

Wrongly identified material of *Davilla macrocarpa* (Dilleniaceae) represents two new species from Brazil

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Background – *Davilla* Vand. is a monophyletic genus and member, with other genera endemic to the Neotropics, of the Doliocarpoideae clade, a natural lineage of the subfamily Doliocarpoideae J.W.Horn. Its sepals, unequal in size, with two inner ones large and crustaceous and completely covering the fruit, represent a morphological synapomorphy for the genus.

Methods – Our fieldwork in remnants of the Atlantic forest in the states of Bahia and Espírito Santo, Brazil, led to the discovery of two new *Davilla* species. Herbarium collections were consulted for their determination and comparison with identified specimens. Morphological data were obtained through the study of herbarium specimens and of fresh material collected in the field.

Key results – *Davilla coriacea* Fraga & Stehmann and *D. undulata* Fraga & Stehmann, are herein described and illustrated. Diagnostic characters and affinities of the new species are discussed, accompanied by notes on their ecology, geographic distribution and conservation status. A key to all species of *Davilla* sect. *Homalochlaena* is also provided. The new species are similar to *D. sessilifolia* Fraga and *Davilla flexuosa* A.St.-Hil. and have been identified in most herbaria as *Davilla macrocarpa* Eichler. In accordance with the criteria of the IUCN Red List of endangered plant species, *D. coriacea* and *D. undulata* are to be assessed as Endangered (EN) and Near Threatened (NT) respectively.

Key words – *Davilla coriacea*, *Davilla undulata*, *Davilla flexuosa*, *Davilla sessilifolia*, *Davilla macrocarpa*, Brazilian Atlantic Forest, endemism, taxonomy.

INTRODUCTION

Monophyly of the genus *Davilla* Vand. has been confirmed in two recent works: the first, analyzing molecular (plastid) data from Dilleniaceae Salisb., with six *Davilla* species (Horn 2009); the second, based on molecular (nuclear and plastid) and morphological data, using 22 *Davilla* species (Fraga 2012). In both analyses, the genus emerged in a clade with other genera endemic to the Neotropics that proved to be a natural lineage of the subfamily Doliocarpoideae J.W.Horn. For this doliocarpoideae clade, Horn (2007, 2009) considered potential synapomorphies, including paniculate inflorescences, or impoverished variants thereof; a peltate stigma, with an even annuliform margin; and the stabilization of two ovules per carpel, with one of them basal, erect, and apotropous, and the other epitropous. On the other hand, Fraga (2012) having included in his analysis *Neodillenia*

Aymard, limited synapomorphy for the subfamily to the peltate stigma.

Kubitzki (1971), in his taxonomic revision of *Davilla*, recognized 18 species. Since then, 14 new Brazilian species of *Davilla* have been described (Kubitzki 1973, 1980, Aymard 1998, 2002a, 2002b, 2007, Fraga 2008, Fraga & Stehmann 2010, Fraga et al. 2017). In addition, Aymard (2002b) and Fraga (2012) adopted new synonyms. This brings the total number of species to 28 when including the two new species described here.

Sepals, unequal in size, with the two inner ones larger and crustaceous and completely covering the fruit, represent the morphological characters of *Davilla* that separate it from the other genera of Dilleniaceae, and the states of these characters allowed Kubitzki (1971) to establish two sections. *Davilla* sect. *Davilla*, defined by the innermost sepals being overlapped at the margins by the adjacent inner sepals, and the margin reflexed, non-alate; and *Davilla* sect. *Homalo-*

chlaena Kubitzki, with the margins of the innermost sepals not overlapped by the inner sepals but pressing against each other and forming circular wings.

Our extensive fieldwork in the Atlantic Coastal Forest of the Brazilian states of Bahia and Espírito Santo, as well as study of herbarium specimens collected in the region, including that of the type material of *Davilla macrocarpa* Eichler, led to determination of the true identity of that species and to the recognition of two new species here described. Both new species had been misidentified in herbarium collections as *D. macrocarpa*, as it also was the case with *Davilla sessilifolia*, before its correct identification and description (Fraga 2008). To assist in identifying, a new key to the members of *Davilla* sect. *Homalochlaena* is provided. This work is a part of the PhD thesis “Phylogeny and taxonomic revision of *Davilla* Vand. (Dilleniaceae)” of the first author (Fraga 2012), made under the supervision of the second author.

MATERIAL AND METHODS

Dried specimens of *Davilla* from the following herbaria were studied either on website or by personal examination after loan: ALCB, B, BM, BR, BHCN, C, CEPEC, CVRD, HRB, HUEFS, IBGE, IPA, K, M, MBM, MBML, MG, NY, P, PORT, RB, R, S, SP, SPF, US, W, WU (acronyms following Thiers 2016). Morphological data were obtained through the study of herbarium specimens and of fresh material collected randomly in pre-selected sites during field work in Bahia and Espírito Santo.

Descriptions and illustrations are based on both living and dried material, studied using a stereomicroscope; morphological characters are based on Harris & Harris (2001) and Hickey & King (2000); inflorescence analysis follows Weberling (1992); the key to the species of *Davilla* sect. *Homalochlaena* is based on Fraga (2012). Voucher specimens were dried and pressed according to Fidalgo & Bononi (1984) and deposited at RB, with duplicates sent to several other herbaria.

Data on the distribution of the new and related species, gathered from field notes and herbarium labels were recorded using the DIVA-GIS, version 5.2 (Hijmans et al. 2005), and are presented in a map, with some coordinates taken from Google Earth. The conservation assessment complies with the criteria of the IUCN (2001), with the extent of occurrence (EOO) and the area of occupancy (AOO) estimated with GeoCAT and the AOO based on a user defined cell size of 2 km² (Bachman et al. 2011).

SPECIES DESCRIPTION AND KEY

Davilla coriacea Fraga & Stehmann, sp. nov.

Similar to *Davilla sessilifolia*, but distinguished by elliptic or oblanceolate leaf blade with straight margin, inflorescence flowers opening successively, or with a few flowers at anthesis simultaneously, and by inner sepals larger than the external, 23.5–30 mm in diameter when fruiting, very hard, and rarely wrinkled when dry. – Type: Brazil, Bahia, Una, Rodovia Ilhéus – Una (BA 676), a 42 km de Ilhéus, próximo a entrada para a Reserva Biológica de Una, perto do Rio

Maruim, 15°11'04"S 39°01'05"W, 17 m elev., 27 Jun. 2009 (fl., fr.), *Fraga, Saavedra, Meirelles & Neri* 2588 (holo-: RB; iso-: B, BHCN, BR, CEPEC, HUEFS, K, MBML, NY, P, PORT, VIES).

