A first record of *Loricalepis* (Melastomataceae) from the Brazilian Atlantic Forest, with the description of a new species from Bahia

Renato Goldenberg[1], Fabian A. Michelangeli[2], and André M. Amorim[3,4]

[1] Departamento de Botânica, Centro Politécnico, Universidade Federal do Paraná, 81531-970, Curitiba, Paraná, Brazil; e-mail: renato.goldenberg@gmail.com
[2] The New York Botanical Garden, Institute of Systematic Botany, Bronx, NY 10458-5126, USA
[3] Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Rodovia Ilhéus-Itabuna, 45, Ilhéus, Bahia 662-900, Brazil
[4] Herbário Centro de Pesquisas do Cacau, CEPEC, Rodovia Ilhéus-Itabuna, 45, Ilhéus, Bahia 650-970, Brazil

Abstract. *Loricalepis* has been known from only three collections from the upper Rio Negro, in Amazonas, Brazil, and the Río Guainía basin, in Colombia, all belonging to a single species, *L. duckei*. Its capsular fruits and cochleate, tuberculate seeds suggest its relation to pantropical "core Melastomeae", but it does not have a particularly close morphological connection with any other genus of the tribe. Here we describe and illustrate a second species in the genus, ***Loricalepis atlantica***, recently collected in white sand vegetation near the coast of Bahia. Although we have not been able to sequence DNA from the new species, we place it in *Loricalepis* due to a long list of characters that it shares with *L. duckei*. Both are shrubs or small trees with scalariform indumentum on the stems and leaves; thick-cartilaginous, crenulate-serrulate and paleaceous-ciliate leaf margins; persistent acute and seta-tipped sepals; glandulose-ciliate petal margins; glabrous and subisomorphic stamens, these with the connective not at all or only shortly prolonged and ventrally bilobed; and the ovary apex with a crown of scales surrounding the style. ***lightface*** differs from *L. duckei* by 5-merous flowers (vs. 4-merous in *L. duckei*), the hypanthium covered with minute scalariform trichomes (vs. glabrous), light-pink petals (vs. white), purple anthers (vs. white), and 5-celled ovary (vs. 4-celled). The new species is known from only one locality, in an extremely endangered vegetation type. Its discovery highlights the need for sustained floristic studies of forest remnants in northeastern Brazil.

Keywords: Amazonas, Bahia, disjunction, *Loricalepis duckei*, mussununga, Rio Negro, taxonomy.

Loricalepis Brade has been up until now a monotypic genus in Melastomataceae (Melastomateae) known only from white sand vegetation along the upper Rio Negro basin, in the state of Amazonas, Brazil (Brade 1938; Goldenberg and Michelangeli 2019a), and in the nearby Río Guainía basin, in the department of Guainía, Colombia. It has been collected only three times: twice in Brazil, the type in 1936 (*Ducke 35,068*, US, RB) and a recent collection quite near the type locality in 2009 (*Hopkins 1904*, INPA, UPCB), and only once in Colombia, in 2006 (*Cárdenas 20,309*, NY), always on white sand vegetation. These last collections brought some light to this otherwise elusive genus, including photos and silica-dried leaf samples. Several morphological characters, such as the ovary crowned with a few setae, and the capsular fruits with cochleate, tuberculate seeds, suggest that it is a member of pantropical Melastomateae sensu stricto or "core Melastomeae" sensu Michelangeli et al. (2013) and Veranso-Libalah et al. (2017)., i.e. excluding Rhexieae, Microlicieae (Fritsch et al. 2004) and Marcetieae (Rocha et al. 2018).

The original diagnosis of *Loricalepis* is very vague, poorly distinguishing it from *Tibouchina* Aubl. s.l. by the glabrous hypanthium and 1-nerved leaves, with the secondary transversal nerves immersed in the leaf blade tissue (Brade

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1938). On the other hand, the combination of these characters with small tree habit, scalariform indumentum on the stems and leaves, thick-cartilaginous, crenulate-serrulate and paleaceous-ciliate leaf margins, 4-merous flowers, persistent acute and seta-tipped sepals, petals with glandulose-ciliate margins, glabrous and subisomorphic stamens, these with the connective not at all or shortly prolonged but ventrally bilobed, the ovary apex with a crown of scaly setae surrounding the style, and dry, capsular fruits (Fig.1) make *Loricalepis* hardly similar to any other genus of Melastomateae s.s. Indeed, Guimarães et al. (2019) suggested that it may be sister to the remainder of the tribe Melastomateae s.s.

