



Dalechampia secco (Euphorbiaceae), a threatened new species from Southeastern Brazil

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ABSTRACT

Dalechampia secco is a new endemic species of Euphorbiaceae from the Atlantic Forest domain, southeastern Brazil. Here we describe and illustrate the new species. Collections of botanical material, and standard herbarium practices were applied. The new species is vegetatively similar to *D. alata*, *D. erythrostylis*, *D. pentaphylla*, *D. violacea*, and *D. purpurata*, however it is distinguished by exclusive characters such as involucre bracts 4–5-lobed, pinkish, staminate sepals vinaceous, resin darkish and stigma yellow lobed to crateriform. The new species is restricted to Seasonal Semideciduous Forest with altitudes of ca. 700 m from Caparaó, south of the state of Espírito Santo. In addition, we provide field photographs, preliminary conservation status assessments using IUCN Red List guidelines, as well as a checklist and key for morphological correlated species.

Keywords: Acalyphoideae, Caparaó, endemism, Espírito Santo, Seasonal Semideciduous Forest, taxonomy.

Introduction

Dalechampia L. is a consistent morphologically genus, characterized by its peculiar pseudanthial inflorescence, which stands out due the involucre bracts, usually colorful. Its pistillate cymule present three flowers and the staminate pleiochasium has few to numerous flowers (Webster & Armbruster 1991). *Dalechampia* is one species-rich genera of the subfamily Acalyphoideae (Euphorbiaceae), it includes ca. 130 species, being the neotropical region the center of

greatest diversity with 90 species, representing 69% of global taxa (Pereira-Silva *et al.* unpubl. res.).

In Brazil, about 73 species are recorded and distributed in all phytogeographic domains, of which 35 are reported for the Southeastern region (Pereira-Silva *et al.* 2019). The Atlantic Forest is one of the richest domains in number of *Dalechampia* species (29 spp.), three less than in the Cerrado (Pereira-Silva *et al.* 2022). Recent studies in *Dalechampia* recorded 15 species for the state of Espírito Santo, in addition to the confirmation of a new taxon for science (Mendes *et al.* 2022).

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Based on morphological characters the new species is classified in *Dalechampia* sect. *Dioscorifoliae* Pax & K.Hoffm. by the leaves simple, lobed or palmately compound, involucre bracts pinkish, staminate bracts 4, free, resiniferous gland with margin fimbriate and seeds rugose (Webster & Armbruster 1991). Regional floras and taxonomic studies have contributed to improve the knowledge of the section *Dioscoreifoliae* in Brazil (e.g., Pereira-Silva *et al.* 2016; 2018; 2019; 2020; Athi-Souza *et al.* 2019; Mendes *et al.* 2021).

Dalechampia seccoi is vegetatively similar to *D. alata* Mll.Arg., *D. erythrotyla* R.A. Pereira-Silva & A.L. Melo, *D. pentaphylla* Lam., *D. violacea* Pax & K.Hoffm. and *D. purpurata* Cordeiro, however it is distinguished by unique reproductive characters. Here we describe, illustrate and present images of *D. seccoi*, including a distribution map, preliminary assessments of the conservation status, identification key and table with main diagnostic characters of the most similar species of *Dioscoreifoliae* section.

Material and methods

The specimens were collected during field expeditions in 2017 and 2020 in an enclave of Seasonal Semideciduous Forest, which composes the Parque Estadual Cachoeira da Fumaa. The specimens of the new species were studied in the field and in CAP, MBML and PEUFR herbaria (acronyms according to Thiers 2023 [continuously updated]). Specimens were analyzed and

photographed with a stereomicroscope (ZEISS Stemi 305). The morphological descriptions followed Webster and Armbruster (1991) and Beentje (2010) terminology. The distribution map was generated in QGIS v. 2.18.2 (QGIS Development Team 2017). The preliminary conservation status was assessed according to the IUCN guidelines and criteria (IUCN 2022). The online geospatial conservation assessment tool (GeoCat) was used to calculate the area of occupancy (AOO), with a user-defined cell of 4 km² (Bachman *et al.* 2011).