Liana or rarely shrub, 2 m high. **Stem** tortuous, branches and branchlets glabrescent and green when young, glabrous, striate, and brown when mature. **Leaves** sessile to sub-sessile; blades 6.5–22.5 × 2.2–10 cm, elliptic or oblanceolate, at base attenuate, at margin straight or slightly revolute, at apex acute or obtuse to rounded, rarely emarginated, coriaceous, glabrous on both surfaces, dark green with secondary nerves greenish on adaxial and abaxial surface, glossy when dry; venation brochidodromous, glabrous, midrib impressed or sulcate on adaxial surface and prominent on abaxial surface, secondary veins 9–15 pairs, evident on both surfaces, convergent and joined together in a series of prominent arches near margin, tertiary veins strongly reticulate, evident on both surfaces. **Inflorescence** 1.5–8 × 0.2–0.3 cm, terminal or axillary, on short stems, 2–7-flowered racemes or occasionally flowers solitary, with flowers opening successively, rachis glabrous. **Flowers** with pedicels 10–45 mm long, 1.5–2.6 mm diameter at base and 2.8–3.6 mm diameter distally, glabrous; bracteole caducous; sepals 5, orbicular, crusty when mature, glabrous, three outer smaller and two inner larger; outer sepals externally rugose and internally shiny, ciliate at the margin, green to dark brown when mature, unequal in size, the external one 4.2–5.3 mm in diameter when flowering and 5.5–10 mm in diameter when fruiting, the median one 8–10 mm in diameter when flowering and 11.5–16 mm in diameter when fruiting, the internal one 10–14.6 mm in diameter when flowering and 15.5–17 mm in diameter when fruiting; inner sepals externally smooth and internally shiny, margins pressed against each other forming circular wings without overlapping and ciliate, green to yellowish when mature, rarely wrinkled when dry, equal in size, 15–21 mm in diameter when flowering and 23.5–30 mm in diameter when fruiting; petals 5, 10–24 mm long, 3–4 mm wide at base and 14–16 mm at the middle, early deciduous, asymmetrical, membranous, glabrous on both sides, attenuate at base, bifid distally, margin not ciliate, yellow; stamens 303–335, arranged in a circle surrounding carpels, included; filaments 5.5–6.5 × 0.1–0.25 mm, terete to clavate, glabrous; anthers 0.5–0.8 × 0.4–0.6 mm, globose to elliptic-oblong, glabrous, dehiscence longitudinal, apex slightly apiculate; carpels 2, free; ovary 1.5–1.9 × 1.2–1.4 mm, conical, glabrous, with 2 basal ovules 0.7–1.1 × 0.4–0.6 mm; style 7.4–11 × 0.2–0.3 mm, one per ovary, terete, erect to sinuous, glabrous, with appressed apex; stigma capitate, discoid, verrucose. **Fruit** an indehiscent follicle, 9.5–12.5 × 7.5–9.6 mm, two- or rarely one-seeded, globose, membranaceous, glabrous; seeds 8.7–11 × 6.7–9 mm, asymmetrical, rugose, glabrous, covered up to half by an aril, black; aril papyraceous, toothed at apex, white. Figs 1 & 2A–E.

Distribution – *Davilla coriacea* is endemic of the south-eastern coast of Bahia State (Brazil) and known from only four municipalities in a narrow geographical range between 14°20'08"S (Fazenda Boa Paz, Itacaré) and 15°17'S (Assentamento Vitorópolis, Una) and between 39°01'W (Serra Grande, Uruçuca) and 39°16'06"W (road between Una and Valença). Its distribution area is delimited by major rivers,

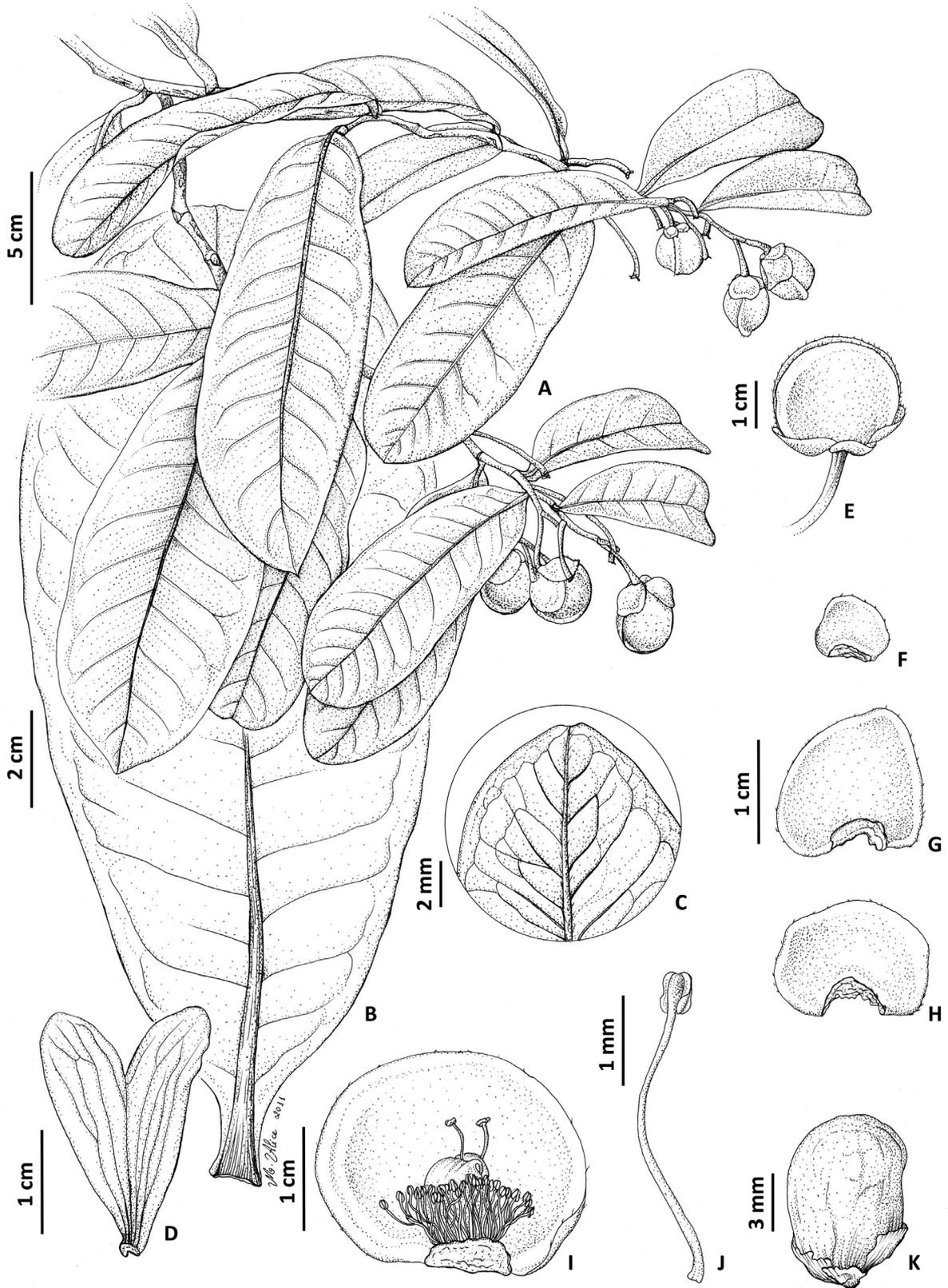


Figure 1 – *Davilla coriacea* Fraga & Stehmann. A, habit; B, adaxial leaf surface; C, leaf apex, abaxial surface; D, petal, adaxial surface; E, flower in lateral view, showing persistent sepals covering stamens and ovary; F-H, three external sepals, abaxial surface (external, median, and internal); I, frontal view of persistent sepal covering stamens and ovary, with the other internal and all external sepals removed; J, stamen in dorsal view; K, Seed in lateral view, with aril removed. From Fraga *et al.* 2588 (RB). Drawn by Maria Alice Rezende.

