNOMEA MEIRELES & A.M.G.AZEVEDO, **GEN. NOV.**

Arbores parvae vel mediocres, foliis alternis unifoliolatis vel raro imparipinnatis. Racemi axillares vel laterales vel cauliflori. Flores papilionacei, calyce 5-fido laciniis summis alte connatis, petalis carinae umbonatis, staminibus diadelphis vexilari libero, antheris subaequalibus. Legumen dehiscens valvis ligneis, seminibus irregularibus testa papyracea, radicula embryonis inflexa.

Type: Semnomea amazonica (Ducke) Meireles & A.M.G.Azevedo. Fig. 1.

Trees; resting buds 1-5 per subtending leaf, inconspicuous, stipules minute, caducous. Leaves alternate, pulvinate, unifoliolate or very rarely mu1tifoliolate with 3-7 clearly opposite leaflets; stipels minute, early caducous or absent. Leaflet pulvini usually as long as the pulvinus, secondary venation brochidodromous. Inflorescences solitary racemes, cauliflorous or axillary, pendant. Flower bilaterally symmetrical, pedicellate; bracteoles 2, opposite, inserted at the base of the calyx. Calyx turbinate-campanulate, sepals 5, basally fused, sub-gibbous and apically toothed, the upper 2 teeth connate almost to their apices, the inner face of the tube glabrous; hypanthium turbinate. Corolla papilionaceous, petals 5, glabrous, unguiculated; standard wider than long; wing petals longer than the keel, inner face of the blades bearing a turgid "callosity" on the proximal upper quarter, the base biauriculate, the lower auricle smaller, outer face sculptured; keel petals slightly adherent along part the lower margin, the blades bossed on the proximal upper quarter, base auriculate on the upper part. Androecium with 10 stamens, diadelphous, the vexillary one free; filaments apically free and curved upward; anthers sub-equal (length difference to 50% between the 2 types), the shorter ones dorsifixed, alternating with the longer basifixed, both anther types ellipsoid. Ovary long stipitate, glabrous to pilose along the margins. Legume with dehiscent and woody valves. Seeds overgrown, parallel to the fruit length; testa thin; embryo with cataphylls on the epicotyl, and hypocotyl-root axis inflexed.

Semnomea has two species, and occurs mainly in the Amazonian forest of Brazil, Colombia, French Guiana, Guyana, Surinam, and Venezuela. We observed that *S. amazonica* and *S. hostmannii* are heterophyllous. Mu1tifoliolate leaves may occasionally occur at the apex of the tree. In these leaves however, the leaflets are clearly opposite while the leaflets in *Poecilanthe* s.s. are alternate.

KEY TO *SEMNOMEA* SPECIES

1. Petiole mostly canaliculated, leaflet surface highly-reticulated; fruits obovate or D-shaped, less than 8 cm long, outer face dull and weekly veined ....*S. amazonica*
1. Petiole mostly terete, leaflet surface weakly-reticulated; fruits oblong to oblanceolate, over 10 cm long, outer face shiny and strongly veined ....*S. hostmannii*

SEMNOMEA AMAZONICA (DUCKE) MEIRELES & A.M.G. AZEVEDO, **COMB. NOV.** (FIG. 1)

Type: BRAZIL: Amazonas: "Barcellos, ad rivulum silvestrem", 03.vii.1905, *A.Ducke 7188* (Lectotype RB!, designated by Meireles & Tozzi, in press.). *Cyclolobium amazonicum* Ducke, Arch. Jard. Bot, Rio de Janeiro 3: 146. 1922. *Poecilanthe amazonica* (Ducke) Ducke, Bull. Mus. Hist. Nat. (Paris), ser. 2, 4: 734. 1932.

Tree or treelet to 10 m tall, terminal branches fissuring or sometimes papery; stipule narrowly triangular, 1.5-3 mm long, glabrescent, caducous. Leaves 1-foliolate, very rarely 3-foliolate; petioles 0.5-3.2 cm long, canaliculate, rarely terete; pulvinule 3-10 mm long. Leaflets ovate to narrowly or broadly elliptic, occasionally oblong, (6.7-)9.5-25(-34) x (3.2-)4.5-9.5(-12.7) cm, base rounded to obtuse, apex acute to shortly acuminate, glabrous; tertiary venation almost as prominent as the secondary rendering a fine reticulation over the leaflet surface. Racemes 1.8-4(-5.3) cm long, moderately to sparsely pilose to tomentose; peduncles 0.4-1.3 cm long; rachis 1.4-3(-4) cm long; bract ovate, 1.8-2.2 x 1 mm, apex acute, outer face tomentose, sub-persistent; floral bud ellipsoid to obovoid, 5-6.5 mm long. Flower 10-15 mm long; pedicel 2.2-3.2 mm long; bracteoles narrowly triangular, 1.4-2 x 0.7-1 mm, outer face tomentose, sub-persistent. Calyx 6.5-10 mm long, sparsely to densely rusty tomentose; tube 2-4.5 mm long; teeth ovate-oblong, 4.5-7 mm long except the upper two that are 1-1.5 mm long, apex acute but the lowest one acuminate; hypanthium 0.6-1.2 mm long. Corolla deep-purple; standard transversely elliptic to depressed ovate, claw 2.5-3.5 mm long, blade 8-10.5 x 11-14 mm, base auriculate, apex emarginate; wing petals widely elliptic to widely elliptic-obovate, claw 2.2-3 mm long, blade 7.6-9.3 x 4.2-5.8 mm, apex rounded; keel petals ovate, subfalcate, claw 1.8-3.2 mm long, blade 6.8-7.2 x 3.3-3.6 mm, apically obtuse to rounded. Androecium 7.5-10.5 mm long, filaments free for 2.6-5.5 mm;