Results

Taxonomic treatment

Dalechampia seccoi J.C.R. Mendes & Pereira-Silva, **sp. nov.**

Type: BRAZIL, Esprito Santo: Alegre, Parque Estadual Cachoeira da Fumaa, 20°37'54"S, 41°36'13"W, 660 m, 01 Aug 2017, fl, fr, F. Torres-Leite, C.T. Leite, A.T. Vieira & P.M. Amaral 560 (holotype: CAP [CAP00007335!]). (Figs 1, 2 and 3; Table 1)

Dalechampia seccoi is recognized by its involucre bracts 4–5-lobed, pinkish, with magenta veins; staminate column elongated beyond the sepal tips after anthesis; staminate sepals widely lanceolate, vinaceous; style tips not moderately down-curved and stigma crateriform to slightly lobed, yellow; pistillate sepals 12, pinnatifid; 4 bracteoles of staminate pleiochasium, deltoid to oblong, free; resiniferous gland with margin fimbriate, and resin secreted darkish; and seeds grayish with macules brownish.

Table 1. Comparison of morphological characters for *Dalechampia seccoi* and related species.

Character	<i>D. seccoi</i>	<i>D. alata</i>	<i>D. erythrotyla</i>	<i>D. pentaphylla</i>	<i>D. purpurata</i>	<i>D. violacea</i>
Leaves	simple, deeply 5-lobed	simple, deeply 5-lobed	simple, deeply 5-lobed	compound, 5-foliolate	compound, 3-foliolate	simple, deeply 5-lobed
Shape involucre bracts	4–5-lobed	3-lobed	3-lobed	5 (–3)-deeply lobed	3-lobed	deeply 3-lobed
Color of involucre bract	pinkish	greenish	greenish	greenish	magenta	pinkish
Color veins of involucre bracts	magenta	greenish	greenish	greenish	reddish	greenish to pinkish
Shape of bracteal stipules	lanceolate	lanceolate	lanceolate	deltoid	lanceolate	ovate
color of staminate sepals	vinaceous	greenish	pinkish	greenish	dark purple	not seen
Openness of staminate sepals	widely open	not seen	widely open	slightly open	widely open	not seen
Color of resin	darkish	not seen	dark green	yellowish	darkish	not seen
Color of stigma	yellow	greenish	reddish	greenish	greenish	reddish
Seeds	oblong, rugose	not seen	subglobose, rugose	globose, smooth	angled	not seen
Geographic distribution	Southeastern	Northeast, Southeastern	Northeast	Paraguay and Brazil (Central-West, Northeast, Southeastern and South)	Northeast	Central-West