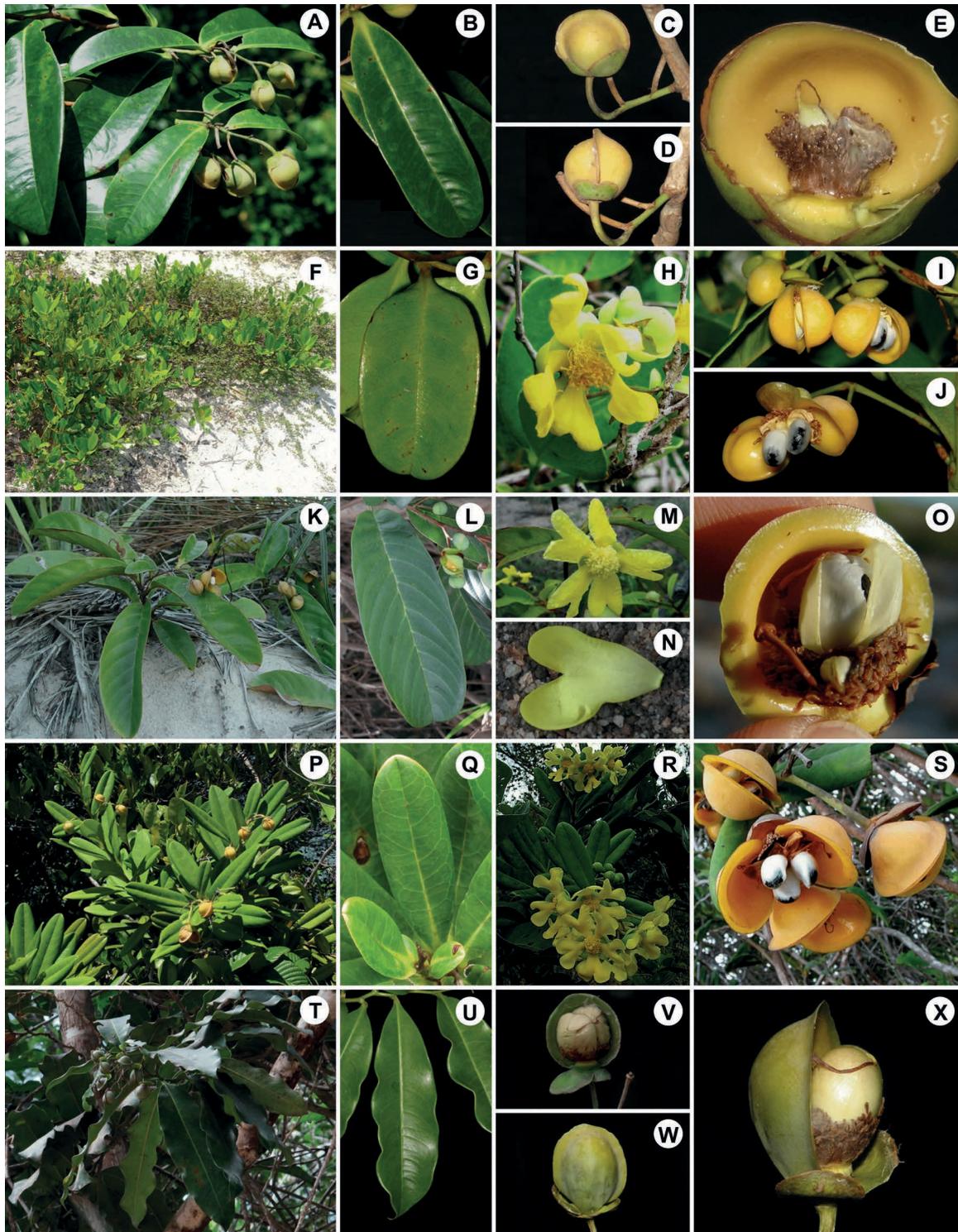


Figure 2 – Morphology of the new species and their allies: A–E, *Davilla coriacea*. A, branch with inflorescence; B, adaxial leaf surface; C, frontal view of persistent sepals covering the fruit; D, lateral view of persistent sepals covering the fruit; E, frontal view of persistent sepals covering stamens and ovary, with one sepal removed. F–J, *Davilla flexuosa*. F, ground habit; G, adaxial leaf surface; H, flower in frontal view, with petals; I–J, fruit in frontal view, with aril and seeds partially exposed. K–O, *Davilla macrocarpa*. K, branch with inflorescence; L, adaxial leaf surface; M, flower in frontal view, with petals; N, petal on the ground; O, frontal view of persistent sepals, with the other sepal removed and showing stamens, unfertilized ovary, seed, and aril. P–S, *Davilla sessilifolia*. P, branch with inflorescence; Q, adaxial leaf surface; R, inflorescence, with all flowers in simultaneous anthesis; S, fruit in frontal view, with exposed arillate seeds. T–X, *Davilla undulata*. T, branch with inflorescence; U, adaxial leaf surface; V, frontal view of persistent sepals covering stamens and ovary, with the other sepal removed; W, persistent sepal in lateral view; X, persistent sepal in lateral view, with the other sepal removed. Photographs by C.N. Fraga, except H by J. Nascimento Junior, M. by O.J. Pereira and R by A.V. Popovkin.

with wide-mouthed estuaries, and running perpendicular to the Atlantic coastline: River Contas in the North, River Pardo in the South, and highlands in the West (fig. 3). The predominant vegetation type in the region is the dense submontane tropical moist forest, typically found in the foothills of Serra da Borborema and in great extension of southern Bahia, in the west of tabuleiro plains, with hills and valleys in its typical topography (Thomas & Barbosa 2008). The canopy of this forest is mostly uniform, with trees of more than 25–30 m (with a few individuals to 40 m), numerous epiphytes, large lianas, and a dense sub-canopy. The geology is dominated by the Pre-Cambrian crystalline rocks, covered in some areas by the Tertiary-Quaternary sediments (Martini et al. 2007, Amorim et al. 2008, Thomas et al. 2008).