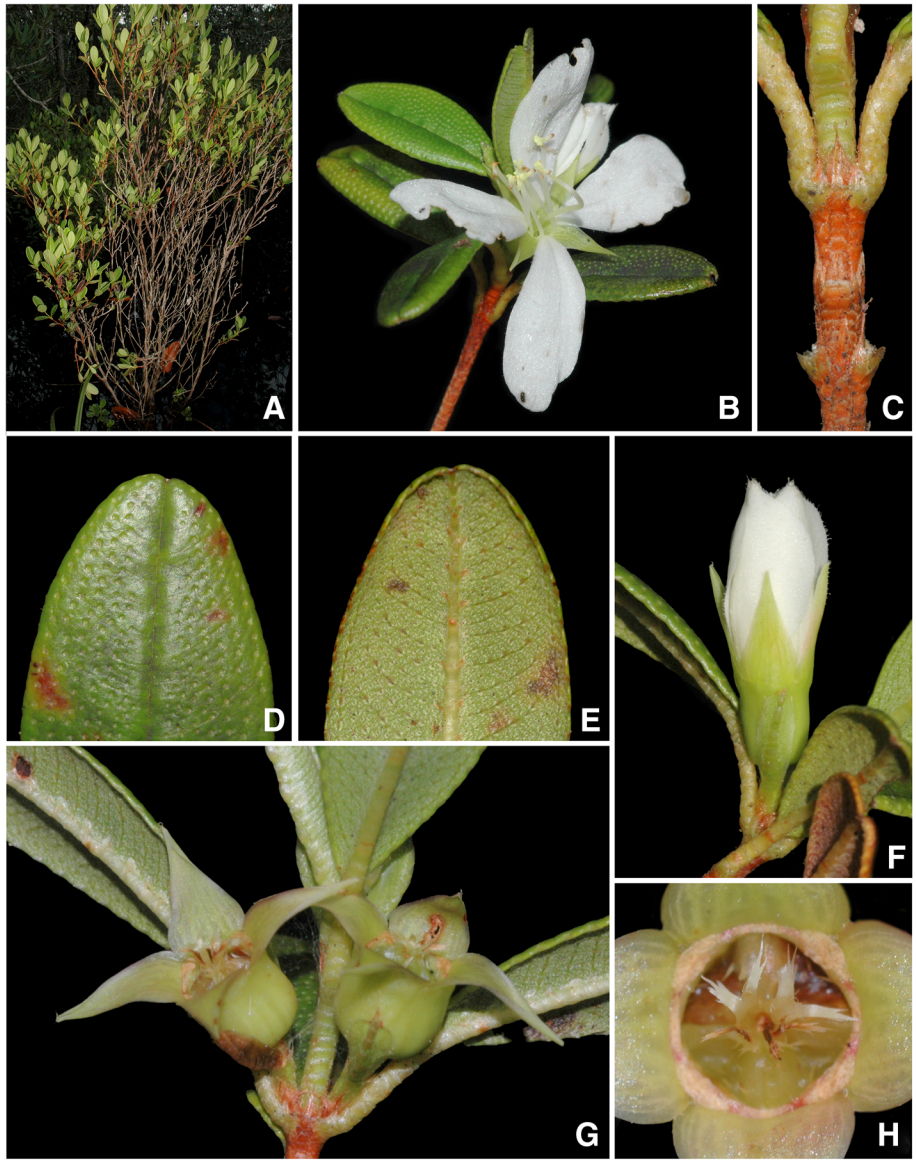

Fig. 1. *Loricalepis duckei*. **A.** Habit. **B.** Branch with an open flower. **C.** Detail of a branch node with a pair of petioles and transversal nodal ridge between them. **D.** Detail of leaf apex, adaxial view. **E.** Detail of leaf apex, abaxial view. **F.** Flower bud, lateral view. **G.** Branch with young fruits. **H.** Detail of a young fruit, apical view. (All photographs by Mike Hopkins of *Hopkins et al. 1904*.)

One of the most striking features in *Loricalepis duckei* is the scalariform indumentum on vegetative organs. The scale-like trichomes, from now on called "scales", are similar to the ones described as "leaf scales, proximally attached" and "leaf scales, with basal ear" by Wurdack (1986). Wurdack mentioned that these scales were found mostly in *Tibouchina* s.l., in species that are now either in the newly re-circumscribed *Tibouchina* s.s. or in *Andesanthus* P.J.F.Guim. & Michelang. (Guimarães et al. 2019), and only in one species of *Pterolepis* (DC.) Miq. Apart from these three genera, such scales are not found elsewhere in Neotropical Melastomateae (Michelangeli et al. 2013; Meyer 2016). *Loricalepis* can be distinguished from *Tibouchina* s.s. and *Andesanthus* by the combination of characters listed above (see also: Guimarães et al. 2019) and from *Pterolepis* by the absence of pennicellate projections on its hypanthia (see Renner 1994).

In a recent discovery, we became aware of a specimen in the CEPEC herbarium (*Larceda 191*) from the white sand vegetation of coastal Bahia that shares most, but not all, of the diagnostic features of *Loricalepis duckei*, The discovery of this apparently closely related species is especially remarkable given the 3000 km distance separating its collection locality from those of *L. duckei* in the upper Rio Negro, although both species appear to be restricted to a similar vegetation type. Subsequently, we revisited the collection site in Bahia and obtained silica-dried leaf samples of the species, but for the last two years, in spite of several attempts, we have been unable to obtain DNA sequences in order to ascertain its generic placement. Nevertheless, we describe the new species here in *Loricalepis* based on its morphological similarity to *L. duckei*, with the hope that our hypothesis will be tested in the future by phylogenetic analysis of molecular data.

Materials and methods

The descriptions and illustrations of the new species are based on field collections and the examination of herbarium specimens housed in the CEPEC, NY and UPCB herbaria. Information concerning plant height, habit, leaf blade surfaces, sepals, petals, fruits and other informative features were noted while examining fresh material in the field, or was transcribed from the collection labels of herbarium specimens. For examination by scanning electron microscopy (SEM), samples of leaves and seeds were placed on stubs, sputter-coated, and photographed in a Quanta 250 (Fei Company) Scanning Electron Microscope in the Microscopy Electronic Center (CME) at Santa Cruz University, Ilhéus, Bahia, Brazil.