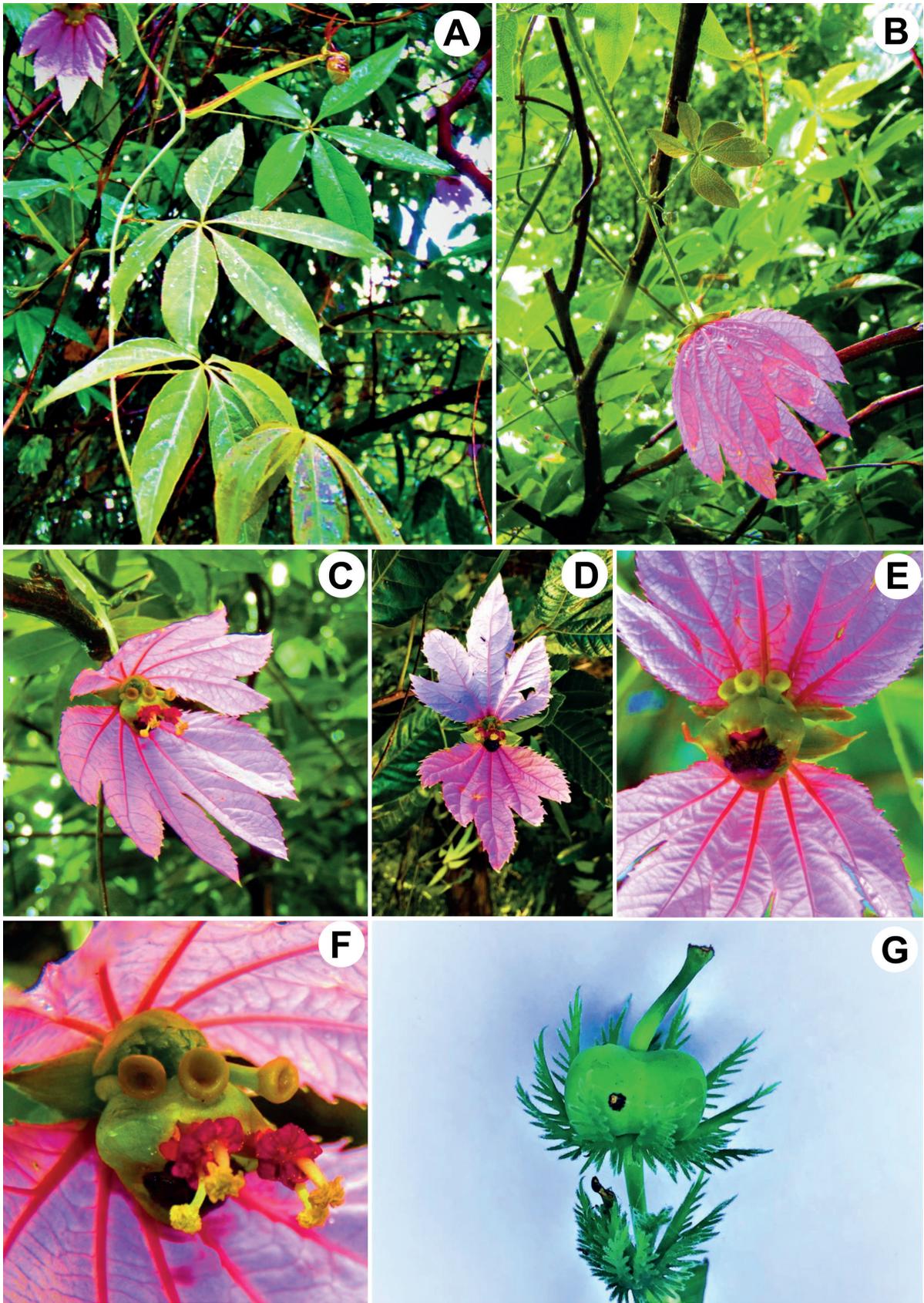


Figure 1. *Dalechampia seccoi*. **A.** Habit. **B.** General view of habit with pseudanthium. **C–D.** Pseudanthium with the two involucrel bracts 4–5-lobed, showy, pinkish. **E.** Detail of staminate pleiochasium, and resin secreted darkish. **F.** Detail of pistillate cymule, and stigma crateriform to slightly lobed. **G.** Fruits (capsule). (Photographs: A, B, C, E, F André S. Pellanda; D. Filipe Leite; G. Karla Pedra).



Twining vines, stems 3–4 mm diam, terete, greenish, glabrescent to glabrous. **Leaves** simple, alternate; petiole 4–6 cm long, greenish; petiolar stipule 2–3 × 1–2 cm, lanceolate, base truncate, margin entire, ciliate, glabrescent; leaf blade 6.5–13.5 × 6–13 cm, deeply 5-lobed; lobe 6.5–13 × 1–2 cm, elliptic, base acute, apex acute, margin entire, without glandular trichomes, adaxial and abaxial surfaces

glabrous; venation eucamptodromous, primary veins 4–5; stipels 1–1.5 × ca. 0.3 mm long, linear to lanceolate, persistent, associated with glands. **Inflorescence** bisexual pseudanthium, axillary, solitary, ca. 10 cm long, peduncle ca. 11 cm long, glabrous; **involucral bracts** ca. 5.5 × 3 cm, 4–5-lobed, lobe acute at apex, pinkish, margin serrate, membranaceous, adaxial and abaxial surfaces glabrescent,



Figure 2. A. *Dalechampia seccoi* in watercolor painting (Made by Cássia Dias).



