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Piptadenia (Leguminosae, Mimosoideae) in the state of Minas Gerais, Brazil

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Abstract

The genus *Piptadenia* includes approximately 24 species that are distributed in the tropical regions of South America, with centers of diversity in the Amazon and Atlantic Forest in Brazil in which twenty-one species occur. A taxonomic study of *Piptadenia* was conducted in the state of Minas Gerais based on an analysis of approximately 270 specimens from 11 herbaria, field observations and field work in the main conservation units and other focal areas in Minas Gerais. These areas include the three vegetation domains in the state: Atlantic Forest, Cerrado and Caatinga. Six of the species in the genus were sampled: *P. adiantoides*, *P. gonoacantha*, *P. macradenia*, *P. micracantha*, *P. paniculata* and *P. viridiflora*. Two species that have previously been cited in the state were not found in this study: *P. irwinii* and *P. stipulacea.* These species were not found in the herbaria collections that were consulted or during the field work. We present an identification key for the Minas Gerais species of *Piptadenia* as well as descriptions, illustrations, geographical distributions, comments about the taxonomic characters and some information related to the flowering and fruiting periods.

Key words: floristics, morphology, taxonomy, phytogeographic domains.

Resumo

O gênero *Piptadenia* apresenta cerca de 24 espécies que estão distribuídas na região tropical da América do Sul, com centros de diversidade na Amazônia e na Floresta Atlântica do Brasil, que abriga vinte e uma espécies deste gênero. Os estudos taxonômicos de *Piptadenia* foram conduzidos no estado de Minas Gerais, baseados na análise de 270 espécimes de 11 herbários, observações de campo e coletas de material botânico nas principais Unidades de Conservação de Minas Gerais, abrangendo os três biomas presentes no Estado: Floresta Atlântica, Cerrado e Caatinga. Seis espécies do gênero em estudo foram amostradas: *Piptadenia adiantoides*, *P. gonoacantha*, *P. macradenia*, *P. micracantha*, *P. paniculata* e *P. viridiflora*. Duas espécies foram citadas para o Estado, mas não constam neste trabalho: *Piptadenia irwinii* e *P. stipulacea*, visto que não apresentaram nenhum material testemunho nos acervos dos herbários consultados e não foram encontradas nos trabalhos de campo. Neste trabalho apresentamos uma chave de identificação para as espécies de *Piptadenia* que ocorrem em Minas Gerais, descrições, ilustrações, distribuição geográfica e comentários sobre os caracteres taxonômicos, bem como algumas informações relacionadas aos períodos de floração e frutificação de cada espécie.

Palavras-chave: florística, morfologia, taxonomia, domínios fitogeográficos.

Introduction

Piptadenia Benth. belongs to Leguminosae Jussieu, the third largest family of flowering plants, which has a cosmopolitan distribution and comprises 36 tribes, 727 genera and approximately 19,000 species (Lewis *et al.* 2005). The genus *Piptadenia* includes approximately 24 species that are distributed in the tropical regions of South America with centers of diversity in the Amazon and Atlantic Forest in Brazil (Luckow 2005) in which 21 species occur (Morim 2010; BFG 2015). Until now, nine species have been reported in Minas Gerais State (Tamashiro 1989; Oliveira-Filho 2006; Morim 2010).

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Phylogenetic studies have indicated a greater affinity of *Piptadenia* with *Parapiptadenia* Brenan, *Pseudopiptadenia* Rauschert and *Plathymenia* Benth. as all share spicate raceme inflorescences and anthers with glands (Grimes 1999; Luckow 2005). Molecular data have shown that *Piptadenia* is a polyphyletic genus (Luckow *et al.* 2003; Jobson & Luckow 2007), and as a result of these molecular studies, two species were transferred to *Pityrocarpa* (Benth.) Britton & Rose: *Piptadenia moniliformis* Benth. and *Piptadenia obliqua* (Pers.) J.F. Macbride (Jobson & Luckow 2007).

Tamashiro (1989), in a taxonomic study of *Piptadenia* species in southeast Brazil, found four species in Minas Gerais, but the sampling effort in the state was not exhaustive, and taxonomic changes have since occurred in the genus. Oliveira-Filho (2006) cited seven species as occurring in the state in a floristic list that was assembled without a taxonomic approach and that only considered trees. Finally, Morim (2010), in the List of Flora Species in Brazil, reported the occurrence of six species in Minas Gerais. However, none of these studies involved collection, revision and characterization with sampling specifically for *Piptadenia*.

Thus, since the above studies do not present a consensus on this issue, the main goal of this study was to understand the diversity of *Piptadenia* in Minas Gerais and to confirm the number of species occurring in the state through increased field sampling, morphological characterization and the review of herbaria collections.

Material and Methods

The study was based on an analysis of approximately 270 specimens from 11 herbaria: BHZB, CEN, CESJ, HUFU, HXBH, IBGE, IBTSP, OUPR, PAMG, RB, UB, VIC (abbreviations follow Holmgreen & Holmgreen [2009]), field observations and collections of botanical material from the main conservation units and specific areas in Minas Gerais, including the three vegetation domains present in the state: Atlantic Forest, Cerrado and Caatinga (Drummond *et al.* 2005). From the RB, the "Reflora- Virtual Herbarium" website was consulted and all the images observed are cited as "RB!" in the examined material.

A total of 27 expeditions to collect botanical specimens were undertaken between January 2008 and August 2010 in 47 conservation areas in the state of Minas Gerais, which are mainly distributed throughout state and national parks as well as biological, ecological and sustainable reserves (Tab. 1; Fig. 1). The expeditions also included 14

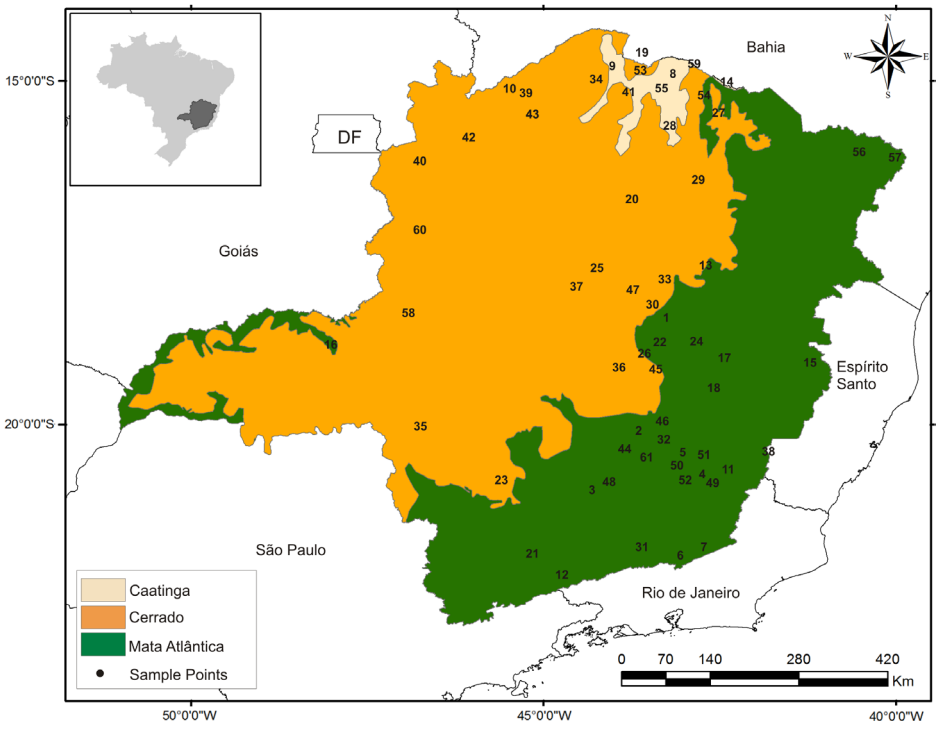

Figure 1 – State of Minas Gerais with phytogeographical areas and sampling sites (Fernandes 2011).

