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Flora of Espírito Santo, Brazil

Synoptic treatment of *Dalechampia* (Euphorbiaceae) from Espírito Santo, Brazil: distribution, morphology, illustration and new occurrences

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Abstract

Euphorbiaceae is one of the largest and more complex families of angiosperms with 6,745 species and 218 genera. *Dalechampia* comprises approximately 130 species, with pantropical distribution, the genus presents pseudantial inflorescence with bilateral symmetry, and this characteristic differs from the others taxons in the family. Were registered 15 *Dalechampia* species for Espiríto Santo, of which *D. margarethiae* until then, it was endemic of state recording here a new occurrence for the state of Minas Gerais. *Dalechampia leandrii*, *D. micromeria*, and *D. stipulacea* constitute new records for the state. After expeditions in the field to observe and collect samples, bibliographic revision, and examination of herbarium specimens, we present a synopsis of *Dalechampia* from Espirito Santo state, in which we provide morphological illustration, an identification key, distribution maps, and comments about each taxon.

Key words: Dalechampiinae, flora, taxonomy, twining vines.

Resumo

Euphorbiaceae é uma das maiores e mais complexas famílias de angiospermas com 6.745 espécies e 218 gêneros. *Dalechampia* compreende aproximadamente 130 espécies, com distribuição pantropical. *Dalechampia* apresenta inflorescência pseudantial com simetria bilateral, característica esta que difere o gênero dos demais da família. Foram registradas 15 espécies de *Dalechampia* para o Espírito Santo, das quais *D. margarethiae* até então, era endêmica do estado, e aqui registramos uma nova ocorrência para o estado de Minas Gerais. *Dalechampia leandrii*, *D. micromeria* e *D. stipulacea* constituem novos registros para o estado. Após expedições em campo para observação e coleta de amostras, revisão bibliográfica e análise de espécimes de herbário, nós apresentamos uma sinopse de *Dalechampia* do Espírito Santo, na qual fornecemos ilustração morfológica, chave de identificação, mapas de distribuição e comentários sobre cada táxon.

Palavras-chave: Dalechampiinae, flora, taxonomia, trepadeiras.

Introduction

Euphorbiaceae Juss. is one of the largest and most complex families of Angiosperms (Webster 1994; Wurdack *et al.* 2005) with about 6,745 species and 218 genera (APG IV 2016). It presents greater diversity in tropical and subtropical regions, especially in the American and African continents (Lucena *et al.* 2009). Based on molecular studies (Chase *et al.* 2002; Wurdack *et al.* 2005; Davis *et al.* 2007; Wurdack & Davis 2009), Euphorbiaceae *s.s.* was classified into four subfamilies: Acalyphoideae, Cheilosoideae, Crotonoideae and Euphorbioideae.

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Acalyphoideae comprises 20 tribes, 99 genera, and approximately 1,865 species (Webster 1975, 1994; APG IV 2016). The genera with the highest species richness in the subfamily are: *Acalypha* (430 species), *Macaranga* (260), *Tragia* (170), *Dalechampia* (ca.130), *Mallotus* (115), *Claoxylon* (80), *Bernardia* (50) and *Ditaxis* (45) (APG IV 2016). Among the tribes of Acalyphoideae, Plukenetieae deserves to be highlighted because it comprises 17 genera and more than 350 species widely distributed in tropical regions (Gillespie 1994; Webster 1994; Govaerts *et al.* 2000; Radcliffe-Smith 2001).

According to Webster (1994, 2014), Plukenetieae comprises the subtribes Dalechampiinae, Plukenetiinae and Tragiinae. Dalechampiinae contains only *Dalechampia*, classified into six sections and approximately 130 species with Pantropical distribution (Webster 1994; Pereira-Silva *et al.* in prep.). In Brazil, ca. 72 species are registered, of which 48 are endemic (Pereira-Silva *et al.* 2020a). According to Pereira-Silva *et al.* (2020a), in Espírito Santo state, 10 species of the genus are registered, however information on the distribution of taxa in this state is scarce. *Dalechampia* is the unique genus of Euphorbiaceae that presents pseudantial inflorescence with bilateral symmetry, thus it is easy to identify the genus, although identification at a specific level is difficult (Pax & Hoffmann 1919; Webster & Armbruster 1991; Webster 1994; Souza *et al.* 2010).

Many studies have been conducted by Pereira-Silva in Madagascar and Neotropical region, as well as by Mendes *et al.* (2021) in Amazon beyond the discovery of new species (Pereira-Silva *et al.* 2016, 2019, 2020b, 2020c, in prep.; Athiê-Souza *et al.* 2019; Pereira-Silva 2019; Mendes *et al.* 2019, 2020, 2021). Thus, as part of the studies in Neotropical *Dalechampia* (Pereira-Silva *et al.* in prep.), here we present a synopsis of the species occurring in the Espírito Santo state, as well as an identification key, character illustration, distribution maps, and comments about each taxon.

Materials and Methods

Study area

The Espírito Santo state is located in the southeastern region of Brazil and comprises an area of 97,123 km^2 (IBGE 2018). It presents quite rugged relief and altitudes that range from sea level in the eastern portion of the state to 2,897 meters at Pico da Bandeira, one of the highest points in Brazil. The entire state is covered by the phytogeographic domain Mata Atlântica, and due to the tremendous altitudinal variation, geological formation, and climatic variables, the state has a high diversity of vegetation formations (IBGE 2004; Garbin *et al.* 2017). Here we will follow the classification proposed by Fraga *et al.* 2019 (with one modification, we used the regional term Campos Nativos instead of Campinarana, like Garbin *et al.* 2017), where the state's vegetation is classified in Seasonal Semideciduous Forest (Fig. 1a), Ombrophilous Dense Forest (Fig. 1b), Ecological Refuges (including Hight Grassland) (Fig. 1c, e), Pioneer Formations (Fig. 1d), Campos Nativos (Fig. 1f), and transition areas.

The climate in the state has two well-defined areas, the low altitude region predominates high temperatures and a pronounced seasonality in winter, while in the region of altitudes above 1,000 meters, the temperatures are milder, and there is not defined seasonality (Alvares *et al.* 2014). The Espírito Santo state has ten Conservation Units (UCs) in the Integral Protection category, with six state Parks, two natural monuments, a National Park, a Biological Reserve, and a Private Reserve of National Heritage (IEMA 2021).

Synopsis Treatment

The preparation of this synopsis was based on field expeditions, bibliographic consultations, review of collections of national and international herbariums, mainly the state herbariums CVRD, MBML, and VIES (acronyms according to Thiers, continuously updated) in physical and virtual form, resulting in the analysis about of 100 specimens. The spelling of the taxon authors follows the International Index of Plant Names - IPNI (<https://www.ipni.org/>), while the systematic arrangement and morphology are based on Webster & Armbruster (1991) and Pereira-Silva *et al.* (2020d).

The identification of the specimens and the identification key was carried out with the aid of specific bibliography, information collected in the field, and herbarium specimens. Specimen analyses were performed with a digital caliper and stereomicroscope. The distribution map was generated in QGis v. 2.18.2 (QGIS Development Team 2017).

Results and Discussion

In Espírito Santo, *Dalechampia* is represented by 15 species, classified into three sections and three subsections (Tab. 1). *Dalechampia margarethiae* Pereira-Silva & Armbr. which until then was endemic to Espírito Santo, was recorded for Minas Gerais state, while *D. leandrii* Baill., *D. micromeria* Baill. and *D. stipulacea* Müll.Arg. constitute new records for the state. Pereira-Silva *et al.* (2020a), mention the occurrence of *D. sylvestris* S. Moore erroneously for Espirito Santo and Webster & Armbruster (1991), they mention *D. armbrusteri* Webster, since none of the specimens were found, these species were excluded from this synopsis.