basifixed anthers 0.7-0.9 mm long, dorsifixed anthers 0.5-0.8 mm long. Gynoecium 8.8-12 mm long, stipe 2-3.3 mm long, pilose to glabrescent; ovary 3-4.3 mm long, pilose basally and along the upper margin, becoming more sparse along the lower margin; style 3.5-4.5 mm long, glabrous; stigma capitate, sometimes slightly laterally compressed; ovules 6. Fruit obovate or somewhat D-shaped, 5-7.8 x 2.2-3; base acute, apex obtuse to rounded, shortly apiculate; stipe 6-12 mm; compressed laterally, the margin plane; outer face basically dull, weakly veined; funiculus anvil-shaped, subterete, 3-5 mm long. Seeds 1-2 per fruit, either transversally oblong or D-shaped, 11-18 mm long x 12-27 mm wide x 4-5 mm high.

Distribution: Inhabiting Brazilian and Venezuelan Amazonian forests (Figure 2), especially in sandy soil along black water, seasonally flooded forests, "igapó" and in shrubby riparian vegetation.

Comments: Semnomea amazonica can be distinguished from *S. hostmannii* by the obovate or D-shaped shorter fruit (to 7.8 cm long) that bears 1-2 seeds. Despite some overlap, the inflorescence in *S. amazonica* is usually shorter, 1.8-4(-5.3) cm long, than it is in *S. hostmannii*, 4.2-8 cm long. In sterile material, *S. amazonica* can be distinguished by its mostly canaliculate petiole and prominent tertiary and quaternary venation, rendering a highly-reticulated leaflet surface.

Examined material: BRAZIL**:** Amazonas**:** Alto Rio Negro, 16.viii.1996, *P. A. Rodriguez et al.* 8387 (INPA, NY); Alto Rio Negro, Ilha do Gavião, 1967, *R. E. Sohultes* 24581 (INPA), 17.iv.1967, *W. Rodrigues* & *L. Coêlho* 8390 (INPA); Anavilhanas, 29.ii.1976, *P. Lisboa* 755 (INPA); Axinim, Rio Abacaxis, 1.vii.1983, *J. L. Zarucchi et al.* 2918 (RB, MG, INPA, NY); Terra Preta, 5.vii.1983, *J. L. Zarucchi et al.* 2961 (RB, INPA, MG, NY), 6.vii.1983, *J. L.*