Table 1 – Conservation Units sampled in Minas Gerais, Brazil. Nº. = number of the Conservation Units corresponding in Figure 1.

Nº.	Conservation Units	Cities
1	Área de Proteção Ambiental Água das Vertentes	Couto de Magalhães de Minas, Diamantina, Felício dos Santos, Rio Vermelho, Santo Antônio do Itambé, Serra Azul de Minas e Serro
2	Área de Proteção Ambiental da Cachoeira das Andorinhas	Ouro Preto
3	Área de Proteção Ambiental da Serra de São João	Cel. Xavier Chaves, Prados, Santa Cruz de Minas, São João Del Rei e Tiradentes
4	Área de Proteção Ambiental Nô da Silva	Cajuri
5	Estação de Pesquisa, Treinamento e Educação Ambiental Mata do Paraíso	Viçosa
6	Estação Ecológica Mar de Espanha	Mar de Espanha
7	Floresta Estadual Uaimii	Ouro Preto
8	Parque Estadual Caminho das Gerais	Mamonas, Monte Azul e Gameleiras
9	Parque Estadual da Mata Seca	Manga
10	Parque Estadual da Serra das Araras	Chapada Gaúcha
11	Parque Estadual da Serra do Brigadeiro	Araponga, Fervedouro, Miradouro, Ervália, Sericita, Pedra Bonita, Muriaé e Divino
12	Parque Estadual da Serra do Papagaio	Aiuruoca, Alagoa, Baependi, Itamonte e Pouso Alto
13	Parque Estadual da Serra Negra	Itamarandiba
14	Parque Estadual de Montezuma	Montezuma
15	Parque Estadual de Sete Salões	Resplendor, Santa Rita do Itueto, Conselheiro Pena e Itueta
16	Parque Estadual do Pau Furado	Uberlândia e Araguari
17	Parque Estadual do Rio Corrente	Açucena
18	Parque Estadual do Rio Doce	Marliéria, Dionísio e Timóteo
19	Parque Estadual do Verde Grande	Matias Cardoso
20	Parque Estadual Lapa Grande	Montes Claros
21	Parque Estadual Nova Baden	Lambari
22	Parque Estadual Pico do Itambé	Santo Antônio do Itambé, Serro e Serra Azul de Minas
23	Parque Estadual Serra da Boa Esperança	Serra da Boa Esperança
24	Parque Estadual Serra da Candonga	Guanhães
25	Parque Estadual Serra do Cabral	Buenópolis, Joaquim Felício
26	Parque Estadual Serra do Intendente	Conceição do Mato Dentro
27	Parque Estadual Serra Nova	Rio Pardo de Minas
28	Parque Estadual Veredas do Peruaçu	Januária
29	Parque Estadual de Grão-Mogol	Grão-Mogol
30	Parque Estadual do Biribiri	Diamantina
31	Parque Estadual do Ibitipoca	Lima Duarte e Santa Rita do Ibitipoca
32	Parque Estadual do Itacolomi	Ouro Preto e Mariana
33	Parque Estadual do Rio Preto	São Gonçalo do Rio Preto
34	Parque Nacional Cavernas do Peruaçu	Januária, São João das Missões, Itacarambi,
35	Parque Nacional da Serra da Canastra	São Roque de Minas, Sacramento e Delfinópolis
36	Parque Nacional da Serra do Cipó	Jaboticatubas, Santana do Riacho, Morro do Pilar e Conceição do Mato Dentro

Nº.	Conservation Units	Cities
37	Parque Nacional das Sempre Vivas	Bocaiúva, Buenópolis, Diamantina e Olhos d'Água
38	Parque Nacional do Caparaó	Alto Caparaó, Caparaó, Alto Jequitibá e Espera Feliz
39	Parque Nacional Grande Sertão Veredas	Chapada Gaúcha
40	Reserva Ambiental de Cabeceira Grande	Cabeceira Grande
41	Reserva Biológica Serra Azul	Jaíba
42	Reserva Ecológica de Sagarana	Arinos
43	Reserva Estadual de Desenvolvimento Sustentável Veredas do Acari	Chapada Gaúcha
44	Reserva Particular do Patrimônio Natural Luiz Carlos Jurovsk Tamassia	Ouro Branco
45	Reserva Particular do Patrimônio Natural Reserva da Cachoeira	Santana do Riacho
46	Reserva Particular do Patrimônio Natural Santuário do Caraça*	Catas Altas e Santa Bárbara
47	Reserva Particular do Patrimônio Natural Serafim Melo Jardim	Diamantina

target areas in the state, particularly micro-regions without protected areas (Tab. 2; Fig. 1). Field collection was performed to increase the sampling effort and provide new specimens for comparison.

Morphological analyses were only performed on specimens from Minas Gerais State and included measures of the vegetative structures in dehydrated material while the floral structures were measured after rehydration. Illustrations were constructed with the aid of a stereomicroscope using botanical samples herborized and/or fixed in 70% ethanol. The abbreviations shown in the descriptions, taxonomic remarks and lists of examined materials are as follows: m = meter, mm = millimeter, fl = flowering and fr = fruiting.

Identification was performed by morphological analysis based on the taxonomic literature for the genus (Bentham 1840; Bentham

Table 2 – Specific areas sampled in Minas Gerais, Brazil. Nº = number of the specific areas corresponding in Figure 1.

Nº.	Specific areas sampled	Cities
48	Fazenda Água Limpa	Prados
49	Fazenda Monte Libra	Cajuri
50	Mata da Biologia	Campus/UFV
51	Mata da Silvicultura	Campus/UFV
52	Mata do Seu Nico	Viçosa
53	Perímetro urbano	Matias Cardoso
54	Perímetro urbano	Mato Verde
55	Perímetro urbano	Jaíba
56	Perímetro urbano	Almenara
57	Perímetro urbano	Santa Maria do Salto
58	Perímetro urbano	Coromandel
59	Perímetro urbano	Mamonas
60	Região do machadinho	Paracatu
61	Serra da Capanema	Ouro Preto

1875; Tamashiro 1989; Lewis *et al*. 2005; Luckow 2005) and by consulting the collections of the herbaria cited above. The analytical and diagnostic characteristics of the studied species were illustrated.

The geographical distributions were based on information from the literature (Tamashiro 1989; Morim 2010) and herbaria records. Phytogeographic information was obtained from the herbaria records when available; the phytophysiognomies were adapted from Veloso *et al*. (1991) and IBGE (1992), and the phytogeographic areas were adapted from Ab'Saber (2003). Flowering and fruiting periods were obtained from the herbaria records and from observations during the field work.

The maps of geographical distributions were elaborated using ArcGIS 10.1 software.

Results and Discussion

1. *Piptadenia* Benth., J. Bot. (Hooker) 2(11): 135. 1840.

Scandent shrubs, lianas or trees up to 25 m tall. Branches cylindrical, unarmed or armed, with straight or curved aculeus. Stipules deciduous or, when persistent, modified in aculeus. Leaves bipinnate, petiolate; petiole cylindrical; leaf rachis cylindrical, unarmed or armed; petiolar nectaries sessile, patelliform, cupuliform or verruciform. Pinnae opposite. Leaflets linear, ovate, ovate-lanceolate or obovate, glabrous or pilous. Basic inflorescence unit is spiciform, isolated or in panicles, axillary or terminal. Flowers hermaphrodite, actinomorphic, sessile; calyx pentamerous, campanulate, glabrous, sericeous or tomentose, gamosepalous; corolla pentamerous, gamopetalous at the base, campanulate, glabrous or sericeous; stamens 10, free at the base; anthers with stipitate gland at the connective, deciduous in anthesis; ovary stipitate, unicarpellate, pluriovulate, glabrous, tomentose or villous. Legumes flat, linear, glabrous; seeds numerous, oblong, rounded or obovate; pleurograma present.