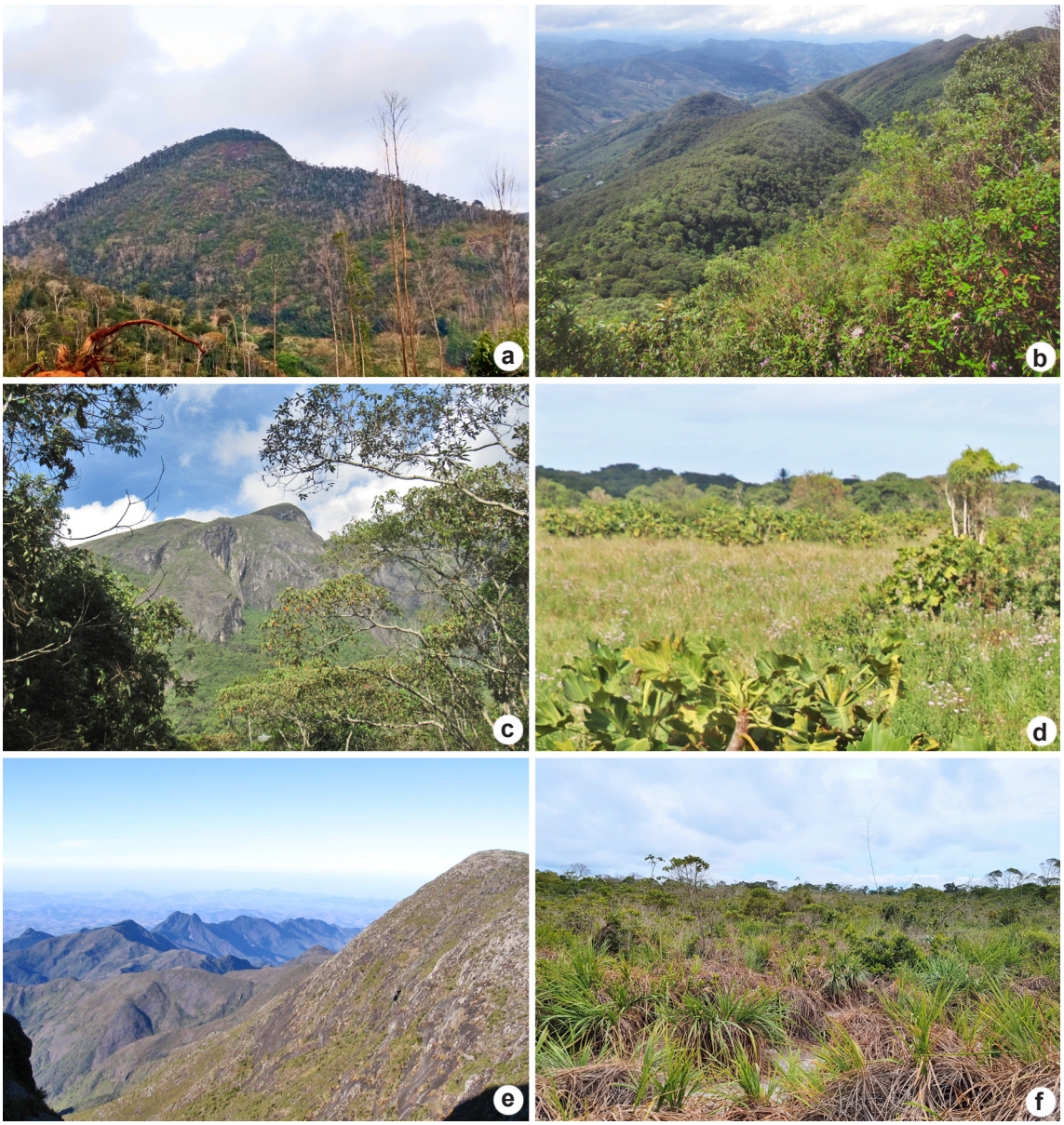

Figure 1 – a-f. Different types of vegetation found in the state of Espírito Santo – a. seasonal semideciduous forest in the municipality of Marilândia; b. ombrophilous dense forest in Parque Nacional do Caparaó; c. ecological refuge (High Grassland) in Parque Nacional do Caparaó; d. pioneer formations in the municipality of Linhares; e. aspect of a stretch of ecological refuge in Parque Nacional do Caparaó; f. *Campos Nativos* in Natural Reserva Vale (Photos: a. Narcísio Bigio; b-c. Guilherme Peres Coelho; d. Josimar Külkamp; e. Lucas Daneu; f. Karinne Valdemarin).

Table 1 – *Dalechampia* species with occurrence in Espírito Santo state, Brazil.

Táxon
Sect. *Dalechampia*
Subsect. *Convolvuloides* G.L.Webster & Armbr.
Dalechampia convolvuloides Lam.
Dalechampia leandrii Baill.
Subsect. *Dalechampia*
Dalechampia brasiliensis Lam.
Dalechampia ficifolia Lam.
Dalechampia stipulacea Müll.Arg.
Dalechampia viridissima Webster
Subsect. *Triphyllae* (Pax & K.Hoffm.) G.L.Webster & Armbr.
Dalechampia clausseniana Baill.
Dalechampia micromeria Baill.
Dalechampia triphylla Lam.
Sect. *Dioscoreifoliae* Pax & K.Hoffm.
Dalechampia alata Müll.Arg.
Dalechampia margarethiae Pereira-Silva & Armbr.
Dalechampia peckoltiana Müll.Arg.
Dalechampia pentaphylla Lam.
Dalechampia sp.
Sect. *Tiliifoliae* G.L.Webster & Armbr.
Dalechampia ilheotica Wawra

Previously some specimens (*e.g.*, B.S. Mendes *et al.* 177 & 186; B.N. Melo *et al.* 78; H.Q.B. Fernandes *et al.* 3328; A. Alves-Araújo *et al.* 1638) were identified as *D. scandens* L., but here we recognized the specimens of the collector number [177, 186, 78] as *D. peckoltiana* Müll.Arg., the number [3328] as *D. brasiliensis* Lam. and [1638] as *D. ficifolia* Lam., thus excluding the occurrence of *D. scandens* for the state. *Dalechampia ficifolia* (29 specimens), *D. peckoltiana* (20), *D. brasiliensis* (13), *D. margarethiae* (12) and *D. pentaphylla* Lam. (9), in this order, they are the most representative species.

Dalechampia species are distributed throughout Espirito Santo and in almost all vegetations. Ombrophilous Dense Forest has the most significant number of *Dalechampia* species registered, 13 species (*D. alata*, *D. brasiliensis*, *D. clausseniana*, *D. convolvuloides*, *D. ficifolia*, *D. ilheotica*, *D. leandrii*, *D. margarethiae*, *D. peckoltiana*, *D. pentaphylla*, *D. stipulacea*, *D. triphylla* and *D. viridissima*), following by Pioneer Formations with ten species (*D. brasiliensis*, *D. clausseniana*, *D. convolvuloides*, *D. ficifolia*, *D. ilheotica*, *D. leandrii*, *D. margarethiae*, *D. micromeria*, *D. peckoltiana* and *D. stipulacea*); the Seasonal Semideciduous Forest six species (*D. brasiliensis*, *D. clausseniana*, *D. ficifolia*, *D. peckoltiana*, *D. triphylla* and *Dalechampia* sp.); the transition areas with four species (*D. brasiliensis*, *D. ficifolia*, *D. peckoltiana* and *D. pentaphylla*); while the Ecological Refuges and Campos Nativos there is no records of collections (Fig. 2).