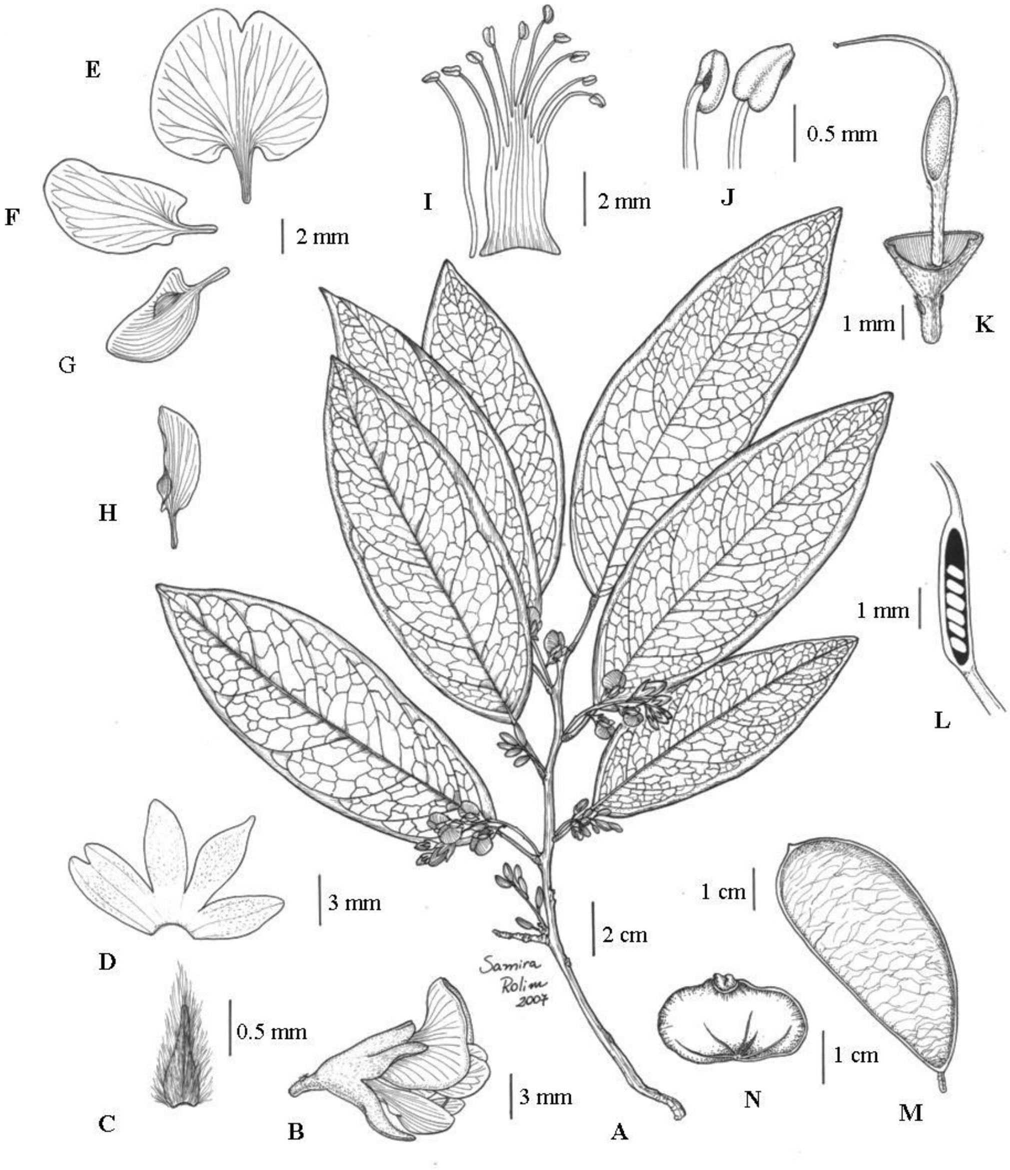

Fig. 1. *Semnomea amazonica*. **A**. Flowering branch; **B.** flower; **C.** bracteole; **D.** calyx (inner face); **E.** standard petal; **F.** wing petal; **G.** keel petal; **H.** keel in lateral view; **I.** stamens; **J.** two anther types; **K.** gynoecium; **L.** ovary in longitudinal section; **M.** fruit; **N. s**eed.

Zarucchi et al. 2968 (RB, F, INPA, NY); Barcelos, Rio Negro, 3.vii.1905, *A. Ducke* 7188 (RB), 7.x.1987, *P. J. M. Maas et al.* 6610 (F, INPA, MG, RB, U, NY); Estrada Manaus - Porto Velho, Igarapé Tupaninha, 8.vii.1972, *M. Silva et al.* 231 (INPA); Estrada Manaus - Porto Velho, 13.vii.1972, *M. F. Silva et al.* 671 (INPA); Estrada Torquato Tapajós km 182, 2.iv.1975, *A. Loureiro et al.* s.n. (INPA); Igapó Açu, 23.xi.1973, *E. Lleras et al.* p19638 (INPA, U, S, NY); Igapó Tupana, 22.iii.1974, *D. G. Campbell et al.* P20822 (MG, INPA, U, S, NY), 23.iii.1974, *D. G. Campbell et al.* P20875 (INPA, MG, S, NY); Igarapé Acajatuba, 20.iv.1986, *G. T. Prance et al.* 30008 (US, NY); Itaubal, Rio Acará, 26.x.1952, *R. L. Fróes* 2979 (IAN); Manaus, Cachoeira baixa do Tarumã, 19.vi.1956, *F. Melo & D. Coelho* s.n. (INPA), 19.vi.1957, *Francisco & D. Coelho* s.n. (IAN), 7.vi.1955, *Luiz* s.n. (MG), 7.vi.1955, *W. Rodrigues* s.n. (INPA); Manaus, Estrada para Itacoatiara km 201, 16.xii.1966, *G. T. Prance et al.* 3681 (MG, INPA, U, S, NY); Manaus, Igarapé da Cachoeira, 20.v.1882, *Schwacke* 354 (RB); Manaus, Igarapé do Franco, 2.i.1956, *J. Chagas & D. Coelho* s.n. (INPA); Manaus, Rio Cuieiras,.vii.1984, *L. Sonkin* 161 (RB), vii.1984, *L. Sonkin* 164 (RB), 5.viii.1981, *S. A. Mori & C. Gracie* 21918 (NY); Manaus, Igarapé do Matrinchão, 19.ix.1956, *Luiz & Francisco* s.n. (IAN); Manaus, Ilha do Cumarú, 9.v.1973, *A. Loureiro et al.* s.n. (INPA, MBM); Manaus, Paracuúba, 9.v.1961, *W. Rodrigues & L. Coelho* 2560 (UB, INPA, IAN); Manaus, Praia Grande, 16.vii.1981, *W. Mantovani & D. M. S. Rocha* 12748 (UEC); 26.vii.1980, *W. W. Benson & W. H. Stubbline* 11400 (UEC); Manaus, Rio Cuieiras, 3.vii.1975, *A. B. Anderson* 157 (INPA), 18.xii.1961, *W. Rodrigues* 3969 (INPA, NY); Manaus, Rio Tarumã, Cachoeira do Passarinho, 10.vi.1933, *A. Ducke* s.n. (RB, U, S); Manaus, Rio Tarumã, 11.v.1941, *A. Ducke* s.n. (IAN, MG, NY), 23.vi.1976, *O. P. Monteiro* 1212 (INPA), 14.viii.1949, *R. L. Fróes* 25025 (SP, IAN, U); Manaus, Rio Tarumãzinho, 7.vii.1976, *G. T. Prance & E. Lleras* 23737 (MG, INPA, U, AAU, GH, NY), 9.i.1977, *J. Adis* s.n. (INPA);