Comments: Six species of the genus were found in Minas Gerais: *Piptadenia adiantoides* (Spreng.) J.F. Macbride, *P. gonoacantha* (Mart.) J.F. Macbride, *P. macradenia* Benth., *P. micracantha* Benth., *P. paniculata* Benth. and *P. viridiflora* (Kunth) Benth. The species may be present as lianas or shrubs, which are predominantly trees, in the state. No species of *Piptadenia* are considered endangered in Minas Gerais or in Brazil according to the List of Endangered Brazilian Species MMA (2014).

Identification key for the taxa of the genus *Piptadenia* Benth. in the state of Minas Gerais

1. Plants with persistent stipules transformed into aculeus..... 1.6. *Piptadenia viridiflora*
1'. Plants with deciduous stipules, never turned into aculeus
   2. Leaves with 3–7 pairs of pinnae; oval-lanceolate leaflets, ovate or obovate-elliptical, with a central midrib, with an obtuse or oblique base, 13–30 × 6–13 mm
      3. Armed rachis; leaflets 3–5 pairs per pinna, ovate or obovate-elliptical, base oblique, apex obtuse; petiolar nectary verruciform, oblong; spiciform axillary inflorescence with 1–2 spikes per axilla; calyx glabrous .....1.1. *Piptadenia adiantoides*
      3'. Rachis unarmed; leaflets 7–15 pairs per pinna, oval-lanceolate, obtuse base, acute apex; nectary petiolar patelliform; spiciform inflorescence grouped in panicles; calyx sericeous .. .. 1.5. *Piptadenia paniculata*
   2'. Leaves with 7–14 pairs of pinnae; linear leaflets with an eccentric main vein, with a truncated or cordate base, 3–8 × 0.5–1.6 mm
      4. Unarmed branches; rachis unarmed; inflorescence grouped in panicles; calyx tomentose; corolla sericeous..... 1.3. *Piptadenia macradenia*
      4'. Armed branches; armed rachis; spiciform axillary inflorescences; calyx glabrous or sericeous; corolla glabrous
         5. Scandent shrubs to climbers; branches not winged; petiolar nectary verruciform, oblong; calyx glabrous; ovary tomentose..... 1.4. *Piptadenia micracantha*
         5'. Trees; winged branches; petiolar nectary cupuliform; calyx sericeous; ovary glabrous .....1.2. *Piptadenia gonoacantha*

1.1. *Piptadenia adiantoides* (Spreng.) J.F. Macbr. Contributions from the Gray Herbarium of Harvard University 59: 17. 1919. Fig. 2a-d

Scandent shrub or, rarely, small tree of ca. 7 m; branches cylindrical, unarmed or armed, curved aculeus, 1.9–3 mm long. Stipules deciduous, not observed. Leaves with 3–4 pairs of pinnae; leaf rachis 5–15 cm long, cylindrical with curved aculeus; leaflets ovate or obovate-elliptical, 3–5 pairs per pinna, 13–22 × 6–12 mm, glabrous on both surfaces, rarely sericeous, base oblique, apex obtuse, mucronate, central midrib; petiolar nectary verruciform, oblong. Inflorescences spiciform, 1–2 per axil, 6–10 cm long. Calyx, 0.89–1.2 mm long, glabrous; corolla 1.61–1.97 mm long, glabrous; filaments roseate or vinaceous; ovary stipitate, tomentose. Legume 11–13 × 2.2–2.7 cm; seed oblong, 0.8–1.2 × 5.2–5.5 mm.

This species is endemic to Brazil. It occurs in the states of Paraíba, Pernambuco, Bahia, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro and Paraná (BFG 2015). It is found from the southeast to the northern regions of Minas Gerais (Fig. 3) in Cerrado, Caatinga and Atlantic Forest domains.

Piptadenia adiantoides is easily recognized by its large leaflets compared to the other species. The leaflets are ovate or obovate-elliptical, and the petiolar nectary is verruciform, oblong, and located just below the first pair of pinnae. The branches have curved aculeus, and the shape of the nectary resembles *P. micracantha*, which differs in the shape, size and quantity of leaflets per pinna (*P. micracantha* has 32–50 pairs of pinnae per leaflet vs. *P. adiantoides* with 3–4 pairs of pinnae per leaflet). Finally, *P. adiantoides* occurs in all three domains of the state, but *P. micracantha* is restricted to the Atlantic Forest domain.

Examined material: Belo Horizonte, Praça Nacional, Portaria, 4.VI.2008, fl. e fr., *J. Ordones et al. 921* (BHZB); 23.III.1919, fr., *A. Gehrt 162* (photo RB!); 17.VI.1934, *H.L. Mello Barreto 6453* (BHCB); 13.V.1980, *J.A. Oliveira* (BHCB 869); 1.VI.1986, *T.S.M. Grandi* (BHCB 10619); 21.VII.1992, *J. Pires* (BHCB 19659); 11.IV.1995, *J.A. Lombardi 738* (BHCB); 10.VIII.1995, *J.A. Lombardi & L.G. Temponi 920* (BHCB); 29.V.1996, *J.D. Souza 91* (BHCB); Berilo, 13.II.2001, *E. Tameirão Neto 3276* (BHCB); Caratinga, Estação Biológica de Caratinga, estrada do Nilo, 23.VII.1984, fr., *E.M. Andrade, 289* (BHCB, photo RB!); Estação Biológica de Caratinga, 22.V.1984, fl., *P.M. Andrade 166* (photo RB!); 9.V.1889, *L.V. Costa & P.H.A. Pequeno 248* (BHCB 16397); 20.XI.1984; *M.A. Lopes et al. 511* (BHCB); XII.1990, *C.V. Mendonça Filho* 127 (BHCB); Catas Altas, Caraça, trilha até Tabões, fr., *J. Ordones et al. 920* (BHZB); 1.IV.2000, *R.C. da Mota 733* (BHCB); 18.VI.2002, *T.M.A. Alves & M. Sobral 53* (BHCB); Catuji, 13.V.1983, fl., *Hatschbach, G. 46303* (photo RB!); Conceição do Mato Dentro, Pousada Vale das Pedras 1.VII.2008, fr., *L.H.Y Kamino 1021* (photo RB!), 1.VII.2008, fl., *L.H.Y Kamino 1026* (photo RB!); Coronel Pacheco, Estação Experimental de Café, 20.V.1941, fl., *E.P. Heringer 601* (photo RB!); Descoberto, Reserva Biológica da Represa do Grama, 15.VI.2002, fr., *R.C. Forzza, B.K.S. Franco, L.D. Meireles 2202* (CESJ); Diamantina, Serra do espinhaço, 17.III.1970, fl., *H.S. Irwin et al. 27772* (UB); Itabira, 1.IV.2002, fl., *J.R. Stehmann 3076* (CESJ); Governador Valadares, caminho para Teófilo Otoni, BR 116, 24.IX.1999, fr., *S.M. Faria 1785* (photo RB!); Itabira, 1.IV.2002, *J.R. Stehmann 3076* (BHCB); Itabirito, 25.III.1994, fl., *W.A. Teixeira,*(BHCB 24263); Itamonte, Fazenda Campo Redondo, s.d., *F.M. de B. Pereira 63* (photo RB!); Hotel Casa Alpina, Est. subindo para as antenas, 4.VIII.2011, fr., *T.A. Batista 415* (photo RB!); Jaboticatubas, Km 126 ao longo da rodovia Lagoa Santa-Conceição do mato dentro, 7.IV.1974, fl., *J. Semir, M. Sazima 145026* (IBTSP); Km 127 ao longo da rodovia Lagoa Santa - Conceição do Mato Dentro - Diamantina, 31.III.1980, fl., *Furlan, A. 6093* (photo RB!); Juiz de Fora, Morro do Imperador, 8.VII.2001, fr., *D.S. Pifano & A.S.M. Valente 33996* (CESJ); Manga, Jaíba, 5.IX.1974, fr., *G.M. Magalhães, M.B. Ferreira 3040* (PAMG); Mariana, Cibrão, 23.III.2004, fl., *M.C.T.B. Messias 8*68 (OURP); Linha Catódica, Sentido- Samarco, 25.VIII.1999, fr., *S.M. de Faria 1758* (photo RB!); Marliéria, 16.VII.1996, *J.A. Lombardi 1295* (BHCB); Ouro Preto, 29.III.2005, fl., *L.C.P. Lima 310 & E.D. Silva* (VIC); Parque Estadual do Itacolomi, morro do cachorro, na estrada para a fazenda do Manso; 12.XII.1990, fr., *H.C. de 4069* (photo RB!); Ponte Nova, Estrada BR-120, em direção a Ponte Nova, a 4 km da ponte sobre o Córrego Bom Jardim e a 8 km da ponte sobre o Ribeirão Vau Açu, 22.V.1978, fl., *J.P. Fontella 1032* (photo RB!); Pedra Azul, 9.V.2003, *I.R. Andrade et al.* (BHCB 89476); Reduto, 3.VI.1954, fl., *E.P. Heringer 3448* (UB); Rio Piracicaba, 23.VI.1989, *H.C. Souza* (BHCB 17158); Santana do Riacho, 12.VII.1987, *I.R. Andrade & M.B. Horta 149* (BHCB); São João Del Rei, 10.VI.2013, *M. Sobral 15511* (BHCB); São Thomé das Letras, 30.IX.1998, fr., *S.M. Faria 1683* (photo RB!); Teixeiras, estrada BR-120, direção a Ponte Nova, a 4 km da ponte sobre o córrego Bom Jardim e a 8 km da ponte sobre o ribeirão Vau-Açu, 22.V.1978, fl., *Fontella 1032, M.R.R. Vidal 406, W.N. Vidal 376* (VIC); Teófilo Otoni, afloramento rochoso, lado esquerdo da MG 418, cerca de 30 km norte de Teófilo Otoni, 1.IV.2011, fl., *L.F.A. de Paula et. al 339* (BHCB, photo RB!); Viçosa, 13.VIII.1979, fr., *R.S. Ramalho e G. Rodrigues 1524* (IBGE), s.d., *R.S. Ramalho 1348* (photo RB!), UFV, Silvicultura, s.d., *R.S. Ramalho 1737* (photo RB!).