We found four species collected in six different UCs (Tab. 2), the most frequent is *D. ficifolia.* We point out that in Espírito Santo there are no endangered *Dalechampia* species (Fraga *et al.* 2019).

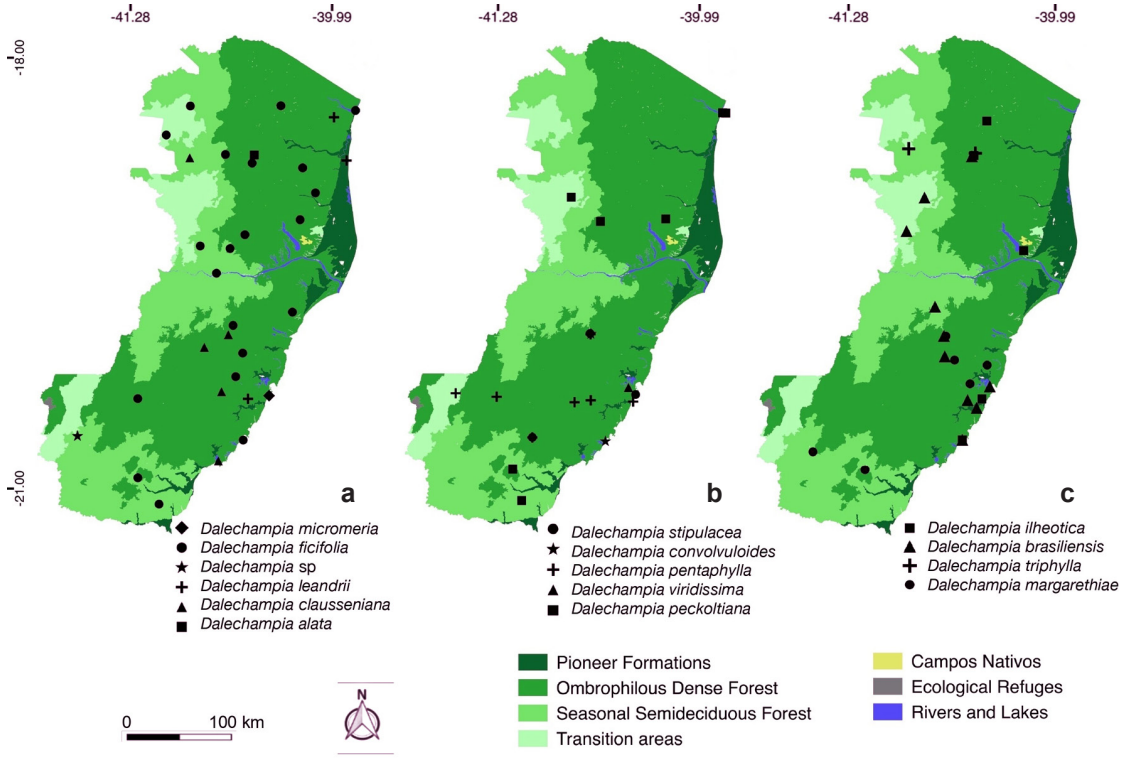

Figure 2 – a-c. Geographic distribution of *Dalechampia* species in Espírito Santo state – a. *Dalechampia micromeria*, *D. ficifolia*, *D.* sp, *D. leandrii*, *D. clausseniana*, *D. alata*; b. *D. stipulacea*, *D. convolvuloides*, *D. pentaphylla*, *D. viridissima*, *D. peckoltiana*; c. *D. ilheotica*, *D. brasiliensis*, *D. triphylla*, *D. margarethiae*.

Relevant morphological aspects in the identification of the taxa

Vegetative characters

The species registered for the Espírito Santo are twining vines or lianas (Fig. 3a), although there is a notable variation in habit, such as erect or decumbent subshrubs, these are not found in the state, however they are quite common in the region Central-West of Brazil (Webster & Armbruster 1991; Pereira-Silva in prep.; Pereira-Silva *et al.* 2020c). The branches are generally striated, angular, cylindrical, and are glabrescent, pubescent, villous, or hirsute (Fig. 3b), sometimes ferruginous as in *D. ficifolia* (Fig. 3c). The stipules are linear, lanceolate or oblong to rounded shape (Fig. 3d), and *D. stipulacea* (Fig. 3e) present glandular trichomes on the margins and commonly parastipules.

Table 2 – Species that occur in protected áreas.

Conservation unit	**Species**
Biological Reserve Augusto Ruschi	*Dalechampia ficifolia*
Biological Reserve of Córrego Grande	*Dalechampia ficifolia*
Biological Reserve Duas Bocas	*Dalechampia margarethiae*
National Park of Caparaó	*Dalechampia pentaphylla*
Natural Reserve Vale	*Dalechampia ficifolia, Dalechampia peckoltiana*
State Park of Itaúnas	*Dalechampia ficifolia, Dalechampia peckoltiana*