A distribution map was generated using the web-based application SimpleMappr (Shorthouse 2010). Geographical coordinates of collection localities were obtained from field GPS determinations or from the online databases speciesLink (http://www.specieslink.org.br) or JABOT (http://www.jbrj.gov.br/jabot).

Taxonomic treatment

Loricalepis atlantica Amorim, Michelang. & R.Goldenb., **sp. nov.**—Type: Brazil. Bahia: Mun. Itacaré, Rodovia Ilhéus-Itacaré, Campo Cheiroso, 14°22′50″S, 39°02′23″W, 100–125 m, 21 Nov 2015 [bud, fl, fr], *A. M. Amorim, C. S. Pessoa, C. C. de Paula, D. S. Lisboa & J. L. Paixão 9900* (holotype: CEPEC; isotypes: HUEFS, INPA, K, MBM, NY, P, RB, SPF, UESC, UPCB). (Figs. 2–3, 4A–E.)

Diagnosis: *Loricalepis atlantica* differs from *L. duckei* Brade by its 5-merous flowers (vs. 4-merous in *L. duckei*), hypanthium covered with minute scales (vs. glabrous), light-pink petals (vs. white), purple anthers (vs. white) and 5-celled ovary (vs. 4-celled).

Shrub to small tree, 3–6 m tall; trunk 3–7 cm diam. at breast height, the bark sulcate, and splitting longitudinally in narrowly oblong, pale-gray to brownish in older branches, glabrous stripes; young branches terete, occasionally pendulous, brown, the nodes with a thick transversal ridge joining the opposite petioles, the surface moderately to densely (particularly immediately below the nodes) covered with thick, appressed, deltoid to lanceolate or rounded scales 0.1–0.6 × 0.1–0.4 mm, with lacerate-ciliate margins and an acute to rounded apex, the scales partially caducous and becoming sparser in older branches. Leaves opposite, isomorphic; petiole (3.3–)4.7–8.8(−13.2) mm, adaxially canaliculate, with the same dense scales as the nodes of young branches; lamina 4.9–8.5(−15.5) × (2.4–)3.1–5.6(−9.8) cm, ovate, obovate to orbiculate, rarely oblong, subcoriaceous, base rounded to obtuse, sometimes rounded-attenuate, apex rounded or rarely obtuse-retuse, margin thick-cartilaginous, slightly crenulate to minutely serrulate in the upper half, and