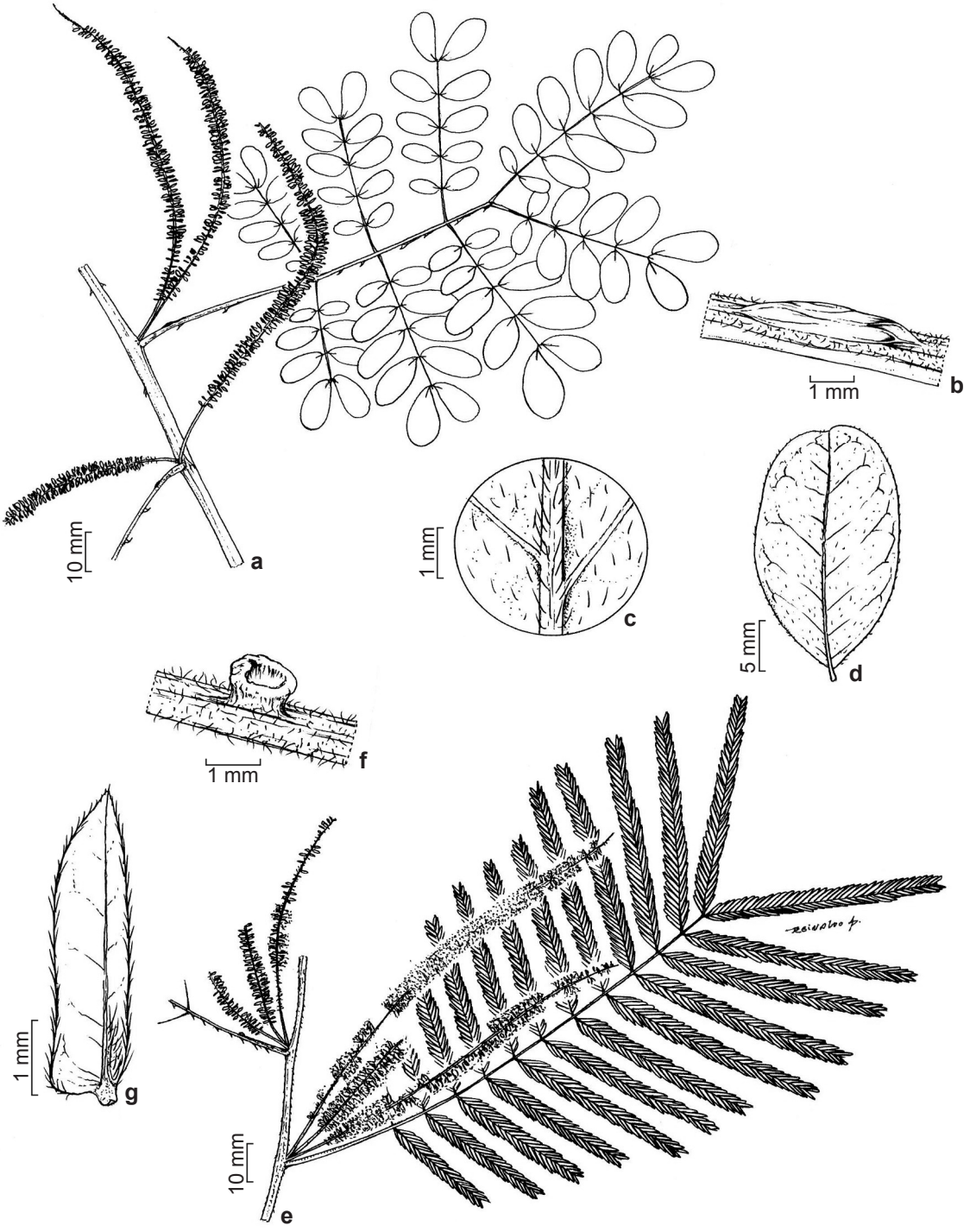

Figure 2 – a-d. *Piptadenia adiantoides* (Spreng.) J.F. Macbr. – a. branch with inflorescences; b. verruciform petiolar nectary; c. sericeous indumentum of the leaflets; d. leaflets (a,c,d *L.C.P. Lima 310*; b *J.R. Stehmann 3076*). e-g. *Piptadenia gonoacantha* (Mart.) J.F. Macbr. – e. branch with inflorescences; f. cupuliform petiolar nectary; g. leaflets (e,g *R.L.C. Bortoluzzi 682*; f *D.S. Pifano 115*).