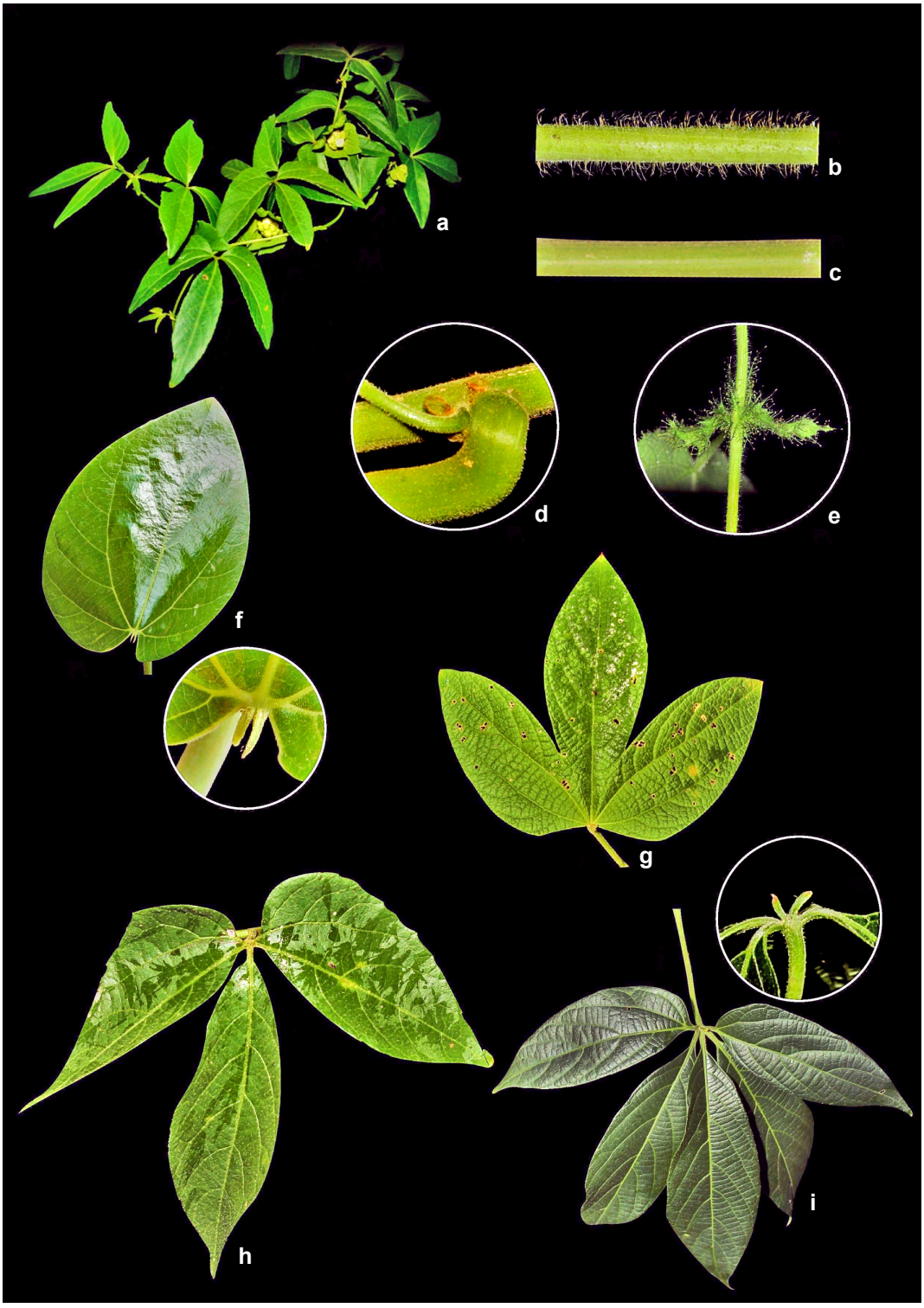

Figure 3 – a-i. Vegetative characters of *Dalechampia* species found in Espírito Santo state – a. habit of *D. micromeria*; b. branches of *D. clausseniana*; c. branches of *D. ficifolia*; d. bracteal stipule of *D. ficifolia*; e. bracteal stipule of *D. stipulacea*; f. leaf unilobed of *D. ilheotica* with details the stipels on the base; g. leaf 3-lobed of *D. brasiliensis*; h. leaf 3-foliolate of *D. clausseniana*; i. leaf 5-foliolate of *D. pentaphylla* with details the stipels on the base. (Photos: a. Alexandre Medeiros; b,e. Otávio Marques; c,d,g,h,i. Josimar Külkamp; f. Alex Popovkin).

The leaves are simple, unilobed (Fig. 3f) to 3-lobed (Fig. 3g), as well as they can vary from unilobed to (2) 3-lobed in the same branch and compound 3–5-foliolate (Fig. 3h-i). Leaflets present acute, rounded, or caudate apex and attenuated, corded or oblique base. Margins are entire to serrated and sometimes with glandular trichomes as in *D. stipulacea*. On the base of leaves there is a pair of stipels, with a linear shape (see detail of Fig. 3f), oblong or lanceolate (see detail of Fig. 3i), most are pubescent, with glands on margins or bases, sometimes deciduous and are present in all species of the genus (Pereira-Silva 2019).

The species present simple trichomes, unicellular, stinging or glandular (Webster & Armbruster 1991). Most of the species show stinging trichomes; the glandular trichomes are less common and easily visible, thus presenting great taxonomic importance for *D. stipulacea*.

Reproductive characters

In *Dalechampia* the pseudantial inflorescence are usually colored, composed of a pleiochasium and pistillate cymule, as well as a resin gland (Fig. 4a,d) (Armbruster 1996; Pereira-Silva *et al.* 2020c). The species registered in this study present greenish, whitish, creamy, or pink to purplish involucral bracts; entire, 3-spit, 3-lobed, 3-toothed or deeply 3–5-lobed (see Figs. 4-6). Each bract has a pair of stipules clearly homologous to the leaves, with different shapes (Fig. 3b).

The staminate pleiochasium is more complex than pistillate (Webster & Armbruster 1991). The taxa studied here present staminate bracteole free, connates to bilabiate or fused at the base and contain 7–15 staminate flowers, plus an adjacent resin gland (Fig. 4c,d). In the *Convolvuloides* and *Dalechampia* sections, the resin gland is laminar with entire apex, while in the *Dioscoreifoliae* section it is fimbriated, and in the *Tiliifoliae* section the gland is laminar with fimbriated or lacerated apex (Webster 1989; Pereira-Silva in prep.).

The pistillate cimules, typically in a contracted 3-flowered (Fig. 4e) with 1–3 bracteoles, 1 more external and two internal, with different shapes, which protect the three pistillate flowers. Each pistillate flower possesses 6–12 lanceolate sepals, often pinnatifid, glandular trichomes on the margins or rarely entire margins. The apex of the stylar column most common are lobed, discoid, dilated, peltate, and terete, in addition variations of these shapes are found in *D. hassleriana* which is unilaterally dilated.

The fruits (Fig. 4f) are capsules with explosive dehiscence (Gillespie & Armbruster 1997), with stylar column and sepals persistent, the involucral bract is rarely persistent (Fig. 4g). Finally, the seeds of the Brazilian *Dalechampia* are often globose to subglobose (Pereira-Silva *et al.* 2020a), rarely apiculate as in *D. macrobractea* R.A. Pereira-Silva & Armbr. an African species (Pereira-Siva *et al.* 2020d).

Key to *Dalechampia* species from Espírito Santo state

1. Leaves simple 2
   2. Leaves unlobed 3
      3. Involucral bracts deeply 3–5-lobed; 6 pistillate sepals, entire ..... 8. *Dalechampia margarethiae*
      3’. Involucral bracts unlobed to moderately 3-lobed or 3-toothed; 12 pistillate sepals, pinnatifid or laciniate 4
         4. Involucral bracts velutinous; resiniferous gland lacerate ..... 6. *Dalechampia ilheotica*
         4’. Involucral bracts hirsute or sparsely pubescent; resiniferous gland laminar 5
            5. Leaves cordiform; bracteal stipule ovate; apex of the stylar column discoid ..... 4. *Dalechampia convolvuloides*
            5’. Leaves ovate; bracteal stipule lanceolate; apex of stylar column slightly lobed ..... 7. *Dalechampia leandrii*
   2’. Leaves lobed 6
      6. Leaves 3-lobed or varying between unlobed to 3-lobed 7
         7. Involucral bracts unlobed (rarely 2–3-lobed); resiniferous gland lacerate ..... 6. *Dalechampia ilheotica*
         7’. Involucral bracts exclusively 3-lobed; resiniferous gland laminar 8

8. Pistillate sepals sub entire; apex of stylar column unlobed to slightly lobed..... .....14. *Dalechampia viridissima*
8'. Pistillate sepals pinnatifid; apex of stylar column discoid or lobed 9
9. Parastipules present on the petiolar stipule; stipitate glandular trichomes present in the margin of petiolar stipules, leaf and, involucral bracts ....12. *Dalechampia stipulacea*
9'. Parastipules absent on the petiolar stipule; stipitate glandular trichomes absent in the margin of petiolar stipules, leaf and, involucral bracts 10
10. Villous branches; membranaceous leaves; oblong to ovate leaves; lanceolate stipules; stylar column 4–5 mm long, apex lobed..... .....2. *Dalechampia brasiliensis*
10'. Pubescent branches; chartaceous or coriaceous leaves; rounded to oblong stipules; stylar column 7–9 mm long, apex discoid to 3-lobed..... ..... 5. *Dalechampia ficifolia*
6'. Leaves deeply 5-lobed 11
11. Involucral bracts pink to purplish; stigma crateriform.....15. *Dalechampia* sp.
11'. Involucral bracts greenish; stigma clavate ..... 1. *Dalechampia alata*
1'. Leaves compound .....12.
12. Leaves 3-foliolate.....13
13. Pistillate flowers with 6 sepals 14
14. Involucral bracts more than 4 cm long; pistillate sepals, lanceolate..... .....10. *Dalechampia peckoltiana*
14'. Involucral bracts 2−2.4 cm long; pistillate sepals pinnatifid..... .....13. *Dalechampia triphylla*
13'. Pistillate flowers with 7–12 sepals 15
15. Leaflet 0.5–0.7 cm wide; involucral bracts moderately 3-toothed; apex of the stylar column cylindrical.....9. *Dalechampia micromeria*
15'. Leaflet 2–3.5 cm wide; involucral bracts moderately 3-lobed; apex of stylar column unilaterally dilated.....3. *Dalechampia clausseniana*
12'. Leaves 5-foliolate.....11. *Dalechampia pentaphylla*

Dalechampia L., Species Plantarum, 2: 1054. 1753. Type: *Dalechampia scandens* L.

