

Anthurium viridivinosum sp. nov. (Araceae; *A.* sect. *Urospadix* subsect. *Flaviscentiviridia*) from a sedimentary coastal plain in southeastern Brazil

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During a floristic survey of the family Araceae in a sedimentary coastal plain in the state of Espírito Santo, southeastern Brazil, we found an unknown species with an intriguing combination of characteristics intermediate among *Anthurium harrisii*, *A. intermedium*, *A. jilekii*, *A. riocense* and *A. zeneidae*. Herein, we describe and illustrate this novelty as *Anthurium viridivinosum* with a comparative analysis of characters that distinguishes it from similar species, and comments about its ecology, distribution and conservation.

Anthurium Schott (Araceae) has 905 recognized species (Boyce and Croat 2012) that occur in a range of environments comprising forests, rocky areas and wetlands. In the Atlantic Forest the genus is represented by 91 species (Coelho et al. 2013), most of which belong to the section *Urospadix* (Temponi 2006, Coelho et al. 2009). Despite the high and continuous fragmentation of the Atlantic Forest, many new species of Araceae have been described in recent decades (Temponi and Coelho 2011).

The Atlantic Forest is composed of biota that probably evolved during the pre-Pliocene and Pleistocene (Silva and Casteleti 2003) with endemic areas described in several studies (Fiaschi and Pirani 2009, Da Silva 2011). Some authors have suggested a recent diversification in *Anthurium* sect. *Urospadix*, reflected by subtle morphological characters (Temponi and Coelho 2011). This type of diversification is possibly related to micro-environmental speciation. Although studies of Araceae have increased in the 1990's, deforestation continues to threaten the biodiversity of non-explored areas.

Since 2009 intense research has been conducted to list and study Araceae species in the restingas of Espírito Santo. This ecosystem is more developed in the northern part of the state, along the mouth of Rio Doce and less developed on the foothills that appear alternately along the coast (Albino et al. 2006). However, samples taken from these less developed relics of restinga have proven to be a new species of *Anthurium*, here described and discussed with regards to its ecology, distribution and conservation.

Methods

We analyzed herbarium material from the herbaria MBML, RB and VIES, in addition to holotype images and specialized bibliography. Morphological studies were performed using a stereoscopic microscope Olympus SZX9. The coloration of vegetative and reproductive structures was observed from sampled and cultivated material, then presented in a widespread fashion avoiding terminology conflict due to great variation in tonality. The floral and vegetative character description follows Croat and Bunting (1979), Stearn (1993) and Mantovani et al. (2009).

Anthurium viridivinosum Theófilo & Sakur. sp. nov. (Fig. 1–2)

A species of *Anthurium* sect. *Urospadix* (Engler) subsect. *Flaviscentiviridia* (Engler) and most similar to *A. intermedium* Kunth, but differs by its median region of the central vein adaxially rounded, the apex of the central vein abaxially rounded and berries translucent towards the base.

Type: Brazil. Espírito Santo, Aracruz, Refúgio de Vida Silvestre de Santa Cruz, 22 May 2013, R. T. Valadares 1.106 (holotype: RB, isotypes: VIES).

Etymology

The epithet refers to the beautiful contrast of the red vinous color of the prophylls, cataphylls and petiole with the intense green color of the leaf blade.