1.2. *Piptadenia gonoacantha* (Mart.) J.F. Macbr. Contributions from the Gray Herbarium of Harvard University 59: 17. 1919. Figs. 2e-g; 4h

Tree, 4.5–20 m tall; trunk exfoliating; branches cylindrical with winged, armed, straight or curved aculeus, 0.6–2 mm long. Stipules deciduous, not observed. Leaves with 7–14 pairs of pinnae; leaf rachis 4–10 cm long, cylindrical, with straight or curved aculeus; leaflets linear, 27–50 pairs per pinna, 5–8 × 1–1.6 mm, glabrous on both surfaces or sericeous on the abaxial surface with margin ciliated, base truncated, apex acute, eccentric midrib; petiolar nectary cupuliform. Inflorescences spiciform, 1–3 per axil, 6–9 cm long. Calyx, 0.7–0.9 mm long, sericeous; corolla 1.75–1.82 mm long, glabrous; ovary stipitate, glabrous. Legume, 10–16 × 1.5–2.5 cm; seed rounded, 6–9 × 6–8 mm.

Species restricted to South America in Brazil, Bolivia, Colombia and Peru (Oliveira-Filho 2006). In Brazil, it is nearly distributed throughout the entire country, occurring in Rio Grande do Norte, Paraíba, Pernambuco, Bahia, Alagoas, Sergipe, Mato Grosso do Sul, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Paraná, Santa Catarina and Rio Grande do Sul (BFG 2015). In Minas Gerais, it was sampled in the south-central region (Fig. 3) in the Atlantic Forest and Cerrado domains (Oliveira-Filho 2006).

Piptadenia gonoacantha is mainly characterized by the presence of an exfoliating trunk and winged branches that allows to easily recognize the species even in a vegetative state. It differs from other species in Minas Gerais by also presenting a cupuliform petiolar nectary.

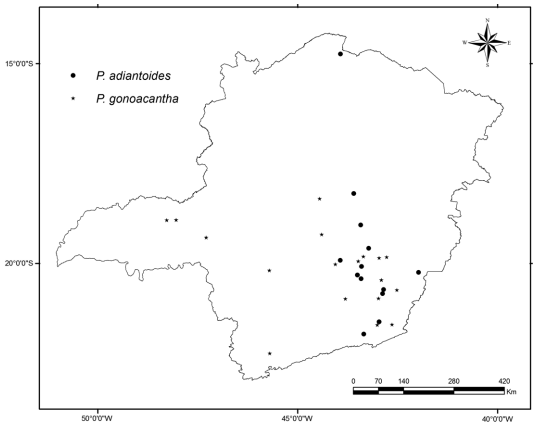

Figure 3 – Distribution of *Piptadenia adiantoides* (Spreng.) J.F. Macbr. and *P. gonoacantha* (Mart.) J.F. Macbr. in Minas Gerais.

Examined material: Araponga, Comunidade São Joaquim, 5.IX.2005, fr., *J.M. Fernandes 06* (VIC); Araxá, 19.XI.2010, *J.R. Stehmann & M. Augsten 6136* (BHCB); Barão de Cocais, Serra da Cambota, 2.VI.1992, est., *M. Brandão 19.448* (PAMG); Belo Horizonte, FZB, Trilha do lobo, 16.I.2008, fl., *J. Ordones et al. 222* (VIC); 9.V.2007, *D.F. Felix 59* (BHCB); 3.I.1983, *G.W.A. Fernandes & E.Tameirão Neto* (BHCB 13110); 1.I.2012, *A. Portugal-Santana 14* (BHCB); 29.VIII.1990, *E. Tameirão Neto 129* (BHCB); 19.IV.1991, *E. Tameirão Neto & C.Y.K. Matsuoka 389* (BHCB); 19.II.1991, E. Tameirão Neto (BHCB 23082); 1957, *L.R. Rennó* (BHCB 3614); 1982, *T.S.M. Grandi & R.C.F. Carvalho 112* (BHCB); 22.V.1942; *T. Barbosa* (BHCB 66425); Brumadinho, Inhotim, 29.IV.2008, fr., *F.M. Rodrigues, F.M.* (BHCB); 19.III.2008, *F.M. Rodrigues & J.G. Oliveira 219* (BHCB); 29.IV.2008, *F.M. Rodrigues & J.G. Oliveira 287* (BHCB); Carandái, Pedra do Sino Hotel Fazenda, BR 040, Km 6: Trilha da Mata atrás do hotel, 1.V.2005, fr., *N.F.O. Mota & P.L. Viana 220* (ICB, BHCB); Caparaó, Alto-Caparaó, propriedade Sr. Jorge Cortez, margem do rio Caparaó Braga, 3.I.1998, fl., *J.M.A. 4702* (photo RB!); Caratinga, 18.III.1994, *C.V. Mendonça 248* (BHCB); 25.IV.1994, *C.V. Mendonça 279* (BHCB); 24.V.1984, *P.M. de Andrade et al. 222* (BHCB); Conceição do Mato Dentro, Santo Antonio do Cruzeiro, Fazenda Eliezer Kamino, 2.VII.2008, fr., *L.H.Y 1032* (BHCB, photo RB!); Corinto, 2.III.1970, fl., *H.S. Irwin et al. 26763* (UB); Descoberto, Reserva Biológica do Grama, 7.V.2001, est., *R.M. Castro et al. 322* (CESJ); Dionísio, Zona de amortecimento do PERD, Mata do Mombaça, 13.IV.2006, *P.B. Souza et al. 19590* (VIC); Ibirité, Serra do Rola Moça, 21.III.1998, est., *M. Brandão 28394* (PAMG); Iguatama, mata da estiva, 28.IV.2000, est., *M. Brandão 29489* (PAMG); Juiz de Fora, 7.IX.2001, fr., *D.S. Pifano & M.O.D. Pivari 115* (CESJ); 11.I.2002, *D.S. Pifano & A.S.M. Valente 252* (BHCB); Leopoldina, Mata da Tulha, 25.V.1998, est., *M. Brandão* 28510 (PAMG); BR 116 Km 757, fl., *Hatschbach, G. 47669* (RB photo!); Mariana, Parque Estadual do Itacolomi, Trilha ao longo do rio Mainarte, 20.I.2005, est., *L.C.P. Lima, F.C.P. Garcia & M.E.F. de Araújo 264* (VIC); 2.XI.2000, *R.C. da Mota & L. Viana 628* (BHCB); 24.X.2002; *A. Salino 8126* (BHCB); Manhuaçu, between Manhuaçu and Realeza, Km 4 E of junction of BR-116 and BR-262, 18.I.1985, fl., *A.H. Gentry* (photo RB!); Monte Carmelo, VII.2008, fr., *I. Schiavini et al. 56051* (HUFU); IX.2008, *I. Schiavini et al. 483* (BHCB); Nova Ponte, área 3, 11.VIII.1987, fr., *J.R. Stehmann* (photo RB 417742!); Nova Lima, IV.2005, *A. Salino et al 10416* (BHCB); VIII.2005, *A. Salino et al. 10578* (BHCB); Paraopeba, Fazenda do Barreiro, 29.III.1956, fl., *E.P. Heringer 5146* (UB); Paula Candido, 2.I.2001, fl., *E.W. Teixeira 25561* (VIC); Pedra Azul, próximo a Estiva Salim, 1.VII.1981, fr., *J. Filho 170* (photo RB!); Perdizes, EPDA - Estação Ambiental Galheiro, 16.I.2003, fl., *E.H. Amorim, S. Mendes, R. Arruda, D.V. Fonseca 425* (HUFU); Ponte