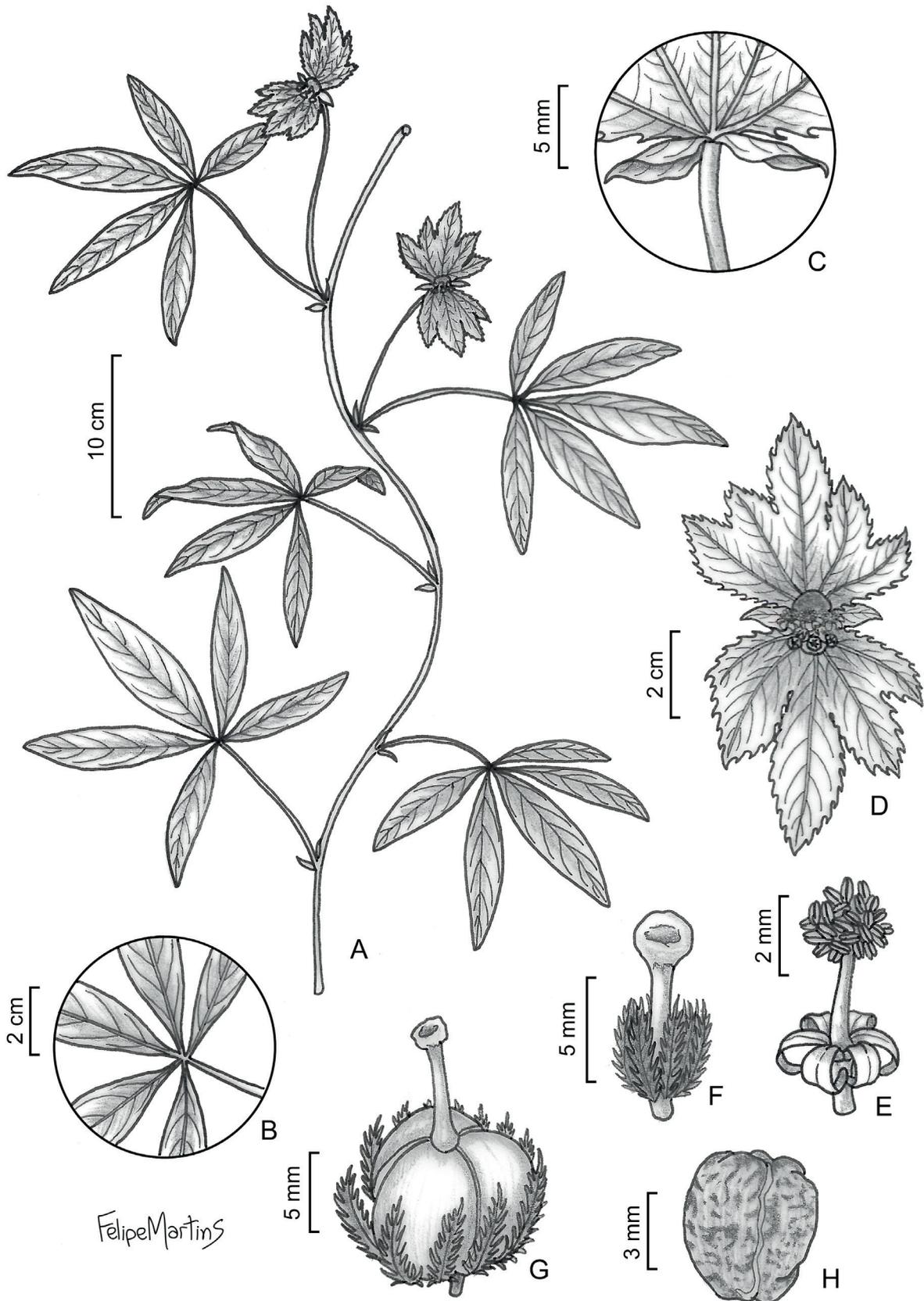


Figure 3. *Dalechampia seccoi*. **A.** Habit. **B.** Detail of the insertion of the base of the leaf blade. **C.** Detail of the bract and stipule. **D.** Pseudanthium. **E.** Staminate flower. **F.** Pistillate flower (pinnatifid sepals and stigma crateriform to slightly lobed). **G.** Fruit. **H.** Seed. (Voucher: *F. Torres-Leite et al.* 560 [holotype]). Drawn by Felipe Martins.

primary veins 5, magenta; bracteal stipule ca. 7 × 5 mm, lanceolate, base truncate, apex acute, margin entire, without glandular trichomes, adaxial and abaxial surface glabrous. **Staminate pleiochasium** with 4 bracteoles, ca. 5-flowered, peduncle ca. 3 mm long; staminate bracteoles 7–8 × 7–8 mm, deltoid to oblong, free; gland composed of numerous resiniferous bractlets, ca. 8 × 7 mm, margin fimbriate, isolated beside the staminate flowers; resin secreted darkish, over all the resiniferous bractlets. **Staminate flowers** ca. 6 mm long; sepals 6, ca. 2 × 1 mm, widely lanceolate, vinaceous; staminate column elongated beyond the sepal tips after anthesis; stamens more than 30; bithecate anthers. **Pistillate cymule** 3-flowered, subsessile, glabrous; pistillate bracteoles 1–3, 2–3 × 2.5–4 mm, widely ovate to very widely ovate, margin irregular to ciliate, without glandular trichomes. **Pistillate flowers** 0.7–1.1 cm long, pedicel sub-sessile; sepals 12, free, 5–7 × ca. 1 mm, pinnatifid, pubescent to villous, margin with eglandular trichomes, sparse; ovary ca. 0.5 × 0.5 mm, trilobular, glabrous; stylar column 0.7–1.2 × ca. 0.1 cm, greenish; style tips not moderately down-curved, stigma crateriform to slightly lobed, yellow. **Capsule** ca. 1 × 1.3–1.5 cm, dark brown, glabrous, sepal in fruit 1–1.2 × ca. 0.05 cm, columella ca. 0.5 cm long. **Seeds** ca. 5 × 5 mm, oblong, rugose, grayish, macules brownish.