17.ii.1977, *L. Coêlho* 609 (INPA), 8.v.1981, *M.Warbes* 20 (INPA); Maués, 25.v.1957, *E. Oliveira* 57 (IAN); 30.xi.1946, *J. M. Pires* 46 (IAN), 30.xi.1946, *J. M. Pires* 93 (IAN, ALCB, NY), 25.v.1957, *R. L. Fróes* 31184 (IAN); Rio Apuahú, 25.vii.1929, *A. Ducke* s.n. (U, RB, S, NY), 25.iii.1941, *A. Ducke* s.n. (IAN, MG, NY); Rio Aracá, 5.xi.1952, *R. L. Fróes & G. Addison* 29295 (IAN); Rio Ariaú, Paraná do Sumauma, 1.iii.1976, *M. Silva et al.* 1898 (INPA); Rio Canumã, 25.x.1957, *R. L. Fróes* 33637 (IAN); Rio Castanho, entre o Castanho e o Araçá, 13.vii.1972, *M. Silva et al.* 671 (RB, INPA, UEC); Rio Guamã,.v.1977, *O. P. Monteiro et al.* 1407 (INPA); Rio Jauaperi, 6.ii.1974, *L. Coêlho* s.n. (INPA); Rio Negro, 2.vii.1979, *L. A. Maia et al.* 302 (INPA, MG), 6.v.1973, *M. F. Silva et al.* 1290 (INPA); Rio Preto, 30.v.1964, *W. Rodrigues & D. Coelho* 5863 (US, INPA); Rio Uneiuxi, 22.x.1971, *G. T. Prance et al.* 15543 (INPA, MG, NY); Rio Univini, 22.iv.1974, *J. M. Pires et al.* 14110 (INPA, IAN, MG, NY); São Francisco, Rio Urubu, 6.x.1949, *R. L. Fróes* 25509 (SP, IAN); São Gabriel da Cachoeira, 03 a 04 km Rio abaixo (SE) da cidade, 26.xi.1987, *M. L. Kawasaki* 297 (INPA, GH, NY); Serra de Jacumim, 2.vii.1979, *L. Alencar* 302 (NY). Pará**:** Oriximiná, Porto Trombetas, Ilha do Descanso, 24.v.2002, *S. M. de Faria et al.* 2428 (RB).

VENEZUELA**:** Amazonas**:** Autana, entre Sta Teresita e Pto Sipapo, 18.viii.1997, *A. Castellanos* 5459 (VEN); Atuana, Río Atuana, 26.ii.2000, *A. Castillo* 7106 (VEN); Autana, Río Sipapo, Caño Gato, 18.viii.1997, *A. Castillo* 5432 (VEN); Atuana, Río Sipapo, entre Caño Veneno e Pendare., 19.ii.2001, *A. Castellanos* 8037 (VEN); Atuana, Río Sipapo, cerca de Cerro Pelota, 21.ii.2001, *A. Castellanos et al.* 8825 (VEN); Rio Orinoco, 30.vii.1959, *J. J. Wurdack & L. S. Adderley* 43675 (RB, U, NY); San Carlos de Rio Negro, 25.i.1980, *R. Liesner* 8680 (VEN); San Fernando de Atabapo, Rio Orinoco, 26.iii.1974, *A. Gentry* 10952 (NY, VEN). Rio Negro**:** Rio Baria, 22.vii.1984, *G. Davidse* 27713 (F, NY).