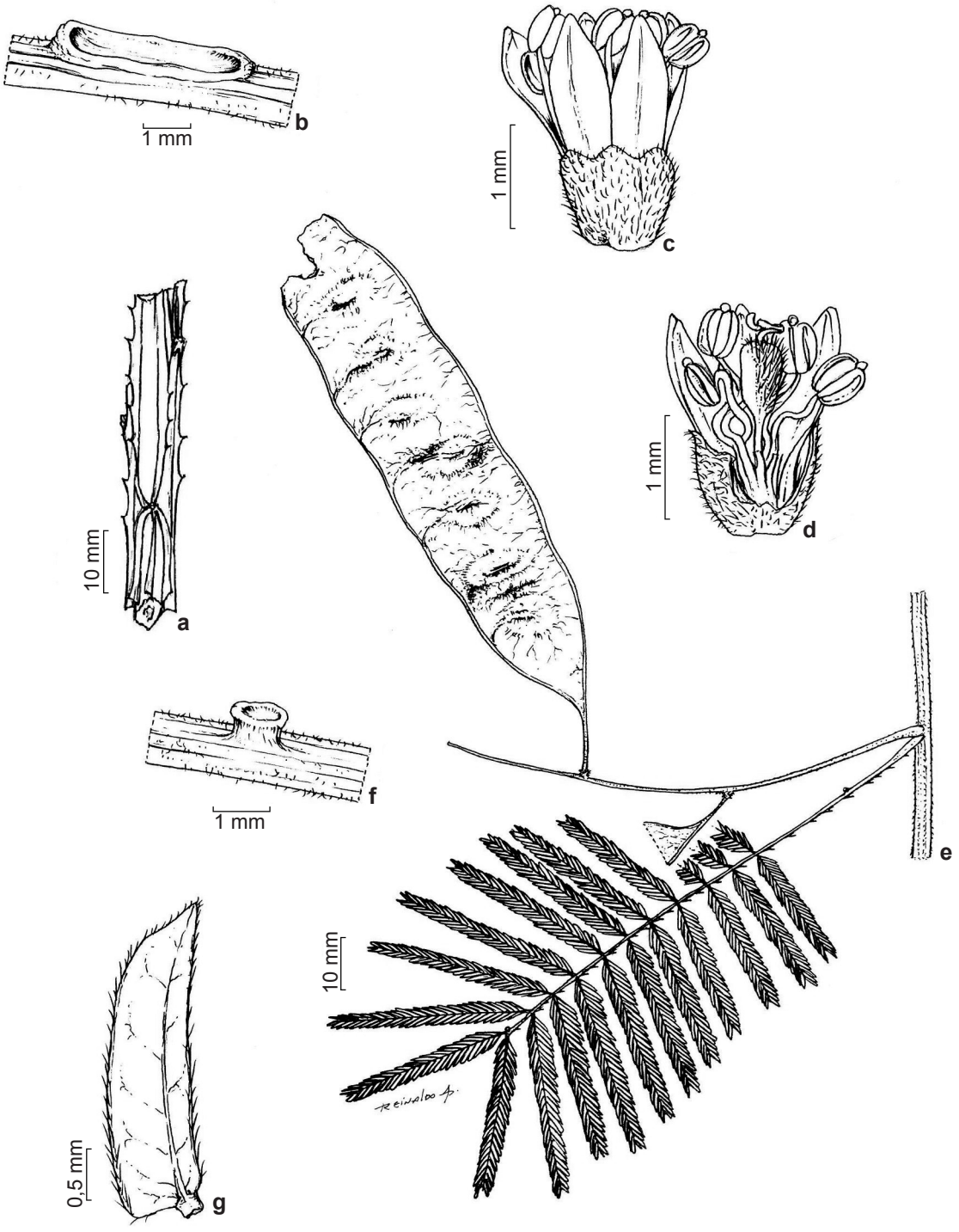

Figure 4 – a. *Piptadenia gonoacantha* (Mart.) J.F. Macbr. – detail of the winged branch. b-d. *Piptadenia macradenia* Benth. – b. patelliform petiolar nectary; c. flower; d. flower in longitudinal section. (*J.R. Pirani et al. 3705*). e-g. *Piptadenia micracantha* Benth. – e. branch with fruit; f. detail of the verruciform petiolar nectary and aculeus; g. leaflets. (e,g *L.C.P. Lima 390*; f *R.S. Ramalho & G. Rodrigues 1163*).

Nova, 16.II.1971, fl., *J. Badini 4573* (VIC); Ribeirão das Neves, 7.XII.2009, *N.C. Moreira et al. 110* (BHCB); Rio Vermelho, Fazenda Portão, 14.V.1986, fr., *M.S. Menandro 78* (photo RB!); Santa Rita do Sapucai, 29.V.1994, *M. Brandão 23964* (PAMG); São Domingos do Prata, Bacia do Macuco, 10.XI.1984, fr., *M. Brandão* 10966 (PAMG); São Gonçalo do Rio Abaixo, 2.X.1986, fr., *Pedralli et al. 7524* (HXBH); São João Nepomuceno, Serra dos Núcleos - Fazenda Primavera, 11.II.2003, fl., *D.S. Pifano et al. 458* (CESJ); São Miguel, 16.II.1930, fl., *Y. Mexia* 4359 (VIC). Uberlândia, Fazenda Buriti, 27.II.1994, fl., *G.M. Araujo et al 1205* (VIC); Teófilo Otoni, 27.X.2011, fl., *L.F.A. de Paula 608* (BHCB, photo RB!); 16.IV.2011, *L.F.A. de Paula & M. Augsten 311* (BHCB); 9.VII.1935, *Mello Barreto1514* (BHCB); Vale do rio Araguari, Triângulo Mineiro, est., *A.L.P. Mota et al. 4277* (VIC); Viçosa, 24.VIII.1999, fl., *R.L.C. Bortuluzzi 682* (VIC); 8.VIII.1935, fr., *J.G. Kuhlmann* (photo RB 78313); 26.XII.1934, fl., *J.G. Kuhlmann 1551* (photo RB!); 30.V.1978, fr., *R.S. Ramalho 1177* (Photo RB!); 23.I.1983, fl., *F.A. da Silveira* (photo RB 235951); 26.III.1987, fl., *A.L. Bernardi 2* (photo RB!).

1.3. *Piptadenia macradenia* Benth. Journal of Botany 4(30): 335-336. 1841. Fig. 4i-k

Tree, ca. 10 m tall; branches cylindrical, unarmed. Stipules deciduous, not observed. Leaves with 7–9 pairs of pinnae; leaf rachis 5–7 cm long, cylindrical, unarmed; leaflets linear, 37–47 pairs per pinna, 7–8 × 1.3–1.5 mm, glabrous on the adaxial surface and sericeous on the abaxial surface, margin ciliated, apex acute, base truncate or cordate, midrib eccentric; petiolar nectary patelliform, oblong. Inflorescences spiciform, grouped in panicles, 6.3–8.5 cm long. Calyx, 0.9–1.1 mm long, tomentose; corolla 1.5–1.7 mm long, sericeous; ovary stipitate, villous in the upper half. Legume flat, 8.4–10 × 1.8–2.4 cm; seeds not observed.

Endemic to Brazil, where it is only found in the states of Goiás and Minas Gerais (Bentham 1875; BFG 2015). Species restricted to the Cerrado domain in the State of Minas Gerais (Fig. 6).

It resembles *P. micracantha* by presenting pinnae with a large number of leaflet pairs (32–50 pairs) but differs by presenting unarmed branches and patelliform petiolar nectaries.

Examined material: Paraopeba, Fazenda do Funil, 31.III.1960, fl., *E.P. Heringer 7484* (UB); Santana do Riacho, Serra do Cipó, Morro da Pedreira, 2.IV.1996, fr., *J.R. Pirani et al. 3705* (IBTSP); Estrada IBAMA - Distrito do Cipó (antigo Cardeal Mota), margem esquerda, em frente à chacara Vila Anstal, 18.III.2012, fl., *L.M. Borges* (photo RB 560455!); 25.II.1985, *Andrade et al.* (BHCB 8869); 14.IV.1985, *Andrade et al.* (BHCB 8913).