1. *Dalechampia alata* Müll.Arg. Linnaea 34: 220. 1865. Fig. 5a

Dalechampia alata is easily recognized by its pistillate sepals laciniate, and clavate stigma. However, it is very close to *D. pentaphylla* (Pereira-Silva *et al.* 2020c). *Dalechampia pentaphylla* and *D. alata* have similar shaped leaves. However, *D. alata* has deeply 5-lobed leaves (*vs.* 5-foliolate), involucral bracts 3-lobed (*vs.* 3–5 deeply lobed), pistillate sepals laciniate (*vs*. pinnatifid), and apex of stigma clavate (*vs.* terete).

Selected specimens: Santa Teresa, 19.VII.2000, fl. and fr., *A.P. Fontana et al. 21* (MBML).

Dalechampia alata are endemic of Brazil, registered in the Northeast (Bahia, Pernambuco), and Southeast (Espírito Santo, Rio de Janeiro, São Paulo (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). In Espírito Santo has one record in the northern region, occurring in the Ombrophilous Dense Forest vegetation (Fig. 2a), growing on the forest edges.

2. *Dalechampia brasiliensis* Lam., Méthodique, Botanique 2: 258. 1786. Fig. 5b

Dalechampia brasiliensis is characterized by villous branches and linear bracteal stipules. In state, *D. brasiliensis* is morphologically similar to *D. ficifolia,* both present simple leaves, 3-lobed and involucral bracts 3-lobed, pale greenish. *Dalechampia brasiliensis* has villous branches (*vs.* pubescent), lanceolate stipules (*vs.* rounded to oblong), membranaceous leaves (*vs.* chartaceous or leathery), oblong to ovate leaves (*vs.* linear), and apex of the lobed stigma (*vs.* discoid to 3-lobed). *Dalechampia brasiliensis* is popularly known as "cipó de fogo" in Espírito Santo state.

Selected specimens: Santa Leopoldina, 11.IV.2009, fl. and fr., *A.P. Fontana et al. 5869* (MBML).

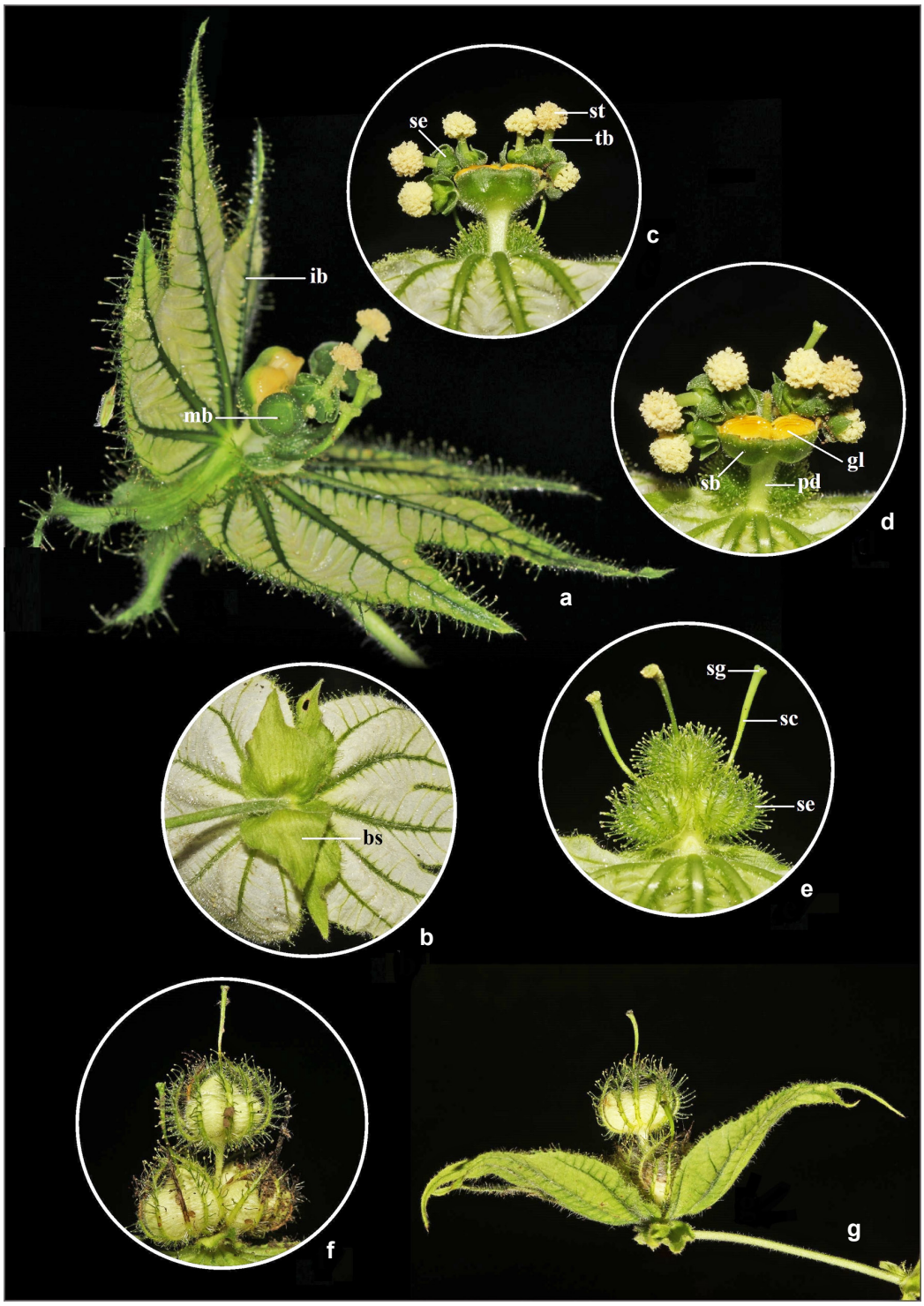

Figure 4 – a-g. Reproductive characters of *Dalechampia stipulacea* found in Espírito Santo state – a. inflorescence (ib = involucral bract; mb = button staminate); b. details of the bracteal stipules (bs); c. staminate pleiochasium (se = sepals; st = stamens; tb = staminal tube); d. staminate pleiochasium with details (pd = peduncle; sb = staminate bracteoles; gl = resiniferous glands); e. pistillate cymule (se = sepals; sc = stylar column; sg = apex); f. fruit; g. fruit with details the presence of bracts, staminate sepals, and the stylar column (Photos: a. Otávio Marques; b,c,d,e,f,g. Josimar Külkamp).

Dalechampia brasiliensis is endemic from Brazil, registered in the Northeast (Paraíba, Pernambuco) and Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo) regions (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). In Espírito Santo, it is distributed in the Ombrophilous Dense Forest, Pioneer Formations, Seasonal Semideciduous Forest, and Transitions Areas (Fig. 2c). This species is widely distributed in the state, growing preferably on the forests edges.