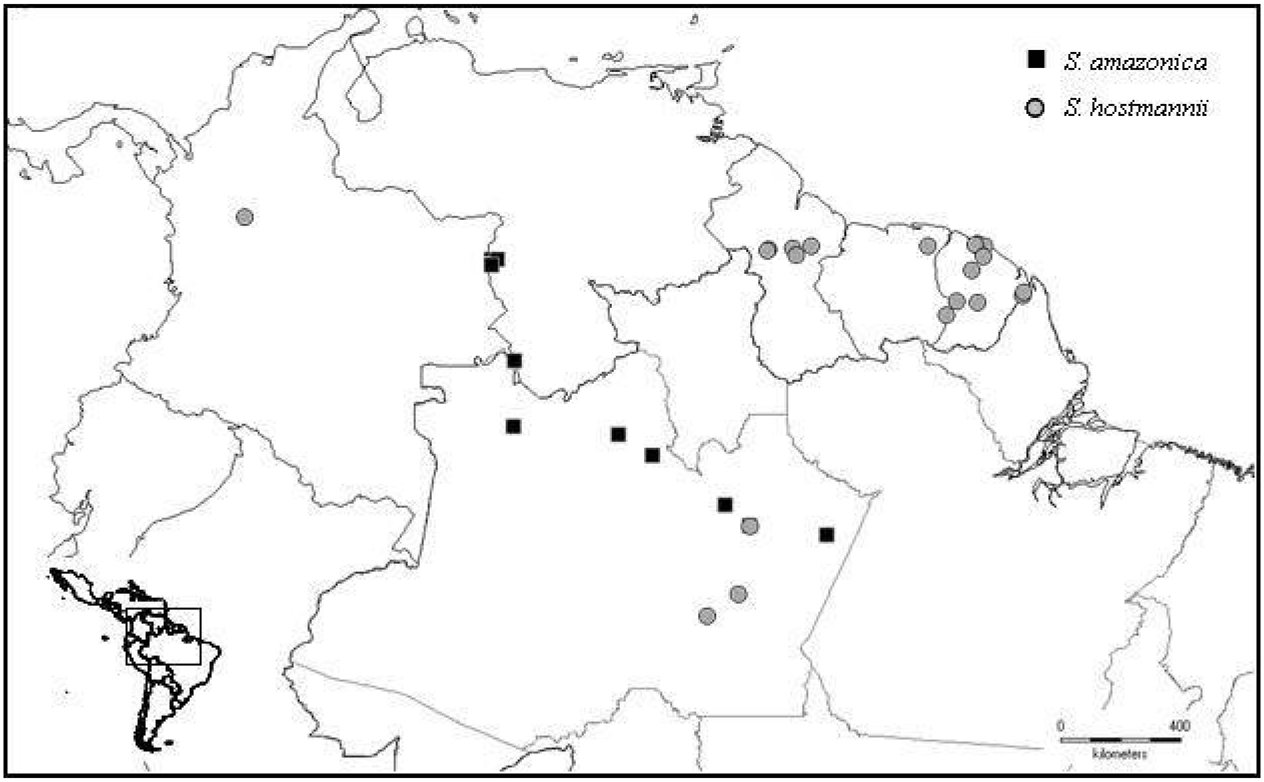

Fig. 2. Distribution map of *S. amazonica* and *S. hostmannii.*

SEMNOMEA HOSTMANNII (BENTH.) MEIRELES & A.M.G. AZEVEDO, **COMB. NOV.** (FIG. 3)

Type: SURINAM: *F.W.Hostmann 172* (Holotype K, photo NY!; Isotypes BM!; S!; P, photo US!). *Cyclolobium hostmannii* Benth., J. Proc. Linn. Soc., Bot. 4, Suppl.: 52. 1860. *Poecilanthe hostmannii* (Benth.) Amsh., Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 52: 61. 1939.

Tree or treelet to 12 m high; terminal branches fissured; stipules narrowly triangular to setaceous, 1.3-3.2 mm long, glabrescent, caducous. Leaves 1-foliolate, rarely to 7 foliolate; petiole (1-)1.5-3(-3.6) cm long, terete; pulvinule 3.5-6 mm long. Leaflets elliptic to obovate, (10-