1.4. *Piptadenia micracantha* Benth. Transactions of the Linnean Society of London 30(3): 369. 1875. Fig. 4l-n

Scandent or climbers shrubs; branches cylindrical, armed, aculeus curved, 0.9–2 mm long. Stipules deciduous, not observed. Leaves 8–13 pairs of pinnae; leaf rachis 5–10 cm long, cylindrical, aculeate; leaflets linear, 32–50 pairs per pinna, 3–7 × 0.5–1 mm, glabrous on both surfaces, rarely sericeous on the abaxial surface, margin ciliate, base truncated, apex acute or cuspidate, eccentric midrib; petiolar nectary verruciform, oblong. Inflorescences spiciform, 1–2 per axil, 3–7 cm long. Calyx, 0.9–1 mm long, glabrous; corolla 1.9–2 mm long, glabrous; ovary stipitate, tomentose. Legume 9–12 × 2.4–3.2 cm; seeds obovate, 6–8.5 × 5.5–7 mm.

Endemic to the southeast of Brazil, occurring in the states of Minas Gerais, São Paulo and Rio de Janeiro (Bentham 1875; BFG 2015). In Minas Gerais, it occurs in the Atlantic Forest domain (Fig. 6).

It is the only species that occurs solely in the Atlantic Forest and is easily recognized among other species of *Piptadenia* in Minas Gerais by its habit (scandent shrub or liana), the armed branches and the linear leaflets with 32–50 pairs per pinna, which is the main character differentiating *P. micracantha* and *P. adiantoides*.

Examined material: Caratinga, Estação Biológica de Caratinga, Mata do Jaó, 23.IV.1984, fl., *M.A. Lopes 331* (photo RB!); Caparaó, Serra do Caparaó, 30.IV.1988, fl., *P.L. Krieger* 079 (photo RB!); Lima Duarte, Ibitipoca, trilha atrás da casa da Polícia Florestal, 30.III.2004, fl., *R.C. Forzza 3287* (CESJ); Manhuaçu, 2.VI.1954, fl., *E.P. Heringer 3422* (UB); Mariana, Parque Estadual do Itacolomi, trilha ao longo do rio Mainarte, 23.VIII.2005, fr., *L.C.P. Lima & J.C. Duelhi-Filho 390* (VIC); Ouro Preto, Parque Estadual do Itacolomi, 14.IV.1994, est., *J.L. Silva, M.C.T.B. Messias & M.B. Roschel 20984* (VIC); São João Nepomuceno, Serra dos Núcleos, Fazenda Primavera, 24.II.2003, fr., *A. Valente, R.O. Garcia et al. 295* (CESJ, BHCB); Tombos, 4.V.1941, fl., *J.E. de Oliveira 327* (UB, BHCB); Viçosa, 19.V.1978, fl., *R.S. Ramalho & G. Rodrigues 1163* (IBGE).

1.5. *Piptadenia paniculata* Benth. Journal of Botany 4(31): 338. 1841. Fig. 5o-t

Trees, 5–25 m tall; branches cylindrical, armed or unarmed; stipules deciduous, not observed. Leaves 3–7 pairs of pinnae; leaf rachis 4–12 cm long, cylindrical, unarmed; leaflets oval-lanceolate, 7–15 pairs per pinna, 15–30 × 7–13 mm, sericeous on both surfaces, base obtuse, apex

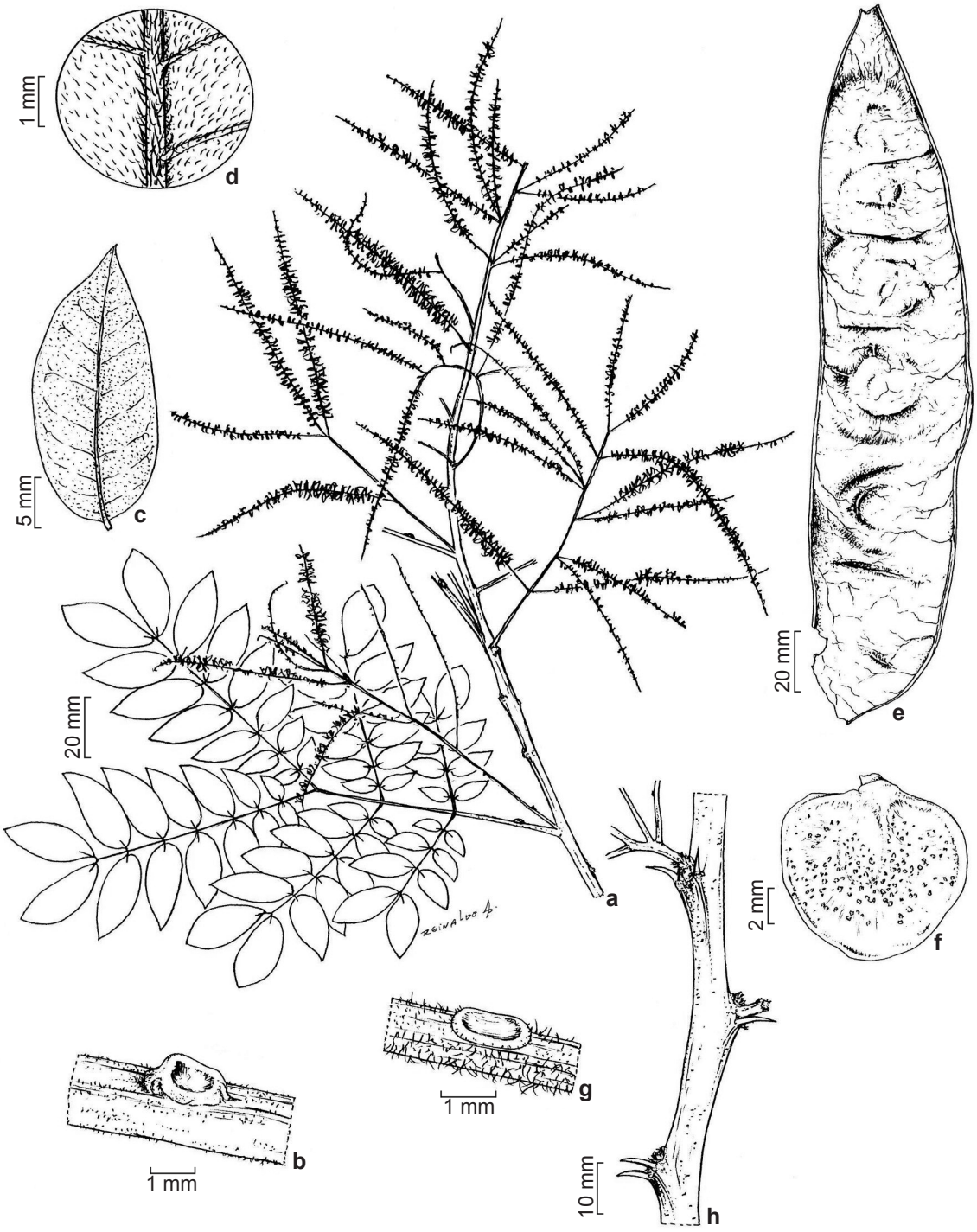

Figure 5 – a-f. *Piptadenia paniculata* Benth. – a. branch with inflorescences; b. detail of the patelliform petiolar nectary; c. leaflets; d. detail of the sericeous indumentum of the leaflets; e. legume; f. suborbicular seed (a *F. da Silva 119*; c,d *J. de Castro 2195-B*; b *W.F. Lopes 17092*). g-h. *Piptadenia viridiflora* (Kunth.) Benth. – g. detail of the patelliform petiolar nectary; h. stipules modified into spines and paired at the nodes (*J.M. Fernandes 1185*).

acute, mucronate, central midrib; petiolar nectary patelliform. Inflorescences spiciform, grouped in panicles, 6–18 cm long. Calyx 0.5–0.7 mm long, sericeous; corolla 1.7–2 mm long, glabrous or sericeous; ovary stipitate, tomentose. Legume 8–20 × 1.7–4.6 cm; seed suborbicular to oblong, 1.1–1.3 × 1.2–1.3 cm.