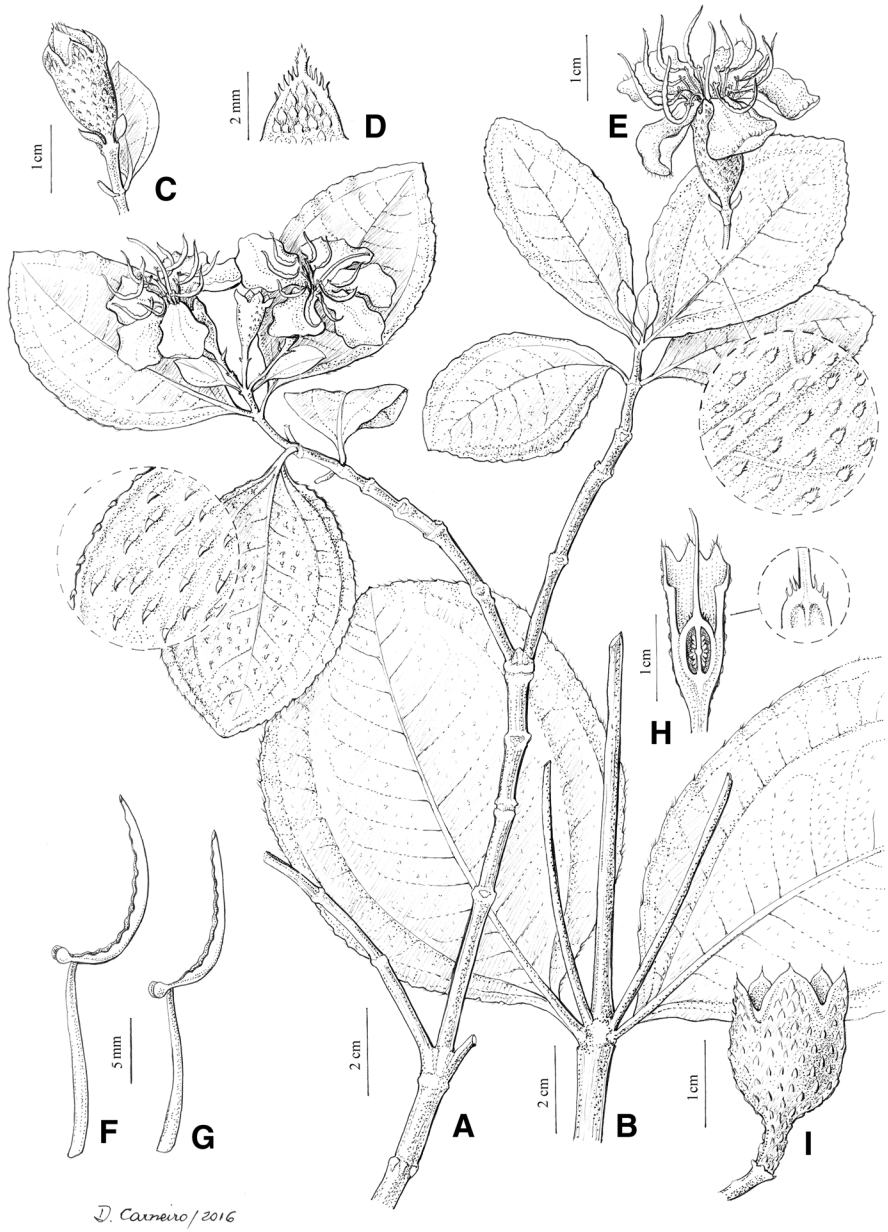

Fig. 2. *Loricalepis atlantica*. **A.** Flowering branch, with a detail of leaf margins in abaxial view (left) and adaxial view (right), showing the scales. **B.** Leaves from the base of the stem. **C.** Floral bud in lateral view. **D.** Detail of a sepal, adaxial view, showing the apex and trichomes. **E.** Flower, lateral view. **F.** Antesepalous stamen, lateral view. **G.** Antepetalous stamen, lateral view. **H.** Hypanthium, longitudinal section with a detail of the ovary apex. **I.** Mature fruit, lateral view. (A–H, based on *Amorim et al. 9990*; I, based on *Amorim et al. 9528*.)

paleaceous-ciliate on the teeth, the scales on the margins 0.4–0.6 mm long, larger and thicker than those on the leaf surfaces, main veins 3, basal, sometimes with an additional, faint, submarginal, confluent (i.e. joining the lateral veins before reaching the leaf base) pair, the midrib slightly impressed, laterals slightly raised, transversal veins barely visible or slightly raised, reticulation not visible on adaxial surface, the midrib slightly raised, laterals plane, not raised, transversal veins

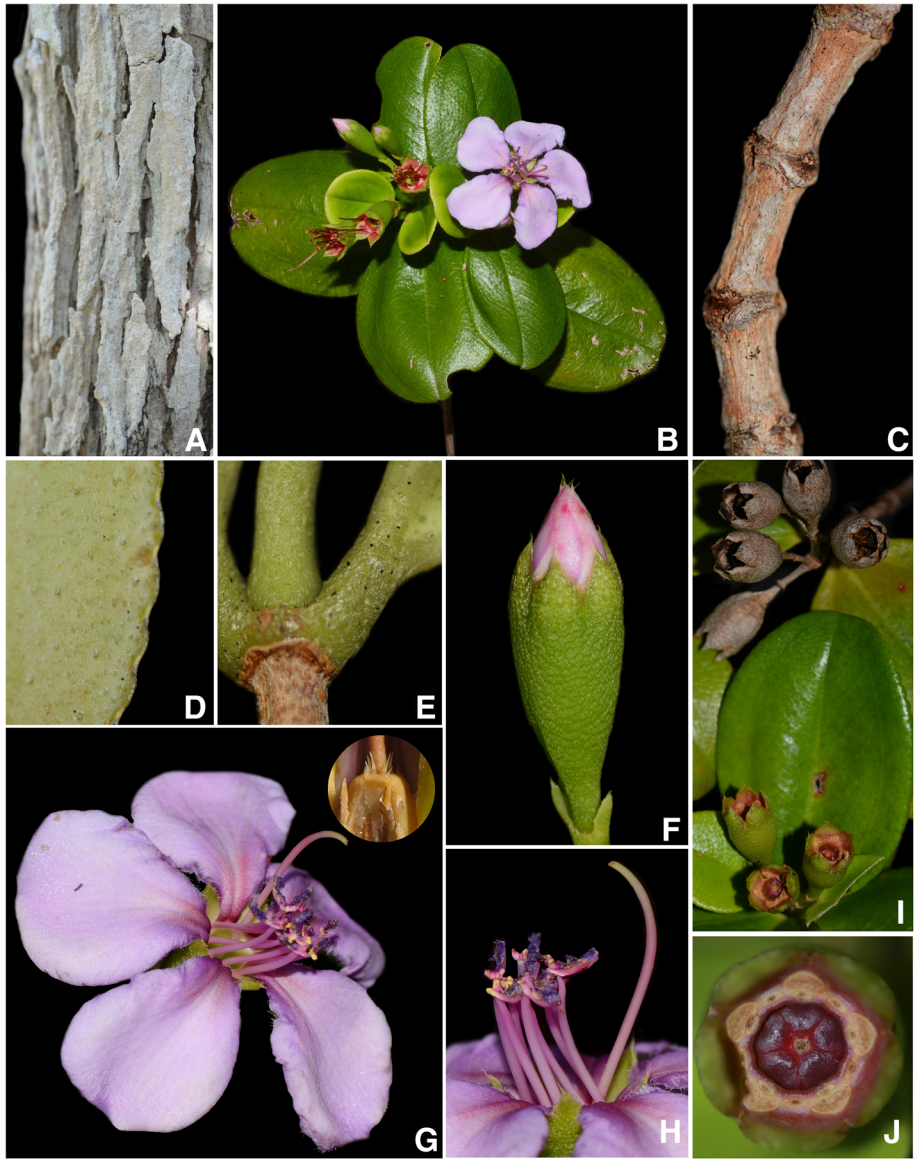

Fig. 3. *Loricalepis atlantica*. **A.** Old stem. **B.** Flowering branch. **C.** Detail of a young stem. **D.** Detail of the leaf margin, abaxial surface. **E.** Detail of a pair of petioles, with transversal ridge between them. **F.** Flower bud, lateral view. **G.** Open flower, with detail of ovary apex crowned with setae. **H.** Detail of androecium (the stamens damaged by bees) and style. **I.** Old and young fruits. **J.** Detail of ovary apex of a young fruit, lacking setae. (All photographs by André Amorim of *Amorim et al. 9990*.)