Additional specimens examined – Brazil: Bahia: Mun.

Ilhéus: Mata da Esperança, entrada a 2 km a partir da antiga ponte do Rio Fundão, 14°46'55"S 39°04'09"W, 5 Apr. 2004, Amorim et al. 3923 (CEPEC, RB); Acuripe, 15 Aug. 1995, Hatschbach & Motta 63337 (CEPEC, BR, MBM, MEXU, US); 2.0 km NNE of Banco da Vitória on road leading to west edge of Mata da Esperança, 14°46'38"S 39°05'28"W, 28 Sep. 1994, Thomas et al. 10724 (CEPEC, NY, VEN, RB).

Mun. Itacaré: Estrada que liga Serra Grande à Uruçuca, 5 km da rodovia Ilhéus-Itacaré, entorno do Parque Estadual Serra do Conduru, 14°28'09"S 39°04'24"W, 25 Jul. 2001, Santana et al. 755 (CEPEC, ALCB); Rodovia Ilhéus-Itacaré, km 59, fazenda Boa Paz, 14°20'08"S 39°01'55"W, 100 m, 22 Nov. 1998, Guedes 193 (ALCB); Fazenda Capitão, 7.9 km W of junction BA 001 on road from Itacaré to Ubaitaba, Southern Bahian, 14°20'65.9"S 39°05'30.4"W, 100 m, 4 Nov. 2001, Thomas et al. 12765 (CEPEC, NY, RB); Estrada Ubaitaba-Itacaré, km 8 RPPN Capitão, 14°25'05"S 39°33'05"W, 12 Feb. 2011, Araújo et al. 76 (CEPEC, RB).

Mun. Una: Reserva Biológica do Mico-Leão – IBAMA, entrada no km 46 da Rod. BA-001 Ilhéus/Una, 15°09'S 39°05'W, 7 Aug. 1980, Hage & Mattos Silva 383 (CEPEC); Una, Reserva Biológica de Una, 15 Apr. 1993, Jardim et al. 119 (NY); *ibid.*, 22 Sep. 1994, Carvalho et al. 4940 (CEPEC, NY); *ibid.*, 12 Dec. 1995, Carvalho et al. 6174 (ALCB, HUEFS, NY, MBM); *ibid.*, 22 Jun. 2007, Pastore & Suganuma 2127 (CEN, HUEFS); Parque Ecoturístico de Una, próximo à REBIO (Reserva Biológica de Una), Zona do Barro Vermelho, km 6, margeando o Rio Maruim, 60 m, 1–12 Jul. 1991, Carvalho et al. 3374 (CEPEC); Litoral Sul, assentamento Vitorópolis, 15°17'S and 39°04'W, 13 Sep. 2006, Iganci et al. 189 (CEPEC); Estrada de terra próximo à rodovia Una-Valença, 13 m, 6 Sep. 1994, Sant'Ana et al. 559 (CEPEC, NY); Estrada Una-Pedra de Una., 15°16'12.1"S 39°03'4.9"W, 71 m, 17 Oct. 1998, Hatschbach et al. 68614 (MBM). **Mun. Uruçuca:** 7.3 km N of Serra Grande on road to Itacaré, fazenda Lagoa do conjunto Fazenda Santa Cruz, 14°25'S 39°01'W, 1–12 Jul. 1991, Thomas et al. 7503 (CEPEC, NY); Distrito de Serra Grande, 7.3 km na estrada Serra Grande/Itacaré, Fazenda Lagoa do conjunto Fazenda Santa Cruz, 14°25'S 39°01'W, 29 Aug. 1995, Sant'Ana et al. 574 (CEPEC, NY); Rodovia que liga o povoado de Serra Grande (litoral) à Uruçuca, km 3 a 8, ramal à direita, 200 m, 10 Nov. 1993, Amorim et al. 1450 (ALCB, HUEFS, NY, VEN).

Habitat and ecology – *Davilla coriacea* is sympatric with *Davilla macrocarpa* and *Davilla flexuosa*, climbing in the

shade of canopy trees and rarely found near ground and exposed to the sun. In contrast, *Davilla flexuosa* and *Davilla macrocarpa*, of the same region, prefer areas of sandy soils, growing near the ground and rarely found as a canopy vine, and are supported by shrubs or lying directly on sandy soil of the Quaternary sediments (Peixoto et al. 2008). *D. coriacea* was collected in flower from April to July and in flower/fruit from June to December.

Etymology – The specific epithet refers to the coriaceous texture of its leaves.

Conservation Status – IUCN Red List category: Endangered [EN]. The extent of occurrence (EOO) of *Davilla coriacea* is estimated to be over 2112 km² (exceeding the 100 km² upper limit for Critically Endangered status under the criterion B1) and its minimal area of occupancy (AOO) is estimated to be 76 km² (within the limits for Endangered status under the criterion B2). The species is endemic to the submontane tropical moist forest, with populations represented by several scattered individuals in five IUCN locations (*sensu* IUCN 2001), which falls within the limits for Endangered status under subcriterion "a". Even though some of the populations are found within protected areas, the region as a whole has undergone severe fragmentation and deforestation over the past 40 years (Thomas & Barbosa 2008), mostly through establishment of intensive cacao-growing plantations, with the accompanying vine eradication, and vacation housing and hotel construction. We expect that the ongoing loss of the species habitat is leading and will lead to the decline in its mature individuals in the near future. For that reason, *Davilla coriacea* is therefore assigned a preliminary status of EN B1ab(iii,v)+2ab(iii,v).

Notes – *Davilla coriacea* was first collected in 1980 in Una (Hage & Mattos Silva 383). That material was identified by Kubitzki as a possible hybrid between *Davilla macrocarpa* and *Davilla flexuosa*. Analysis of herbarium specimens from southeastern Bahia revealed that *D. coriacea* had been misidentified as *D. macrocarpa*, and is more closely related to *Davilla sessilifolia*, *Davilla flexuosa*, and *Davilla undulata*, all of them of the same clade (Fraga, unpublished data), whereas *Davilla macrocarpa* belongs to a sister clade.

Davilla coriacea resembles *Davilla sessilifolia* by sessile leaves with obtuse apex, and pedicels dilated distally. However, *D. coriacea* has elliptic or oblanceolate leaf blade, with straight margin, inflorescences with few flowers in simultaneous anthesis, inner sepals 23.5–30 mm in diameter, very hard and rarely wrinkled when dry. In contrast, *D. sessilifolia* has lanceolate-spatulate leaf blade, with revolute margin, inflorescences with all flowers in simultaneous anthesis, inner sepals 15–28 mm in diameter, hard but usually wrinkled when dry. Additional diagnostic characters are presented in table 1.