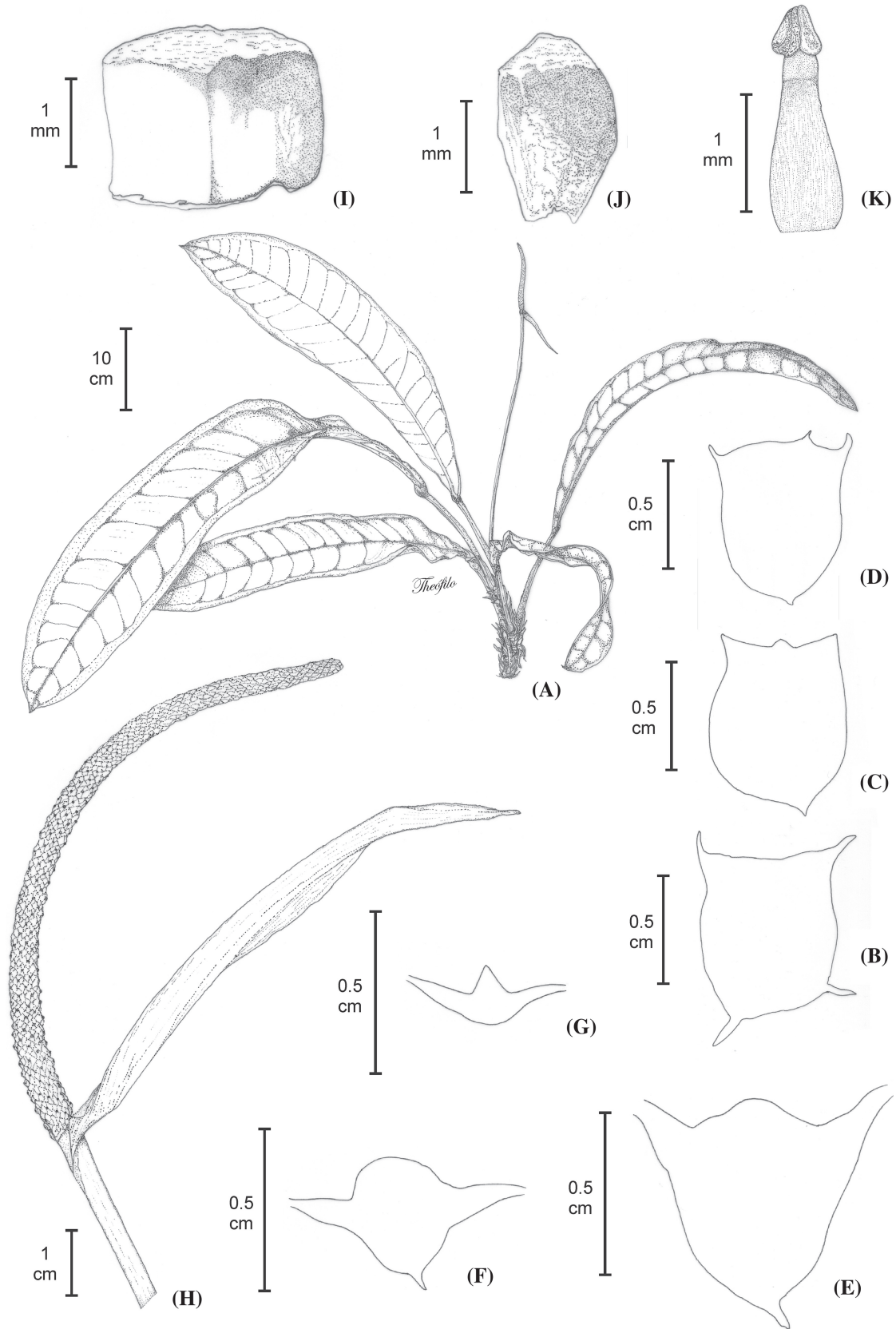


Figure 1. *Anthurium viridivinosum* sp. nov. (A) habit, (B) proximal petiole in cross section, (C) mid petiole in cross section, (D) distal petiole in cross section, (E) proximal midrib in cross section, (F) mid midrib in cross section, (G) distal midrib in cross section, (H) inflorescence, (I) lateral tepal in front view, (J) anterior tepal in front view, (K) stamen in front view.



Figure 2. (A) Aspect terraces of lateritic abrasion where *Anthurium viridivinosum* develops, (B) habit of *A. viridivinosum*, (C) inflorescence, (D) infructescence.