Distribution – *Dalechampia seccoi* is recorded until this moment to the municipality of Alegre, Espírito Santo, Southeast Brazil, specifically in the Parque Estadual da Cachoeira da Fumaça (PECF), see Figure 4.

Habitat and ecology – The species occurs in Semideciduous Seasonal Forest vegetation, growing in edge areas in hillside forests with altitudes ranging from 663 to 700 m (Fig. 4). According to Borges and Azevedo (2017) the PECF is composed by several phytophysionomies, such as rocky vegetation, herbaceous swamp, fragments in the

initial, medium and advanced stage of regeneration, exotic vegetation and agriculture areas. In addition, the presence of several exotic species, with high invasive potential, present threats to the conservation of native species of the PECF vegetation that has environments in regeneration.

Due to the vegetational similarity, we believe that the species also occur in other isolated forest areas along the Caparaó region. New expeditions should be conducted to better explore the region in search of new records, mainly in the Reserva Particular do Patrimônio Natural da Cachoeira da Fumaça in the municipality of Ibitirama, located close to the area where the species occurs.

Phenology – *Dalechampia seccoi* was collected with flowers in August and November and with fruits in August.

Etymology – The specific epithet honors Dr. Ricardo de S. Secco, renowned botanist at the Museu Paraense Emílio Goeldi, who contributes significantly to knowledge of the Amazonian flora, as well as of the whole of Brazil, specifically the Euphorbiaceae family, and who greatly assists in the formation of stimulating human resources Euphorbiologists.

IUCN preliminary conservation assessment – *Dalechampia seccoi* is known for only two records in the same locality, with an area of occupancy (AOO) of 4 km² in which habitat fragmentation is the main threat observed. The fragmentation indicates a decline in habitat quality and a decline in extent of occurrence and area of occupation. The unique known populations are protected by the PECF, which is a conservation unit, but not fully protected because tourist activities are allowed. Based on the geographic criteria B1ab (i,ii,iii) and knowing the threats, we propose that if a formal assessment were performed *D. seccoi* would probably be evaluated as Critically Endangered (CR).

Additional material examined (paratype). BRAZIL. Espírito Santo: Alegre, 20°37'25"S, 41°36'21"W, 663 m, 21 Nov 2020, fl, J.C.R. Mendes et al. 790 (MBML, PEUFR).

Key to *Dalechampia seccoi* and morphologically similar species

1. Involucral bracts pinkish to magenta 2
- 1'. Involucral bracts greenish 4
2. Leaves compound (3-foliolate); pistillate sepals pinkish **D. purpurata**
- 2'. Leaves simple (deeply 5-lobed); pistillate sepals light green 3
3. Involucral bracts 4–5-lobed; stigma yellow; restricted geographic distribution to Southeastern **D. seccoi**
- 3'. Involucral bracts deeply 3-lobed; stigma reddish; restricted geographic distribution to Central-West **D. violacea**
4. Leaves compound (5-foliolate); involucral bracts 3-5 lobed; bracteal stipule deltoid; pistillate sepals 6, entire **D. pentaphylla**
- 4'. Leaves simple (deeply 5-lobed); involucral bracts exclusively 3-lobed; bracteal stipule lanceolate; pistillate sepals 12, pinnatifid or lacinate 5
5. Staminate sepals greenish; stigma clavate, greenish in the upper half of the stylar column after pollination **D. alata**
- 5'. Staminate sepals pinkish; stigma slightly lobate, reddish in the upper half of the stylar column after pollination **D. erythrostyla**



Dalechampia seccoi (Euphorbiaceae), a threatened new species from Southeastern Brazil