3. *Dalechampia clausseniana* Baill. Adansonia, 5: 310. 1865. Fig. 5c

Dalechampia clausseniana is characterized by compound leaves, 3-foliolate, involucral bracts moderately 3-lobed, and apex of stylar column unilaterally dilated. In Espírito Santo this species is similar to *D. triphylla,* both have 3-foliolate leaves. *Dalechampia clausseniana* is distinguished by 7–12 pistillate sepals pinnatifid (*vs.* widely pinnatifid), the apex of the stylar column unilaterally dilated (*vs.* apex moderately lobed).

Selected specimens: Domingos Martins, 8.II.1973, fl. and fr., *G. Hatschbach et al. 31379* (MBM, US, NY, MO). Santa Teresa, São Lourenço, Mata Fria, 7.IV.1999, fl., *L. Kolmmann et al. 2442* (MBML).

Dalechampia clausseniana are endemic from Brazil, registered in the Central-West (Goiás), and Southeast (Espírito Santo, Rio de Janeiro, and São Paulo) regions (Webster & Armbruster 1991). In Espírito Santo, the species is found in Ombrophilous Dense Forest, Pioneer Formations, Seasonal Semideciduous Forest (Fig. 2a), growing on the forest edges.

4. *Dalechampia convolvuloides* Lam. Encycl. Methodique, Botanique, 2: 256, 1786. Fig. 5d

In Espírito Santo, *D. convolvuloides* is morphologically similar to *D. leandrii* due to unlobed leaves. However, *D. convolvuloides* can be differentiated by cordiform leaves (*vs.* ovate), bracteal stipule ovate (*vs.* lanceolate), and apex of stylar column discoid (*vs.* slightly lobed).

Selected specimens: Santa Teresa, 8.V.1984, fl. and fr., *R.M. Piziolo 52* (MBML).

Dalechampia convolvuloides are endemic from Brazil, registered in Northeast (Bahia) and Southeast (Espírito Santo and Rio de Janeiro) (Webster & Armbruster 1991; Pereira-Silva *et al*. 2020a). In Espírito Santo, the species grows in Pioneer Formation (Guarapari) and in Ombrophilous Dense Forest (Santa Teresa) (Fig. 2b), growing on the forest edges.

5. *Dalechampia ficifolia* Lam., Encyclopédie Méthodique, Botanique 2: 258. 1786. Fig. 5e

Dalechampia ficifolia is characterized by presenting leaves 3-lobed, similar to *D. brasiliensis*. These species can be differentiated by present pubescent branches (*vs.* villous), rounded to oblong stipules (*vs.* lanceolate), chartaceous or leathery leaves (*vs.* membranaceous), linear leaves (*vs.* oblong to ovate), and the apex of the stigma discoid to 3-lobed (*vs.* lobed). This species is popularly known as "cipó urtiga" in Espírito Santo.

Selected specimen: Conceição da Barra, 17.X.2019, fl., *A.F.A. Scheidegger et al. 117* (VIES).

Dalechampia ficifolia is endemic from Brazil and widely distributed. Registered in the regions Central-West (Goiás, Mato Grosso), Northeast (Bahia, Pernambuco), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo), and Southern (Paraná, Santa Catarina) (Webster & Armbruster 1991; Pereira-Silva *et al*. 2020a). In Espírito Santo is the most widely distributed species, occurs in the Ombrophilous Dense Forest, Pioneer Formation, Seasonal Semideciduous Forest, and Transitions Areas (Fig. 2a). This species grows on the forest edges and rocky outcrops.

6. *Dalechampia ilheotica* Wawra, Oesterr. Bot. Z., 13: 222. 1863. Fig. 5f

Dalechampia ilheotica differs from the other species in the state by presenting coriaceous to membranaceous leaves, which can be simple, unlobed to 2–3-lobed in the same individual, prominent veins, besides having velutine involucral bracts, usually with entire apex and apex of the stigma crateriform. This species is known in Espírito Santo as "urtiga branca".

Selected specimen: Vila Velha, 7.II.1975, fl., *M. Sazima & I. Sazima 170* (UEC).

Dalechampia ilheotica are endemic from Brazil, being registered for the Northeast (Bahia, Pernambuco) and Southeast (Espírito Santo) regions (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). In Espírito Santo *D. ilheotica* is restricted in Ombrophilous Dense Forest and Pioneer Formation (Fig. 2c), growing mainly at the forest edges.

7. *Dalechampia leandrii* Baill., Adansonia 5: 315. 1865. Fig. 6a

Dalechampia leandrii is characterized by presenting unilobed leaves with undulate margins and involucral bracts entire to 3-lobed. It is similar to *D. convolvuloides* by ovate leaves

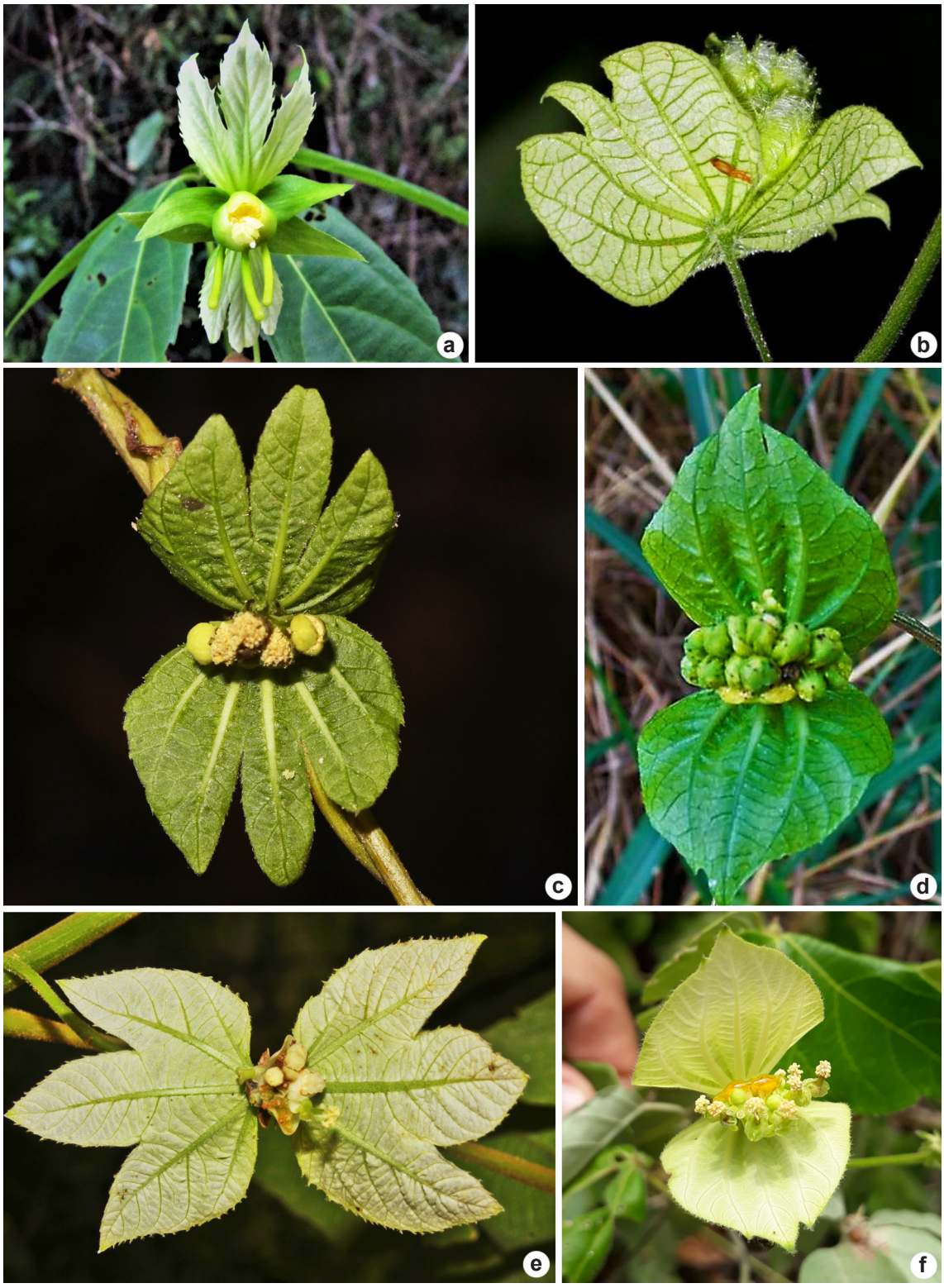

Figure 5 – a-f. Inflorescences of *Dalechampia* species found in Espírito Santo state – a. *D. alata*; b. *D. brasiliensis*; c. *D. clausseniana*; d. *D. convolvuloides*; e. *D. ficifolia*; f. *D. ilheotica* (Photos: a. João Zorzanelli; b,c,e. Josimar Külkamp; d. Rafaela Pereira; f. Jone Mendes).