Description

Terrestrial; stem elongated, erect to decumbent; internodes 0.4–0.6 cm long. Prophylls and cataphylls reddish and vinaceous when young, brownish to chestnut when old, entire to slightly decomposed at the apex, decomposed to fibers at base of the stem, $2.0\text{--}3.8 \times 1.4\text{--}1.9$ cm. Sheath 1.5–1.7 cm long. Petiole flat with acute to carinate margins, with a distal central rib adaxially, 2-ribbed on proximal direction becoming acute at the distal direction abaxially, $7.1\text{--}9.6 \times 0.4\text{--}0.5$ cm; geniculum vinaceous, thicker than the petiole, flattened with ribbed margins adaxially, 1–2-ribbed abaxially, 1.3–1.6 cm long. Leaf blade elliptic to lanceolate, membranaceous to subchartaceous, coriaceous when dry, acute at apex, cuneate at base, with strongly contrasting colors on the two surfaces (upper surface dark green, lower surface light green), $40.9\text{--}44.4 \times 7.2\text{--}9.6$ cm; midrib vinaceous or lighter than the blade adaxially, obtuse at the base, rounded and prominent on the middle becoming acute at the apex adaxially, 1-ribbed becoming rounded at the apex abaxially; primary lateral veins impressed adaxially, lightly prominent abaxially, 17–18 on both sides, arched, darker than the blade abaxially, forming an angle of $30\text{--}40^\circ$ with the midrib at the leaf base, $20\text{--}30^\circ$ in the middle, $30\text{--}45^\circ$ at the apex; infra-marginal collective vein starting from the leaf base or, more rarely 2.8 cm above it, 0.2–0.7 cm from margin; peduncle 1-ribbed, vinaceous, $13.9\text{--}28.1 \times 0.3$ cm. Spathe membranaceous, vinaceous, linear-lanceolate, reflexed during anthesis and in fruit, $5.5\text{--}7.0 \times 0.6\text{--}0.8$ cm, forming an acute angle with the peduncle, decurrent to 0.8 cm. Spadix sessile, cylindrical, tapered, vinaceous during anthesis, brownish post-anthesis and in fruit, $5.5\text{--}9.7 \times 0.3\text{--}0.5$ cm, with 4–5 flowers visible

per principal spiral and 6 visible per secondary spiral. Tepals vinaceous until anthesis, brownish at the apex, becoming greenish towards the base post-anthesis and in fruit, dorsally acute, internally convex; lateral tepals $2.50\text{--}2.51 \times 1.50\text{--}2.00$ mm, tepals anterior/posterior $1.5\text{--}2.0 \times 1.0\text{--}1.1$ mm. Filaments flattened, $1.50\text{--}1.75 \times 0.55\text{--}0.80$ mm; anthers dorsifixed, extrorse, $0.40\text{--}0.45 \times 0.45\text{--}0.55$ mm. Gynoecium globose with vinaceous sessile stigma; ovary bi-locular, with one ovule per locule and axial placentation; funicle glabrous, $1.50\text{--}2.60 \times 0.55\text{--}0.60$ mm. Berries with green and vinaceous apex when immature, greenish at the apex, becoming translucent on the base when mature; seed rounded, lenticulate, yellowish.

Habitat and distribution

Anthurium viridivinosum occurs in an ecotone between the dry bush formation of restinga (Pereira 2003) and the dense rainforest in the lowlands (Veloso et al. 1991). Individuals were also found in shoreface, developing in leaf litter deposited on the terraces of a lateritic abrasion (Fig. 2).

Similar species

Anthurium viridivinosum and correlated species belong to section *Urospadix*, subsection *Flavicentiviridia* due to the presence of chartaceous or membranaceous leaf blades, pale green with primary lateral veins visible (5–29) and spathe and spadix green or vinaceous (Coelho et al. 2009).

The characteristics of *A. viridivinosum* sp. nov. are similar to a group of species including *A. harrisii* (Graham) G. Don, *A. intermedium* Kunth, *A. jilekii* Schott, *A. riodocense* Nadruz, and *A. zeneidae* Nadruz (Table 1). The last two

Table 1. Key morphological traits in *A. viridivinosum* sp. nov. and closely related taxa.