***Davilla undulata* Fraga & Stehmann, sp. nov.**

Similar to *Davilla flexuosa*, but differing from it by sessile leaves with elliptic to lanceolate leaf blade, acute at apex and undulate at margin, inner sepals 12–16 mm in diameter at anthesis and to 19–26 mm in diameter when mature, and in the number of stamens (310–330). – Type: Brazil. Bahia: Porto Seguro, Trancoso, estrada BA-001, trecho entre Trancoso e Rio dos Frades, 16°36'58"S 39°08'28"W, 57 m elev., 10 May

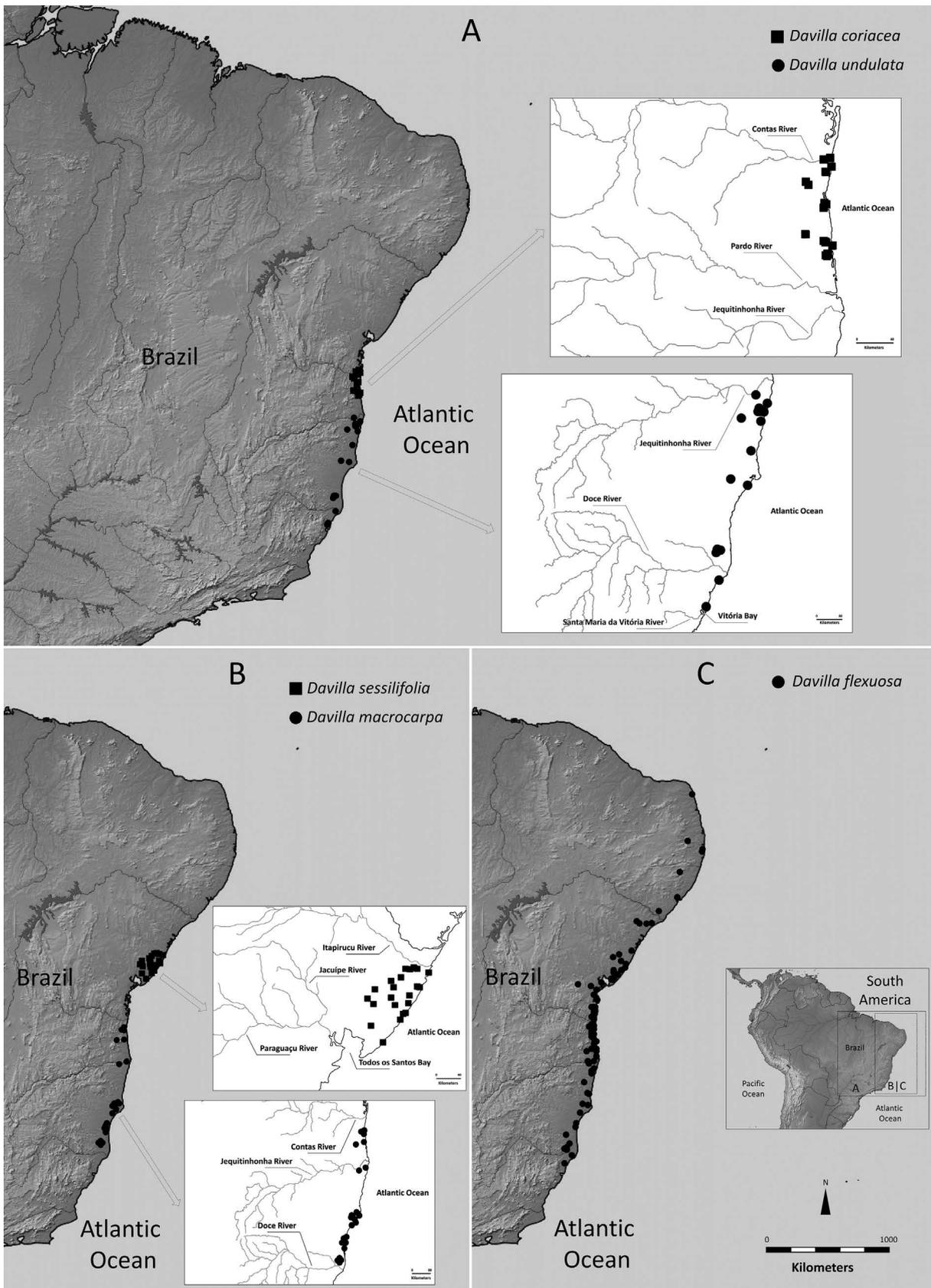


Figure 3 – The geographical distribution of the new species and their allies in southeastern Bahia and northern Espírito Santo, Brazil: A, *Davilla coriacea* (black squares) and *Davilla undulata* (black dots); B, *Davilla sessilifolia* (black squares) and *Davilla macrocarpa* (black dots); C, *Davilla flexuosa* (black dots).

Table 1 – Key characters of the two new species *Davilla coriacea* and *D. undulata*, and comparison with their allies *D. flexuosa*, *D. macrocarpa* and *D. sessilifolia*.

Character	<i>Davilla coriacea</i>	<i>Davilla flexuosa</i>	<i>Davilla macrocarpa</i>	<i>Davilla sessilifolia</i>	<i>Davilla undulata</i>
Leaf blade	6.5–22.5 × 2.2–10 cm	4.5–15 × 1.5–8 cm	6.5–29.5 × 2.2–12 cm	4.5–15 × 1.5–8 cm	4.5–15 × 1.5–8 cm
Leaf shape	elliptic or oblanceolate	elliptic, elliptic-spatulate or spatulate	elliptic or elliptic-lanceolate	lanceolate-spatulate	lanceolate or elliptic-lanceolate
Leaf texture	coriaceous	sub-coriaceous	coriaceous	coriaceous	papyraceous to sub-coriaceous
Leaf venation	brochidodromous	brochidodromous	eucamptodromous	brochidodromous	brochidodromous
Secondary venation	9–15	5–12	9–15	8–12	12–19
Leaf base	attenuate	cuneate	attenuate	cuneate	attenuate
Leaf margin	Entire, slightly revolute	Entire, slightly sinuous	entire, slightly revolute	entire, strongly revolute	entire, slightly revolute
Leaf apex	acute, obtuse, rounded or occasionally emarginated	acute, obtuse, rounded or occasionally emarginated	obtuse or rounded	mucronate, obtuse or retuse	acute or acuminate
Petiole	absent or very short	0.6–2.3 × 0.1–0.2 cm	1.5–4 × 0.8–1 cm	absent	absent or very short
Flowers pedicels	10–45 × 1.5–2.6 (base) to 2.8–3.6 cm (apex)	12–46 × 0.8–1.5 mm	15–60 × 1.3–1.8 mm	15–60 × 1.3–1.6 (base) to 2.2–2.5 cm (apex)	13–40 × 1.5–2.6 mm
Inner sepals (flower)	15–21 mm diameter	8.4–9.2 mm diameter	10.1–13 mm diameter	12–18.2 mm diameter	12–16 mm diameter
Inner sepals (fruit)	23.5–30 mm diameter	8.8–12.3 mm diameter	13.5–16 mm diameter	18–23 mm diameter	19–26 mm diameter
Petals	10–24 × 14–16 mm (the middle part)	10–15 × 7.2–10 mm (the middle third)	19–25.8 × 1.7–2.1 mm (the middle third)	21–26 × 18–20 mm (the middle third)	27–30 × 23–26 mm (the middle part)
Stamens number	303–335	82–93	121–143	380–410	310–330
Filaments	5.5–6.5 × 0.1–0.25 mm	6.1–8.9 × 0.1–0.3 mm	6–7.6 × 0.1–0.3 mm	6–9 × 0.1–0.3 mm	5–7 × 0.1–0.3 mm
Ovary	1.5–1.9 × 1.2–1.4 mm	1.5–1.8 × 1.3–1.5 mm	1.7–2 × 1.2–1.5 mm	1.6–1.9 × 1.3–1.5 mm	1.2–1.4 × 0.6–0.9 mm
Style	7.4–11 × 0.2–0.3 mm	7.3–9.2 × 0.2–0.3 mm	6.9–9.1 × 0.2–0.3 mm	7.2–9 × 0.2–0.3 mm	8–9.5 × 0.2–0.3 mm
Fruit	9.5–12.5 × 7.5–9.6 mm	8–9.5 × 6–7.4 mm	8–9 × 6–7.1 mm	8–9.5 × 6–7.4 mm	12–14 × 7.5–9 mm
Seeds	8,7–11 × 6.7–9 mm	7.5–8.1 × 4.6–6 mm	7–8 × 4–6 mm	7.5–8 × 4.6–6 mm	10.1–11.7 × 5.5–6.4 mm