(*vs*. cordiform), bracteal stipule lanceolate (*vs*. ovate), and apex of stylar column slightly lobed (*vs*. discoid).
Selected specimen: Conceição da Barra, 20.II.2019, fl. and fr., *R. Nichio-Amaral et al. 590* (VIES).

Dalechampia leandrii are endemic from Brazil, registered for the Northeast (Paraíba), Southeast (Espírito Santo, São Paulo, Rio de Janeiro), and Southern (Paraná) regions (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). Here we present the first records of *D. leandrii* for Espírito Santo (Fig. 2a). In the state, it is found in Ombrophilous Dense Forest (Conceição da Barra) and in Pioneer Formation (Gururi and Viana) (Fig. 5a), growing on the forest edges.

8. *Dalechampia margarethiae* Pereira-Silva & Armbr., Systematic Botany 44(4): 832-837. 2019. Fig. 6b

Dalechampia margarethiae is recognized by its leaves unlobed, cordiform, involucral bracts deeply 3–5-lobed usually in the same individual, staminate column not elongated and staminate sepals slightly open after anthesis. *Dalechampia margarethiae* is very similar to *D. peckoltiana* due to the shapes of the stylar column, resiniferous gland, and pistillate sepals. *Dalechampia margarethiae* differ by present entire leaves (*vs*. 3-foliolate), involucral bracts deeply 3–5-lobed (*vs*. involucral bracts 3-lobed), and slightly open sepals in the staminate flowers at anthesis (*vs*. widely open).
Selected specimen: Serra, 22.I.2013, fl., *P.H.D. Barros et al. 129* (VIES).
Additional specimen: BRAZIL. MINAS GERAIS: Marliéria, Parque Estadual do Rio Doce, trilha do Vinhático, 29.III.1996, fl., *J.A. Lombardi et al.1163* (BHCB).

Dalechampia margarethiae were endemic from Espírito Santo state (Pereira-Silva *et al.* 2019), here we present a new record of the species for Minas Gerais state. In Espírito Santo, *Dalechampia margarethiae* occurs in Ombrophilous Dense Forest (Fig. 2c), growing on the forest edges.

9. *Dalechampia micromeria* Baill., Adansonia 5: 310. 1865. Fig. 6c

Dalechampia micromeria is easily identified by a set of morphological characters that differentiate from other species with 3-foliolate from Espírito Santo, and these are: leaves with 3.5–4 cm long (*vs*. 5–10 cm long in the others species); involucral bracts moderately 3-toothed (*vs*. moderately 3-lobed or 3-lobed); stylar column in flower 3 mm long (*vs*. 0.4–1.8 cm long). The stylar column can variate in size when these are in the fruits.
Selected specimen: Vila Velha, 5.III.2001, fl., *P. Fiaschi et al. 652* (SPF).

Dalechampia micromeria occurs in Brazil, registered for the Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo), Southern (Paraná, Rio Grande do Sul, Santa Catarina), and in Paraguay (Cordillera de Altos) (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020d). Here we present the first record of *D. micromeria* for Espírito Santo (Fig. 2a). It is found in Pioneer Formation (Vila Velha) (Fig. 5a), growing in a dense shrubby sandbank, with an abundance of *Allagoptera arenaria* (Gomes) Kuntze and *Bromelia balansae* Mez.

10. *Dalechampia peckoltiana* Müll.Arg., *Fl. bras.* 11(2): 647. 1874. Fig. 6d

Dalechampia peckoltina can be recognized by the presence of involucral bracts monomorphic, always 3-lobed, and staminate sepals widely open. It is similar to *D. margarethiae*, and differs from this by the presence of 3-foliolate leaves (*vs*. entire), involucral bracts 3-lobed (*vs*. deeply 3–5-lobed), and widely open sepals in the staminate flowers at anthesis (*vs*. slightly open). The species is known as "urtiga mirim" in Espírito Santo.
Selected specimen: Conceição da Barra, 18.VII.2019, fl. and fr., *B.N. Mello et al. 204* (VIES).

Endemic species from Brazil, registered in the Northeast (Alagoas, Bahia, Pernambuco and Sergipe), and Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro) (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). In the Espírito Santo, this species occurs in all vegetation types in Espirito Santo, except in Ecological Reguge (Fig. 2b), growing on the forest edges.

11. *Dalechampia pentaphylla* Lam., Encycl. 2: 258. 1786. Fig. 6e

Dalechampia pentaphylla is recognized by leaves 5-foliolate, involucral bracts deeply 3–5-lobed. It is similar to *D. alata*, and can be differentiated by 5-foliolate leaves (*vs*. 5-lobed), involucral bracts 3–5 deeply lobed (*vs*. 3-lobed), pistillate sepals pinnatifid (*vs*. laciniate), and apex of stigma terete (*vs*. clavate).
Selected specimen: Iúna, 7.I.2013, fl., *J.P.F. Zorzanelli & G. Graciliano 614* (VIES).