barely visible or slightly raised, reticulation not visible on abaxial surface, adaxial leaf surface dark-green, sparsely covered with minute, hyaline, appressed, deltoid to rounded scales 0.1–0.3 × 0.1–0.3 mm, these scales sunken and more easily distinguished in pickled or fresh leaves than in dried samples, the scales on the base of the veins larger, up to ca. 0.5 × 0.4 mm, abaxial leaf surface pale-green, with similar sparse scales, but these on a flat surface and not sunken. Inflorescence usually cymose, with up to 3 dichasia, 3–7 flowers, 3–4.6 cm long (including flowers), terminal; bracts 0.8–1.4(−4.8) × 0.6–2(−4.5) cm, foliaceous, sessile, concave, ovate, oblanceolate to orbiculate, apex rounded or acute and seta-tipped, margins ciliate, adaxial surface with small scales as in the

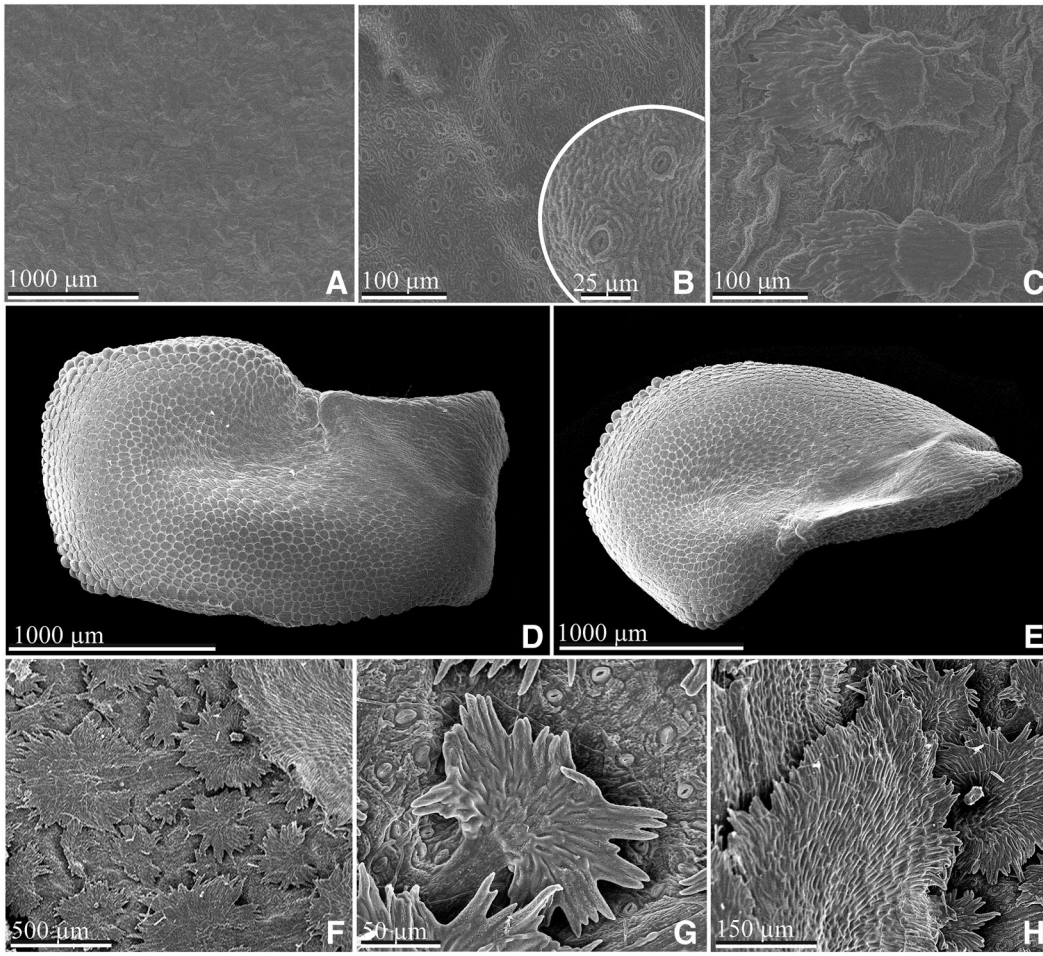

Fig. 4. SEM images of the *Loricalepis* species. **A–E.** *L. atlantica* [from *Amorim et al. 9900* (CEPEC)]. **A.** Adaxial view of leaf surface. **B.** Abaxial view of leaf surface with detail of stomata. **C.** Detail of scales. **D, E.** Seeds in lateral view. **F–H.** *L. duckei* [from *Hopkins et al. 1904* (UPCB)]. **F.** Abaxial view of leaf surface. **G.** Detail of scales on abaxial leaf surface. **H.** Detail of scales on midrib.