2011 (fl. and fr.), *Fraga* 3268 (holo-: RB; iso-: ALCB, B, BM, BR, BHC, C, CEPEC, CVRD, HUEFS, K, M, MBM, MBML, MO, NY, P, PORT, S, SP, SPF, VIES, W, WU).

Liana, rarely caespitose shrub when young. **Stem** tortuous, branches and branchlets glabrescent and green when young, glabrous, striate, and brown when mature. **Leaves** sessile to sub-sessile; blades 4.5–15 × 1.5–8 cm, lanceolate to elliptic-lanceolate, at base attenuate, at margin undulate and slightly revolute, at apex acute or acuminate, papyraceous to sub-coriaceous, glabrous on both surfaces, dark green with secondary nerves greenish on both surfaces, opaque when dry; venation brochidodromous, glabrous, midrib impressed on adaxial surface and prominent on abaxial surface, secondary veins 12–19 pairs, impressed on adaxial surface and slightly prominent on abaxial surface, convergent and joined together in a series of prominent arches near margin, tertiary veins strongly reticulate, evident on both surfaces. **Inflores-**

cence 1.5–5.5 × 0.15–0.2 cm, terminal or axillary, on short stems, 2–7-flowered racemes, or occasionally solitary flowers, with flowers opening successively, rachis slightly rugose. **Flowers** with pedicels 13–40 × 1.5–2.6 mm, glabrous; bracteole caducous; sepals 5, sub-orbicular, crusty when mature, glabrous, three outer smaller and two inner larger; outer sepals, externally rugose and internally shiny, ciliate at the margin, green to dark green when mature, unequal in size, the external one 3–4 mm in diameter when flowering and 4–6.1 mm in diameter when fruiting, the median one 7–8 mm in diameter when flowering and 9–11 mm in diameter when fruiting, the internal one 9.1–10 mm in diameter when flowering and 10–14.2 mm in diameter when fruiting; inner sepals externally smooth and internally shiny, margins pressed against each other forming circular wings without overlapping and ciliate, green to yellowish when mature and covered by blue wax, usually wrinkled when dry, equal in

size, 12–16 mm in diameter when flowering and 19–26 mm in diameter when fruiting; petals 5, 27–30 mm long, 2–4 mm wide at base and 23–26 mm at the middle, early deciduous, asymmetrical, membranous, glabrous on both sides, attenuate at base, bifid distally, margin ciliate, yellow; stamens 310–330, arranged in a circle surrounding carpels, included; filaments 5–7 × 0.1–0.3 mm, terete to clavate, glabrous; anthers 0.7–0.9 × 0.4–0.5 mm, globose to elliptic-oblong, glabrous, dehiscence longitudinal, apex not apiculate; carpels 2, free; ovary 1.2–1.4 × 0.6–0.9 mm, conical, glabrous, with 2 basal ovules 0.5–0.7 × 0.5–0.6 mm; style 8–9.5 × 0.2–0.3 mm, one per ovary, terete, erect to sinuous, glabrous, with appressed apex, stigma capitate, discoid, verrucose. **Fruit** an indehiscent follicle, 12–14 × 7.5–9 mm, one- or two-seeded, globose, membranaceous, glabrous; seeds 10.1–11.7 × 5.5–6.4 mm, asymmetrical, rugose, glabrous, covered at apex by an aril, black; aril papyraceous, toothed at apex, white. Figs 2T–X & 4.

Distribution – *Davilla undulata* occurs in a narrow geographic range of Atlantic Forest from southern Bahia to northern Espírito Santo (Brazil), being found in seven municipalities in Bahia and three of Espírito Santo, between 16°05'55"S (Barrolândia, Belmonte) and 20°13'00"S (Cidade Continental, Serra) and between 39°01'W (RPPN Veracel, Santa Cruz de Cabrália) and 40°13'48.9"W (Cidade Continental, Serra). It is delimited in the North by River Jequitinhonha, in the South by River Santa Maria da Vitória and the Vitória Bay, in the East by the Atlantic Ocean, and in the Northwest by highlands mountains (fig. 3). The predominant vegetation is that of tabuleiro forests and restingas, with the local geology dominated by Tertiary and Quaternary sediments, respectively (Peixoto et al. 2008).