Taxonomic notes for D. seccoi and related species: a morphological inference

Currently, the section *Dioscoreifoliae* comprises 26 species (Webster & Armbruster 1991; Athiê-Souza *et al.* 2019), which present morphological variation in the

leaves being simple (unlobed and palmately lobed) and compound. However, the three types rarely coexist in the same species, as occurs in *Dalechampia* sect. *Dalechampia* and *Dalechampia* sect. *Tiliifoliae* G.L. Webster & Armbr. (Webster & Armbruster, 1991). In addition, the section *Dioscoreifoliae* presents involucre bracts diverse in

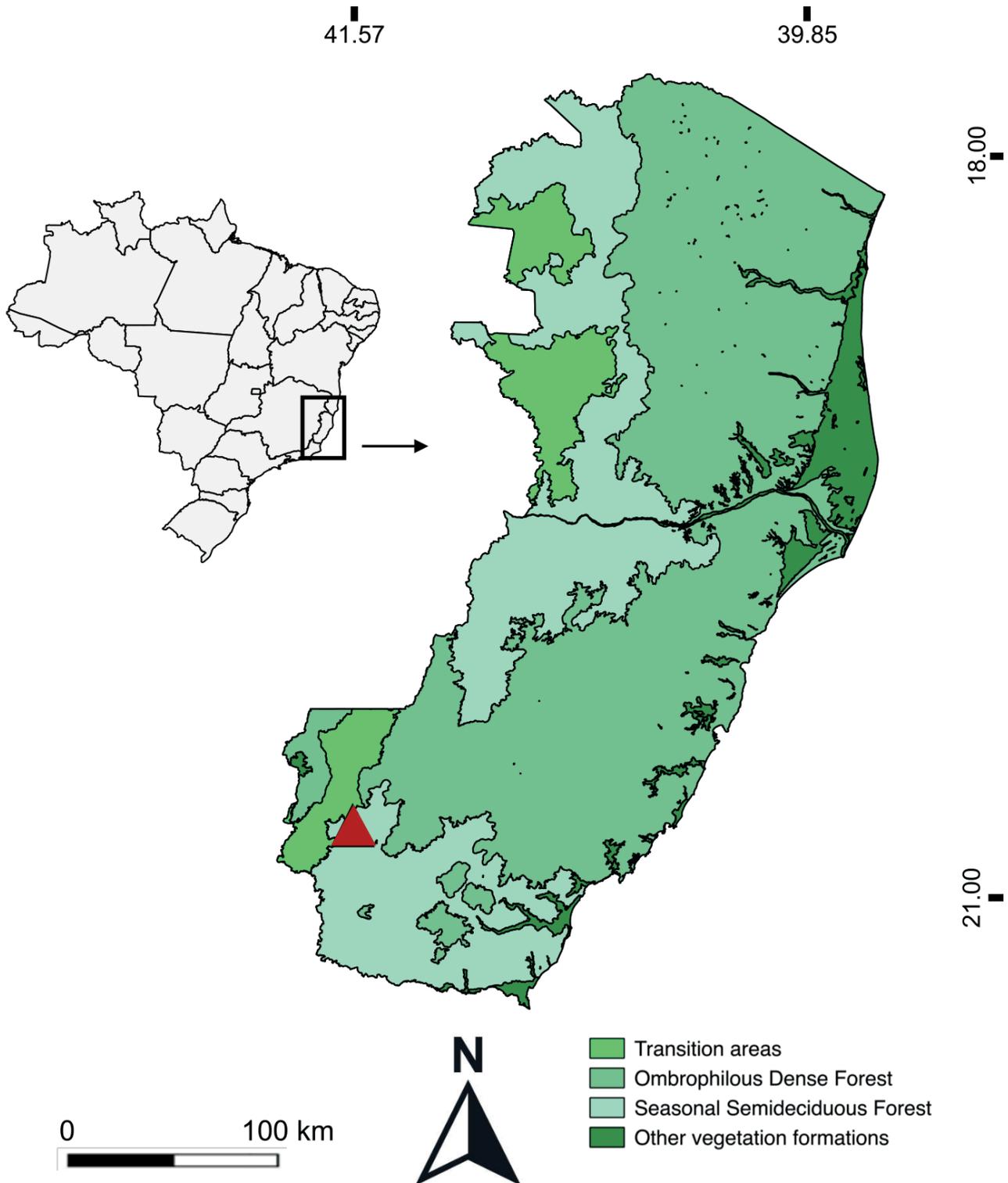


Figure 4. Distribution map of *Dalechampia seccoi*, represented by red triangle in Espírito Santo state (Brazil).



color, but the most are pinkish, magenta or purplish, as *D. aristolochiifolia* Kunth, *D. colorata* (Pereira-Silva *et al.* 2018), *D. cujabensis* Müll.Arg., *D. dioscoreifolia* Poepp. (Mendes *et al.* 2020), *D. erythrostyla*, *D. magnoliifolia* Müll. Arg., *D. purpurata*, and *D. violacea*, for example.