leaves, abaxial surface with scales as in the young branches; bracteoles 2, persistent at anthesis, 3.7–5 × 1.3–1.4 mm, thick, concave, oblong-lanceolate, apex acute and seta-tipped, margins ciliate, adaxial surface glabrous, abaxial surface with scales as in the young branches; pedicels green, 2.5–3.6 mm long. Flowers bisexual, 5-merous; hypanthium green, 1.2–1.4 × 0.8–1 cm, terete to narrowly campanulate, densely covered with adpressed, deltoid to lanceolate scales 0.1–0.6 × 0.1–0.4 mm, torus glabrous; calyx tube 1–2 mm long, at anthesis partially tearing at the apex between the lobes, lobes 5.6–6.4 × 4.2–5 mm, persistent in fruit, deltoid, apex acute and seta-tipped, the seta up to 1.4 mm long, margins membranaceous and ciliate, cilia up to 0.5 mm long, adaxial surface reddish at the base, pale green at the apex, glabrous, abaxial surface green, with scales as in the hypanthium; petals light-pink, 2–2.3 × 1.4–2 mm, obovate and slightly uncinate, apex rounded-retuse, both surfaces glabrous, margin glandulose-ciliate, the glandular heads caducous, slightly more persistent toward the base of the petal; stamens 10, subisomorphic, filaments light-pink, 1–1.4 cm long, glabrous, connectives cream-colored, not prolonged below the thecae, ventrally bilobed, the lobes 0.5–0.6 mm long, obovate, glabrous, anthers (from pre-anthesis flower buds) purple, 9.8–11.5 mm long, long-subulate, the pore ventral; ovary ca. 8 mm long,

superior, but with longitudinal trabeculae joined to the surface of the hypanthium for ca. 90% of the ovary length (or in an alternative interpretation, 90% inferior with longitudinal pockets—each filled with a curved stamen in bud—that reach the ovary base), 5-locular, the free apical portion with a narrow crown of scales 1–1.3 mm long, these thickened at the base and subulate distally, and rows of smaller (but similar) scales 0.3–0.6 mm long along the furrowed sutures between carpels, both sets of scales caducous after anthesis and not seen in young fruits, style light-pink, 2–2.4 cm, filiform, sigmoidal, glabrous, stigma punctiform. Capsule persisting on plants for long periods, green to brownish or pale-gray, 18–23(−25) × 11–13.4 mm, campanulate, coriaceous to strongly lignified at maturity, densely covered with appressed, deltoid to lanceolate scales, the scales partially caducous and becoming sparser in maturity, sepals persistent. Seeds ca. 1.9 × 0.6 mm, 9–11 per locule, cochleate, testa tuberculate.

Distribution and habitat.—*Loricalepis atlantica* is endemic to the Atlantic Forest domain in Bahia state (Fig. 5A), where it is known from a single locality in the Municipality of Itacaré. The species occurs exclusively in "mussununga" vegetation (see comments below) on white sand soils (Fig. 5B). This area, locally known as Campo Cheiroso, comprises 160 ha and is located about 3 km from the coastline, at about 120 m elevation. The species grows in the border of forest remnants with open scrub physiognomies (Fig. 5C).

Conservation status.— *Loricalepis atlantica* is known only from the type locality, which is not