Character	<i>A. viridivinosum</i>	<i>A. intermedium</i>	<i>A. zeneidae</i>	<i>A. jilekii</i>	<i>A. harrisii</i>	<i>A. riocense</i>
Shape 1/2 length midrib adaxially	Rounded	Acute	Acute	Acute	Acute	Acute
Shape of apex midrib abaxially	Rounded	Obtuse to acute	1-ribbed to acute	1-ribbed	Rounded, acute a 1-ribbed	1-ribbed
Angle spathe/peduncle	Acute	Acute, obtuse to straight	Acute, obtuse to straight	Acute to obtuse	Acute to obtuse	Obtuse to straight
Peduncle	1-ribbed	1–2-ribbed	2–7-ribbed	Terete to 1-ribbed	1-angular to 1-ribbed	2-ribbed
Berry	Greenish apex, base translucent	Totally greenish, greenish apex, base off-white	Totally greenish	Red–purplish apex, base pale	Totally greenish, green-vinaceous apex, base green–yellowish to white	Totally greenish

species are restricted to the northern part of Espírito Santo state and exhibit more than a single rib in the peduncle, as opposed to only one rib in *A. viridivinosum*. In *A. riocense* the spathe forms a 90° angle, obtuse to the peduncle, versus forming an acute angle in *A. viridivinosum*.

Anthurium jilekii ranges from the wet forests in the southern Bahia state to the restingas in the center–south region of Espírito Santo state. The main character for delimitation of the sympatric species *A. jilekii* is the color of the berries: red or purple in *A. jilekii* and green in *A. viridivinosum*.

The new species differs from *A. harrisii* by the form of the midrib in the median region and the color of the basal portion of the berry. Furthermore, the distribution of the latter species is restricted to the coast of Rio de Janeiro state. Other differences between them are pointed out on Table 1.

The related species with the broadest distribution is *A. intermedium* that occurs in Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo states. The new species differs from *A. intermedium* by having the median region of the midrib rounded adaxially, the apex of the midrib rounded abaxially and with the fresh berries green toward the apex becoming translucent toward the base, versus having the median region of the midrib acute adaxially, the apex of the midrib obtuse to acute abaxially and berries completely green becoming whitish at the base in *A. viridivinosum*.

Conservation status

Anthurium viridivinosum is ‘Critically Endangered’ (CR, B1ab (ii, iii, v) + 2ab (iii, v)) in accordance to IUCN (2001) categories and criteria. In this category are species facing a high risk of extinction in the wild, with extent of occurrence < 100 km², area of occupancy < 10 km², heavily fragmented, known from a single location, with continuing decline inferred from the number of mature individuals and steady decline in habitat quality.

Although great effort was made to collect other specimens along the coastal area in the Espírito Santo state, the new species is so far only known from the type locality. The species current distribution add value to the restinga

remnants, especially in areas where the littoral plains is less developed on the base of the cliffs (Albino et al. 2006), and adds important recognition to public politics that created the Wildlife Refuge of Santa Cruz (RVS Santa Cruz). Besides being inserted in a conservation unit, the restinga fragments and the lowland rainforest on this region have extremely high importance to biodiversity conservation, suffering threats such as native vegetation suppression and real estate expansion on the coast line (Brasil 2007). *Anthurium viridivinosum* is the ninth species of *Anthurium* distributed along the restingas in Espírito Santo (Valadares et al. 2010, Haigh et al. 2011), and the description of this new species highlights the priority actions proposed by IPEMA (2011), that includes floristic inventories to survey for future adjustments in conservation actions in the state. Living material of this new species is being grown at Universidade Federal do Espírito Santo.

Additional specimens examined (paratypes)

Brazil. Espírito Santo, Aracruz, Refúgio de Vida Silvestre de Santa Cruz, 7 Nov 2012, Valadares 1087 (RB); Id. 22 May 2013, R. T. Valadares 1.107 (VIES).