The section *Dioscoreifoliae* is subdivided into five informal groups, named 1 to 5 that are differentiated by the shape of leaves and number of pistillate sepals (6–12, entire, bifid, lacinate or pinnatifid), as well as the shape of stylar column apex, including the texture of seeds (Webster & Armbruster 1991). We analyzed the five informal groups, and based in morphological data, here *D. seccoi* is included in the group 4, mainly due the number and shape of pistillate sepals (12, pinnatifid) and stylar column apically dilated.

Dalechampia seccoi was mentioned as possible new species in Mendes *et al.* (2022) can be confused with

D. alata, *D. erythrostyla*, *D. pentaphylla*, *D. purpurata* and *D. violacea* by the involucre bracts pink, magenta or purplish (Table 1 and Figure 5A–F). *Dalechampia seccoi*, *D. alata* and *D. erythrostyla* are similar by the leaf blades deeply 5-lobed but can be distinguished by the involucre bracts 4–5-lobed, pinkish (Fig. 5A), staminate sepals vinaceous and stigma yellow [vs. involucre bracts 3-lobed, green in *D. alata* and *D. erythrostyla*, staminate sepals and stigma green in *D. alata* (Fig. 5B) and staminate sepals pinkish and stigma green and becoming reddish in the upper half in *D. erythrostyla* after pollination (Fig. 5C)] (see Pereira-Silva *et al.* 2016).

Although *Dalechampia pentaphylla*, *D. purpurata* and *D. violacea* compound present leaves (3–5-foliolate) they also can be confused with *D. seccoi* (leaves deeply 5-lobed). Therefore, the new species can be differentiated from