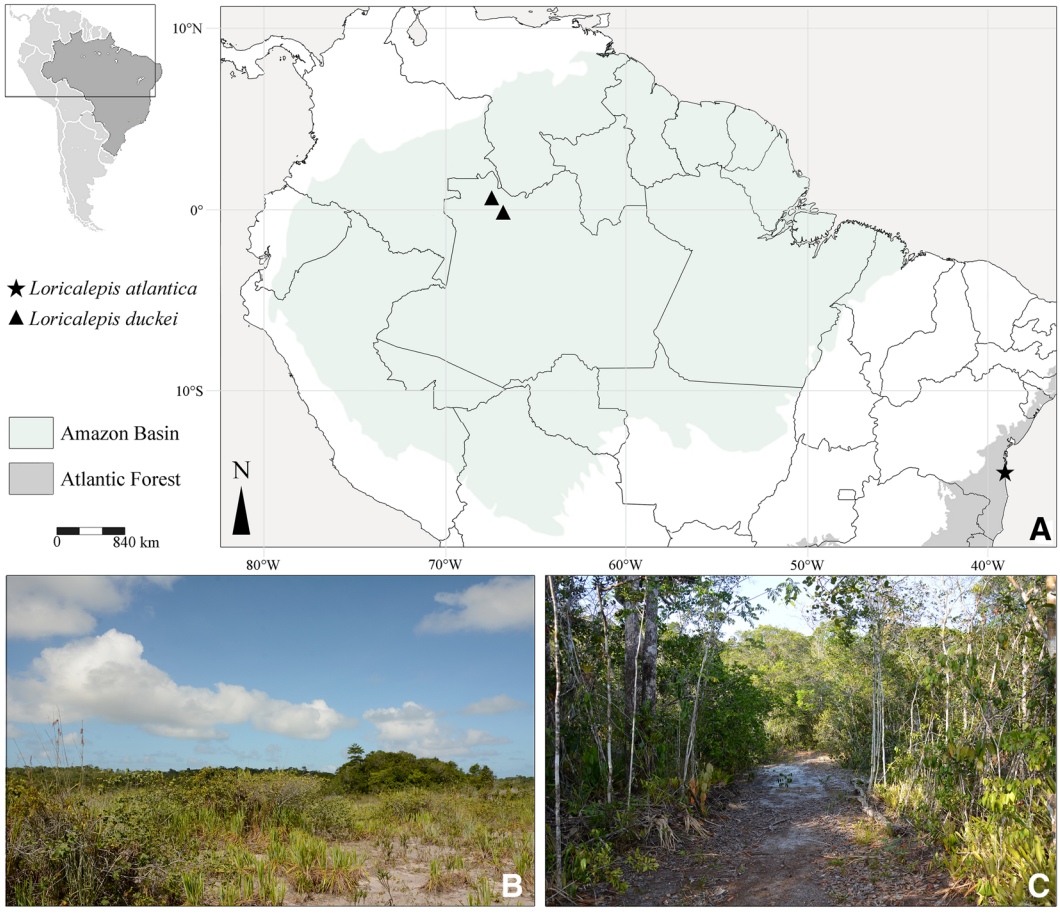

Fig. 5. Distribution and habitat of *Loricalepis atlantica*, endemic to southern Bahia, Brazil. **A.** Geographic distributions of the two species of *Loricalepis*. **B.** Typical "mussununga" vegetation on white sand. **C.** Locality where *L. atlantica* was collected, in "Campo Cheiroso", Mun. Itacaré, Bahia, Brazil. (Photographs by André Amorim.)

part of a protected area. The locality has been disturbed for coconut (*Cocos nucifera* L.) cultivation, which involves burning of the vegetation to clear the ground for planting. Following the IUCN Red List categories and criteria (IUCN 2012), this species can be considered critically endangered (CR). Its area of occupancy is < 10 km^2, and there is only a small number of mature individuals [B2ab(ii)+D]. All of the specimens of the new species were collected within the last nine years.

Phenology.— Plants were found in flower in November and March (just one inflorescence), young fruits in November and March, and mature fruits in March and June.

Etymology.—The specific epithet refers to the species' occurrence in the Brazilian Atlantic Forest.

Additional specimens examined. BRAZIL. Bahia: Mun. Itacaré, Rodovia Ilhéus–Itacaré, Campo Cheiroso, 14°22′50″S, 39°02′23″W, 100–125 m, 12 Jun 2011 (fr), *V. D. Lacerda 191* (CEPEC); 14 Mar 2015 (fl, fr), *A. M. Amorim* et al. *9528* (CEPEC, HUEFS, K, MBM, NY, P, RB, SPF, UPCB); 18 Mar 2017 (fr), *R. P. Asprino* et al. *159* (CEPEC, RB, UPCB, US).

Loricalepis atlantica and *L. duckei* are both shrubs or small trees that share similar scalariform indumentum covering the stems and leaves (the minute scales on the hypanthium of *L. atlantica* also curiously similar to the scales on the vegetative parts of *L. duckei*); young stem nodes with a transversal ridge joining the opposite petioles; thick-cartilaginous, crenulate-serrulate and paleaceous-ciliate leaf margins; persistent acute and seta-tipped sepals; petals with glandulose-ciliate margins; glabrous and subisomorphic stamens, these with the connectives not at all or little prolonged and ventrally bilobed; the ovary apex with a crown of scales surrounding the style; and dry, capsular fruits. As detailed in the diagnosis, they differ in flower merosity, hypanthium indument, petals and anther color, and ovary division.

Despite the great distance separating the geographical distributions of *Loricalepis duckei* and *L. atlantica*, the two species may experience similar ecological conditions. *Loricalepis duckei* has been found growing in *igapó* vegetation (fide *Hopkins 1904*) and in white sand vegetation (i.e. "Amazonian *caatinga*", fide *Ducke 35,068*, and "*sabana natural de arenas blancas*", fide *Cárdenas 20,309*). *Igapó* is a semi-aquatic Amazonian forest type occurring on river floodplains that are periodically inundated by oscillating water levels (Junk et al. 2011). It frequently occurs on patches of white sand soils, which often support open vegetation types, locally known as *campinas* and *campinaranas*. One of the possible explanations for these big white sand deposits in the Rio Negro basin is that they may result from leaching of alluvial deposits, these products of erosion of sandstones from the Guiana Shield (Capurucho et al. 2020). Similarly, in the Atlantic Forest Domain, *Loricalepis atlantica* occurs in vegetation known as *mussunungas* and *campos nativos* (Saporetti-Junior et al. 2012) that grow on isolated patches of white sands distant from the coast. The occurrence of these white sands can be explained by the uplifting of river beaches, imprisonment of water in periods of higher sea levels or ancient lakes (Araujo et al. 2008), or by deposition from the weathering of sandstone rocks and/or podzolization due to water table fluctuation (Anderson 1981). Thus, the white sand soils along the Brazilian coast may have been structured by aquatic transgression events (Rossetti et al. 2013), as is the case for similar Amazonian phytophysiognomies. Regardless of the origins of the white sand deposits, whether in the Rio Negro basin or in the *mussunungas* in coastal Bahia, the vegetation in both grow on poor-nutrient soils with low water retention capacity, and that are subject to high precipitation. In both, the physiognomy is more or less similar, with a gradient from dense and tall shrubs or small trees (up to ca. 4 m) to more open grasslands. These facts may help explaining the extensive disjunction between the two species of *Loricalepis*.

Disjunctions between the Atlantic Forest in Bahia and Amazonia are quite frequent in Melastomataceae. For example, what were thought to be exclusively Amazonian species *Graffenrieda intermedia* Triana and *Votomita guianensis* Aubl. were recently discovered in Bahia (Jardim 2010 and Goldenberg and Michelangeli 2019b, respectively), making these the only species of their respective genera found in the Atlantic Coastal Forest. Similarly, the clade comprising the former genus *Conostegia* is common in northern South America and Central America, but there is one species, *Miconia subhirsuta* (DC.) M.Gómez [formerly *Conostegia icosandra* (Sw.) Urb.], with a disjunct population in Bahia (Kriebel 2016).