)15-30(-35) x (3,5-)5,5-10(-14) cm; base acute to obtuse; apex acute to shortly acuminate, rarely narrowly obtuse, mucronate; glabrous but some hairs along the lower midvein face; tertiary and quaternary veins weakly prominent, so the general aspect of the blade is not finely reticulated. Racemes 4.2-8 cm long, tomentose, peduncle 0.5-1.2 cm long, rachis 3.5-7 cm long; bract ovate, 0.8-1.3 x 0.5-0.6 mm, apex obtuse to acute, outer face tomentose, persistent; floral bud obovoid, 5-6 mm long. Flowers 8-11 mm long; pedicels ca. 1 mm long; bracteoles ovate to triangular, 1 x 0.5 mm; outer face tomentose, caducous. Calyces 5.5-7 mm long, sparsely to densely tomentose; tube 2-3 mm long; teeth elliptic-ovate, 3.5-4 mm long, apex acute, the lower one rarely acuminate, upper two ca. 1 mm separated; hipanthium ca. 1 mm long. Corolla deep-red; standard oblate to transversely elliptic, claw 3 mm long, blade 6 x 8-9 mm, base auriculate, apex emarginated; wing petals wide elliptic-obovate, claw 2-3 mm long, blade 6-6.5 x 3 mm, apex obtuse to rounded; keel petals elliptic to elliptic-obovate, subfalcate, claw 2.5-3 mm long, blade 4.5-5 x 2.2-2.8 mm, apex obtuse. Androecium 7-9 mm long, filaments free for 1.6-2 mm; basifixed anthers 6-8 mm long, dorsifixed anthers 5-6 mm long. Gynoecium ca. 8-9 mm long, stipe 2-2.3 mm long, glabrous; ovary 2.8-3 mm long, glabrous; style 3-4 mm long; stigma capitate, sometimes slightly laterally compressed; ovules 8-9. Legumes oblong to oblanceolate, 14-18 x 2-3 cm, apex acute or obtuse, base acute, stipe 1-1.5 cm long, outer face shiny and conspicuous veined. Seeds 3-5(-7) per fruit, ovate, wide-elliptic or somewhat D-shaped, rarely transversally oblong, 15-22 mm long x 12-21 mm wide x 4-8 mm high.

Distribution: Amazonian forest in Brazil (Amapá and Amazonas), Colombia, French Guiana, and Surinam (Fig. 2), especially along small rivers “igarapé” (but in areas that are not susceptible to seasonal flooding) and in “terra firme” forests (also non-flooded).

Vernacular names: nikkoehout (Surinam)

Comments: Semnomea hostmannii is distinguished by its larger, over 14 cm long, oblong to oblanceolate fruits with 4-5(-7) seeds, and usually longer inflorescences, 4.2-8 cm long. Some vegetative features such as the terete petiole and the weak tertiary and quaternary veins, wich yield a weak reticulate pattern on the surface of the leaflet blade can also distinguish *S. hostmannii* from *S. amazonica*.

Examined material: BRAZIL**:** Amapá**:** Rio Araguari, 30.viii.1961, *J. M. Pires et al.* 50591 (RB, SP, B, IAN, MG, NY, S); 12.ix.1961, *J. M. Pires et al.* 50874 (UB, BM, IAN, MG, U, NY); Oiapoque, 19.x.1950, *R. L. Fróes* 26693 (IAN, SPF). Amazonas**:** Estrada Manaus – Itacoatiara, 11.ii.1971, *W. Rodrigues* 9001 (INPA, MG, MBM), 5.vi.1973, *W. Rodrigues et al.* 9076 (INPA); Manaus, 12.v.1978, *L. Coêlho et al.* 777 (INPA), 5.v.1981, *L. Coêlho* 1839 (INPA, HRB, NY); Manicoré, Rod. Transamazônica, a 275-300 km de Humaitá, 24.iv.1985, *C. A. Cid Ferreira* 5829 (MG, RB, NY); Novo Aripuanã, Rod. Transamazônica, a 300 km de Humaitá, 24.iv.1985, *C. A. Cid Ferreira* 5741 (RB, F, MG, INPA, MBM, NY); Rio Javari, 8.viii.1973, *E. Lleras et al.* p17236 (INPA, NY). COLOMBIA**:** Antioquia**:** San Rafael, Vereda Falditas, 6.vi.1991, *R. Callejas & F. J. Roldán* 10166 (NY). FRENCH GUIANA**:** Bas Oyapock, 3.vi.1970, *Oldeman* B 3354 (US, U), 26.vi.1970, *Oldeman* B 3452 (U, NY); Cayenne**,** 13.ii.1983, *M. F. Prévost* I422 (INPA, U); Crique Gabaret - Basin de Oyapock., 13.iv.1988, *J. J. Granville* 10281 (U, NY), 14.iv.1988, *J. J. Granville* 10317 (U, NY); Crique Carbet Mais., 6.vii.1979, *J. J. Granville* 3055 (U); Montagne Longi, 9.iii.1994, *B. Bordenave* 793 (U); Montagne de la Trinité, 24.i.1984, *J. J. Granville* 6257 (U), 2.ii.1984, *J. J. Granville et al.* 6453 (INPA, U, NY), 7.vii.1999, *O. Poncy et al.* 1206 (U, NY); Fleuve Approuaque, 14.viii.1977, *C. Sastre* 5650 (U, NY); Rivière Grand