Additional specimens examined – **Brazil: Bahia: Mun. Belmonte:** Estrada de Barrolândia para Belmonte, a 3.7 km de Barrolândia, Floresta de tabuleiro, 16°05'55"S 39°14'48"W, 27 Jul. 2009, *Fraga et al.* 2775 (RB, BHCB, CEPEC, NY, K). **Mun. Caravelas:** Área de influência da CAF, 17°44'07"S 39°45'16"W, 4 Feb. 2002, *Guedes* 9725 (ALCB). **Mun. Itabela:** Cascalheira, 13 Aug. 1995, *Hatschbach & Motta* 63277 (MBM, CEPEC, US). **Mun. Nova Viçosa:** 8 Dec. 1984, *Hatschbach & Silva* 48719 (MBM, US). **Mun. Porto Seguro:** Km 6, BR 005, 4 Jun. 1962, *Duarte* 6688 (RB, CEPEC, NY, K, MBML); Vera Cruz, 19 Jul. 1988, *Hatschbach & Silva* 52230 (MBM, US); Estrada Eunápolis a Porto Seguro, RPPN Estação Vera Cruz, 16 Jun. 2006, 16°25'09"S 39°12'08"W, *Lopes et al.* 866 (NY); *ibid.* 2 Jul. 2006, 16°25'09"S 39°12'08"W, *Lopes et al.* 938 (NY, RB); Estrada dos blocos 2 e 3 da RPPN Estação VERACEL, 16°25'09"S 39°12'08"W, 9 Mar. 2010, *Daneu & Gomes* 258 (CEPEC, RB). **Mun. Prado:** Parque Nacional do Descobrimento, Área alterada na beira da estrada (Km 24 da estrada principal que atravessa o parque), 17°11'S 39°20'W, 11 Jun. 2009, *Matos et al.* 1667 (CEPEC, RB). **Mun. Santa Cruz de Cabrália:** Estação Ecológica do Pau-Brasil, c. 16 km W of Porto Seguro, 25 Nov. 1987, *Maas et al.* 7015 (CEPEC); Extremos Sul, 16°16'S 39°01'W, 19 Oct. 1999, *Guedes et al.* 6757 (ALCB); Extremos sul, RPPN Veracel, 16°16'S 39°01'W, 10 Feb. 2003, *Guedes et al.* 9997 (ALCB). **Es-pírito Santo: Mun. Aracruz:** Comboios, Restinga mata seca, 28 Oct. 1992, *Pereira et al.* 4023 (VIES). **Mun. Lin-**

hares: Reserva de Linhares DOCEMADE, 3 Feb. 1972, *Sucre* 8436 (RB); Reserva Florestal de Linhares, aceiro Dois Irmãos, km 0.015, próximo ao córrego atravessado, 1 Jan. 1998, *Folli* 3064 (CVRD, PORT). BR 101, entre Sooretama e Linhares, Reserva CVRD, 19°5'56.9"S 40°02'52.6"W, 39 m, *Bruniera et al.* 265 (SPFR, RB). **Mun. Serra:** Carapebus, APA Praia Mole, Floresta sobre Tabuleiro do Terciário na encosta voltada para o fundo do vale úmido, 20°12'56.5"S 40°13'48.7"W, 14 May 2009, *Pereira* 7807 (VIES); Cidade Continental, Setor África, floresta do entorno da Lagoa de Carapebus, área não alagada, Floresta de tabuleiro costeiro, 20°13'00"S 40°13'48.9"W, 31 Jul. 2009, 15 m, *Fraga et al.* 2793 (RB, BHCB, MBML, VIES, K, PORT).

Habitat and ecology – *Davilla undulata* is sympatric with *Davilla macrocarpa* and *Davilla flexuosa*. It prefers areas of tall forests on clay ground, growing as a canopy liana shaded by supporting trees, and is rarely seen near the ground and exposed to the sun. *Davilla flexuosa* and *Davilla macrocarpa* grow near ground, supported by shrubby vegetation or directly on sandy soil. *D. undulata* was collected in flower from March to July and with flowers/fruits from July to December.

Etymology – The specific epithet refers to the characteristic undulate margin of its leaves.

Conservation Status – IUCN Red List category: Near Threatened [NT]. The extent of occurrence (EOO) of *Davilla undulata* is estimated to be 14813 km², which falls within the limits for Vulnerable status under criterion B1, and its area of occupancy (AOO) is about 68 km², which falls within the limits for Endangered status under criterion B2. *Davilla undulata* is known from 13 localities in the Atlantic forest areas of Bahia and Espírito Santo, in small populations represented by scattered individuals. These subpopulations represent a total of eleven IUCN locations which fall above the limit of Vulnerable status. Even though some of the populations are found within protected areas, the region as a whole has undergone severe fragmentation and deforestation through the spread of eucalyptus monoculture, livestock raising, and vacation housing and hotel construction, with the habitat destruction greater than 30% in the last few years, a situation that could lead to a rapid diminution of the species population which justifies a preliminary risk of extinction assessment of NT.

Notes – *Davilla undulata* was first collected in 1972 in Linhares (*Sucre* 8436), with that material identified by Kubitzki as *Davilla macrocarpa* Eichler. As had been the case with *Davilla coriacea*, herbarium specimens of *Davilla undulata* were found mixed with those of *D. macrocarpa*, or left indeterminate in all herbarium collections studied.

The new species resembles *Davilla flexuosa* in its papyraceous to sub-coriaceous leaves, brochidodromous venation, with the tertiary venation strongly reticulate on both surfaces, and longer pedicels. However, *D. flexuosa* has petiolate, elliptic to oblong leaves, with obtuse to rounded apex and sub-revolute margin, flowers with inner sepals 8.4–9.2 mm in diameter at anthesis to 8.8–1.2 mm in diameter when mature, and stamens numbering 82–93. In contrast, *D. undulata* has sessile, elliptic to lanceolate leaves, with acute apex and undulate margin (crispated when dry), flowers with inner sepals