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Literature cited

Anderson, A. B. 1981. White-sand vegetation of Brazilian Amazonia. Biotropica 13:199–210. https://doi.org/10.2307/2388125

Araujo, D. S. D., O. J. Pereira & A. L. Peixoto. 2008. Campos nativos at the Linhares Forest Reserve, Espírito Santo, Brazil. Pp. 371–394. *In:* W. W. Thomas (ed.), The Atlantic Coastal Forest of Northeastern Brazil. New York Botanical Garden Press, Bronx.

Brade, A. C. 1938. Melastomataceae Novae II. Archivos do Instituto de Biologia Vegetal do Rio de Janeiro 4: 71–94.

Capurucho, J. M. G., S. H. Borges, C. Cornelius, A. Vicentini, E. M. B. Prata, F. M. Costa, P. Campos, A. O. Sawakuchi, F. Rodrigues, A. Zular, A. Aleixo, J. M. Bates, & C. Ribas. 2020. Patterns and processes of diversification in Amazonian white sand ecosystems: Insights from birds and plants. Pp. 245–270. *In:* V. Rull & A. C. Carnaval (eds.), Neotropical Diversification: Patterns and Processes. Springer Nature, Switzerland

Fritsch, P. W., F. Almeda, S. S. Renner, A. B. Martins, & B. C. Cruz. 2004. Phylogeny and circumscription of the near-endemic Brazilian tribe Microlicieae (Melastomataceae). American Journal of Botany 91: 1105–1114. https://doi.org/10.3732/ajb.91.7.1105

Goldenberg, R. & F.A. Michelangeli. 2019a. *Loricalepis*. *In:* Flora do Brasil 2020 under construction. Jardim Botânico do Rio de Janeiro, Rio de Janeiro http://reflora.jbrj.gov.br/reflora/floradobrasil/FB79270 (accessed 29 May 2019).

Goldenberg, R. & F.A. Michelangeli. 2019b. *Votomita*. *In:* Flora do Brasil 2020 under construction. Jardim Botânico do Rio de Janeiro, Rio de Janeiro http://reflora.jbrj.gov.br/reflora/floradobrasil/FB85546 (accessed 29 May 2019).

Guimarães, P. J. F., F. A. Michelangeli, K. Sosa, & J. R. Santiago. 2019. Systematics of *Tibouchina* and allies (Melastomataceae: Melastomateae): a new taxonomic classification. Taxon 68: 937–1002.

IUCN. 2012. IUCN Red List Categories and Criteria, Version 3.1. IUCN, Gland, Switzerland and Cambridge, U.K.

Jardim, A. Q. B. S. 2010. Melastomataceae de floresta montana no complexo Serra das Lontras, Bahia, Brasil. MSc thesis, Universidade Estadual de Feira de Santana, Feira de Santana, Brazil.

Junk, W. J., M. T. F. Piedade, J. Scheongart, M. A. J. Cohn-Haft, & F. K. Wittmann. 2011. A classification of major naturally-occurring Amazonian lowland wetlands. Wetlands 31: 623–640.

Kriebel, R. 2016. A monograph of *Conostegia* (Melastomataceae, Miconieae). Phytokeys 67: 1–326. https://doi.org/10.3897/phytokeys.67.6703

Meyer, F. S. 2016. Estudos sistemáticos no clado de *Chaetogastra* DC. e gêneros aliados (Melastomataceae: Melastomeae). PhD thesis, Universidade Estadual de Campinas, Campinas, Brazil.

Michelangeli, F. A., P. J. F. Guimaraes, D. S. Penneys, F. Almeda & R. Kriebel. 2013. Phylogenetic relationships and distribution of New World Melastomeae (Melastomataceae). Botanical Journal of the Linnean Society 171: 38–60. https://doi.org/10.1111/j.1095-8339.2012.01295.x

Renner, S. S. 1994. Revision of *Pterolepis* (Melastomataceae, Melastomeae). Nordic Journal of Botany 14: 73–104.

Rocha, M. J. R., P. J. F. Guimarães, F. A. Michelangeli & J. A. N. Batista. 2018. Taxonomy of Marcetieae: a new Neotropical tribe of Melastomataceae. International Journal of Plant Sciences 179: 50–74.

Rossetti, D. F., F. H. R. Bezerra, & J. M. L. Dominguez. 2013. Late Oligocene-Miocene transgressions along the equatorial and eastern margins of Brazil. Earth-Science Reviews 123: 87–112.

Saporetti-Junior, A. W, Schaefer, C. E. R. J., Souza, A. L, Soares, M. P., Araújo, D. S. D., Meira-Neto, J. A. A. (2012) Influence of soil physical properties on plants of the mussununga ecosystem, Brazil. Folia Geobotanica 47(1): 29–39. https://doi.org/10.1007/s12224-011-9106-9

Shorthouse, D. P. 2010. SimpleMappr, an online tool to produce publication-quality point maps. **Available at:** http://www.simplemappr.net

Veranso-Libalah, M. C., R. D. Stone, A. G. N. Fongod, T. L. P. Couvreur & G. Kadereit. 2017. Phylogeny and systematics of African Melastomateae (Melastomataceae). Taxon 66: 584–614.

Wurdack, J. J. 1986. Atlas of hairs for Neotropical Melastomataceae. Smithsonian Contributions to Botany 63: 1–80.