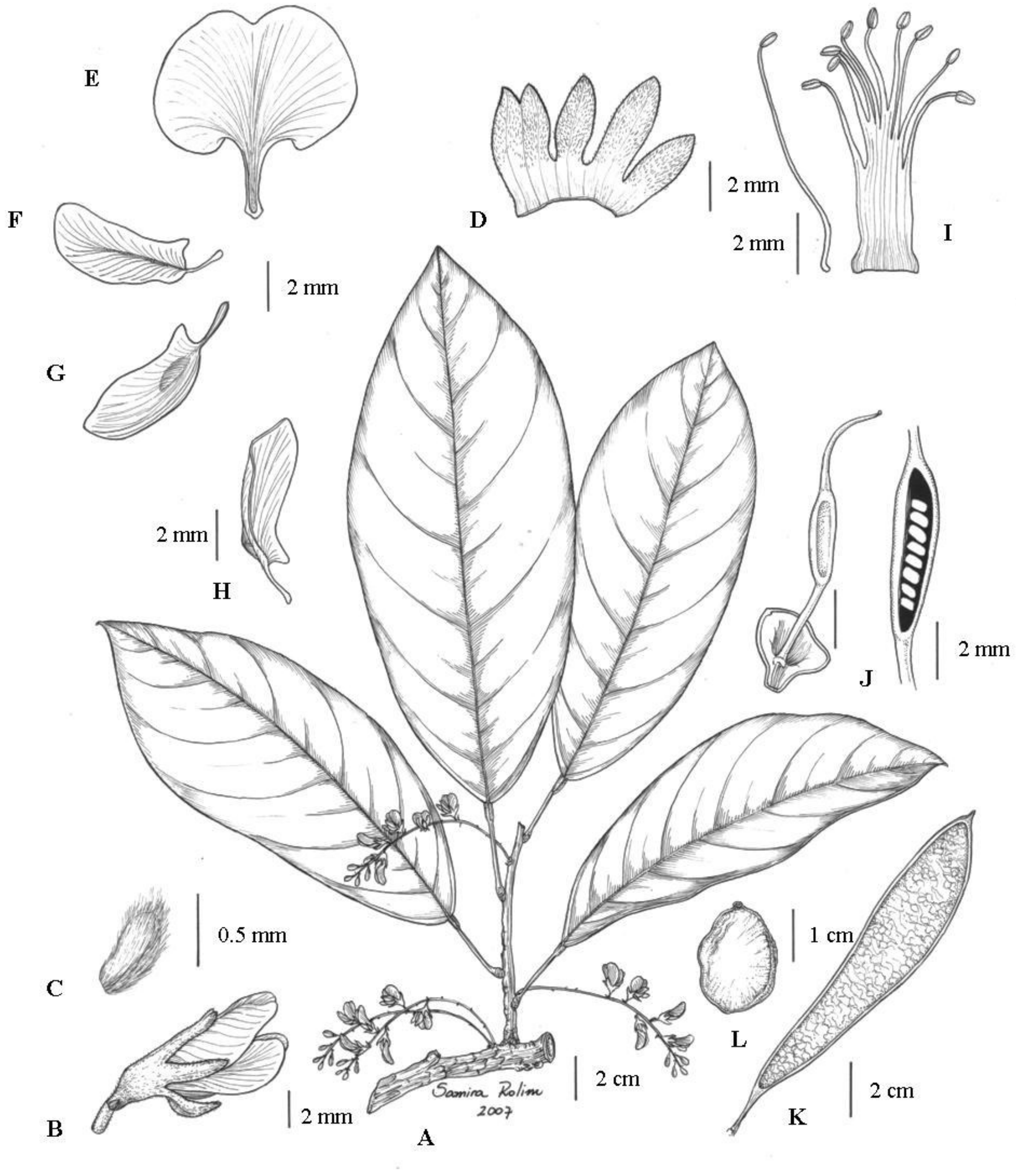

Fig. 3. *Semnomea hostmannii*. **A.** Flowering branch; **B.** flower; **C.** bracteole; **D.** calyx (inner face); **E.** standard petal; **F.** wing petal; **G.** keel petal; **H.** keel petal from a basal view; **I.** stamens; **J.** gynoecium; **K.** fruit; **L.** seed.