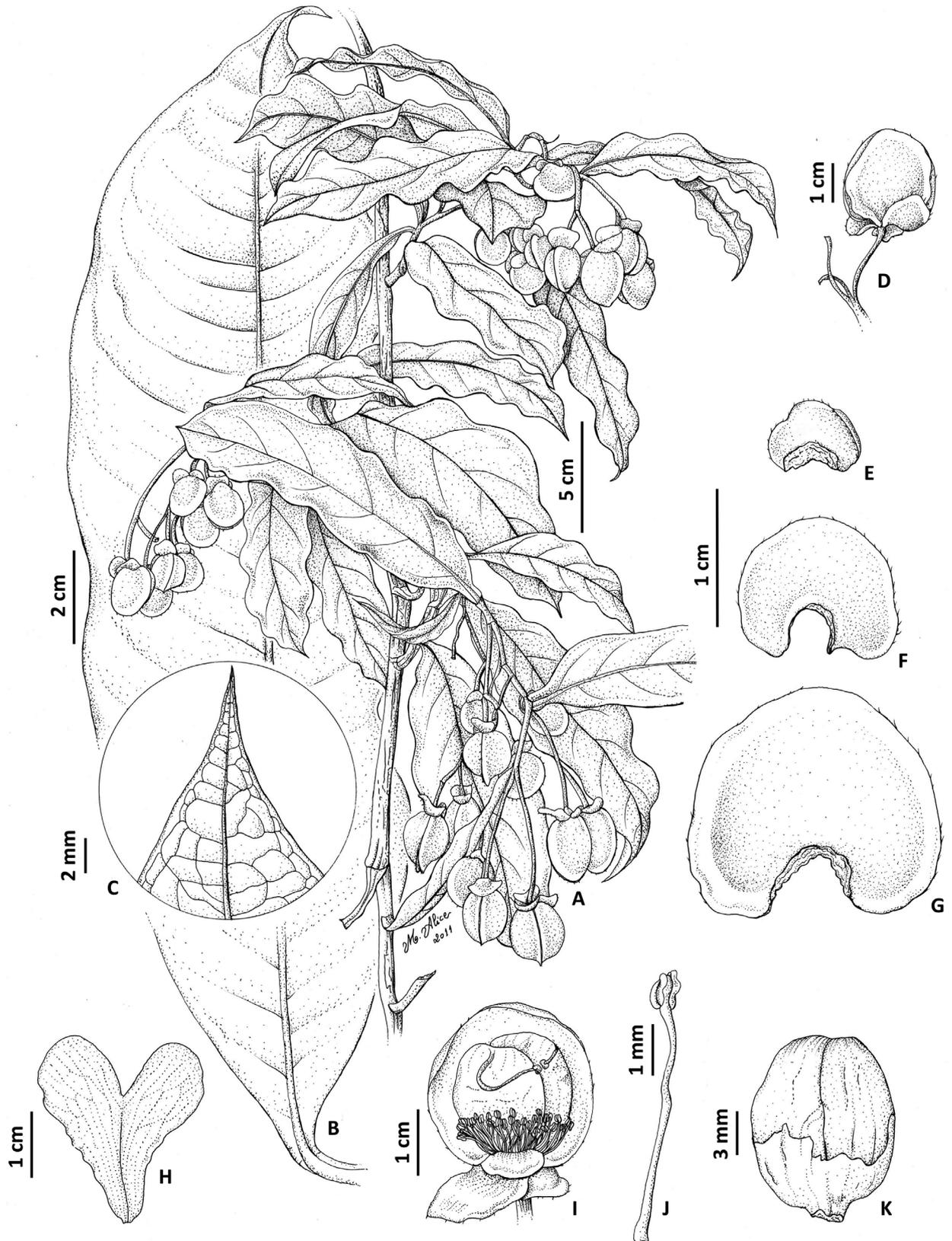


Figure 4 – *Davilla undulata* Fraga & Stehmann: A, habit; B, adaxial leaf surface; C, leaf apex, abaxial surface; D, flower in lateral view, with persistent sepals covering stamens and ovary; E-G, three external sepals, abaxial surface (external, median, and internal); H, adaxial surface of petal; I, frontal view of persistent sepals covering stamens and ovary, with the other sepal removed; J, stamen in dorsal view; K, two seeds in dorsal view, with aril removed. From *Fraga* 3268, except H from *Hatschbach* 48719. Drawn by Maria Alice Rezende.

Key to species of *Davilla* sect. *Homalochlaena*

1. Branchlets and leaves covered by golden or ferruginous trichomes on the lower surface; petioles vaginate, distinctly winged 2
- 1'. Branchlets and leaves covered by white, green or castaneous trichomes, or glabrous; leaves occasionally sparsely pilose along the midrib and apex on lower surface; petioles normally canaliculate, not winged..... 4
2. Leaves oblong, shorter than 10 cm long, scabrous on the upper surface, densely ferruginous pubescent on the lower surface, venation prominently lacunose-areolate; fruit less than 1 cm in diameter ..
..... *Davilla steyermarkii* Kubitzki
- 2'. Leaves elliptic-oblong, longer than 10 cm long, smooth to glabrescent on the upper surface, golden pubescent on the lower surface, venation not lacunose-areolate; fruit more than 2 cm in diameter... 3
3. Leaves coriaceous, apex acute or occasionally acuminate, sparsely golden pubescent on the lower surface, petioles 4–8 cm long..... *D. alata* (Vent.) Briq.
- 3'. Leaves papyraceous to sub-coriaceous, apex acute, densely golden pubescent on the lower surface, petioles 1.5–4 cm long *D. grandifolia* Moric. ex Eichler
4. Flowers with 30–50 stamens, filaments dorsiventrally flattened 5
- 4'. Flowers with over 50 stamens, filaments cylindrical 9
5. Branchlets and leaves covered by trichomes when young, glabrescent when mature..... 6
- 5'. Branchlets and leaves glabrous on both surfaces, occasionally sparsely pilose along the midrib and apex on the lower surface..... 8
6. Branchlets villous, sepals externally sericeous *D. villosa* Eichler
- 6'. Branchlets glabrescent to sparsely pubescent, sepals externally pubescent to glabrescent when mature 7
7. Leaves glabrous to glabrescent on the upper surface and tomentose along the midrib on the lower surface, petioles glabrescent *D. cearensis* Huber
- 7'. Leaves sparsely pilose on the upper surface, densely pilose on the lower surface, densely tomentose along the petiole and midrib on the lower surface, petioles densely pilose..... *D. strigosa* Kubitzki
8. Pedicels shorter than 1cm; external sepals longer than 5 mm *D. minutifolia* Fraga
- 8'. Pedicels longer than 1cm; external sepals shorter than 5 mm *D. pedicellaris* Benth.
9. Leaf venation brochidodromous 10
- 9'. Leaf venation not brochidodromous 13
10. Flowers with less than 200 stamens; fruit less than 1 cm in diameter *D. flexuosa* A.St.-Hil.
- 10'. Flowers with more than 200 stamens; fruit more than 1 cm in diameter.....11
11. Leaves elliptic to lanceolate, apex acute, margin undulate, crisped when dry; pedicels terete
..... *D. undulata* Fraga & Stehmann
- 11'. Leaves elliptic to spatulate or oblanceolate, apex obtuse, margin straight; pedicels dilated distally
..... 12
12. Leaves lanceolate-spatulate, margin revolute; inner sepals 1.5–2.8 mm, hard, usually wrinkled when dry, number of stamens 380–410 *D. sessilifolia* Fraga
- 12'. Leaves elliptic or oblanceolate, margin straight; inner sepals 2–3.5 mm, very hard, rarely wrinkled when dry; number of stamens 303–335 *D. coriacea* Fraga & Stehmann
13. Leaf venation eucamptodromous 14
- 13'. Leaf venation semi-craspedodromous 15
14. Fruit less than 1 cm in diameter *D. latifolia* Casar.
- 14'. Fruit more than 2 cm in diameter..... *D. macrocarpa* Eichler
15. Leaves prominently bullate on the upper surface *D. glaziovii* Eichler
- 15'. Leaves not bullate or sub-bullate on the upper surface..... 16
16. Leaves lanceolate, smooth on the upper surface, sparsely pubescent and densely pilose along the midrib on the lower surface..... *D. angustifolia* A.St.-Hil.
- 16'. Leaves ovate or lanceolate, sub-bullate on the upper surface, densely pubescent on the lower surface
..... *D. tintinnabulata* Schldtl.

12–16 mm in diameter at anthesis to 19–26 mm in diameter when mature, and stamens numbering 310–330. Additional diagnostic characters are presented in table 1.

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