Endemic to Brazil, it is primarily distributed in the northeast, southeast and south regions in the states of Bahia, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Paraná and Santa Catarina (Oliveira-Filho 2006; BFG 2015). In Minas Gerais, it is found in the southeast and west regions (Fig. 6), occurring in Cerrado and Atlantic Forest vegetation.

When compared with other species of the genus, it is easily recognizable due to the longer shape of the leaflets with more than two pairs of pinnae (Ribeiro 2012). *Piptadenia paniculata* is similar to *P. adiantoides* by the size of the leaflets, but the former has obovate-elliptical or ovate leaflets, and the latter has oval-lanceolate leaflets. Another detail is the shape of the petiolar nectary, which is verruciform-oblong in *P. adiantoides* and patelliform in *P. paniculata*.
Examined material: Bias Fortes, 6.V.1952, fr., *L. Roth 1895* (photo RB!); Conceição das Alagoas, Represa de Volta Grande, 5.X.1988, fr., *G. Pedralli & J.R. Stehmann 5505* (HXBH); Coronel Pacheco, 28.I.1952, fl. e fr., *E.P. Heringer 2579* (UB); Descoberto, Reserva Biológica da Represa do Grama, fl., *L. Meireles 2001* (photo RB!); Juiz de Fora, VII.1945, fl., *P.L. Krieger 1093* (CESJ); Morro do Imperador, 8.IV.2003, fr., *D.S. Pifano 521* (photo RB!), 26.II.1969, fl., *V. Gomes* (photo RB 144181!); Ouro Preto, 14.XII.1990, fl., *H.C. de Lima 4113* (photo RB!); Teixeiras, 26.II.1969, fr., *E.P. Heringer 1361* (UB); Viçosa, 15.VII.1935, fr., *J. de Castro 2195-B* (VIC), fl., 13.VIII.1979, fr., *R.S. Ramalho 1524* (photo RB!), 27.XII.1978, fr., *R.S. Ramalho 1348* (photo RB!), 1.II.1983, fl., *R.S. Ramalho 2549* (photo RB!), fl., G.*L. Rodrigues* (photo RB 173841!); Tombos, 18.VII.1935, *H.L. Mello Barreto 1655* (BHCB).

1.6. *Piptadenia viridiflora* (Kunth) Benth. Journal of Botany 4(31): 337. 1841. Fig. 5u-v

Trees up to 7 m tall; trunk smooth; branches cylindrical. Stipules modified into aculeus paired at the nodes. Leaves 11–15 pairs of pinnae; leaf rachis 6–12 cm long, cylindrical, unarmed; leaflets linear, 24–34 pairs per pinnae, 4–6.5 × 1–2 mm, sericeous on both surfaces, base truncate, apex acute, eccentric midrib; petiolar nectary patelliform. Inflorescences speciform, two or three per axil, 6.3–8.8 cm long. Flowers not observed. Legume flat, compressed, 10.5–19 × 1.7–2.5 cm. Seeds were not observed.

Species restricted to South America in Argentina, Brazil and Bolivia. In Brazil, occurs in the states of Ceará, Paraíba, Pernambuco, Bahia, Mato Grosso do Sul and Minas Gerais (Oliveira-Filho 2006; BFG 2015). In Minas Gerais, it is found in the north and south regions of the state in the three vegetation domains (Fig. 6).

Piptadenia viridiflora is easily recognized, even when sterile, due to its significant, paired nodal aculeus representing modified stipules (spiny) (Ribeiro 2012). The green and speciform inflorescences, which are characters unique in the genus, also differentiate it from the other species of the genus (Ribeiro 2012). Seeds were not observed because the fruits were collected in the early stage of maturation.
Examined material: Águas Vermelhas, 6.V.1979, fr., *E.C. Tenório 79* (photo RB!); Espinosa, rio Capivara, 1.XI.1991, fr., *G. Pedralli 25* (photo RB!); Itacarambi, 15.V.2010, *C. Vidal & T. Mansur 825* (BHCB); Itacambira, 29.I.2010, *E. Tameirão NetoVidal 4794* (BHCB); Januária, 30.VI.1976, fr., *J.A. Ratter, J. Fonseca Filho, S.G. da Fonseca 3236* (UB); 29.VII.1993, *E. Tameirão Neto 914* (BHCB); 21.VII.1997, *A. Salino & J.R. Stehmann 3306* (BHCB); Juiz de Fora, Mata da Candeia, 4.IV.2003, fr., *W.C. Carvalho et al. 41891* (CESJ); Manga, 18.I.2010, fr., *J.M. Fernandes 1215* (VIC); 30.IV.1991, *T.C.S. Sposito 64* (BHCB); Fazenda dos Portugueses, 26.VI.1974, fr., *M. Magalhães 160* (photo RB!); Matias Cardoso, Parque Estadual Verde Grande, 18.II.2009, fr., *J.M. Fernandes 1021* (VIC); Montes Claros, 13.XI.2010, fr., *J.M. Fernandes 1185* (VIC).

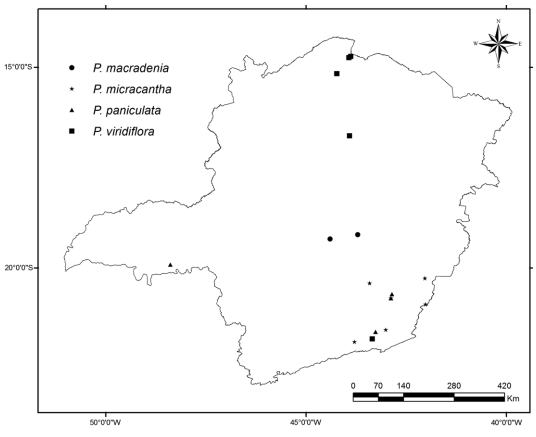

Figure 6 – Distribution of *Piptadenia macradenia* Benth., *P. micracantha* Benth., *P. paniculata* Benth. and *P. viridiflora* (Kunth.) Benth. in Minas Gerais.

Species not confirmed in Minas Gerais

Although Oliveira-Filho 2006 reported the occurrence of *Piptadenia irwinii* G.P. Lewis and *P. stipulacea* (Benth.) Ducke in Minas Gerais, these species were not found in the herbaria collections or in our field work. Queiroz (2009) and Morim (2010) stated that the former is restricted to Bahia state, and the latter is endemic to the Caatinga areas in the Brazilian northeast. Another species described in the literature for the state (Oliveira-Filho 2006) but not mentioned in the present study is *P. moniliformis* Benth., which was transferred to the genus *Pityrocarpa* (Jobson & Luckow 2007).

Conclusion

The state of Minas Gerais proved to be rich in the number of species of *Piptadenia*, accounting for approximately 29% of the diversity of this genus in Brazil. All species are native, and most are endemic to Brazil. Only *P. gonoacantha* and *P. viridiflora* occur in other South American countries. In Minas Gerais, the genus is represented in the three phytogeographic domains: Atlantic Forest, Cerrado and Caatinga, but only *P. adiantoides* and *P. viridiflora* are found in all three domains. *P. macradenia* is restricted to the Cerrado and *P. micracantha* to the Atlantic Forest, where, with five species, the highest diversity was found.

In most species, the flowering period usually extends from December to April with fruiting from April to August, but it may last until October in some species.

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