Inini, bassin du Maroni., 8.vii.1990, *D. Sabatier & M. F. Prévost* 3086 (NY), 3.ix.1970, *J. J. Granville* B 3642 (NY); Saul, 1.x.1982, *S. A. Mori et al.* 15013 (NY), 11.ii.1993, *S. A. Mori et al.* 22928 (NY). GUYANA**:** Mabura, 3.iii.1991, *M. Polak & S. Robberts* 240 (U, NY); Mabura hill, 1.ii.1989, *H. Steege* 581 (U, NY), 28.iii.1994, *R. C. Ek* 1047 (NY), 5.xii.1994, *R. C. Ek et al.* 1128 (U, NY); Potaro-Siparuni, 16.iv.1988, *W. Hahn et al.* 4716 (NY), 19.vii.1991, *K. Lance & A. Petersen* 35 (NY). SURINAM**:** 14.iii.1949, *J. Lanjouw & J. C. Lindeman* 2688 (IAN, U, AAU, NY)

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REFERENCES

Amshoff GJH. 1939. On South American Papilionaceae. *Mededelingen van het botanisch laboratorium der rijksuniversiteit te Utrecht* **52:** 1-73.

Barneby RC & Heald SV. 2002. Fabaceae. In: **Mori SA.**, **Cremers G.**, **Gracie CA.**, **Granville JJ.**, **Heald SV.,** **Hoff M.** and **Mitchell JD.** (eds.). Guide to the Vascular plants of central French Guiana. *Memoris of the New York Batanical Garden*, **76(2):** 312-313.

Bentham G. 1860. Synopsis of Dalbergieae, a tribe of Leguminosae. *Journal of the Proceedings of the Linnean Society*. Botany. **4**, Suppl.: 1-134.

Cuello NLA. 1999. *Poecilanthe* In: **Berry PE.**, **Yatskievych K.** & **Holst BK.** (eds.). *Flora of the Venezuelan Guayana*, volume 5. Missouri Botanical Garden Press. p. 378-379

Ducke A. 1922. Plantes nouvelles ou peu connues de la région amazonienne II. *Archivos do Jardim Botanico do Rio de Janeiro* **3:** 161-162.

___________ 1932. Reunion Mensuelle des Naturalists du Museus. *Bulletin du Museum d'Historie Naturelle*. Paris; sér. 2, **4:** 733-734.

Geesink R. 1981. Tephrosieae (Benth.) Hutch. In: **Polhill RM.** & **Raven PH.** (eds.), *Advances in Legume Systematics*, part 1. Royal Botanic Gardens, Kew. p. 245-260.

Klitgaard BB 1995. *Systematics of Platymiscium (Leguminosae: Papilionoideae: Dalbergieae): taxonomy, morphology, ontogeny and phylogeny*. Ph.D. Thesis, University of Aarhus, Aarhus.

Meireles JE. & Tozzi AMGA. A synopsis of *Poecilanthe* (Leguminosae, Papilionoideae, Brongniartieae). *Rodriguésia*. (**in press**.)

Ross JH & Crisp MD 2005. Brongniartieae. In: **Lewis GP, Schrire B., Mackinder B.** and **Lock M.** (eds.), *Legumes of the World*. Royal Botanic Gardens, Kew. p. 252-259.

CONSIDERAÇÕES FINAIS

O estudo sobre morfologia de semente e embrião de *Poecilanthe* ampliou o conhecimento sobre a diversidade morfológica do gênero e permitiu separá-lo em quatro grupos de acordo com os padrões de morfologia encontrados. Estes grupos se distinguem por diversos atributos tais como tipo de crescimento e posição da semente, presença de arilo, micrópila, rafe e apêndices no epicótilo, inflexão do eixo hipocótilo-radícula, entre outros.

Poecilanthe mostrou-se um gênero não-monofilético na filogenia baseada em morfologia e seqüências de ITS. Foi constatado que as espécies de *Poecilanthe* se distribuem em 3 clados separados, os quais foram considerados como gêneros distintos: *Poecilanthe s.s.*, *Amphiodon* e o terceiro com o nome provisório "*Semnomea*".

Poecilanthe s.s. ficou caracterizado principalmente pelas folhas imparipinadas com folíolos alternos, presença de gemas protegidas por catáfilos, estames monadelfos ou monadelfos/diadelfos no mesmo indivíduo (mas nunca apenas diadelfos) com anteras fortemente dimórficas, pelo fruto deiscente não septado e pelo embrião com eixo hipocótilo radícula reto e plúmula sem apêndices. Desta forma, *Poecilanthe s.s.* fica restrito às seis espécies extra-amazônicas.

Amphiodon Huber, descrito com base em *A. effusus* Huber, foi revalidado e *P. ovalifolia* combinada neste. Este gênero fica caracterizado por apresentar panículas muito ramificadas com o eixo primário encurtado, prefloração do cálice valvar, estame vexilar geralmente aderido à unguícula do estandarte, fruto septado com sementes transversais ao eixo do fruto e pelo epicótilo apresentando dois tipos de tricomas.

Semnomea é o nome provisório do novo gênero descrito para abarcar as espécies amazônicas *P. amazonica* e *P. hostmannii*. O novo gênero é distinto dos demais por apresentar folhas unifolioladas, alas com base biauriculada, pétalas da quilha umbonadas, anteras subiguais, sementes “overgrown” e eixo hipocótilo-radicula infletido.