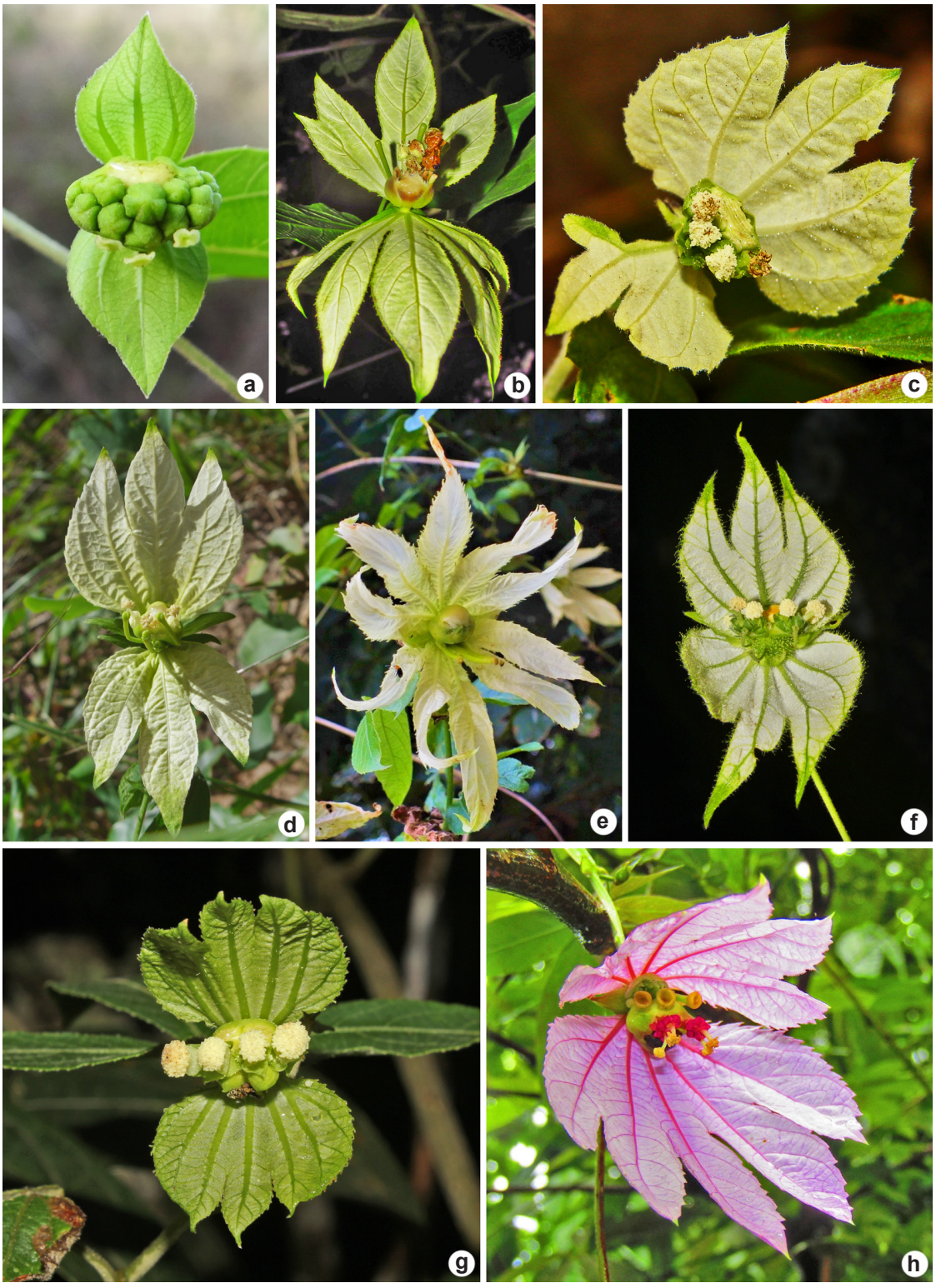

Figure 6 – a-h. Inflorescences of *Dalechampia* species found in Espírito Santo state – a. *D. leandrii*; b. *D. margarethiae*; c. *D. micromeria*; d. *D. peckoltiana*; e. *D. pentaphylla*; f. *D. stipulacea*; g. *D. triphylla*; h. *D.* sp. (Photos: a. Juliano R. Fabricante; b. Otávio Marques; c. Alexandre Medeiros; d,e. Antônio Farias; f,g. Josimar Külkamp; h. André S. Pellanda).

Dalechampia pentaphylla occurs in Brazil and Paraguay. In Brazil is registered in the Central-West (Goiás, Mato Grosso do Sul), Northeast (Bahia), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo), and Southern (Paraná) regions (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). In Espírito Santo it is found in the Ombrophilous Dense Forest and Transition Areas (Fig. 2b), mainly in the Serra do Valentim (Iúna), as well as in the municipalities of Conceição do Castelo, Domingos Martins, Marechal Floriano, Santa Teresa and Vargem Alta, growing on the forest edges, with altitude up to 1,900 meters.

12. *Dalechampia stipulacea* Müll.Arg., Linnaea, 34: 221. 1865. Fig. 6f

Dalechampia stipulacea is a very peculiar species due to present glandular trichomes in margins of leaves, petiolar stipule, bracteal stipule, and involucral bracts. This kind of trichome is very apparent in this taxon, making it different from other *Dalechampia* with 3-foliolate leaves. The species is known as "micuim" in Espírito Santo.
Selected specimen: Vila Velha, 21.X.1987, fl., *O.J. Pereira et al. 1186* (VIES).

Dalechampia stipulacea is distributed in South America, registered in Argentina, Brazil, Colombia, Peru, Venezuela and Paraguay (Webster & Armbruster 1991). In Brazil it is registered in the Central-West (Mato Grosso do Sul), Northeast (Bahia, Maranhão, Pernambuco, Piauí), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo), and Southern (Paraná, Rio Grande do Sul, Santa Catarina) regions (Webster & Armbruster 1991; Pereira-Silva *et al.* 2020a). Here we presented the first record of *D. stipulacea* for Espírito Santo, where it is found in the Pioneer Areas and Ombrophilous Dense Forest (Fig. 2b), growing on the forest edges.

13. *Dalechampia triphylla* Lam., Encycl. 2: 258. 1786. Fig. 6g

Dalechampia triphylla is recognized by its branches, glabrescent, elongated leaflets, margins serreate, and pistillate sepals widely pinnatifid. The species is compared and differentiated in the comments of *D. clausseniana*.
Selected specimen: Barra de São Francisco, 21.XI.2000, fl. and fr., *L. Kollmann et al. 3292* (MBML, PEUFR).

Dalechampia triphylla is distributed in Brazil, French Guiana, Mexico, and Suriname. In Brazil it is occurs in the Northeast (Bahia, Pernambuco), North (Amazonas, Roraima), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo), and Southern (Paraná, Santa Catarina) regions (Webster & Armbruster 1991; Funk *et al.* 2007; Pereira-Silva *et al.* 2020a). In Espírito Santo state, *D. triphylla* is found in Ombrophilous Dense Forest and Seasonal Semideciduous Forest (Fig. 2c). Occurs in the Municipal Park Sombra da Tarde (Barra de São Francisco), as well as in the Environmental Protection Area of Pedra do Elefante (Nova Venécia), growing on the forest edges.

14. *Dalechampia viridissima* Webster, Brittonia 41: 6. 1989.

In all species with 3-lobed leaves, *Dalechampia viridissima* is easily recognized due to involucral bracts deep green, pistillate sepals subentire, and apex of stylar column unlobed to slightly lobed.
Selected specimen: Vitória, 2.II.1969, fl. and fr., *D. Sucre & P.I.S. Braga 4587* (RB).

Dalechampia viridissima is endemic to Brazil, occurring in the Northeast (Bahia) and Southeast (Espírito Santo) (Webster & Ambruster 1991). In the Espírito Santo, *D. viridissima* is found in Ombrophilous Dense Forest (Fig. 2b). Occurs in the Municipal Park Gruta da Onça (Vitória), specifically in Morro do Vigia, growing in secondary forest, in a place with rocky outcrop.

15. *Dalechampia* sp. Fig. 6h

Dalechampia sp. differs from the other species registered in the state by the pink to purplish, 3–5-lobed involucral bracts, and the stigma's apex crateriform. The deeply 5-lobed leaves are similar to *Dalechampia alata*, while in *D. pentaphylla* the leaves are 5-foliolate, but *Dalechampia* sp. differs from these by the pink color of the involucral bracts (*vs.* greenish in *D. alata* and *D. pentaphylla*). We still need to see more specimens to concluded that can be a new species. Due to its morphology, the taxon might be classified in the *Dioscoreifoliae* section, which presents deeply laciniate resiniferous bractlets, larger distal involucral bract and staminate involucral of free decussate bracts (Cordeiro 1998), with *D. violacea* Pax & K.Hoffm, from Central Brazil and *D. purpurata* Cordeiro endemic from Bahia.
Selected Specimen: Alegre, 21.XI.2020, fl., *J.C.R. Mendes et al. 790* (PEUFR, MBML).

Dalechampia sp. occur in the Seasonal Semideciduous Forest (Fig. 2a). This taxon was

registered inside a Conservation Unit (Parque Estadual Cachoeira da Fumaça) in the municipality of Alegre. The specimen was collected at the forest edges.

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