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References

- Albino, J. et al. 2006. Espírito Santo. – In: Mueher, D. (ed.), Erosão e Progradação do Litoral Brasileiro. Ministério do Meio Ambiente, pp. 227–264.
- Boyce, P. C. and Croat, T. B. 2012. The Überlist of Araceae: totals for published and estimated number of species in aroid genera. – <<http://www.aroid.org/genera/12011Überlist.pdf>>, accessed 26 Mar 2013.

- Brasil 2007. Portaria MMA no. 9, de 23 de janeiro de 2007. Atualização das áreas prioritárias para conservação, uso sustentável e repartição de benefícios da biodiversidade brasileira. Brasília, 300 pp.
- Coelho, M. A. N. et al. 2009. Revisão taxonômica das espécies de *Anthurium* (Araceae) seção *Urospadix* subseção *Flavescentiviridia*. – *Rodriguésia* 60: 799–864.
- Coelho, M. A. N. et al. 2013. *Anthurium* in lista de espécies da flora do Brasil. – *Jard. Bot. Rio de Janeiro*. – <<http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB4912>>, accessed 10 Dec 2013.
- Croat, T. B. and Bunting, G. S. 1979. Standardization of *Anthurium* descriptions. – *Aroideana* 2: 15–25.
- Da Silva, M. B. 2011. Áreas de endemismo: as espécies vivem em qualquer lugar, onde podem ou onde historicamente evoluíram? – *Rev. Biol. Vol. Esp. Biogeogr.* 12–17.
- IPEMA 2011. Áreas e ações prioritárias para a conservação da biodiversidade da Mata Atlântica no estado do Espírito Santo. – Inst. de Pesquisas da Mata Atlântica.
- IUCN 2001. IUCN red list categories and criteria, ver. 3.1. – IUCN Species Survival Commission.
- Fiaschi, P. and Pirani, J. R. 2009. Review of plant biogeographic studies in Brazil. – *J. Syst. Evol.* 47: 477–496.
- Haigh, A. et al. 2011. Four new species of *Anthurium* (Araceae) from Bahia, Brazil. – *Kew Bull.* 66: 123–132.
- Mantovani, A. et al. 2009. Leaf midrib outline as a diagnostic character for taxonomy in *Anthurium* section *Urospadix* subsection *Flavescentiviridia* (Araceae). – *Hoehnea* 36: 269–277.
- Pereira, O. J. 2003. Restinga: origem, estrutura e diversidade. Desafios da Botânica Brasileira no Novo Milênio: inventário, sistematização e conservação da biodiversidade vegetal. – Museu Paraense Emílio Goeldi, pp. 177–179.
- Silva, J. M. C. and Casteleti, C. H. M. 2003. Status of the biodiversity of the Atlantic Forest of Brazil. – In: Galindo-Leal, C. and Câmara, I. G. (ed.), *The Atlantic forest of South America: biodiversity status, trends, and outlook*. Center Appl. Biodiv. Sci. Island Press, pp. 43–59.
- Stearn, W. T. 1993. *Botanical Latin*. – A David and Charles Book.
- Temponi, L. G. 2006. *Sistemática de Anthurium sect. Urospadix (Araceae)*. – PhD thesis, Inst. Biociências, Univ. de São Paulo, Brazil.
- Temponi, L. G. and Coelho, M. A. N. 2011. Two new species of *Anthurium* sect. *Urospadix* (Araceae) for Brazil. – *Rodriguésia* 62: 315–320.
- Valadares, R. T. et al. 2010. O gênero *Anthurium* Schott (Araceae) no Parque Estadual Paulo César Vinha, Guarapari, Espírito Santo. – *Natureza on line* 8: 107–113.
- Veloso, E. M. et al. 1991. Classificação da vegetação brasileira, adaptada a um sistema universal. – IBGE Depto de Recursos Naturais e Estudos Ambientais.