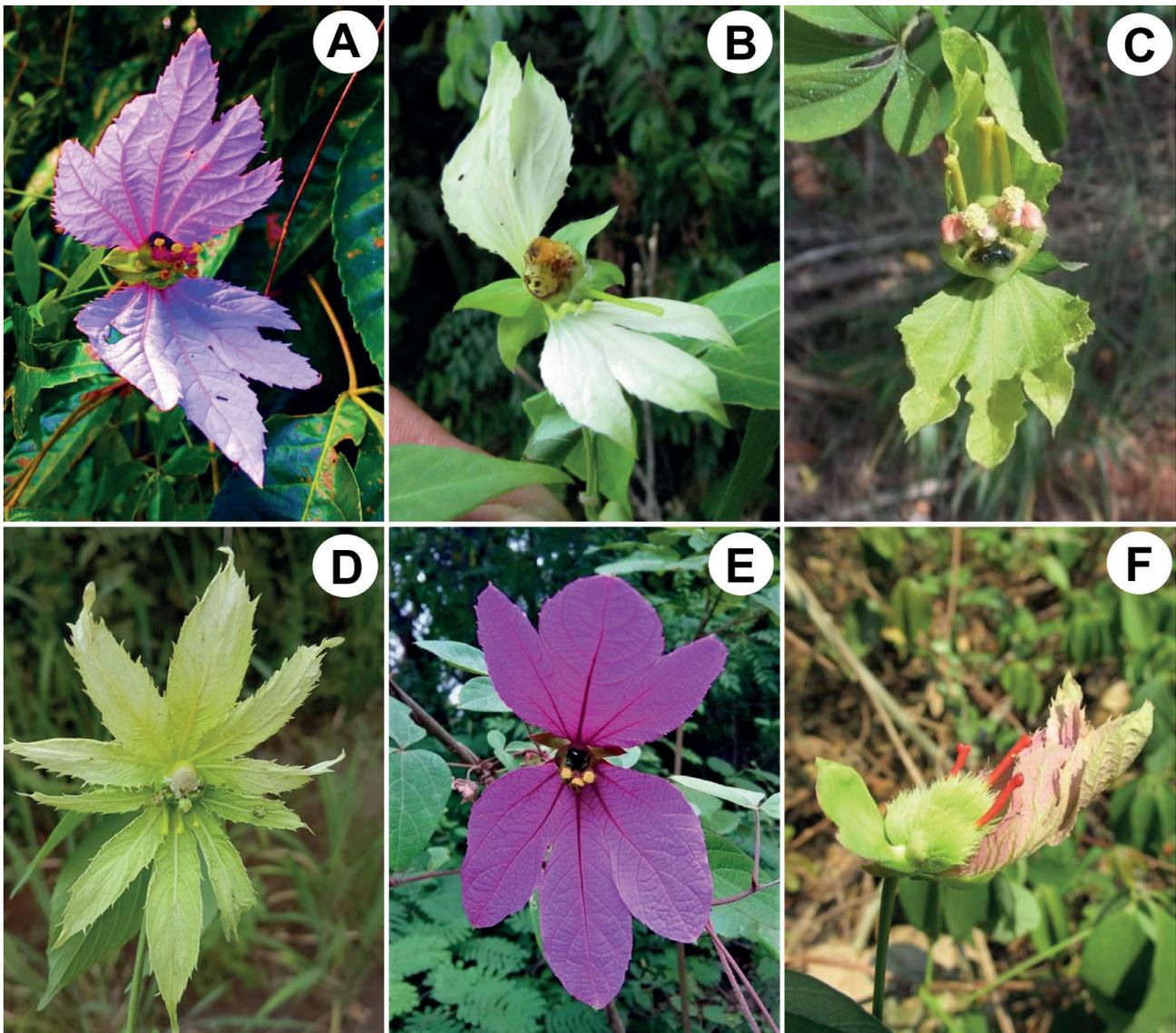


Figure 5. Involucre bracts of congeneric species with deeply 5-lobed or 3-5-foliolate leaves belonging to the *Dioscoreifoliae* section. **A.** *Dalechampia seccoi*. **B.** *Dalechampia alata*. **C.** *Dalechampia erythrostyla*. **D.** *Dalechampia pentaphylla*. **E.** *Dalechampia purpurata*. **F.** *Dalechampia violacea*. (Photographs: A. Filipe Leite; B. João Zorzanelli; C–F. Rafaela Pereira-Silva; D. Felipe Amorim; E. Eduardo Saar).

D. pentaphylla (Fig. 5D) by having involucre bracts 4–5-lobed, pinkish and 12 pistillate sepals pinnatifid (vs. involucre bracts 5 (–3)-deeply lobed, greenish and 6 pistillate sepals entire, respectively). The colors of the involucre bracts of *D. purpurata* (Fig. 5E) and *D. violacea* (Fig. 5F) are similar to *D. seccoii* that differs of *D. purpurata* by having involucre bracts 4–5-lobed, pinkish, staminate sepals vinaceous and stigma yellow (vs. involucre bracts 3-lobed, magenta, staminate sepals dark purple and stigma greenish, respectively).

Dalechampia violacea differs of the new species by presenting involucre bracts deeply 3-lobed, pistillate sepals fimbriate, stylar column and stigma reddish. The pistillate sepals of *D. violacea* have an irregularly dentate apex and never lobed, which we treat here as fimbriate. Even so, worth mentioning that stigmatic surface of *Dalechampia* can be useful to differentiate some species according to Webster & Armbruster (1991), in some representatives, the style column is notable for having longitudinal bands of stigmatic surfaces running halfway or more towards the base. In the case of *D. erythrostyla* (Pereira-Silva *et al.* 2016) and *D. violacea* (Mendes *et al.* 2020) these stigmatic surfaces run up to the middle of the stylar column and become reddish. While in other species of the section, as in *D. seccoii*, the longitudinal bands of the stigmatic surfaces can be shorter and yellow in color.

Another important aspect among the species correlated to *D. seccoii* is the geographic distribution, where *D. pentaphylla* has a wide distribution in Brazil (Central-West, Northeast, Southeastern and South), reaching Paraguay and *D. alata* occurs in Northeast and Southeastern of Brazil (Webster & Armbruster 1991; Mendes *et al.* 2022). *Dalechampia seccoii*, *D. erythrostyla*, *D. purpurata* and *D. violacea* present a restrict geographical distribution in the country, being *D. seccoii* in the Southeastern region, while *D. erythrostyla* and *D. purpurata* are listed to the Northeast, and *D. violacea* to the Central-West.

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